

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

Scientific Name:

Ochrosia haleakalae

Common Name:

holei

Lead region:

Region 1 (Pacific Region)

Information current as of:

06/01/2013

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:

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 this 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.

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:** Hawaii, HI, Maui, HI
- **Countries:**Country information not available

Land Ownership:

On the island of Maui *Ochrosia haleakalae* occurs within one privately-owned parcel in Auwahi and on State land in the Makawao Forest Reserve. On the island of Hawaii *O. haleakalae* occurs within several State-owned Forest Reserves and privately-owned lands as well as one population in Hawaii Volcanoes National Park.

Lead Region Contact:

Lead Field Office Contact:

Biological Information

Species Description:

Ochrosia haleakalae is a tree 6.7 to 26.3 feet (ft) (2 to 8 meters (m)) tall. The elliptic leaves are clustered three or four per node. Tubular flowers occur in relatively open inflorescences. Robust, ovoid drupes are yellow or plum-colored, streaked with brown and often have irregular ridges at maturity due to differential thickening of the exocarp (Wagner et al. 1999, p. 218).

Taxonomy:

Ochrosia haleakalae was described by St. John (1978). This species is recognized as a distinct taxon in Wagner et al. (1999, p. 218), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History:

Typical *Ochrosia haleakalae* habitat is dry to mesic, and sometimes wet, forest, often on lava, at elevations between 2,300 and 4,000 ft (700 and 1,200 m) (The Nature Conservancy (TNC) 2006; Wagner et al. 1999, p. 218). On east Maui, the species occurs in diverse mesic and wet forest (Medeiros et al. 1986; TNC 2006; Medeiros 2007, in litt.). On the island of Hawaii, *O. haleakalae* is known from gulches and valleys in the Hamakua district and from degraded *Metrosideros polymorpha*-*Pisonia sandwicensis* (ohia-papala kepau) mesic and forest in the Kohala Mountains (Perlman and Wood 1996; Wagner et al. 1999, p. 218; TNC 2006).

Historical Range/Distribution:

Historically *Ochrosia haleakalae* was known from two islands, Maui and Hawaii. On Maui the species was known to occur from the Koolau and Makawao Forest Reserves (FRs), the northern slope of Haleakala, and from Auwahi and Kanaio on the southern slopes of Haleakala volcano (Hawaii Biodiversity and Mapping Program (HBMP) 2008). On the island of Hawaii the species was known from valleys in the Kohala Mountains (Pololu, Honopue, and Waipio) and from Kalopa gulch on the eastern (Hamakua) slope of Mauna Kea volcano (HBMP 2008).

Current Range Distribution:

Ochrosia haleakalae is currently known from Makawao FR and Auwahi/Kanaio on the island of Maui, and from Kohala FR (Honopue gulch), Waipio, Hilo FR (Laupahoehoe section), Hamakua FR (Kalopa gulch), and at Hawaii Volcanoes National Park on the island of Hawaii (Pratt 2005, in litt.; Agorastos 2007, pers. comm.; Medeiros 2007, in litt.; HBMP 2008; Oppenheimer 2008, in litt.).

Population Estimates/Status:

Ochrosia haleakalae is currently known from eight populations on Maui and Hawaii totaling between 64 to 76 wild individuals. Four populations occur on east Maui and four populations occur on the island of Hawaii (Pratt 2005, in litt.; HBMP 2008; Agorastos 2007, pers. comm.; Bio 2008, PEP, in litt.; Agorastos 2010, in litt.). On the island of Maui, 15 individuals are known from a population on private land at Auwahi (with 123 more outplanted individuals), and approximately 44 individuals occur inside the Makawao FR (Oppenheimer 2005, in litt.; USGS-BRD 2006; Medeiros 2007, in litt.; Oppenheimer 2008, in litt.). On the island of Hawaii,

