

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

Scientific Name:

Schiedea pubescens

Common Name:

ma`oli`oli

Lead region:

Region 1 (Pacific Region)

Information current as of:

06/19/2014

Status/Action

Funding provided for a proposed rule. Assessment not updated.

Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

New Candidate

Continuing Candidate

Candidate Removal

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

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

Range is no longer a U.S. territory

Insufficient information exists on biological vulnerability and threats to support listing

Taxon mistakenly included in past notice of review

Taxon does not meet the definition of "species"

Taxon believed to be extinct

Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

X Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing?
Yes

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, emergency listings, and essential litigation-related, administrative, and program management functions.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** Hawaii
- **US Counties:** Maui, HI
- **Countries:** United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** Hawaii
- **US Counties:** Hawaii, HI, Maui, HI
- **Countries:** United States

Land Ownership:

Schiedea pubescens occurs on both private and State lands.

Lead Region Contact:

ARD-ECOL SVCS, Jesse D'Elia, 5032312349, jesse_delia@fws.gov

Lead Field Office Contact:

Biological Information

Species Description:

Schiedea pubescens is a reclining or weakly climbing vine with a woody base. The plant is glabrous except for the inflorescence, which has dense purple-tinged hairs. The stems are 3.3 to 20 feet (ft) (1 to 6 meters (m)) long with internodes that are usually 2.4 to 4.7 inches (in) (6 to 12 centimeters (cm)) long. Opposite, green leaves are sometimes purple tinged especially along the midrib. In addition they are thick, leathery and narrowly lanceolate. The tiny flowers are perfect and are arranged in open cymes. The inflorescence is 12 to 20 in (30 to 50 cm) long with green bracts, which are sometimes tinged with purple (Wagner et al. 1999a, p. 519).

Taxonomy:

Schiedea pubescens was described by Hillebrand (1888). This species is recognized as a distinct taxon in the Manual of Flowering Plants of Hawaii (Wagner et al. 1999a, p. 519), and Wagner et al. (2005), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History:

This species occurs in diverse mesic to wet *Metrosideros* (ohia) forest at elevations between 2,000 and 3,000 ft (600 and 900 m) (Hawaii Biodiversity and Mapping Program (HBMP) 2008; Wagner et al. 1999a, 519).

Historical Range/Distribution:

Schiedea pubescens was historically found scattered on the islands of Molokai, Lanai, and Maui. On Molokai, it was found from Kalae to Pukoo ridge; on Maui, it was known from the western mountains at Olowalu, Kaanapali, and Waihee, and from the eastern mountains at Makawao; and on Lanai, it was known from the Lanaihale area (HBMP 2008).

Current Range Distribution:

This species, which is declining and extremely threatened, is known from 13 populations on Maui, Molokai, and Hawaii (Wood, in litt. 2001; Oppenheimer, in litt. 2006; HBMP 2008; Bakutis, in litt. 2010; Oppenheimer, in litt. 2010; Perlman, in litt. 2010).

Population Estimates/Status:

Currently, *Schiedea pubescens* is limited to the islands of Maui, Molokai, and Hawaii. Individuals were observed during surveys conducted as recently as 2010. We are unaware of any additional surveys conducted to date. On Hawaii, this species occurs at the Pohakuloa Training Area (4 to 6 individuals). On Maui, there are eight populations totaling 30 to 32 individuals at Honokowai, Hahakea, Iao (1 individual), Nakalaloe stream, Helu (10-20 individuals), Ukumehane, Papalaua and Pohakea. On Molokai, there are four populations: at Waihanau stream, Waihanui gulch, Waimanu stream, and Kawela ditch trail, totaling 21 to 22 individuals (Wood, in litt. 2001; Oppenheimer, in litt. 2006; HBMP 2008; Bakutis, in litt. 2010; Oppenheimer, in litt. 2010; Perlman, in litt. 2010; Plant Extinction Prevention Program (PEPP), in litt. 2012).

