

Kanaloa kahoowawensis
(Kohe malama malama o kanaloa)

**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: *Kanaloa kahoowawensis* (Kohe malama malama o kanaloa)

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5-YEAR REVIEW

Kanaloa kahoolawensis (Kohe malama malama o kanaloa)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Jesse D'Elia, Chief, Division of Recovery, (503) 231-2071

Lead Field Office:

Pacific Islands Fish and Wildlife Office, Gina Shultz, Assistant Field Supervisor for Endangered Species, (808) 792-9400

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 (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) between June 2006 and June 2007. The National Tropical Botanical Garden provided most of the updated information on the current status of *Kanaloa kahoolawensis*. They also provided recommendations for conservation actions that may be needed prior to the next five-year review. The evaluation of the lead PIFWO biologist was reviewed by the Plant Recovery Coordinator. These comments were incorporated into the draft five-year review. The draft five-year review was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before final approval.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

USFWS. 2006. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 70 species in Idaho, Oregon, Washington, Hawaii, and Guam. Federal Register 71(69):18345-18348.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1999. Endangered or threatened wildlife and plants; final endangerment status for 10 plant taxa from Maui Nui, HA; final rule. Federal Register 64(171):48307-48324.

Date listed: September 3, 1999
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:

USFWS. 2003. Endangered and threatened wildlife and plants; designation of critical habitat for 60 plant species from the islands of Maui and Kahoolawe, HI; final rule. Federal Register 68(93):25934-26165.

Critical habitat was designated for *Kanaloa kahoolawensis* in three units totaling 1,180 hectares (2,915 acres) on the island of Kahoolawe. This designation includes habitat on state land (USFWS 2003).

1.3.4 Review History:

Species status review [FY 2006 Recovery Data Call (September 2006)]:
Declining

Recovery achieved:

1 (0-25%) (FY 2006 Recovery Data Call)

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

1

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Addendum to the recovery plan for the Multi-Island plants. 2002. U.S. Fish and Wildlife Service, Portland, Oregon. viii + 125 pages.

Date issued: September 19, 2002

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
 X 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
 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?

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, and E) affecting this species is presented in section 2.4. D (inadequacy of existing regulatory mechanisms) is not known to be threats to this species.

Stabilizing, downlisting, and delisting objectives are provided in the addendum to the recovery plan for the Multi-Island plant cluster (USFWS 2002), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Kanaloa kahoowawensis* is a long-lived perennial, and to be considered stable, the taxon must be managed to control threats (e.g., fenced, weeded, etc.) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented 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.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Kanaloa kahoowawensis* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 100 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Kanaloa kahoowawensis* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 100 mature individuals per population for short-lived perennials. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

In addition to the status summary table below, information on the species' status and threats was included in the final critical habitat rule referenced above in section 1.3.3 ("Associated Rulemakings") and in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

Status of *Kanaloa kaahoolawensis* from listing through 5-year review.

Date	No. wild inds	No. outplanted	Stability Criteria	Stability Criteria Completed?
1999 – listing	2	0	All threats managed in all 3 populations	No
			Complete genetic storage	Yes
			3 populations with 25	No

Date	No. wild inds	No. outplanted	Stability Criteria	Stability Criteria Completed?
			mature individuals each	
2002 – recovery plan	1	0	All threats managed in all 3 populations	No
			Complete genetic storage	Yes
			3 populations with 25 mature individuals each	No
2003 – critical habitat	1	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Yes
			3 populations with 25 mature individuals each	No
2007 – 5-yr review	1	0	All threats managed	Partially
			Complete genetic storage	Yes
			3 populations with 25 mature individuals each	No

2.3.1 Biology and Habitat

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

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:

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

2.3.1.4 Taxonomic classification or changes in nomenclature:

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.):

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

2.3.1.7 Other:

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:

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:

2.3.2.5 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

Kanaloa kahoowawensis has declined from two plants at the time it was discovered to only one plant remaining in the wild. *Kanaloa kahoowawensis* was discovered on the sea stack Aleale on the south central coast of the island of Kahoolawe, Hawaii, in 1992 and it was subsequently determined to be a new genus and species (Lorence and Wood 1994). One individual was 90 percent dead by January 2001 despite watering, and the remaining plant was dying from two years of drought and windstorms (Wood *et al.* 2000; Wood and LeGrande 2001). The remaining plant continued to recover through November, 2003. When visited in 2004, recent flowering was abundant and male flowers were piled in leaf litter. Leaves at this time were in healthy condition (just past recent flush); no seeds were observed (Wood 2004). Only one plant remains in cultivation at National Tropical Botanical Garden in Lawai (Lorence 2006).

The historic range has been documented as pollen from soil cores at several locations throughout the Hawaiian Islands and suggests that *Kanaloa kahoowawensis* was quite widespread in lowland dry mesic ecosystems, along with *Dodonea viscosa* (aalii) and undetermined species of *Pritchardia* (loulou) palms, from the early Pleistocene through 1210 B.C. to 1565 A.D. (Athens *et al.* 1992; Athens 1997; Wood 1999; Burney *et al.* 2001). All three species diminished with human contact and the introduction of Pacific rats (*Rattus exulans*) after 900 to 1200 A.D. (USFWS 2002; Athens *et al.* 2002).

