5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Caesalpinia kavaiensis* (uhiuhi)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2013. Endangered and threatened wildlife and plants; Initiation of 5-year status reviews of 44 species in Oregon, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 78(24):8185-8187.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer(s):

Chelsie Javar-Salas, Plant Biologist, PIFWO

Marie Bruegmann, Plant Recovery Coordinator, PIFWO

Kristi Young, Programmatic Deputy Field Supervisor, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on March 4, 2013. The review was based on a review of current, available information since the last 5-year review for *Caesalpinia kavaiensis* (USFWS 2010). The evaluation by Chelsie Javar-Salas, Plant Biologist, was reviewed by the Plant Recovery Coordinator. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

Background:

For information regarding the species listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species at: *http://ecos.fws.gov/tess_public*.

Review Analysis:

Please refer to the previous 5-year review for *Caesalpinia kavaiensis* published on August 27, 2010 (available at: *https://ecos.fws.gov/docs/five_year_review/doc3823.pdf*) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of *C. kavaiensis*.

This medium-sized tree in the pea family (Fabaceae) is endangered and was known historically from the islands of Kauai, Oahu, Lanai, Maui, and Hawaii (USFWS 1996). The status and trends for *Caesalpinia kavaiensis* are provided in the tables below.

New taxonomic changes:

The 2012 supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner *et al.* 2012) recognizes and accepts the taxonomic change for *Caesalpinia kavaiensis* to *Mezoneuron kavaiense*. In 2012, USFWS proposed to revise the taxonomic status for

this species when it proposed to designate critical habitat on Hawaii Island (USFWS 2012). The proposed change will recognize *C. kavaiensis* with the new name of *Mezoneuron kavaiense.* The range of the species has not changed with this taxonomic revision. The recognition and official taxonomic change by USFWS of *M. kavaiense* was finalized in the final rule for the determination of endangered species status for 15 species on Hawaii Island (USFWS 2013). This species is now listed as *Mezoneuron kavaiense* and addressed as such for the remainder of this review.

New threats:

- Invasive species degradation of habitat – Established invasive plant species competition – The reintroduced population on Lanai is threatened by *Ageratina adenophora* (Maui pamakani), *Ageratina riparia* (Hamakua pamakani), *Buddleja asiatica* (dog tail), *Cinnamomum burmannii* (Padang cassia), *Leptospermum scoparium* (New Zealand tea tree), *Morella faya* (fire tree), and *Rubus rosifolius* (Plant Extinction Prevention Program [PEPP] 2013, 2015a, b).
- Landslides and flooding loss or degradation of habitat – Erosion is a threat to this species on Oahu (PEPP 2010), Kauai (PEPP 2013), and Lanai (PEPP 2015b).
- Slug herbivory – On Lanai, herbivory by slugs were reported as a threat (PEPP 2015b).
- Invertebrate predation or herbivory – The white fly (unknown species) and cottony cushion scale (*Icerya purchasi*) are a threat to this species in North Kona and may lead to the death of young plants if not controlled (J. Wagner, Future Forests Nursery, pers. comm. 2015).

New status information:
On Kauai and Oahu, *Mezoneuron kavaiense* is categorized as Rare on Island (ROI) and is monitored by the Plant Extinction Prevention Program (2012). On Hawaii Island, the numbers exceed 50 individuals in the wild and, thus; this species is not a priority.

On Kauai, the species was rediscovered during a survey in Waimea Canyon by Natalia Tangalin and Emory Griffin-Noyes of the National Tropical Botanical Garden (PEPP 2012). A single large tree was found in flower and containing seedpods (National Tropical Botanical Garden 2015a).

On Oahu, there are two populations containing a total of five wild mature individuals and two seedlings of *Mezoneuron kavaiense* (PEPP 2011). In 2012, there were only four wild mature individuals (PEPP 2012). As of 2014, only three out of the twelve wild individuals are known from East Makaleha and one wild individual remains at Manuwai on Oahu (USFWS 2014). A reintroduced population protected in a 1-acre fenced unit contains a single individual on Oahu (USFWS 2014).

The species is extirpated from the island of Lanai; however, two individuals have been reintroduced into a fenced exclosure (Plant Extinction Prevention Program [PEPP] 2012).

On Hawaii Island, there were three wild populations containing 75 individuals of *Mezoneuron kavaiense* (PEPP 2009, 2010). Surveys conducted between 2003 and 2007

at Puu Waawaa discovered 48 individual records of *M. kavaiense* on State owned lands (State of Hawaii Department of Land and Natural Resources [DLNR] 2015). A total of 254 individuals were reintroduced at Puu Waawaa from 2013 to 2015 (DLNR 2014a). There are seven wild mature individuals and seven immature naturally regenerated individuals at Kealakehe. There are six wild mature individuals located on private lands in North Kona with 77 reintroduced individuals (J. Wagner, pers. comm. 2015). At Waikoloa in South Kohala, there are 11 wild mature individuals and 15 wild immature individuals of *M. kavaiense* on private property (J. Lawson, pers. comm. 2015). There are an additional 189 reintroduced individuals at Waikoloa (184 immature and 5 mature individuals). Currently, *M. kavaiense* is found in six occurrences totaling 72 mature wild and 22 immature wild individuals on Hawaii Island.

There are approximately 11 occurrences containing 99 wild individuals (77 mature and 22 immature) and 535 reintroduced individuals (6 mature and 529 immature) of *Mezoneuron kavaiense* on Kauai, Oahu, Lanai, and Hawaii.

Overall, the numbers of individuals have increased from the approximately 70 to 80 individuals reported in the previous 5-year review to approximately 99 mature wild individuals in 2015. The numbers of reintroduced individuals have also increased from the approximately 149 individuals reported in the previous 5-year review to approximately 535 individuals in 2015.

New management actions:

- Surveys / inventories – In 2011, a survey of Waimea Canyon discovered a single wild mature individual of *M. kavaiense* (PEPP 2012).
- Ungulate monitoring and control
    - Fenced exclosures at Puu Waawaa were monitored for the presence of ungulates (DLNR 2014b).
    - The Waikoloa Dry Forest Initiative fenced 275 acres of dry forest habitat that protects nine of the 11 mature wild individuals of *M. kavaiense* from feral goats (J. Lawson, Waikoloa Dry Forest Initiative, pers. comm. 2015). Three of the wild individuals of *M. kavaiense* are located outside of the preserve; however, small-scale fencing to protect these individuals is planned as future management actions.
    - On Kauai, the fence protecting the reintroduced population was monitored and evaluated for possible maintenance repairs in the future (PEPP 2013).
- Invasive plant monitoring and control
    - Nonnative weed control occurred monthly at the Hauaina exclosure at Puu Waawaa Forest Reserve (Parsons *et al*. 2014).
    - During 2013 to 2014 at the Hauaina Reservoir exclosure in Puu Waawaa, weeds removed around reintroduced plants included *Cenchrus setaceus* (fountain grass), *Lantana camara* (lantana), *Ricinus communis* (castor bean), and *Chenopodium murale* (nettleleaf goosefoot) (DLNR 2014b). Small invasive tree seedlings were also removed including *Grevillea robusta* (silver oak), *Schinus molle* (pepper tree), *Olea europaea* subsp. *europaea* (European olive), and *Jacaranda*

mimosifolia (jacaranda) (DLNR 2014b). At the Uhiuhi 1/wiliwili exclosure, all invasive *Nicotiana glauca* (tree tobacco) was removed (DLNR 2014b).
    - Nonnative weeds were controlled at a new reintroduction site on Lanai containing two plants (PEPP 2013). Manual and chemical weed control continued at the site in 2015 (PEPP 2015a, b).
    - Weeds were controlled at the Manuwai population on Oahu (PEPP 2012).
    - The reintroduced population in Waimea Canyon on Kauai was controlled for nonnative weeds (PEPP 2013). Nonnative weed control efforts continued in 2014 (PEPP 2014).
    - Invasive grasses and other nonnative weeds are managed around existing *M. kavaiense* trees at Waikoloa (J. Lawson, pers. comm. 2015)
- Captive propagation for genetic storage and reintroduction
    - The Volcano Rare Plant Facility (2014) has more than 1,400 seeds in storage from Puu Waawaa. The Facility propagated 78 individuals for reintroduction at Puu Waawaa in 2014. The Facility has a single individual propagated for reintroduction in 2015.
    - The Lyon Arboretum's Seed Conservation Laboratory (2014) has 3,800 seeds in storage representing four islands.
    - The National Tropical Botanical Garden (2014) has three plants growing in their gardens and has more than 800 seeds in storage from the islands of Kauai, Hawaii, and Oahu.
    - The Maui Nui Botanical Garden (2014) has 105 seeds in storage collected from cultivated plants from two accessions.
    - The Olinda Rare Plant Facility (2014) has 10 plants growing in their nursery.
    - The Pahole Rare Plant Facility (2014) has 10 plants growing in their nursery.
    - The Waimea Valley (2014) has 21 plants in their garden representing the islands of Hawaii and Oahu.
    - The National Tropical Botanical Garden (2015b) Limahuli Preserve has a single individual in their garden.
- Reintroduction / translocation
    - In 2012, two individuals of *M. kavaiense* were reintroduced on Lanai within a fenced exclosure (PEPP 2012). In 2013, an additional 10 individuals were reintroduced (PEPP 2013).
    - On Kauai, six plants propagated from seeds collected from the rediscovered individual were reintroduced into a fenced exclosure (PEPP 2014).
    - At Puu Waawaa Forest Reserve within two fenced exclosures, 207 individuals of *M. kavaiense* were reintroduced (DLNR 2014b, c).
- Population viability monitoring and analysis
    - On Oahu, four individuals of *M. kavaiense* were observed at the Pahole reintroduction site in 2009 (PEPP 2009).
    - In 2009, four individuals were monitored at East Makaleha on Oahu (PEPP 2009). In 2010, only three individuals were observed and monitored, with one individual noted as dead (PEPP 2010). Seedpods were collected from a single wild individual in February 2010 (PEPP 2010). The population containing three wild individuals was monitored in 2011 and seedpods were collected (PEPP 2011, 2012).

- The population at Manuwai on Oahu containing a single wild mature individual and two seedlings was monitored in 2011 (PEPP 2011). The population was revisited in 2012 and seeds were collected from a single individual (PEPP 2012).
- Seeds were collected from the single wild individual discovered on Kauai and distributed to the National Tropical Botanical Garden for propagation and genetic storage, as well as the State of Hawaii Department of Land and Natural Resources (DLNR). The single wild individual on Kauai was monitored in 2012 and seeds were collected and delivered to DLNR, Harold L. Lyon Arboretum Seed Conservation Laboratory, Lyon Arboretum Micropropagation Laboratory, and the National Tropical Botanical Garden (PEPP 2013).
- In 2013, the reintroduced population containing five plants was monitored in Waimea Canyon on Kauai (PEPP 2013). The population was monitored again in 2014 and an additional six individuals were reintroduced (PEPP 2014). There are now 12 individuals at this reintroduction site (PEPP 2014).
- In 2013, 11 of the 12 individuals were monitored at the reintroduced population on Lanai (PEPP 2013). *Pipturus albidus* (mamaki) was reintroduced at the site for habitat restoration purposes (PEPP 2013). In 2015, the two reintroduced populations containing a single individual each were monitored on Lanai (PEPP 2015a, b).
- *Mezoneuron kavaiense* seeds were collected from State lands in North Kona (DLNR 2014b).
- At Waikoloa, the wild individuals are visited quarterly, at the minimum, for regular health assessments and seed collection (J. Lawson, pers. comm. 2015). Reintroduced individuals are monitored annually.

- Reintroduced / translocated population management and monitoring – To address information gaps regarding reintroduction survival, performance, and causes of mortality, 478 native dryland plants from 18 species including *M. kavaiense* were reintroduced in 2011 and 2012 at Puu Waawaa Forest Reserve (Parsons *et al*. 2014). After one year of planting, all individuals were assessed for survival, reproduction, and growth. In addition, plants were assessed for the presence of aphids, scales, mealy bugs, ants, fungi, as well as exposed roots, dead branches or signs of herbivory. Eighty-four individuals of *M. kavaiense* were reintroduced for this project with a 31 percent survival rate after 16 to 28 months. *Mezoneuron kavaiense* was highly susceptible to aphids, scales, and mealy bugs with more than 65 percent of the reintroduced individuals reported to have dead branches following one year of reintroduction. The high presence of pests resulted in the decline in canopy cover and foliage over time.
- Stochastic events – Build resilience and redundancy – At the end of 2012, the wild individual at North Kona was watered twice with 2.5 gallons of water (Wagner 2014). The health of the plant improved with the emergent of new leaves and flowers.
- Climate change adaptation strategy – Fortini *et al*. (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i 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) concluded that *M. kavaiense* is moderately vulnerable to the impacts of climate change.

Therefore, additional management actions are needed to conserve this taxon into the future.

- Predator / herbivore monitoring and control
  - Rat traps were used to control rats (*Rattus* sp.) around individuals of *M. kavaiense* at Waikoloa and seeds are collected as soon as they mature to avoid predation by rats (J. Lawson, pers. comm. 2015).
  - The reintroduced population in Kauai was treated for black twig borer (PEPP 2014).
- Listing and critical habitat designation – On Hawaii Island, seven units of critical habitat were proposed in the lowland dry ecosystem for *M. kavaiense* (USFWS 2012). The final rule for critical habitat designations has not been published at the time of this review.

Synthesis:
Stabilizing and downlisting objectives are provided in the recovery plan for the *Caesalpinia kavaiensis* and *Kokia drynarioides* (USFWS 1994). No delisting criteria were identified in the recovery plan for this species. For *Mezoneuron kavaiense* to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*i.e.*, fenced and protected from fire) to protect the few remaining trees in the wild. In addition, the environmental factors which prevent this species' regeneration and dispersal must be addressed. This includes region-wide invasive plant control, feral ungulate control, and insect control.

The interim stabilization goals for this species have not been met as all threats (*i.e.*, fenced and protected from fire) are not being sufficiently managed throughout all of the populations (Table 2). The second objective has not been addressed as well which involves developing effective region-wide control methods, such as biological control for fountain grass and other invasive plants, feral ungulate control, and insect control. Therefore, *Mezoneuron kavaiense* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Surveys / inventories – Survey geographical and historical range for a current assessment of the species' status.
- Captive propagation for genetic storage and reintroduction
  - Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
  - Evaluate genetic resources currently in storage to determine the need to place additional genetic resources in long-term storage due to this species' vulnerability to climate change.
- Ungulate monitoring and control – Maintain existing exclosures and monitor for potential incursions.
- Invasive plant monitoring and control – Eradicate invasive introduced plants within ungulate exclosures and maintain exclosures free of invasive plants.
- Population viability monitoring and analysis – Continue monitoring wild and reintroduced individuals.

- Fire monitoring and control – Develop and implement a fire management plan for all existing exclosures.
- Climate change adaptation strategy – Research the suitability of habitat for reintroducing this species in the future due to the impacts of climate change.
- Alliance and partnership development – Initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

Table 1. Status and trends of *Mezoneuron kavaiense* from listing through current 5-year review.

Date	No. wild indivs	No. outplanted	Downlisting Criteria identified in Recovery Plan	Stability Criteria Completed?
1986 (listing)	>50	0	Regeneration adequate to replace individuals lost from population for at least 13 years	No
			Minimum habitat determined, current habitat secured and protected	No
			3 populations with 100 mature individuals each	Unknown
1994 (recovery plan)	>80	17	Regeneration adequate to replace individuals lost from population for at least 13 years	Partially
			Minimum habitat determined, current habitat secured and protected	Partially
			3 populations with 100 mature individuals each	No
2010 (5-yr review)	70-80	149	Regeneration adequate to replace individuals lost from population for at least 13 years	Partially
			Minimum habitat determined, current habitat secured and protected	Partially
			3 populations with 100 mature individuals each	No
2012 (critical habitat - proposed)	90-140 (Hawaii Island only)	n/a	Regeneration adequate to replace individuals lost from population for at least 13 years	Partially
			Minimum habitat determined, current habitat secured and protected	Partially
			3 populations with 100 mature individuals each	Partially

Date	No. wild indivs	No. outplanted	Downlisting Criteria identified in Recovery Plan	Stability Criteria Completed?
2015 (5-yr review)	99 (22 immature)	535	Regeneration adequate to replace individuals lost from population for at least 13 years	Partially
			Minimum habitat determined, current habitat secured and protected	Partially
			3 populations with 100 mature individuals each	No

Table 2. Threats to *Mezoneuron kavaiense* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, D, E	Ongoing	Partially, Puu Waawaa, Kaupulehu, Waikoloa, and Kealakehe are fenced
Invasive introduced plants	A, E	Ongoing	Partially, weeds controlled at Kapunakea and Puu Waawaa
Invertebrate predation or herbivory – black twig borer, white fly, cottony cushion scale	C	Ongoing	Partially, controlled at Kealakehe, private lands in North Kona; treated on Kauai
Rodent predation or herbivory – rats	C	Ongoing	Partially, snap traps at Waikoloa
Slug herbivory (Lanai)	C	Ongoing	None
Drought	E	Ongoing	Partially, irrigated
Fire	E	Ongoing	Partially, firebreak at Kealakehe
Landslides and erosion	E	Ongoing	None
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2010). Only references for new information are provided below.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Mezoneuron kavaiense* (uhiuhi)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

_____ Delisting
_____ Reclassify from Endangered to Threatened status
_____ Reclassify from Threatened to Endangered status
_X_ No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable:_____

for **Programmatic Deputy Field Supervisor, Pacific Islands Fish and Wildlife Office**

Maine M Bluegmann Date 2015-07-21