

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Delissea rivularis* (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 the final critical habitat designation for *Delissea rivularis* 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 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).

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 *Delissea rivularis* published in the Federal Register on February 27, 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 *D. rivularis*.

At the time of listing in 1996, one population of *Delissea rivularis* containing 15 to 20 individuals was known (USFWS 1996). Currently, there are three populations containing a total of 19 mature and immature individuals. A fourth population consisting of a single individual has not been observed since 1988.

In the Upper Hanakoa Valley, *Delissea rivularis* has been visited and monitored by botanists from the National Tropical Botanical Garden since 1993. In January 1993, Ken Wood and Steve Perlman observed about 20 individuals in the Upper Hanakoa Valley (National Tropical Botanical Garden 2008a). Subsequently it was seen again, along with other individuals, in 1994. In September 2000, Ken Wood identified three locations with three to four individuals within each location (Wood 2008). Natalia Tangalin of the National Tropical Botanical Garden visited the area every year from 2004 through 2007 and described five separate groups that contained one to four individuals in each group (Tangalin 2008). Group 1 is located on the east side of the stream after the second falls, about six meters (20 feet) above the plunge pool and stream on a shelf. Group 1 once consisted of two individuals; currently only one individual plant remains. Group 2 occurs nine meters (30 feet) above the stream on the northwest valley wall, about 10 minutes down a winding stream from group 1. Group 2 consists of two individuals. Group 3 is on the same wall as group 2, at a little higher in elevation, 21 meters (70 feet) above the stream and 15 meters (50 feet) downstream (north). This group had as many as four individuals, but many were completely girdled by rats (*Rattus* spp.) and an undetermined slug species. At last visit there were only one adult and two immature individuals left. Group 4 was also located on the east side of the stream, on a wall above a *Melicope degeneri* (alani) population. Groups 3 and 4 are both gone now. Group 5 was located the furthest downstream, about 15 minutes from group 4. This group had three individuals, the lowermost having since died (Tangalin 2008). The total number of individuals in the Hanakoa area in 2007 was estimated to contain from five to six mature individuals and one to two immature individuals. In July 2008, one mature and two immature individuals were observed in the Hanakoa area by Steve Perlman of the National Tropical Botanical Garden and staff from the Hawaii Department of Land and Natural Resources (Perlman 2008).

In Upper Hanakapiai, in the Hono o Na Pali Forest Reserve, 20 individuals of *Delissea rivularis* were observed in 1998 at 1,097 to 1,219 meters (3,600 to 4,000 feet) elevation (Wood 2008). Fifteen remaining individuals of various ages and states of health were described by Tangalin when she and Perlman visited this area in 2007 (Perlman 2008; Tangalin 2008).

In Kawaikoi's upper eastern fork of the western branch, above where the Alakai Bog Trail crosses Kawaikoi Stream, one plant was seen by Wood in 2000 (National Tropical Botanical Garden 2008b; Wood 2008). In 2008, a possible sighting of *Delissea rivularis* was also reported from the Mohihi Trail to Waialae by staff of the Kokee Resource Conservation Program, but this has not been confirmed (Cassel 2008).

A fourth population was observed in 1988 but not recorded at the time of listing in 1996, upon publication of the recovery plan in 1998, or when critical habitat was designated in 2003 (USFWS 1996, 1998, 2003; Wood 2008). In 1988, one individual of *Delissea rivularis* was seen at Blue Hole in the upper reaches of the Wailua River. This is the only reported location on eastern Kauai, and is at a lower elevation, 600 to 700 meters (1,969 to 2,297 feet), than other sites. Previous to this Blue Hole collection in 1988, *D. rivularis* was last collected in 1916 and the species was considered to be extinct (Wood 2008). No more recent observations of the species from this location are known and no critical habitat was designated in this area in 2003.

In his 2005 treatment of the genus *Delissea*, Thomas Lammers reclassified this species as *Cyanea rivularis*, with no change in the range or distribution of the species (Lammers 2005). The species will be referred to as *Cyanea rivularis* in the remainder of this review.

