Euphorbia eleanoriae
(‘Akoko)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

5-YEAR REVIEW

Species reviewed: *Euphorbia eleanoriae* (‘Akoko)

TABLE OF CONTENTS

1.0 GENERAL INFORMATION 3
1.1 Reviewers 3
1.2 Methodology used to complete the review: 3
1.3 Background: 3
2.0 REVIEW ANALYSIS 4
2.1 Application of the 1996 Distinct Population Segment (DPS) policy 4
2.2 Recovery Criteria 5
2.3 Updated Information and Current Species Status 8
2.4 Synthesis 15
3.0 RESULTS 15
3.1 Recommended Classification: 15
3.2 New Recovery Priority Number: 15
3.3 Listing and Reclassification Priority Number: 15
4.0 RECOMMENDATIONS FOR FUTURE ACTIONS 15
5.0 REFERENCES 16
Signature Page 19

5-YEAR REVIEW
Euphorbia eleanoriae (‘Akoko)

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Sarah Hall, (503) 231–6868

Lead Field Office:
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Cooperating Field Office(s):
N/A

Cooperating Regional Office(s):
N/A

1.2 Methodology used to complete the 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 in June 2016. The review was based on the final rule listing this species; the final critical habitat designation; the recovery outline; peer reviewed scientific publications; unpublished field observations by the USFWS, State of Hawaii, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information. The evaluation of Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, Conservation and Restoration Team Manager.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2015a. Endangered and threatened wildlife and plants; 5-year status reviews of 133 species in Hawaii, Oregon, Idaho, and Washington. Federal Register 80(30): 8100–8103.

1.3.2 Listing history:

Original Listing
FR notice: USFWS. 2010a. Endangered and threatened wildlife and plants; determination of endangered status for 48 species on Kauai and designation of critical habitat, final rule. Federal Register 75(70): 18960–19165.
Date listed: April 13, 2010
Entity listed: Species
Classification: Endangered

Revised Listing, if applicable
FR notice: N/A
Date listed: N/A
Entity listed: N/A
Classification: N/A

1.3.3 Associated rulemakings:

N/A

1.3.4 Review History:

This is the first 5-year review for this species. *Euphorbia eleanoriae* is a shrub that was listed as endangered, with designation of critical habitat, on April 13, 2010 (USFWS 2010a). The recovery outline for *E. eleanoriae* is included in the recovery outline for the Kauai Ecosystem, published in 2010 (USFWS 2010b). A draft recovery plan is in preparation.

1.3.5 Species' Recovery Priority Number at start of this 5-year review:

At the start of the 5-year review, the Recovery Priority Number proposed for *Euphorbia eleanoriae* is 5 (using the USFWS scale of 1 to 18), based on the high degree of threat, a moderate potential for recovery with some threats that are well understood and easily alleviated and others that are currently difficult to alleviate, and its status as a full species (USFWS 2010b).

1.3.6 Current Recovery Plan or Outline:

Name of plan or outline: USFWS. 2010b. Recovery outline for the Kauai ecosystem. U.S. Fish and Wildlife Service, Portland, Oregon. 43 pages.
Date issued: June 17, 2010
Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

_____ ***Yes***
__X__ ***No***

2.1.2 Is the species under review listed as a DPS?

____ ***Yes***

___ ***No***

2.1.3 Was the DPS listed prior to 1996?

____ ***Yes***

___ ***No***

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

____ ***Yes***

____ ***No***

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

____ ***Yes***

____ ***No***

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

____ ***Yes***

___ ***No***

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

___ ***Yes***

_X_ ***No***

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

_____ ***Yes***

_____ ***No***

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

_____ ***Yes***

_____ ***No***

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Factors A, B, C, D, and E) affecting this species is presented in section 2.3.2.

The recovery plan is currently being drafted. However, the Hawaii and Pacific Plants Recovery Coordinating Committee (HPPRCC) has outlined the actions and goals for stages leading towards recovery (2011). These stages are described below.

