

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Alectryon macrococcus* (mahoe)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 58 species in Washington, Oregon, California, and Hawaii. Federal Register 75(226):71726-71729.

Lead Region/Field Office:

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

Name of Reviewer(s):

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Kristi Young, Programmatic Deputy Field Supervisor, 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 January 31, 2012. The review was based on a review of current, available information since the last 5-year review for *Alectryon macrococcus* (mahoe) (USFWS 2010a). The National Tropical Botanical Garden provided an initial draft of portions of the five-year review and recommendations for conservation actions needed prior to the next five-year review. The document was reviewed by the Plant Biologists, Islands Team Manager, and Plant Recovery Coordinator, followed by the Recovery Program Lead. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

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 review for *Alectryon macrococcus* published on August 27, 2010 (available at http://ecos.fws.gov/docs/five_year_review/doc3311.pdf) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of *A. macrococcus*.

This endemic tree species has two recognized varieties: *Alectryon macrococcus* var. *macrococcus*, found on the islands of Maui, Molokai, Oahu and Kauai, and *A. macrococcus* var. *auwahiensis*, found only on Maui. The current status and trends for *Alectryon macrococcus* and its varieties are provided in the tables below.

New threats:

Climate change - Climate change may 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 funded climate modeling that will help resolve these spatial limitations. High spatial resolution climate outputs are expected to be available sometime in 2013.

New management actions:

- Surveys and inventories:
 - The Oahu Army Natural Resources Program (OANRP) staff has conducted additional surveys for *Alectryon macrococcus* var. *macrococcus* on the island of Oahu and revised their plant counts (U.S. Army Garrison 2011).
 - The OANRP staff has monitored trees in Waianae Kai, Makua, and the Kahanahaiki to West Makaleha population units, and monitored the living collection at Waimea Valley Botanical Garden (U.S. Army Garrison 2011).
- Ungulate exclosures - Construction of the Kaluaa and Waieli fence was completed in 2011 on Oahu (U.S. Army Garrison 2011), securing reintroduction habitat within the State of Hawaii's Honouliuli Forest Reserve while protecting wild individuals of *A. macrococcus* var. *macrococcus* within that area (U.S. Army Garrison 2010).
- Captive propagation for genetic storage and reintroduction:
 - One individual of *Alectryon macrococcus* var. *auwahiensis* was outplanted at Puu Mahoe Arboretum in February 2012 (PEPP 2012).
 - Oahu Army Natural Resource Program staff partially completed genetic storage for individuals of *Alectryon macrococcus* var. *macrococcus* found on Army lands (U.S. Army Garrison 2011).
 - *In situ* clonal propagation was successfully for two of four air-layers collected in Makaha and South Mohiakea on Oahu in 2011; these two plants are growing in OANRP's greenhouse (U.S. Army Garrison 2010).
 - Fruit was collected from a few trees in the Makaha and Makua population units on Oahu and several seedlings are growing in the Oahu Army Natural Resources Program nursery (U.S. Army Garrison 2010).
 - Maui Nui Botanical Garden has 15 individuals of *Alectryon macrococcus* var. *auwahiensis* from Auwahi on Maui in their nursery as of 2011 (Maui Nui Botanical Garden 2011).
 - Waimea Valley Arboretum (2011) on Oahu has one individual of *A. macrococcus* var. *macrococcus* in their nursery.
 - In 2012, the Harold L. Lyon Arboretum (2012) had approximately 33 seeds in storage for *A. macrococcus* var. *macrococcus*.

- Four individuals of *A. macrococcus* var. *macrococcus* are in micropropagation storage at Lyon Arboretum Micropropagation Laboratory (Lyon) as of 2012 and an embryo of *A. macrococcus* var. *auwahiensis* is in storage (Lyon 2012).
- One rooted air-layer from the Makawao Forest Reserve population is in the Olinda Rare Plant Facility (H. Oppenheimer, pers. comm. 2011; USFWS 2010b).

Synthesis:

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the multi-island plants (USFWS 1997), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Alectryon macrococcus* is a long-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 each island where they now occur or occurred historically. 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, since only two populations of 25 or more mature individuals exist and total numbers have declined (Table 1), and all threats are not being sufficiently managed throughout all of the populations (Table 2). Therefore, *Alectryon macrococcus* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Surveys / inventories - Continue surveys for female individuals.
- Captive propagation for genetic storage and reintroduction - Continue collection of seeds and propagation for reintroduction, using hand pollination of flowers to increase seed set, where possible.
- Population biology research
 - Consider crossing isolated male trees with isolated female trees, even if in distant populations.
 - Continue research to find the best seed storage methods and to identify and control other seed predator insects.
- Threats research - Continue research on methods to control the black twig borer.
- Ungulate exclosures - Continue ungulate fencing of suitable *Alectryon micrococcus* habitat.
- Ecosystem-altering invasive plant species control - Continue removal of invasive introduced plant species and maintain *Alectryon macrococcus* habitat free of invasive introduced plants.
- Predator / herbivore control - Continue control of rats at wild *Alectryon macrococcus* populations.
- Alliance and partnership development - Initiate planning and contribute to implementation of ecosystem level restoration and management to benefit this taxon.

Table 1. Status and trends of *Alectryon macrococcus* (mahoe) from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	500	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1997 (recovery plan)	500	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2003 (critical habitat)	500-515	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2009 (5-yr review)	337	2	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2013 (5-yr review)	9 var. <i>auwahiensis</i> ; ~294 var. <i>macrococcus</i>	1	All threats managed in all 3 populations	Partially (Table 2)
			Complete genetic storage	Partially; propagation occurring on Oahu and Maui
			3 populations with 25	Partially; two

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
			mature individuals each	Oahu populations have over 25 mature individuals

Table 2. Threats to *Alectryon macrococcus* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates - habitat modification and herbivory	A, C, D	Ongoing	Partially: areas fenced on Oahu, trees in East Maui are fenced.
Insect predation - black twig borer	C	Ongoing	Partially: twig borer biocontrol experiments with traps on Oahu.
Rat herbivory	C	Ongoing	Partially: rat management at Auwahi and by U.S. Army Oahu in Ohikilolo
Invertebrate herbivory	C	Ongoing	No
Landslides and flooding - landslides	A, E	Ongoing	No
Fire – habitat modification and plant destruction	E	Ongoing	Army has fire prevention program on Oahu.
Pollination problems due to separation of male and female trees	E	Increasing	Propagation of trees in Makaha and South Mohiakea
Invasive introduced plants	A, E	Ongoing	Army Oahu controls weeds inside fences
Climate change	A, E	Increasing	No

References:

See previous 5-year review for a full list of references (USFWS 2007). Only references for new information are provided below.

Harold L. Lyon Arboretum Micropropagation Laboratory. 2012. Micropropagation and seed storage databases. University of Hawaii at Manoa, Honolulu, Hawaii. Unpublished.

Maui Nui Botanical Garden. 2011. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. 26 pages. Unpublished.

[PEPP] Plant Extinction Prevention Program. 2010. Plant Extinction Prevention Program annual report, fiscal year 2010 (July 1, 2009-June 30, 2010). 122 pages. Unpublished.

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U.S. Army Garrison. 2010. 2010 status report for the Makua and Oahu implementation plans. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 730 pages. Available online at http://manoa.hawaii.edu/hpicesu/dpw_mit.htm.

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Personal Communications:

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Bustamente, Keahi. 2012. Maui Nui Technician, Plant Extinction Prevention Program. E-mail to Vickie Caraway, U.S. Fish and Wildlife Service, dated September 5, 2012. Subject: 2 new mahoe trees.

Oppenheimer, Hank. 2011. Maui Nui Manager, Plant Extinction Prevention Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated December 28, 2011. Subject: *Ale_mac_mac*.

Oppenheimer, Hank. 2012. Maui Nui Manager, Plant Extinction Prevention Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated January 9, 2012. Subject: *Alectryon*.

Perlman, Steve. 2011. *Alectryon macrococcus* - population information. National Tropical Botanical Garden. Unpublished data.

Tangalin, Natalia. 2011. Field Botanist, National Tropical Botanical Garden. E-mail to Margaret Clark, National Tropical Botanical Garden, dated November 30, 2011.
Subject: 5 year review data.

Wood, Ken R. 2011. Research Biologist, National Tropical Botanical Garden. E-mail to Margaret Clark, National Tropical Botanical Garden, dated December 2, 2011.
Subject: changes in #s of Ale_mac_mac?

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Alectryon macrococcus* (mahoe)

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

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Date 2013-08-07