

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Huperzia nutans* (no common name)

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, Hawai‘i, 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 *Huperzia nutans* (USFWS 2017). 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 *Huperzia nutans* in the Federal Register on July 21, 2009, August 19, 2013, and September 4, 2017 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/1380.pdf, https://ecos.fws.gov/docs/tess/species_nonpublish/2078.pdf, and https://ecos.fws.gov/docs/tess/species_nonpublish/2452.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 *H. nutans*.

This short-lived perennial lycophyte in the hanging fir moss family (Lycopodiaceae, Phlegmariura group) is endangered and occurs on O‘ahu and is historically known from Kaua‘i. The status and trends for *Huperzia nutans* are provided in the tables below.

New Status Information:

- In 2012, critical habitat was designated on O‘ahu for *Huperzia nutans* in 14 units in the lowland wet and wet cliff ecosystems (12,162 hectares [ha], 30,058 acres [ac]) (77 FR 57648, September 18, 2012).
- In the 2012, we accepted and published the taxonomic revision from *Phlegmariurus nutans* to *Huperzia nutans* for this species (77 FR 57648, September 18, 2012). Since that time, Ranker et al. (2019) published taxonomic and nomenclatural updates to the Hawaiian fern and lycophyte flora, and transferred *Huperzia nutans* back to *Phlegmariurus nutans*, based on morphological and physiological characteristics. This taxonomic change does not affect the range or status of the species and we will address this revision in a future publication in the Federal Register.
- Surveys conducted from 2012 through 2017 indicated there were two individuals at Koloa, one individual at Kawai Iki-Opaepaue divide, three at Kaukonahua, and one at Schofield Barracks Military Range-East, all in the northern Ko‘olau mountains of O‘ahu (Plant Extinction Prevention Program [PEPP] 2012, 2017; Army Natural Resources Program [ANRP] 2018).

New Threats:

- None

New Management Actions:

- Surveys and monitoring—The Plant Extinction Prevention Program (PEPP) surveyed individuals at the Kawai Iki-‘Ōpae‘ula divide and the Schofield-Waikane Trail (PEPP 2017).
- Collection and propagation for genetic storage and reintroduction—In 2017, one founder at Kaukonahua was rescued and propagated at the ANRP nursery. There are currently two clones at the Army’s nursery, two at the Pahole Rare Plant Facility (PRPF), and one introduced to Ka‘ala with unuglate, rat, and slug control (PRPF 2020; Ching and Togikawa 2021, in litt.).

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1994 (listing)	<50 (O‘ahu) 0 (Kaua‘i)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No

1998 (recovery plan)	4 (O'ahu)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	7 (O'ahu)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2009 (5-year review)	11 (O'ahu)	0	All threats managed in all 3 populations	Partial, plans for fencing in Kawailoa Training Area, SBMR-East, Koloa, and Kaukonahua
			Complete genetic storage	Partial, some collection attempts and propagation research with related species
			3 populations with 50 mature individuals each	No
2012 (critical habitat, O'ahu)	10–15 (O'ahu)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals	No
2013 (5-year review)	11 (O'ahu)	0	All threats managed in all 3 populations	No, fencing planned but not conducted
			Complete genetic storage	Partial, propagation trials using related species

			3 populations with 50 mature individuals	No
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2017 (5-year review)	10 (O'ahu)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			Natural reproduction at all 3 populations	Unknown
			3 populations with 50 mature individuals	No
2021 (5-year review)	<10 (O'ahu)	1	All threats managed in all 3 populations	Partial, Koloa and Kaukonahua (Poamoho South) fenced, rat and slug control for 1 individual
			Complete genetic storage	Partial, one founder
			Natural reproduction at all 3 populations	Unknown
			3 populations with 50 mature individuals each	No

* 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 *Huperzia nutans* 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 at Koloa and Kaukonahua management units
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, some nonnative plant control in management units
Degradation and destruction by fire	A	Ongoing	Partial, fire management plan for Army-managed lands
Reduced viability due to low numbers, possible hybridization	E	Ongoing	Partial, propagation trials
Military activities	E	Potential	Partial, INRMP guidelines
Climate change, including hurricanes	E	Ongoing	Partial, introduction trial initiated

Synthesis:

Between 2012 and 2017, there were fewer than 10 wild individuals of *Huperzia nutans* in the northern Ko‘olau mountains on O‘ahu. Some sites have not been visited in more than five years and their current status is not known. Two areas are within fenced management units and one introduced plant is protected by rat traps and slug control. Propagation trials are ongoing and four clones of one founder have been produced and are being propagated at two rare plant facilities.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Oahu Plants (USFWS 1998) 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.

Huperzia nutans is a short-lived perennial lycophyte. 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 a

total of three populations should be documented on O‘ahu and/or Kaua‘i where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable spores, gametophytes, sporophytes), with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There are fewer than 10 wild individuals of *Huperzia nutans* on O‘ahu. Two areas are fenced and managed, one introduced plant is protected by rat traps and slug control, and there is implementation of a fire management plan for Army training areas. There are four cloned plants in storage representing one wild plant but no other propagative materials. Not all threats, including small numbers, hybridization, and climate change, are being addressed (Table 2). Therefore, *Huperzia nutans* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

We are not aware of any new threats or significant new information regarding the species’ biological status since the last 5-year review in 2017. Thus, the following recommendations for future actions are 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 and suitable habitat on Kaua‘i where this species is currently considered extirpated.
- Ungulate monitoring and control—Continue to construct ungulate exclosures or strategic fencing where possible to protect all occurrences from the impacts of feral ungulates, including browsing.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species at all known populations.
- Fire monitoring and control—Implement fire management plans for all populations on lands managed by the military. Develop and implement fire management plans for all other populations.
- Captive propagation for genetic storage and reintroduction—Continue propagation trials for production and collection of genetic resources.
- Reintroduction and translocation—Begin reintroductions and augmentations into suitable habitat within historical range in areas that are managed for known threats.
- Population biology and genetic research—
 - Assess the genetic variability within extant and *ex situ* populations, especially concerning possible hybridization.
 - Determine mycorrhizal associations that may be necessary for natural recruitment.
 - Determine viable population size and structure, geographical distribution, reproductive cycles, longevity, specific environmental requirements, limiting factors, and threats.
- Human interaction monitoring and management—
 - Develop and implement effective measures to reduce the impacts of hikers and trail maintenance.
 - Continue to implement INRMP guidelines for military training areas.

- Climate change adaptation strategy—
 - Research suitability of habitat for reintroduction of this species in the future due to impacts of climate change.
 - Build resiliency and redundancy by increasing numbers of populations and individuals to reduce the impacts of climate change, hurricanes, and low viability.
- Federal Register updates—Amend the list of Threatened and Endangered Species at 50 CFR 17 to reflect the revised taxonomy.
- 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. 2018. Appendices to the Status report for the Mākua and O‘ahu Implementation Plans, Army Natural Resources Program, O‘ahu, Office of the Vice President for Research and Innovation, University of Hawai‘i.

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[PRPF] Pahole Rare Plant Facility. 2020. Pahole Rare Plant Facility 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. 2012. PEPP annual report fiscal year 2012 (July 1, 2011-June 30, 2012). 169 pp.

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Ranker, T.A., C.T. Imada, K. Lynch, D.D. Palmer, A.L. Vernon, and M.K. Thomas. 2019. Taxonomic and nomenclatural updates to the fern and lycophyte flora of the Hawaiian Islands. *American Fern Journal* 109(1): 54–72.

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- [USFWS] 2012. Endangered and threatened wildlife and plants; endangered status for 23 species on Oahu and designation of critical habitat for 124 species. 77 FR 57648, September 18, 2012.
- [USFWS] 2013. *Huperzia nutans* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.
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https://ecos.fws.gov/docs/tess/species_nonpublish/2452.pdf.
- [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.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Huperzia nutans*
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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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