

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Chamaesyce halemanui* (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 proposed rule and final critical habitat designation for *Chamaesyce halemanui* and other species from the island of Kauai (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 *Chamaesyce halemanui* published in the Federal Register on February 27, 2003 (USFWS 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 *C. halemanui*.

At the time of listing, 50 *Chamaesyce halemanui* individuals were known from three populations (USFWS 1992). In 2003, there were nine populations of *C. halemanui*, containing about 85 to 135 individuals in Kuia Valley, Poopooiki Valley, Kauhao Valley, Kaha Ridge, Awaawapuhi Valley, Waipio Falls, Halemanu, and Kaluahaulu; all on State-owned land in the Kokee State Park, Kuia Natural Area Reserve, and Na Pali-Kona Forest Reserve (USFWS 2003). From more current data it appears there may be as many as 300 to 400 individuals at various locations, with most occurring in Halemanu and Poopooiki Valley (Perlman 2008, Wood 2008).

In September 2008, National Tropical Botanical Garden botanists surveyed the forest below and across the four wheel drive road in Halemanu, Kokee State Park. They counted at least 135 individuals. They estimated the population in that immediate area north of the road at 150 to 200 individuals (N. Tangalin, National Tropical Botanical Garden, pers. comm. 2008a, b). *Chamaesyce halemanui* and *C. celastroides* both occur in Halemanu, but no hybrid plants were found when the area was resurveyed in 2008 (N. Tangalin, pers. comm. 2008a).

Chamaesyce halemanui was last reported from Waialae Valley in August 2001, when 25 to 100 or more individuals were observed by botanists along the west stream bank at an elevation of 872 meters (2,860 feet). Plants were in flower at the time, and vouchers were collected (Perlman 2008; Wood 2008). In 2006, Tangalin observed about five inaccessible individuals in the very back of Poomau Canyon, off the Mohihi Ditch trail (N. Tangalin, pers. comm. 2008a), which could be *C. halemanui* or *C. celastroides*, but definite identification required additional rope work. Observations were also made in August 2000 from Poopooiki Valley's north facing slope at 719 meters (2,360 feet) elevation; plant numbers were not reported (Perlman 2008; Wood 2008).

Plants were seen in the past at Mahanaloa Valley, Makaha Valley, and on the Waimea Canyon rim near a *Nothocestrum peltatum* exclosure at 1,006 meters (3,300 feet) elevation from 1996 to 1999, but have not been reported there since. It was also reported from Kohua Ridge, Maile Flat Trail in 1990, but has not been seen since (Wood 2008).

The total number of individuals is currently estimated at 300 to 400 individuals in four populations.

New research about this species' life history and biology is in progress. Researchers Maggie Sporck and Lawren Sack, of the University of Hawaii Botany Department, visited the *Chamaesyce* species in the Halemanu area at Kokee State Park at 1,115 meters (3,658 feet) elevation with botanists from the National Tropical Botanical Garden on Kauai. Using leaf samples from five individuals, the species was characterized by looking at vascular structure, habitat, and leaf functional traits. Leaf functional trait information was collected to distinguish the morphology of this population and species from others, provide functional and ecological information, and to track plant functional responses to climate change. Large leaf area, high leaf mass per area, and low nitrogen

concentration indicate that this species is adapted to establishing in forest shade habitat. These traits also indicate a life history that includes slow respiration and growth, and long-lived leaves. A high carbon isotope composition confirmed that *C. halemanui* and other Hawaiian *Chamaesyce* species have C₄ photosynthesis, a biochemical pathway that is advantageous in conditions of drought and high temperatures. As one of only a handful of rainforest trees with C₄ photosynthesis, *C. halemanui* is of exceptional botanical and evolutionary importance. Results are expected to be published in 2009 (M. Sporck, University of Hawaii, pers. comm. 2008).

Steinman and Porter (2002) studied the phylogenetic relationship of the tribe Euphorbieae, in the Euphorbiaceae (spurge family). As a result of their work, *Chamaesyce* is no longer recognized as a separate genus from *Euphorbia*. Therefore, *Chamaesyce halemanui* will be referred to as *Euphorbia halemanui* in the remainder of this review.

