5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Pritchardia schattaueri* (loulu)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. Federal Register 88(83): 20088–20092, May 7, 2018.

Lead Region/Field Office:

Interior Region 12/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2019. The review was based on a review of current, available information since the last 5-year review for *Pritchardia schattaueri* (USFWS 2015). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

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 (*http://ecos.fws.gov/tess_public*).

Review Analysis:

Please refer to the previous 5-year reviews for *Pritchardia schattaueri* published in the Federal Register on June 2, 2009 and August 6, 2015 (available at *https://ecos.fws.gov/docs/five_year_review/doc2438.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4560.pdf*) for a complete review of the species' status, threats, management efforts, and references cited. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *P. schattaueri*.

This long-lived perennial tree in the Arecaceae (palm) family is endangered and found on the island of Hawai‘i. The current status and trends for *Pritchardia schattaueri* are provided in the tables below.

New Status Information:

- At the time of the 5-year review in 2015 there were an estimated 12 individuals of *Pritchardia schattaueri* in the South Kona area of the island of Hawai‘i. Hodel (2012, p. 141) also published that there were approximately 12 wild individuals, 10 of which were in one small population, with two separate plants more than one mile distant. Currently, it is likely these plants remain at the same locations.

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. 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 *Pritchardia schattaueri* is extremely vulnerable to the impacts of climate change, with a vulnerability score of 0.884 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). In addition, this species has no overlap between current and future climate envelopes, and is unlikely to tolerate expected changes in climate at its current location. This means that this species must persist within suitable microrefugia, or move to newly available climate-compatible areas to avoid extinction. Therefore, additional management actions are likely needed to conserve this taxon into the future, such as identifying suitable microsites where climate change is anticipated to occur more slowly and considering suitable habitat in areas outside of its known range.
- Invertebrate predation—In 2013, the nonnative coconut rhinoceros beetle (CRB, *Oryctes rhinoceros*) was discovered on O‘ahu and spread across the island within a few months (OISC 2018, in litt.). The CRB, a large scarab beetle about two inches long, is considered one of the most damaging insects to coconut and African oil palm trees in southern and southeast Asia, as well as to the western Pacific Islands, and could devastate populations of native and nonnative palm trees in Hawai‘i (OISC 2018, in litt.). The CRB bore into the crowns of palms where they feed on sap. When a beetle bores through developing leaves, those leaves grow out with distinctive V-shaped cuts. Adult beetles are active at night and can fly. Eggs are laid inside rotting coconut logs, mulch, or compost, and larvae develop to adults within four months, continuing the cycle. A rapid response team headed by Hawai‘i Department of Agriculture (with the USDA, University of Hawai‘i, U.S. Navy, and other partners) has set up pheromone traps island-wide, and capture and range delineation efforts are ongoing, along with funding for support services to control the CRB. If the CRB should be transported to the island of Hawai‘i, effects on the remaining endangered palms could be devastating.

New Management Actions:

- Surveys and inventories—PEPP continues to survey and monitor populations of *Pritchardia schattaueri* (PEPP 2017).

- Ungulate monitoring and control—PEPP constructed small exclosures to protect reintroduced individuals (PEPP 2017).
- Ecosystem-altering nonnative plant control—Nonnative plants are controlled within the Nature Conservancy's preserve (The Nature Conservancy of Hawai'i 2020, in litt.).
- Captive propagation for genetic storage and reintroduction—
    - Between 2015 and 2019, the Volcano Rare Plant Facility (VRPF) reported propagation of 240 plants representing 16 wild and reintroduced individuals from one location, and 66 plants representing five wild and reintroduced individuals at a second location. Currently, 200 of these from the first location remain in refugia (VRPF 2015–2019).
    - In 2019, Lyon Arboretum reported collection and storage of 73 fruit from three individuals of *Pritchardia schattaueri* in a living collection at Koko Crater Botanical Garden on Oahu (Lyon Arboretum 2019).
    - In 2019, the National Tropical Botanical Garden (NTBG) reported 11 plants (representing one founder) in a living collection at the Southshore Garden (NTBG 2019).
- Reintroduction and translocation—
    - PEPP reintroduced 100 individuals to a protected location (PEPP 2017).
    - From 2016 to 2019, the VRPF provided eight plants representing four wild individuals for reintroduction to two State Natural Area Reserves, and 180 plants representing 10 wild or reintroduced individuals to State and privately-managed areas (VRPF 2015–2019).
- Seed storage research—A study by Walters (2015, in litt.) was conducted to determine optimal seed bank storage methods for Hawaiian plants including the palm species *Pritchardia remota* and *P. aylmer-robinsonii*. The results of this study may also apply to *Pritchardia schattaueri.* The highest viability after stress challenges were achieved from embryos excised from fruits that are dark brown (older and drier) rather than green. Coloration of maturing fruits appears to be linked to the water content of the embryo, a measure of maturity in freshly harvested fruits. Embryos with more water are less likely to survive freezing temperatures associated with preparation for storage. Embryos kept within whole fruits can survive the initial stress of freezing if methods used for drying and use of liquid nitrogen are optimal, with 80 to 100 percent viability. Embryos are excised from larger fruits for better temperature control. In addition, removal of embryos saves on the storage space required and maintenance costs. Studies using fruit from *P. hillebrandia* are ongoing.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	12	> 122 in 1993 10 in 1996	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
1998 (recovery plan)	12	56; 68 remain	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2003 (critical habitat, not designated, not prudent)	1 mature 12 immature	Unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2009 (5-year review)	12	109	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2015 (5-year review)	12	518	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially

			3 populations with 25 mature individuals each	Partially
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2020 (5-year review)	12	Unknown (ca 288 planted)	All threats managed in all 3 populations	Partially, exclosures at some reintroduced populations
			Complete genetic storage	Complete
			Reproduction (i.e. viable seeds, seedlings) at all 3 populations	Yes, viable seeds
			3 populations with 25 mature individuals each	No

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second stage after Preventing Extinction).

Table 2. Threats to *Pritchardia schattaueri* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat	A, E	Ongoing	Partial, small exclosures and some larger fenced managed areas
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, nonnative plant control reported at 1 reintroduction site
Agriculture and urban development	A	Ongoing	None
Lava flows destruction and degradation of habitat	A	Potential	None

Climate change degradation and loss of habitat	A	Ongoing	None
Illegal collection for horticultural trade	B	Ongoing	None
Ungulate predation and herbivory	C	Ongoing	Partial, small exclosures and some larger fenced managed areas
Rodent predation and herbivory	C	Ongoing	Partial, rat control at 1 location
Invertebrate predation and herbivory	C	Potential	None
Lack of adequate hunting regulations	D	Ongoing	Partial, small exclosures within some hunting areas
Low numbers and small, fragmented populations	E	Ongoing	Partial, collection, propagation and reintroduction

Synthesis:
Currently, 12 wild individuals of *Pritchardia schattaueri* remain on the island of Hawai‘i in two locations in South Kona. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *P. schattaueri* is extremely vulnerable to the effects of climate change and there is no overlap between current and future climate envelopes. Seed collections from wild and reintroduced individuals, propagation, and reintroduction are ongoing. Research on optimal seed storage techniques is ongoing. Approximately 288 individuals have been reintroduced since the last 5-year review. Older reintroduced populations in urban and agricultural areas continue to decline. The introduction of the nonnative coconut rhinoceros beetle to O‘ahu poses a threat to *P. schattaueri* if the beetle is transported to the island of Hawai‘i.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Pritchardia schattaueri is a long-lived perennial tree. To prevent extinction, which is the first milestone in recovering the species, the taxon must be managed to control threats (e.g., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on the island of Hawai‘i where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, saplings), with a minimum of 25 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Numbers of known wild individuals continues to decline. Currently, there are 12 mature wild individuals, with numbers of previously reintroduced individuals in urban or agricultural areas continuing to decline. Genetic representation is complete for the 12 wild individuals and hundreds of plants have been reintroduced (Table 1). No successful recruitment has been reported. In addition, all threats are not being managed with the addition of the potential threat of predation by a nonnative invertebrate (Table 1, Table 2). Therefore, *Pritchardia schattaueri* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
The introduction of the coconut rhinoceros beetle to O‘ahu is a potential threat should it be transported to the island of Hawai‘i; however, we are not aware of any significant new information regarding the species’ biological status since the last 5-year review in 2015. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2020.

- Surveys and inventories—Continue to survey geographical and historical range for a current assessment of the species’ status.
- Ungulate monitoring and control—Maintain existing exclosures and monitor for ungulate incursions.
- Established ecosystem-altering invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species, and those that compete with *Pritchardia schattaueri* at all populations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Predation and herbivore control—
    - Implement effective control methods for rodents at all wild and reintroduced populations.
    - Implement effective control methods for the coconut rhinoceros beetle if this invertebrate is transported to the island of Hawai‘i.
    - Continue to construct exclosures at wild and reintroduced populations to prevent seedling predation by feral pigs, mouflon, and cattle.
- Captive propagation for genetic storage and reintroduction—

    - Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
    - 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.
- Reintroduction and translocation—
    - Continue to reintroduce individuals into areas that are managed for known threats.
    - Select reintroduction areas with least exposure to strong winds and areas with lower risk for lava flows.
- Biosecurity legislation—
    - Develop and enforce effective regulations to prevent vandalism and collection.
    - Develop and enforce effective regulations to prevent deleterious effects of yellow lethal disease facilitated by the banana moth.
    - Develop and enforce effective regulations to prevent predation and habitat destruction by feral ungulates.
    - Develop and enforce effective regulations to prevent transport of the coconut rhinoceros beetle to the island of Hawai‘i.
- Population biology research—Continue seed storage techniques investigations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for its recovery.
- Alliance and partnership development—Continue to work with the Hawai‘i Division of Forestry and Wildlife, the Nature Conservancy of Hawai‘i, and other partners and land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Pritchardia schattaueri* (loulu)

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

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

_____ Date_____