

Sicyos alba
(Anunu)

**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: *Sicyos alba* (Anunu)

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5-YEAR REVIEW
***Sicyos alba* (Anunu)**

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, Loyal Mehrhoff, 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 of the U.S. Fish and Wildlife Service (USFWS), beginning on April 8, 2010. The review was based on the designation of critical habitat for *Sicyos alba* and the Big Island II: Addendum to the recovery plan for the Big Island plant cluster (USFWS 2003, 1998), as well as a review of current, available information. The 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 Samuel Aruch, biological consultant, was reviewed by a recovery biologist and 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.

1.3 Background:

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

USFWS. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii,

Guam, and the Commonwealth of the Northern Mariana Islands.
Federal Register 75(67):17947-17950.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1996. Endangered and threatened wildlife and plants; determination of endangered or threatened status for thirteen plant species from the island of Hawaii, State of Hawaii; final rule. Federal Register 61(198):53137-53153.

Date listed: October 10, 1996

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; final designation and nondesignation of critical habitat for 46 plant species from the island of Hawaii, Hawaii; final rule. Federal Register 68(127):39624-39761.

Critical habitat was designated for the *Sicyos alba* in a single unit totaling 6,266 hectares (15,483 acres) on Hawaii Island on State and Federal lands (USFWS 2003).

1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:
Decreasing

Recovery achieved:

1 (0-25%) (FY 2007 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: USFWS. 1998. Big Island II: Addendum to the recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 80 pages + appendices. Available online at <<http://www.fws.gov/pacificislands/recoveryplans.html>>.

Date issued: May 11, 1998

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 (Listing Factors A, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Stabilizing, downlisting, and delisting objectives are provided in the Addendum to the recovery plan for the Big Island plant cluster (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Sicyos alba* is an annual, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on the Big Island (Hawaii Island). For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 100 mature individuals per population.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Sicyos alba* should be documented on the island of Hawaii. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 500 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 *Sicyos alba* should be documented on the island of Hawaii. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 500 mature individuals per population. 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

2.3.1 Biology and Habitat

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

Sicyos alba is an annual species (Wagner *et al.* 1999) that varies somewhat each year in population size. The species is monoecious, with male and female flowers being borne on the same individual (USFWS 1998). Relatively little is known about the life history of the species (USFWS 2002), although records from Bishop Museum (2011) and National Tropical Botanical Garden (2011a) indicated the species is known to flower from July through November and fruit from June through December.

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:

Sicyos alba is endemic to the island of Hawaii and historically was found in the Kilauea area (USFWS 1996, 2002). As expected for an annual species, its population numbers fluctuate yearly.

At the time of listing in 1996, two large vines were found between two survey transects in the Koa Unit of O'laa Forest (Pratt and Abbott 1997). When the recovery plan was published, 21 individuals were known in 2 populations on Hawaii Island (USFWS 1998).

At the time critical habitat was proposed, the species was known from about 30 individuals (USFWS 2002). One population was located within Puu Makaala Natural Area Reserve; two populations were found at the O'laa tract of Hawaii Volcanoes National Park; and a fourth population was located at O'laa Forest Reserve (USFWS 2002). At the time that critical habitat was designated, the species was known from five populations within the Hawaii Volcanoes National Park (USFWS 2003).

In 2007, a single individual was observed in fruit at Puu Makaala Natural Reserve Area (Plant Extinction Prevention Program 2008). From 2007 and 2008, a total of five individuals were observed at two sites in the Koa Unit of Hawaii Volcanoes National Park (Plant Extinction Prevention Program 2008). In 2010, the Plant Extinction Prevention Program (2009) reported a total of only five wild individuals of *Sicyos alba* on Hawaii Island.

