

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Lobelia koolauensis* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Lead Region/Field Office:

Region 1/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 2018. The review was based on a review of current, available information since the last 5-year review for *Lobelia koolauensis* (as *Lobelia gaudichaudii* subsp. *koolauensis*) (USFWS 2013). The evaluation completed 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 *Lobelia koolauensis* (as *Lobelia gaudichaudii* subsp. *koolauensis*) published in the Federal Register on July 21, 2009 and August 19, 2013 (available at https://ecos.fws.gov/docs/five_year_review/doc2452.pdf and https://ecos.fws.gov/docs/five_year_review/doc4223.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 *L. koolauensis*.

This short-lived perennial, monocarpic shrub in the Campanulaceae (bellflower) family is endangered and endemic to O‘ahu. The current status and trends for *Lobelia koolauensis* are provided in the tables below.

New Status Information:

- Currently, there are approximately 100 to 300 individuals of *Lobelia koolauensis* in four populations (‘Ōpae‘ula, Schofield Barracks-East Range, Kīpapa, and Waiawa-Waimano-Manana) in the Ko‘olau mountains of O‘ahu (U.S. Army 2018; Weisenberger *et al.* 2016). This subspecies is monocarpic (dies after flowering) so mature individuals are rarely observed, making estimates of population size approximate. The Schofield Barracks–East Range population has been monitored within the last five years and has shown a decline (PEPP 2019). The two largest populations have not been monitored within the last ten years (ANRP 2018, PEPP 2019).
- Lammers (in Wagner *et al.* (1999)) recognized two subspecies of *Lobelia gaudichaudii* (subsp. *koolauensis* and subsp. *gaudichaudii*), based on differences in corolla color and branching of inflorescences. In 2007, Lammers determined that these subspecies do not interbreed where sympatric and elevated both taxa to full species status. This change is accepted in the most recent update to the Manual of Flowering Plants of Hawai‘i (Wagner *et al.* 2012). We published a technical correction for this and other species in the Federal Register (80 FR 35860, June 23 2015) recognizing this taxonomic change and updated the List of Endangered and Threatened Species at section 17.12 in the Code of Federal Regulations. This change does not affect the range or endangered status of this taxon
- In 2012, 11 critical habitat units in the lowland wet ecosystem were designated for *Lobelia koolauensis* in the Ko‘olau mountains of O‘ahu (25,114 ac, 10,162 ha) (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. The assessment by Fortini *et al.* (2013) concluded that *Lobelia koolauensis* (as *Lobelia gaudichaudii*) is extremely vulnerable to the impacts of climate change, with a vulnerability score of 0.973 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). In addition, the assessment classified this taxon as a “wink-out” species. “Wink-out” species are those with no future climate envelope. No projected suitable climate areas exist for the species to persist into the future. This means that this species must persist within suitable microrefugia, or move to newly available climate-compatible areas to avoid extinction.

New Management Actions:

- Ungulate monitoring and control—Approximately 25 individuals of *Lobelia koolauensis* occur within one fenced area managed by the Army’s Natural Resources Program-O‘ahu (ANRP) (South Kaukonahua Subunit I) and may benefit from protection from habitat degradation or predation by feral pigs (U.S.

- Army 2010). A few individuals occur in a fenced enclosure constructed for another plant species at Waimano. Construction of an enclosure at Waiawa is in progress and may also include some individuals of this taxon.
- Captive propagation for genetic storage and reintroduction—
 - Seven founders from the Waiawa population and 23 founders from the SBMR-East Range population have been collected (Plant Extinction Prevention Program (PEPP) 2017).
 - Almost 2,000 seeds from 12 wild individuals collected from the Waiawa, ‘Ōpae‘ula, and SBMR-East Range populations are in storage (U.S. Army 2018).

Synthesis:

Currently there approximately 100 to 300 individuals of *Lobelia koolauensis* in four populations, though the two populations estimated to have 100 individuals each have not been visited in over ten years. 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 *L. koolauensis* is extremely vulnerable to the effects of climate change. Almost 2,000 seeds are in storage, and two occurrences are provided protection from feral ungulates in enclosures.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the O‘ahu 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.

Lobelia koolauensis is a short-lived perennial shrub that is monocarpic. 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 O‘ahu where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Some of the populations have not been monitored within recent years, there are only two populations that total more than 50 individuals each, but no observations of 50 plants flowering

within one year, genetic representation is incomplete and not all threats are managed (Table 1, Table 2). Therefore, *Lobelia koolauensis* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

Other than the new data on this taxon's vulnerability to climate change, we are not aware of any new threats or significant new information regarding the species' biological status since the last 5-year review in 2013. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2019.

- Surveys and inventories—Conduct surveys for a thorough current assessment of the status of known populations.
- Ungulate monitoring and control—Continue to construct large-scale fences around all naturally occurring and future reintroduced individuals and monitor exclosures regularly.
- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species and those that compete with *Lobelia koolauensis* at all occurrences.
- Site and habitat protection—Develop and implement effective measures to reduce the impact of landslides and flooding.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Rodent control—Control rats in the vicinity of all populations.
- Slug control—Control slugs in the vicinity of all populations.
- Population biology research—Study *Lobelia koolauensis* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Captive propagation for genetic storage and reintroduction—
 - Continue to collect cuttings and seeds from all existing populations and send to two or three different facilities for propagation and storage.
 - Conduct further research on seed storage and viability.
- Reintroduction and translocation—Begin reintroduction efforts, establish new populations and augment existing populations with genetically appropriate individuals within suitable habitat to increase numbers.
- Alliance and partnership development—Continue to work with the U.S. Army and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

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

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1991 (listing)	<250	0	All threats managed in all 5–7 populations	No
			Complete genetic storage	Unknown
			5–7 populations with 300 mature individuals each	No
1998 (recovery plan)	<280	0	All threats managed in all 5–7 populations	No
			Complete genetic storage	Unknown
			5–7 populations with 300 mature individuals each	No
2003 (critical habitat)	<270	0	All threats managed in all 5–7 populations	No
			Complete genetic storage	Unknown
			5–7 populations with 300 mature individuals each	No
2009 (5-year review)	5–310	0	All threats managed in all 5–7 populations	No
			Complete genetic storage	Partially
			5–7 populations with 300 mature individuals each	No
2012 (critical habitat)	ca 280	0	All threats managed in all 5–7 populations	No
			Complete genetic storage	Partially

			5–7 populations with 300 mature individuals each	No
2013 (5-year review)	>400	0	All threats managed in all 5–7 populations	No
			Complete genetic storage	Partially
			5–7 populations with 300 mature individuals each	No
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2019 (5-year review)	100–300	0	All threats managed in all three populations	Partially, for one population
			Complete genetic storage	Partially
			Reproduction (<i>i.e.</i> viable seeds, seedlings) at all three populations	Unknown
			Three populations with 50 mature individuals each	Unknown

* 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 *Lobelia koolauensis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation and destruction of habitat	A	Ongoing	Partial, ungulate fencing at two managed areas
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	None
Landslides destruction or loss of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation and herbivory	A	Ongoing	Partial, ungulate fencing at two managed areas
Rodent predation and herbivory	C	Ongoing	None
Invertebrate predation and herbivory	C	Ongoing	None
Competition with established invasive plant species	E	Ongoing	None
Stochastic events and small populations	E	Ongoing	Partial, seed collection and storage

References:

See previous 5-year reviews for a full list of references (USFWS 2009, 2013). Only references for new information are provided below.

[ANRP] Army Natural Resource Program-O‘ahu. 2018. 2018 status report for the Makua and Oahu implementation plans. 217 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. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 134 pp.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

[PEPP] Plant Extinction Prevention Program. 2017. PEPP annual report for fiscal year 2017 (October 1, 2016 – September 30, 2017). 200 pp.

[PEPP] 2019. Plant Extinction Prevention Program (PEPP) interim report for fiscal year 2019 (October 1, 2018 – September 30, 2019).

- U.S. Army Garrison Hawai‘i. 2010. Integrated natural resources management plan 2010-2014, Island of O‘ahu. 375 pp.
- [U.S. Army] U.S. Army, Environmental Division. 2018. Report to the U.S. Fish and Wildlife Service for Oahu Army Natural Resource Program, Permit: TES-043638, Reporting period January 1, 2018-December 31, 2018. 16 pp.
- [USFWS] U.S. Fish and Wildlife Service. 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, Federal Register 77 (181): 57648–57862, September 18, 2012.
- [USFWS] 2013. *Lobelia gaudichaudii* subsp. *koolauensis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/five_year_review/doc4223.pdf.
- [USFWS] 2015. Endangered and threatened wildlife and plants; technical corrections for 54 wildlife and plant species on the list of endangered and threatened wildlife and plants, direct final rule. 80 FR 35860, Tuesday June 23, 2015.
- [USFWS] 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.
- Wagner, W.L., D.R. Herbst, N. Khan, and T. Flynn. 2012. Hawaiian vascular plant updates: a supplement to the Manual of the Flowering Plants of Hawaii and Hawaii’s Ferns and Fern Allies Version 1.1 19 MAR 2012. 126 pp.
- Weisenberger, L., Sugii, N., Sporck-Koehler, M., Chau, M., Kwon, J., Caraway, V.L. & Gon, S.M. 2016. *Lobelia koolauensis*. The IUCN Red List of Threatened Species 2016: e.T80166134A115502744. <http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T80166134A80166155.en>.

U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW of *Lobelia koolauensis* (no common name)

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

Date _____