Recent surveys of the habitat in which *Cyanea rivularis* occurs have updated the associated plant types. In Hanakapiai the habitat is *Metrosideros polymorpha* (ohia) – *Dicranopteris linearis* (uluhe) wet forest with associated species including *Antidesma platyphylla* (hame), *Bohea elatior* (ahakea lau nui), *Boehmeria grandis* (akolea), *Broussaisia arguta* (kanawao), *Carex alligata* (no common name [NCN]), *Charpentiera* spp. (papala), *Cheirodendron* spp. (olapa), *Cibotium* spp. (hapuu), *Cyanea fissa* (haha), *Diplazium sandwichianum* (hoio), *Dubautia knudsenii* (naenae), *Elaeocarpus bifida* (kalia), *Freycinetia arborea* (ieie), *Gunnera* sp. (ape ape), *Ilex anomala* (aeia), *Kadua affinis* (manono), *K. foggiana* (NCN), *K. tryblium* (NCN), *Machaerina angustifolia* (uki), *Melicope anisata* (mokihana), *M. clusiifolia* (kukaemoa), *M. degeneri* (alani), *Perrottetia sandwicensis* (olomea), *Pipturus ruber* (mamake), *Pisonia sandwicensis* (kauulu), *Psychotria hexandra* (kopiko), *Sadleria* sp. (amau), *Syzygium sandwicense* (ohia ha), and *Touchardia latifolia* (olona) (Perlman 2008).

Upper Hanakoa has a *Metrosideros polymorpha* – *Cheirodendron* sp. – *Dicranopteris linearis* wet riparian habitat. Some associated species are *Anoectochilus sandwicensis* (jewel orchid), *Astelia* sp. (painiu), *Athyrium microphyllum* (akolea), *Bidens* spp. (kookoolau), *Boehmeria grandis*, *Broussaisia arguta*, *Carex alligata*, *Cheirodendron trigynum*, *C. platyphyllum*, *Cibotium* spp., *Clermontia fauriei* (haha aiakamanu), *Coprosma* sp. (pilo), *Cyanea fissa*, *Cyrtandra heinrichii* (haiwale), *C. longifolia* (haiwale), *C. kauaiensis* (ulunahale), *Diplazium sandwichianum*, *Diplopterygium pinnatum* (uluhe lau nui), *Dryopteris sandwicensis* (NCN), *Dubautia knudsenii*, *D. raillardoides* (naenae ula), *Gunnera* sp., *Ilex anomala*, *Kadua acuminata* (au), *K. affinis*, *K. foggiana*, *K. cordata* subsp. *cordata* (kopa), *Labordia hirtella* (kamakahala), *Lobelia kauaiensis* (pue), *Machaerina angustifolia*, *Melicope anisata*, *M. clusiifolia*, *M. peduncularis* (alani), *M. wawraeana* (alani), *Perrottetia* sp., *Pipturus kauaiensis* (mamake), *P. ruber*, *Pittosporum confertiflorum* (hoawa), *Platydesma rostrata* (pilo kea lau lii), *Pteris excelsa* (waimakanui), *Sadleria cyatheoides* (amau), *Sticherus owbyhensis* (uluhe), *Touchardia latifolia* (olona), *Trematolobelia kauaiensis* (kolii), *Urera glabra* (opuhe), *Viola kauaiensis* (nani Waialeale), and *Wikstroemia* sp. (akia) (National Tropical

Botanical Garden 2008c). One *Cyrtandra cyaneoides* (mapele) was observed on the side of a stream bank (Tangalin 2008).

Kawaikoi's habitat is *Metrosideros polymorpha* - *Cheirodendron* sp. montane wet forest with associated species including *Broussaisia arguta*, *Cyrtandra longifolia* (haiwale), *C. kauaiensis* (ulunahele), *Dicranopteris linearis* (uluhe), *Melicope clusiifolia*, *Melicope puberula* (alani), and with ferns common in the understory (Wood 2008).

Below North Bog the habitat is wet montane *Metrosideros polymorpha* riparian forest with associated native species including *Broussaisia arguta*, *Cheirodendron* spp., *Clermontia fauriei*, *Cyanea fissa*, *Cyrtandra oenobarba* (haiwale), *Diplazium sandwichianum*, *Dubautia knudsenii*, *Huperzia serrata* (NCN), *Ilex anomala*, *Labordia degeneri* (kamakahala), *M. clusiifolia*, *Melicope waialealae* (alani wai), *Myrsine* spp. (kolea), *Trematolobelia kauaiensis*, *Vaccinium calycinum* (ohelo), and *Viola wailenalenae* (NCN) (Tangalin 2008).

Blue Hole is a deep, narrow valley surrounded by vertical cliffs that are laced with waterfalls. In this low, undisturbed wet forest of small, stunted trees and shrubs, *Cyanea rivularis* was found with *Metrosideros polymorpha*, *Bobea* sp., *Perrottetia* sp., and a ground cover of ferns, *Gunnera* sp., *Cyrtandra* spp., and *Cyanea* spp., over saturated, rocky ground (Wood 2008).

Invasive introduced plant species (Factor E) compete with and crowd out *Cyanea rivularis*. These include *Clidemia hirta* (Koster's curse), *Hedychium gardnerianum* (Kahili ginger), *Erigeron karvinskianus* (daisy fleabane), *Kalanchoe pinnata* (airplant), *Cyperus meyenianus* (NCN), *Paspalum urvillei* (vasey grass), *Rubus argutus* (prickly Florida blackberry), *R. rosifolius* (thimbleberry), and *Juncus planifolius* (bog rush) (Perlman 2008; Tangalin 2008; Wood 2008). Other threats are from feral ungulates that modify the landscape and increase soil erosion (Factor A) (Perlman 2008). In Hanakoa, a collapsed ledge killed a couple of individuals and other individuals were damaged by a small landslide (Factor E) (Tangalin 2008). The bark of *Cyanea rivularis* individuals in Hanakoa was scarred from chewing by rats or slugs (Factor C) (Tangalin 2008).

Climate change may also pose a threat to *Cyanea rivularis* (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.

In addition to all of the other threats, species like *Cyanea rivularis* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes, landslides, flooding and disease outbreaks (Factor E). The extent of these natural processes on this single island endemic are exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species (Factor E) (USFWS 1996).

The National Tropical Botanical Garden in Lawai has one individual plant, grown from seed collected in 2005 by David Boucher, Research Associate (National Tropical Botanical Garden 2008b). This botanical garden also has 1,850 seeds in storage, 300 from the Kawaikoi Stream population and 1,550 from the Hanakoa Stream population (National Tropical Botanical Garden 2009). The Harold L. Lyon Arboretum micropropagation lab has 45 clones from the upper Hanakoa Valley population, representing four individuals (Harold L. Lyon Arboretum 2008).

Stabilizing, downlisting, and delisting objectives are provided in the addendum to the recovery plan for the Kauai plant cluster (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Cyanea rivularis* 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 Kauai. 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 none of the three populations have 50 mature individuals and all threats are not being managed. Therefore, *Cyanea rivularis* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Conduct rat and slug control around known plants.
- Fence areas where this species grows to protect against ungulate damage.
- Create erosion protection to prevent landslides, if possible.
- Collect material for genetic storage and propagation for reintroduction.
- Identify protected sites for reintroduction and augmentation.
- Work with Hawaii Division of Forestry and Wildlife to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.

References:

Harold L. Lyon Arboretum. 2008. Micropropagation laboratory database. University of Hawaii, Manoa, Hawaii. 5 pages.

- Lammers, T.G. 2005. Revision of *Delissea* (Campanulaceae-Lobelioideae). Systematic Botany Monographs 73:1-75.
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- [USFWS] U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; determination of endangered or threatened status for nineteen plant species from the island of Kauai, Hawaii; final rule. Federal Register 61(198):53070-53089.
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- Wood, K.R. 2008. Biogeography data, *Delissea rivularis*. National Tropical Botanical Garden, Kalaheo, Hawaii. 6 pages. Unpublished.

Personal Communications

Cassel, Katie. 2008. Kokee Resource Conservation Program, Kalaheo, Hawaii. E-mail to Natalia Tangalin, National Tropical Botanical Garden, dated November 14, 2008. Subject: *Cyanea rivularis*.

Table 1. Status of *Cyanea rivularis* from listing through 5-year review.

Date	No. wild indivs.	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1996 (listing)	15-20	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	40	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	40	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2009 (5-year review)	19	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

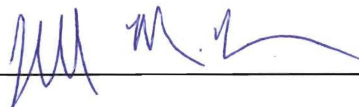
U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Delissea rivularis* (no common name)

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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