Current information is lacking for many Hawaiian plant species on the status of the species and their habitats, breeding systems, genetics, and propagule storage options. The following downlisting and delisting criteria for plants have therefore been adopted from the revised recovery objective guidelines developed by the HPPRCC (2011). Many of the Hawaiian plant species are at very low numbers, so USFWS also developed criteria for avoiding imminent extinction and an interim stage before downlisting, based on the recommendations of the HPPRCC, to assist in tracking progress toward the ultimate goal of recovery. These criteria are assessed on a species-by-species basis, especially as additional information becomes available.

In general, long-lived perennials are those taxa either known or believed to have life spans greater than 10 years; short-lived perennials are those known or believed to have life spans greater than one year but less than 10 years; and annuals are those known or believed to have life spans less than or equal to one year. When it is unknown whether a species is long- or short-lived, USFWS has erred on the side of caution and considered the species short-lived. This will be revised as more is learned about the life histories of these species. A species with a narrow extant range is one currently known from one or two adjacent gulches or ridges within the same mountain range. Some species have historically been known from only one population. For these species, given the limited information known of their habitat requirements, the number of mature individuals needed to prevent extinction was doubled within the known population rather than expanding the known range of the species for preventing extinction and the interim stage. Obligate outcrossers are those species that either have male and female flowers on separate plants or otherwise require cross-pollination to fertilize seeds, and therefore require equal numbers of individuals contributing to reproduction as males and females, doubling the number of mature individuals. Species that reproduce vegetatively may reproduce sexually only on occasion, resulting in the majority of the genetic variation being between populations, therefore requiring additional populations. Species that have a tendency to fluctuate in number from year to year require a larger number of mature individuals on average to allow for decline in years of extreme habitat conditions and recuperation in numbers in years of more normal conditions.

Preventing Extinction

To prevent extinction of *Euphorbia eleanoriae* (a short-lived shrub) the species needs a minimum of three populations consisting of 50 mature individuals per population. In addition to achieving the numbers of reproducing individuals, all major threats must be controlled in the immediate vicinity of the populations, each population must show evidence of some stage of natural reproduction (*i.e.*, viable seeds or seedlings), and 50 mature individuals from each of three populations, or less if fewer than 50 remain, must be represented in an *ex situ* collection that is secure and well managed.

This recovery objective has not been met (see Table 1).

Interim Stage

To meet the interim stage of recovery of *Euphorbia eleanoriae*, 300 mature individuals are needed in each of three populations and all major threats must be controlled around the populations designated for recovery at this stage. There should also be demonstrated regeneration of seedlings and growth to at least sapling stage for woody species and documented replacement regeneration within each of the target populations. The populations must be adequately represented in an *ex situ* collection as defined in the Center for Plant Conservation's guidelines (Guerrant *et al.* 2004). Adequate monitoring must be in place and conducted to assess individual plant survival, population trends, trends of major limiting factors, and response of major limiting factors to management.

This recovery objective has not been met (see Table 1).

Downlisting Criteria

In addition to achieving 5 to 10 populations with 500 mature individuals per population and all of the goals of the interim stage, all target populations must be stable, secure, and naturally reproducing for a minimum of 10 years. Species-specific management actions are not ruled out. Downlisting should not be considered until an adequate population viability analysis (PVA) has been conducted to assess needed numbers more accurately based on current management and monitoring data collected at regular intervals determined by demographic parameters of the species, although they should only be one of the factors used in making a decision to downlist. Information necessary for the PVA that should be available through monitoring (ideally annually) includes: major limiting factors, breeding system, population structure and density, and proven management methods for major threats.

This recovery objective has not been met (see Table 1).

