

*Isodendrion hosakae*  
(Aupaka)

**5-Year Review  
Summary and Evaluation**

**U.S. Fish and Wildlife Service  
Pacific Islands Fish and Wildlife Office  
Honolulu, Hawaii**

**5-YEAR REVIEW**  
**Species reviewed: *Isodendrion hosakae* (Aupaka)**

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**5-YEAR REVIEW**  
***Isodendrion hosakae* (Aupaka)**

**1.0 GENERAL INFORMATION**

**1.1 Reviewers**

**Lead Regional Office:**

Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia,  
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**Lead Field Office:**

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808)  
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**Cooperating Field Office(s):**

N/A

**Cooperating Regional Office(s):**

N/A

**1.2 Methodology used to complete the 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 8, 2010. The review was based on the designation of critical habitat for *Isodendrion hosakae* and the recovery plan for *Lipochaeta venosa* and *Isodendrion hosakae* (USFWS 2003, 1994), as well as a review of current, available information. The Bernice Pauahi Bishop Museum 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 Samuel Aruch, biological consultant, was reviewed by a recovery biologist and the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

**1.3 Background:**

**1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

### 1.3.2 Listing history

#### Original Listing

**FR notice:** USFWS. 1991. Endangered and threatened wildlife and plants; *Isodendrion hosakae* (aupaka), a Hawaiian plant listed as Endangered; final rule. Federal Register 56(9):1454-1457.

**Date listed:** January 14, 1991

**Entity listed:** Species

**Classification:** Endangered

#### Revised Listing, if applicable

**FR notice:** N/A

**Date listed:** N/A

**Entity listed:** N/A

**Classification:** N/A

### 1.3.3 Associated rulemakings:

USFWS. 2003. Endangered and threatened wildlife and plants; final designation and nondesignation of critical habitat for 46 plant species from the island of Hawaii, Hawaii; final rule. Federal Register 68(127):39624-39761.

Critical habitat was designated for *Isodendrion hosakae* in six units totaling 244 hectares (603 acres) on Hawaii Island. These designations include habitat on private lands (USFWS 2003).

### 1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:  
Undetermined

#### **Recovery achieved:**

1 (0-25%) (FY 2007 Recovery Data Call)

### 1.3.5 Species' Recovery Priority Number at start of this 5-year review:

5

### 1.3.6 Current Recovery Plan or Outline

**Name of plan or outline:** USFWS. 1994. Recovery plan for *Lipochaeta venosa* and *Isodendrion hosakae*. U.S. Fish and Wildlife Service, Portland, Oregon. 42 pages + appendices. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.

**Date issued:** May 23, 1991

**Dates of previous revisions, if applicable:** N/A

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

*Yes*

*No*

2.1.2 Is the species under review listed as a DPS?

*Yes*

*No*

2.1.3 Was the DPS listed prior to 1996?

*Yes*

*No*

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

*Yes*

*No*

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

*Yes*

*No*

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

*Yes*

*No*

### 2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

*Yes*

*No*

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

*Yes*

*No*

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?**

*Yes*  
 *No*

**2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**

A synthesis of the threats (Listing Factors A, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Downlisting and delisting objectives are provided in the recovery plan for *Lipochaeta venosa* and *Isodendrion hosakae* (USFWS 1994). For downlisting, identified threats must be controlled and *Isodendrion hosakae* must be present at all six Parker Ranch sites where the species occurred (as identified in the recovery plan). Each site must contain naturally reproducing populations that include seedlings, juveniles, and adults, with an age distribution allowing for a stationary or growing population size. These populations should be maintained for at least 10 years. Activities that must be completed include: construction and maintenance of ungulate-proof fences around each population; establishment of firebreaks and development of a fire response and suppression plan for Parker Ranch; establishment of a germ plasm reserve; control of fountain grass and restoration of native habitat; and successful expansion of the species to all six Parker Ranch sites where the species occurred.

This recovery objective has not been met.

Delisting objectives for *Isodendrion hosakae* was not developed because it was not foreseen at the time the recovery plan was written (USFWS 1994). Largely due to the continuation of ranching, cinder mining, and the nearly complete destruction of the native vegetation have left only small remnants of habitat for *I. hosakae*.

**2.3 Updated Information and Current Species Status**

**2.3.1 Biology and Habitat**

**2.3.1.1 New information on the species' biology and life history:**

*Isodendrion hosakae* is a short-lived perennial species. No evidence presently exists for vegetative reproduction (Center for the Environmental Management of Military Lands [CEMML] 2003a). Flowering is known from November through July, whereas fruiting is known from March through July (Arnett 2002; Bishop Museum 2011; National Tropical Botanical Garden 2011). The species evidently was seen rooted in the

crowns of other plant species (Cuddihy *et al.* 1982). A specimen at Bishop Museum (Bishop Museum 2011; *C. Corn s.n.* [Bishop Museum specimen no. 770750]) indicates that the flowers last about 4 to 5 days and emit a sweet fragrance during the day and night. The combination of having a sweet floral fragrance and white flower is considered a pollination syndrome for moths (CEMML 2003a). However, the pollination and seed dispersal mechanisms remain unknown for the species.