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

In their phylogenetic study of Cucurbitaceae, Kocyan *et al.* (2007) mentioned several genera that appeared to be poly- or paraphyletic based on their results, but *Sicyos* was found to be monophyletic. Schaefer *et al.* (2008) followed up on that study of Cucurbitaceae in the context of testing hypotheses of repeated long-distance dispersal and a taxonomic origin of the family in Asia. Four species of *Sicyos* were included in the study; however *S. alba* was not included in the study. The four sampled species in *Sicyos* were grouped together within the tree, which was based on a Bayesian analysis and subjected to dense taxonomic sampling within the family (Schaefer *et al.* 2008).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Sicyos alba, a member of the gourd family (Cucurbitaceae), was first described by Harold St. John in 1978 as the segregate genus *Sarx*. The holotype specimen was collected in Kulani on Hawaii Island by Wayne Gagné in 1974 and is housed at Bishop Museum (Telford 1989). However, the first collection was made by the U.S. Exploring Expedition in 1840 and 1841. Telford (1989) transferred the species to the genus *Sicyos*, and indicated that the floral and vegetative morphology of *S. alba* was so close to that of *S. cucumerinus* that further studies were warranted regarding whether the two species were distinct. Wagner and Shannon (1999) summarized the nomenclatural situation for Hawaiian members of the genus.

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.):

No new information.

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

Sicyos alba typically grows in forest dominated by *Metrosideros polymorpha* (ohia) and *Cibotium glaucum* (hapuu) in montane forests between 966 and 1,546 meters (3,270 to 5,072 feet) elevation (USFWS 2002; Hawaii Biodiversity and Mapping Program 2010). The species has been collected from the typic tropofolists at Puu Makaala and typic hydrandeps at Olaa Forest Reserve soil types (Hawaii Biodiversity and Mapping Program 2010). Associated native plant species include *Astelia menziesiana* (painiu), *Athyrium microphyllum* (akolea), *Broussaisia arguta* (kanawao), *Cheirodendron trigynum* (olapa), *Cyanea tritomantha* (aku), *Cyrtandra lysiosepala* (haiwale), *Platydesma spathulata* (pilo kea), *Perrottetia sandwicensis* (olomea), *Pritchardia beccariana* (loulou), and species of *Psychotria* (kopiko), *Coprosma* (pilo), and *Stenogyne* (USFWS 2002).

2.3.1.7 Other:

No new information.

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:

Threats:

- Ungulate degradation of habitat – Feral pigs (*Sus scrofa*) (USFWS 1996, 1998, 2002; Plant Extinction Prevention Program 2008; Hawaii Biodiversity and Mapping Project 2010)
- Established ecosystem-altering invasive plant species degradation of habitat (USFWS 1996, 1998, 2002; Plant Extinction Prevention Program 2008)
 - *Hedychium gardnerianum* (kahili ginger)
 - *Passiflora tarminiana* (banana poka)
 - *Psidium cattleianum* (strawberry guava)

- *Rubus ellipticus* (yellow Himalayan raspberry)
- *Setaria palmifolia* (palm grass)
- *Tibouchina urvilleana* (glory bush)
- Lava flow degradation of habitat (USFWS 1998, 2002)

Current conservation efforts:

- Ungulate exclosure – A fenced exclosure was constructed at Puu Makaala Natural Reserve Area at the Aku Unit to protect *Sicyos alba* from feral pigs (Plant Extinction Prevention Program 2008)

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

None reported.

2.3.2.3 Disease or predation:

None reported.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Threats:

- Lack of adequate hunting regulation in areas with ungulates – The lack of adequate ungulate control and the existence of established hunting programs in areas where *Sicyos alba* occurs outside of the National Park Service continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Hiking and trail maintenance (USFWS 1996, 1998, 2002; Hawaii Biodiversity and Mapping Program 2010)
- Low numbers (USFWS 1998, 2002; Plant Extinction Prevention Program 2010)
- Climate change may 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.

Current conservation efforts:

- Captive propagation for genetic storage and reintroduction:
 - In 1998, only nine seeds of *Sicyos alba* were known, all of them were in storage at the National Tropical Botanical Garden (USFWS 1998).
 - In 2010, the National Tropical Botanical Garden (2010) had five seeds in storage for genetic storage purposes. The 2011 report did not indicate any seeds were in storage (National Tropical Botanical Garden 2011b)
 - In its most recent report of *ex situ* collections, the Plant Extinction Prevention Program (2010) indicated a total of five individuals of *S. alba* in three populations, representing 60 percent of the wild population. In 2009, these values were also reported by the Plant Extinction Prevention Program (2009), but it included an indication that the current number of individuals in the wild was less than 50.
 - Hawaii Volcanoes National Park (2011) reported they had two individuals in storage.
 - The Center for Conservation Research and Training (2009) reported nine seeds in storage.
 - The Volcano Rare Plant Facility (2011) reported one individual in storage. In 2008: 7 individuals were in controlled propagation; 2009: 10 individuals were in genetic storage and 6 individuals in controlled propagation; 2010: 7 individuals were in genetic storage and 5 individuals in controlled propagation (Volcano Rare Plant Facility 2008, 2009, 2010)
 - In September 2007 and March 2008, fruit was collected by the Plant Extinction Prevention Program from the Koa unit of Hawaii Volcanoes National Park and given to the Volcano Rare Plant Facility Plant Extinction Prevention Program (2008).

- Reintroduction / translocation implementation – The Volcano Rare Plant Facility reported for the following years: in 2008, 12 individuals were reintroduced at Puu Makaala; in 2009, two individuals were reintroduced at Puu Makaala; in 2010, two individuals were reintroduced at Hawaii Volcanoes National Park (Volcano Rare Plant Facility 2008, 2009, 2010).
- Surveys / inventories:
 - In July 2007 and May 2008, the Plant Extinction Prevention Program conducted surveys for *Sicyos alba* at the Puu Makaala Natural Area Reserve Aku Unit (Plant Extinction Prevention Program 2008).
 - In March 2008, the Plant Extinction Prevention Program conducted surveys for *Sicyos alba* at the Koa unit of Hawaii Volcanoes National Park (Plant Extinction Prevention Program 2008).
- Population viability monitoring – The Plant Extinction Prevention Program monitors the status, seed production, and any new threats to the population at Puu Makaala Natural Area Reserve and the Koa unit of Hawaii Volcanoes National Park (Plant Extinction Prevention Program 2008).

2.4 Synthesis

The interim stabilization goals for this species have not been met. There are five known individuals in the wild (Table 1), and all threats are not being managed (Table 2). Therefore, *Sicyos alba* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Sicyos alba* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	21	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 100 mature individuals each	No
1998 (recovery plan)	21	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 100 mature individuals each	No
2003 (critical habitat)	31	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 100 mature individuals each	No
2012 (5-year review)	5	16	All threats managed in all 3 populations	Partially (see Table 2)
			Complete genetic storage	Partially
			3 populations with 100 mature individuals each	No

Table 2. Threats to *Sicyos alba* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat	A, D	Ongoing	Partially: Ungulate exclosure at Puu Makaala Natural Area Reserve
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Lava flows degradation of habitat	A	Ongoing	No
Hiking and trail maintenance	E	Ongoing	No
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction, reintroduction / translocation implementation, and monitoring
Climate change	A, E	Increasing	No

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

- Captive propagation for genetic storage and reintroduction:
 - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation.
 - Propagate the species *ex situ* in at least two or three separate venues.
- Reintroduction / translocation site identification – Determine areas within the native range of the species that are most suitable for reintroduction purposes.
- Reintroduction / translocation implementation – Continue to reintroduce the species back into its known historical range.
- Ungulate exclosure – Continue to construct fenced exclosures around all existing wild and reintroduced populations and monitor the fences for any signs of breaching.
- Ungulate control – Protect all populations against disturbances from feral pigs.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species within exclosures and from areas immediately adjacent to all known populations.
- Surveys / inventories – Resurvey the historical geographical range of the species for previously unknown populations or individuals.
- Population biology research – Carry out field studies to hand pollinate individuals in the wild to enhance reproductive success of the species.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impacts of hiking and trail maintenance and lava flow.
- Threats monitoring and control:
 - Monitor populations at least twice a year for evidence of fence breaching by feral pigs or other introduced vertebrate species.
 - Monitor reintroductions and wild populations twice a year for evidence of pests or diseases.
- Alliance and partnership development – Work with the National Park Service, Hawaii Division of Forestry and Wildlife, and other land managers to continue implementation of ecosystem-level restoration and management to benefit this species.

- 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.

5.0 REFERENCES

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Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Sicyos alba* (Anunu)

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

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:

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 Jess Newton

Date 8/28/2012