Threats

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

Schiedea pubescens is highly and imminently threatened by feral pigs (*Sus scrofa*) and feral goats (*Capra hircus*) that degrade and destroy habitat (HBMP 2008). Evidence of the activities of feral pigs has been reported at the Hawaii, Maui, and Molokai populations, and of feral goats at the Hawaii population (HBMP 2008).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Captain James Cook in 1778, with many other introductions thereafter (Tomich 1986). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State to optimize hunting opportunities (Tomich 1986; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, with *Acacia koa* (koa) and *Metrosideros polymorpha* (ohia). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm) greatly disrupting the leaf litter and topsoil layers and contributing to erosion and changes in ground topography. The feeding habits of pigs created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope et al. 1991).

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, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. Goats are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott et al. 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). A study conducted at Puuwaawaa 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, *A. koa* and *Metrosideros* spp. seedlings were observed germinating by the thousands (Department of Land and Natural Resources 2002).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs, goats, and other introduced ungulates (Loope et al. 1991). Because of demonstrated habitat modifications by feral pigs and goats, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the U.S. Fish and Wildlife Service (FWS) believes they are a threat to *S. pubescens*.

Climate change may pose a threat to the ecosystem that supports this species. Fortini et al. (2013, pp. 1134) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini et al. (2013, p. 78) concluded that *Schiedea pubescens* is vulnerable to the impacts of climate change. Therefore, additional management actions may be needed to conserve this taxon into the future.

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

None known.

C. Disease or predation:

Predation by feral pigs and goats is a likely threat to *Schiedea pubescens* (HBMP 2008).

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* when it was available. Pigs were observed felling and removing the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species (herbaceous and woody plants), and causing enough damage to kill larger trees over a few months of repeated feedings (Diong 1982).

Goats 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).

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope et al. 1991). Therefore, though we have no direct evidence of browsing for this species, it is likely that pigs and goats impact *S. pubescens* directly as well as the surrounding habitat.

As of May 2013, we do not have information to indicate that disease poses a threat to *S. pubescens*.

D. The inadequacy of existing regulatory mechanisms:

Schiedea 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).

Goats are managed in Hawaii as a game animal, 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). Goat hunting is allowed year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003). However, public hunting is not adequate to eliminate this threat to *S. pubescens*.

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

Numerous weed species threaten *Schiedea pubescens* (HBMP 2008). On Hawaii, the nonnative plant that is reported to be the greatest threat is *Pennisetum setaceum* (fountain grass). On Maui, the nonnative plants reported to be the greatest threats are *Ageratina adenophora* (Maui pamakani), *Buddleja madagascariensis* (smoke bush), *Psidium cattleianum*, *Rubus rosifolius* (thimbleberry), and *Tibouchina herbacea* (glorybush) (HBMP 2008). On Molokai, the nonnative plants reported to be the greatest threats are *Kalanchoe pinnata* (air plant), *Melinis minutiflora* (molasses grass), and *R. rosifolius* (HMBP 2008).

Ageratina adenophora is native to tropical America and has naturalized in dry to wet forest on the islands of Oahu, Molokai, Lanai, and Maui (Wagner et al. 1999a). *A. adenophora* is a shrub 3 to 5 ft (1 to 1.5 m) tall with trailing branches that root on contact with soil. It forms dense mats which prevent regeneration of native plants (Anderson et al. 1992; University of California 2006). It is considered a serious weed in agriculture, especially in rangeland, because it often replaces more desirable vegetation or native species, and it is fatally toxic to horses and most livestock. The eupatorium gall fly, *Procecidochares utilis*, was introduced to Hawaii in 1944 for control of *A. adenophora*, and has been successful in suppression of most of the infestations (Bess and Haramoto 1959).

Buddleja madagascariensis is a sprawling shrub, native to Madagascar, and naturalized in Hawaii in mesic areas. It tolerates a wide range of tropical habitats, forms dense thickets, and is rapidly spreading into wet forest and even lava and cinder substrate areas in Hawaii (Wagner et al 1999a; Pacific Island Ecosystems at Risk (PIER) 2006a). The Oahu Invasive Species Committee targets this plant as one of the more invasive nonnative plants in Hawaii (Oahu Invasive Species Committee 2000). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Kalanchoe pinnata is an herb which is widely established in many tropical and subtropical areas. In Hawaii it has been naturalized prior to 1871 and is abundant in low elevation disturbed areas on all the main islands except Niihau and Kahoolawe (Wagner et al. 1999). *K. pinnata* can reproduce vegetatively at indents along the leaf. Usually new plants take root after the leaf has broken off the plant and falls to the ground. *K. pinnata* can form dense stands that prevent reproduction of native species (Starr 2006). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Melinis minutiflora is native to Africa, and now introduced to many parts of the tropics as a fodder plant. In Hawaii it is naturalized and common in dry to mesic disturbed open areas on all the main islands except Niihau. It is considered to be a serious pest, choking out and covering native vegetation and preventing seedling establishment (OConnor 1999). The mats it forms fuel more intense fires (Cuddihy and Stone 1990). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Pennisetum setaceum, a grass native to northern Africa, was introduced to 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. *P. setaceum* is also fire-adapted, and burns swiftly and hot, causing extensive damage to the surrounding habitat (OConnor 1999). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Psidium cattleianum, a tree native to tropical America, has become widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, *P. cattleianum* develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985; Wagner et al. 1985). To date, no biological control agents have been released against *P. cattleianum* in Hawaii, though insects for biocontrol are undergoing host-screening (Institute of Pacific Islands Forestry 2005).

Rubus rosifolius is native to Asia and is common in Hawaii in disturbed mesic to wet forest on all of the main islands. It is a sparse shrub, covered with prickles, and has edible red fruit. It invades the understory, forming dense thickets and outcompetes native plant species. It easily reproduces from roots left in the ground, and seeds are spread by feral animals and birds. There is no specific management information for *R. rosifolius*, but techniques used for the control of blackberry *R. fruticosus*, which is a related species, may be applicable (PIER 2006b; Global Invasive Species Database 2006).

Tibouchina herbacea, a member of the Melastomataceae family, is native to southern Brazil, Uruguay, and Paraguay. In Hawaii, it is naturalized and abundant in disturbed mesic to wet forest on the islands of Hawaii, Maui, and Lanai (Wagner et al. 1999a). It forms dense thickets, crowding out all other plant species and inhibiting regeneration of native plants (The Nature Conservancy 2003). All members of this genus are declared noxious in the state of Hawaii (HAR Title 4, Subtitle 6, Chapter 68). Research is ongoing for biological controls of this species (Smith 1998; The Nature Conservancy 2003).

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 *S. 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; 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 diverse mesic to wet forest habitat of *S. pubescens*, the FWS believes nonnative plant species are a threat.

Fire is a likely threat to the population in the Armys Pohakuloa Training Area on the island of Hawaii (HBMP 2008). This area is dry, windy, and at risk of fire due to military training activities. The fire-adapted plant identified above (*Pennisetum setaceum*) as a threat to *S. pubescens* can alter the fire characteristics of its habitat (Smith 1989). 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. 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).

Conservation Measures Planned or Implemented :

The FWS has funded several projects through cooperative agreements or grants, which will provide conservation benefits to *Schiedea pubescens*. On Lanai, a non-profit grassroots community organization had constructed an ungulate exclosure fence and will continue to remove nonnative plants in the summit area, which can then be used for reintroduction into areas of historical occurrence (FWS 2003). The West Maui Mountain Watershed Partnership, a non-governmental, non-profit partnership composed of west Maui landowners and managers, erected some ungulate fencing, and nonnative plant removal is ongoing (Maui Land and Pineapple 2002). On Hawaii, the U.S. Army at Pohakuloa Training Area has completed 30 miles (mi) (48 kilometers (km)) and has an additional 32 mi (51 km) of ungulate exclusion fencing planned that is expected to provide habitat for *S. pubescens*. Nonnative feral ungulates and nonnative plants will be controlled within the fenced areas (U.S Army Garrison, Hawaii, Pohakuloa Training Area 2009). This species is not represented in an ex situ collection (Conry, in litt. 2012).

Summary of Threats :

Based on our evaluation of habitat degradation and loss by feral pigs, goats, and nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Schiedea pubescens* due to competition with nonnative plants for space, nutrients, water, and light. Predation by feral pigs and goats is a likely threat to *S. pubescens*. Fire is a likely threat to the population at the Pohakuloa Training Area on Hawaii.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

- Survey for populations of *Schiedea pubescens* in areas of potentially suitable habitat.
- Control feral pigs and goats by removing these species from areas where *S. pubescens* populations exist and preventing reinvasion through the use of exclosures.
- Control alien plants using physical, mechanical, and biological control methods, as well as herbicides when necessary. Continue to conduct research into potential biocontrol species.
- 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.