11 individuals are known from a population on private land in Alakahi gulch, 1 individual is found at Kailikaula Stream within Honopue Valley, 1 to 2 individuals are at Kalopa gulch, and 3 are found along Blair Road. The status of the individuals at Alakahi Gulch are uncertain since the earthquake in 2006, the 1 individual found at Kailikaula Stream was last observed in 2011 and is vulnerable to landslides (Hadway 2013, in litt.), and the individual(s) at Kalopa has not been confirmed since 1999 (Agorastos 2010, in litt. and 2011, in litt.; Conry 2012, in litt.; Hadway 2013, in litt.). More than 100 have been outplanted at Kipuka Puaulu and Kipuka Ki in Hawaii Volcanoes National Park; however, survivorship of these individuals is unclear (Pratt 2005, in litt.; Agorastos 2007, pers. comm.; HBMP 2008; Bio 2008, in litt.; Pratt 2011, in litt.; Conry 2012, in litt.).

Threats

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

Ochrosia haleakalae is highly and imminently threatened by feral pigs (*Sus scrofa*) on both islands, and by goats (*Capra hircus*) and cattle (*Bos taurus*) on Maui (Oppenheimer 2004, in litt.; HBMP 2008). Evidence of the activities of feral pigs, goats and cattle has been reported in areas where *O. haleakalae* is known to occur (Medeiros 1995, in litt.; Oppenheimer 2004, in litt.; Agorastos 2007, pers. comm.).

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, pp. 120-126). 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, p. 125; State of Hawaii 2001). In a study conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui, the deleterious effects of feral pig rooting on native forest ecosystems was documented (Diong 1982, 408 pp.). Kipahulu 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* (koa) and/or *Metrosideros polymorpha* (ohia lehua). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 inches (20 centimeters) 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 were observed to create 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 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, 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 the eventual extinction of *A. koa* because it is unable to reproduce (Spatz and Mueller-Dombois 1973, p. 874). 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 *A. koa* (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 germinating by the thousands (Department of Land and Natural Resources 2002, p. 52).

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 (Cuddihy and Stone 1990, p. 40). 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 (Stone 1985, pp. 256, 260). 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 disperse 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. Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986, pp. 140-150; Cuddihy and Stone 1990, p. 29).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs, goats, and other introduced ungulates (Loope et al. 1991, p. 3). Because of demonstrated habitat modifications by feral pigs, goats, and cattle, 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 potential threats to *O. haleakalae*.

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

None known.

C. Disease or predation:

Ochrosia haleakalae is potentially threatened by feral pigs on both islands, and by goats and cattle on Maui at all but three locations (Medeiros 1995, in litt.; Oppenheimer 2004, in litt.; Pratt 2005, in litt.; USGS-BRD 2006; Agorastos 2007, pers. comm.). Browsing by ungulates has been observed on many native plant species, including common and rare or endangered species (Cuddihy and Stone 1990, pp. 40, 61, 63-64; Loope et al. 1991, p. 3). Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, p. 173; Lamoureux 1994, pp. 55-57).

Pigs are omnivorous in their diet. In the study described above on feral pig populations in the Kipahulu Valley, pigs were observed browsing on young shoots, leaves and fronds of a wide variety of plants, over 85 percent of which were endemic species (Diong 1982, p. 138). A stomach content analysis showed that the pigs' food sources consisted of native plants, primarily tree ferns (*Cibotium* spp.) at 60 percent, 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, pp. 138, 144).

Predation and habitat degradation by goats is a potential threat where populations of *O. haleakalae* occur on Maui (Bruegmann in litt. 1995; HBMP 2008). Feral goats eat native vegetation, are able to forage in extremely rugged terrain, and have a high reproductive capacity. 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 (*Stenogyne microphylla*, *Schiedea haleakalaensis*, *Plantago princeps*) from areas heavily foraged by goats (Cuddihy and Stone 1990, p. 64).

The ability of cattle to degrade native vegetation by grazing and trampling was recognized as a major threat to native vegetation very soon after large-scale ranching began in Hawaii (Cuddihy and Stone 1990, pp. 29, 47). Even though we have no evidence of direct grazing on *O. haleakalae*, predation by feral pigs, goats, and cattle is a potential threat to this species as well.

