5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Chamaesyce deppeana* (Akoko)

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 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

Lead Region/Field Office:

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

Name of Reviewer(s):

Chelsie Javar, Fish and Wildlife Biologist, PIFWO
Marie Bruegmann, Plant Recovery Coordinator, PIFWO
Jess Newton, Recovery Program Leader, PIFWO
Assistant Field Supervisor for Endangered Species, 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 April 8, 2010. The review was based on a review of current, available information since the last 5-year review for *Chamaesyce deppeana* (USFWS 2007). Bernice Pauahi Bishop Museum 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 Chelsie Javar, Fish and Wildlife Biologist, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the 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).

Review Analysis:

Please refer to the previous 5-year review for *Chamaesyce deppeana* published on August 2, 2007 (available at http://ecos.fws.gov/docs/five_year_review/doc1124.pdf) and the recovery plan for Oahu plants (USFWS 1998), for a complete review of the species' status, threats, and management efforts. No new threats or no new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of *Chamaesyce deppeana*.

This short-lived perennial shrub is endangered and occurs only on the island of Oahu (USFWS 1998). The current status and trends for *Chamaesyce deppeana* are provided in the tables below.

New taxonomic information:

Chamaesyce, a cosmopolitan genus of about 250 species, has historically often been treated as a subgroup of the genus *Euphorbia*, but is sometimes recognized as a segregate genus (Koutnik 1987). In Hawaii, Sherff (1937) published a full treatment of this group in the genus *Euphorbia*, and at about the same time, Degener and Croizat (1936a, 1936b, 1937) argued for the recognition of *Chamaesyce* as a separate genus and published new combinations for all Hawaiian endemic members known at the time. St. John (1973) continued to recognize all taxa under *Euphorbia* rather than *Chamaesyce*. Koutnik (1987) chose to treat the group under *Chamaesyce*, and his taxonomy was accepted in the *Manual of the Flowering Plants of Hawaii* (Wagner *et al*. 1999). With subsequent improvement of molecular techniques and analysis, however, it has become clear that *Chamaesyce* was one of several polyphyletic genera nested among species of *Euphorbia* (Steinmann and Porter 2002; Bruyns 2006). Steinmann and Porter (2002) argued for a broader concept of *Euphorbia*, in opposition to the trend at the time of splitting the genus into segregate genera, such as *Chamaesyce*. Bruyns (2006) formally proposed a reclassification of the subtribe Euphorbiinae (family Euphorbiaceae), up to that point including several genera (such as *Euphorbia*, *Chamaesyce*, *Monadenium*, *Pedilanthus*, and *Synadenium*), synonymizing all genera into a single large genus, *Euphorbia*. Within the genus, four subgenera were proposed; Hawaiian material previously in *Chamaesyce* would fit into *Euphorbia* subg. *Chamaesyce* (Bruyns 2006). Warren Wagner (Botanist, Smithsonian Institution, pers. comm. 2009) confirmed that the evidence for lumping segregate genera into a large *Euphorbia* was compelling, and that *Chamaesyce* in Hawaii would be synonymized. Names for all taxa recognized as *Chamaesyce* in Wagner *et al*. (1999) all have valid alternatives in *Euphorbia*. *Chamaesyce deppeana*, for instance, was originally described in the genus *Euphorbia* as *E. deppeana* by Boissier in 1860 (Smithsonian Institution 2011). This change in taxonomy does not result in any change in the range of the taxon as it was listed. Recently published taxonomic papers accepting the enlarged *Euphorbia* include Pahlevani (2011). Therefore, this taxon will now be referred to as *Euphorbia deppeana* for the remainder of this review.

New threats:

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.

New management actions:

- Captive propagation for genetic storage and reintroduction:

- In 2008, cuttings and seeds of *Euphorbia deppeana* were collected from the only extant population at the Nuuanu Pali site and taken to the Harold L. Lyon Arboretum (Plant Extinction Prevention Program 2008).
- In 2009, the Harold L. Lyon Arboretum had 16 propagules of *Euphorbia deppeana* in containers (Harold L. Lyon Arboretum 2009).
- In 2010, the National Tropical Botanical Garden (2010) had 46 seeds of *Euphorbia deppeana* in storage.
- The Pahole Rare Plant Facility had 9 propagules of *Euphorbia deppeana* growing at their nursery (Pahole Rare Plant Facility 2010).

Synthesis:

As of 2008, there were an estimated 50 mature and five immature individuals of *Euphorbia deppeana* on Oahu (Plant Extinction Prevention Program 2008). Because many more individuals were discovered for this species, it has been moved to a lower priority by the Plant Extinction Prevention Program, which focuses on plant species containing less than 50 individuals in the wild. No other reports were submitted on the current status of the species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Oahu (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Euphorbia deppeana* 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 Oahu. 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 not been met, as currently only a single population of 50 mature individuals exists (Table 1) and all threats are not being managed (Table 2). Therefore, *Euphorbia deppeana* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Captive propagation for genetic storage and reintroduction:
  - Continue to collect seeds from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.
  - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation.
- Reintroduction / translocation implementation – Reintroduce the species back into its known historical range.

- Genetic research – Confirm the putative hybridization between *Euphorbia deppeana* and *E. multiformis* var. *microphylla*.
- Surveys / inventories – Resurvey the historical range of the species to search for additional populations or individuals and to determine the current status of the species.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Fire protection – Develop and implement a fire management plan for all populations.
- Alliance and partnership development – Work with the Hawaii Department of State Parks, Hawaii Division of Forestry and Wildlife, and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Federal Register update – Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

Table 1. Trends of *Euphorbia deppeana* from listing through current 5-year review.

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	50-100	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	<50	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	~50	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2007 (5-year review)	>100	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2012 (5-yr review)	>50	0	All threats managed in all 3 populations	No (see Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

Table 2. Threats to *Euphorbia deppeana* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Established ecosystem-altering invasive plant species	A	Ongoing	No
Fire	E	Ongoing	No
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.

Bruyns, P.V., R.J. Mapaya and T. Hedderson. 2006. A new subgeneric classification for *Euphorbia* (Euphorbiaceae) in southern Africa based on ITS and *psbA-trnH* sequence data. Novon 55(2):397-420.

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Pahlevani, A. H. and R. Riina. 2011 (Pre-print copy). A synopsis of *Euphorbia* subgen. *Chamaesyce* (Euphorbiaceae) in Iran. Annales Botanici Fennici 48:pages not yet assigned. Available online at <http://www.sekj.org/PDF/anb47-free/Pahlevani-free.pdf>. Accessed 5 April 2011.

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Steinmann, V.W., and J.M. Porter. 2002. Phylogenetic relationships in Euphorbieae (Euphorbiaceae) based on ITS and ndhF sequence data. Annals of the Missouri Botanical Garden 89(4):453-490.

[USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for Oahu plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pages + appendices. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.

[USFWS] U.S. Fish and Wildlife Service. 2007. *Chamaesyce deppeana* (‘akoko) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 9 pages. Available online at <http://ecos.fws.gov/docs/five_year_review/doc1124.pdf>.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. Manual of the flowering plants of Hawaii, revised edition. University of Hawaii and Bishop Museum Press, Honolulu, Hawaii. 1,918 pages.

Personal communications:

Wagner, Warren. 2009. Botanist, Smithsonian Institution. Email to Marie Bruegmann, U.S. Fish and Wildlife Service, Margaret Clark, National Tropical Botanical Garden, Clyde Imada, Bishop Museum, dated 16 November 2009. Subject: Acceptance of *Euphorbia* for Hawaiian members of *Chamaesyce*.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Chamaesyce deppeana* (Akoko)

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

Appropriate Listing/Reclassification Priority Number, if applicable:_____

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