Priority Table

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	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

This species is highly threatened by feral pigs and goats that directly prey upon it and degrade and destroy habitat, and by nonnative plants that compete for light and nutrients. Fire is a likely threat to *Schiedea pubescens*. Threats to the diverse mesic to wet forest habitat of *S. pubescens*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication. Nonnative plants have been reduced in numbers in the populations that are fenced. These ongoing conservation efforts for this species benefit only west Maui 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. This species is not represented in an ex situ collection.

Imminence :

Threats to *Schiedea pubescens* from feral pigs, goats, and nonnative plants are considered imminent because they are ongoing.

Yes No Have you promptly reviewed all of the information received regarding the species for the purpose

of determination whether emergency listing is needed?

Emergency Listing Review

 No Is Emergency Listing Warranted?

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, individuals of *Schiedea pubescens* will benefit from conservation actions initiated by a community group on Lanai and the West Maui Mountain Watershed Partnership, funded in part by the FWS. These conservation actions include construction of an ungulate exclosure fence and removal of nonnative plants in the summit area of Lanai and eventual reintroduction of *S. pubescens*; and construction of ungulate exclosures and control of nonnative species in the West Maui Mountains. 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 *S. 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 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 Manual of Flowering Plants of Hawaii (Wagner et al. 1999a). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, HBMP; Arthur Medeiros, U.S. Geological Survey-Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden (NTBG). No new information was provided. In 2005, we contacted species experts and confirmation of status was provided by Hank Oppenheimer from the Maui Land and Pineapple Company and Ken Wood from NTBG. In 2006 and 2008 status information was provided by Hank Oppenheimer, PEPP, and incorporated into this assessment. In 2009, we received no new information. In 2010, we received new information from Ane Bakutis, PEPP-Molokai, Hank Oppenheimer, PEPP-Maui Nui, and Steve Perlman, NTBG. In 2011, we contacted the species experts listed below and received no new information. In 2012, we received information from the State and incorporated it into this form.

List all experts contacted in 2011:

Name Date Affiliation

Agorastos, Nick 02/16/11 Division of Forestry and Wildlife, Hawaii
Bakutis, Ane 02/16/11 Plant Extinction Prevention Program, Molokai
Ball, Donna 02/16/11 U.S. FWS, Partners Program, Hawaii
Bily, Pat 02/16/11 The Nature Conservancy, Maui
Bio, Kealii 02/16/11 Plant Extinction Prevention Program, Hawaii
Caraway, Vickie 02/22/11 Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan 02/16/11 Plant Extinction Prevention Program, Oahu
Clark, Michelle 02/16/11 U.S. FWS, Partners Program, Kauai
Duvall, Fern 02/16/11 Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri 02/16/11 The Nature Conservancy, Maui
Garnett, Bill 02/16/11 National Park Service, Kalaupapa, Molokai
Haus, Bill 02/16/11 National Park Service, Haleakala NP, Maui
Higashino, Jennifer 02/16/11 U.S. FWS, Partners Program, Maui
Imada, Clyde 02/16/11 Bishop Museum, Botany Department
Kawelo, Kapua 02/16/11 U.S. Army, Environmental Division

McDowell, Wendy 02/16/11 Plant Extinction Prevention Program, Kauai
Medeiros, Arthur 02/16/11 U.S. Geological Survey
Moses, Wailana 02/16/11 The Nature Conservancy, Molokai
Oppenheimer, Hank 02/16/11 Plant Extinction Prevention Program, Maui Nui
Perlman, Steve 02/16/11 National Tropical Botanical Garden
Perry, Lyman 02/16/11 Division of Forestry and Wildlife, Hawaii
Pratt, Linda 02/16/11 U.S. Geological Survey, Biological Resources Division
Starr, Forest 02/16/11 U.S. Geological Survey
Stevens, Bryon 02/16/11 DLNR Natural Area Reserves, Maui
Ward, Joe 02/22/11 Puu Kukui Watershed Preserve
Welton, Patti 02/16/11 National Park Service, Haleakala NP, Maui
Wysong, Michael 02/16/11 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) by Wagner et al. (1999b). *Schiedea pubescens* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Hawaii

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

On February 20, 2013, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. New information was received on April 12, 2013, and incorporated into this report. In addition, we are in frequent contact with State botanists and, PEPP, a multiagency (including State and Federal) organization operated by the University of Hawaii that functions to prevent extinction of Hawaii's rarest and most threatened plants. Therefore, we believe this assessment contains the most recent available information on *Schiedea pubescens*.

Literature Cited:

Anderson, S.J., C.P. Stone, and P.K. Higashino. 1992. Distribution and spread of alien plants in Kipahulu Valley, Haleakala National Park, above 2,300 ft. elevation. In *Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research*, C.P. Stone, C.W. Smith, and J.T. Tunison (eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 300-338.

Bess, H.A. and F.H. Haramoto. 1959. Biological control of Pamakani, *Eupatorium adenophorum*, in Hawaii by a tephritid gall fly, *Proceicidochoares utilis*. 2. Population studies of the weed, the fly, and the parasites of the fly. *Ecology* 40: 244-249.

Carlquist, S. 1980. *Hawaii: a natural history*, second edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Clarke, G., and L.W. Cuddihy. 1980. A botanical reconnaissance of the Na Pali coast trail: Kee Beach to Kalalau Valley (April 9-11, 1980). Division of Forestry and Wildlife, Department of Land and Natural

Resources, Hilo.

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.

Culliney, J.L. 1988. Islands in a far sea; nature and man in Hawaii. Sierra Club Books, San Francisco. 410 pp.

Department of Land and Natural Resources. 2002. Draft management plan for the ahupuaa of Puuwaawaa and the makai lands of Puuanahulu. State of Hawaii, Division of Forestry and Wildlife. p. 52.

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.

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.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Ohukaniohia Gon III, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Hawaii Cooperative Studies Unit, University of Hawaii, Hilo. Technical Report HCSU-044. 141 pp.

(FWS) U.S. Fish and Wildlife Service. 2003. Lanaihale cloudforest exclosure. Cooperative agreement (122000J010).

Global Invasive Species Database. 2006. *Rubus rosifolius*.
<http://www.issg.org/database/species/ecology.asp?si=500&fr=1&sts=>, accessed on February 20, 2007.

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

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.

(HBMP) Hawaii Biodiversity and Mapping Program. 2008. Program database. Unpublished.

(HBMP) Hawaii Biodiversity and Mapping Program. 2006. *Schiedea pubescens* var. *pubescens*.
<http://hbmp.hawaii.edu/printpage.asp?spp=PDCAR0ROL4>, accessed on April 14, 2007.

Hillebrand, W. 1888. Flora of the Hawaiian Islands: a description of their phanerogams and vascular cryptogams. C. Winter, Heidelberg; Williams and Norgate, London; and B. Westermann and Company, New York. 673 pp.

Institute of Pacific Islands Forestry. 2005. *Tectococcus ovatus*. A biological control agent proposed for release against strawberry guava (waiawi), research update. Pacific Southwest Research Station, United States Department of Agriculture, Forest Service. 2 pp.

Loope, L., A.C. Medeiros, and B.H. Gagne. 1991. Recovery of vegetation of a montane bog following protection from feral pig rooting. Cooperative National Park Resources Studies Unit, University of Hawaii,

Honolulu, Technical Report 77. 23 pp.

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

Loope, 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.

Maui Land and Pineapple Company. 2002. Natural area partnership program, Puu Kukui watershed management area, annual report for fiscal year 2002, July 2001-June 2002. 25 pp plus appendices.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and 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, and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. 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.

Oahu Invasive Species Committee. 2000. Pest alert flyers. Hawaii Ecosystems at Risk, <http://www.hear.org/oisc>, accessed on April 9, 2007.

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

(PIER) Pacific Island Ecosystems at Risk. 2006a. *Buddleia madagascariensis*. http://www.hear.org/pier/species/buddleja_madagascariensis.htm, accessed on February 21, 2007.

