U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Sicyos macrophyllus*

COMMON NAME: ʻAnunu

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X__ Continuing candidate
___ Non-petitioned
_X__ Petitioned - Date petition received: May 11, 2004
_ 90-day positive - FR date:
X 12-month warranted but precluded - FR date: May 11, 2005
N Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

_N_ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined): February 21, 1990
___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Cucurbitaceae (Gourd family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Hawaii and Maui

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Hawaii

LAND OWNERSHIP: Two populations of *Sicyos macrophyllus* occur on federal land (Hawaii Volcanoes National Park and Hakalau NWR-Kona Unit). All other populations occur on State land.

LEAD REGION CONTACT: Linda Belluomini, (503) 231- 6283, linda_belluomini @fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, (808) 792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description
Sicyos macrophyllus is a perennial vine with stems up to 49 feet (ft) (15 meters (m)) long and 1.6 inches (in) (4 centimeters (cm)) in diameter. Annual stems are sparsely pubescent with black spots. Leaves are broadly ovate with a narrow basal sinus and are deeply lobed. The upper leaf surface is glabrous while the lower surface is densely pubescent. Tendrils are twice branched. Flowers are either male or female, occur in pubescent panicles, and have a greenish yellow corolla. The fruit is round and green (Telford 1999, p. 578).

Taxonomy
Sicyos macrophyllus was described by Asa Gray. This species is recognized as a distinct taxon in the *Manual of Flowering Plants of Hawaii* (Telford 1999, p. 578), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History
Typical habitat is wet *Metrosideros polymorpha* (ohia) forest and subalpine *Sophora chrysophylla-Myoporum sandwicense* (mamane-naio) forest at elevations between 4,000 and

6,600 ft (1,200 and 2,000 m) (Hawaii Biodiversity and Mapping Program (HBMP) 2008; Telford 1999, p. 578).

Historical Range

Historically, *Sicyos macrophyllus* was known from Puuwaawaa, Laupahoehoe, Puna, and South Kona on the island of Hawaii; and from Kipahulu Valley on the island of Maui (HBMP 2008).

Current Range/Distribution

Currently, this species occurs on the island of Hawaii at Puu Mali, Puuwaawaa (Puu Iki), Honaunau, Hakalau National Wildlife Refuge-Kona Unit, Kaohe, Kukuiopae, Kipuka Maunaiu, Kipuka Ki, and Puu Huluhulu (HBMP 2008; L. Pratt, U.S.G.S. Biological Resources Discipline, pers. comm. 2008; K. Bio, Plant Extinction Prevention (PEP) Program, pers. comm. 2008).

Population Estimates/Status

Sicyos macrophyllus is known from 10 populations totaling between 24 and 26 individuals (HBMP 2008; L. Pratt, U.S.G.S. Biological Resources Discipline, pers. comm. 2008; K. Bio, Plant Extinction Prevention Program, pers. comm. 2008). It appears that a naturally occurring population at Kipuka Ki in Hawaii Volcanoes National Park is reproducing on its own by seeds but seeds have not been successfully germinated under nursery conditions (HBMP 2008; L. Pratt, pers. comm. 2005).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Sicyos macrophyllus is threatened by feral pigs (*Sus scrofa*), mouflon sheep (*Ovis aries*), and feral cattle (*Bos taurus*) that degrade and destroy habitat (HBMP 2008; PEP Program 2008, p. 109). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on the island of Hawaii. The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs, introduced to Hawaii by Captain James Cook in 1778, became feral and invaded forested areas, especially wet and mesic forests and dry areas at high elevations. They are currently present on the island of Hawaii and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al*. 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999a).

Sheep have become established on the island of Hawaii since their introduction almost 200 years ago (Tomich 1986; Cuddihy and Stone 1990). Sheep roam the upper elevation dry forests of Mauna Kea, Mauna Loa, and Hualalai (above 3,300 ft (1,000 m)), causing damage similar to that of goats (Stone 1985). Sheep have decimated vast areas of native forest and shrubland on Mauna

Kea and continue to do so as a managed game species (Stone 1985; Cuddihy and Stone 1990). A survey conducted in 2004 of the Kahuku section of Hawaii Volcanoes National Park estimated that there were more than 2,500 sheep within the unit, and that without removals, the population doubling time would occur within three to four years (Hess *et al.* 2006).

Cattle, the wild progenitor of which was native to Europe, northern Africa, and southwestern Asia, were introduced to the Hawaiian Islands in 1793. Large feral herds developed as a result of restrictions on killing cattle decreed by King Kamehameha I. While small cattle ranches were developed on Kauai, Oahu, and west Maui, very large ranches of tens of thousands of acres were created on east Maui and Hawaii. Cattle eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. The forest in areas grazed by cattle becomes degraded to grassland pasture, and plant cover is reduced for many years following removal of cattle from an area. In addition, several alien grasses and legumes intentionally introduced for cattle forage have become invasive, noxious weeds that outcompete and replace native plants (Tomich 1986; Cuddihy and Stone 1990; Wagner *et al*. 1999a).