The associated native species that exist in the same ecosystem as *Euphorbia halemanui* have been recently updated in field surveys. The species occurs only on the island of Kauai, Hawaii, at elevations between 556 and 1,249 meters (1,825 and 4,097 feet) in *Acacia koa* (koa) - *Metrosideros polymorpha* (ohia) or mixed mesic forests with associated species including *Alphitonia ponderosa* (kauila), *Antidesma platyphyllum* (hame), *Bobea brevipes* (ahakea lau lii), *Carex meyenii* (no common name [NCN]), *C. wahuensis* (NCN), *Cheirodendron trigynum* (olapa), *Coprosma* spp. (pilo), *Cyanea leptostegia* (haha lua), *Diospyros sandwicensis* (lama), *Dodonaea viscosa* (aalii), *Elaeocarpus bifidus* (kalia), *Kadua affinis* (manono), *Kokia kauaiensis* (kokio), *Leptecophylla tameiameia* (pukiawe), *Melicope anisata* (mokihana), *Melicope haupuensis* (alani), *Microlepis strigosa* (palapalai), *Myrsine lessertiana* (kolea lau nui), *Nestegis sandwicensis* (olopua), *Nototrichium sandwicense* (kulei), *Panicum nephelophilum* (konakona), *Pisonia* spp. (papala kepau), *Pittosporum* spp. (hoawa), *Pleomele aurea* (hala pepe), *Pouteria sandwicensis* (alaa), *Psychotria greenwelliae* (kopiko) *P. mariniana* (kopiko), *Santalum freycinetianum* var. *pyrularium* (iliahi), *Scaevola procera* (naupaka kuahiwi), *Sophora chrysophylla* (mamane), *Streblus pendulinus* (aiai), *Viola chamissoniana* ssp. *tracheliifolia* (pamakani), and *Wikstroemia* spp. (akia) (Perlman 2008; USFWS 2003).

Additional associated native species at Halemanu include *Melicope barbiger* (uahiapele), *Psychotria greenwelliae* (kopiko), *Cryptocarya mannii* (holio), *Coprosma waimeae* (pilo), and *Cordyline fruticosa* (ti) (N. Tangalin, pers. comm. 2008a). In Poopooiki Valley, *C. halemanui* occurs at an elevation of 686 to 890 meters (2,250 to 2,920 feet) in *Acacia koa*-*Metrosideros polymorpha* mesic forest. Associated native species include *Isodendron* sp. (aupaka), *Euphorbia haeleleana* (NCN), *Freycinetia arborea* (ie ie), *Diplazium sandwichianum* (hoio), *Kadua knudsenii* (NCN), *Alyxia stellata* (maile), *Claoxylon sandwicensis* (laukea), *Dicranopteris linearis* (uluhe), and *Melicope barbiger* (uahiapele) (Wood 2008).

At an elevation of 792 meters (2,600 feet), *Euphorbia halemanui* occurs in the Kuia drainage, below a confluence of upper branches, on a 20-degree north slope, 50 feet above the drainage, on substrate of granular soil with talus and leaf litter, boulders, and in

shade 60 percent of the day. The habitat is *Metrosideros polymorpha* - *Acacia koa* montane mesic forest with *Melicope ovata* (alani), *Tetraplasandra kauaiensis* (ohe ohe), and *Wikstroemia furcata* (akia) (Wood 2008).

Euphorbia halemanui occurs in a headwater streamlet of Waialae just south of Kaluahaulu Ridge Trail at an elevation of 945 meters (3,100 feet) in *Acacia koa* - *Metrosideros polymorpha* montane mesic forest with *Charpentiera elliptica* (papala), *Claoxylon sandwicensis* (laukea), *Coprosma foliosa* (pilo), *Isodendrion laurifolium* (aupaka), *Kadua knudsenii* (NCN), *Lipochaeta fauriei* (nehe), *Perrottetia sandwicensis* (olomea), *Urera glabra* (opuhe), and *Zanthoxylum dipetalum* (kawau). The area is a moderately steep north facing slope 20 meters (67 feet) above the drainage, with brown soil, talus, boulders, and terrestrial moss, in about 40 percent filtered light (Wood 2008). On the Kohua Ridge's Maile Flat Trail, at an elevation of 850 to 900 meters (2,790 to 2,950 feet) in *Acacia koa* - *Metrosideros polymorpha* mesic forest *C. halemanui* grows with *Remya kauaiensis* (NCN) and *Lysimachia kalalauensis* (NCN) in addition to some of the species listed above (Wood 2008).

Pigs (*Sus scrofa*), goats (*Capra hircus*), and mule deer (*Odocoileus hemionus*) threaten *Euphorbia halemanui* (Factor A). Although pigs were considered a threat when the final listing rule, recovery plan, and critical habitat designation were written (USFWS 1992, 1995, 2003), goats and deer are newly reported threats. Pig scat is ample in the Halemanu area, as well as goat droppings. Signs of mule deer have also been noted. Pigs uproot and trample native vegetation and open the area to invasive introduced plant species (Factor E). Invasive introduced plant species which threaten this species by degrading and modifying its habitat include *Psidium cattleianum* (strawberry guava), *Lantana camara* (lantana), *Rubus argutus* (prickly Florida blackberry), and *Passiflora edulis* (purple passion fruit) (Factor E) (Perlman 2008; N. Tangalin, pers. comm. 2008a). *Rubus argutus* and *Passiflora edulis* are new threats that were not reported when critical habitat was designated in 2003 (USFWS 2003). Fire (Factor E) and road clearing or realignment (Factor A) could easily damage this species, which occurs adjacent to the highway going through Kokee State Park (Perlman 2008; N. Tangalin, pers. comm. 2008a). Climate change may also pose a threat to *E. halemanui* (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.

