5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Isodendrion hosakae* (aupaka)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. Federal Register 88(83): 20088–20092, May 7, 2018.

Lead Region/Field Office:

Interior Region 12/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2019. The review was based on a review of current, available information since the last 5-year review for *Isodendrion hosakae* (USFWS 2012). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

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*).

Review Analysis:

Please refer to the previous 5-year review for *Isodendrion hosakae* published in the Federal Register on August 28, 2012 (available at *https://ecos.fws.gov/docs/five_year_review/doc4080.pdf*) for a complete review of the species' status, threats, management efforts, and references cited. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *I. hosakae*.

This short-lived perennial terrestrial shrub in the Violaceae (violet) family is endangered. The status and trends for *Isodendrion hosakae* are provided in the tables below.

New Status Information:

- In 2013, there were 99 reported locations of *Isodendrion hosakae* on the Pōhakuloa Training Area (PTA) on the island of Hawai‘i (U.S. Army Garrison

2013, p. 10). From April 2016 through December 2019, the numbers of mature and immature individuals increased, with large flushes of seedlings observed (U.S. Army Garrison 2020, p. 16). Currently, there are two populations at Pu‘u Hāpapa and Nohonaohae, totaling 58 mature, 76 immature, and 7 seedlings (U.S. Army Garrison 2020, p. 13). The status of the population at Holoholokū, lasted surveyed in 1982, is unknown.

- In 2019, the Service published an amendment to the 1994 Recovery Plan for *Lipochaeta venosa* and *Isodendrion hosakae* (USFWS 2019). In 1994, to be considered for downlisting, the criteria for *I. hosakae* included control of identified threats and that plants must be present at Sites #1-6 located on Parker Ranch. The 2019 amendment criteria are aligned with standards provided based on the subspecies' life history and reproductive biology as described in the Hawai‘i and Pacific Plants Recovery Coordinating Committee's revised recovery objective guidelines (HPPRCC 2011; see Table 1). The downlisting objective of "identified threats must be controlled" has not changed. The downlisting objective of "must be present at Sites #1-6 located on Parker Ranch" is replaced by the criterion of 5 to 10 populations of 500 individuals each in protected (ungulate-free), suitable habitat. The downlisting objectives that specifies that there be "complete genetic storage," and "naturally reproducing populations at all six sites maintained for 10 years" has been changed to 5 to 10 populations, but otherwise the content remains the same.

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i 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. This assessment concluded that *Isodendrion hosakae* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.827 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). In addition, this species has no overlap between current and future climate envelopes, and is unlikely to tolerate expected changes in climate at its current location. This means that this species must persist within suitable microrefugia, or move to newly available climate-compatible areas to avoid extinction. Therefore, additional management actions may be needed to conserve *I. hosakae* into the future, such as identifying suitable microsites where climate change is anticipated to occur more slowly and considering suitable habitat in areas outside of its known range

New Management Actions:

- Surveys and inventories—The U.S. Army Garrison monitors *Isodendrion hosakae* at Pōhakuloa Training Area (PTA) (U.S. Army Garrison 2010, 213 pp.). PTA

reported conducting 42 surveys from 2011 to 2015 to assess the status of *I. hosakae* (U.S. Army Garrison 2020, p. 13).

- Ungulate monitoring and control—Fenced management units at Puu Nohonaohae and Pu‘u Pāpapa on PTA protect wild populations of *I. hosakae* (U.S. Army Garrison 2010, p. 2-48).
- Nonnative plant control—Control of nonnative plants is conducted within all fenced units at PTA (U.S. Army Garrison 2020, p. 16).
- Captive propagation for genetic storage and reintroduction—
    - In 2013, PTA reported collection of 29 seeds for genetic storage representing nine founders from one management unit (U.S. Army Garrison 2013, p. 14). In 2019, 454 seeds were collected representing 16 founders (U.S. Army Garrison 2020, p. 35).
    - There were 454 seeds collected for storage from plants at Puu Pāpapa in 2019 (U.S. Army Garrison 2020, pp. 60–61).
    - PTA conducted 47 germination trials of 480 seeds from *I. hosakae*, and reported that seeds germinated readily, with greater than 52 percent germination (U.S. Army Garrison 2020, pp. 40–41). Longevity of seeds is estimated to be four years (U.S. Army Garrison 2013, p. 16).
    - The Volcano Rare Plant Facility (VRPF) reported one plant in refugia representing one founder from Puu Pāpapa from 2012 through 2017 (VRPF 2019).
- Reintroduction—
    - PTA reported no reintroduction efforts in 2013 (U.S Army Garrison 2013, p. 16).
    - In 2017, PTA developed the Genetic Conservation and Outplanting Plan, with the focus on establishing a new reintroduction site (U.S. Army Garrison 2020, p. 47).
    - PTA assessed previous reintroduction sites and found that at Pu‘uwa‘awa‘a 14 mature and one immature plant survive, 2 mature plants survive at West Hawaii Veteran’s Cemetery, and 3 mature plants remain at ASR (U.S. Army Garrison 2020, pp. 48–49).