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

D. The inadequacy of existing regulatory mechanisms:

Ochrosia haleakalae is not currently protected under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs and goats are managed in Hawaii as game animals, but many animals populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990, p. 3). Pig and 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 does not adequately control the number of ungulates to eliminate this threat to *O. haleakalae*. Hunting of feral cattle is no longer allowed in Hawaii (Hawaii Department of Land and Natural Resources 1985) except under permitted conditions.

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

Fire is a major threat to *Ochrosia haleakalae* and is exacerbated by the presence of introduced plant species such as *Pennisetum clandestinum* (kikuyu grass) (HBMP 2008). Because Hawaiian plants were only subjected to fire during their evolution in areas of volcanic activity or 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 such as *P. clandestinum* have become widespread where *O. haleakalae* occurs (DAntonio and Vitousek 1992, p. 73; Friefelder et al. 1998, pp. 296-297; HBMP 2008). The presence of such species in Hawaiian ecosystems greatly increases the intensity, extent, and frequency of fire, especially during the drier months or periods of drought. Fire can destroy dormant seeds as well as plants, even in steep or inaccessible areas. Fires may result from natural causes, or they may be accidentally or intentionally started by humans (Cuddihy and Stone 1990, p. 74; DAntonio and Vitousek 1992, p. 73; Friefelder et al. 1998, pp. 296-297).

In addition to fire, *O. haleakalae* is threatened by alien plant species that degrade and destroy habitat and outcompete native plants (HBMP 2008). The nonnative plants that are reported to be the greatest threats to *O. haleakalae* on the island of Maui are *Asclepias physocarpa* (balloon plant), *Cestrum diurnum* (day jessamine), *Fraxinus uhdei* (tropical ash), *Pennisetum clandestinum*, *Psidium cattleianum*, *Rubus argutus* (prickly Florida blackberry), and *Setaria palmifolia* (palm grass) (Medeiros 2004, in litt.; Starr 2006, in litt.; HBMP 2008). Nonnative plants which pose the greatest threats to *O. haleakalae* on the island of Hawaii are *Aleurites moluccana* (kukui), *Clidemia hirta* (Kosters curse), *Hedychium coronarium* (white ginger), *Psidium cattleianum*, *Psidium guajava* (common guava), *Rubus rosifolius* (thimbleberry), *Setaria palmifolia* (palm grass), and *Toona ciliata* (Australian red cedar) (Perry 2006, DOFAW, in litt.; HBMP 2008).

Aleurites moluccana is a spreading tree 33 to 65 ft (10 to 20 m) tall, native to the region of Malesia, and considered a Polynesian introduction to Hawaii. It is now a significant component of the mesic valley vegetation from sea level to 2,300 ft (700 m) on all the main islands (Wagner et al. 1999, 598). This species favors moist valleys; however, it is now growing in seemingly totally inaccessible spots (Pacific Island Ecosystems at Risk (PIER) 2006a). The Hawaii Weed Risk Assessment Protocol places *A. moluccana* in the high risk category (PIER 2006a). We are unaware of any control methods for this species.

Asclepias physocarpa is native to South Africa and was originally introduced to Hawaii as a fiber crop, is naturalized in low elevation, dry habitats, occasionally up to 6,000 ft (1,830 m) on all islands except Niihau and Molokai (Wagner et al. 1999, p. 240). The plumed seeds are wind-dispersed (PIER 2011). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Cestrum diurnum is a tall shrub native to the West Indies, cultivated for its fragrant flowers, and is now naturalized on Kauai, Oahu, and Molokai. This species invades dry and wet areas and forms dense thickets. Seeds are dispersed by birds; however the seeds are poisonous to humans and other mammals (Florida Exotic

Pest Plant Council 2006). We are unaware of any control methods for this species although herbicide has been shown to control other *Cestrum* spp. (University of Hawaii 2013).

Clidemia hirta is a noxious shrub first cultivated in Wahiawa on Oahu before 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. 64). 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 a terminal growth-feeding insect (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989, p. 189).

