

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. 2009. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 103 species in Hawaii. Federal Register 74(49):11130-11133.

Lead Region/Field Office:

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

Name of Reviewer(s):

Marie Bruegmann, Plant Recovery Coordinator, PIFWO

Jess Newton, Recovery Program Lead, PIFWO

Assistant Field Supervisor for Endangered Species, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on March 16, 2009. The review was based on final critical habitat designations for *Geranium multiflorum* and other species from the island of Maui (USFWS 2003) as well as a review of current, available information. The National Tropical Botanical Garden provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Samuel Aruch, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Lead and the 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 *Geranium multiflorum* published in the Federal Register on May 14, 2003 (USFWS 2003) for a complete review of the species' status (including biology and habitat), threats, and management efforts. 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 *G. multiflorum*.

At the time of listing in 1992, there were 11 populations with less than 3,000 known individuals of *Geranium multiflorum* (USFWS 1992). The total current number of individuals for this species is approximately 600 individuals within Haleakala National Park and Koolau Gap.

Historically, *Geranium multiflorum* was known from Ukulele, Waieleele, and Waianapanapa on East Maui. It is now known from Haleakala National Park, Hanawi Natural Area Reserve, Koolau Forest Reserve, Waikamoi Preserve, and Kula Forest Reserve. In Haleakala National Park, at Puu Oili off the Halemauu Trail, *Geranium multiflorum* was first recorded in 1991 at 1,990 meters (6,530 feet) elevation, and again in 1997 at 2,103 meters (6,900 feet) elevation, with about 100 individuals in a gulch northeast of the ridge (National Tropical Botanical Garden 2009; Perlman 2009). Approximately 410 individuals of *G. multiflorum* were observed in the crater area of Haleakala National Park from approximately 1,981 to 2,103 meters (6,500 to 6,900 feet) elevation by Haleakala National Park Resource Management staff in 2004 (Haleakala National Park Resource Management, Vegetation Management 2004). In 2005, two new individuals were found in the Crater-Kapalaoa area at 2,195 meters (7,200 feet) elevation (Haleakala National Park Resource Management, Vegetation Management 2005). In Hanawi Natural Area Reserve, on the East ridge from Frisbee Meadow, *G. multiflorum* was observed in 1995 at 1,859 to 2,073 meters (6,100 to 6,800 feet) elevation (National Tropical Botanical Garden 2009; Perlman 2009). In the Waikamoi Preserve, Ainahou Bowl, upper Keanae (Koolau Forest Reserve), a single individual of *Geranium multiflorum* was observed in 2003 at 1,707 meters (5,600 feet) elevation (Bily 2003; National Tropical Botanical Garden 2009). In 2010, Haleakala National Park staff estimated that approximately 500 individuals are found throughout the Park's boundary and approximately 100 individuals are located in the Koolau Gap (USFWS 2010), for a total of approximately 600 individuals.

In Koolau Gap, this species is sympatric with and may hybridize with *Geranium cuneatum* (USFWS 1997).

In Haleakala National Park at Puu Oili off Halemauu Trail, the habitat where *Geranium multiflorum* occurs is *Deschampsia nubigena* (hairgrass) subalpine mesic grassland and forested gulches with *Dubautia menziesii* (naenae), *Geranium hillebrandii* (nohuanu), *Leptecophylla tameiameia* (pukiawe), *Metrosideros polymorpha* (ohia), *Myrsine* sp. (kolea), *Sophora chrysophylla* (mamane), *Tetramolopium humile* (no common name [NCN]), and *Vaccinium reticulatum* (ohelo) (Perlman 2009; Wood 2009).

In the Hanawi Natural Area Reserve, the habitat types are *Metrosideros polymorpha* — *Cheirodendron* (olapa) montane wet forest and *Leptecophylla tameiameia* subalpine shrubland with *Coprosma ernodeoides* (kukaenene), *Deschampsia nubigena*, *Dryopteris* spp. (hohiu, ii, kilau or akole), *Dubautia menziesii* (naenae), *Lycopodium venustulum* (NCN), *Melicope clusifolia* (kolokolo mokihana), *Morelotia gahniiiformis* (NCN), *Plantago pachyphylla* (laukahi kuahiwi), *Polystichum bonseyi* (NCN), *Pteridium aquilinum* var. *decompositum* (kilau), *Rubus macraei* (kala), *R. hawaiiensis* (akala),

Sanicula sandwicensis (NCN), *Stenogyne rotundifolia* (puaaainaka), and *Vaccinium reticulatum* (National Tropical Botanical Garden 2009; Perlman 2009; Wood 2009).

In the Waikamoi Preserve, at Ainahou Bowl and in the Koolau Forest Reserve the forest community is dominated by *Metrosideros polymorpha* var. *glaberrima* (ohia) and *M. polymorpha* var. *incana* (ohia) with *Broussaisia arguta* (kanawao), *Cheirodendron trigynum* subsp. *trigynum* (olapa), *Coprosma ernodeoides*, *C. ochracea* (pilo), *Cyrtandra hashimotoi* (keokeo haiwale), *C. platyphylla* (ilihia), *Dryopteris fusco-atra* (ii), *D. subbipinnata* (NCN), *D. wallichiana* (io nui), *Dubautia dolosa*, *D. linearis* subsp. *opposita*, *D. reticulata*, *D. scabra* subsp. *scabra* (all naenae), *Gunnera petaloidea* (ape ape), *Ilex anomala* (kawau), *Kadua acuminata* (au), *K. affinis* (manono), *K. centranthoides* (NCN), *K. hillebrandii* (manono), *Leptecophylla tameiameia*, *Lobelia hypoleuca* (kuhiaikamoowahie), *Luzula hawaiiensis* var. *hawaiiensis* (wood rush), *Melicope clusiifolia*, *Myrsine lessertiana* (kolea lau nui), *Perrottetia sandwicensis* (olomea), *Pipturus albidus* (mamake), *P. forbesii* (mamake), *Sadleria cyatheoides* (amau), *S. pallida* (amau ii), *Syzygium sandwicensis* (ohia ha), *Uncinia uncinata* (NCN), *Vaccinium calycinum* (ohelo), and *V. dentatum* (ohelo) (Bily 2003; National Tropical Botanical Garden 2009).

Feral ungulates such as deer (*Axis axis*) and pigs (*Sus scrofa*) degrade the habitat for *Geranium multiflorum* and thereby hamper regeneration of the species (Listing Factors A and D). Invasive introduced plant species have altered the habitat for *Geranium multiflorum* and compete for resources, these species include *Ageratina adenophora* (sticky snakeroot), *Anthoxanthum odoratum* (sweet vernal grass), *Dactylis glomerata* (cocksfoot), *Holcus lanatus* (common velvet grass), *Hypochoeris radicata* (hairy cat's ear), *Lapsana communis* (nipplewort), *Lythrum maritimum* (loosestrife), *Prunella vulgaris* (selfheal), *Rubus argutus* (blackberry), *R. niveus* (Mysore raspberry), and *R. rosifolius* (thimbleberry) (Listing Factor E) (Perlman 2009; Wood 2009).

Seed predation by rats (*Rattus* sp.) and consumption of leaves, stems, and seeds by deer, slugs (unidentified species), and ants (various species) are threats to *Geranium multiflorum* (Listing Factor C) (Perlman 2009; Wood 2009). Loss of pollinators is probably contributing to a decline in this species, which is now propagated from cuttings rather than seed (Listing Factor E) (Perlman 2009; Wood 2009).

Climate change may also pose a threat to *Geranium multiflorum* (Listing Factors A and E). However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

Haleakala National Park staff have been collecting and propagating *Geranium multiflorum* since at least 2004 when they collected 41 cuttings from 29 founder individuals located at the Crater area and reintroduced 18 individuals into the Crater (Haleakala National Park Resource Management, Vegetation Management 2004). In

2005, 259 cuttings were collected from 136 founder individuals from the Crater, and 28 individuals were reintroduced in the Crater and two in the West Slope-Summit area (Haleakala National Park Resource Management, Vegetation Management 2005). In 2006, 40 individuals were reintroduced in the Crater (Haleakala National Park Resource Management, Vegetation Management 2006). In 2007, 27 cuttings were collected from 25 founder individuals from Paliku and were grown in their nursery; from these cuttings 31 individuals were reintroduced, but recorded poor survivorship (Haleakala National Park Resource Management, Vegetation Management 2007). In 2008, 25 cuttings were made from plants located in the Crater, for propagation in the nursery (Haleakala National Park 2008). Currently, there are 26 individuals growing in the nursery and 12 individuals have been reintroduced into the Park (Haleakala National Park 2010).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Maui plant cluster (USFWS 1997), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Geranium multiflorum* is a long-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.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on islands where they now occur or occurred historically. For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

The interim stabilization goals for this species have not been met. Although, there are approximately 600 individuals, the current status of each population is unknown (Table 1), and all threats are not being managed (Table 2). Therefore, *Geranium multiflorum* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Survey known localities and suitable habitat areas in East Maui to determine current status of all populations of *Geranium multiflorum*.
- Collect propagules from all known populations for propagation and genetic storage.
- Consider long term tissue culture storage for some material, as no seed appears to be stored at this time.
- Fence all known populations to provide protection from the negative impacts of feral ungulates.
- Control invasive introduced plant species around all known populations.
- Control rats in the vicinity of these populations.

- Develop and implement methods to control ants and slugs.
- Establish additional populations within protected suitable habitat.
- Research pollinators and seed distributors to determine limiting factors; investigate techniques to improve natural recruitment.
- Work with Hawaii Division of Forestry and Wildlife, National Park Service, and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

References:

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

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	<3000	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	Yes
1997 (recovery plan)	< 3000	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	Yes
2003 (critical habitat)	< 3000	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	Yes
2010 (5-year review)	~600	89	All threats managed in all 3 populations	Partially (Table 2)
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Unknown

Table 2. Threats to *Geranium multiflorum*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification and herbivory	A, C, D	Ongoing	No
Rats – herbivory	C	Ongoing	No
Slugs and ants – herbivory	C	Ongoing	No
Invasive introduced plants	A, E	Ongoing	No
Loss of pollinators and seed dispersers	E	Ongoing	No
Climate change	A, E	Increasing	No

U.S. FISH AND WILDLIFE SERVICE
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

Field Supervisor, Pacific Islands Fish and Wildlife Office



Date 8/24/11