

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

SCIENTIFIC NAME: *Canavalia pubescens*

COMMON NAME: 'Awikiwiki

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

Continuing candidate

Non-petitioned

Petitioned - Date petition received: May 11, 2004

90-day positive - FR date:

12-month warranted but precluded - FR date: May 11, 2005

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.

Listing priority change

Former LP: \_\_\_\_

New LP: \_\_\_\_

Date when the species first became a Candidate (as currently defined):

September 19, 1997

Candidate removal: Former LP: \_\_\_\_

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, Fabaceae (Pea family)

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

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

LAND OWNERSHIP: *Canavalia pubescens* occurs almost entirely on State land, with a small population on private 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

*Canavalia pubescens* is a perennial climber with elliptic leaves, 2.4 to 5 inches (in) (2.3 to 10.2 centimeters (cm)) long and 0.7 to 3.0 in (1.8 to 7.6 cm) wide, the upper surfaces moderately pubescent, and the lower surfaces densely pubescent. Flowers number 8 to 20 in pseudoracemes 1.2 to 2 in (3 to 5 cm) long, with the lowest lobe broadly lanceolate and 0.16 to 0.24 in (4 to 6 millimeters (mm)) long. The corolla is dark red to pink (rarely white), with a white spot and streaks toward the base. Fruits are compressed pods 4.7 to 7 in (12 to 18 cm) long and 1 to 1.3 in (2.5 to 3.2 cm) wide. Seeds are brown to dark reddish brown, oblong-elliptic, strongly compressed, 0.6 to 0.75 in (15 to 19 mm) long, 0.4 to 0.5 in (10 to 13 mm) wide (Wagner and Herbst 1999, p. 654). Degener and Degener (1959, 2 pp.) report white to pink flowers for Lanai collections of this species.

### Taxonomy

*Canavalia pubescens* was originally described by Hooker and Arnott (1832). This species is recognized as a distinct taxon by Wagner and Herbst (1999, p. 654) in the *Manual of the Flowering Plants of Hawaii*, the most recently accepted Hawaiian plant taxonomy.

### Habitat/Life History

*Canavalia pubescens* is found on dry, open lava fields and in dryland forest. On Kauai, *C. pubescens* was found in open, moist forest and in dry scrub forest at elevations between 180 to 2,900 feet (ft) (55 to 884 meters (m)). On Niihau, this species was last seen growing on an exposed basalt ledge at 300 ft (91 m) in elevation. On Lanai, *C. pubescens* was observed growing among sun-scorched lava rocks along a coastal trail at 50 ft (15 m) elevation with *Cordia subcordata* (kou) (H. Oppenheimer, PEP Program, pers. comm. 2007). On Maui, *C. pubescens* is found on recent lava flows in *Erythrina* (wiliwili) lowland dryland forest and shrubland with the following native species: *Capparis sandwichiana* (maiapilo), *Chamaesyce celastroides* var. *lorifolia* (akoko), *Dodonaea viscosa* (aalii), *Ipomoea* spp. (no common name), *Morinda* spp. (noni), *Sida fallax* (ilima), *Rauvolfia sandwicensis* (hao), and *Waltheria indica* (uhaloa); at elevations between 80 to 400 ft (24 to 122 m) (Wagner and Herbst 1999, p. 654; Hawaii Biodiversity and Mapping Program (HBMP) 2008).

### Historical Range

Historically, *Canavalia pubescens* was wide ranging in the coastal dryland forest and shrublands of southeastern Maui, Lanai, northwestern Kauai, and Niihau (HBMP 2008). It was historically recorded from one population on Niihau at Haao Valley (1949); from six populations ranging from Awaawapuhi to Wainiha on the northwest coast of Kauai; from six populations ranging from Keokea to Wailaulau-Pahihi on Maui; and from four populations on Lanai, from Kaena Point to Huawai Bay (HBMP 2008).

### Current Range/Distribution

Currently, *Canavalia pubescens* is found on the island of Maui (HBMP 2008; H. Oppenheimer, Plant Extinction Prevention Program (PEP), pers. comm. 2006; F. Starr, U.S. Geological Survey, Biological Resources Discipline (USGS-BRD), pers. comm. 2006). No plants were observed at the last known location (observed in 1998) of this species on Lanai in 2007; however, it could possibly be found there again (H. Oppenheimer, pers. comm. 2007).

### Population Estimates/Status

Five populations are known on Maui: Keokea and Puu o Kali with “hundreds” observed; Papaka Kai with six individuals; fewer than 20 individuals at Palauea-Keahou, a few individuals at southeast Pohakea, and at Ahihi Kinau NAR, with 140 to 210 individuals (HBMP 2008; F. Starr, pers. comm. 2006; H. Oppenheimer, pers. comms. 2006, 2007; Altenburg 2007, pp. 12-13; L. Altenberg, pers. comm. 2010). These populations total between 360 and 500 individuals.

## THREATS

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

*Canavalia pubescens* is highly threatened by feral goats (*Capra hircus*) and axis deer (*Axis axis*) that degrade and destroy habitat. Feral goats and the effects of their activities have been reported

at the Papaka Kai population on Maui (HBMP 2008; H. Oppenheimer, pers. comm. 2006; F. Starr, pers. comm. 2006). Axis deer and the effects of their activities have been reported at the Keokea, Papaka Kai, Palauea-Keauhou, Kanahena-Kalua o Lapa, and southwest Kalua o Lapa populations of *C. pubescens* on Maui (Altenberg 2007, pp. 12-13; HBMP 2008; D. Hopper, U.S. Fish and Wildlife Service (Service), in litt. 1999). Goats are no longer present on Lanai; they were eradicated from that island by 1981 (Hobdy 1993, p. 207). Mouflon sheep were introduced to Lanai in 1954, and their range has been expanding; however, they have not been reported as a threat to *C. pubescens* at this time (Hobdy 1993, p. 209; HBMP 2008).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Goats browse on introduced grasses and native plants, especially in drier and more open ecosystems. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980, p. C20; van Riper and van Riper 1982, pp. 34-35; Scott *et al.* 1986, pp. 352-358; Tomich 1986, pp. 150-156; Culliney 1988, pp. 336-337; Cuddihy and Stone 1990, p. 64). A study of goat predation on the native *Acacia koa* forest on the island of Hawaii has shown that grazing pressure by goats can cause its eventual extinction because it is unable to reproduce (Spatz and Mueller-Dombois 1973, p. 876). The effects on mesic and wet forest habitat by the foraging of feral goats have also been reported in fencing studies. An enclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of koa (Spatz and Mueller-Dombois 1973, p. 876). Another study at Puu Waawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, koa and *Metrosideros* spp. (ohia) seedlings were observed geminating by the thousands (Department of Land and Natural Resources 2002, p. 52).

Axis deer were introduced to Maui in 1959, with five being released east of Kihei. By 1968, the Maui population was estimated to be 85 to 90 animals, and by 1995 there were over 500 axis deer found on Ulupalakua Ranch alone (Waring 1996, p. 2). Currently, there is concern that their numbers could expand to between 15,000 to 20,000 or more within a few years (E. Nishibayashi, The Nature Conservancy of Hawaii (TNCH), in litt. 2001; S. Anderson, University of California-Davis, in litt. 2001). Deer are primarily grazers, but also browse numerous palatable plant species including those grown as commercial crops (Waring 1996, pp. 3-4; J. Simpson, Kula farmer, in litt. 2001). Deer prefer the lower, more openly vegetated areas for browsing and grazing, which is current habitat of *Canavalia pubescens*; however, recent episodes of drought have driven deer further into urban and forested areas in search of food (Waring 1996, p. 5; E. Nishibayashi, in litt. 2001).

Axis deer were introduced to Lanai in 1959, and are a likely threat to the only known population of *C. pubescens* on that island (Tomich 1986, p. 127; Hobdy 1993, p. 207). After goats were eradicated from Lanai, the deer began to occupy slopes and cliffs previously thought to be too steep for them (Hobdy 1993, p. 207). Currently, axis deer number approximately 6,000 to 8,000

on Lanai, and damage to the landscape has increased dramatically (The Insider 2007; WCities 2007; D. Leone, in litt. 2001).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by introduced ungulates (Merlin and Juvik, p. 597). Because of demonstrated habitat modifications by feral goats and wild deer such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the Service believes they are a threat to *Canavalia pubescens*.

Land development is also a threat to *Canavalia pubescens*, especially the population at Palauea-Keahou on Maui (Altenberg 2007, pp. 12-13; H. Oppenheimer, pers. comms. 2000, 2007). Two known individuals at Palauea-Keahou were destroyed by development prior to 2001 (F. Starr, pers. comm. 2006; H. Oppenheimer, pers. comm. 2007). A small population (fewer than 20 known individuals) persists in the area (L. Altenberg, pers. comm. 2010).