**2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:**

In January 1980, a specimen was collected from a single individual seen by the collector on Nohonaohae cinder cone (*Corn s.n.* [Bishop Museum 2011]), but an additional 10 individuals were said to have been observed about 100 feet (30 meters) higher on the cone by Gar Clarke. Cuddihy *et al.* (1982) summarized the number of populations nearly thirty years ago, including its initial “rediscovery” on Nohonaohae cinder cone in 1980 after its description by St. John (1952). Shortly thereafter the population at Puu Papapa was said to have “excellent vigor,” and seedlings were present when it was collected by Clarke and Nagata in 1982 (USFWS 1994; Bishop Museum 2011).

Arnett (2002) reported 871 individuals located across 101 global positioning system (GPS) “points,” referring to sites where latitude and longitude readings were taken during surveys at Pohakuloa Training Area, located in Areas of Species Recovery units 71 and 72 (U.S. Army Garrison 2007). Of these two units, a single individual of *Isodendrion hosakae* occurred in Areas of Species Recovery unit 71, which was fenced. The remaining 870 individuals occurred in Areas of Species Recovery unit 72, which was unfenced, but 5 percent of which was then under weed control (U.S. Army Garrison 2007).

CEMML (2003) reported three known populations, one of which was said to occur on Parker Ranch lands based on a report by Cuddihy *et al.* (1982). When critical habitat was finalized (USFWS 2003), the species was still known from only three populations, all on private lands. According to CEMML (2003), the known populations occurred on Nohonaohae Cinder Cone and Puu Papapa, with an estimated total of 523 individuals occurring on the “off-road mounted maneuver areas” (CEMML 2003a). Surveys for additional populations at Pohakuloa Training Area were put on hold due to ongoing environmental impact statement litigation (U.S. Army Garrison 2007).

The population on Puu Papapa Crater on Parker Ranch lands was still extant in 2005, when a specimen was collected by Steve Perlman (National Tropical Botanical Garden 2011).

The population of *Isodendrion hosakae* at Puu Nohonaohae in the Keamuku parcel was unaffected by the wildfire that occurred north of the parcel in 2007. The Plant Extinction Prevention Program (2007) reported 709 individuals at Holoholoku that evidently were last counted in 1982. The Plant Extinction Prevention Program (2007) reported 90 individuals occurring at 2,977 meters (9,767 feet) elevation on an unnamed “Puu” (cinder cone); likewise evidently last observed in 1982.

In the most current estimate, the Plant Extinction Prevention Program (2010) reported three populations of *Isodendrion hosakae* totaling 871 individuals, which suggest that no recent information has been collected from the field since the study by Arnett (2002).

#### **2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**

The chromosome number is unknown for *Isodendrion hosakae*, although the haploid number of  $n = 8$  was reported for two Hawaiian species by Carr (1985). Tokuoka (2008) included two species of *Isodendrion* in a molecular phylogenetic analysis of Violaceae and found them to be sister to a clade of four species of *Hybanthus*, although *I. hosakae* was not among the species sampled. Dr. Harvey Ballard (Ohio University, pers. comm. 2011), who has studied Violaceae in Hawaii, indicated that no recent studies have been carried out on *I. hosakae*.

#### **2.3.1.4 Taxonomic classification or changes in nomenclature:**

*Isodendrion hosakae* is a branched shrub from the violet family (Violaceae). The species was originally described by St. John (1952) based on specimens collected by Edward Hosaka in 1948 and 1949 (Arnett 2002). There are no known synonyms associated with the species (Wagner *et al.* 1999).

#### **2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):**

No new information.



### **2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**

The historical range of *Isodendrion hosakae* is uncertain, given that it was only first collected and described about fifty years ago and that by then most of the native vegetation in the general area had been converted to pasture or other uses (CEMML 2003a). USFWS (1994) noted that it was reasonable to assume that the former range included populations between the three sites where the species presently occurs.

*Isodendrion hosakae* occurs in dry shrubland and grasslands from 900 to 1,030 meters (2,953 to 3,379 feet) elevation on three cinder cones in the South Kohala district on Hawaii Island (Wagner *et al.* 1999; Arnett 2002; USFWS 2003). These areas are associated with the soil groups ustollic eutrandedpts and mollic vitrandrepts (Hawaii Biodiversity and Mapping Program 2010) that form over ash or pahoehoe rubble (Arnett 2002).

The most complete summary of species associated with *Isodendrion hosakae* on the cinder cones of South Kohala is provided in Cuddihy *et al.* (1982). The habitats of *I. hosakae* are dominated by *Dodonaea viscosa* (aalii), *Sida fallax* (ilima), *Eragrostis atropioides* (no common name [NCN]), *Leptecophylla tameiameiae* (pukiawe), *Melanthera venosa* (nehe), *Wikstroemia phillyreifolia* (akia), *Santalum paniculatum* (iliahi), *Chenopodium oahuense* (aweoweo), *Bidens menziesii* (kookoolau), *Ipomoea indica* (koali awa), *Carex wahuensis* var. *rubiginosa* (NCN), and *Osteomeles anthyllidifolia* (ulei) (Wagner *et al.* 1999; Arnett 2002; USFWS 2003; U.S. Army Garrison 2007; Bishop Museum 2011; National Tropical Botanical Garden 2011). Another rare species, *Lipochaeta viscosa*, occurs in the area of the Nohonaohae cinder cone population (Cuddihy *et al.* 1982; U.S. Army 2009).

### **2.3.1.7 Other:**

No new information.

## **2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

### **2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:**

#### **Threats:**

- Ungulate degradation of habitat – Cattle (*Bos taurus*) (CEMML 2003a)

- Established ecosystem-altering invasive plant species degradation of habitat (Arnett 2002; CEMML 2003a; USFWS 2003)
  - *Lantana camara* (lantana)
  - *Pennisetum setaceum* (fountain grass)
  - *Senecio madagascariensis* (fireweed)
- Agricultural and urban development – Cinder mining (Arnett 2002; CEMML 2003a; USFWS 2003)

**Current conservation efforts:**

- Ungulate exclosure:
  - A fenced exclosure was constructed at the Keamuku parcel to protect *Isodendrion hosakae* from cattle (CEMML 2003a; U.S. Army Garrison 2007).
  - At Pohakuloa Training Area, a single individual of *I. hosakae* in Areas of Species Recovery unit 71 is fenced (U.S. Army Garrison 2007).

**2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:**

None reported.

**2.3.2.3 Disease or predation:**

**Threats:**

- Ungulate predation or herbivory – Cattle (*Bos taurus*) (Arnett 2002; CEMML 2003a; USFWS 2003)
- Invertebrate predation or herbivory – Insect damage on the shoots and leaves was identified at the Nohonaohae cinder cone population, but no further reports of insect damage have been made (Cuddihy *et al.* 1982).

**2.3.2.4 Inadequacy of existing regulatory mechanisms:**

**Threats:**

- Lack of adequate hunting regulation in areas with ungulates – The lack of adequate ungulate control and the existence of established hunting programs in areas where *Isodendrion hosakae* occurs continue to threaten this species.

**2.3.2.5 Other natural or manmade factors affecting its continued**

**existence:**

**Threats:**

- Ungulate trampling (CEMML 2003a)
- Fire (Arnett 2002; CEMML 2003a; USFWS 2003)
- Military activities – Dust, military maneuvers, and newly invasive introduced plant species brought by military vehicles or the clothing of personnel (Arnett 2002; CEMML 2003a; USFWS 2003)
- Climate change may pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

**Current conservation efforts:**

- Captive propagation for genetic storage and reintroduction:
  - Attempts to grow *Isodendron hosakae* from seed and cuttings have had meager success (USFWS 1994). In 1994, two individuals were reported in cultivation at the University of Hawaii Lyon Arboretum (USFWS 1994).
  - Arnett (2002) reported that seeds had been successfully germinated, but did not specify where or how many were germinated, or under what conditions.
  - The U.S. Army Garrison (2007) reported that no source material was on hand for attempts at propagation.
- Threats research – Although CEMML (2003a) recommended studying the effects of dust on *I. hosakae*, it might be better to postpone any such study until the number of individuals and populations is greatly increased, since the loss of any individuals to experimental procedure at this time is undesirable.
- Fire protection – In 2003, the Pohakuloa Training Area completed an Integrated Wildland Fire Management Plan to reduce the threat of wildfires (CEMML 2003b). In June 2012, Pohakuloa Training Area drafted a revision of their 2003 Integrated Wildland Fire Management Plan (CEMML 2012).

## 2.4 Synthesis

The downlisting goals (USFWS 1994) for this species have not been met, as not all populations are managed to control threats (*e.g.*, fenced, invasive species controlled, etc.) (Table 2) and are represented in an *ex situ* (such as a nursery or arboretum) collection. In addition, all sites at Parker Ranch do not contain naturally reproducing populations that include seedlings, juveniles, and adults. Likewise, these populations were not secured and maintained for at least 10 years. Therefore, *Isodendron hosakae* meets the definition of endangered as it remains in danger of extinction throughout its range.

**Table 1. Status of *Isodendron hosakae* from listing through 5-year review.**

<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>Downlisting Criteria identified in Recovery Plan</b>	<b>Downlisting Criteria Completed?</b>
1991 (listing)	275	0	All threats managed at all six sites on Parker Ranch lands	No
			Complete genetic storage	No
			Naturally reproducing populations at all six sites	No
			Maintained for 10 years	No
1994 (recovery plan)	~36	0	All threats managed at all six sites on Parker Ranch lands	No
			Complete genetic storage	Partially
			Naturally reproducing populations at all six sites	No
			Maintained for 10 years	No
2003 (critical habitat)	523	0	All threats managed at all six sites on Parker Ranch lands	No
			Complete genetic storage	Partially
			Naturally reproducing populations at all six sites	No
			Maintained for 10 years	No
2012 (5-year review)	871	0	All threats managed at all six sites on Parker	Partially (See Table 2)

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
			Ranch lands	
			Complete genetic storage	Partially
			Naturally reproducing populations at all six sites	No
			Maintained for 10 years	No

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat, herbivory, trampling	A, C, D, E	Ongoing	Partially: Ungulate exclosure at Keamuku parcel and Pohakuloa Training Area
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Agricultural and urban development – Cinder mining	A	Ongoing	No
Invertebrate predation or herbivory	C	Ongoing	No
Fire	E	Ongoing	No
Military activities	E	Ongoing	No
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction
Climate change	A, E	Increasing	No

### 3.0 RESULTS

#### 3.1 Recommended Classification:

**Downlist to Threatened**

**Uplist to Endangered**

**Delist**

*Extinction*

*Recovery*

*Original data for classification in error*

**No change is needed**

### 3.2 New Recovery Priority Number:

**Brief Rationale:**

### 3.3 Listing and Reclassification Priority Number:

**Reclassification (from Threatened to Endangered) Priority Number: \_\_\_\_\_**

**Reclassification (from Endangered to Threatened) Priority Number: \_\_\_\_\_**

**Delisting (regardless of current classification) Priority Number: \_\_\_\_\_**

**Brief Rationale:**

## 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Captive propagation for genetic storage and reintroduction :
  - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation and genetic storage.
  - Collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.
- Reintroduction / translocation site identification – Reintroduce the species into other areas of its native range or in similar habitats.
- Reintroduction / translocation site identification – Reintroduction attempts should be made at known historical sites such as Nohonaohae cinder cone, Puu Papapa, and within Pohakuloa Training Area that are free from ungulates (fenced) and introduced invasive plant species.
- Reintroduction / translocation implementation – Reintroduce the species back into known historical sites.
- Fire protection – Develop and implement a fire management plan for all populations.
- Ungulate exclosures:
  - Monitor the structural integrity of currently existing fences and for any evidence of ungulates breaching the fences.
  - Continue to construct fenced exclosures around all populations
- Ungulate control – Protect all populations against browsing, trampling, and disturbances from feral ungulates.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Surveys / inventories – Re-survey the known historical range of the species for surviving populations and potentially undiscovered populations.

- Population biology research – Carry out studies to determine the pollination biology and seed dispersal mechanism of the species.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impacts of agricultural and urban development (cinder mining) and military activities.
- Threat monitoring and control – Monitor the health of existing populations and determine if any insects or plant diseases might be affecting the survival of individuals, especially the population from Nohonaohae cinder cone which already reported insect damage to the population. If threats are found, implement effective control methods.
- Alliance and partnership development – Work with the U.S. Army Garrison Pohakuloa Training Area, Department of Hawaiian Home Lands, and other land managers to continue implementation of ecosystem-level restoration and management to benefit this species.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.
- Revise recovery criteria – Update and define recovery objectives in a revised recovery plan for *Isodendrion hosakae* based on current, available scientific information.

## 5.0 REFERENCES

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**Personal Communications:**

Ballard, Harvey E. 2011. Associate Professor, Department of Environmental and Plant Biology, Ohio University, Athens, Ohio. E-mail to Neil Snow, Bernice P. Bishop Museum, dated March 4, 2011. Subject: Recent molecular studies of *Isodendrion* or *I. hosakae*.

**Signature Page**  
**U.S. FISH AND WILDLIFE SERVICE**  
**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:**

<u>          </u>	Delisting
<u>          </u>	Reclassify from Endangered to Threatened status
<u>          </u>	Reclassify from Threatened to Endangered status
<u>      X      </u>	No Change in listing status

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

**Review Conducted By:**

Chelsie Javar, Fish and Wildlife Biologist  
Marie Bruegmann, Plant Recovery Coordinator  
Jess Newton, Endangered Species Recovery Program Leader  
Assistant Field Supervisor for Endangered Species

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

*for*

  *Jess Newton*  

Date   8/28/2012