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

Scientific Name:

Huperzia (=phlegmariurus) stemmermanniae

Common Name:

Wawae`iole

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

_X_ 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**: Hawaii, HI, Maui, HI
- **Countries**: United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Hawaii
- **US Counties**: Honolulu, HI, Maui, HI
- **Countries**:Country information not available

Land Ownership:

One population occurs on State land within Laupahoehoe Natural Area Reserve, and one population is on private land, both on the island of Hawaii. On Maui, one population occurs on Federal land in Kaapahu Valley in Haleakala National Park.

Lead Region Contact:

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

Lead Field Office Contact:

PACIFIC ISLANDS FISH AND WILDL OFC, Kristi Young, 808-792-9419, kristi_young@fws.gov

Biological Information

Species Description:

Huperzia stemmermanniae is a pendant epiphytic clubmoss. Sterile stem bases are unforked or once-forked, short, usually much less than 6 inches (15 centimeters) long, green to pale yellow, with fertile terminal strobili. The strobili fork at an acute angle and the branches are usually straight (Palmer 2003, pp. 257-259).

Taxonomy:

Huperzia stemmermanniae was first described as a species of Phlegmariurus by Medeiros and Wagner (Medeiros et al. 1996, pp. 90-96). Kartesz (1999) moved the species to the genus *Huperzia* and this species is recognized as a distinct taxon in the latest treatment of ferns and fern allies, Hawaiis Ferns and Fern Allies (Palmer 2003, pp. 257-259).

Habitat/Life History:

This species is epiphytic on rough bark of living trees or fallen logs in mesic to wet *Metrosideros polymorpha-Acacia koa* (ohia-koa) forests on east Maui and the island of Hawaii, between 3,199 to 3,806 feet (ft) (975 to 1,160 meters (m)) in elevation (Medeiros et al. 1996, p. 93; Palmer 2003, pp. 257, 259; Hawaii Biodiversity Mapping Program (HBMP) 2006). *Huperzia stemmermanniae* has been reported growing on moss-covered logs of *Metrosideros* sp. and on *Syzygium sandwicensis* (ohia ha) trees. Associated native species include *Cheirodendron* spp. (olapa), *Cibotium* spp. (hapuu), *Cyrtandra* spp. (haiwale), *Ilex anomala* (kawau), *Melicope* spp. (alani), *Myrsine* spp. (kolea), *Psychotria* spp. (kopiko), and *S. sandwicensis* (Medeiros et al. 1996, p. 93).

Historical Range/Distribution:

There is little information available on the historical range of this species. *Huperzia stemmermanniae* was first collected in 1981 from two populations totaling 10 individuals in Laupahoehoe Natural Area Reserve (NAR) on the island of Hawaii, initially identified as *H. mannii* (Medeiros et al. 1996, p. 93; HBMP 2008). In 1996, Medeiros et al. described *H. stemmermanniae* as a distinct taxon (Medeiros et al. 1996, pp. 90-96). At that time it was known from Laupahoehoe NAR and Kaapahu on east Maui.

Current Range Distribution:

Currently, this species is known from the Laupahoehoe NAR, the Laupahoehoe section of the Hilo Forest Reserve, and on private land, on the island of Hawaii; and from Kaapahu Valley on east Maui (HBMP 2008; Perry, in litt. 2006; Conry, in litt. 2012). According to State of Hawaii botanists, one population occurring on State land had been affected by drought in 2011, with some individual plants becoming desiccated; however, the State plans new surveys of the population in April 2013 (Hadway, in litt. 2013).

Population Estimates/Status:

Currently, *Huperzia stemmermanniae* is known from three populations, one on east Maui of one individual that has not been relocated since the late 1990s, and two on the island of Hawaii, totaling approximately 30 individuals (Medeiros et al. 1996, p. 93; Wood, in litt. 2003; Perry, in litt. 2006; Hadway, in litt. 2013; Imoto,

in litt. 2013). The two Hawaii Island populations totaling approximately 30 individuals occur in the States Laupahoehoe NAR, east of Blair Road, and on privately-owned land west of Blair Road on Waipunalei Stream, within the Laupahoehoe section of the Hilo Forest Reserve (Perry, in litt. 2006; Wood, in litt. 2003; Conry, in litt. 2012). On east Maui, there was one individual in Kaapahu Valley in Haleakala National Park, but this individual has not been relocated since 1995 (Welton, in litt. 2008). A survey was conducted in Opana Gulch in the Koolau Forest Reserve on Maui in 2007, but no individuals were found (Plant Extinction Prevention Program 2008, p. 67).

