

## 5-YEAR REVIEW

Short Form Summary

**Species Reviewed:** *Diplazium molokaiense* (no common name)

**Current Classification:** Endangered

### **Federal Register Notice announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; 5-year status reviews of 46 species in Idaho, Oregon, Washington, Nevada, Montana, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 77(44):13248-13251.

### **Lead Region/Field Office:**

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

### **Name of Reviewer(s):**

Ann Marie Gawel, Plant Biologist, PIFWO

Chelsie Javar-Salas, Plant Biologist, PIFWO

Maui nui and Hawaii Island Team Manager, PIFWO

Marie Bruegmann, Plant Recovery Coordinator, PIFWO

Recovery Program Lead, 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 6, 2012. The review was based on a review of current, available information since the last 5-year review for *Diplazium molokaiense* (USFWS 2010). The evaluation by Ann Marie Gawel and Chelsie Javar-Salas, both Plant Biologists, were reviewed by the Island Team Manager, and Plant Recovery Coordinator, followed by the Recovery Program Lead. 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 ([http://ecos.fws.gov/tess\\_public](http://ecos.fws.gov/tess_public)).

### **Review Analysis:**

Please refer to the previous 5-year review for *Diplazium molokaiense* published on August 27, 2010 (available at [http://ecos.fws.gov/docs/five\\_year\\_review/doc3326.pdf](http://ecos.fws.gov/docs/five_year_review/doc3326.pdf)) for a complete review of the species' status, threats, and management efforts. 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. molokaiense*.

This terrestrial fern is endangered and is known historically from Kauai, Oahu, Lanai, Maui, and Molokai. However, the only known extant populations are on the island of

Maui (Plant Extinction Prevention Program [PEPP] 2013). The current status and trends for *Diplazium molokaiense* are provided in the tables below.

New status information:

In addition to those populations cited in the previous 5-year review, new observations include the following:

- Control of *Rubus rosifolius* at the Kula Forest Reserve in 2009 to 2010 revealed approximately 27 new individuals (PEPP 2010).
- Five individuals were discovered by the Plant Extinction Prevention Program (2012) during a survey of the Kahikinui area where a single individual was reported in 1980.
- Two individuals were discovered within the Nakula Natural Area Reserve (PEPP 2012).
- In 2012, monitoring by the Plant Extinction Prevention Program discovered ten new individuals in an area where only four individuals were previously recorded (PEPP 2012).

Overall, the numbers of individuals have increased from approximately 65 individuals reported in the previous 5-year review to approximately 81 individuals in 2013 (PEPP 2012, 2013). The increase in numbers resulted from additional surveys and weed control.

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 *D. molokaiense* is moderately vulnerable to the impacts of climate change. Therefore, additional management actions are needed to conserve this taxon into the future.
- Landslides and flooding mortality and reduced viability – All Maui populations are threatened by erosion (PEPP 2009, 2013). Flooding events threaten all Maui populations of *D. molokaiense* (PEPP 2009, 2013).
- Stochastic events – Drought mortality and reduced viability – Drought may exacerbate the effects of ungulates and has direct adverse impacts on *D. molokaiense* (PEPP 2010, 2013).
- Slug herbivory – Herbivory by slugs have been reported impacting populations located at the Kula Forest Reserve (PEPP 2009, 2013) and at the Nakula Natural Area Reserve (PEPP 2012).
- Human impacts – Fire mortality and reduced viability – Fire is a threat to the Kula Forest Reserve population (PEPP 2009, 2013).

New management actions:

- Captive propagation for genetic storage and reintroduction
  - The National Tropical Botanical Garden (2013) has a spore collection of *D. molokaiense* in storage.

- A single individual is in propagation at the Olinda Rare Plant Facility (2013).
- There are six individuals at the Harold L. Lyon Arboretum Micropropagation Laboratory (2013).
- Ungulate monitoring and control
  - In 2010, a perimeter fence at the Kula Forest Reserve population began (PEPP 2011) and was completed in 2012 (PEPP 2013).
  - In 2013, the Plant Extinction Prevention Program (2013) inspected the fenced enclosure.
- Surveys / inventories
  - The historical site at Kahikinui containing a single individual of *D. molokaiense* was surveyed by the Plant Extinction Prevention Program (2012). Five individuals were reported.
  - Two individuals were discovered at the Nakula Natural Area Reserve during a survey by the Plant Extinction Prevention Program (2012).
- Invasive plant monitoring and control – The Plant Extinction Prevention Program conducted weed control at the Kula Forest Reserve population in 2009 (PEPP 2009) and inside the fenced enclosure (PEPP 2013).
- Listing and critical habitat designation – A single unit of unoccupied area of critical habitat for *D. molokaiense* was proposed in the lowland mesic ecosystem on Molokai and 25 units of occupied and unoccupied areas on Maui (USFWS 2012). An additional four units of unoccupied area of critical habitat was proposed on Lanai (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 four species of ferns (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Diplazium molokaiense* is a short-lived perennial, and to be considered stable, this species 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 Maui and at least one other island on which 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 interim stabilization goals for this species have not been met, as the three known populations each contain less than 50 individuals (Table 1), and no new populations have been established on other islands where the species' occurred historically. In addition, all threats are not being sufficiently managed throughout all of the populations (Table 2). Therefore, *Diplazium molokaiense* meets the definition of endangered as it remains in danger of extinction throughout its range.

**Recommendations for Future Actions:**

- Captive propagation for genetic storage and reintroduction

- Continue collecting material for genetic storage and propagation for reintroduction.
- Evaluate genetic resources currently in storage to determine the need to place additional genetic resources in long-term storage due to this species' vulnerability to climate change.
- Reintroduction / translocation – Augment current natural populations to increase numbers of individuals.
- Ungulate monitoring and control – Fence remaining populations to protect them from the impacts of feral ungulates.
- Invasive plant monitoring and control – Control invasive introduced plant species within exclosures.
- Surveys / inventories – Continue to survey the geographical and historical range of *D. molokaiense* for a thorough current assessment of the species' status.
- Predator / herbivore monitoring and control – Control slugs within the vicinity of all known *D. molokaiense* populations.
- Climate change adaptation strategy – Research the suitability of habitat for reintroducing this species in the future due to the impacts of climate change.
- 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 *Diplazium molokaiense* from listing through current 5-year review.**

<b>Date</b>	<b>No. wild indivs</b>	<b>No. outplanted</b>	<b>Stabilization Criteria identified in Recovery Plan</b>	<b>Stabilization Criteria Completed?</b>
1994 (listing)	23	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	1	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	23	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2010 (5-year review)	~65	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2012 (critical habitat – proposed)	~70	0	All threats managed in all 3 populations	Unknown
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Partially
2014 (5-year review)	~81	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

**Table 2. Threats to *Diplazium molokaiense* and ongoing conservation efforts.**

<b>Threat</b>	<b>Listing factor</b>	<b>Current Status</b>	<b>Conservation/ Management Efforts</b>
Ungulates – degradation of habitat and herbivory	A, C, D, E	Ongoing	Partially, only the Kula Forest Reserve population is fenced
Invasive introduced plants	A, E	Ongoing	Partially, control at Kula Forest Reserve only
Flooding	A	Ongoing	None
Slugs herbivory	C	Ongoing	None
Drought	E	Ongoing	None
Landslides and erosion	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 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 Micropropagation Laboratory. 2013. Micropropagation database. University of Hawaii at Manoa, Honolulu, Hawaii. Unpublished.

National Tropical Botanical Garden. 2013. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. 30 pages. Unpublished.

Olinda Rare Plant Facility. 2013. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. 5 pages. Unpublished.

[PEPP] Plant Extinction Prevention Program. 2009. Annual report for Plant Extinction Prevention Program, fiscal year 2009 (July 1, 2008-June 30, 2009). 115 pages. Unpublished.

- [PEPP] Plant Extinction Prevention Program. 2010. Plant Extinction Prevention Program annual report, fiscal year 2010 (July 1, 2009-June 30, 2010). 122 pages. Unpublished.
- [PEPP] Plant Extinction Prevention Program. 2011. Plant Extinction Prevention Program annual report, fiscal year 2011 (July 1, 2010-June 30, 2011). 200 pages. Unpublished.
- [PEPP] Plant Extinction Prevention Program. 2012. Plant Extinction Prevention Program annual report, fiscal year 2012 (July 1, 2011-June 30, 2012). 169 pages. Unpublished.
- [PEPP] Plant Extinction Prevention Program. 2013. Plant Extinction Prevention Program annual report, fiscal year 2013 (July 1, 2012-June 30, 2013). 207 pages. Unpublished.
- [USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for four species of Hawaiian ferns. U.S. Fish and Wildlife Service, Portland, Oregon. 78 pages.
- [USFWS] U.S. Fish and Wildlife Service. 2010. *Diplazium molokaiense* 5-year review short form summary. U.S. Fish and Wildlife Service, 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.

**U.S. FISH AND WILDLIFE SERVICE**  
**SIGNATURE PAGE for 5-YEAR REVIEW of *Diplazium molokaiense* (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

**Appropriate Listing/Reclassification Priority Number, if applicable:** \_\_\_\_\_

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

Mai M. Buegman

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