

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Mariscus pennatiformis* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 58 species in Washington, Oregon, California, and Hawaii. Federal Register 75(226):71726-71729.

Lead Region/Field Office:

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

Name of Reviewer(s):

Vickie Caraway, Plant Biologist, PIFWO

Daniel Clark, Oahu, Kauai, Northwest Hawaiian and American Samoa Islands Team Manager, PIFWO

Marie Brueggemann, 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 January 31, 2012. The review was based on a review of current, available information since the last 5-year review for *Mariscus pennatiformis* (USFWS 2010). The National Tropical Botanical Garden provided an initial draft of portions of the 5-year review and recommendations for conservation actions needed prior to the next 5-year review. The document was reviewed by the Plant Biologist, Islands Team Manager, and Plant Recovery Coordinator, followed by the Recovery Program Lead. It was then 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).

Review Analysis:

Please refer to the previous 5-year review for *Mariscus pennatiformis* published on August 27, 2010 (available at http://ecos.fws.gov/docs/five_year_review/doc3329.pdf) for a complete review of the species' status, threats, and management efforts.

Two varieties of this endangered short-lived perennial sedge are known. *Mariscus pennatiformis* var. *pennatiformis* is known from the islands of Hawaii, Maui, Oahu and Kauai and is still extant on Hawaii and Maui. *Mariscus pennatiformis* var. *bryanii* is found only on Laysan in the Papahānaumokuākea Marine National Monument,

Northwestern Hawaiian Islands. 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 *Mariscus pennatiformis*. The current status and trends for *Mariscus pennatiformis* are provided in the tables below.

New taxonomic information:

No new taxonomic information has been received since the last 5-year review (USFWS 2010). However, the 2012 supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner *et al.* 2012) reiterates the change from the genus *Mariscus* to the currently accepted *Cyperus*, and the recognition of the two former subspecies as varieties *Cyperus pennatiformis* var. *bryanii* and *C. pennatiformis* var. *pennatiformis*. In 2012, USFWS revised the taxonomic status for this species when it revised critical habitat on Oahu, with no change in range or distribution (USFWS 2012). This species is now listed as *Cyperus pennatiformis*, with var. *pennatiformis* and var. *bryanii*, and addressed as such for the remainder of this review.

New threats:

Climate change - Climate change may also 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) funded climate modeling that will help resolve these spatial limitations. High spatial resolution climate outputs are expected to be available sometime in 2013.

New status information:

- Maui Nui Plant Extinction Prevention Program (PEPP) verified that 20 individuals still remain in Nahiku on Maui (H. Oppenheimer, PEPP, pers. comm. 2012).

New management actions:

- Ecosystem-altering invasive plant species control - *Pluchea indica* (sourbush) was removed on Laysan (Farmer *et al.* 2011).
- Reintroduction / translocation - Papahānaumokuākea Marine National Monument staff reintroduced 65 individuals of *Cyperus pennatiformis* var. *bryanii* on Laysan in 2009, and 38 individuals in 2010 (Kristof and Stelmach 2009-2010). *Cyperus pennatiformis* var. *bryanii* has been actively collected, propagated, and reintroduced on Laysan since 1995, and 962 surviving individuals were counted in a 2010 survey (Kristof and Stelmach 2009-2010). An additional 187 individuals were reintroduced in 2011 (C. Rehkemper, Papahānaumokuākea Marine National Monument, pers. comm. 2012; Farmer *et al.* 2011).
- Captive propagation and genetic storage
 - Papahānaumokuākea Marine National Monument nursery on Laysan had 500 seeds of *Cyperus pennatiformis* var. *bryanii* in storage in 2010, representing 40 founders (Papahānaumokuākea Marine National Monument 2011). In 2011, Papahānaumokuākea Marine National Monument had 100 seeds of *Cyperus pennatiformis* var. *bryanii* in storage and two plants in the nursery (C. Rehkemper, pers. comm. 2012; Kristof and Stelmach 2009-2010).

- Several thousand seeds of *Cyperus pennatiformis* var. *pennatiformis* from Nahiku are in seed storage at Lyon Arboretum (H. Oppenheimer, pers. comm. 2012).
- Vegetative material of *Cyperus pennatiformis* var. *pennatiformis* is growing at Olinda Rare Plant Facility (H. Oppenheimer, pers. comm. 2012).
- Waimea Valley Arboretum has one individual of *Cyperus pennatiformis* var. *bryanii* in its nursery (Waimea Valley 2011).
- National Tropical Botanical Garden has one seed accession for *Cyperus pennatiformis* var. *bryanii* in storage from a third generation Laysan collection (National Tropical Botanical Gardens 2012), from plants grown at Waimea Valley.
- The Hanawi population of *Cyperus pennatiformis* var. *pennatiformis* is represented at Kahanu Garden, Maui; seed from 90 of these plants will be shared with the Maui Nui Plant Extinction Prevention Program (I. Cole, Kahanu Garden, National Tropical Botanical Garden pers. comm. 2012). In addition, Kahanu Garden has about 40 *Cyperus pennatiformis* var. *pennatiformis* individuals on their grounds and about 50 in their nursery. These individuals were from seed collected in 1998 in Hanawi, Maui (National Tropical Botanical Garden 1998).

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. *Cyperus pennatiformis* is a short-lived perennial and to be considered stable, the taxon must be managed to control threats 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 of Hawaii, Maui, Kauai, Laysan, or any of the islands 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 stabilization goals for this species have not been met for *Cyperus pennatiformis* var. *bryanii* or *C. pennatiformis* var. *pennatiformis* (see Table 1), as only one population of *C. pennatiformis* var. *bryanii* has the requisite number of individuals and *C. pennatiformis* var. *pennatiformis* has only one population with 20 individuals. However, while threats are being addressed for *Cyperus pennatiformis* var. *bryanii*, threats for *Cyperus pennatiformis* var. *pennatiformis* are not being sufficiently managed throughout all of the populations (Table 2). Therefore *Cyperus pennatiformis* meets the definition of endangered, as it remains in danger of extinction throughout its range.

Recommendations for Future Actions for *Cyperus pennatiformis* var. *pennatiformis*:

- Reintroduction / translocation
 - Find appropriate protected habitat for reintroduction for both varieties.
 - Reintroduce new individuals from appropriate seed sources into new sites.
- Population viability monitoring - Monitor existing wild population and any new reintroductions and manage threats.

- Ecosystem-altering invasive plant species control – Implement control of invasive introduced plant species around the Nahiku population.
- Surveys / inventories - Conduct thorough surveys of all suitable habitats where *Cyperus pennatiformis* var. *pennatiformis* was found historically.
- Existing population management and restoration - Explore possible construction of barriers to protect individuals from tree fall and landslides.
- Captive propagation for genetic storage and reintroduction
 - Collect materials for propagation whenever possible.
 - Propagate to augment existing populations, and to maintain *ex situ* populations until other appropriate areas can be protected for outplanting within historical suitable habitat.
- Threats research - Explore the use of Sluggo for control of non-native slugs around known individuals.
- Alliance and partnership development - Initiate planning and contribute to implementation of ecosystem-level management and restoration to benefit this species.

Recommendations for Future Actions for *Cyperus pennatiformis* var. *bryanii*:

- Existing population management and restoration - Continue monitoring, fence maintenance and protection program for the current wild individuals.
- Captive propagation for genetic storage and reintroduction
 - Determine additional methods to prevent Laysan finch predation for seed collection.
 - Continue to collect seeds from tagged individuals, keeping track of the maternal source for use in *ex situ* propagation.
- Reintroduction / translocation
 - Directly sow mature seed in suitable areas.
 - Continue reintroduction of the species back into its known historical range.
 - Assess Lehua Islet and other Northwest Hawaiian Islands for potential reintroduction sites.
- Invasive introduced plant species control - Control *Pluchea indica* when they begin to cover *Cyperus pennatiformis* var. *bryanii*.
- Alliance and partnership development - Continue planning and contribute to implementation of ecosystem-level management and restoration to benefit this species with the Pacific Remote Islands National Wildlife Refuge Complex and Papahānaumokuākea Marine National.

Recommendations for Future Actions for both varieties:

- Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.

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

Date	No. wild individuals (var. <i>pennatiformis</i>/ var. <i>bryanii</i>).	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1994 (listing)	Unknown/30	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1999(recovery plan)	Unknown/200	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	0/200	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2010 (5-yr review)	0/488	0/48	All threats managed in all 3 populations	Partially, var. <i>bryanii</i>
			Complete genetic storage	Partially, var. <i>bryanii</i>
			3 populations with 50 mature individuals each	Unknown
2013 (5-yr review)	20+/962	0/reintroductions not separated from wild individuals, at least 250	All threats managed in all 3 populations	Partially, for var. <i>bryanii</i>
			Complete genetic storage	Partially, for both varieties
			3 populations with 50	Partially for var.

Date	No. wild individuals (var. <i>pennatiformis</i> / var. <i>bryanii</i>).	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
			mature individuals each	<i>bryanii</i> .

Table 2. Status of threats to *Cyperus pennatiformis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Landslides and flooding - Habitat modification and plant destruction (<i>C. var. pennatiformis</i>)	A, C, E	Ongoing	None
Seed predation (<i>C. var. bryanii</i>)	A, E	Ongoing	Partially
Invasive introduced plants- both varieties.	A, E	Ongoing	Partially: ongoing removal on Laysan
Slug herbivory(<i>C. var. pennatiformis</i>)	C	Ongoing	None
Insects – mealybugs, aphids, ants on (<i>C. var. bryanii</i>)	C	Ongoing	Partially
Climate change	A, E	Increasing	None
Stochastic events	A, E		None

References:

See previous 5-year review for a full list of references (USFWS 2010). Only references for new information are provided below.

Farmer, C., R. Kohley, H. Freifeld, and S. Plentovich. 2011. Nihoa millerbird (*Acrocephalus familiaris kingi*): translocation protocols, final. USFWS – Pacific Islands Field Office. Available online at <http://www.fws.gov/pacificislands/Nihoa%20Millerbird/Millerbird%20Translocation%20Protocols%202011.pdf>. Accessed August 21, 2012.

Kristof, A.A. and M.W. Stelmach. 2009-2010. Trip report: Laysan Island 11 August 2009 - 22 March 2010. Administrative report, U.S. Fish and Wildlife Service, Honolulu, Hawaii. Unpublished.

National Tropical Botanical Garden. 2012. Seed storage inventory. Kalaheo, Hawaii. Unpublished.

Papahānaumokuākea Marine National Monument. 2011. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Honolulu, Hawaii. 2 pages. Unpublished.

[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. 2010. *Cyperus pennatiformis* (no common name) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 10 pages. Available online at http://ecos.fws.gov/docs/five_year_review/doc3329.pdf.

[USFWS] U.S. Fish and Wildlife Service. 2012. 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 77:57648-57862.

Wagner, W.L., D.H. Herbst, N. Khan, and T. Flynn. 2012. Hawaiian vascular plant updates: a supplement to the manual of the flowering plants of Hawaii and Hawaii's ferns and fern allies, version 1.3. Available online at http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/Hawaiian_vascular_plant_updates_1.3.pdf. Accessed August 21, 2012.

Waimea Valley. 2011. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Waimea, Hawaii. 15 pages. Unpublished.

Personal Communications:

Cole, Ian. 2012. Curator, National Tropical Botanical Garden, Kahanu, Maui. Phone call to Margaret Clark, National Tropical Botanical Garden, Kalaheo, Kauai, dated September 12, 2012. Subject: *Cyperus pennatiformis* var. *pennatiformis*.

Oppenheimer, Hank. 2012. Coordinator, Maui Nui Plant Extinction Prevention Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated August 16, 2012. Subject: 5 year reviews.

Rehkemper, Cynthia L. 2012. Biological Science Technician, Papahānaumokuākea Marine National Monument. E-mail to Margaret Clark, National Tropical Botanical Garden, dated September 18, 2012. Subject: FTP or Cloud site for USFWS large files #1,two attachments: Appendix G (autplant) and Appendix J (surviving).

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

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