Delisting Criteria

In addition to achieving 5 to 10 populations with 500 mature individuals per populations and all of the goals of the interim and downlisting stages, all target populations must be stable, secure, naturally reproducing, and within secure and viable habitats for a minimum of 20 years. Species-specific management actions

must no longer be necessary, but ecosystem-wide management actions are not ruled out if there are long-term agreements in place to continue management. These numbers are initial targets, but may be revised upward as additional information is available, including adequate PVAs for individual species based on current management and monitoring data collected at regular intervals determined by demographic parameters of the species, although they should only be one of the factors used in making a decision to delist. Genetic analyses should be conducted to ensure that adequate genetic representation is present within and among populations compared to the initial variation assessed in the interim stage. Numbers need to be considered on a species-by-species basis.

This recovery objective has not been met (see Table 1).

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

A recent study has confirmed that the Hawaiian species of *Euphorbia* are a diverse and unique lineage, with a North American origin. DNA analysis suggests that extensive hybridization was involved in the evolution of Hawaiian *Euphorbia*. C_4 photosynthesis is a physiological and anatomical system commonly associated with plants adapted to warm, dry climates. In the Hawaiian Islands, there are many *Euphorbia* that use the C_4 system, including *Euphorbia eleanoriae,* that grow in mesic (wetter) habitats or have evolved into woody plants and trees, which is highly unusual for plants using this type of photosynthetic process (Yang and Berry 2011). Little else is known about the life history of *E. eleanoriae*. This species has been observed flowering in January, February, April, May, and October (Perlman 2007; PEPP 2015). Its pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (USFWS 2010a).

Euphorbia eleanoriae, a member of the spurge family (Euphorbiaceae), is a small shrub endemic to Kauai. It has brittle, dense, erect-ascending (growing upward) branches, and dark gray basal stems. The leaves are elliptical to broadly ovate, with blades 10 to 20 millimeters (mm) (0.4 to 0.8 inches (in)) long and 6 to 14 mm (0.2 to 0.6 in) wide. The leaves are usually pale green, sometimes with a reddish tint on the margins, oppositely arranged with each succeeding pair set at right angles to the previous pair, or sometimes spirally arranged. The inflorescences (flowering clusters) are cyathia (containing unisexual flowers without petals) that are borne either solitary or at the terminal branch tips. The styles and stamens are dark purple. The fruit is a capsule, green with a

purple-red apex, and the seeds are 2.2 mm (0.09 in) long and 1.3 mm (0.05 in) in diameter (Lorence and Wagner 1996).

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Euphorbia eleanoriae was historically known from 10 populations totaling fewer than 500 individuals when first discovered in 1992 (Wood 2007; Lorence and Wagner 1996). Described in 1996, it occurs only in and around Kalalau Valley Rim on Na Pali Coast of Kauai. In the 1990s, eight populations were known (from Honopu Valley rim, Kalalau Valley rim and cliffs to the hanging valley of Pohakuao), totaling at least 260 individuals. When monitored in 2005, there were three populations totaling fewer than 50 individuals (Perlman 2007; USFWS 2010a). Currently, there is only one population of 26 individuals at Pohakuao (PEPP 2015).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature:

This species was described by D.H. Lorence and W.L. Wagner (1996) under the name *Chamaesyce eleanoriae*, based on a specimen collected in 1992. 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*. This change in genus is recognized in the most recent treatment of the Hawaiian flora (Wagner *et al.* 2012). In 2015, the Service published a technical correction for this and other plant and wildlife species, recognizing the taxonomic change from *Chamaesyce eleanoriae* to *Euphorbia eleanoriae* (80 FR 35860, June 23, 2015). Therefore, we refer to this species as *Euphorbia eleanoriae*, and the List of Endangered and Threatened Plants (50 CFR 17.12) has been updated to reflect the new taxonomy (USFWS 2015b). The taxonomic change does not affect the range or endangered status of this species.

Euphorbia eleanoriae differs from the closely related *E. sparsiflora* by its consistently present white, glandular cyathial appendages (Lorence and Wagner 1996).

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

See section 2.3.1.2 above for spatial distribution of the species.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Euphorbia eleanoriae is restricted to steep, north-facing, narrow ridge crests, outcrops, and steep rocky slopes and upper portions of basalt cliffs of northern Kauai (Lorence and Wagner 1996; Wood 2007). Documented habitats include *Metrosideros polymorpha* (ohia)—*Diospyros* spp. (lama) mesic forest, *M. polymorpha* cliff and mesic shrubland, and *Eragrostis variabilis* (kawelu) coastal dry cliffs, between 270 and 1,100 meters (885 and 3,609 feet) elevation (Lorence and Wagner 1996; HBMP 2010).

When first described, *Euphorbia eleanoriae* occurred in *Metrosideros* shrubland with herbaceous species *Eragrostis* spp., *Poa mannii*, and *Stenogyne campanulata*; and shrubby native taxa including *Coprosma* spp. (pilo), *Dubautia* spp. (naenae), *Lepidium serra* (anaunau), *Lobelia niihauensis* (NCN), *Lysimachia glutinosa* (NCN), *Nototrichium divaricatum* (kului), *Hibiscus kokio* ssp. *saintjohnianus* (kokio), *Bidens sandvicensis* (kookoolau), and *Vaccinium* spp. (ohelo) (Lorence and Wagner 1996; Perlman 2007). Currently, at Pohakuao, *E. eleanoriae* typically occurs with other *Euphorbia* species, *Artemisia australis* (hinahina), *Bidens sandvicensis* (kookoolau), *Boehmeria grandis* (akolea), *Eragrostis variabilis*, *Kadua acuminata* (au), *Leptecophylla tameiameiae* (pukiawe), *Lipochaeta connata* ssp. *acris* (nehe), *Lythrum maritimum* (pukamole), *Nototrichium sandwicense* (kului), *Panicum lineale* (panic grass), *Sida fallax* (ilima), *Vaccinium dentatum* (ohelo), *Wikstroemia oahuensis* (akia), and *Wilkesia gymnoxiphium* (iliau). Occasional tree species include *Acacia koaia* (koaia), *Antidesma platyphyllum* var. *hillebrandii* (hame), *Bobea elatior* (ahakea), *Diospyros* spp. (lama), *Dodonaea viscosa* (aalii), *Hibiscus kokio* ssp. *saintjohnianus* (kokio ulaula), *Melicope pallida* (alani), *Metrosideros polymorpha* var. *glaberrima*, and *Psydrax odorata* (alahee). Common herbs include *Dianella sandwicensis* (uki uki), *Peperomia* spp. (alaala wai nui), *Peucedanum sandwicense* (makou), *Pilea peploides* (NCN), and *Plectranthus parviflorus* (alaala wai nui). Sedges include *Carex meyenii* (NCN) and *Cyperus phleoides* (NCN). Occasional ferns are also a component of these cliff regions and include *Doodia kunthiana* (okupukupu lauii), *Doryopteris decipiens* (kumuniu), *Lepisorus thunbergianus* (pakahakaha), *Microlepia strigosa* (palapalai) *Nephrolepis exaltata* ssp. *hawaiiensis* (naniau), *Psilotum nudum* (moa), and *Selaginella*

arbuscula (lepelepe a moa) (Wood 2007).

2.3.1.7 Other:

N/A

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range (Factor A):

Ungulate degradation of habitat—Feral goats (*Capra hircus*) and black-tailed deer (*Odocoileus hemionus*) modify and degrade habitat by disturbing and destroying vegetative cover, trampling plants and seedlings, reducing or eliminating plant regeneration by damaging seeds and seedlings, and increasing erosion by creating large areas of bare soil (Lorence and Wagner 1996; Wood 2007; PEPP 2014).

Established ecosystem-altering invasive plant modification and degradation of habitat—Invasive introduced plant species modify habitats occupied by native plant species by changing the availability of light, altering soil-water regimes, modifying nutrient cycling, and changing the fire characteristics of the native plant community. Invasive introduced plants with the greatest impacts on *Euphorbia eleanoriae* are: *Andropogon glomeratus* (bushy beardgrass), *Erigeron karvinskianus* (daisy fleabane), *Kalanchoe pinnata* (air plant), *Lantana camara* (lantana), *Pluchea carolinensis* (sourbush), *Psidium guajava* (common guava), and *Rubus rosifolius* (thimbleberry) (Lorence and Wagner 1996; Wood 2007).

Landslides and flooding destruction or degradation of habitat—The only known individuals of *Euphorbia eleanoriae* occur on cliffs at Pohakuao (PEPP 2015). Large herds of feral goats browse and cause erosion in the area where *E. eleanoriae* occurs (Lorence and Wagner 1996). Landslides, due to natural weathering and ungulate disturbance, destabilize substrates, damage and destroy individual plants, and alter hydrological patterns (Stearns 1985).

Hurricanes—Loss and degradation of habitat—In November 1982, Hurricane Iwa struck the Hawaiian Islands, with wind gusts exceeding 100 miles per hour (mph) (161 kilometers per hour (kph)), causing extensive damage, especially on the islands of Niihau, Kauai, and Oahu (Businger 1998). In September 1992, Hurricane Iniki, a category 4 hurricane with maximum sustained wind speeds recorded at 140 mph (225 kph), passed directly over the island of Kauai. Many forest trees were destroyed (Perlman 1992), which opened the canopy and facilitated the invasion of

nonnative plants (Kitayama and Mueller-Dombois 1995). A destructive hurricane holds the potential of driving a localized endemic species to extinction in a single event. Hurricanes pose an ongoing and ever-present threat because they can happen at any time, although their occurrence is not predictable. Tropical cyclone frequency and intensity are projected to change as a result of climate change over the next 100 to 200 years (Vecchi and Soden 2007; Emanuel *et al.* 2008; Yu *et al.* 2010). In the central Pacific, modeling projects an increase of up to two additional tropical cyclones per year in the main Hawaiian Islands by 2100 (Murakami *et al.* 2013).

Climate change loss or degradation of habitat—Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. This assessment concluded that *Euphorbia eleanoriae* is highly vulnerable to the impacts of climate change with a vulnerability score of 0.783 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes (Factor B):

Not a threat.

2.3.2.3 Disease or predation (Factor C):

Ungulate predation or herbivory—Herbivory by feral goats and black-tailed deer is a threat to *Euphorbia eleanoriae* (Lorence and Wagner 1996; Wood 2007; PEPP 2014).

2.3.2.4 Inadequacy of existing regulatory mechanisms (Factor D):

Lack of adequate hunting regulations—All of the historic and currently known populations of *Euphorbia eleanoriae* occur or occurred in state hunting areas. Feral goats and black-tailed deer and the effects of their activities are noted to be a threat to *E. eleanoriae*. Nonnative feral ungulates pose a major ongoing threat to native species through destruction and modification of habitat, and by direct herbivory or predation. The population of *E. eleanoriae* is not fenced. Public hunting areas are not fenced and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land use designation; therefore, any unfenced populations are at risk (DLNR 2010).

Lack of adequate biosecurity legislation—Invasion of the State of Hawaii by invasive nonnative plant species, and destruction of habitat and competition by nonnative plants are threats to *Euphorbia eleanoriae.* Pest species have caused the extinction of native species, the destruction of native forests, and the spread of disease. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, is authorized to prevent the introduction or dissemination of animal and plant pests on all ships, aircraft, and their cargo and baggage arriving in the U.S. and its territories; however, pest species continue to enter the State. In addition, Federal import regulations do not address many species that could be pests in Hawaii (CGAPS 2009; Ikuma *et al.* 2002).

