

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Diellia erecta* (Asplenium-leaved diellia)

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 *Diellia erecta* (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 *Diellia erecta* published on April 7, 2009 (available at: http://ecos.fws.gov/docs/five_year_review/doc2466.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 *D. erecta*.

This short-lived perennial fern in the spleenwort family (Aspleniaceae) is endangered and is historically known from Kauai, Oahu, Molokai, Maui, Lanai, and Hawaii (Palmer 2003). The status and trends for *D. erecta* are provided in the tables below.

New taxonomic information:

- In 2012, USFWS proposed to revised the taxonomic status for this species when it revised and proposed designation of critical habitat on Maui nui (USFWS 2012a). The name for this species has undergone several revisions, and it is currently

recognized as *Asplenium dielerectum* (Viane and Reichstein 1991; Schneider *et al.* 2005; Smith *et al.* 2006; Schuettpelz and Pryer 2007). The range of the species at the time of listing and now has not changed. This species will be addressed as *Asplenium dielerectum* for the remainder of this review.

New status information:

- On Kauai, there are three populations of *Asplenium dielerectum* with 33 mature, three immature, and 5 sporelings (Plant Extinction Prevention Program [PEPP] 2011).
- On Oahu, only a single population is known containing approximately 20 to 30 individuals in the Koolau Mountains (USFWS 2012b).
- Currently, *Asplenium dielerectum* is known from an unknown number of individuals in two populations on Molokai (USFWS 2012a) and four populations totaling four individuals on Maui (PEPP 2014). On Molokai, an unknown number of plants were last seen in Onini and Makolelau Gulches in the 1990s (J. Lau, private consultant, pers. comm. 2010). Two individuals occur on West Maui at Papalaua and Manawainui Gulches and on East Maui, one individual occurs in Kula Forest Reserve and a single individual at Wailea (PEPP 2014).
- Overall, the numbers of individuals have decreased from the approximately 100 wild individuals reported in the previous 5-year review to approximately 57 to 67 wild individuals in 2015 (USFWS 2012a; USFWS 2012b; PEPP 2011, 2013).

New threats:

- Climate change destruction or degradation of habitat – 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 *A. dielerectum* is minimally vulnerable to the impacts of climate change.
- Slug herbivory – Herbivory by slugs (*Derocerus* species) has been reported as a threat to this species on Maui and Oahu (PEPP 2009).

New management actions:

- Surveys / inventories
 - In 2008, the historical location containing a single individual at Halawa Valley on Molokai was surveyed; no individuals were found (PEPP 2009).
 - A survey discovered a single individual of *A. dielectum* on East Maui (PEPP 2012).
- Ungulate monitoring and control
 - Temporary fences were constructed around individual ferns at the first population at Kawaiiki on Kauai (PEPP 2009). The boundaries of a potential fence were discussed and mapped (PEPP 2009).
 - In 2009 and 2010, small fences were installed around both populations of *A. dielerectum* on Kauai (PEPP 2010). The fences were inspected in November 2010 (PEPP 2011).

