

Lobelia niihauensis
(no common name)

**5-Year Review
Summary and Evaluation**

**U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii**

5-YEAR REVIEW

Species reviewed: *Lobelia niihauensis* / no common name

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5-YEAR REVIEW
***Lobelia niihauensis* (no common name)**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

Lead Field Office:

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 792-9400

Cooperating Field Office(s):

N/A

Cooperating Regional Office(s):

N/A

1.2 Methodology used to complete the 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 *Lobelia niihauensis* and other species from the islands of Kauai and Oahu (USFWS 2003a, b) 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 Tamara Sherrill, 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 Deputy Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation 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.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1991. Endangered and threatened wildlife and plants; determination of endangered status for 26 plants from the Waianae Mountains, island of Oahu, Hawaii; final rule. Federal Register 56(209):55770-55786.

Date listed: October 29, 1991

Entity listed: Species

Classification: Endangered

Revised Listing, if applicable

FR notice: N/A

Date listed: N/A

Entity listed: N/A

Classification: N/A

1.3.3 Associated rulemakings:

USFWS. 2003a. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, Hawaii; final rule. Federal Register 68(39):9116-9479.

USFWS. 2003b. Endangered and threatened wildlife and plants; final designations or nondesignations of critical habitat for 101 plant species from the island of Oahu, Hawaii; final rule. Federal Register 68(116):35949-36406.

Critical habitat was designated for *Lobelia niihauensis* in two units totaling 2,090 hectares (5,165 acres) on Kauai (USFWS 2003a) and two units totaling 85 hectares (210 acres) on Oahu (USFWS 2003b). These designations include habitat on State and private lands. No critical habitat was designated on the island of Niihau (USFWS 2003a, b).

1.3.4 Review History:

Species status review [FY 2010 Recovery Data Call (September 2010)]:
Declining

Recovery achieved:

1 (0-25%) (FY 2007 Recovery Data Call – most recent year reported)

1.3.5 Species' Recovery Priority Number at start of this 5-year review:

8

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: U.S. Fish and Wildlife Service. 1998. Recovery plan for Oahu plants. U.S. Fish and Wildlife Service. Portland, Oregon. 207 pages, plus appendices.

Date issued: August 10, 1998.

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

Yes

No

2.1.2 Is the species under review listed as a DPS?

Yes

No

2.1.3 Was the DPS listed prior to 1996?

Yes

No

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

Yes

No

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

Yes

No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

Yes

No

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

Yes
 No

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

Yes
 No

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Listing Factors A, C, D, and E) affecting this species is presented in section 2.3.2 and Table 2. Listing Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for Oahu plants (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Lobelia niihauensis* is a short-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, weeding, etc.) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on Oahu, and if possible, islands where they now occur or occurred historically. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

This recovery objective has not been met. There are currently at least three populations on Oahu and three populations on Kauai that contain at least 50 individuals (Table 1), and although not all threats are being managed for all

populations most threats are being managed in Makua Valley on Oahu (Table 2).

For downlisting, a total of five to seven populations of *Lobelia niihauensis* should be documented on Oahu, and if possible, islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Lobelia niihauensis* should be documented on Oahu, and if possible, islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 300 mature individuals per population for short-lived perennials. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

No new information.

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Lobelia niihauensis not only produces flowers and fruit during summer and autumn, but also has a winter/spring flowering cycle which is documented on herbarium vouchers with flowers recorded from June thru October, February thru April; June thru July; and October thru December (K. Wood, National Tropical Botanical Garden, pers. comm. 2009). Fruits mature one month to six weeks after flowering. Plants are known to live as long as 20 years. Few juveniles have been observed in the wild (USFWS 2007).

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age

structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Lobelia niihauensis has not been reported on Niihau since 1931 (USFWS 1991). On Kauai, *Lobelia niihauensis* has been known to occur at a wide range of locations throughout the valleys of the Na Pali Coast, in Waimea Canyon (S. Perlman, National Tropical Botanical Garden, pers. comm. 2009), and in mountains to the east as far as Haupu and Kipu Kai. Since 2000, observations of only about 170 individuals have been recorded: Limahuli (50), Pohakuao Valley (20) Hanakoa Valley (100), with a few individuals seen at Milolii in 2000 (Clark 2009). In addition, about 1,000 individuals are estimated to occur within the cliff system in Kalalau Valley (K. Wood, pers. comm. 2009).