Fraxinus uhdei is a tree up to 92 ft (28 m) tall, native to central and southern Mexico and introduced to Hawaii by the thousands in the 1900s as forestry plantings (Wagner et al. 1999, p. 991). This species disrupts native habitat due to copious seed production, prolific seedling recruitment, rapid early growth, and shade tolerance (Tunison 1991, p. 1). It forms single species stands, and can spread downstream and down slope from plantings. The Pacific Island Ecosystems at Risk (PIER) species risk analysis places *F. uhdei* in the high risk category (PIER 2009). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Hedychium coronarium is native to India and favors wet habitats including rainforest, moist forest, roadsides, open areas, and sides of streams. In Hawaii it is frequently cultivated and naturalized in mesic forest (Wagner et al. 1999, p. 1,622). Its creeping growth overwhelms low-growing plants in pastures and forests (Motooka et al. 2002). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Pennisetum clandestinum is from tropical eastern Africa and is found on all major Hawaiian Islands from 1,640 to 6,560 ft (500 to 2,000 m) in dry and mesic habitats. It will also invade wet environments when the forest is disturbed (Smith 1985, pp. 197-198). *P. clandestinum* is one of the most serious pest species threatening native vegetation; its smothering, thick, dense growth prevents virtually any new seedling establishment (Holm et al. 1977; OConnor 1999, pp. 1,578-1,579). 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, p. 200; Wagner et al. 1999). A biological control agent, *Tectococcus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve on the island of Hawaii (ScienceDaily 2008).

Psidium guajava, a small shrub or tree native to the Neotropics, is naturalized in Hawaii and forms dense stands in disturbed forest. It is not as common as *P. cattleianum*. The seeds are spread by feral pigs and alien birds (Wagner et al. 1999, p. 972). Extensive stands of young trees must be controlled through burning, as cutting results in regrowth with multiple stems. Regeneration from underground parts by suckering limits the effectiveness of manual control. Trees grown from seed produce fruit in 2 to 4 years, with a life expectancy of 30 to 40 years (Global Invasive Species Database 2006a). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

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 (Tunison 1991, p. 2). *R. argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Tunison 1991, p. 2; Wagner et al. 1999, pp. 1,107). This taxon grows via runners underground, and readily resprouts from them if above ground tissue is treated with herbicide (U.S. Army 2006, pp. 21-22). Biological controls were

introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986, entire).

Rubus rosifolius is native to Asia and is common in Hawaii in disturbed mesic to wet forest on all of the main islands (Wagner et al. 1999, p. 1,110). 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 *R. fruticosus* (blackberry), which is a related species, may be applicable (PIER 2006b; Global Invasive Species Database 2006b).

Setaria palmifolia is native to tropical Asia and was first collected on Hawaii Island in 1903 (O'Connor 1999, pp. 1,592-1,593). A large-leafed perennial herb, this species attains about 6.5 ft (2 m) in height at maturity, shading out native vegetation. *S. palmifolia* is resistant to fire and recovers quickly after being burned. Feral animals provide new opportunities for establishment by disturbing and opening areas in native vegetation (Cuddihy and Stone 1990, pp. 82-83). Chemical control methods are used currently, and no known biocontrol research is being conducted for this species (Motooka et al. 2003).

Toona ciliata is a fast-growing tree, 66 to 98 ft (20 to 30 m) tall. It is native to India, southeastern Asia, and Australia, and is cultivated as a timber tree (Koala Native Plants 2006). In Hawaii it was first collected on Oahu in 1929, and was extensively planted. *T. ciliata* is a well-branched shade tree with an open spreading crown. It has wind-dispersed seeds and is naturalized in mesic to wet disturbed habitats on Maui, Hawaii, Kauai, Oahu and Lanai (Wagner et al. 1999, p. 920). We are unaware of any control methods for this species beyond herbicide application (BioNET-EAFRINET 2013).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total current native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 of those species are considered pests (Smith 1985, p. 180; Wagner et al. 1999). Confirmed personal observations (HBMP 2008) and several studies (Cuddihy and Stone 1990, p. 74; Wood and Perlman 1997, p. 18; Robichaux et al. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *O. haleakalae*. Competition may be for space, light, water, or nutrients, or they may produce a chemical that inhibits the 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 (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, p. 73). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to that of *O. haleakalae*, the FWS believes nonnative plant species are a threat to this species.