- A small fence was constructed around the newly discovered individual of *A. dielerectum* at Manawainui Gulch on Maui with the assistance from Leeward Haleakala Watershed Recovery Program staff (PEPP 2014).
- The fence was inspected at Wailea on East Maui (PEPP 2013, 2014) and tree falls were noted in the area following the passing of Tropical Storm Iselle (PEPP 2015).
- Invasive plant monitoring and control
 - *Rubus niveus* (mysore or hill raspberry) was chemically controlled and manually removed around the single individual at Kula Forest Reserve on Maui (PEPP 2009). Other species manually removed by hand include *Rubus rosifolius* (thimbleberry), *Cirsium vulgare* (bull thistle), *Prunella vulgaris* (selfheal), *Paraserianthes lophantha* subsp. *montana* (mountain albizia) (PEPP 2009).
 - The population at Kawaiiki on Kauai was weeded (PEPP 2009).
 - *Rubus niveus* was chemically controlled and *Rubus rosifolius* was manually controlled at Kula Forest Reserve (PEPP 2010, 2012, 2013).
 - Weeds were manually and chemically controlled at Wailea on East Maui (PEPP 2013, 2014, 2015).
 - Weeds were controlled at Manawainui Gulch on Maui (PEPP 2014).
 - Weed control occurred at the population in Papalaua and Manawainui Gulches on Maui (PEPP 2014).
- Captive propagation for genetic storage and reintroduction
 - The Lyon Arboretum's Seed Conservation Laboratory (2014) has approximately 20,000 spores of *A. dielerectum* in storage from Oahu.
 - The National Tropical Botanical Garden (2014a) has one plant in the McBryde Garden and there are unknown amount of spores in storage (National Tropical Botanical Garden 2014b).
 - In 2009, spores were collected from individuals at Kawaiiki on Kauai and at Kula Forest Reserve on Maui (PEPP 2009).
 - In 2011, spores were collected at Kawaiiki on Kauai by Ruth Aguraiuja and sent to Lyon Arboretum Micropropagation Laboratory for genetic storage (PEPP 2011).
 - In 2012, the Lyon Arboretum's Seed Conservation Laboratory propagated *Asplenium dielerectum* in the greenhouse to collect spores for storage and propagation purposes (PEPP 2012).
- Population viability monitoring and analysis
 - In 2008 and 2009, the single individual at Kula Forest Reserve on East Maui was monitored for fertile spores (PEPP 2009). The single individual was monitored again in 2010, 2011, and 2012 (PEPP 2010, 2012, 2013).
 - In 2008, four individuals were monitored on West Maui (PEPP 2009).
 - The single individual at Wailea on East Maui was monitored (PEPP 2013, 2014). In 2015, the single individual at Wailea on East Maui was monitored and an old broken frond was transported to Lyon Arboretum for potential gene bank storage (PEPP 2015).
 - A single wild individual at Manawainui Gulch on Maui was monitored (PEPP 2013, 2014). Two individuals were monitored at Papalaua and Manawainui gulches on Maui (PEPP 2014).

- In 2009, 28 individuals were monitored at the first population at Kawaiiki on Kauai and an additional 6 individuals were monitored at the second population (PEPP 2009). Monitoring in 2010 recorded 7 individuals at the second population (PEPP 2010). In 2011, those 7 individuals within the second population were monitored again (PEPP 2011). In 2011, the third wild population at Kawaiiki was monitored and it contained 100 mature reproductive individuals (PEPP 2011). In 2012, there were approximately 24 individuals at the first population at Kawaiiki and 7 individuals at the second population (PEPP 2012).
- In 2008, 4 mature and 10 sporelings were monitored at Hawaii Loa on Oahu (PEPP 2009). Monitoring in 2010 recorded 6 mature and approximately 30 sporelings at Hawaii Loa (PEPP 2010). In 2014, there were 2 mature wild individuals and several sporelings (PEPP 2014).
- Reintroduced / translocated population management and monitoring
 - Three individuals were monitored at the Kupaua reintroduction site on Oahu (PEPP 2009). In 2011, no individuals remained at the reintroduction site (PEPP 2011).
- Listing and critical habitat designation
 - Four units of critical habitat were designated for *A. dielerectum* on Oahu in the lowland mesic ecosystem (USFWS 2012b).
 - Twelve units of critical habitat for *A. dielerectum* were proposed in the lowland dry, lowland mesic, lowland wet, and montane mesic ecosystem on Maui. On Molokai, five units of critical habitat was proposed in the lowland mesic, lowland wet, and montane mesic ecosystems (USFWS 2012a). On Lanai, critical habitat for *A. dielerectum* was proposed in five units in the lowland dry and dry cliff ecosystems. The final rule for these 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 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. *Asplenium dielerectum* 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 islands 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 as no known population contains more than 50 mature individuals (Table 1). In addition, all threats are not being sufficiently managed throughout all of the populations (Table 2). Therefore, *Asplenium dielerectum* 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 exclosures and monitor for potential incursions.
- Invasive plant monitoring and control – Eradicate invasive introduced plants within ungulate exclosures and maintain exclosures free of invasive plants.
- Population viability monitoring and analysis – Continue monitoring wild and outplanted individuals.
- Fire monitoring and control – Develop and implement a fire management plan at the existing exclosures.
- 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 *Asplenium dielerectum* from listing through current 5-year review.