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Predation by feral pigs, mouflon sheep, and cattle is a likely threat to *Sicyos macrophyllus* (HBMP 2008; Plant Extinction Prevention (PEP) Program 2008, p. 109). Evidence of browsing on and removal of *S. macrophyllus* by feral cattle has been observed at the population at Hakalau NWR-Kona Unit (PEP Program 2008, p. 109).

In a study conducted in the 1980s, feral pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982). A stomach content analysis in this study showed that the pigs' food sources consisted of native plants, 60 percent of which were *Cibotium* spp., (tree ferns) alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species, with larger trees killed over a few months of repeated feeding (Diong 1982).

Sheep browse on introduced grasses and native plants, and are able to reach more remote and inaccessible areas than other ungulates. They thrive on a variety of food plants, and are instrumental in the decline of native vegetation in many areas (Cuddihy and Stone 1990).

D. The inadequacy of existing regulatory mechanisms.
Sicyos macrophyllus currently receives no protection under Hawaii's endangered species law or the Federal Endangered Species Act.

Pigs and sheep are managed in Hawaii as game animals. Pigs and sheep may populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig hunting is allowed on all islands either year-round or during certain months, depending on the area, and sheep hunting is allowed on the

island of Hawaii (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting is not adequate to eliminate this threat to *Sicyos macrophyllus*. Hunting of feral cattle is no longer allowed in Hawaii (Hawaii Department of Land and Natural Resources 1985) except under permitted conditions.

E. Other natural or manmade factors affecting its continued existence.
Sicyos macrophyllus is threatened by alien plant species that degrade habitat and outcompete native plants (HBMP 2008; PEP Program 2008, p. 109). The nonnative plants that are the greatest threats to *Sicyos macrophyllus* on the island of Hawaii include *Pennisetum setaceum* (fountain grass), *P. clandestinum* (kikuyu grass), and *Delairea odorata* (German ivy) at the Puu Iki populations; *D. odorata* at the Puu Huluhulu and Hakalau NWR-Kona Unit populations (HBMP 2008; PEP Program 2008, p. 109).

Delairea odorata is a perennial vine native to South Africa and cultivated in Hawaii as an ornamental. It is naturalized on Maui and Hawaii (Wagner *et al.* 1999, p. 356). This vine grows rapidly and smothers other vegetation, affecting regeneration (Smith 1985, pp. 202-203). The Hawaii Weed Risk Assessment Protocol places *D. odorata* in the high risk category (Pacific Island Ecosystems at Risk (PIER) 2009a).

Pennisetum clandestinum is a rhizomatous and stoloniferous grass up to 1.5 ft (4.5 dm) long (when not grazed), native to Africa. It was introduced to Hawaii as a pasture grass, and is widely cultivated and naturalized. It is one of the most serious pest species threatening native vegetation, as its dense growth smothers other plants and prevents seedling establishment (O'Connor 1999, pp. 1,578-1,579). It releases allelopathic substances which kill almost all other species in its vicinity (Sanchez and Davis 1969). It poses a fire hazard as old stolons die and accumulate with new growth over the top (Edgar and Connor, 2000, p. 574). It will invade wet environments and is shade tolerant (Edgar and Connor, 2000, p. 574; Smith 1985). The Hawaii Weed Risk Assessment Protocol places *P. clandestinum* in the high risk category (Pacific Island Ecosystems at Risk (PIER) 2009b).

Pennisetum setaceum a grass native to northern Africa, was introduced for many areas as an ornamental, and is now naturalized in Hawaii. This grass is a serious pest in dry areas. It is an aggressive colonizer, and outcompetes most native species. *Pennisetum setaceum* is also fire-adapted, and burns swiftly and hot, causing extensive damage to the surrounding habitat (O'Connor 1999, p. 1,581).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *Sicyos macrophyllus*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence

1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1997). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the wet forest and subalpine forest habitat of *S. macrophyllus*, the Service believes nonnative plant species are a threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The National Park Service has fenced the populations of *Sicyos macrophyllus* within the Mauna Loa Strip area of Hawaii Volcanoes National Park and conducts routine nonnative plant control (L. Pratt, pers. comm. 2005). *Sicyos macrophyllus* is in propagation at the Volcano Rare Plant Facility (VRPF) and seeds are in refugia at the National Tropical Botanical Garden (NTBG) (NTBG 2008, p. 14; VRPF 2008; P. Moriyasu, VRPF, pers. comm. 2009).