The current habitat on Aleale is steep rocky talus slopes, in mixed coastal shrubland (Wood 2004).

A study undertaken at National Tropical Botanical Garden between 2000 and 2001 found that the soil in which the *Kanaloa kahoowawensis* was growing on Aleale had considerably higher acidity than the soil in the container at National Tropical Botanical Garden in which the cultivated plant was growing. The results suggested that the *K. kahoowawensis* at the National Tropical Botanical Garden only be watered with rainwater, as the piped water contains salts (sodium and chloride) from chlorination treatment. The researchers also recommended top dressing with peat moss to acidify the soil. The study also found that phosphorus levels were quite high in the cultivated plants, and that boron levels in the wild plant were two to three times higher than in the National Tropical Botanical Garden soil samples (Laidlaw 2001).

Kanaloa kahoowawensis is possibly threatened by trampling (Factor E) and habitat degradation (Factor A) by introduced cats (*Felis catus*) and native seabirds present in Aleale (USFWS 2002; Lorence and Wood 1994). The area of Aleale is a nesting site for Bulwer's petrel (*Bulweria bulwerii*) and wedge-tailed shearwater (*Puffinus pacificus chlororhynchus*) (Lorence and Wood 1994; K. Wood, National Tropical Botanical Garden, pers. comm. 2003). Unrestricted collecting or excessive visits by individuals interested in seeing rare plants was identified as a threat for *K. kahoowawensis* (Factor B). Possible seed predation by rats and mice may threaten *K. kahoowawensis* (Factor C) (USFWS 2002; Wood 2005). Mice are now present on the sea stack and they are known to eat seeds and flowers of other endangered plants and they may be affecting *K. kahoowawensis* (Factor C) (Wood 2005). Pollen core studies show that Pacific rats (*R. exulans*) probably decimated the forest vegetation by stopping the processes of regeneration in plants like of *K. kahoowawensis* and *Pritchardia* spp. (loulou) even before human settlement (Factors A and C) (Athens *et al.* 2002).

Kanaloa kahoowawensis has been susceptible to red spider mite and two-spotted mite and scale in cultivation (Factor C), when these appear they have been controlled by a systemic insecticide (R. Nishek, National Tropical Botanical Garden, pers. comm. 2007). An adventive black beetle, *Gonocephalum adpressiforme* was found in the soil at the plant's base in 2003 (Factor C) (K. Wood, pers. comm. 2003), but it is unclear whether it has any impact on the species.

Kanaloa kahoowawensis is also threatened by competition with and habitat degradation by introduced invasive plant species (Factor E) (Wood 2004; USFWS 2002). This species is also threatened by stochastic extinction caused by random environmental events such as high winds, tsunamis, hurricane, landslides, droughts, and fire due to small population numbers (Factor E) (USFWS 2002; Wood 2004).

Conservation efforts for this species include propagation by seeds that were collected from plants at Aleale from 1992 to 1998, and were sent to National Tropical Botanical Garden and Harold L. Lyon Arboretum (Harold L. Lyon Arboretum

Micropropagation Laboratory 2006; National Tropical Botanical Garden 2006). The National Tropical Botanical Garden currently maintains the only large healthy plant in cultivation. This cultivated plant produced several aborted fruits and three apparently fully developed in mid-2006. Carefully opening the dry, indehiscent fruit revealed that only one of the fruits had a single mature seed; the other two fruits contained aborted seed and fungus infected seed (Lorence 2006). The mature seed was planted and germinated, but unfortunately did not survive to seedling stage (R. Nishek, pers. comm. 2007). Propagation from cuttings, air and root grafts has been attempted repeatedly since 1992, with no success (Laidlaw 2001; K. Wood, pers. comm. 1999).

Micropropagation efforts have been attempted several times, but research has indicates it is likely that *Kanaloa kahoowawensis* requires a symbiont for proper growth (Murch 2004; S. Murch, University of British Columbia Okanagan, pers. comm. 2006). Murch speculates that as a legume this species seems susceptible to infections. So far, no one has been successful at micropropagating this species, but there are preliminary indications that it may yet be possible, particularly since the parent plant in cultivation is in better health than it has been for several years. Plant material has also been sent to the Center for Conservation and Research on Endangered Wildlife at Cincinnati Zoo and Botanical Garden, to attempt micropropagation of *K. kahoowawensis* (E. Coulombe, National Tropical Botanical Garden, pers. comm. 2006).

The stabilization and recovery goals for this species have not been met, as only one mature individual is known in the wild. Therefore, *Kanaloa kahoowawensis* 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

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:

- Establish *in vitro* cultures of the last two individuals.
- Any fruits produced by the cultivated plant should be used for micropropagation attempts.
- Continued monitoring four times a year to determine if plant needs to be treated for drought and rockslides.
- Control introduced invasive plant species around the remaining plant.
- Remove rats, mice, and cats on the sea stack Aleale.
- Research on the root microflora associated with *Kanaloa kahoolawensis*, to increase success in micropropagation techniques.

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