Table 1. Status and trends of *Isodendrion hosakae* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1991 (listing)	ca 275	0	All threats managed at all 6 sites on Parker Ranch lands	Partially, one area fenced
			Complete genetic storage	No
			Naturally reproducing populations at all 6 sites	No

			Maintained for 10 years	No
1994 (recovery plan)	few dozen	0	All threats managed at all 6 sites on Parker Ranch lands	Partially, one area fenced
			Complete genetic storage	Partially
			Naturally reproducing populations at all 6 sites	No
			Maintained for 10 years	No
2003 (critical habitat)	ca 218	0	All threats managed at all 6 sites on Parker Ranch lands	Partially, one area fenced
			Complete genetic storage	Partially
			Naturally reproducing populations at all 6 sites	No
			Maintained for 10 years	No
2012 (5-year review)	871	Unknown	All threats managed at all 6 sites on Parker Ranch lands	Partially, two populations fenced; fire management plan
			Complete genetic storage	Partially
			Naturally reproducing populations at all 6 sites	No
			Maintained for 10 years	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**

2020 (5-year review)	134	19 remain	All threats managed in all 3 populations	Partially, 2 populations fenced; fire management plan
			Complete genetic storage	Partially
			Reproduction (i.e. viable seeds, seedlings, saplings) at all 3 populations	Partially, 7 seedlings observed at 1 population
			3 populations with 50 mature individuals each	No

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second stage after Preventing Extinction).

Table 2. Threats to *Isodendrion hosakae* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat	A, E	Ongoing	Partial, 2 populations fenced
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, nonnative plant control efforts in fenced areas
Fire destruction and degradation of habitat	A	Ongoing	Partial, PTA fire management plan
Agriculture and urban development	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Predation and herbivory by invertebrates	C	Ongoing	None
Lack of adequate hunting regulations	D	Ongoing	Partial, 2 populations within exclosures
Military activities	E	Ongoing	Partial, military activities monitored for effects to species

Reduced viability due to low numbers	E	Ongoing	Partial, collection, storage, and reintroduction

Synthesis:
Currently, there are two populations of *Isodendrion hosakae* totaling 134 individuals on the island of Hawai‘i. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *I. hosakae* is highly vulnerable to the effects of climate change and has no overlap between current and future climate envelopes. All known wild and reintroduced individuals are provided protection from feral ungulates by fencing. Some nonnative plant control is ongoing within exclosures. Seed collection, propagation, and reintroduction are ongoing, with some recruitment in at least one area (seven seedlings).

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for *Lipochaeta venosa* and *Isodendrion hosakae* (USFWS 1994), and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Isodendrion hosakae is a short-lived perennial shrub. To prevent extinction, which is the first milestone in recovering the species, the taxon must be managed to control threats (e.g., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections that are well managed. In addition, a minimum of three populations should be documented on the island of Hawai‘i where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings), with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There are two populations totaling 134 individuals; however, recruitment is reported at only one (Table 1). Genetic representation is partially complete with at least 16 founders represented (Table 1). In addition, not all threats are being managed (Table 1, Table 2). Therefore, *Isodendrion hosakae* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

There are no new threats or other significant new information regarding the species' biological status since the last 5-year review in 2012. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2020.

- Surveys and inventories—Continue to survey historical range of *Isodendrion hosakae.*
- Site and habitat protection—Develop and implement effective measures to reduce the impacts of agriculture and cinder mining.
- Ungulate monitoring and control—Continue to construct, maintain, and monitor exclosures to protect individuals from the negative impacts of feral ungulates.
- Ecosystem-altering invasive plant monitoring and control—Continue to control nonnative invasive plant species and those that degrade and destroy habitat and that compete with *I. hosakae* within exclosures.
- Fire protection—Continue to improve and implement the fire management plan developed for PTA.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for its recovery.
- Predation and herbivory by invertebrates—Determine effects of invertebrates and develop and implement effective control methods within the vicinity of all known *I. hosakae* populations if necessary.
- Captive propagation for genetic storage and reintroduction—
    - Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
    - Keep close track of maternal source used for *ex situ* propagation.
- Reintroduction and translocation—Identify suitable reintroduction sites and continue to establish new populations in historical and other suitable habitat, and augment wild populations on the island of Hawai‘i.
- Population biology research—Carry out studies to determine the pollination biology and seed dispersal mechanisms of the species.
- Alliance and partnership development—Continue to work with the U.S. Army Garrison at PTA, the Department of Hawaiian Home Lands, and other partners and land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

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 Hawai‘i at Hilo, Hawai‘i. 134 pp.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

U.S. Army Garrison. 2010. Integrated natural resources management plan 2010-2014, Island of Hawai‘i, Pōhakuloa. Prepared for the Directorate of Public Works, Environmental Division, Natural Resources Section by the Center for Environmental Management of Military Lands, Colorado State University, Fort Collins, Colorado. 213 pp.

U.S. Army Garrison. 2013. Memorandum: FY 2012 annual report for the Natural Resources Office, Pōhakuloa Training Area, Island of Hawai‘i, Department of the Army, Headquarters, U.S. Army Garrison, Pōhakuloa, Hilo, HI 26 pp.

U.S. Army Garrison. 2020. 2019 annual report for Pōhakuloa Training Area, Hawai‘i Island, Hawai‘i. Recovery Permit TE-40123A-2. Prepared by Colorado State University, Center for Environmental Management and Military Lands. 190 pp.

[USFWS] U.S. Fish and Wildlife Service. 1994. Recovery plan for *Lipochaeta venosa* and *Isodendrion hosakae*. Portland, OR 42 pp. + appendices.

[USFWS] 2012. *Isodendrion hosakae* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4080.pdf.*

[USFWS] 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. 88 FR 20088, May 7, 2018.

[VRPF] Volcano Rare Plant Facility. 2019. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Isodendrion hosakae*
(aupaka)

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

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

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