

Kokia drynarioides
(Koki`o)

**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: *Kokia drynarioides* (Koki`o)

TABLE OF CONTENTS

1.0	GENERAL INFORMATION	1
1.1	Reviewers	1
1.2	Methodology used to complete the review	1
1.3	Background	1
2.0	REVIEW ANALYSIS	3
2.1	Application of the 1996 Distinct Population Segment (DPS) policy	3
2.2	Recovery Criteria.....	3
2.3	Updated Information and Current Species Status	4
2.4	Synthesis.....	6
3.0	RESULTS	7
3.3	Recommended Classification	7
3.2	New Recovery Priority Number	8
3.3	Listing and Reclassification Priority Number.....	8
4.0	RECOMMENDATIONS FOR FUTURE ACTIONS	8
5.0	REFERENCES	9
	Signature Page.....	11

5-YEAR REVIEW
***Kokia drynarioides*/ Koki`o**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

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

Lead Field Office:

Pacific Islands Fish and Wildlife Office, Gina Shultz, Deputy Field Supervisor,
(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) on March 8, 2007. Bernice P. Bishop Museum provided most of the updated information on the current status of *Kokia drynarioides* and also provided recommendations for conservation actions needed prior to the next five-year review. The evaluation of the status of the species was prepared by the lead PIFWO biologist and reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species, and Deputy Field Supervisor, before submission to the Field Supervisor for approval.

1.3 Background:

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

USFWS. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and Territory of Guam. Federal Register 72(45):10547-10550.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1984. Endangered and threatened wildlife and plants; determination of endangered status and critical habitat for *Kokia drynarioides* (Kokio); final rule. Federal Register 49(234):47397-47401.

Date listed: December 4, 1984

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. 1984. Endangered and threatened wildlife and plants; determination of endangered status and critical habitat for *Kokia drynarioides* (Kokio); final rule. Federal Register 49(234):47397-47401.

Critical habitat was designated for *Kokia drynarioides* in three units totaling 1,052 hectares (2,600 acres) on the island of Hawaii. This designation includes habitat on State and private lands (USFWS 1984).

1.3.4 Review History:

Species status review [FY 2008 Recovery Data Call (September 2008)]:
Stable

Recovery achieved:

1 (0-25%) (FY 2008 Recovery Data Call)

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

2

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Recovery plan for *Caesalpinia kavaiensis* and *Kokia drynarioides*. U.S. Fish and Wildlife Service, Portland, OR. 82 pages + 8 pages Appendix.

Date issued: May 6, 1994

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
 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
 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 2.4.

Kokia drynarioides may be downlisted when there are a minimum of 100 naturally reproducing individuals in each of three secure populations in North Kona.

This recovery objective has not been met.

Currently, there is no scientific basis for setting minimum population sizes or minimum number of populations required for downlisting or delisting *Kokia drynarioides*. The lack of such basic knowledge as life span and age at reproductive maturity make demographic modeling and projections impossible. Therefore, recovery objectives dealing with minimum population size should be viewed as temporary estimates which will be updated and refined as more information becomes available.

Interim stability and delisting criteria were not identified in this recovery plan.

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.

Table 1. Status of *Kokia drynarioides* (Koki`o) from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1984 (listing and critical habitat)	15	Unknown	3 populations consisting of a minimum of 100 individuals should be documented in secure sites in South Kona	No
1994 (recovery plan)	4	21	3 populations consisting of a minimum of 100 individuals should be documented in secure sites in South Kona	No
2008 (5-year review)	2	75	3 populations consisting of a minimum of 100 individuals should be documented in secure sites in South Kona	No

2.3.1 Biology and Habitat [see note in section 2.3]

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) [see note in section 2.3]

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:

No new information.

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:

No new information.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

Kokia drynarioides is endemic to the island of Hawaii and is currently restricted to two populations at Kaupulehu and Hawaii Volcanoes National Park. At the time of Federal listing of the species as endangered one small population of 15 individuals was located in and near Kaupulehu Forest Reserve and Puu Waawaa Ranch, Hawaii (USFWS 1984). Currently, two extant populations remain: the first at Kaupulehu containing one mature individual and the second population at Kipuka Nene containing a single surviving mature individual. This individual came from hundreds of seedlings originally from Puu Waawaa stock outplanted in the 1940s and is capable of producing seeds (Plant Extinction Prevention 2007, 2008; USFWS 2008). The single remaining individual at Puu Waawaa was observed as dead in 2006, but 75 outplanted individuals survive and are reproducing (Plant Extinction Prevention 2007, USFWS 2008).

The species produces abundant viable seeds that are easy to germinate and maintain. Seeds can be stored at room temperature, in a freezer, refrigerator or desiccation chamber for three or more years (Lilleeng-Rosenberger 2005). Seed requires scarification for germination (Cabin *et al.* 2002). *Kokia drynarioides* is often used as a base for grafting the even rarer endangered *Kokia cookei* (USFWS 1994).

The main threats for this species are habitat degradation by feral cattle (*Bos taurus*) and goats (*Capra hircus*), sheep (*Ovis aries*) (Factors A and D), fire (Factor E), habitat disturbance due to development (Factor A) and competition from introduced invasive species such as *Pennisetum setaceum* (fountain grass) (Factor E) (USFWS 1984; 1994; 2008; Cabin *et al.* 2002; Thaxton *et al.* 2005). Invasive introduced plant species such as *P. setaceum* exacerbate the effect of fire due to the heavy fuel load

they provide (Factor E) (D'Antonio and Vitousek 1992). Invertebrate and rat (*Rattus* spp.) predation of seeds (Factor C), infestation of invasive introduced aphids (*Aphis gossypii*) (Factor C), and overgrazing by ungulates (Factor C) remain a threat for the existing individuals (USFWS 1984; 1994; 2008; Messing *et al.* 2007). A single event such as volcanic eruption (Factor E) or fire (Factor E) could eliminate all of the remaining individuals. Further, because of the extremely low number of individuals remaining, there is likely to be a reduction in the genetic variation within the species, and the collection of any plant parts for scientific or other purposes could further exacerbate the threat. (Factors B and E) (USFWS 1994). Finally, the existing two populations are protected from the activities of feral ungulates, but seed predation by rats and adverse impacts of invertebrates pose a significant threat to the remaining wild individuals.

