

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

Scientific Name:

Kadua haupuensis

Common Name:

Lead region:

Region 1 (Pacific Region)

Information current as of:

06/23/2014

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

Petitioned

90-Day Positive:

12 Month Positive:

Did the Petition request a reclassification?

For Petitioned Candidate species:

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

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

Explanation of why precluded:

Historical States/Territories/Countries of Occurrence:

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

Current States/Counties/Territories/Countries of Occurrence:

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

Land Ownership:

Private (Kipu Ranch).

Lead Region Contact:

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Lead Field Office Contact:

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

Biological Information

Species Description:

Kadua haupuensis is a subdioecious shrub that grows between 1 and 1.5 meters (m) (3.3 to 4.9 feet (ft)) tall with erect, brittle stems and terete, glabrous branchlets with the exception of minutely puberulent nodes.

Older branches are brown with longitudinally fissured bark. Leaves are oblong to lanceolate or lanceolate-ovate and abaxially glabrous or sparsely hirtellous, more densely so on costa. Leaves have conspicuous tertiary reticulate veins. Leaves are 3 to 11.5 centimeters (cm) (1 to 4.5 inches (in)) by 0.7 to 3.2 cm (0.3 to 1.3 in). Petioles are 0.2-1.6 cm (0.1-0.6 in) long and narrowly winged. Stipules are externally glabrous with sheaths. Inflorescence are cymose to paniculiform, with leaf-like bracts. *K. haupuensis* has green with purple tint flowers with a four lobed calyx, lobes are linear-oblong to linear-oblong. Pistillate and staminate plants have sporadic hermaphroditic flowers. *K. haupuensis* produces numerous brown or blackish seeds (Lorence et al. 2010, pp. 137-144).

Taxonomy:

Kadua haupuensis is recognized as a distinct taxon by Lorence et al. (2010, pp. 137-144).

Habitat/Life History:

Kadua haupuensis occurs just below and along the cliffline in an isolated area on the northern face of Mt. Haupu, on southern Kauai between 300 and 500 m (984 and 1640 ft) elevation, in the lowland mesic ecosystem (Lorence et al. 2010, pp. 137-144).

Historical Range/Distribution:

Kadua haupuensis is relatively new described species (2010), and is known from one small occurrence on the north face of Mt. Haupu, on the island of Kauai (on Kipu Ranch) ((Lorence et al. 2010, pp. 137-144).

Current Range Distribution:

Currently, there are no known extant individuals of *Kadua haupuensis*. There are 11 cultivated individuals of this species, seeded from the fruits collected from the original 7 plants, at the National Tropical Botanical Gardens, on the island of Kauai.

Population Estimates/Status:

Originally in 2010, there were 7 individuals of *Kadua haupuensis*; however, subsequent attempts to relocate this species have been unsuccessful. Currently, there are no known extant individuals of *Kadua haupuensis*; although it is believed by experts that there may be extant individuals that have not yet been observed, although in very low numbers. *Kadua haupuensis* is being cultivated at the National Tropical Botanical Gardens on Kauai and is expected to be outplanted in the future for the purpose of reestablishing an extant population. In addition, scientific research directed toward specific species in Hawaii is limited because of their rarity and the generally challenging logistics associated with conducting field work in Hawaii (e.g., areas are typically remote, difficult to survey in a comprehensive manner, and the target species are exceptionally uncommon).

Threats

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

We acknowledge that the specific natures of the threats to individual native Hawaiian plant species are not completely understood. Scientific research directed toward native Hawaiian species is limited because of their rarity and the challenging logistics associated with conducting field work in Hawaii (e.g., areas are typically remote, difficult to access and work in, and expensive to survey in a comprehensive manner).

However, there is information available on many of the threats that act on Hawaiian ecosystems, and, for some ecosystems, these threats are well studied and understood. Each of the native species that occur in Hawaiian ecosystems suffers from exposure to those threats to differing degrees. For the purposes of our candidacy determination, our assumption is that the threats that act at the ecosystem level also act on each of the species that occur in those ecosystems. Some native Hawaiian species, including the plant *Kadua haupuensis*, are components of the native ecosystems that have shown declines in number of individuals, number of occurrences, or changes in species abundance and species composition that can be reasonably attributed to the threats discussed below.

The Hawaiian Islands are located over 2,000 mi (3,200 km) from the nearest continent. This isolation has allowed the few plants and animals that arrived in the Hawaiian Islands to evolve into many highly varied and endemic species (species that occur nowhere else in the world). The only native terrestrial mammals in the Hawaiian Islands are two bat taxa, the extant Hawaiian hoary bat (*Lasiurus cinereus semotus*) and an extinct, unnamed insectivorous bat (Ziegler 2002, p. 245). The native plants of the Hawaiian Islands, therefore, evolved in the absence of mammalian predators, browsers, or grazers. As a result, many of the native species have lost unneeded defenses against threats such as mammalian predation and competition with aggressive, weedy plant species that are typical of continental environments (Loope 1992, p. 11; Gagne and Cuddihy 1999, p. 45; Wagner et al. 1999d, pp. 36). For example, Carlquist (in Carlquist and Cole 1974, p. 29) notes that Hawaiian plants are notably free from many characteristics thought to be deterrents to herbivores (toxins, oils, resins, stinging hairs, coarse texture).

Native Hawaiian plants are therefore highly vulnerable to the impacts of introduced mammals and alien plants. In addition, species restricted and adapted to highly specialized locations (e.g., *Kadua haupuensis*) are particularly vulnerable to changes (e.g., nonnative species, hurricanes, fire, and climate change) in their habitat (Carlquist and Cole 1974, pp. 2829; Loope 1992, pp. 36; Stone 1992, pp. 88102).

The following constitutes a list of ecosystem-scale threats that may affect *Kadua haupuensis* in the lowland mesic ecosystem on Kauai:

(1) Foraging and trampling of native plants by goats (*Capra hircus*), pigs (*Sus scrofa*) and black-tailed deer (*Odocoileus hemionus*), which results in severe erosion of watersheds because these mammals inhabit terrain that is often steep and remote (Cuddihy and Stone 1990, p. 63; Wood 2011, p. 98). These events destabilize soils that support native plant communities, bury or damage native plants, and have adverse water quality effects due to runoff over exposed soils;

(2) Disturbance of soils by feral pigs, which creates fertile seedbeds for alien plants (Cuddihy and Stone 1990, p. 65);

(3) Increased nutrient availability as a result of pigs rooting in nitrogen-poor soils, which facilitates the establishment of alien weeds. Alien weeds are more adapted to nutrient rich soils than native plants (Cuddihy and Stone 1990, p. 63), and rooting activity creates open areas in forests allowing alien species to completely replace native stands;

(4) Ungulate destruction of seeds and seedlings of native plant species (Cuddihy and Stone 1990, p. 63), which facilitates the conversion of disturbed areas from native to nonnative vegetative communities;

(5) Rodent damage to plant propagules, seedlings, or native trees, which changes forest composition and structure (Cuddihy and Stone 1990, p. 67; Wood 2011, p. 98);

(6) Feeding or defoliation of native plants from alien insects, which reduces geographic ranges of some species because of damage (Cuddihy and Stone 1990, p. 71);

(7) Alien insect predation on native insects, which affects pollination of native plant species (Cuddihy and Stone 1990, p. 71);

(8) Significant changes in nutrient cycling processes because of large numbers of alien invertebrates such as earthworms, ants, slugs, isopods, millipedes, and snails, resulting in the changes to the composition and structure of plant communities (Cuddihy and Stone 1990, p. 73); and

(9) competition and displacement by nonnative plants (e.g., competition for water, nutrients, light and space; allelopathy (chemical inhibition of other plants; or even the alteration of entire ecosystems by forming monotypic stands, changing fire characteristics of native communities, altering soil-water regimes, changing nutrient cycling, or encouraging other nonnative organisms) (Smith 1985, pp. 180-250; Vitousek et al. 1987 in Cuddihy and Stone 1990, p. 74).

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. 95) concluded that *Kadua haupuensis* 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 at this time.

C. Disease or predation:

None known at this time.

D. The inadequacy of existing regulatory mechanisms:

The capacity of Federal and State agencies and their nongovernmental partners in Hawaii to mitigate the effects of introduced pests, such as ungulates and weeds, is limited due to the large number of taxa currently causing damage (Coordinating Group on Alien Pest Species (CGAPS) 2009). Many invasive weeds established in the Hawaiian Islands have currently limited but expanding ranges and are of concern. Although additional funding has recently been approved by the State legislature for the Hawaii Invasive Species Committee (HB1716), resources available to reduce the spread of these species and counter their negative ecological effects are still quite limited. Control of established pests is largely focused on a few invasive species that cause significant economic or environmental damage to public and private lands. Comprehensive control of an array of invasive pests and management to reduce disturbance regimes that favor certain invasive species remains limited in scope. If current levels of funding and regulatory support for invasive species control are maintained on Kauai, the Service expects existing programs to continue to exclude or, on a very limited basis, control invasive species only in high-priority areas. Threats from established pests (e.g., nonnative ungulates, weeds, and invertebrates) are ongoing and expected to continue into the future.

Currently, four agencies are responsible for inspection of goods arriving in Hawaii (CGAPS 2009). The Hawaii Department of Agriculture (HDOA) inspects domestic cargo and vessels, and focuses on pests of concern to Hawaii, especially insects or plant diseases not yet known to be present in the State (HDOA 2009). The U.S. Department of Homeland Security-Customs and Border Protection (CBP) is responsible for inspecting commercial, private, and military vessels and aircraft, and related cargo and passengers arriving from foreign locations. Customs and Border Protection focuses on a wide range of quarantine issues involving non-propagative plant materials (processed and unprocessed); wooden packing materials, timber,

and products; internationally regulated commercial species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); seeds and plants listed as noxious; soil; and pests of concern to the greater United States, such as pests of mainland U.S. forests and agriculture. The U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Plant Protection and Quarantine (USDA-APHIS-PPQ) inspects propagative plant material, provides identification services for arriving plants and pests, conducts pest risk assessments, trains CBP personnel, conducts permitting and preclearance inspections for products originating in foreign countries, and maintains a pest database that, again, has a focus on pests of wide concern across the United States. The Service inspects arriving wildlife products, with the goal of enforcing the injurious wildlife provisions of the Lacey Act (18 U.S.C. 42; 16 U.S.C. 3371 et seq.), and CITES.

The State of Hawaii's unique biosecurity needs are not recognized by Federal import regulations. Under the USDA-APHIS-PPQs commodity risk assessments for plant pests, regulations are based on species considered threats to the mainland United States and do not address many species that could be pests in Hawaii (Hawaii Legislative Reference Bureau (HLRB) 2002, pp. 1109; USDA-APHIS-PPQ 2010, pp. 188; CGAPS 2009, pp. 114). Interstate commerce provides the pathway for invasive species and commodities infested with non-Federal quarantine pests to enter Hawaii. Pests of quarantine concern for Hawaii may be intercepted at Hawaiian ports by Federal agents, but are not always acted on by them because these pests are not regulated under Federal mandates. Hence, Federal protection against pest species of concern to Hawaii has historically been inadequate. It is possible for the USDA to grant Hawaii protective exemptions under the Special Local Needs Rule, when clear and comprehensive arguments for both agricultural and conservation issues are provided; however, this exemption procedure operates on a case-by-case basis. Therefore, that avenue may only provide minimal protection against the large diversity of foreign pests that threaten Hawaii.

Adequate staffing, facilities, and equipment for Federal and State pest inspectors and identifiers in Hawaii devoted to invasive species interdiction are critical biosecurity gaps (HLRB 2002, pp. 114; USDA-APHIS-PPQ 2010, pp. 188; CGAPS 2009, pp. 114). State laws have recently been passed that allow the HDOA to collect fees for quarantine inspection of freight entering Hawaii (e.g., Act 36 (2011) H.R.S. 150A5.3). Legislation passed and enacted on July 8, 2011 (H.B. 1568), now requires commercial harbors and airports in Hawaii to provide biosecurity and inspection facilities to facilitate the movement of cargo through the ports. This enactment is a significant step toward optimizing the biosecurity capacity in the State of Hawaii; however, only time will determine the true effectiveness of this Act (Act 202(11)). From a Federal perspective, there is a need to ensure that all civilian and military port and airport operations and construction are in compliance with the Act. The introduction of new pests to the State of Hawaii is a significant risk to federally listed species.

On the basis of the above information, existing State and Federal regulatory mechanisms are not adequately preventing the introduction of nonnative species to Hawaii via interstate and international mechanisms, or intrastate movement of nonnative species between islands, and watersheds, and thus do not adequately protect native plants from the threat of new introductions of nonnative species, or from and the continued expansion of nonnative species populations on and between islands and watersheds. Nonnative species may prey upon, modify, or destroy habitat, or directly compete with native species for food, space, and other necessary resources. The impacts from these introduced threats are ongoing and are expected to continue into the future.

The State of Hawaii provides game mammal (feral pigs, goats, cattle, sheep, and mouflon sheep) hunting opportunities on over 100 State-designated public hunting areas, which includes lands in State Forest Reserves (FR) and Natural Area Reserves (NAR) (H.A.R. 13-123; Mello 2011, pers. comm.). The States management objectives for game animals range from maximizing public hunting opportunities (e.g., sustained yield) in some areas to removal by State staff, or their designees, in other areas (H.A.R. 13-123). Often, endemic Hawaiian plants occur in areas where terrestrial habitat may be manipulated for game enhancement and where game populations are maintained at prescribed levels using public hunting (H.A.R. 13123). Public hunting areas are not fenced, and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land-use designation. While fences are sometimes built to

protect areas from game mammals, the current number and locations of fences are not adequate to prevent habitat degradation and destruction for many threatened and endangered species. However, the State game animal regulations are not designed nor intended to provide habitat protection, and there are no other regulations designed to address habitat protection from ungulates.

