

## **5-YEAR REVIEW**

Short Form Summary

**Species Reviewed:** *Zanthoxylum dipetalum* var. *tomentosum* (A`e)

**Current Classification:** Endangered

### **Federal Register Notice announcing initiation of this review:**

U.S. Fish and Wildlife Service. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and territory of Guam. Federal Register 72(45):10547-10550.

### **Lead Region/Field Office:**

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

### **Name of Reviewer(s):**

Christian Torres-Santana, Pacific Islands Fish and Wildlife Office, Student Trainee Biologist  
Marie M. Bruegmann, Pacific Islands Fish and Wildlife Office, Plant Recovery Coordinator  
Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species

### **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 on March 8, 2007. The review was based on the proposed rule and final critical habitat designation for *Zanthoxylum dipetalum* var. *tomentosum* and other species from the island of Hawaii, as well as a review of current, available information (USFWS 2002, 2003). The Bernice P. Bishop Museum provided an initial draft of portions of the five-year review and they also provided recommendations for conservation actions needed prior to the next five-year review. The evaluation of the status of the species was prepared by our lead PIFWO biologist and reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and acting 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](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 proposed and final rule for critical habitat designation for *Zanthoxylum dipetalum* var. *tomentosum* published in the Federal Register on May 28, 2002 and July 2, 2003, respectively (USFWS 2002, 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 *Z. dipetalum* var. *tomentosum*.

At the time of Federal listing as endangered, approximately 24 individuals of *Zanthoxylum dipetalum* var. *tomentosum* had been recorded (USFWS 1996, 1998). Currently, the taxon is declining in number of wild individuals. A single population of 13 mature individuals occurs on State-owned land at Puu Waawaa on the mountain of Hualalai, on the island of Hawaii, with no immature individuals or seedling recruitment. A population of 15 immature individuals has been established near the Puu Waawaa Sanctuary Cabin (Plant Extinction Prevention Program 2007). Two additional individuals were reintroduced on Puu Waawaa in 2006 (Volcano Rare Plant Facility 2006) and two individuals remain from outplantings in Manuka Natural Area Reserve (Plant Extinction Prevention Program 2008). The outplanted seedlings are fenced and protected from the activities of ungulates. Invasive introduced plant species are also being controlled within the exclosures. However, no naturally recruited plants have been observed within the wild population, and seeds have low viability, most likely due to the low number of individuals in the one remaining wild population and the resulting limited genetic diversity (Plant Extinction Prevention Program 2007).

Habitat in which the extant mature individuals occur is extremely degraded lowland dry forest, with only ten percent native species (Plant Extinction Prevention Program 2007). The outplanted population is found in weedy habitat with a native overstory. There is a lack of healthy, suitable habitat for the establishment of *ex situ* populations of this taxon.

Little is known about the biology of *Zanthoxylum dipetalum* var. *tomentosum*; however, most of the trees were observed with flowers and fruits during April 1999 and occasionally in February 2001 (Wood *et al.* 2001). Seeds of other *Zanthoxylum* species have low germination rates, and other abort (have no embryo); and seedlings are often weak (Lilleeng-Rosenberger 2005).

The major threats to *Zanthoxylum dipetalum* var. *tomentosum* are degradation of habitat and predation and trampling by feral pigs (*Sus scrofa*), goats (*Capra hircus*), cattle (*Bos taurus*) and mouflon sheep (*Ovis aries*) (Factors A, C, and D). Invasive introduced plant species (Factor E) compete for light, space, and water resources, and exacerbate the threat of fire in dry forest (Factor E) (Cuddihy and Stone 1990; D'Antonio and Vitousek 1992; USFWS 1996, 1998, 2002; Friefelder *et al.* 1998; Wood *et al.* 2001). The most serious plant species impacting *Z. dipetalum* var. *tomentosum* include *Pennisetum setaceum* (fountain grass), *P. clandestinum* (kikuyu grass), *Lantana camara* (lantana), *Leucaena leucocephala* (koa haole), and *Grevillea robusta* (silk oak) (USFWS 1996, 1998, 2002; Wood *et al.* 2001). Outplanted seedlings compete with introduced invasive plant species such as *P. setaceum*, *P. clandestinum*, *Passiflora tarminiana* (banana poka), and *Senecio mikanioides* (German ivy). All outplanted individuals are surrounded by a fence, and mulching and invasive introduced plant species control are occurring within the fenced area at Puu Waawaa Sanctuary (Plant Extinction Prevention Program 2007).

Unrestricted collections for scientific or horticultural purposes and excess visitation pose a threat to the only known population (Factor B). Any collection of whole plants or reproductive parts of any of the individuals not for storage, propagation, and reintroduction for conservation purposes could impact the genetic pool, threatening survival (Plant Extinction Prevention Program 2007). Rats (*Rattus* spp.) consume seeds (Factor C), limiting the reproductive success of the taxon (Wood *et al.* 2001). Insects known to affect Hawaiian *Zanthoxylum* species (Factor C) include the most significant, the black twig borer (*Xylosandrus compactus*), and various species of ants

and their associated pests (scales, mealybugs, thrips, and aphids) (Wood *et al.* 2001; Lilleeng-Rosenberger 2005). The species is also threatened by loss of reproductive vigor as result of limited numbers of extant individuals (Factor E) (USFWS 1996, 1998, 2002; Wood *et al.* 2001). In addition, most of the remaining individuals are quite old and may be senescent (Factor E) (Wood *et al.* 2001)

In addition to all of the other threats, species such as *Zanthoxylum dipetalum* var. *tomentosum* 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, volcanic activity and disease outbreaks (Factor E). When considered on their own, the natural processes associated with being a single island endemic do not affect *Z. dipetalum* var. *tomentosum* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss for human development or predation by introduced species (Factor E) (USFWS 1996, 1998, 2002).

The Bishop Museum Amy B. H. Greenwell Ethnobotanical Garden has one individual growing *ex situ* (off-site) (Plant Extinction Prevention Program 2007; Center for Plant Conservation 2008; B. Kiyabu, Horticulturist, Amy B. H. Greenwell Ethnobotanical Garden, pers. comm. 2008), and the Volcano Rare Plant Facility has 17 specimens in controlled propagation representing 3 different wild individuals (Volcano Rare Plant Facility 2008).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Hawaii (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Zanthoxylum dipetalum* var. *tomentosum* 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* collection. In addition, a minimum of three populations should be documented on the island of Hawaii. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

The stabilization goals for this species have not been met, as only 13 wild and 19 reintroduced individuals remain and not all threats are being managed (see Table 1). Therefore, *Zanthoxylum dipetalum* var. *tomentosum* meets the definition of endangered as it remains in danger of extinction throughout its range.

### **Recommendations for Future Actions:**

- Continue seed collection for *ex situ* genetic storage and reintroduction.
- Control introduced invasive plant species around wild and outplanted plants.
- Establish new populations within historical range or suitable habitat where threats have been controlled.
- Control rodents around remaining plants.

- Investigate and implement methods of control for twig borer and other insects.
- Construct large-scale fences around all naturally occurring and reintroduced individuals to control feral ungulates.
- Work with the Hawaii Division of Forestry and Wildlife to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species in the Puu Waawaa area of dry forest.
- Assess genetic variability within extant and *ex situ* collections.
- Study *Zanthoxylum dipetalum* var. *tomentosum* 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.

#### References:

- Center for Plant Conservation . 2008. CPC National Collection Plant Profile for *Zanthoxylum dipetalum* var. *tomentosum*. CPC, Missouri Botanical Garden, St. Louis, Missouri. Available online at <[http://www.centerforplantconservation.org/ASP/CPC\\_ViewProfile.asp?CPCNum=13418](http://www.centerforplantconservation.org/ASP/CPC_ViewProfile.asp?CPCNum=13418)>. Accessed 9 May 2008.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii. 138 pages.
- D'Antonio, C.M. and P.M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle and global change. *Annual Review of Ecology and Systematics* 23:63-88.
- Friefelder, R.R., P.M. Vitousek, and C.M. D'Antonio. 1998. Microclimate change and effect on fire following forest-grass conversion in seasonally dry tropical woodland. *Biotropica* 30:286-297.
- Lilleeng-Rosenberger, K.E. 2005. Growing Hawaii's native plants. Mutual Publishing, Honolulu, HI. 416 pages.
- Plant Extinction Prevention Program. 2007. Big Island Plant Extinction Prevention Program database. University of Hawaii's Pacific Cooperative Studies Unit, University of Hawaii at Manoa. Unpublished. Accessed on April 28, 2008.

- [USFWS] U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; determination of endangered status for thirteen plants from the island of Hawaii, State of Hawaii; final rule. Federal Register 61(198):53137-53153
- [USFWS] U.S. Fish and Wildlife Service. 1998. Big Island II: addendum to the recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, OR. 80 pages + appendices.
- [USFWS] U.S. Fish and Wildlife Service. 2002. Endangered and threatened wildlife and plants; designation of critical habitat for plant species from the island of Hawaii, HI; proposed rule. Federal Register 6(102):36968-37106.
- [USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designation and nondesignation of critical habitat for 46 plant species from the island of Hawaii, HI; final rule. Federal Register 68(127):39624-39761.
- Volcano Rare Plant Facility. 2006. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished.
- Volcano Rare Plant Facility. 2008. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished.
- Wood, K.R., M.H. Chapin, S. Perlman and M. Maunder. 2001. Critically endangered Hawaiian plant taxa and conservation collections within the Genetic Safety Net (GSN). Interim report on field research conducted under USFWS Grant No. 122000G001. Unpublished.

### **Personal communications**

- Kiyabu, Brian. 2008. Horticulturist, Amy B. H. Greenwell Ethnobotanical Garden. E-mail communication with Christian Torres-Santana (USFWS) on May 12, 2008.

**Table 1. Status of *Zanthoxylum dipetalum* var. *tomentosum* from listing through 5-year review.**

<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>Stability Criteria identified in Recovery Plan</b>	<b>Stability Criteria Completed?</b>
1996 – listing	24	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1998 – recovery plan	24	20	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with mature individuals 25 each	No
2002 – critical habitat (proposed)	9	2-3	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2003 – critical habitat (final)	14	Unknown	All threats managed in all 3 populations	Unknown
			Complete genetic storage	Unknown
			3 populations with 25 mature individuals each	No
2007 – 5-yr review	13	19	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No

**U.S. FISH AND WILDLIFE SERVICE**  
SIGNATURE PAGE for 5-YEAR REVIEW of *Zanthoxylum dipetalum* var. *tomentosum*

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

**Acting Field Supervisor, Pacific Islands Fish and Wildlife Office**

Patrick Sousa

Date 6/2/09