Studies show that invasive grass removal coupled with at least an initial period of supplemental water and shade significantly increased seedling survival for *Kokia drynarioides* (Cabin *et al.* 2002; Thaxton *et al.* 2005).

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at the University of Hawaii's Lyon Arboretum Micropropagation Laboratory (2007), Honolulu Botanical Gardens (2007), Waimea Arboretum (2007), Volcano Rare Plant Facility (2007) and National Tropical Botanical Garden (2007). Twenty-three individuals were reintroduced to Puu Waawaa in 2007 (Volcano Rare Plant Facility 2007). Seventy-five individuals have survived reintroduction at Puu Waawaa, and some of these are mature and reproducing. The area is enclosed in a small fence and weeds are being controlled (USFWS 2008).

The downlisting goals for this species have not been met as only two mature individuals remain in the wild, with 75 reintroduced and reproductive individuals, and not all threats are being controlled (see Table 1). Therefore, *Kokia drynarioides* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.3 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: N/A

Brief Rationale:

3.3 Listing and Reclassification Priority Number: N/A

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

- Control introduced invasive plant species around wild and outplanted plants.
- Construct large-scale fences around all naturally occurring and reintroduced individuals to control feral ungulates and restore habitat.
- Continue collection of genetic resources for storage, future propagation and reintroduction into protected suitable habitat within historical range.
- Control rats around wild and outplanted individuals.
- Determine and implement methods to control aphids and other invertebrates if observed to be affecting wild individuals.
- Continue reintroductions and establishment of new populations.
- Initiate planning and contribute to implementation of ecosystem level restoration and management to benefit this species.
- Establish a fire prevention and control strategy.
- Assess genetic variation within remaining wild individuals and outplants; and individuals retained within living collections.
- Study *Kokia drynarioides* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.

5.0 REFERENCES

References:

- Cabin, R.J., S.G. Weller, D.H. Lorence, S. Cordell, and L.J. Hadway. 2002. Effects of microsite, water, weeding, and direct seeding on the regeneration of native and alien species within a Hawaiian dry forest preserve. *Biological Conservation* 104:181-190.
- D'Antonio, C.M. and P.M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle and global change. *Annual Review of Ecology and Systematics* 23:63-88.
- Honolulu Botanical Gardens. 2007. Report on controlled propagation for listed and candidates species, as designated under the U.S. Endangered Species Act. Unpublished.
- National Tropical Botanical Garden. 2007. Report on controlled propagation for listed and candidates species, as designated under the U.S. Endangered Species Act. Unpublished.
- Messing, R.H., M.N. Tremblay, E.B. Mondor, R.G. Footitt, and K.S. Pike. 2007. Invasive aphids attack native Hawaiian plants. *Biological Invasions* 9:601-607.
- Lilleeng-Rosenberger, K.E. 2005. Growing Hawaii's native plants. Mutual Publishing, Honolulu, HI. 416 pages.
- Plant Extinction Prevention Program. 2007. Annual performance report (July 1, 2006 to June 30, 2007), Plant Extinction Prevention (PEP) program for Oahu, Maui Nui, Hawaii. Unpublished.
- Plant Extinction Prevention Program. 2008. Section 6 annual performance report for endangered plant restoration and enhancement - Plant Extinction Prevention (formerly Genetic Safety Net), Fiscal Year 2008 (July 1, 2007 – June 30, 2008). Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife. 113 pages. Unpublished.
- Thaxton, J., R. Cabin, S. Cordell, and D. Sandquist. 2005. Effect of shade, water and grass removal on Hawaiian dry forest restoration. (Abstract) presented in Meeting of Ecological Society of America in Montréal, Canada. Available online at <<http://abstracts.co.allenpress.com/pweb/esa2005/document/?ID=50005>>. Accessed on July 6, 2007.
- [USFWS] U.S. Fish and Wildlife Service. 1984. Endangered and threatened wildlife and plants; determination of endangered status and critical habitat for *Kokia drynarioides* (koki`o). Federal Register 49(234):47397-47401.
- [USFWS] U.S. Fish and Wildlife Service. 1994. Recovery plan for *Caesalpinia kavaiensis* and *Kokia drynarioides*. U.S. Fish and Wildlife Service, Portland, OR. 88 pages + 8pages Appendix.

[USFWS] U.S. Fish and Wildlife Service. 2008. Rare plant tracking database. Pacific Islands Fish and Wildlife Office, Honolulu, HI. Accessed on April 28, 2008. Unpublished.

Volcano Rare Plant Facility. 2007. 2007 Report on controlled propagation for listed and candidates species, as designated under the U.S. Endangered Species Act. Unpublished.

Waimea Arboretum. 2007. Report on controlled propagation for listed and candidates species, as designated under the U.S. Endangered Species Act. Unpublished.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Kokia drynarioides* (Koki`o)

Current Classification: _____ E _____

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:

Christian Torres-Santana, Student Trainee Biologist
Marie Bruegmann, Plant Recovery Coordinator
Marilet A. Zablan, Recovery Program Leader for Endangered Species and
acting Assistant Field Supervisor for Endangered Species
Gina Shultz, Deputy Field Supervisor

Approved  Date 21 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office