2.3.2.5 Other natural or manmade factors affecting its continued existence (Factor E):

Invasive species—Established invasive plant species competition—Nonnative plant species including *Andropogon glomeratus* (bushy beardgrass), *Erigeron karvinskianus* (daisy fleabane), *Kalanchoe pinnata* (air plant), *Lantana camara* (lantana), *Pluchea carolinensis* (sourbush), *Psidium guajava* (common guava), and *Rubus rosifolius* (thimbleberry) compete with *Euphorbia eleanoriae* for space, water, light, and nutrients (Lorence and Wagner 1996; Wood 2007).

Stochastic events—Reduced viability due to low numbers—Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species' capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (Barrett and Kohn 1991; Newman and Pilson 1997). The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as anthropogenic impacts like habitat loss from human development or predation by nonnative species. Very small plant populations may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. Small numbers are noted as a cause of loss of reproductive vigor of *Euphorbia eleanoriae* (Wood 2007).

Current Management Actions:

- Captive propagation for genetic storage and reintroduction—
    - Cuttings were taken from individuals of the Pohakuao population for propagation (PEPP 2015). No propagules, however, are currently in *ex situ* storage.
    - Population viability monitoring and analysis (PEPP 2015).

Table 1. Status and trends of *Euphorbia eleanoriae* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Preventing Extinction Criteria identified by HPPRCC	Preventing Extinction Criteria Completed?
2010 (listing and critical habitat)	< 50	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2016 (5-year review)	26	0	All threats managed in all three populations	No
			Reproduction (*i.e.*, viable seeds, seedlings) at all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No

Table 2. Threats to *Euphorbia eleanoriae* and conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	None
Established ecosystem-altering invasive plant modification and degradation of habitat	A	Ongoing	None
Landslides and flooding destruction or degradation of habitat	A	Ongoing	None
Hurricane destruction and degradation of habitat	A	Ongoing	None
Climate change loss or degradation of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	None
Inadequacy of existing regulatory mechanisms—Lack of adequate hunting	D	Ongoing	None

regulations			
Inadequacy of existing regulatory mechanisms—Lack of adequate biosecurity legislation	D	Ongoing	None
Invasive species—Established invasive plant species competition	E	Ongoing	None
Stochastic events—Reduced viability due to low numbers	E	Ongoing	Partial

2.4 Synthesis

Preventing extinction, interim stabilization, downlisting, and delisting objectives are provided in HPPRCC's Revised Recovery Objective Guidelines (2011). To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and have 50 individuals (or the total number of individuals if fewer than 50 in a population) from each of three populations represented in an *ex situ* (at other than the plant's natural location, such as a nursery or seed bank) collection. In addition, a minimum of three populations should be documented on Kauai where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, or saplings), with a minimum of 50 mature individuals per population.

The preventing extinction goals for this species have not been met, as currently only one population of 26 individuals currently exists, there is no genetic storage representation (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Euphorbia eleanoriae* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (regardless of current classification) Priority Number: ____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Surveys and inventories—Survey for populations of *Euphorbia eleanoriae* in areas of potentially suitable habitat.
- Ungulate monitoring and control—Construct ungulate exclosures around remaining population to protect individuals from the impacts of feral ungulates. Protect all occurrences against browsing and disturbances from feral ungulates.
- Invasive plant monitoring and control—
    - Control established ecosystem-altering nonnative invasive plant species around all populations.
    - Control invasive nonnative plant species around all populations that compete with the species.
- Predator and herbivore monitoring and control—Construct small-scale fences strategically at the unprotected population until a larger surrounding area is fenced and ungulate-free.
- Captive propagation for genetic storage and reintroduction—Collect material for genetic storage and propagation for reintroduction.
- Reintroduction and translocation—Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Population biology research—Study *Euphorbia eleanoriae* populations to determine viable population size and structure, geographical distribution, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Stochastic events—Build resilience and redundancy—Increase numbers of populations and individuals scattered through historic range to reduce impacts from landslides and storms.
- Based on the recovery criteria above, consider development of a recovery plan.

5.0 REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Euphorbia eleanoriae* (‘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:_____

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

GREGORY KOOB Digitally signed by GREGORY KOOB
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