

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Ctenitis squamigera* (Pauoa)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and territory of Guam. Federal Register 72(45):10547-10550.

Lead Region/Field Office:

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

Name of Reviewer(s):

Christian Torres-Santana, Student Trainee Biologist

Marie Bruegmann, Plant Recovery Coordinator

Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species

Gina Shultz, Deputy Field Supervisor

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 (USFWS) beginning on March 8, 2007. The review was based on the final critical habitat designation for *Ctenitis squamigera* and other species from the island of Lanai, Kauai, Molokai, Maui, Oahu, and Hawaii (USFWS 2003a, b, c, d, e, f), as well as a review of current, available information. The Bernice P. Bishop Museum provided an initial draft of portions of the 5-year review and they also provided recommendations for conservation actions needed prior to the next five-year review. The evaluation of the status of the species was prepared by the lead PIFWO biologist and reviewed by the Plant Recovery. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

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).

Application of the 1996 Distinct Population Segment (DPS) Policy:

This Policy does not apply to plants.

Review Analysis:

Please refer to the final critical habitat designations for a complete review of the *Ctenitis squamigera* status (including biology and habitat), threats, and management efforts (USFWS 2003a, b, c, d, e). No new threats and 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 *C. squamigera*.

Historically, *Ctenitis squamigera* was recorded from Kauai, the Koolau and Waianae Mountains on Oahu, Lanai, Molokai, Maui, and possibly the island of Hawaii (USFWS 1994, 1998, 2003a, b, c, d, e, f). Populations are no longer extant on Kauai or in the Koolau Mountains of Oahu. In 1998, the taxon was known from 10 populations, totaling about 100 individuals (USFWS 1998) and in 2003, it was known from 23 populations of more than 183 individuals (USFWS 2003a, b, c, d, e). The Waianae Mountain populations were in Makaleha Valley, Kaawa Gulch, Makua Valley and Waianae Kai Forest Reserve. On Lanai, *C. squamigera* was known from the Waiapaa-Kapohaku area on the leeward side of the island, and Lopa Gulch and Waiopa Gulch on the windward side. Populations were also recorded from Iao Valley and Kapunakea Preserve, West Maui, and Wawaia Gulch, Molokai. The number of wild individuals has increased somewhat from the time of Federal listing as endangered in 1994 as the result of additional botanical surveys, but the current status of most populations is unclear as populations have not having been recently monitored (USFWS 2008).

Ctenitis squamigera currently consists of about 20 individuals in Kapunakea Preserve (Honokowai Valley), two to four individuals at Puu Kaeo, one individual at Kahana Iki, 14 individuals at Kahana, 10 individuals in Kanaha Valley in the Panaewa Section of the West Maui Natural Area Reserve, one or two individuals in Puehuehu Nui, one or two individuals in Ukumehame Valley below the Hanaula Reservoir, and approximately 30 individuals in Iao Valley, all on West Maui; 28 individuals at Pohakea on East Maui; an unknown number on Lanai; and 20 individuals at Wawaia on Molokai (H. Oppenheimer, Maui Nui Plant Extinction Prevention Program, pers. comm. 2008; Wood and Perlman 2002). Surveys in the Kipahulu Forest Reserve (Kaapahu) area apparently located the taxon, but no further details have been provided (East Maui Watershed Partnership 2006), and it has not been verified by recent surveys (Welton and Haus 2008).

On Oahu, there are currently three extant populations totaling about 107 individuals: two individuals in Makua, one individual in West Makaleha, and 80 mature and 21 immature individuals in East Makaleha, and three individuals on Puu Pane (Palikea). The Waianae Kai population is no longer extant. The taxon is declining in range with time, with no populations remaining on Kauai (not seen since 1896), the island of Hawaii (not seen since 1909), in the Koolau Mountains on Oahu, and the only individual of the Waianae Kai population in the Waianae Mountains of Oahu recently died (USFWS 2003f, 2007, 2008a; Hawaii Biodiversity and Mapping Program 2007; K. Wood, Research Biologist, National Tropical Botanical Garden, pers. comm. 2008).

Currently, about 10 populations with approximately 234 to 242 individuals are believed to be extant on Oahu, Molokai, and Maui. The number of individuals in the Lanai population are currently unknown (H. Oppenheimer, pers. comm. 2008; USFWS 2008).

Habitat degradation caused by axis deer (*Axis axis*) and mouflon sheep (*Ovis musimon*) are now considered a major threat to the forests of Lanai and *Ctenitis squamigera* are negatively affected by axis deer (USFWS 1994, 1998, 2003a, 2007, 2008a). All populations remain threatened by the negative impacts of feral pigs (*Sus scrofa*) and goats (*Capra hircus*) (Factors A and D) and the habitat destruction caused by introduced invasive plant species (Factor E) (USFWS 1994, 1998, 2003a, b, c, d, e, 2008a). The population in Ukumehame Valley below the Hanaula Reservoir on Maui has declined from 25 individuals to only a few due to the presence of *Erigeron karvinskianus* (daisy fleabane) (Factor E) (H. Oppenheimer, pers. comm. 2008). Threats to *C. squamigera* in Puehuehu Nui on West Maui include the introduced invasive plants *Buddleia asiatica* (white butterfly bush), *Psidium guajava* (guava), *Grevillea robusta* (silk oak), *Ageratina adenophora* (Maui pamakani), and *Rubus rosifolius* (thimbleberry) (Factor E) (K. Wood, pers. comm. 2008). Other introduced invasive plants threatening this species on Maui, Lanai, and previously on Kauai include *P. cattleianum* (strawberry guava) and *Schinus terebinthifolius* (Christmasberry). On Oahu, introduced invasive plants posing threats to this species include *A. riparia* (Hamakua pamakani), *Aleurites moluccana* (kukui), *Blechnum appendiculatum* (hammock fern), *Clidemia hirta* (Koster's curse), *P. cattleianum*, *P. guajava*, *S. terebinthifolius*, *Syzygium cumini* (java plum), and *Toona ciliata* (Australian red cedar) (Factor E) (USFWS 2003a, b, d, e). On Molokai, introduced invasive plants threatening the species include *S. terebinthifolius* and *Melinis repens* (natal red top), *M. minutiflora* (molasses grass), *Buddlia asiatica*, and *Lantana camara* (lantana) (Factor E) (Wood and Perlman 2002; USFWS 2003c).

Human disturbance from hikers and vehicles is believed to pose a significant threat to this species (Factor E) (USFWS 2008). The Makua population, located within the Army's training area, is in an area of low risk from training-related wildfire (USFWS 2007). Weapon restrictions and the implementation of suppression actions, include fuel breaks and firebreaks at Makua minimize the risk of a fire directly impacting *C. squamigera* in the action area (USFWS 2007). However, fire still threatens other populations (Factor E) (USFWS 2003a, b, c, d, e).

Two populations are fenced (West Makaleha and Palikea) and feral ungulates and introduced invasive plants are controlled at these populations. The U.S. Army plans to fence the East Makaleha management unit by the end of 2008. There are currently 100 individuals in this unit (USFWS 2007). Fencing on Lanaihale is complete, but eradication of feral ungulates within the fence is not yet complete (J. Higashino, USFWS, pers. comm. 2008). The population on Puu Kaeo on West Maui is also fenced (H. Oppenheimer, pers. comm. 2008).

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at the National Tropical Botanical Garden (2007) and Harold L. Lyon Arboretum Micropropagation Laboratory (2007).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for four species of Hawaiian ferns (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Ctenitis squamigera* 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.*, fencing, weeding) and be represented in an *ex situ* (off-site) collection. In addition, at least three populations should be documented on islands where they now occur or occurred historically on more than one island. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population (minimum of 150 mature plants).

The stabilization goals for this species have not been met (see Table 1), as only one population has more than 50 mature individuals and not all of the threats are being managed. Therefore, *Ctenitis squamigera* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue collection of genetic resources for storage, future propagation and reintroducing into protected suitable habitat within historical range.
- Construct enclosure fences to protect individuals from the adverse effects of feral pigs, goats, mouflon sheep, and axis deer, and eradicate introduced invasive plant species within the enclosures.
- Enhance current natural populations to increase number of individuals.
- Initiate planning and contribute to implementation of ecosystem-level management and restoration to benefit this species.
- Survey geographical and historical range for a thorough current assessment of the status of the species.
- Assess genetic variability within extant populations.
- Study *Ctenitis squamigera* populations with regard to population size and structure, geographical distribution, spore production and gametophytic stage development, longevity, specific environmental requirements, limiting factors, and threats.

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- [USFWS] U.S. Fish and Wildlife Service. 2003c. 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.
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- [USFWS] U.S. Fish and Wildlife Service. 2003e. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, HI; final rule. Federal Register 68(116):35949-35998.
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[USFWS] U.S. Fish and Wildlife Service. 2007. Reinitiation of the 1999 Biological Opinion of the U.S. Fish and Wildlife Service for U.S. Army military training at Makua Military Reservation, island of Oahu. Unpublished.

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Personal communications:

Oppenheimer, Hank. Maui Nui Coordinator, Plant Extinction Prevention Program. Email communication to Bernice P. Bishop Museum on May 9, 2008.

Higashino, Jennifer. Fish and Wildlife Biologist, USFWS. Email communication to Marie Brueggemann (USFWS) on September 2, 2008.

Wood, Ken. Research Biologist, National Tropical Botanical Garden. Email communication to Bernice P. Bishop Museum, June 2008.

Table 1. Status of *Ctenitis squamigera* (Pauoa) from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	~ 80	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	~ 100	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	192	Unknown	All threats managed in all 3 populations	Unknown
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Unknown
2008 (5-year review)	~ 234 - 242	0	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

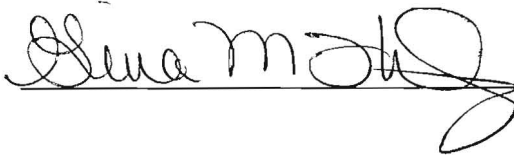
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SIGNATURE PAGE for 5-YEAR REVIEW of *Ctenitis squamigera* (Pauoa)

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

Acting Field Supervisor, Pacific Islands Fish and Wildlife Office



Date 21 July 2009