On Oahu, *Lobelia niihauensis* is found on Ohikilolo Ridge, Kaimokuiki-Manuwai Ridge, Kamaileunu Ridge, Mt. Kaala, Makaha-Waianae Kai, Makua, Nanakuli, South Mohiakea Gulch, east of Puu Kalena, Kahanahaiki Valley, between Puu Hapapa and Puu Kanehoa, Puu Kailio, between Kolekole Pass and Puu Hapapa, North of Palikea, Puu Kaua-Kauhiuhi-Paho-Halona subdistricts, and Lualualei Naval Magazine. There were at least 90 individuals located in Lualualei in 1994. That number remained in 2004, and additional populations were located in Puhawai and Mikilua subdistricts (Hawaii Natural Heritage Program 2004). It was estimated in 2006 that at least 13 populations of *L. niihauensis* existed on Oahu, with a total numbers between 350 and 475 individuals. USFWS estimated in 2006 that at Ohikilolo, Kahanahaiki, and Eastern Makua there were 150 individuals; at Keaau between 40 and 80; at Kauhiuhi Gulch 4 individuals; at Waianae 30; at Puu Kumakalii a single individual; at Kolekole 3; at Makaha 50; at Manuwai 2; at Mohiakea and Nanakuli Forest Reserve none; and at Lualualei 110 (USFWS 2007).

In summary, approximately 1,170 individuals occur on Kauai in 4 populations and between 350 and 475 individuals in 13 populations on Oahu, for a statewide total of 1,520 to 1,645 individuals in at least 17 populations. Three populations on Kauai and three populations on Oahu contain at least 50 individuals in each population; a single population on Kauai contains at least 300 individuals, however, there are no populations on Oahu that contains at least 300 individuals.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Recent molecular research on Campanulaceae (lobeliads) confirms that the Hawaiian members of the family arose from a single introduction event roughly 13 million years ago. The research places the original ancestor of the Hawaiian lobeliads on a former tall island near French Frigate Shoals and Gardner Pinnacles. This overturns previous thinking, based on morphological differences, that five independent colonizations had occurred. Hawaiian Campanulaceae (126 species) represent the largest plant clade on any single oceanic island or archipelago, and is viewed as the largest group of Hawaiian plants derived from a single ancestor. The ancestor was most likely woody, wind-dispersed, bird-pollinated, and adapted to open habitats at mid-elevations. The worldwide lobeliad radiation is even more dramatic than previously known, involving four more genera or sections, 19 additional species and a much wider range of growth forms and habitats. The two sections which include *Lobelia* species (i.e. *Lobelia* sect. *Galeatella*, *Trematolobelia*, *Lobelia* sect. *Revolutella*, and *Brighamia*) are believed to have diversified less than the *Cyanea-Clermontia-Delissea* genera. The lowest overall diversity and percentage of single-island endemics is in lineages with wind-dispersed seeds, including the *Lobelia* species, and the highest diversity and percentage of single-island endemics is in *Cyanea*, with fruits poorly dispersed by forest-interior birds (Givnish *et al.* 2008).

2.3.1.4 Taxonomic classification or changes in nomenclature:

No new information.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species within its historic range, etc.):

See section 2.3.1.2 above.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

On Kauai in Limahuli Valley's lower west side, below and south of Maunapuluo, *Lobelia niihauensis* grows in *Metrosideros polymorpha* (ohia) – *Diospyros* sp. (lama) – *Eragrostis variabilis* (kawelu) shrubland and mesic forest with associated native species including *Alyxia stellata* (maile), *Artemisia australis* (ahinahina), *Bidens* sp. (kookoolau), *Bobea brevipes* (akupa), *Carex wahuensis* (no common name [NCN]), *Chamaesyce celastroides* (akoko), *Diplazium sandwichianum* (hoio), *Dodonaea viscosa* (aalii), *Freycinetia arborea* (ie ie), *Hibiscus kokio* subsp. *saintjohnianus* (kokio ula), *Kadua acuminata* (pilo), *K. affinis* (manono), *Lipochaeta connata* (nehe), *Pleomele aurea* (hala pepe), *Perrottetia sandwicensis* (olomea), *Peucedanum sandwicense* (makou), *Pipturus* sp. (mamake), *Pouteria sandwicensis* (alaa), *Psychotria mariniana* (kopiko), *Psydrax odorata* (alahee), *Tetraplasandra* sp. (ohe), *Wilkesia gymnoxiphium* (iliau), and *Xylosma hawaiiense* (ae) (National Tropical Botanical Garden 2010a).

On the Na Pali Coast Trail, 3.25 miles (5.2 kilometers) in, between Hanakapiai and Hoolulu Valleys, *Lobelia niihauensis* grows in *Metrosideros polymorpha* – *Eragrostis variabilis* mixed coastal native cliff with associated native species including *Artemisia australis*, *Bidens forbesii* (kookoolau), *Chamaesyce celastroides*, *Hibiscus kokio* subsp. *saintjohnianus*, *Kadua fluviatilis* (kamapuaa), *Lythrum maritimum* (pukamole), and *Pandanus tectorius* (hala) (National Tropical Botanical Garden 2010b).

In Kalalau Valley, *Lobelia niihauensis* grows in mixed mesic shrub cliff with associated native species such as *Acacia koa* (koa) and *A. koaia* (koaie), *Alyxia stellata*, *Artemisia australis*, *Bidens cervicata*, *B. forbesii*, *B. sandwicensis* (all kookoolau), *Carex meyenii* (NCN), *Carex wahuensis* subsp. *wahuensis*, *Chamaesyce celastroides* var. *hanapepensis*, *Coprosma* sp. (pilo), *Dianella sandwicensis* (uki uki), *Diospyros* spp., *Dodonaea viscosa*, *Doodia kunthiana* (okupukupu), *Doryopteris decipiens* (kumuniu), *Dubautia microcephala* (naenae), *Eragrostis variabilis*, *Hibiscus kokio* subsp. *saintjohnianus*, *Kadua flynnii* (NCN), *Lepidium serra* (anaunau), *Lipochaeta connata* var. *acris*, *Luzula hawaiiensis* var. *hawaiiensis* (wood

rush), *Lysimachia glutinosa* (NCN), *L. scopulensis* (NCN), *Mariscus phleoides* subsp. *phleoides* (NCN), *Melicope pallida* (alani), *Microlepis strigosa* (palapalai), *Nestegis sandwicensis* (olopua), *Nototrichium divaricatum* (kului), *Panicum lineale* (NCN), *Peperomia blanda* var. *floribunda* (ala ala wai nui), *P. tetraphylla* (ala ala wai nui), *Peucedanum sandwicense*, *Plantago princeps* var. *anomala* (laukahi kuahiwi), *Pleomele aurea*, *Pipturus albidus*, *P. kauaiensis*, *Pisonia* sp. (papala), *Poa mannii* (NCN), *Pouteria sandwicensis*, *Psychotria greenwelliae* (kopiko), *P. mariniana*, *Psydrax odorata*, *Pteralyxia kauaiensis* (kaulu), *Rauvolfia sandwicensis* (hao), *Remya montgomeryi* (NCN), *Santalum freycinetianum* var. *pyrularium* (iliahi), *Schiedea apokremnos* (NCN), *Selaginella arbuscula* (lepelepe a moa), *Sida fallax* (ilima), *Stenogyne campanulata* (NCN), *Wikstroemia oahuensis* (akia), *Wilkesia gymnoxiphium* (iliau), *W. hobyi* (dwarf iliau), and *Xylosma* sp. (National Tropical Botanical Garden 2010a; Perlman 2009; Wood 2009a, b) .

On Kalalau rim, *Lobelia niihauensis* grows in several areas: on the Kalahu side below and west of first Kalalau lookout; north, below Puu o Kila, and north of Kahuamaa Flat in diverse mesic forest surrounded by precipitous cliffs with associated native species including *Acacia koa*, *Chamaesyce eleanoriae*, *Diospyros* sp., *Dryopteris* sp., *Dubautia* sp., *Eragrostis* sp., *Euphorbia haeleeleana* (NCN), *Eurya sandwicensis* (anini), *Flueggea neowawraea* (mehamehame), *Gouania* sp. (NCN), *Hibiscadelphus woodii* (hau kuahiwi), *Hibiscus kokio*, *Kadua acuminata*, *K. flynnii*, *Lepidium* sp. (anaunau), *Lipochaeta subcordata* (nehe), *Lysimachia glutinosa* (NCN), *Lysimachia* sp., *Melicope pallida*, *Metrosideros polymorpha*, *Myrsine linearifolia* (kolea), *Nestegis sandwicensis*, *Nototrichium divaricatum*, *N. sandwicense* (both kului), *Nothoctrum longifolium* (aeia), *Peucedanum sandwicense*, *Phyllostegia electra* (NCN), *Poa mannii*, *Psydrax odorata*, *Pleomele aurea*, *Psychotria* sp., *Rauvolfia sandwicensis*, *Remya montgomeryi*, *Santalum* sp., *Schiedea membranacea* (NCN), and *Stenogyne campanulata* (National Tropical Botanical Garden 2010a; Wood 2009b).

In Pohakuao Valley, cliffs of Kaaalahina and Manono ridges, Kanakou and Puu Ki, *Lobelia niihauensis* grows in *Eragrostis variabilis* coastal dry cliffs and shrubland and in *Diospyros sandwicensis* – *Metrosideros polymorpha* mesic forest with native vegetation including *Artemisia australis*, *Bidens* sp.,

Canavalia napaliensis (awikiwiki), *Carex wahuensis*, *C. meyenii*, *Chamaesyce celastroides*, *Diospyros hillebrandii* (lama), *Dodonaea viscosa*, *Eragrostis variabilis*, *Lepidium serra*, *Lipochaeta connata* var. *acris*, *Microlepia strigosa* (palapalai), *Peperomia tetraphylla*, *Peucedanum sandwicense*, *Pleomele aurea*, *Psychotria mariniana*, *Rauvolfia sandwicensis*, *Schiedea apokremnos*, *Streblus pendulinus* (aiiai), *Tetraplasandra waimeae* (ohe kikoola), and *Wilkesia gymnoxiphium* (National Tropical Botanical Garden 2010a, 2010b; Perlman 2009; Wood 2009b)

In Hanakoa Valley, on northeast facing slopes and cliffs of Manono Ridge, *Lobelia niihauensis* grows in *Diospyros sandwicensis* relic forest and cliffs with associated native species such as *Artemisia australis*, *Bidens sandwicensis*, *Chamaesyce celastroides* var. *hanapepensis*, *Eragrostis variabilis*, *Hibiscus kokio* subsp. *saintjohnianus*, *Peucedanum sandwicense*, *Schiedea apokremnos*, and *Sida fallax* (National Tropical Botanical Garden 2010a; Wood 2009a, b)

In Waiahuakua Valley's north aspect, *Lobelia niihauensis* grows with associate native species including *Artemisia australis*, *Bidens sandwicensis*, *Boehmeria grandis* (akolea), *Carex wahuensis*, *Chamaesyce celastroides*, *Cyanea hardyi* (haha), *Eragrostis variabilis*, *Hibiscus kokio* subsp. *saintjohnianus*, *Kadua affinis*, *K. cookiana* (awiwi), *K. flynnii* (NCN), *Lepidium serra*, *Leptecophylla tameiameiae* (pukiawe), *Lipochaeta connata* var. *acris*, *Metrosideros polymorpha*, *Panicum lineale*, *Peucedanum sandwicense*, and *Wilkesia gymnoxiphium* (National Tropical Botanical Garden 2010a; Wood 2009b).

In Milolii Valley, *Lobelia niihauensis* grows in *Metrosideros polymorpha* – *Eragrostis variabilis* shrubland with native vegetation such as *Artemisia australis*, *Bidens* sp., *Peucedanum sandwicensis*, *Chamaesyce celastroides*, *Lipochaeta connata*, *Dodonaea viscosa*, and *Wilkesia gymnoxiphium* (National Tropical Botanical Garden 2010a; Perlman 2009; Wood 2009b).

On Kaaweiki Ridge, *Lobelia niihauensis* grows in dry shrubland on steep slopes with invasive introduced plant species *Leucaena leucocephala* (haole koa) that is dominant, but also with associated native species including *Myoporum sandwicensis* (naio), *Nototrichium* sp., and native and introduced grasses (National Tropical Botanical Garden 2010a).

In Koaie Canyon's upper drainage *Lobelia niihauensis* grows on *Metrosideros polymorpha* – *Diospyros* sp. mesic cliffs with mixed mesic forest with riparian vegetation, associated with native species including *Antidesma platyphyllum* (hame), *Artemisia australis*, *Bidens sandwicensis*, *Carex wahuensis*, *Chamaesyce celastroides* var. *hanapepensis*, *Cheirodendron fauriei* (olapa), *Dodonaea viscosa*, *Diplazium sandwichianum* (hoio), *Dryopteris fusco-atra* (ii), *Eragrostis variabilis*, *Lepidium serra*, *Leptecophylla tameiameiae*, *Lipochaeta connata*, *Microlepia strigosa*, *Neraudia melastomifolia* (maaloa), *Nototrichium sandwicense*, *Peucedanum sandwicense*, *Pleomele aurea*, *Pouteria sandwicensis*, *Pritchardia minor* (loulu), *Rumex albescens* (huahuako), *Schiedea spergulina* (NCN), *Sida fallax*, and *Wilkesia gymnoxiphium* (National Tropical Botanical Garden 2010a, 2010b; Wood 2009a, b).

On the Haupu Range, at Keopaweo above Huleia Stream and at Kipu Kai the plant community is invasive vegetation on cliffs with associated native species including *Artemisia australis*, *Bidens sandwicensis*, *Carex wahuensis*, *Dodonaea viscosa*, *Eragrostis variabilis*, *Lepidium orbiculare* (NCN), *Osteomeles anthyllidifolia* (ulei), and *Sida fallax*. The endangered native *Brighamia insignis* was also once present in the area (National Tropical Botanical Garden 2010b; Perlman 2009).

On Oahu, *Lobelia niihauensis* grows in the Waianae Mountains at Waianae Kai, on eastern slopes of Mt. Kaala; at Puu Kalena at the base of cliffs; in the drainage just northeast of Puu Kalena, north of Mohiakea Gulch; on the south side ridge and Manuwai Gulch; at Puu Kawiwi, and at Kamaileunu Summit (Uluhulu Gulch to Nanakuli Valley) (USFWS 2007) in *Metrosideros polymorpha* lowland mesic forests and cliffs with associated native species such as *Antidesma platyphyllum*, *Artemisia australis*, *Asplenium* sp., *Bidens torta* (kookoolau), *Carex* sp., *Chamaesyce celastroides*, *Dodonaea viscosa*, *Dryopteris* sp., *Eragrostis grandis* (large Hawaii lovegrass), *Gouania vitifolia* (NCN), *Labordia kaalae* (kamakahala), *Lepidium arbuscula* (NCN), *Leptecophylla tameiameiae*, *Melanthera tenuis* (nehe), *Osteomeles anthyllidifolia*, *Perrottetia sandwicensis*, *Peucedanum sandwicense*, *Pipturus* sp., *Pouteria sandwicensis*, *Pritchardia kaalae* (loulu), *Schiedea mannii* (NCN), and *Sida fallax* (National Tropical Botanical Garden 2010a; Perlman 2009; Wood 2009b).

Also in the Waianae Mountains, in Makua Valley, *Lobelia niihauensis* grows in the back of the valley and up a north facing dark gulch, in lowland mesic forest with associated native species including *Bidens torta*, *Bobea timonioides*, *B. sandwicensis* (both ahakea), *Neraudia angulata* var. *dentata* (NCN), *Melanthera tenuifolia*, *Sida fallax*, and *Wikstroemia* sp. (National Tropical Botanical Garden 2010a; Wood 2009b).

Lobelia niihauensis grows in the Makua Military Reserve, in the Ohikilolo Ridge cliff community with native vegetation that includes *Artemisia australis*, *Bidens torta*, *Carex* sp., *Chamaesyce celastroides*, *Dodonaea viscosa*, *Dubautia herbstobatae* (naenae), *Leptecophylla tameiameiaie*, *Melanthera tenuifolia*, *Lysimachia remyi* (NCN), *Metrosideros polymorpha*, *Nototrichium humile* (kului), *Osteomeles anthyllidifolia*, *Schiedea hookeri* (NCN), *S. mannii*, *Silene lanceolata* (NCN), *Stenogyne kaalae* (NCN), and *Tetramolopium filiforme* (NCN) (National Tropical Botanical Garden 2010b; Perlman 2009; Wood 2009b).

In Keaau Valley, *Lobelia niihauensis* grows in *Metrosideros polymorpha* – *Eragrostis variabilis* shrubland with native species *Artemisia australis*, *Bidens torta*, *Chamaesyce celastroides*, *Dodonaea viscosa*, *Dubautia herbstobatae*, *D. sherffiana* (NCN), *Schiedea mannii*, *Leptecophylla tameiameiaie*, *Osteomeles anthyllidifolia*, and *Peucedanum sandwicense* (Perlman 2009).

At Lualualei on Oahu, *Lobelia niihauensis* grows on cliffs in Puu Kailio, Puu Kaua Region, a ridge south of Kaua, at Puu Hapapa, on a ridge west of Pohakea Pass, and northwest and below Palikea in *Metrosideros polymorpha* lowland mesic and mixed cliff communities with associated native species including *Alyxia stellata*, *Bidens torta*, *Carex meyenii*, *Carex wahuensis*, *Chamaesyce multiformis* (akoko) and *C. kuwaleana* (akoko), *Cocculus* sp. (huehue), *Coprosma longifolia* (pilo), *Cyperus phleoides* (NCN), *Dianella sandwicensis*, *Dodonaea viscosa*, *Doryopteris decora* (NCN), *Eragrostis grandis*, *Kadua cordata* subsp. *remyi* (kopa), *K. acuminata* (au), *Lepidium arbuscula*, *Lysimachia hillebrandii* (kolokolo lehua), *Metrosideros polymorpha* var. *polymorpha*, *Myrsine lessertiana* (kolea lau nui), *M. sandwicensis* (kolea lau nui lii), *Osteomeles anthyllidifolia*, *Peperomia tetraphylla*, *Panicum beecheyi*

(NCN), *Pittosporum confertiflorum* (hoawa), *Psychotria hathewayi* (kopiko), *Rumex albescens*, and *Schiedea ligustrina* (NCN) (National Tropical Botanical Garden 2010a; Perlman 2009; Wood 2009a, b).

2.3.1.7 Other:

No new information.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

All populations of *Lobelia niihauensis* are threatened by invasive introduced plant species. On Kauai, these plant species include *Adiantum* sp. (maidenhair fern), *Ageratina riparia* (spreading mist flower), *Aleurites moluccana* (kukui), *Andropogon glomeratus* (bluestem), *Blechnum appendiculatum* (NCN), *Bryophyllum pinnatum* (airplant), *Casuarina equisetifolia* (ironwood), *Clidemia hirta* (Koster's curse), *Clusia rosea* (autograph tree), *Elephantopus mollis* (soft elephant's foot), *Erigeron karvinskianus* (daisy fleabane), *Ficus* sp. (fig), *Furcraea foetida* (Mauritius hemp), *Lantana camara* (lantana), *Melinis minutiflora* (molasses grass), *Melinis* sp., *Paspalum urvillei* (vasey grass), *Pluchea* sp. (marsh fleabane), *Pluchea carolinensis* (marsh fleabane), *Psidium guajava* (common guava), *Rubus argutus* (blackberry), *Rubus rosifolius* (thimbleberry), *Schinus terebinthifolius* (Christmas berry), *Setaria parviflora* (yellow foxtail), *Syzygium cumini* (Java plum), (National Tropical Botanical Garden 2010a,b; Perlman 2009; Wood 2009a, b).

Cliff habitat in Kalalau, Hanakoa, Waiahuakua Valley, Koaie, Haupu, and at Kalalau Rim is severely degraded by feral goats (*Capra hircus*) and pigs (*Sus scrofa*), landslides, drought, and fallen boulders (National Tropical Botanical Garden 2010a, 2010b; Perlman 2009; Wood 2009a, b).

On Oahu, invasive competing plant species include *Acacia confusa* (Formosan koa), *Ageratina riparia*, *Conyza bonariensis* (hairy horseweed), *Grevillea robusta* (silk oak), *Lantana camara*, *Melinis minutiflora* (molasses grass), *Erigeron*

karvinskianus, *Gamochaeta purpurea* (cudweed), *Schinus terebinthifolius*, *Stachytarpheta jamaicensis* (Jamaica vervain), (National Tropical Botanical Garden 2010b; Perlman 2009; Wood 2009b). Feral goats also degrade the habitat on Oahu (USFWS 2007).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Not a threat.

2.3.2.3 Disease or predation:

Herbivory by goats, rats (*Rattus* sp.), and slugs (unidentified species) on *Lobelia niihauensis* is noted on both Kauai and Oahu (National Tropical Botanical Garden 2010a, 2010b; Perlman 2009; USFWS 2007; Wood 2009a).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Not a threat.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

On Oahu, other threats to *Lobelia niihauensis* are fire and military training activities. Three populations of *Lobelia niihauensis* occur on military lands on Oahu (USFWS 2007). The military classifies it as a species which is disturbance averse (Orth 2006).

Climate change may also pose a threat to this species. 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.

Lobelia niihauensis was propagated at the National Tropical Botanical Garden in 2005 and 2008 from material which originated from Pohakuao, Manono Ridge on Kauai (National Tropical Botanical Garden 2010b; Wood 2009b). The U.S. Army Environmental staff on Oahu do not report any seed

storage or propagation of this species in their current recovery program, as this is considered a non-target species for the U.S. Army (USFWS 2007). At the Harold L. Lyon Arboretum on Oahu, more than 90,000 seeds from unknown sources are in long-term storage (Center for Conservation Research and Training Seed Storage Laboratory 2010). The Kauai Division of Forestry and Wildlife nursery has 100 seeds from cultivated plants (Kauai Division of Forestry and Wildlife 2009).

Requirements for mitigation of incidental damage to the species is covered by the Biological Opinion of the USFWS for U.S. Army Military Training at Makua Military Reservation (USFWS 2007). The Army has completed a fence that runs the south and southeast perimeter of Makua Valley, protecting the plants on Ohikilolo Ridge. Management activities where this species is located include fencing, weeding, ungulate control, rat baiting, fuel modification, firebreak management, habitat restoration, and slug control (USFWS 2007).

2.4 Synthesis

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for Oahu plants (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Lobelia niihauensis* is a short-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 Oahu, and if possible, at least one other island 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 50 mature individuals per population.

The interim stabilization goals for this species have been partially met. There are currently at least three populations on Oahu and three populations on Kauai that contain at least 50 individuals in each population (Table 1). However, not all threats are being managed for all populations, but most of the threats are being managed in the Makua Valley on Oahu (Table 2). Therefore, *Lobelia niihauensis* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Lobelia niihauensis* from listing through 5-year review.

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1991 (listing)	400-1,400	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Unknown
1998 (recovery plan)	967-2,852	0	All threats managed in all 3 populations	No
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Yes
2003 (critical habitat)	646-2,531	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Yes
2010 (5-year review)	1,520 – 1,645	0	All threats managed in all 3 populations	Partially (Table 2)
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Yes: 3 populations on Kauai and 3 populations on Oahu with 50 individuals each

Table 2. Threats to *Lobelia niihauensis*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification and herbivory	A, C, D	Ongoing	Partially: Makua populations fenced from goats but some pigs still in area
Rats – herbivory	C	Ongoing	Partially: rat baiting on Ohikilolo may benefit Makua populations
Slugs – herbivory	C	Ongoing	Partially: slug control on Ohikilolo may benefit Makua populations
Fire	E	Ongoing	Partially: weed control in Makua includes fire breaks
Military training activities	E	Ongoing	No
Invasive introduced plants	A, E	Ongoing	Partially: weed control in Makua and other areas
Climate change	A, E	Increasing	No

3.0 RESULTS

3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

Extinction

Recovery

Original data for classification in error

No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: _____

Reclassification (from Endangered to Threatened) Priority Number: _____

Delisting (regardless of current classification) Priority Number:

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Collect and store seed from all known populations for genetic storage and reintroduction.
- Construct large-scale fences around all naturally occurring and reintroduced individuals to control feral ungulates.
- Continue to implement methods to control rats and slugs in all populations.
- Control introduced invasive plant species in all populations.
- Continue to protect populations from fire.
- Work with U.S. Army, Hawaii Division of Forestry and Wildlife, Hawaii State Parks, 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.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Lobelia niihauensis* (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
- No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable: _____

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Date 