Threats

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

The mesic to wet forest habitat of *Huperzia stemmermanniae* is highly and imminently threatened by feral pigs (*Sus scrofa*), goats (*Capra hircus*), cattle (*Bos taurus*), and axis deer (*Axis axis*) that degrade and destroy habitat (Medeiros et al. 1996, p. 96; Wood, in litt. 2003; HBMP 2008). Evidence of the activities of feral pigs has been reported at the Kaapahu and Laupahoehoe populations of *H. stemmermanniae* (Perlman, in litt. 2010; 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, p. 121). 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 (Tomich 1986, p. 125; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982, 408 pp.). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* to *Metrosideros polymorpha*. 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 (Diong 1982, pp. 143-150). The feeding habits of pigs also created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava) (Diong 1982, pp. 164-165). 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, pp. 166-167). 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, pp. i, 13). Feral goats are reported to be a threat to the dense *A. koa* forest habitat of *H. stemmermanniae* on Maui and the island of Hawaii (Medeiros et al. 1996, p. 96). The goat is originally native to the Middle East and India, but was successfully introduced to the Hawaiian Islands in 1792. The effects on mesic and wet forest habitat by the foraging of feral goats have been reported in fencing studies. An exclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of the native *A. koa* tree (Spatz and Mueller-Dombois 1973, p. 876). Another study 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 geminating by the thousands (Department of Land and Natural Resources 2002, p. 52).

Feral cattle are reported to be a threat to the dense *A. koa* forest habitat of *H. stemmermanniae* on Maui and the island of Hawaii (Medeiros et al. 1996, p. 96). Cattle, the wild progenitors of which were 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. Feral cattle can presently be found on the islands of Hawaii and Maui, and ranching is still a major commercial activity. 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 (Cuddihy and Stone 1990, pp. 59-63; Tomich 1986, pp. 140-150). Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986, p. 145; Cuddihy and Stone 1990, pp. 47, 61-62).

Evidence of the activities of axis deer has been reported at the Kaapahu population of *H. stemmermanniae* (HBMP 2008). 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 currently there is concern that their numbers could expand to 15,000 to 20,000 or more within a few years (Waring 1996, p. 2; Nishibayashi, in litt. 2001; Anderson, in litt. 2001). They trample roots and seedlings, cause erosion, and promote the invasion of alien plants (Cuddihy and Stone 1990, pp. 66-67).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs and other introduced ungulates (Loope et al. 1991, p. 3). As an epiphytic species, *H. stemmermanniae* is provided some degree of protection from ground disturbance by feral ungulates (Medeiros et al. 1996, p. 96); however, because of the extent of demonstrated habitat modifications, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants caused by feral pigs, goats, cattle, and deer, the U.S. Fish and Wildlife Service (FWS) believes they are threats to *H. stemmermanniae.*

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. 77) concluded that *Huperzia stemmermanniae* 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, goats, cattle, and axis deer is a potential threat to *Huperzia stemmermanniae*. Because Hawaiis native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Merlin and Juvik, p. 597). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990, pp. 63-67; Loope et al. 1991, p. 1,472). 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, p. 138). A stomach content analysis in this study showed that the pigs food sources consisted of native plants, 60 percent of which was 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* (herbaceous and woody plants), and causing enough damage to kill larger trees over a few months of repeated feeding (Diong 1982, pp. 138, 144). The ability of cattle to degrade native vegetation by grazing and trampling was recognized very soon after large-scale ranching began in Hawaii (Cuddihy and Stone 1990, pp. 59-63).

Feral goats eat native vegetation, 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). Elimination of rare native plants such as *Argyroxiphium kauense* and *A. sandwicense* ssp. *sandwicense* (Hawaiian silverswords), *Canavalia kauensis* (awikiwiki), and a number of Maui species (*Plantago princeps,*

Stenogyne microphylla, *Schiedea haleakalaensis*), from areas heavily foraged by goats has been documented (Cuddihy and Stone 1990, p. 64).

Deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops. Damage to crops by the foraging of feral deer, costing farmers thousands of dollars in revenue, has been documented on Maui (Waring 1996, pp. 3-4; Simpson, in litt. 2001).

As an epiphytic species (reported to grow on upright native trees as well as on fallen logs), *H. stemmermanniae* may be afforded some degree of protection from these ground disturbing mammals because individuals of this species may be unreachable by these animals (Medeiros et al. 1996, p. 96). However, even though there are no observations of browsing for this species, predation by feral pigs, goats, cattle, and axis deer is a potential threat to this species.

D. The inadequacy of existing regulatory mechanisms:

Huperzia stemmermanniae currently receives no protection under Hawaiis endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pig, goat, and deer hunting is allowed year-round, or during certain months, depending on the area (Hawaii Department of Land and Natural Resources (HDLNR) 1999, 2003); however, public hunting does not adequately eliminate the threats posed by ungulates to native plant species (Hawaii Heritage Program 1990, p. 3). Hunting of feral cattle is no longer allowed in Hawaii (HDLNR 1985) except under permitted conditions.

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

Huperzia stemmermanniae is highly threatened by nonnative plants that degrade and destroy the forest habitat that supports the native species upon which this epiphytic plant grows (Medeiros et al. 1996, p. 96; HBMP 2008; Perry, in litt. 2006). With only three to four populations totaling 30 individuals on two islands, reduced reproductive vigor and extinction due to randomly occurring events, such as hurricanes, are also a potential threat to this species (Mangel and Tier 1994, pp. 607, 612; Pimm et al. 1998, pp. 757-758, 777).

The nonnative plant species that are threats to *H. stemmermanniae* include *Sphaeropteris cooperi* (Australian tree fern), *Paspalum conjugatum* (Hilo grass), *Psidium cattleianum* (strawberry guava), and *Rubus argutus* (prickly Florida blackberry) at the east Maui populations; and *P.cattleianum* and *Clidemia hirta* (Kosters curse) at the Hawaii island populations (Medeiros et al. 1996, p. 96; HBMP 2008; Perry, in litt. 2006).

Clidemia hirta is a noxious shrub first cultivated on Oahu prior to 1941. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious plant threat (Wagner et al. 1985, p. 41; Smith 1989, p. 189). The most promising biological control to date for *C. hirta* is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae*, released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect (*Mompha trithalama*), and terminal growth-feeding insects called thrips (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989, p. 189).

Paspalum conjugatum is a grass native to the Neotropics, and was introduced for cattle fodder and quickly spread (Cuddihy and Stone 1990, pp. 82-83,). It is naturalized in moist to wet disturbed sites along roadsides and in open fields (OConnor 1999, p. 1,576). It forms a dense ground cover even on acidic, low-nutrient soils (Pacific Island Ecosystems at Risk 2006). Its small hairy seeds are easily transported on humans and animals or are carried by the wind through native forests. No biological control agents have been released for this species (University of Hawaii 2006).

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, p. 200; Wagner et al. 1985, pp. 40-41). A biological control agent, *Tectococus ovatus* (Brazilian scale), has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve (ScienceDaily 2008).

Rubus argutus is native to the central and eastern United States, and is a serious weed that naturalizes in a variety of disturbed habitats (Tunison 1991, p. 2). It reproduces both vegetatively and by seed. *R. argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner et al. 1999a, p. 1,107; Tunison 1991, p. 3). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986, p. 53).

Sphaeropteris cooperi, a tree fern native to Australia, is used in landscaping in Hawaii because it is faster growing and more tolerant of warmer, drier conditions than the native Hawaiian tree ferns (Medeiros et al. 1992, pp. 30-31). It can achieve high densities in native Hawaiian forests, grows up to 1 ft (0.3 m) in height per year with maximum known heights of 39 ft (12 m) (Jones and Clemesha 1981, pp. 56-57), and can displace native species. Understory disturbance by pigs facilitates the establishment of *S. cooperi* (Medeiros et al. 1992, pp. 30-32). This species has been known to spread over seven miles (12 kilometers) by windblown dispersal of spores from plant nurseries (Medeiros et al. 1992, pp. 28-31; Palmer 2003, p. 245).

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 of these are considered pests (Smith 1985, p. 180; Wagner et al. 1999a, p. 45). Confirmed personal observations (Medeiros et al. 1996, p. 96; HBMP 2008; Perry, in litt. 2006) and several studies (Cuddihy and Stone 1990, p. 74; Robichaux et al. 1998, p. 4) indicate nonnative plant species may outcompete native plants that support individuals of the epiphytic *H. stemmermanniae*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition 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, pp. 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 mesic to wet *Metrosideros polymorpha-Acacia koa* habitat of *H. stemmermanniae*, the FWS believes nonnative plant species are a threat to this species.

Conservation Measures Planned or Implemented :

This species is represented in ex situ collections at the Volcano Rare Plant Facility (1 individual from Laupahoehoe) and at Lyon Arboretum (approximately 24 individuals from Laupahoehoe) (Sugii, in litt. 2006; Perry, in litt. 2006; Conry, in litt. 2012; Imoto, in litt. 2013).

No other known conservation measures have been implemented for this species.

Summary of Threats :

Based on our evaluation of habitat degradation and loss by feral pigs, goats, cattle, axis deer, 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 the native plant species that provide physical support for individuals of the epiphytic *Huperzia*

stemmermanniae due to competition with nonnative plants for space, nutrients, water, and light. Predation by ungulates is a potential threat to this species. The small number of remaining individuals and limited range make this species susceptible to randomly occurring natural events such as hurricanes. 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.

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 :

- Control ungulates by removing these species from areas where *H. stemmermanniae* populations exist and preventing reinvasion through the use of exclosures.
- Control alien plants through physical, mechanical, and biological control methods, as well as herbicides when necessary.
- Continue to conduct research into potential biocontrol species.
- Continue collection for ex situ genetic storage and reintroduction.
- Survey for populations at known locations and in suitable habitat.
- 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, goats, cattle, and axis deer that degrade and/or destroy habitat and nonnative plants that compete with the native species (that support this epiphytic plant) for light, space, and nutrients. This species is potentially threatened by predation by nonnative ungulates, and by randomly

occurring events, such as hurricanes. Threats to the mesic to wet forest habitat of *Huperzia stemmermanniae*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication.

Imminence :

Threats to *Huperzia stemmermanniae* from feral pigs, goats, cattle, deer, and nonnative plants are imminent because they are ongoing. Potential threats from predation by nonnative ungulates and randomly occurring events such as hurricanes are considered nonimminent.

__Yes__ 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. *Huperzia stemmermanniae* is represented in ex situ collections. If it becomes apparent that the routine listing process is not sufficient to prevent further losses that may result in this subspecies' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *H. stemmermanniae* 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:

The information in this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December 1995 and November 1996. We incorporated additional new information on this species from information in our files and from Hawaiis Ferns and Fern Allies (Palmer 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife (DOFAW); Joel Lau, Hawaii Natural Heritage Program; 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. No new status or range information was provided. In 2005 we contacted species experts, but received no new information on this taxon. In 2006 new status and range information was provided by Lyman Perry, DOFAW; Hank Oppenheimer, Plant Extinction Prevention Program; and Nellie Sugii, Lyon Arboretum, and was incorporated into this assessment. In 2008, we received status information from Patti Welton, National Park Service. In 2009, we did not receive new information. In 2010, we received new information from Steve Perlman, National Tropical Botanical Garden. In 2011, we contacted the species experts listed below, and received no new information. In 2012 and 2013, 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 (could be considered at risk) by Wagner et al. (1999b, p. 57). *Huperzia stemmermanniae* is included in the list of species in Hawaiis 2005 Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005, p. B 7).

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 Hawaiis rarest and most threatened plants. Therefore, we believe this assessment contains the most recent available information on *Huperzia stemmermanniae*.

Literature Cited:

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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:  06/18/2014
Date

Concur:  11/18/2014
Date

Did not concur: _____
Date

Director's Remarks: