

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Achyranthes splendens* var. *rotundata*

(Round-leaved chaff flower; 'Ewa hinahina)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. Federal Register 88(83): 20088–20092, May 7, 2018.

Lead Region/Field Office:

Interior Region 12, Portland Regional Office/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 2019. The review was based on a review of current, available information since the last 5-year review for *Achyranthes splendens* var. *rotundata* (USFWS 2013). 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).

Review Analysis:

Please refer to the previous 5-year reviews for *Achyranthes mutica* published in the Federal Register on July 22, 2009 and August 7, 2013 (available at https://ecos.fws.gov/docs/five_year_review/doc2424.pdf and https://ecos.fws.gov/docs/five_year_review/doc4192.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 *A. splendens* var. *rotundata*.

This short-lived perennial shrub in the Amaranthaceae (amaranth) family is endangered. The status and trends for *Achyranthes splendens* var. *rotundata* are provided in the tables below.

New Status Information:

- Currently, *Achyranthes splendens* var. *rotundata* only occurs on O‘ahu, with some reintroduced plants on Moloka‘i. There are 79 first-generation wild immature individuals resulting from reintroductions at the Kalaeloa Unit of the Pearl Harbor National Wildlife Refuge Complex on O‘ahu for mitigation for loss of wild plants from Kenai Industrial Park (SWCA 2019). The Army’s Natural Resources Program (ANRP-O‘ahu) reports presence of *A. splendens* var. *rotundata* within the Mākaha management unit in 2019 with possibly as many as 900 plants remaining, but this is an estimate that was made in 2005 through surveying cliffs from afar with binoculars. They also report individuals within the Ka‘ena management unit in 2017; however, no individuals were found during December 2017 surveys at Ka‘ena (ANRP 2017, 2019; Weisenberger 2017, in litt.).
- In 2016, funding for protection and enhancement of two endangered dryland plants (*Achyranthes splendens* var. *rotundata* and *Chamaesyce* [*Euphorbia*] *skottsbergii* var. *skottsbergii*) was obtained through a Cooperative Recovery Initiative (CRI) grant, with restoration activities including reintroductions to be conducted at the Kalaeloa Unit of the Pearl Harbor National Wildlife Refuge Complex on O‘ahu (USFWS 2016). See below for current information regarding this project.
- In 2012, 17 critical habitat units in the coastal, lowland dry, and dry cliff ecosystems were designated for *Achyranthes splendens* var. *rotundata* on O‘ahu (2,905 hectares (ha); 11,735 acres (ac)) (77 FR 57648, September 18, 2012).

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. 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. This assessment concluded that *Achyranthes splendens* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.507 (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.
- Fire destruction and degradation of individuals and habitat—In August, 2018, a controlled burn escaped, and burned 2,023 ha (5,000 ac) in the Wai‘anae, Kea‘au, and Mākaha valleys. The fire destroyed wild individuals of *A. splendens* var. *rotundata* at Wai‘anae Kai and Mākaha, and reintroduced populations of two other endangered plants, *G. vitifolia* and *Hibiscus brackenridgei* subsp.

mokuleianus, in two exclosures in the Kea‘au Forest Reserve, which was a major setback for restoration work (ANRP 2018.).

- A new insect, the highly destructive bostrichid beetle (*Amphicerus* sp.) was identified as a threat to *A. splendens* var. *rotundata* in early 2017 (SWCA 2018).

New Management Actions:

- Surveys and inventories—There have not been any reported surveys for populations or individuals of *Achyranthes splendens* var. *rotundata* since 2005 (Keawa‘ula-Ka‘ena, and Mākaha-Kamaile‘unu), except for the 2017 Ka‘ena surveys and those reintroduced at the Kalaeloa Unit of the Pearl Harbor National Wildlife Refuge Complex (USFWS 2019).
- The persistent presence of mealybugs (scale insect in the family Pseudococcidae) and the presence of the highly destructive bostrichid beetle (*Amphicerus* sp.) identified in early 2017, have led to application of two pesticides approved by the USFWS to be used at the Kalaeloa restoration plots (SWCA 2018).
- Captive propagation for genetic storage and reintroduction—
 - In 2017, with funding through the CRI grant, the Division of Forestry and Wildlife (DOFAW) collected 750 seeds and propagated 375 plants, representing 10 founders, for reintroduction to Kalaeloa (DOFAW 2017). In 2018, 957 plants representing one founder were propagated for reintroduction to Kalaeloa (DOFAW 2018). In 2019, 1,590 plants representing eight founders were grown for reintroduction at Kalaeloa and 75 plants representing eight founders were grown for reintroduction at Ka‘ena-Keawa‘ula (DOFAW 2019).
 - The National Tropical Botanical Garden (NTBG) reported collection and storage of 237 seeds from a living collection at the garden (and two more individuals planted into the collection) in addition to adding seven plants to the living collection at the garden sourced from wild plants at Barber’s Point and Ka‘ena Point (O‘ahu) (NTBG 2019). In 2018, NTBG collected and stored 3,750 seeds from four plants in the living collection at the McBryde garden (founder from Barber’s Point, O‘ahu) (NTBG 2018).
 - The Lyon Arboretum Seed Conservation Laboratory reports collection and storage of 1,347 seeds from a living collection at Koko Crater Botanical Garden and 14,951 seeds in storage representing four founders from Campbell Industrial Park (Lyon Arboretum 2019).
 - In 2018, Waimea Arboretum reported 51 plants in storage representing seven founders (Waimea Arboretum 2018).
- Reintroduction—
 - The State’s plant nursey at Makiki reported propagation and reintroduction of 47 individuals, representing one wild plant, into a restoration area at Kailua (DOFAW 2019).
 - Reintroduction of plants at the Kalaeloa Unit began in 2016 with funding provided by the CRI grant. From 2016 to 2019: 176, 714, 1,751, and 254 (respectively) *A. splendens* var. *rotundata* were reintroduced (a total of 2,895 plants) (USFWS 2019). A monitoring survey in 2019 reported that there were 999 mature plants, 173 immature, and four seedlings

remaining, with 28 documented as dormant or dead. The June 2020, survey reported a total of 560 mature plants and three seedlings remaining, with 71 plants documented as dead.

- The Moloka‘i Land Trust reports outplanting of 79 individuals at ‘Īlio Point, Moloka‘i, representing one founder from Kalaeloa, O‘ahu, and recruitment observed (MLT 2019).

Table 1. Status and trends of *Achyranthes splendens* var. *rotundata* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1986 (listing)	~400	0	3 naturally reproducing populations of 500 reproductive plants each at the ‘Ewa Plain and Ka‘ena Point regions	No
			Each population secure from threats	No
			Each population stable and increasing in number for a minimum of 10 consecutive years	No
			Land area for each population sufficient to provide a buffer of 30-50 meters around the expanded population	No
1994 (draft recovery plan)	~1,500	0	3 naturally reproducing populations of 500 reproductive plants each at the ‘Ewa Plain and Ka‘ena Point regions	Partially
			Each population secure from threats	No

			Each population stable and increasing in number for a minimum of 10 consecutive years	No
			Land area for each population sufficient to provide a buffer of 30–50 meters around the expanded population	No
2009 (5-year review)	~1,600–1,700	100s	3 naturally reproducing populations of 500 reproductive plants each at the ‘Ewa Plain and Ka‘ena Point regions	Partially
			Each population secure from threats	Partially
			Each population stable and increasing in number for a minimum of 10 consecutive years	Partially
			Land area for each population sufficient to provide a buffer of 30–50 meters around the expanded population	No
2013 (5-year review)	~1,600–1,700	11	3 naturally reproducing populations of 500 reproductive plants each at the ‘Ewa Plain and Ka‘ena Point regions	Partially
			Each population secure from threats	Partially
			Each population stable and increasing in number for a minimum of 10 consecutive years	No

			Land area for each population sufficient to provide a buffer of 30–50 meters around the expanded population	No
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2020 (5-year review)	Unknown (<1,000 from 2005)	641 (560 at Kalaeloa; 2 at Ka‘ena; 79 at Moloka‘i (unknown survival))	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			Reproduction (i.e. viable seeds, seedlings) at all 3 populations	Partially, recruitment at Kalaeloa & ‘Īlio Point
			3 populations with 50 mature individuals each	Partially, 1 population not monitored in 15 years

* 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 *Achyranthes splendens* var. *rotundata* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Habitat conversion for industrial and agricultural developments	A	Ongoing	Partial, reintroductions fenced
Deposition of trash and construction material into exclosures	A, E	Ongoing	Partial, periodic removal from fenced areas

Degradation and destruction by drought	A	Ongoing	None
Degradation and destruction of habitat, and competition by nonnative invasive plants	A, E	Ongoing	Partial, nonnative plant control at Kalaeloa and Ka'ena
Climate change degradation or loss of habitat	A	Ongoing	None
Mortality of wild and reintroduced individuals due to predation by insects and due to insect farming by ants	C	Ongoing	Partial, periodic insect control at Kalaeloa

Synthesis:

Currently there is an unknown number of wild individuals of *Achyranthes splendens* var. *rotundata*, as estimates of extant wild populations are greater than 15 years old, and fires have impacted those habitats since surveys. Recruitment and growth past seedlings stage (not maturation) has been documented at the Kalaeloa reintroduction. A landscape-based assessment of climate change vulnerability for native plants of Hawai'i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *A. splendens* (at the species level) is highly vulnerable to the effects of climate change. Two reintroduced populations are provided protection from development by fencing, one of which is established on the Kalaeloa Unit of the Pearl Harbor NWR. Seed collection, propagation, and reintroduction are ongoing. Of the 3,049 individuals reintroduced since the last 5-year review, approximately 600 survive.

Stabilizing (interim), downlisting, and delisting objectives were provided the draft Recovery Plan for *Chamaesyce skottsbergii* var. *kalaeloana* and *Achyranthes splendens* var. *rotundata* (USFWS 1994), 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.

Achyranthes splendens var. *rotundata* is a short-lived perennial shrub. 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 three populations should be documented on the island of O'ahu where they now occur or occurred historically and each of these populations must be

naturally reproducing (i.e., viable seeds, seedlings) a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There is one wild population estimated at 900 individuals but that population has not been surveyed since 2005 and the habitat is fire-threatened. Two reintroduction attempts have documented recruitment. Several founders are represented in genetic storage but goals have not been met (Table 1). Of the 3,049 individuals reintroduced, approximately 600 survive, with the majority in one population. In addition, not all threats are being managed (Table 1, Table 2). Therefore, *Achyranthes splendens* var. *rotundata* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

A new insect was identified as a predator; however, no other significant new information regarding the species' biological status was identified since the last 5-year review in 2013. Thus, the following recommendations for future actions are added or reiterated for the 5-year review for 2020.

- Surveys and inventories—Continue to survey suitable habitat and historical range for a thorough assessment of the species' status.
- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species and those that compete with *A. splendens* var. *rotundata* at all populations.
- Fire management plan—Develop and implement a fire management plan for all wild and reintroduced populations.
- Invertebrate control research—
 - Develop and implement control methods for scale insects and ants at all populations.
 - Develop and implement control methods for the bostrichid beetle (*Amphicerus* sp.) at all wild and reintroduced populations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species to determine future landscape needed for its recovery.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Reintroduction and translocation—Continue to reintroduce individuals into suitable habitat within historic range that is being managed for known threats.
- Genetics research—Assess the genetic variability within extant populations.
- Population biology research—Study populations with regard to size and structure, geographical distribution, flowering cycles, pollination mechanisms, seed dispersal agents, longevity, seed banks, specific environmental requirements, limiting factors, and threats.
- Recovery plan update—Revise draft recovery plan with current information.
- Alliance and partnership development—Continue to work with partners and land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

- [ANRP-O‘ahu] Army Natural Resources Program-Oahu. 2017. Appendices for 2017 status report for the Makua and Oahu Implementation Plans. Prepared by Pacific International Center for High Technology Research. 715 pp.
- [ANRP-O‘ahu] 2018. Report to the U.S. Fish and Wildlife Service for O‘ahu Army Natural Resources Program, Permit: TES-043638, reporting period January 1, 2018-December 31, 2018. 16 pp.
- [ANRP-O‘ahu] 2019. Appendices for 2019 status report for the Makua and Oahu Implementation Plans. Prepared by Pacific International Center for High Technology Research. 662 pp.
- [DOFAW] Division of Forestry and Wildlife. 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.
- [DOFAW] 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.
- [DOFAW] 2019. Makiki nursery, 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.
- 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.
- Weisenberger, L. 2017, in litt., Email to US Army Doug Gomez regarding status of *Achyranthes splendens* var. *rotundata* at Ka‘ena-Keawa‘ula, Mākaha, and Wai‘anae Kai. 21 DEC 2017.
- [HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lyon Arboretum. 2019. 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.

- [MLT] Moloka'i Land Trust. 2019. 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.
- [NTBG] National Tropical Botanical Garden. 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.
- [NTBG] 2019. 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.
- SWCA Environmental Consultants. 2018. Annual report for the Kenai Industrial Park round-leaved chaff flower (*Achyranthes splendens* var. *rotundata*) habitat conservation plan, July 1, 2017-June 30, 2018. Prepared for CIRI Land Development Company and AKC Leasing Corporation. 75 pp.
- SWCA Environmental Consultants. 2019. Threatened and endangered species report to the US Fish & Wildlife Service. Population, site monitoring, nursery accessions, plants & collections, stored seeds data. Excel table.
- [USFWS] U.S. Fish and Wildlife Service. 1994. Draft recovery plan for *Chamaesyce skottsbergii* var. *kalaeloana* and *Achyranthes splendens* var. *rotundata*. Portland. 79 pp.
- [USFWS] 2009. *Achyranthes splendens* var. *rotundata* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/five_year_review/doc2424.pdf.
- [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. 77 FR 57648, September 18, 2012.
- [USFWS] 2013. *Achyranthes splendens* var. *rotundata* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/five_year_review/doc4192.pdf.
- [USFWS] 2016. Cooperative recovery initiative: FY16 proposal. 13 pp.
- [USFWS] 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. Federal Register 88(83): 20088–20092, May 7, 2018.
- [USFWS] 2019. Cooperative recovery initiative: 2019 annual report. 48 pp.

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.

U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW of *Achyranthes splendens* var. *rotundata*
(round-leaved chaff flower, 'Ewa hinahina)

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

For Field Supervisor, Pacific Islands Fish and Wildlife Office

_____ Date _____