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

Kadua haupuensis is threatened by small number of individuals and populations. Species that are endemic to single islands or small island groups are inherently more vulnerable to extinction than are widespread species, because of the increased risk of genetic bottlenecks, random demographic fluctuations, climate change effects, and localized catastrophes such as hurricanes, drought, rockfalls, landslides, and disease outbreaks (Pimm et al. 1988, p. 757; Mangel and Tier 1994, p. 607). These problems are further magnified when populations are few and restricted to a very small geographic area, and when the number of individuals in each population is very small. Populations with these characteristics face an increased likelihood of stochastic extinction due to changes in demography, the environment, genetics, or other factors (Gilpin and Soule 1986, pp. 2434). Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (e.g., Barrett and Kohn 1991, p. 4; Newman and Pilson 1997, p. 361). Very small, isolated populations are also more susceptible to reduced reproductive vigor due to ineffective pollination, inbreeding depression, and hybridization. The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats (e.g., nonnative plants and animals, drought, or fire).

Conservation Measures Planned or Implemented :

Mature fruits with seeds were collected upon initial discovery of this species. Currently, *K. haupuensis* is being cultivated at the National Tropical Botanical Gardens on Kauai and is expected to be outplanted in the future for the purpose of reestablishing an extant population (Lorence et al. 2010, pp. 137-144).

Summary of Threats :

Introduced, nonnative animals damage and destroy plants and seeds, modify habitat, create habitat more conducive to alien plant introductions, and spread nonnative plant seeds. Nonnative plants displace and outcompete native species. We therefore consider introduced, alien plants and animals to be a serious and ongoing threat to *Kadua haupuensis*, exacerbated by the continued inadequacy of existing protective regulations. In addition, we consider the threat from limited number of populations and few (less than 100) individuals to be a serious and ongoing threat to the *Kadua haupuensis* because (1) this species may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression; (2) this species may experience reduced levels of genetic variability, leading to diminished capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence; and (3) a single catastrophic event may result in extirpation of remaining populations and extinction of the species. Climate change may pose a threat to the ecosystems that support this species, thus exacerbating the effects of the aforementioned threats. These threats apply to the entire range of this species.

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 :

Continue to survey for populations of *Kadua haupuensis* in areas of potentially suitable habitat.

Continue propagation efforts for maintenance of genetic stock.
 Reintroduce individuals into suitable habitat within historic range that is being managed for additional known threats (e.g., nonnative animals and plants) 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 low number of individuals (see Factor E, above).

Imminence :

The threats to *Kadua haupuensis* associated with low number of individuals are considered imminent because they are ongoing.

 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, individuals of *Kadua haupuensis* will benefit from conservation actions initiated by the Hawaii Plant Extinction Prevention Program, funded in part by the FWS. These conservation actions may include monitoring, propagation, and outplanting. 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 *Kadua haupuensis* 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 data collected by the Hawaii Plant Extinction Prevention Program. In addition, we incorporated additional information on this species from our files and the Manual of Flowering Plants of Hawaii (Wagner et al. 1999, p. 1218).

List all experts contacted in 2014:

Name Date Affiliation

Yoshioko, Joan 04/10/14 Plant Extinction Prevention Program Coordinator

Bakutis, Ane 04/10/14 Plant Extinction Prevention Program, Molokai

Ching, Susan 04/10/14 Plant Extinction Prevention Program, Oahu

McDowell, Wendy 04/10/14 Plant Extinction Prevention Program, Kauai

Oppenheimer, 04/10/14 Plant Extinction Prevention Program, Maui Nui

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

none

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

Hawaii

State Coordination:

The most recent data for this species was received from PEPP on April 10, 2014. PEPP is a multi-agency (including State) program operated by the University of Hawaii that functions to prevent extinction of Hawaii's rarest and most threatened plants. This assessment contains the most recent available information on *Kadua haupuensis*.

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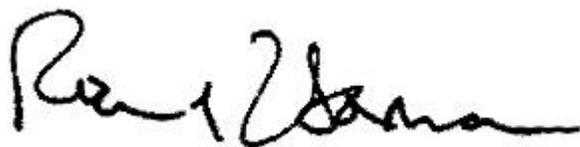
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Approval/Concurrence:

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: