

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Geranium multiflorum* (nohoanu)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewers:

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, PIFWO

Gregory Koob, 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 (USFWS) beginning in August 2017. The review was based on a review of current, available information since the last 5-year review for *Geranium multiflorum* (USFWS 2011). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, 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 review for *Geranium multiflorum* published in the Federal Register on August 29, 2011 (available at https://ecos.fws.gov/docs/five_year_review/doc3837.pdf) for a complete review of the species’ status, threats, and management efforts. 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 *G. multiflorum*.

This long-lived perennial shrub in the Geraniaceae (geranium) family is endangered and endemic to east Maui. The current status and trends for *Geranium multiflorum* are provided in the tables below.

New Status Information:

- In 2011, the 5-year review reported about 600 individuals in five locations on Haleakalā Crater on east Maui. Currently, there are about nine populations totaling more than 500 individuals on east Maui at Honomanū, Pu‘u Ko‘olau, Ko‘olau Gap, Pu‘uo Mālei, upper Kīpahulu, Greensword Bog, Kūhiwa Stream, Hanawī Stream, Pu‘u‘alea, and Waikamoi Preserve (Oppenheimer 2007 and 2018, in litt.; Robertson 2016, in litt.).
- In 2016, 13 critical habitat units were designated in four ecosystems (montane wet, montane mesic, subalpine, and dry cliff) on east Maui for *Geranium multiflorum* (59,933 ac; 24,254 ha) (81 FR 17790, March 30, 2016).

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. The assessment by Fortini *et al.* (2013) concluded that *Geranium multiflorum* is vulnerable to the impacts of climate change, with a vulnerability score of 0.533 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future.

New Management Actions:

- Surveys and population monitoring—Staff of Haleakalā National Park (HNP) and The Nature Conservancy (TNC) monitor populations of *Geranium multiflorum* (NPS 2012; TNC 2014).
- Invasive plant monitoring and control—HNP and TNC conduct weed control at populations of *G. multiflorum* in the Park and in Waikamoi Preserve (NPS 2012; TNC 2014).
- Ungulate monitoring and control—Fences have been constructed to protect some populations of *G. multiflorum* in Hanawī Natural Area Reserve (NAR), on East Maui Irrigation lands below Waikamoi PR, and at Waikamoi PR (DLNR 2008; TNC 2014).
- Captive propagation for genetic storage and reintroduction—
 - The Lyon Seed Conservation Laboratory reports 55 seeds in storage from a collection pooled from 10 plants and collected in 2011 (Lyon Arboretum 2017).
 - Between 2013 and 2017, Haleakalā National Park has propagated over 12 plants representing seven wild individuals and has outplanted at least 28 individuals at Honokahua (HNP 2013, 2015, 2017; NPS 2014).

Synthesis:

Currently, there are more than 500 wild individuals of *Geranium multiflorum* on east Maui. 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 *G. multiflorum* is vulnerable to the effects of climate change, in that there will be a smaller area of suitable habitat available for the species in the near future. Most populations in Haleakalā National Park, Waikamoi Preserve, and Hanawī NAR may be provided protection by fencing and ongoing ungulate control and nonnative plant control. Limited seed collection and storage and reintroduction efforts are ongoing. About 28 individuals have been outplanted at one site.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Maui Plant Cluster (USFWS 1997), 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.

Geranium multiflorum is a long-lived perennial shrub. To prevent extinction, which is the first step 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. In addition, a minimum of three populations should be documented on east Maui. Each of these populations must be naturally reproducing (viable seeds, seedlings, saplings) and increasing in number, with a minimum of 25 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met as, although there are two populations of at least 25 individuals (100 at Greensword Bog in 2009 and about 200 at Hanawī Stream in 2011), genetic representation is incomplete (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Geranium multiflorum* 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 2011. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2018.

- Population viability and monitoring—Survey known localities and suitable habitat areas on east Maui to determine the current status of all populations of *Geranium multiflorum*.
- Ungulate monitoring and control—Continue to construct and maintain exclusion fences to protect *G. multiflorum* from the impacts of feral ungulates.

- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species around all populations.
- Predator and herbivore monitoring and control—
 - Implement effective control methods for rodents at wild and reintroduced populations.
 - Develop and implement effective control methods for slugs and ants.
- Captive propagation for genetic storage and reintroduction—
 - Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
 - Evaluate genetic resources currently in storage to determine the need to place additional material into long-term storage due to this species’ vulnerability to climate change.
- Reintroduction and translocation—Continue reintroduction of individuals into suitable habitat within historic range that is managed for known threats to this species.
- Population biology research—Research pollinators and seed distributors to determine limiting factors and investigate techniques to improve natural recruitment.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use this information to determine future landscape needed for the recovery of the species.
- Alliance and partnership development—Continue to work with land managers to implement of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	< 3,000	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	Yes
1997 (recovery plan)	< 3,000	0	All threats managed in all three populations	No
			Complete genetic storage	No

			Three populations with 25 mature individuals each	Yes
2003 (critical habitat)	< 3,000	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	Yes
2011 (5-year review)	~ 600	89	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	Yes
2016 (critical habitat)	500–1,000	150	All threats managed in all three populations	Partially, ungulate and nonnative plant management
			Complete genetic storage	Partially
			Three populations with 25 mature individuals each	Unknown
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2018 (5-year review)	500+	28	All threats managed in all three populations	Partially, ungulate and nonnative plant management
			Complete genetic storage	Partially

			Reproduction (<i>i.e.</i> viable seeds, seedlings) at all three populations	No
			Three populations with 25 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 after Preventing Extinction).

Table 2. Threats to *Geranium multiflorum* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, some fencing
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, some management in fenced areas
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partial, some fencing
Rodent predation or herbivory	C	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	None
Loss of mutualists—Loss of pollinators and seed dispersers	E	Ongoing	None

References:

See the previous 5-year review for a full list of references (USFWS 2011). Only references for new information are provided below.

[DLNR] Department of Land and Natural Resources. 2008. NARS commission enhancement subcommittee meeting. June 4, 2008. 16 pp.

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. Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo, Hawai‘i. 134 pp.

- [HNP] Haleakalā National Park. 2013. Controlled propagation report.
- [HNP] 2015. Controlled propagation report.
- [HNP] 2017. Controlled propagation report.
- [HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lyon Arboretum. 2017. Micropropagation and seed conservation laboratory databases.
- [NPS] National Park Service. 2012. Information for programmatic section 7 consultation, Haleakalā National Park, Maui, Hawaii. 171 pp.
- Oppenheimer, H. 2018, in litt. GIS data and population information for *Geranium arboreum*.
- Robertson, S. 2016, in litt., Email regarding plant species in Haleakalā National Park. 23 MAY 2016.
- [TNC] The Nature Conservancy. 2014. Waikamoi Preserve East Maui Irrigation (EMI) addition, east Maui, Hawai‘i, long-range management plan, fiscal years 2015-2020. The Nature Conservancy, Maui Program, March 2014. 29 pp.
- [USFWS] U.S. Fish and Wildlife Service. 2011. *Geranium multiflorum* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/five_year_review/doc3837.pdf.
- [USFWS] 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573, February 12, 2016.
- [USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; final rule. Federal Register 81 (61): 17790–18110, March 30, 2016.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Geranium multiflorum* (nohoanu)

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

For Field Supervisor, Pacific Islands Fish and Wildlife Office