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs, mouflon sheep, cattle, and nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, alteration, or curtailment of its habitat and range, and the displacement of individuals of *Sicyos macrophyllus*, due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs, mouflon sheep, and cattle is a likely threat to *S. macrophyllus*. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Survey for populations of *Sicyos macrophyllus* in areas of potentially suitable habitat
- Control feral pigs, sheep, and cattle
- Control alien plants
- Begin propagation efforts for maintenance of genetic stock
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:
This species is highly threatened by feral pigs, sheep, and cattle that directly prey upon it and degrade and destroy habitat, and nonnative plants that compete for light and nutrients. Threats to the wet to subalpine forest habitat of *Sicyos macrophyllus*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication. Feral pigs have been fenced out of some of the areas where *S. macrophyllus* occurs, but the fences must be continually maintained to prevent incursion. Nonnative plant numbers have been reduced in the populations that are fenced. These ongoing conservation efforts for this species benefit only some of the known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat-free areas

Imminence:
Threats to *Sicyos macrophyllus* from pigs, sheep, cattle, and nonnative plants are considered imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the National Park Service has fenced at least one population and is conducting routine nonnative plant control in that area. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency

rule process for this species will be initiated. We will continue to monitor the status of *Sicyos macrophyllus* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

Much of the information on this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995. We incorporated additional information on this species from our files and the most recent supplement to the *Manual of Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Biodiversity and Mapping Program; Arthur Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information was provided. In 2005 we contacted species experts and confirmation of the status was provided by Linda Pratt, U.S.G.S. Biological Resources Discipline (BRD). In 2006 new status information was provided by Jack Jeffrey, U.S. Fish and Wildlife Service, Thomas Belfield, U.S.G.S. BRD, and Lyman Perry, Division of Forestry and Wildlife. In 2008, new information was provided by Linda Pratt, and Kealii Bio, Plant Extinction Prevention Program. In 2009 new information was provided by Patrice Moriyasu, Volcano Rare Plant Facility. In 2010 we contacted the species experts listed below and received no new information.

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Division of Forestry and Wildlife
Anderson, Stephen	02/09/10	National Park Service, Haleakala NP, Maui
Aruch, Sam	02/09/10	private contractor
Bakutis, Ane	02/09/10	Plant Extinction Prevention Program, Molokai
Ball, Donna	02/09/10	U.S. FWS, Partners Program, Hawaii Island
Beavers, Sally	02/09/10	National Park Service, Hawaii Island
Bily, Pat	02/09/10	The Nature Conservancy, Maui
Bio, Kealii	02/09/10	Plant Extinction Prevention Program, Hawaii Island
Brosius, Chris	02/09/10	West Maui Mountains Watershed Partnership
Caraway, Vickie	02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan	02/09/10	Plant Extinction Prevention Program, Oahu
Cole, Colleen	02/09/10	Three Mountain Alliance
Conry, Paul	02/09/10	Hawaii Department of Land and Natural Resources
Coordinator	02/09/10	East Maui Watershed Partnership
Duvall, Fern	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri	02/09/10	The Nature Conservancy, Maui
Garnett, Bill	02/09/10	National Park Service, Kalaupapa, Molokai
Giffin, Jon	02/09/10	The Nature Conservancy, Hawaii Island
Haus, Bill	02/09/10	National Park Service, Haleakala NP, Maui
Higashino, Jennifer	02/09/10	U.S. FWS, Maui
Imada, Clyde	02/09/10	Bishop Museum

Jacobi, Jim	02/09/10	U.S.G.S., Biological Resources Division
Kawakami, Galen	02/09/10	Division of Forestry and Wildlife, Kauai
Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. FWS, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S. Geological Survey
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. FWS, Refuges, Maui
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Division of Forestry and Wildlife, Hawaii Island
Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.S., Biological Resources Division
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. FWS, Refuges, Oahu
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S. Geological Survey
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) (IUCN 2006). *Sicyos macrophyllus* is not included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al*. 2005).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments were received.

LITERATURE CITED

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp.

Diong, C.H. 1982. Population biology and management of the feral pig (*Sus scrofa* L.) in Kipahulu Valley, Maui. Dissertation to the Zoology graduate division of the University of Hawaii. 408 pp.

Edgar, E., and H. O'Connor. 2000. Flora of New Zealand, vol. V. Gramineae. Manaaki Whenua Press. p. 574.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guava* (common guava), forest weeds in Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 95. 105 pp.

Hawaii, Department of Land and Natural Resources. 1985. Hunting in Hawaii, Division of Forestry and Wildlife, Honolulu, 3 pp.

Hawaii, Department of Land and Natural Resources. 1999. Rules regulating game mammal hunting, updated 2003. 56 pp.

Hawaii Biodiversity and Mapping Program. 2008. Hawaii Biodiversity and Mapping Program species database, unpublished.

Hawaii Biodiversity and Mapping Program. 2006. *Sicyos macrophyllus*. http://hbmp.hawaii.edu/printpage.asp?spp=PDCUC0N0C0, accessed on May 3, 2007.

Hawaii Heritage Program. 1990. Management recommendations for Na Pali coast state park, island of Kauai. The Nature Conservancy, prepared for the Hawaii Department of Land and Natural Resources, Division of State Parks, Honolulu. 18 pp.

Hess, S.C., B. Kawakami Jr., D. Okita, and K. Medeiros. 2006. A preliminary assessment of mouflon abundance at the Kahuku unit of Hawaii Volcanoes National Park. Pacific Island Ecosystems Research Center, U.S. Department of the Interior and U.S. Geological Survey, Report 2006-1193. 22 pp.

International Union for Conservation of Nature and Natural Resources. 2006. *Sicyos macrophyllus*, http://www.iucnredlist.org.

Loope, L.L., F. Starr, and K. Starr. 2004. Protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.

Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.

Medeiros, A.C., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, east Maui, Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 59. 230 pp.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.

Medeiros, A.C., L.L. Loope, P. Conant, S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Records of the Hawaii Biological Survey for 1996, Bishop Museum Occasional Papers 48: 23-36.

Meyer, J.Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's comprehensive wildlife conservation strategy. Department of Land and Natural Resources, Honolulu, Hawaii. 722 pp.

National Tropical Botanical Garden. 2008. 2007-2008 report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. 15 pp.

O'Connor, P.J. 1999. Poaceae (grass family). *In* Manual of the Flowering Plants of Hawaii, Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 97. Pp. 1,481-1,604.

Pacific Island Ecosystems at Risk. 2009a. *Delairea odorata*. http://www.hear.org/pier/species/delairea_odorata.htm, accessed on February 26, 2009.

Pacific Island Ecosystems at Risk. 2009b. *Pennisetum clandestinum*. http://www.hear.org/pier/species/pennisetum_clandestinum, accessed on February 26, 2009.

Robichaux, R., J. Canfield, R. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. "Radiating" plants-adaptive radiation. Endangered Species Bulletin November/December. 3 pp.

Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9:1-429.

Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawaii. Proceedings of the Second Conference on Natural Science, Hawaii Volcanoes National Park. Pp. 274-288.

Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management, Stone, C. P., and J. M. Scott (Eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 180-250.

Stone, C.P. 1985. Alien animals in Hawaii's native ecosystems: toward controlling the adverse effects of introduced vertebrates. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management, Stone, C. P. and J. M. Scott (Eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 251-297.

Telford, I. 1999. Cucurbitaceae. *In* Manual of the Flowering Plants of Hawaii, Wagner, W. L., D. R. Herbst, and S. H. Sohmer (eds.), University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 97. Pp. 568-581.

Tomich, P.Q. 1986. Mammals in Hawaii; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.

U.S. Fish and Wildlife Service. 2005. Controlled propagation database, unpublished.

Vitousek, P.M., C.M. D'Antonio, L. L. Loope, M. Rejmanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21: 1-16.

Volcano Rare Plant Facility. 2008. Report on controlled propagation, database.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. Manual of the flowering plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 97. 1,919 pp.

Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. National Tropical Botanical Garden. 25 pp.

Personal Communication and in litt

Belfield, T., U.S.G.S. BRD, Response to request for candidate plant species information, August 15, 2006.

Bio, K., Plant Extinction Prevention Program, Electronic mail message regarding status of *Sicyos macrophyllus*, March 3, 2008.

Jeffrey, J., Service, Response to request for candidate plant species information, August 15, 2006.

Moriyasu, P., Volcano Rare Plant Facility, Electronic mail response to request for candidate species information, February 25, 2009.

Perry, L., Hawaii Division of Forestry and Wildlife, response to request for propagation information, September 20, 2006.

Pratt, L., U.S.G.S. BRD, Response to request for candidate plant species information, 2005.

Pratt, L., Electronic mail message regarding status of *Sicyos macrophyllus*, February 21, 2008.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Carolyn A. Bohan
Regional Director, Region 1, Fish and Wildlife Service

5/18/10
Date

Rowan W Gould
ACTING
Director, Fish and Wildlife Service

October 22, 2010

Concur:

Do not concur: _____ Date: _____
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: Date: April 22, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 26, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: April 26, 2010
Assistant Field Supervisor, Endangered Species Division

Gina Shultz Date: April 30, 2010
Acting Field Supervisor