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

Predation by feral goats on Maui is a likely threat to *Canavalia pubescens*, as this species is a vine that is supported by shrubs and trees that may be food sources for goats (HBMP 2008; H. Oppenheimer, pers. comm. 2006; F. Starr, pers. comm. 2006).

Predation by axis deer is a likely threat to *Canavalia pubescens* on both Maui and Lanai. Axis deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops (Waring 1996, pp. 3-4; J. Simpson, in litt. 2001). The numbers of deer on Maui have been increasing since their introduction in 1959, with increasing reports of damage to fencing and crops (J. Simpson, in litt. 2001). Axis deer have been reported on Maui at Kanahena-Kalua o Lapa, and southwest Kalua o Lapa in large numbers, and at Palauea-Keahou (Altenberg 2007, pp. 12-13; Waring 1996, pp. 3-4; HBMP 2008; E. Nishibayahi, in litt. 2001; D. Hopper, in litt. 1999); and are also present on Lanai (Hobdy 1993, p. 207). Therefore, due to the increasing size of deer populations on Maui and Lanai, it is likely that deer impact this species directly as well as the surrounding habitat.

D. The inadequacy of existing regulatory mechanisms.

*Canavalia pubescens* currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Feral goats and axis deer are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990, p. 3). Goat and deer hunting is allowed year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 20030; however, public hunting is not adequate to eliminate this threat to *Canavalia pubescens*.

E. Other natural or manmade factors affecting its continued existence.

*Canavalia pubescens* is highly threatened by alien plant species that degrade and destroy habitat and outcompete native plants. The nonnative plant species that are reported to be the greatest threats to *C. pubescens* on Maui are: *Cenchrus ciliaris*, *Leucana leucocephala* (koa haole), *Melinus repens* (natal reedtop), *Neonotonia wightii* (glycine), and *Prosopis pallida* at Puu o Kali and Palauea-Keauhou; *Melinus repens* and *Leucana leucocephala* at Papaka Kai; and *L. leucocephala*, *Kalanchoe pinnata* (air plant), and *Neonotonia wightii* at Ahihi-Kinau NAR (F. Starr, pers. comm. 2006; Altenberg 2007; HBMP 2008; J. Fell-McDonald, DOFAW, pers. comm. 2010). The nonnative plant species that are reported to be the greatest threats to *C. pubescens* on Lanai are: *Prosopis pallida*, *Leucana leucocephala*, *Acacia farnesiana* (klu), and *Cenchrus ciliaris* (H. Oppenheimer, pers. comm. 2007).

*Acacia farnesiana* is a shrub up to 13 ft (4 m) tall, native to the Neotropics, and formerly cultivated in Hawaii for an attempted perfume industry. It is now naturalized and common on all of the main islands except Niihau (Geesink *et al.* 1999, p. 641). *Acacia farnesiana* is thorny, forms dense thickets, and regenerates quickly after fire. The seeds are dispersed by ungulates that eat the pods. The Hawaii Weed Risk Assessment Protocol, based on information on the biology of the species obtained from scientific literature and other documented sources used to predict likely invasiveness of a plant species, places *A. farnesiana* in the high risk category with a score of 14 (plants with scores greater than 6 are recommended to be rejected from importation (Australia) or a species likely to be of high risk (Pacific Island Ecosystems at Risk (PIER) 2006a).

*Cenchrus ciliaris* is native to Africa and tropical Asia. It is naturalized in Hawaii and common in dry areas in a wide variety of disturbed habitats. It is a fire-adapted grass that provides fuel for fires and recovers quickly, increasing its cover with each succeeding fire (PIER 2006b).

*Kalanchoe pinnata* is an herb which is widely established in many tropical and subtropical areas. It was naturalized in Hawaii prior to 1871, and is abundant in low elevation disturbed areas on all the main islands except Niihau and Kahoolawe (Wagner *et al.* 1999, p. 568). The air plant can reproduce vegetatively at indents along the leaf, usually after the leaf has broken off the plant and is lying on the ground, where a new plant can take root. *Kalanchoe pinnata* can form dense stands that prevent reproduction of native species (Starr and Starr 2006).

*Leucana leucocephala*, a shrub native to the Neotropics, was cultivated for fodder and is now naturalized in Hawaii. It sometimes forms the dominant element of the vegetation in low elevation, dry, disturbed areas. It is also an aggressive competitor that fixes nitrogen (Geesink *et al.* 1999, pp. 679-680).

*Melinus repens*, a perennial grass native to Africa, is now widely naturalized in the tropics and in Hawaii. It invades disturbed dry areas from coastal regions to subalpine forest (O'Connor 1999, p. 1,588). Dense stands of natal reedtop can contribute to recurrent fires (Desert Museum 2006).

*Neonotonia wightii*, a twining or prostrate perennial herb native to Central and South America and the West Indies, is cultivated in Hawaii as a fodder plant and is naturalized in pastures and disturbed areas on all the main islands (Wagner *et al.* 1999, p. 674). This vine forms dense clumps that can smother low-lying vegetation (Csurhes and Edwards 1998, p. 121)

*Prosopis pallida* was introduced to Hawaii in 1828, and its seeds were used as fodder for ranch animals. The seeds were quickly spread by ranch animals. Kiawe became a dominant component of the vegetation in low elevation, dry, disturbed sites, as it is well adapted to dry habitats. It overshadows other vegetation and the deep tap roots use all available water. This species fixes nitrogen and can outcompete native species (Geesink *et al.* 1999, pp. 692-693; PIER 2006c).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 species are pests (Smith 1985; Wagner *et al.* 1999). Confirmed personal observations (Altenberg 2007, pp. 12-13; F. Starr, pers. comm. 2006; J. Fell-McDonald, pers. comm. 2010) and several studies (Cuddihy and Stone 1990, p. 74; Wood and Perlman 1997, pp. 6-7; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *Canavalia pubescens*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74). 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 (Smith 1985, p. 240-241; Loope and Medeiros 1992, pp. 7-8; Medeiros *et al.* 1992, p. 30; Ellshoff *et al.* 1995, pp. ii, 3-4; Meyer and Florence 1996, p. 778; Medeiros *et al.* 1997, pp. 23-24, Loope *et al.* 2004, p. 1,472). 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, pp. 227-230; Cuddihy and Stone 1990, p. 74; Vitousek *et al.* 1997, pp. 6-10). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the dry open lava field and dry forest and shrubland habitat of *C. pubescens*, the Service believes nonnative plant species are a threat to this species.

Fire is reported to be a threat at the Puu o Kali population of *Canavalia pubescens* (Altenberg 2007, pp. 12-13; HBMP 2008; F. Starr, pers. comm. 2006). This population is in a dry, low elevation area with degraded habitat that is more susceptible to accidental fire (Earth Observatory 2007; Department of Land and Natural Resources 2007; C. Wilson, in litt. 2007). The fire-adapted plants identified above as threats to *C. pubescens* can alter the fire characteristics of its habitat (Smith 1989, p. 62). Because Hawaiian plants were subjected to fire during their evolution only in areas of volcanic activity and from occasional lightning strikes, they are not adapted to recurring fire regimes and do not quickly recover following a fire. Alien plants are often better adapted to fire than native plant species, and some fire-adapted grasses have become widespread in Hawaii (D'Antonio and Vitousek 1992, pp. 64-65, 70-74; Friefelder *et al.* 1998, pp. 286-287). Native shrubland and dry forest can thus be converted to land dominated by alien grasses. The presence of such species in Hawaiian ecosystems greatly increases the intensity, extent, and frequency of fire, especially during drier months or drought. Fire-adapted alien plant taxa can reestablish in a burned area, resulting in a reduction in the amount of native vegetation after each fire. Fire can destroy dormant seeds as well as plants, even in steep or inaccessible areas. Fires may result from natural causes, or may be accidentally or purposely started by humans (Cuddihy and Stone 1990, pp. 29-31; D'Antonio and Vitousek 1992, pp. 70-74; Friefelder *et al.* 1998, pp. 286-287).

## CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service has provided funding through its Partners for Fish and Wildlife Program to a private organization (Olino) for construction of axis deer enclosure fences and ungulate control at Puu o Kali, which will provide protection for the “hundreds” of individuals of *Canavalia pubescens* at that site (Service 2005a). The Native Hawaiian Plant Society (a Maui organization) has constructed a native plant enclosure for feral goats and deer at Papaka Kai (Native Hawaiian Plant Society 1997 and 2002; Starr and Starr 2007; Waring 1996, p. 9). This enclosure includes six individuals of *C. pubescens*, and weed control is ongoing at this location (Native Hawaiian Plant Society 1997 and 2002; Starr and Starr 2007). These efforts will benefit *C. pubescens* in two of the five known populations on Maui by reduction of the feral goat and nonnative plant threats. A small fenced area (less than 5 ac; 2 ha) of Ahihi-Kinau NAR is fenced for deer and provides protection to 20 to 30 individuals of *C. pubescens* (J. Fell-McDonald, pers. comm. 2010). The U.S. Fish and Wildlife Service is working with a developer at Palauea-Keauhou to provide and implement a management plan for rare native plants and animals in the area (Honuaula-Wailea 670 Conservation and Stewardship Plan, Kihei, Maui, 2010).

This species is represented in ex situ collections at the Waimea Valley Audubon Center on Oahu, and at the Maui Nui Botanical Garden on Maui, and seeds are in refugia at Lyon Arboretum Seed Bank (Service 2005b; S. Seidman, Maui Nui Botanical Garden, pers. comm. 2006; Maui Nui Botanical Garden 2008, p. 2; Lyon Arboretum Seed Bank Inventory database 2008; J. Fell-McDonald, pers. comm. 2010).

## SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral goats, deer, nonnative plants, and development, we conclude there is sufficient information to develop a proposed listing 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 *Canavalia pubescens* due to competition with nonnative plants for space, nutrients, water, air, and light. Fire and predation by feral goats and deer are likely threats to *C. pubescens*. We find that this species is warranted for listing throughout all 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 *Canavalia pubescens* in areas of potentially suitable habitat on Maui, Lanai, Kauai, and Niihau
- Control feral ungulates
- Control of alien plants
- Continue 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
<b>High</b>	<b>Imminent</b>	Monotypic genus	1
		<b>Species</b>	<b>2*</b>
		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 goats and axis deer that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. *Canavalia pubescens* is also threatened by fire and land development on Maui. Predation by feral goats and axis deer is a likely threat to this species. Threats to the lowland dryland forest habitat of *C. pubescens*, and to individuals of this species, occur throughout its range and are expected to continue or increase without control or eradication.

*Imminence:*

Threats to *Canavalia pubescens* from feral goats, axis deer, and nonnative plants are imminent because they are ongoing in four of the five known populations. Land development threatens one population on Maui and is imminent. Fire is a likely threat to one population and is non-imminent.

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. *Canavalia pubescens* is currently known from five populations totaling between 360 and 500 individuals. 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 Service has provided funding to organizations on Maui for ungulate and weed control at one population of *C. pubescens*, and a private organization has constructed an ungulate exclusion fence at another population of *C. pubescens*. *Canavalia pubescens* is

represented in separate ex situ collections. 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 *C. pubescens* 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 in 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 new information on this species from information in our files and the *Manual of Flowering Plants of Hawaii* (Wagner *et al.* 1999). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau of the Hawaii Natural Heritage Program; Arthur Medeiros, USGS-BRD; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood of the National Tropical Botanical Garden. New status information was provided by Hank Oppenheimer. In 2005 we contacted species experts and confirmation of the status of *Canavalia pubescens* was provided by Hank Oppenheimer. In 2006 new status and range information was provided by Forest Starr, USGS-BRD; S. Seidman of the Maui Nui Botanical Garden, and Hank Oppenheimer, Plant Extinction Prevention Program, and was incorporated into this assessment. In 2007 and 2008, Hank Oppenheimer provided new information for *C. pubescens* on Maui and Lanai. We contacted the species experts in 2009, but received no new information. In 2010, we contacted the species experts listed below, and received new information from J. Ford, SWCA Consultants, J. Fell-McDonald, DOFAW, and L. Altenberg, private contractor.

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Division of Forestry and Wildlife
Altenberg, Lee	02/09/10	Contractor
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
Fell-McDonald, J.	02/09/10	Division of Forestry and Wildlife, Maui
Ford, John	02/09/10	SWCA Consultants

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 Critically Endangered (facing an extremely high risk of extinction in the wild) (Bruegmann and Caraway 2003). *Canavalia pubescens* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al.* 2005, p. B2).

#### 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. We received new

information from J. Fell-McDonald (Maui District, Hawaii Division of Forestry and Wildlife).

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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 D. Bohan 5/18/10  
Regional Director, Region 1, Fish and Wildlife Service 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 7, 2010  
Conducted by: Cheryl Phillipson, Pacific Islands FWO  
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 21, 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