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	63	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1999 (recovery plan)	34-36	<100	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	119	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2009 (5-yr review)	~100	4	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2015 (5-yr review)	~58-68	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

Table 2. Threats to *Asplenium dielerectum* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, D, E	Ongoing	Partially, the populations on Kauai and Maui are fenced
Invasive introduced plants	A, E	Ongoing	Partially, weeds controlled on Kauai and Maui
Landslides and flooding loss or degradation of habitat	A	Ongoing	None
Slug herbivory	C	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	None
Drought	E	Ongoing	None
Fire	E	Ongoing	None
Low numbers	E	Ongoing	Partially, captive propagation for genetic storage and reintroduction
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2011). 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.

National Tropical Botanical Garden. 2014a. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act; controlled propagation report. Unpublished.

National Tropical Botanical Garden. 2014b. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act; seed bank report. Unpublished.

Palmer, D. 2003. Hawaii’s ferns and fern allies. University of Hawaii Press, Honolulu. 324 pages.

- [PEPP] Plant Extinction Prevention Program. 2009. Plant Extinction Prevention Program annual report, fiscal year 2009 (July 1, 2008-June 30, 2009). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [PEPP] Plant Extinction Prevention Program. 2010. Plant Extinction Prevention Program annual report, fiscal year 2010 (July 1, 2009-June 30, 2010). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [PEPP] Plant Extinction Prevention Program. 2011. Plant Extinction Prevention Program annual report, fiscal year 2013 (July 1, 2010-June 30, 2011). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [PEPP] Plant Extinction Prevention Program. 2012. Plant Extinction Prevention Program annual report, fiscal year 2012 (July 1, 2011-June 30, 2012). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [PEPP] Plant Extinction Prevention Program. 2013. Plant Extinction Prevention Program annual report, fiscal year 2013 (July 1, 2012-June 30, 2013). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [PEPP] Plant Extinction Prevention Program. 2014. Plant Extinction Prevention Program annual report, fiscal year 2014 (July 1, 2013-June 30, 2014). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [PEPP] Plant Extinction Prevention Program. 2015. Maui nui Plant Extinction Prevention Program monthly report for April 2015. Microsoft Excel worksheet. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- Schneider, S.H., T.A. Ranker, S.J. Russell, R. Cranfill, J.M.O. Geiger, R. Agurauja, K.R. Wood, M. Grundmann, K. Kloberdanz, and J.C. Vogel. 2005. Origin of the endemic fern genus *Diellia* coincides with the renewal of Hawaiian terrestrial life in the Miocene. *Proceedings of the Royal Society B-Biological Sciences* 272: 455–460.
- Schuettpelz, E. and K.M. Pryer. 2007. Fern phylogeny inferred from 400 leptosporangiate species and three plastid genes. *Taxon* 56: 1037–1050.
- Smith, A.R., K.M. Pryer, E. Schuettpelz, P. Korall, H. Schneider, and P.G. Wolf. 2006. A classification for extant ferns. *Taxon* 55: 705–731.

[USFWS] U.S. Fish and Wildlife Service. 1999. Recovery plan for multi-island plants. U.S. Fish and Wildlife Service, Portland, Oregon. 206 pages + appendices.

[USFWS] U.S. Fish and Wildlife Service. 2009. *Diellia erecta* (Asplenium-leaved diellia) 5-year review short form summary. Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 9 pages.

[USFWS] U.S. Fish and Wildlife Service. 2012a. 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.

[USFWS] U.S. Fish and Wildlife Service. 2012b. Endangered and threatened wildlife and plants; endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Federal Register 77(181):57648-57862.

Viane, R.L.L. and T. Reichstein. 1991. Notes about *Asplenium* II: some new names and combinations in *Asplenium* L. (Aspleniaceae, Pteridophyta). Biol. Jb. Dodonaea 59: 157–165.

Personal communication:

Lau, Joel. 2010. Private consultant. *Diellia erecta*, comments from Maui Nui Task Force meeting, Maui, Hawaii. Dated 9 September 2010.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Asplenium dielirectum* (Asplenium-leaved diellia)

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

Appropriate Listing/Reclassification Priority Number, if applicable: _____

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

Maie M. Buegman

Date 2015-08-20