5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Stenogyne bifida* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 70 species in Idaho, Montana, Oregon, Washington, and the Pacific Islands. Federal Register 73(83):23264-23266.

Lead Region/Field Office:

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

Name of Reviewer(s):

Marie Bruegmann, Pacific Islands Fish and Wildlife Office, Plant Recovery Coordinator
Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Assistant Field Supervisor for Endangered Species
Jeff Newman, Pacific Islands Fish and Wildlife Office, Acting Deputy Field Supervisor

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 April 29, 2008. The review was based on the final critical habitat designation for *Stenogyne bifida* and other species from the island of Molokai (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 Tamara Sherrill, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Assistant Field Supervisor for Endangered Species and Acting Deputy Field Supervisor 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 designation for *Stenogyne bifida* published in the Federal Register on March 18, 2003 (USFWS 2003) for a complete review of the species' status (including biology and habitat), threats, and management efforts. No new threats or 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 *S. bifida*.

Stenogyne bifida is a climbing herbaceous vine of the Lamiaceae (mint) family and is endemic to the island of Molokai. It was historically recorded from a number of sites on Molokai but is now nearly extinct in the wild. At the time of listing in 1992, there were less than 10 individuals in three populations in eastern Molokai, at Manawai-Kahananui Ridge, on Kolo Ridge, and on the eastern fork of Kawela Gulch (USFWS 1992). In 1997, Ken Wood of the National Tropical Botanical Garden, observed five individuals of *Stenogyne bifida* in Kua Gulch, Molokai (National Tropical Botanical Garden 2008a). No other observations have been recorded in Kua Gulch since 1997 (Hawaii Biodiversity and Mapping Program 2009; National Tropical Botanical Garden 2008a).

A single wild individual *Stenogyne bifida* is currently known. It is a newly germinated seedling in an exclosure where mature plants had previously occurred in Kamakou Preserve, Molokai, in the east fork of Kawela Gulch, off the Puu Kolekole Trail. Another population located on private lands within the East Molokai Watershed Partnership has not been recently revisited and its current status is unknown (H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2009). Botanists have visited the Kamakou population exclosure at least annually since 1990, when there were five individuals, and at least seven times from September 2004 through May 2006 (National Tropical Botanical Garden 2008a). In 2004, there were three individuals, two in poor condition. In the course of the following year and a half, the two ailing individuals died and the third was damaged, and then apparently disappeared also (Tangalin 2009). However, one individual in very poor condition was reported in 2008 (Perlman 2009). Plant Extinction Prevention Program staff reported that no other wild plants of *S. bifida* are currently known apart from the one seedling. Botanists have visited several historical locations in recent years without success of finding *S. bifida* individuals (Hawaii Department of Land and Natural Resources 2007).

The origins of the 58 Hawaiian mint species, including those in the genus *Stenogyne*, were evaluated in a study published in 2002. Hawaiian endemic mints constitute a major island radiation, displaying a remarkable diversity of floral, fruit, and vegetative features. Species in the genera *Haplostachys* and *Phyllostegia* have flowers associated with insect pollination, whereas those in *Stenogyne* have flowers typical of bird pollination. Using phylogenetic analyses of DNA sequence data, the Hawaiian genera were found to be most closely related to a group of temperate North American *Stachys* from the Pacific coast, suggesting that the Hawaiian mints derived from a single colonization event from western North America to the Hawaiian Islands (Lindqvist and Albert 2002). A subsequent study indicates that most *Stenogyne* species come from a single introduction with a comparatively recent origin; Oahu (3.0 million years ago or less) or the Maui Nui island complex (2.2 million years ago or less). Subsequent diversification appears to have involved multiple inter-island dispersal events (Lindqvist *et al.* 2003). The Hawaiian mints have been the subject of further studies exploring mechanisms of evolutionary adaptation (Lindqvist *et al.* 2007).

There is no new information regarding changes in nomenclature or taxonomy for this species.

The habitat in the Kamakou area where *Stenogyne bifida* grows is disturbed *Metrosideros polymorpha* mesic to wet forest with associated native species including *Alyxia stellata* (maile), *Athyrium microphyllum* (akolea), *Bidens wiebkei* (kookoolau), *Broussaisia arguta* (kanawao), *Cheirodendron trigynum* (olapa), *Cibotium* sp. (hapuu), *Coprosma foliosa* (pilo), *Cyanea mannii* (haha), *Dicranopteris linearis* (uluhe), *Dodonaea viscosa* (aalii), *Dryopteris unidentata* var. *paleacea* (akole), *Dubautia linearis* subsp. *opposita* (naenae), *Gahnia beecheyi* (no common name [NCN]), *Kadua affinis* (manono), *Kadua cordata* var. *cordata* (kopa), *Leptecophylla tameiameiae* (pukiawe), *Liparis hawaiensis* (awapuhiakanaloa), *Lysimachia remyi* (NCN), *Melicope clusiifolia* (alani kuahiwi), *Nephrolepis* sp. (kupukupu), *Pipturus albidus* (mamake), *Scaevola chamissoniana* (naupaka kuahiwi), *Sadleria* sp. (amau), *Streblus pendulinus* (aiai), and *Vaccinium* sp. (ohelo) (National Tropical Botanical Garden 2008b; Tangalin 2009).

The habitat at Kua Gulch is *Metrosideros polymorpha – Dicranopteris linearis* lowland wet to mesic forest. Associated species include *Canavalia molokiniensis* (awikiwiki), *Cyanea angustifolia* (haha), *Melicope peduncularis* (alani), *Metrosideros waialealae* var. *fauriei* (NCN), *Nephrolepis multiflora* (NCN), *Neraudia sericea* (NCN), and *Panicum tenuifolium* (mountain pili) (National Tropical Botanical Garden 2008a).

The primary threat to the survival of *Stenogyne bifida* is habitat degradation by feral pigs (*Sus scrofa*) (Factor A), which are very abundant in habitat where it occurs (W. Garnett, Wiliwili Hawaiian Plants, pers. comm. 2009). Invasive introduced plant species that compete with and alter the habitat for *S. bifida* include large mats of *Melinis minutiflora* (molasses grass), *Buddleia asiatica* (dogtail), *Cyrtomium falcatum* (holly fern), *Rubus rosifolius* (thimbleberry), and *Schinus terebinthifolius* (Christmasberry) (Factor E) (Tangalin 2009). Climate change may also pose a threat to *Stenogyne bifida* (Factors A and E). However, current climate change models do not allow us to predict specifically what those effects, and their extent, would be for this species.

There is no new information regarding overutilization of this species for commercial, recreational, scientific, or educational purposes (Factor B).

Red spots and a white mold or fungus (Factor C) were observed on the remaining plant in Kamakou in 2005 (Tangalin 2009). Apparently this disease has not been diagnosed further, but it could be powdery mildew, which also occurs on nursery plants. Insect vectors that may contribute to disease problems have also not been identified, but ants are mentioned as a greenhouse pest (Factor C) (Lilleeng-Rosenberger 2005). Powdery mildew, root mealy bugs, snails, and slugs (Factor C) have also been challenges to growing *Stenogyne bifida* in the greenhouse (W. Garnett, pers. comm. 2009). One botanist states that this may be a species that will require ongoing treatment with pesticides to survive introduced pest threats (W. Garnett, pers. comm. 2009).

There is no new information regarding the inadequacy of existing regulatory mechanisms for this species (Factor D).

In addition to all of the other threats, species like *Stenogyne bifida* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes, landslides, flooding, and disease outbreaks (Factor E). The effects of these processes on this single-island endemic are exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species (Factor E) (USFWS 1996). The limited number of individuals of this species which remain, and that fact that most plants in cultivation are clones of one parent, creates a strong risk of genetic bottle-necking and exacerbates the risk presented by stochastic environmental events such as those mentioned above (Factor E).

In 2007, Plant Extinction Prevention Program staff, and Steve Perlman and Natalia Tangalin of the National Tropical Botanical Garden constructed an exclosure to protect individuals of *Stenogyne bifida* near the Kawela tunnel on The Nature Conservancy's Kamakou Preserve. It was revisited in the hope that seeds from the soil seed bank had germinated, but no plants were observed. There are 249 seeds in storage at the National Tropical Botanical Garden on Kauai from Kamakou and Kua Gulch, collected from 1990 to 1997 (National Tropical Botanical Garden 2009a, b). Fourteen individual plants propagated from cuttings are in cultivation at the National Tropical Botanical Garden on Kauai (M. Clark, National Tropical Botanical Garden, pers. comm. 2009). Two additional individual plants propagated from cuttings are in cultivation at a shade house in Kalae, Molokai (W. Garnett, pers. comm. 2009). Harold L. Lyon Arboretum has 71 tissue cultured (cloned) plants from three individuals collected in 1995 from Kawela Gulch (Harold L. Lyon Arboretum 2009). Plans are being made to reintroduce *S. bifida* on Molokai (W. Garnett, pers. comm. 2009; Hawaii Department of Land and Natural Resources 2007).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants in the Molokai plant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Stenogyne bifida* is a short-lived perennial, and to be considered stable, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on the island of Molokai. 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 (see Table 1), as only one immature individual exists and all threats are not being managed. Therefore, *Stenogyne bifida* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue to collect seeds and/or cuttings from cultivated individuals for genetic

storage and propagation.

- Treat plants with systemic fungicide and pesticide solution, if the plants can tolerate it, before reintroducing into natural habitat settings.

- Grow a percentage of the plants to maturity in a nursery setting before reintroduction to improve survival and shorten time until flowering and to generate additional seeds, if possible.

- As adequate material becomes available, outplant propagules into a minimum of two reintroduction sites and an easily accessible site where the plants can be intensively managed for threats from invasive introduced plants, disease, and insects.

- Monitor all wild and reintroduced individuals frequently to discover any negative impacts and manage them as quickly as possible.

- Continue to propagate from cuttings, leaving some plants in *ex situ* collections to maintain material for replacement plants.

- Work with Hawaii Division of Forestry and Wildlife and The Nature Conservancy to contribute to implementation of ecosystem-level restoration and management to benefit this species.

References:

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Personal Communications

Clark, Margaret. 2009. Seed Bank Manager, National Tropical Botanical Garden, Kalaheo, Hawaii. E-mail to Tamara Sherrill, Biological Consultant, dated October 6, 2009. Subject: *Stenogyne bifida* plants in cultivation.

Garnett, William. 2009. Wiliwili Hawaiian Plants, Molokai, Hawaii. E-mail to Margaret Clark, National Tropical Botanical Garden, dated January 22, 2009. Subject: *Stenogyne bifida*

Oppenheimer, Hank. 2009. Maui Nui Coordinator, Plant Extinction Prevention Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated January 19, 2009. Subject: *Centaurium sebaeoides, Stenogyne bifida*

Table 1. Status of *Stenogyne bifida* from listing through 5-year review.

Date	No. wild indivs.	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	>10	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1996 (recovery plan)	12	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	12	unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2009 (5-year review)	1	0	All threats managed	Partially
			Complete genetic storage	Yes
			3 populations with 50 mature individuals each	No

U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW of *Stenogyne bifida* (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_AUG 2 7 2010_____