Perlman cited seed predation by rats as a problem (Factor C) (Perlman 2008). Field botanists observed that many seed capsules contained frass (insect feces), indicating possible insect predation (Factor C).

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

Botanists have collected seed of *Euphorbia halemanui* in 2008, which will be sown in the nursery at the National Tropical Botanical Garden for reintroduction (B. Neal, National Tropical Botanical Garden, pers. comm. 2008). Eight seeds from the Halemanu population have been planted at the National Tropical Botanical Garden in the last year

(National Tropical Botanical Garden 2009). The Hawaii Department of Forestry and Wildlife outplanted six individuals in Kokee State Park, three of which have survived (M. Wysong, Division of Forestry and Wildlife, pers. comm. 2008). There are no other *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) populations known.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Kauai (USFWS 1995), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Euphorbia halemanui* is a short-lived perennial, and to be considered for downlisting from endangered to threatened status, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* collection. In addition, a minimum of five to seven populations should be documented on the island of Kauai. Each of these populations must be naturally reproducing and increasing in number, 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.

The downlisting goals for this species have not been met (see Table 1). There are only four populations that have a total of 300 to 400 mature individuals, these populations are only partially represented in an *ex situ* population of six individuals, and no threats are being controlled. Therefore, *Euphorbia halemanui* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Fence to prevent further ungulate damage.
- Control invasive introduced species around wild populations.
- Collect material for genetic storage and propagation for reintroduction.
- Survey areas where *Euphorbia halemanui* has been observed in the past (Mahanaloa Valley, Makaha Valley, and on Waimea Canyon Rim) to obtain a more accurate assessment of population occurrences and numbers.
- Support incipient invasive species control work by the Kokee Resource Conservation Program in Kokee State Park.
- Work with Hawaii Division of Forestry and Wildlife and Hawaii State Parks to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

References:

- National Tropical Botanical Garden. 2009. Controlled propagation report to U.S. Fish and Wildlife Service. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- Perlman, S. 2008. *Chamaesyce halemanui*. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished. Three pages.
- 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. 1992. Endangered and threatened wildlife and plants; determination of endangered status for six plants from Kokee Region, island of Kauai, Hawaii; final rule. *Federal Register* 57(93):20580-20589.
- [USFWS] U.S. Fish and Wildlife Service. 1995. Recovery plan for the Kauai plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 270 pages.
- [USFWS] U.S. Fish and Wildlife Service. 2003. 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.
- Wood, K.R. 2008. Notes on *Chamaesyce halemanui* (Euphorbiaceae). National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished. Two pages.

Personal Communications:

- Neal, Barbara. 2008. National Tropical Botanical Garden. Electronic mail message regarding *Chamaesyce halemanui*. Received by Margaret Clark, National Tropical Botanical Garden, October 12, 2008.
- Sporck, Maggie. 2008. Graduate Student, University of Hawaii. Electronic mail message regarding *Chamaesyce halemanui*. Received by Margaret Clark, National Tropical Botanical Garden, October 24, 2008.
- Tangalin, Natalia. 2008a. Field botanist, National Tropical Botanical Garden. Electronic mail message regarding *Chamaesyce halemanui*. Received by Margaret Clark, National Tropical Botanical Garden, September 19, 2008.
- Tangalin, Natalia. 2008b. Field botanist, National Tropical Botanical Garden. Electronic mail message regarding *Chamaesyce halemanui*. Received by Margaret Clark, National Tropical Botanical Garden, October 11, 2008.

Wysong, Michael. 2008. Natural Area Reserves Manager, Hawaii Division of Forestry and Wildlife. Electronic mail message regarding *Chamaesyce halemanui*. Received by Margaret Clark, National Tropical Botanical Garden, October 21, 2008.

Table 1. Status of *Euphorbia halemanui* from listing through 5-year review.

Date	No. wild indivs.	No. outplanted	Downlisting Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	50	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Sustained for 5 years	Unknown
1995 (recovery plan)	96-151	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Sustained for 5 years	Unknown
2003 (critical habitat)	85-135	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Sustained for 5 years	Unknown
2009 (5-year review)	300-400	3	All threats managed in all 5-7 populations	No
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Sustained for 5 years	Unknown

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Chamaesyce halemanui*
(no common name)

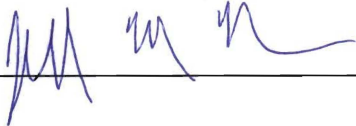
Pre-1996 DPS listing still considered a listable entity? N/A

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

Field Supervisor, Pacific Islands Fish and Wildlife Office

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Date AUG 27 2010