Conservation Measures Planned or Implemented :

A population of approximately 15 wild trees and 123 outplanted individuals has been fenced and is being managed on private lands in Auwahi on Maui (USGS-BRD 2006; Medeiros 2007, in litt.). Two populations are fenced and managed on the island of Hawaii: one population of 3 wild trees is in the Hilo FR (Laupahoehoe section) (Agorastos 2007, pers. comm.), and the other is a reintroduced population of more than 100 trees at Hawaii Volcanoes National Park; however, survivorship of these outplants is unclear (Pratt 2005, in litt. and 2011, in litt.; Conry 2012, in litt.). Nonnative plant control is ongoing within all of the protected areas (Pratt 2006, in litt.; USGS-BRD 2006; Agorastos 2007, pers. comm.). There has also been extensive reintroduction into Laupahoehoe Natural Area Reserve and FR (Agorastos 2011, in litt.).

This species is represented in an ex situ collection at the Volcano Rare Plant Facility and seeds are in refugia

at Lyon Arboretum Seed Storage Lab (FWS 2005; Volcano Rare Plant Facility 2008; Lyon Arboretum Seed Bank Inventory 2008; Conry 2012, in litt.).

Summary of Threats :

Based on our evaluation of habitat degradation and loss by feral pigs, goats, and cattle, and by the potential for habitat loss due to fire, and competition with 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 *Ochrosia haleakalae* due to fire and competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs, goats, and cattle are potential threats to *O. haleakalae*. 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 :

Protect all individuals from feral pigs, goats, and cattle by removing these species from areas where *O. haleakalae* 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.
 Protect populations from fire by removing nonnative grasses.
 Conduct field surveys for additional populations in suitable *O. haleakalae* habitat.
 Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
 Propagate and maintain genetic stock.

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, and cattle that degrade and destroy habitat. Two of the largest populations of this species are highly threatened by fire and nonnative plants, such as *Pennisetum clandestinum*. Three populations of outplanted individuals are protected from ungulates and nonnative plants (Pratt 2006, in litt.; USGS-BRD 2006; Agorastos 2007, pers. comm.). Nonnative species add to the fuel load, replace native species after fire, and compete with *Ochrosia haleakalae* for light, space, and nutrients. Threats to the dry to mesic forest habitat of *O. haleakalae*, and to individuals of this species, occur throughout its range and are expected to continue or increase without protection from fire, control or eradication of non-native animals, and control of nonnative weeds.

Imminence :

Habitat degradation by feral pigs, goats, and cattle, and the potential for fire and competition with nonnative plants are imminent threats because they are ongoing. Possible predation by feral ungulates is considered non-imminent.

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. In addition, three populations of *Ochrosia haleakalae* are benefiting from ungulate exclosure fencing and nonnative plant control. 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 *O. haleakalae* 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, and was updated by personal communication with Arthur Medeiros, USGS-BRD in 1995 and 1999. The form has also been updated with information from a FWS-funded survey by the National Tropical Botanical Garden in 1995. We have incorporated additional information on this species from our files and the most recent supplement to the Manual of Flowering Plants of Hawaii (Wagner and Herbst 2003). In 2006, the Pacific Islands office contacted the following species experts: Forest Starr from Pacific Islands Ecosystems at Risk and Lyman Perry from the Hawaii Division of Forestry and Wildlife (DOFAW). New status and range information was provided in 2007 by Patty Moriysau, Volcano Rare Plant Facility; Nick Agorastos, Hawaii Division of Forestry and Wildlife; and Art Medeiros, USGS-BRD; and was incorporated into this assessment. In 2008 new status and range information was received from Hank Oppenheimer, Plant Extinction Prevention Program, for populations on Maui. In 2009 we received no new information, and in 2010, we received new information from Nick Agorastos, DOFAW. In 2011, we contacted the species experts listed below and received new information from Nick Agorastos from DOFAW and Linda Pratt of the USGS-BRD. 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.G.S., 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) (Bruegmann and Caraway 2003). *Ochrosia haleakalae* 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. We received information on April 12, 2013, and incorporated it into this form.

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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:



06/13/2013

Date

Concur:



10/28/2013

Date

Did not concur:

Date

Director's Remarks: