Mariscus fauriei
(No common name)

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: *Mariscus fauriei* (No common name)

TABLE OF CONTENTS

5-YEAR REVIEW
Mariscus fauriei (No common name)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

Lead Field Office:
Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 792-9400

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 final critical habitat designated for *Mariscus fauriei* and other species from the islands of Lanai, Molokai, and Hawaii (USFWS 2003a-c), 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. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 21 plants from the island of Hawaii, State of Hawaii; final rule. Federal Register 59(43):10305-10325.
Date listed: March 4, 1994
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] U.S. Fish and Wildlife Service. 2003a. Endangered and threatened wildlife and plants; final designation of critical habitat for three plant species from the island of Lanai, Hawaii; final rule. Federal Register 68(6):1220-1274.

[USFWS] U.S. Fish and Wildlife Service. 2003b. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 42 plant species from the island of Molokai, Hawaii; final rule. Federal Register 68(52):12982-13141.

[USFWS] U.S. Fish and Wildlife Service. 2003c. 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.

On Lanai, *Mariscus fauriei* was one of four taxa excluded from a proposed critical habitat designation for 32 species because the taxa were no longer extant on the island and it was impossible to determine essential habitat required for their conservation and recovery (USFWS 2003a). Subsequently, the USFWS deferred a critical habitat designation for 5,861 hectares (14,482 acres) surrounding Lanaihale (Lanai D) for the remaining 28 plant taxa because of a preexisting cooperative agreement between the USFWS and Castle and Cooke Resorts, LLC to manage the lands in proposed unit Lanai D, as well as adjacent lands, for the conservation benefit of the 28 listed species. Because large portions of proposed unit D were already being managed under the Lanai Forest and Watershed Partnership by Castle and Cooke on a voluntary basis in cooperation with the USFWS and the State of Hawaii to achieve important conservation goals, and critical habitat designation threatened to reduce the landowner's cooperation, it

was decided that the benefits of excluding unit Lanai D from critical habitat designation outweighed the costs (USFWS 2003a).

Critical habitat was designated for *Mariscus fauriei*, a multi-island species, on Molokai in two units totaling 316 hectares (780 acres) on State and private lands (USFWS 2003b), and on Hawaii Island in a single unit of 127 hectares (313 acres) on State lands (USFWS 2003c).

[USFWS] U.S. Fish and Wildlife Service. 2012. U.S. Fish and Wildlife Service: 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. Federal Register 77(112):34464-34775.

Critical habitat revisions are being proposed for *Mariscus fauriei* (USFWS 2012).

1.3.4 Review History:
Species status review [FY 2010 Recovery Data Call (August 2010)]: 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:
14

1.3.6 Current Recovery Plan or Outline
Name of plan or outline: USFWS. 1996. Recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 176 pages + appendices. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.
Date issued: September 26, 1996
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***
__X__ ***No***

2.1.2 Is the species under review listed as a DPS?
____ ***Yes***
__X_ ***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***
__X_ ***No***

2.2 Recovery Criteria

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

__X_ ***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?

__X_ ***Yes***
____ ***No***

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

__X_ ***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.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Big Island plant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial.

Mariscus fauriei is a short-lived perennial, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on Hawaii Island. For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

This recovery objective has been partially met.

For downlisting, a total of five to seven populations of *Mariscus fauriei* should be documented on the island of Hawaii and at least one other island where it now occurs or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Mariscus fauriei* should be documented on the island of Hawaii and at least one other island where it now occurs or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 300 mature individuals per population for long-lived perennials. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

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:

No new information.

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:

Historically, *Mariscus fauriei* was found on Molokai, Lanai, and the island of Hawaii (USFWS 2003a). It currently occurs on Molokai and Hawaii Island. It was last seen on Lanai in 1929 (USFWS 1996; 2003a). While

census numbers on Hawaii Island and Lanai have remained relatively unchanged, surveys on Molokai in the 1990s and 2000s, primarily conducted by National Tropical Botanical Garden staff (National Tropical Botanical Garden 2010), have discovered populations of *Mariscus fauriei* on dissected leeward slopes and gulches of eastern Molokai between 777 and 975 meters (2,550 and 3,200 feet) elevation, ranging from Onini Gulch in the west to Kua Gulch in the east, as well as a population in upper Waihanau Valley, located on the windward side south of Kalaupapa peninsula, within the Kalaupapa National Historical Park. A particularly dense population occurs east of the east fork of Kawela Gulch (Hank Oppenheimer, Plant Extinction Prevention Program, pers. comm., 2010). While no solid population numbers have been recorded in the collection data, the species is described variously as "occasional," "locally common," "common," or "abundant" on collections made in different gulch systems (National Tropical Botanical Garden 2010), suggesting that population numbers were too large to bother counting individuals.

Current estimates of *Mariscus fauriei* through informal communications range from 2,000 to as many as 10,000 individuals (H. Oppenheimer, pers. comm. 2010; Ken Wood, National Tropical Botanical Garden, pers. comm. 2010). Whether the individuals located on the southern slopes of Molokai represent discrete population's remains to be determined, and could be addressed with a comprehensive survey. The Kua Gulch population, for instance, might be considered separate, as it occurs to the east of the highly degraded Kamalo Gulch (K. Wood, pers. comm. 2010), and it is probable that there are gaps in the species' presence along the south slope, suggesting the possibility of adjacent but separate populations (H. Oppenheimer, pers. comm. 2010). As of 2010,there were three known populations of *M. fauriei*: two small populations on Hawaii Island at Kamaoa-Puueo and Kaloko totaling 17 individuals, and a single large population on Molokai estimated to number in the thousands (USFWS 2010).

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

No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature:

Mariscus fauriei is a short-lived perennial sedge (Cyperaceae) endemic to eastern Molokai, northwestern and southwestern Lanai, and the northern slope of Hualalai and northwestern and southernmost slopes of Mauna Loa on Hawaii Island (Wagner *et al*. 1999; USFWS 1994). First collected at Kamalo on Molokai in 1910, it was described in 1920 as *Cyperus fauriei* by G. Kukenthal (USFWS 1996). In Wagner *et al*. (1999), T. Koyama

segregated it and 11 other *Cyperus* species into the genus *Mariscus*, and the species was federally listed in 1994 under the name *Mariscus fauriei* (USFWS 1994). Strong and Wagner (1997), acknowledging a trend among sedge taxonomists to apply a broad circumscription to the genus *Cyperus* (e.g., Tucker 1994), accepted the synonymization of the genus *Mariscus* back into *Cyperus* for Hawaiian taxa. Therefore, the taxa will be referred to as *Cyperus fauriei* for the remainder of this review.

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):

On Molokai, *Cyperus fauriei* historically has been associated with *Diospyros sandwicensis* (lama)-dominated lowland dry forests, often on lava substrates, between 436 and 1,120 meters (1,430 and 3,673 feet) elevation. Other plant species associated with *C. fauriei* are *Peperomia* sp. (alaala wai nui), *Psydrax odorata* (alahee), and *Rauvolfia sandwicensis* (hao) (USFWS 2003b). Collections in the past 20 years have been made primarily in mesic to wet *Metrosideros polymorpha* (ohia) shrubland or forest associated with *Dodonaea viscosa* (aalii), *Leptecophylla tameiameiae* (pukiawe), *Myrsine* sp. (kolea), *Nestegis sandwicensis* (olopua), *Eragrostis* sp. (no common name), *Dicranopteris linearis* (uluhe), *Melicope* sp. (alani), *Pleomele* sp. (halapepe), and *Bidens* sp. (kookoolau), sometimes on steep talus slopes (Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010).

Nothing is known of the preferred habitats or associated species of *Cyperus fauriei* on the island of Lanai (USFWS 2003a).

On Hawaii Island, the preferred historic habitat of *Cyperus fauriei* is lowland dry forest, often on a lava substrate, dominated by *Diospyros sandwicensis*, *Metrosideros polymorpha*, and *Sapindus saponaria* (manele), associated with *Myoporum sandwicense* (naio), *Osteomeles anthyllidifolia* (ulei), *Peperomia blanda* var. *floribunda* (alaala wai nui), *Psydrax odorata*, *Rauvolfia sandwicensis*, and *Sophora chrysophylla* (mamane), between 278 and 342 meters (913 and 1,123 feet) elevation (USFWS 2003c). The Kamaoa-Puueo population grows in forest dominated by *Diospyros sandwicensis* and *Psydrax odorata*, associated with *Rauvolfia sandwicensis*, *Senna gaudichaudii* (kolomona), and *Peperomia blanda* var. *floribunda* (National Tropical Botanical Garden

2010). The Kaloko population occurs at a lower elevation (116 meters [380 feet]) in dry *Metrosideros* forest on a gently sloping aa flow, associated with *Reynoldsia sandwicensis* (ohe makai), *Psydrax odorata*, *Sophora chrysophylla*, *Myoporum sandwicense*, and *Bidens micrantha* subsp. *ctenophylla* (kookoolau); it is described as five individuals growing on a single boulder (National Tropical Botanical Garden 2010).

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
    - On Molokai (USFWS 1994, 1996, 2003b; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010; H. Oppenheimer, pers. comm. 2010)
        - Feral goats (*Capra hircus*)
        - Axis deer (*Axis axis*)
        - Pigs (*Sus scrofa*)
    - On Hawaii Island – Feral goats (USFWS 2002)
- Established ecosystem-altering invasive plant species degradation of habitat
    - On Molokai(USFWS 1994, 1996, 2003b; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010; H. Oppenheimer, pers. comm. 2010)
        - *Ageratina adenophora* (Maui pamakani)
        - *Andropogon virginicus* (broomsedge)
        - *Erigeron karvinskianus* (daisy fleabane)
        - *Lantana camara* (lantana)
        - *Macroptilium* spp.
        - *Melinis minutiflora* (molasses grass)
        - *Pinus* spp.

        - *Psidium cattleianum* (strawberry guava)
        - *Rubus argutus* (blackberry)
        - *Rubus rosifolius* (thimbleberry)
        - *Schinus terebinthifolius* (Christmasberry)
    - On Hawaii Island (USFWS 1994, 2002; National Tropical Botanical Garden 2010)
        - *Leucaena leucocephala* (koa haole)
        - *Oplismenus hirtellus* (basketgrass)
        - *Pennisetum setaceum* (fountain grass)
        - *Schinus terebinthifolius*
- Agricultural and urban development – At Kaloko on Hawaii Island (National Tropical Botanical Garden 2010)

Current conservation efforts:

- Ungulate exclosures – Castle and Cooke is constructing approximately 35 kilometers (22 miles) of fencing around Lanaihale to control the depredations of feral axis deer. The fence will be completed in three increments. The first increment is completed and the second increment is well under construction (H. Oppenheimer, pers. comm. 2010). Reintroduction of Molokai material of *Cyperus fauriei* in appropriate habitats within the fenced sites is a possibility.

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

Not considered a threat.

2.3.2.3 Disease or predation:

Threats:

- Ungulate predation or herbivory
    - On Molokai (USFWS 1994, 1996, 2003b; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010; H. Oppenheimer, pers. Comm. 2010)
        - Feral goats
        - Axis deer
    - On Hawaii Island – Feral goats (USFWS 2002)

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 *Cyperus fauriei* occurs continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Ungulate trampling – On Molokai (USFWS 1994, 1996, 2003b; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010; H. Oppenheimer, pers. Comm. 2010):
    - Feral goats
    - Axis deer
    - Pigs
- Landslides and flooding – On Molokai (USFWS 1994, 1996, 2003b; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010; H. Oppenheimer, pers. comm. 2010); not reported as a threat on Hawaii Island.
- Established invasive plant species competition – On Molokai (Hawaii Biodiversity and Mapping Program 2010)
    - *Buddleia asiatica* (dog tail)
    - *Eucalyptus robusta* (swamp mahogany)
    - *Pinus elliotti* (slash pine)
    - *Fraxinus uhdei* (tropical ash)
- Fire – On Molokai (USFWS 1994, 1996, 2003b; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2010; H. Oppenheimer, pers. comm. 2010)); not reported as a threat on Hawaii Island.
- 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:

There are no reports of controlled propagation of this species, nor any genetic seed storage, by the Center for Conservation Research and Training Seed Storage Laboratory (2010), the Volcano Rare Plant Facility (2011), or National Tropical Botanical Garden (2011).

2.4 Synthesis

The interim stabilization goals for this species have only been partially met. The taxon numbers are apparently in the thousands, but there are only three or four populations on Molokai and Hawaii Island, with only a single large population numbering in the thousands on Molokai (Table 1). In addition, not all threats are being managed (Table 2). Therefore, *Cyperus fauriei* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Cyperus fauriei* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1994 (Listing)	33-43	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1996 (Recovery plan)	45-60	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (5-year review)	120-230	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2012 (5-year review)	>1,017	0	All threats managed in all 3 populations	Partially (see Table 2)
			Complete genetic storage	No
			3 populations with 50 mature individuals each	Partially

Table 2. Threats to *Cyperus fauriei* 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 constructed at Lanaihale
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Agricultural and urban development	A	Ongoing	No
Fire	E	Ongoing	No
Landslides and flooding	E	Ongoing	No
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*
__X__ 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 reintroduction and storage:
    - Collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.

    - Collect seeds from all existing populations and send to at least two or three different venues for propagation and storage.
- Reintroduction / translocation site selection – Study the possibility of reintroducing material from Molokai to appropriate and protected habitats on Lanai.
- Ungulate exclosure:
    - Complete the fence at Lanaihale.
    - Construct fenced exclosures around all populations.
- Ungulate control – Protect all populations against disturbances from feral ungulates.
- Ecosystem-altering invasive plant species control – Control all invasive introduced plant species around all populations.
- Fire protection – Develop and implement fire management plans for all wild and reintroduced populations
- Site / area / habitat protection:
    - Develop and implement effective measures to reduce the impacts of agricultural and urban development.
    - Implement erosion control measures to prevent landslides and flooding.
- Federal register updates – Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.
- Surveys / inventories:
    - Because the species has a wide elevational range and can be difficult to distinguish from weedy sedges, more populations should be sought on Hawaii Island, especially in the Puu Waawaa area and slopes of Hualalai.
    - A population census and monitoring of *Cyperus fauriei* on Molokai should be undertaken to confirm current population estimates and determine how much population numbers fluctuate from year to year. For recovery purposes, there is a need to clarify how many discrete populations exist on the island.
- Alliance and partnership development – Work with Hawaii Division of Forestry and Wildlife and other land managers to initiate planning and contribute to 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.

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Wood, Ken. 2010. Research Biologist, National Tropical Botanical Garden, Kalaheo, Hawaii. E-mail to Clyde Imada, Bernice Pauahi Bishop Museum, dated November 3, 2010. Subject: *Mariscus fauriei*.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Mariscus fauriei* (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
_X_ No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable:_____

Review Conducted By:
Chelsie Javar, Fish and Wildlife Biologist
Vickie Caraway, Fish and Wildlife Biologist
Marie Bruegmann, Plant Recovery Coordinator
Jess Newton, Endangered Species Recovery Program Leader
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Date 8/28/2012