(PIER) Pacific Island Ecosystems at Risk. 2006b. *Rubus rosifolius*. http://www.hear.org/Pier/species/rubus_rosifolius.htm, accessed on February 20, 2007.

Robichaux, R., J. Canfield, F. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. Radiating plants-adaptive radiation. Endangered Species Bulletin November/December. Pp. 3-5.

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 Stone, C.P. and J.M. Scott (eds.), Hawaii's Terrestrial Ecosystems: Preservation and Management, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 191-192.

- Smith, C.W. 1989. Non-native plants. In Stone, C.P. and D.B. Stone (eds.), Conservation Biology in Hawaii, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp 60-69.
- Smith, C.W. 1998. Impact of alien plants on Hawaii's native biota. Cooperative National Park Studies Unit. http://www.botany.hawaii.edu/faculty/cw_smith/aliens.htm#Plant%20Pests%20of%20Hawaiian%20Native, accessed on February 20, 2007.
- Starr, F. 2006. *Kalanchoe pinnata*. Photographs. http://www.hear.org/starr/hiplants/images/thumbnails/html/kalanchoe_pinnata.htm
- State of Hawaii. 2001. Game mammal hunting guide. http://hawaii.gov/dlnr/dofaw/hunting/game_summary, accessed May 10, 2013.
- Tomich, P.Q. 1986. Mammals in Hawaii; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
- The Nature Conservancy. 2003. Kapunakea Preserve, West Maui, Hawaii: long-range management plan fiscal years 2004-2009. 29 pp.
- University of California. 2006. *Ageratina adenophora*. <http://ucce.ucdavis.edu/datastore/detailreport.cfm?usernumber=2&surveynumber=182>, accessed on February 20, 2007.
- U.S Army Garrison, Hawaii, Pohakuloa Training Area. 2009. Natural Resources Program Annual Report, Pohakuloa Training Area, Island of Hawaii, 01Jan-30Sep 2009. Prepared in cooperation with Center for Environmental Management of Military Lands, Colorado State University. 105 pp.
- van Riper, S.G., and C. van Riper III. 1982. A field guide to the mammals in Hawaii. The Oriental Publishing Company, Honolulu. 68 pp.
- Vitousek, P.M., C.M. DAntonio, 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.
- Wagner, W.L., D.R. Herbst, and R.S.N. Yee. 1985. Status of the native flowering plants of the Hawaiian Islands. In Stone, C.P., and J.M. Scott (eds.), *Hawaii's Terrestrial Ecosystems: Preservation and Management*, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 23-74.
- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. *Manual of the flowering plants of Hawaii*. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 97. 1,918 pp.
- Wagner, W.L., M.M. Brueggemann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. *Bishop Museum Occasional Papers* 60:1-58.
- Wagner, W.L., S.G. Weller, and A. Sakai. 2005. Monograph of *Schiedea* (Caryophyllaceae-Alsinoideae). *Systematic Botany Monographs* 72:99-102.
- Wood, K.R., and S. Perlman. 1997. Maui 14 plant survey final report. National Tropical Botanical Garden. 25 pp.

Personal Communications and In Litteris

Bakutis, A., Plant Extinction Prevention Program, Meeting notes, February 4, 2010.

Conry, P.J., DOFAW, 2012 CNOR, request for comments on USFWS species assessment and listing priority assignment forms, April 9, 2012.

Oppenheimer, H., Plant Extinction Prevention Program, Telephone interview regarding plant candidate species information updates, September 15, 2006.

Oppenheimer, H., Electronic mail message and ArcMap data points regarding *Schiedea pubescens*, February 18, 2008.

Oppenheimer, H., Meeting notes, February 4, 2010.

(PEP) Plant Extinction Prevention Program. 2012. Annual report fiscal year 2012 (July 1, 2011-June 30, 2012). 169 pp.

Perlman, S., National Tropical Botanical Garden, Meeting notes, February 4, 2010.

Wood, K., National Tropical Botanical Garden, Response to request for candidate plant information, August 7, 2001.

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:



06/18/2014

Date

Concur:



11/18/2014

Date

Did not concur:

Date

Director's Remarks: