

## 5-YEAR REVIEW

Short Form Summary

**Species Reviewed:** *Cenchrus agrimonioides* (kāmanomano)

**Current Classification:** Endangered

### **Federal Register Notice announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2019. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 91 species in Oregon, Washington, Hawaii, and American Samoa. Federal Register 84(112): 27152–27154, June 11, 2019.

### **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 2020. The review was based on a review of current, available information since the last 5-year review for *Cenchrus agrimonioides* (USFWS 2014). 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](http://ecos.fws.gov/tess_public)).

### **Review Analysis:**

Please refer to the previous 5-year reviews for *Cenchrus agrimonioides* in the Federal Register on July 21, 2009 and March 12, 2014 (available at [https://ecos.fws.gov/docs/five\\_year\\_review/doc2455.pdf](https://ecos.fws.gov/docs/five_year_review/doc2455.pdf) and [https://ecos.fws.gov/docs/five\\_year\\_review/doc4386.pdf](https://ecos.fws.gov/docs/five_year_review/doc4386.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 *C. agrimonioides*.

This short-lived perennial grass in the Poaceae (grass) family is endangered. There are two varieties: var. *agrimonioides*, endemic to the islands of O‘ahu, Lāna‘i, and Maui; and var. *laysanensis*, endemic to the Northwest Hawaiian Islands. The variety *laysanensis* is considered possibly extinct. The status and trends for *Cenchrus agrimonioides* are provided in the tables below.

#### New Status Information:

- In 2012, critical habitat was designated for *Cenchrus agrimonioides* on O‘ahu in 11 units in the lowland mesic and dry cliff ecosystems (2,960 hectares [ha], 7,312 acres [ac]) (77 FR 57648, September 18, 2012). In 2016, critical habitat was designated for *C. agrimonioides* on Maui in six units in the lowland dry ecosystem (8,392 ha, 20,740 ac). Also, critical habitat (4,521 ha, [11,172 ac]) was proposed in one unit in the lowland mesic ecosystem on Lāna‘i but was excluded in the final rule (77 FR 34464, June 11, 2012; 81 FR 17790, March 30, 2016).
- Currently, on Maui, there are two wild populations of *C. agrimonioides*, one on west Maui of one mature individual, and one on east Maui of five individuals (Plant Extinction Prevention Program [PEPP] 2014, 2016). On O‘ahu, there are approximately 145 wild individuals in the Wai‘anae mountains at Kuaokalā, Kahanahāiki-Pahole, Mākaha-Wai‘anae Kai, South Huliwai, and Central ‘Ēkahanui (Army Natural Resources Program [ANRP] 2020). The variety *laysanensis*, known from the Northwest Hawaiian Islands on Kure, Midway, and Laysan, was last observed in 1964, and with no naturally occurring individuals on these islands or propagative materials in storage, is possibly extinct in the wild (Wood et al. 2019, p. 4).

#### New Threats:

- 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. The assessment concluded that *Cenchrus agrimonioides* is vulnerable to the impacts of climate change with a vulnerability score of 0.409 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions may be needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.
- Predation and herbivory by rats are observed to be threats at Kanaio Natural Area Reserve (NAR) and Pāpalaua-Manawainui Plant Sanctuary populations on east and west Maui (ANRP 2020; BioPacifica as submitted by Oppenheimer and Padgett 22 DEC 2015 and 8 APR 2016).

#### New Management Actions:

- Surveys and inventories—PEPP continues to survey and monitor populations on east and west Maui (PEPP 2014, 2016, 2020, 2021). Some O‘ahu populations are monitored by the ANRP (ANRP 2020).
- Ungulate monitoring and control—Fenced areas include Kanaio NAR on Maui and Pahole, Kahanahāiki, and ‘Ēkahanui on O‘ahu (PEPP 2016; ANRP 2020).
- Invasive nonnative plant control—
  - PEPP conducts nonnative plant control at Pāpalaua-Manawainui Plant Sanctuary, Kanaio, and ‘Āhihi-Kīna‘u populations (west and east Maui) (PEPP 2014, 2016, 2020).

- The ANRP controls nonnative plants at Kahanahāiki-Pahole, Central ‘Ēkahanui, Mākaha-Wai‘anae Kai, and South Huliwai on O‘ahu (ANRP 2020).
- Control of predation and herbivory by rats—The ANRP reports implementation of rat control at the Kahanahāiki-Pahole, Central ‘Ēkahanui, and Mākaha-Wai‘anae Kai populations (ANRP 2020).
- Collection and propagation—
  - Lyon Arboretum Micropropagation Laboratory reported five explants in storage representing two founders at Pāpalaua-Manawainui Plant Sanctuary on west Maui (Lyon Arboretum 2020). The Lyon Arboretum Seed Conservation Laboratory reported storage of 27 seeds representing one founder at Kanaio, Maui, and 448 seeds representing a second founder at Kanaio (Lyon Arboretum 2020).
  - PEPP reported collection of seeds representing one founder from Pāpalaua-Manawainui Plant Sanctuary on west Maui (PEPP 2014). In 2016, seeds were collected from one founder at Kanaio (PEPP 2016).
  - The ANRP reported storage of 16,990 seeds representing 120 individuals at Pahole, 42 individuals at Makua Military Reservation, 35 individuals at Huliwai, 200 individuals at ‘Ēkahanui, 3 individuals at Wai‘anae Kai, 79 individuals at Mākaha, and 59 individuals at Schofield Barracks West, in the Wai‘anae mountains of O‘ahu (ANRP 2020).
  - In 2013, Waimea Arboretum propagated two plants representing two founders from O‘ahu; in 2014, these plants remained in storage. In 2015, there were six plants in storage representing one founder. In 2017, there were eight plants in storage representing two founders. In 2018, no plants were reported in storage (Waimea Arboretum 2013, 2014, 2015, 2017, 2018).
- Reintroduction—
  - The ANRP reported augmentation of the wild population of 21 mature and 5 immature plants at Kahanahāiki-Pahole to total 229 mature and 62 immature plants; augmentation of the wild population of 6 mature plants at Mākaha-Wai‘anae Kai to total 193 mature and 4 immature plants; and augmentation of the wild population of 75 mature and 13 immature plants at Central ‘Ēkahanui to total 182 mature and 28 immature plants (ANRP 2020). There is one wild plant at Kuaokalā, and 42 wild plants at South Huliwai (ANRP 2020). This population augmentation effort has greatly increased the total number of plants in the Wai‘anae mountains to 604 mature and 94 immature plants. The ANRP also reports establishment of a living collection at the Wahaiwā Botanic Garden.
  - In 2016, PEPP reported that two small patches remained of a previous reintroduction at ‘Āhihi-Kīna‘u NAR (PEPP 2016). By 2021, five plants remained at a previous reintroduction at Kanaio (PEPP 2021).

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

<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>Stability Criteria identified in Recovery Plan</b>	<b>Stability Criteria Completed?</b>
1996 (listing)	ca 25 (O‘ahu) 10 sq ft patch (Maui) unknown (NWHI)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1999 (recovery plan)	40–41 (O‘ahu) 10 sq-ft patch (Maui) est total statewide <100	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	113–118 (O‘ahu) 0 (Lāna‘i) unknown (Maui) 0 (NWHI)	Unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Unknown
2009 (5-year review)	144 mature, 14 immature (O‘ahu) 0 (Lāna‘i) 4 (Maui) 0 (NWHI)	312 (O‘ahu)	All threats managed in all 3 populations	Partially, ungulate exclosures on O‘ahu and east Maui
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

2012 (critical habitat, O'ahu)	ca 300 (O'ahu)	Unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2014 (5-year review)	645 (O'ahu) 0 (Lāna'i) 4 (Maui) 0 (NWHI)		All threats managed in all 3 populations	Partially, ungulate exclosures on O'ahu and east Maui, with nonnative plant control
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2016 (critical habitat, Maui Nui)	0 (Lāna'i) 5 (Maui)	Unknown (Maui)	All threats managed in all 3 populations	Partially, ungulate exclosures on O'ahu and Maui, some nonnative plant control
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	None on Maui
<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>*Preventing Extinction Criteria identified by HPPRCC</b>	<b>*Preventing Extinction Criteria Completed?</b>
2021 (5-year review)	145 mature, 23 wild immature (O'ahu) 6 (Maui)	>400 (O'ahu)	All threats managed in all 6 populations	Partially, ungulate exclosures on O'ahu and Maui, some nonnative plant control

			Complete genetic storage	Partially, 89 founders represented on O‘ahu, and 3 founders on Maui
			6 populations with 50 mature individuals each	Partially, 3 augmented populations >50 mature individuals
			Natural reproduction at all 6 populations	Partially, recruitment at Mākaha-Wai‘anae Kai

\* 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 *Cenchrus agrimonioides* and ongoing conservation efforts.**

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, ungulate exclosures on O‘ahu and Maui
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control within exclosures
Drought destruction and degradation of habitat	A	Ongoing	None
Fire destruction and degradation of habitat	A	Ongoing	Partial, fire management plan for military training area on O‘ahu
Predation and herbivory by rats	C	Ongoing	Partial, control implemented at 3 locations on O‘ahu
Human disturbance–trampling by hikers	E	Ongoing	Partial, management plan for military training area
Climate change degradation or loss of habitat	E	Ongoing	None

**Synthesis:**

Currently there are approximately 145 wild individuals of *Cenchrus agrimonioides* on the islands of O‘ahu and Maui. These populations have been augmented bringing the total to

more than 600 mature plants. Ungulate exclosures on O‘ahu and Maui protect four populations. Nonnative plant control is ongoing within ungulate exclosures and at reintroduction sites. Rats are controlled at three sites on O‘ahu. Seeds are in storage representing close to 100 founders. Propagation is ongoing and more than 450 plants have been outplanted to augment existing populations.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Multi-Island Plants (USFWS 1999) 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.

*Cenchrus agrimonioides* is a short-lived perennial grass with vegetative reproduction. 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 six populations total should be documented on the islands 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 approximately 145 wild individuals in five occurrences on O‘ahu and six individuals in two occurrences on Maui. Plants are extirpated from Lanai and the variety *laysanensis* is possibly extinct in the Northwest Hawaiian Islands. Three populations on O‘ahu contain more than 50 mature, reproducing individuals because of population augmentations; however, only one of these populations has been observed recruiting new individuals (Table 1). In addition, not all threats are being managed (Table 2). Therefore, *Cenchrus agrimonioides* meets the definition of Endangered as it remains in danger of extinction throughout its range.

#### **Recommendations for Future Actions:**

Predation and herbivory by rats is a new threat on O‘ahu; however, we are not aware of any significant new information regarding the species’ biological status since the last 5-year review in 2014. Thus, the following recommendations for future actions are added or reiterated for the 5-year review for 2021.

- Surveys and inventories—Continue to survey geographical and historical range for a current assessment of the species’ status, especially in areas where the taxon was recently extirpated.

- Ungulate monitoring and control—Continue to monitor and maintain exclosures and construct additional exclosures or strategic fencing where possible to protect all occurrences.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species at all occurrences.
- Fire monitoring and control—Continue to develop and implement fire prevention management plans for sites with known occurrences.
- Rat control—Continue to implement effective rat control methods at populations when necessary.
- Captive propagation for genetic storage and reintroduction—Continue collection of genetic resources for storage, propagation, and reintroduction.
- Reintroduction and translocation—Continue reintroductions into suitable habitat within historical range with protection from threats to build population resiliency and redundancy and reduce the impacts of all threats, including drought, fire, and climate change.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this taxon.

#### References:

- [ANRP] Army Natural Resources Program. 2020. 2020 Status report for the Mākua and O‘ahu implementation plans, appendices. Office of the Vice President for Research and Innovation, University of Hawai‘i. 516 pp.
- BioPacifica Database. 2021. Data for *Cenchrus agrimonioides* as submitted by Oppenheimer and Padgett 22 DEC 2015 and 8 APR 2016.
- 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 Hawaii at Hilo, Hawai‘i. 134 pp.
- [HPPRCC] Hawaii and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lyon Arboretum 2020. 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.
- [PEPP] Plant Extinction Prevention Program. 2014. PEPP annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 pp.
- [PEPP] 2016. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species

- Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.
- [PEPP] 2019. U.S. Fish and Wildlife Service Coast Program, Catalog of Federal Domestic Assistance Number: 15.657, Award #F18AC00502. Interim report, reporting period October 1, 2018 to September 30, 2019. Pacific Cooperative Studies Unit, Honolulu, HI. 53 pp. + appendices.
- [PEPP] 2020. Plant Extinction Prevention Program, interim reports for 2020. Excel table.
- [PEPP] 2021. Plant Extinction Prevention Program, interim reports for 2020. Excel table.
- [USFWS] U.S. Fish and Wildlife Service. 1999. Recovery plan for the multi-island plants. Portland, OR. 206 pp. + appendices.
- [USFWS] 2009. *Cenchrus agrimonioides* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. [https://ecos.fws.gov/docs/five\\_year\\_review/doc2455.pdf](https://ecos.fws.gov/docs/five_year_review/doc2455.pdf).
- [USFWS] 2012. 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; proposed rule. Department of the Interior. 77 FR 34464–34775, June 11, 2012.
- [USFWS] 2012. Endangered and threatened wildlife and plants; endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Department of the Interior, 77(181) FR 57648–57862, September 18, 2012.
- [USFWS] 2014. *Cenchrus agrimonioides* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. [https://ecos.fws.gov/docs/five\\_year\\_review/doc4386.pdf](https://ecos.fws.gov/docs/five_year_review/doc4386.pdf).
- [USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species. Department of the Interior. 81 FR 17790–18110, March 30, 2016.
- [USFWS] 2019. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 91 species in Oregon, Washington, Hawaii, and American Samoa. Federal Register 84(112): 27152–27154, June 11, 2019.
- Waimea Arboretum. 2013. 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.

- Waimea Arboretum. 2014. 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.
- Waimea Arboretum. 2015. 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.
- Waimea Arboretum. 2017. 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.
- Waimea Arboretum. 2018. 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.
- Wood, K.W., H. Oppenheimer, and M. Keir. 2019. A checklist of endemic Hawaiian vascular plant taxa that are considered possibly extinct in the wild. 17 pp.

**U.S. FISH AND WILDLIFE SERVICE**  
SIGNATURE PAGE for 5-YEAR REVIEW of *Cenchrus agrimonioides*  
(kāmanomano)

**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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Date \_\_\_\_\_