Exocarpos menziesii
(heau)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawai‘i

5-YEAR REVIEW

Species reviewed: *Exocarpos menziesii* (heau)

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5-YEAR REVIEW
Exocarpos menziesii (heau)

1.0 GENERAL INFORMATION

1.1 Reviewers:

Cheryl Phillipson, Biologist, Pacific Islands Fish and Wildlife Office (PIFWO)
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Conservation and Restoration Team Manager, PIFWO

Lead Regional Office:
Interior Region 12, Portland Regional Office

Lead Field Office:
Pacific Islands Fish and Wildlife Office

Cooperating Field Office(s):
N/A

Cooperating Regional Office(s):
N/A

1.2 Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (Service), beginning in October 2020. The review was based on the final rule listing this species; peer reviewed scientific publications; unpublished field observations and species status report by the Service, State of Hawai‘i, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information. The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2019. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 91 species in Oregon, Washington, Hawaii, and American Samoa. Federal Register 84 (112): 27152–27154, June 11, 2019.

1.3.2 Listing history:

Original Listing
FR notice: [USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; endangered status for 49 species from the

Hawaiian Islands; final rule. Department of the Interior, Federal Register 81 (190): 67786–67860, September 30, 2016.

Date listed: September 30, 2016
Entity listed: *Exocarpos menziesii*
Classification: Endangered

Revised Listing, if applicable
FR notice: N/A
Date listed: N/A
Entity listed: N/A
Classification: N/A

1.3.3 Associated rulemakings:

N/A

1.3.4 Review History:

This is the first 5-year review for *Exocarpos menziesii*.

1.3.5 Species' Recovery Priority Number at start of this 5-year review:

5

1.3.6 Current Recovery Plan or Outline:

Name of plan or outline: Recovery Outline for the Multi-Island Species
Date issued: August 2020
Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

____**Yes**
__X_**No**

2.1.2 Is the species under review listed as a DPS?

____**Yes**
____**No**

2.1.3 Was the DPS listed prior to 1996?

____**Yes**
____**No**

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

____Yes
____No

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

____Yes
____No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

____Yes
____No

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

____Yes
__X_ No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

____Yes
____No

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery?

____Yes
____No

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:
A synthesis of the threats (Listing Factors A, B, C, D, and E) affecting this species is presented in section 2.3.2 and Table 2.

The recovery plan is currently being drafted. However, the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC) has outlined the actions and goals for stages leading towards recovery (2011). These stages are described below.

Current information is lacking for many Hawaiian plant species on the status of the species and their habitats, breeding systems, genetics, and propagule storage options. The following downlisting and delisting criteria for plants have therefore been adopted from the revised recovery objective guidelines developed by the HPPRCC (2011). Many of the Hawaiian plant species are at very low numbers, so the Service also developed criteria for avoiding imminent extinction and an interim stage before downlisting, based on the recommendations of the HPPRCC, to assist in tracking progress toward the ultimate goal of recovery. These criteria are assessed on a species-by-species basis, especially as additional information becomes available.

In general, long-lived perennials are those taxa either known or believed to have life spans greater than 10 years; short-lived perennials are those known or believed to have life spans greater than one year but less than 10 years; and annuals are those known or believed to have life spans less than or equal to one year. When it is unknown whether a species is long- or short-lived, the Service has erred on the side of caution and considered the species short-lived. This will be revised as more is learned about the life histories of these species. Narrow extant range and broad contiguous range are recognized as not needing different numbers of individuals or populations, but that the populations will be distributed more narrowly or more broadly, respectively, across the landscape. Obligate outcrossers are those species that either have male and female flowers on separate plants or otherwise require cross-pollination to fertilize seeds, and therefore require equal numbers of individuals contributing to reproduction as males and females, doubling the number of mature individuals. Species that reproduce vegetatively may reproduce sexually only on occasion, resulting in the majority of the genetic variation being between populations, therefore requiring additional populations. Species that have a tendency to fluctuate in number from year to year require a larger number of mature individuals on average to allow for decline in years of extreme habitat conditions and recuperation in numbers in years of more normal conditions.

Preventing Extinction

Stabilizing (interim), downlisting, and delisting objectives have been updated according to the draft revised recovery objective guidelines developed by the 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.

Exocarpos menziesii is a long-lived perennial shrub. 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 that are well managed. In addition, a minimum of three populations total should be documented on the islands of Hawai‘i and/or Lāna‘i where they now occur or occurred historically. Each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, saplings) with a minimum of 25 mature individuals per population.

This recovery objective has not been met (see Table 1). Although there are approximately 1,983 to 2,431 individuals in 17 populations on the island of Hawai‘i, the majority (as many as 2,292) are located within the U.S. Army's Pōhakuloa Training Area, where some threats are not controlled. This area is subject to the effects of training with live fire weapons and wildfire, either caused by training or by ignition sources outside the training area, and all or a large portion of this population could be impacted or destroyed with one event. There are no known individuals on Lāna‘i. In addition, *ex situ* genetic representation is incomplete.

Interim Stage

To meet the interim stage of recovery of *Exocarpos menziesii*, 100 mature individuals are needed in each of three populations and all major threats must be controlled around the populations designated for recovery at this stage. Multi-island species should be represented by at least one population on each of the islands from which they were known historically as long as suitable habitat exists. There should also be demonstrated regeneration of seedlings and growth to at least sapling stage for woody species and documented replacement regeneration within each of the target populations. The populations must be adequately represented in an *ex situ* collection as defined in the Center for Plant Conservation's guidelines (Guerrant et al. 2004, entire) that is secure and well managed. Adequate monitoring must be in place and conducted to assess individual plant survival, population trends, trends of major limiting factors, and response of major limiting factors to management.

This recovery objective has not been met (see Table 1).

Downlisting Criteria

In addition to achieving 5 to 10 populations with 200 mature individuals per population and all of the goals of the interim stage, all target populations must be stable, secure, and naturally reproducing for a minimum of 10 years. Multi-island species should be represented by at least one population on each of the islands from which they were known historically as long as suitable habitat exists. Species-specific management actions are not ruled out. Downlisting should not be considered until an adequate population viability analysis (PVA) has been conducted to assess needed numbers more accurately based on current management and monitoring data collected at regular intervals determined by

demographic parameters of the species, although they should only be one of the factors used in making a decision to downlist. Information necessary for the PVA that should be available through monitoring (ideally annually) includes major limiting factors, breeding system, population structure and density, and proven management methods for major threats.

This recovery objective has not been met (see Table 1).

Delisting Criteria
In addition to achieving 5 to 10 populations with 200 mature individuals per population and all of the goals of the interim and downlisting stages, all target populations must be stable, secure, naturally reproducing, and within secure and viable habitats for a minimum of 20 years. Multi-island species should be represented by at least one population on each of the islands from which they were known historically as long as suitable habitat exists. Species-specific management actions must no longer be necessary, but ecosystem-wide management actions are not ruled out if there are long-term agreements in place to continue management. These numbers are initial targets, but may be revised upward as additional information is available, including adequate PVAs for individual species based on current management and monitoring data collected at regular intervals determined by demographic parameters of the species, although they should only be one of the factors used in making a decision to delist. Genetic analyses should be conducted to ensure that adequate genetic representation is present within and among populations compared to the initial variation assessed in the interim stage. Numbers need to be considered on a species-by-species basis.

This recovery objective has not been met (see Table 1).

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Exocarpos menziesii (heau) is a shrub in the Santalaceae (sandalwood) family, 0.5 to 2 meters (m) (1.6 to 6.5 feet (ft)) tall. Stems are densely branched, especially toward the ends; the tips are maroon-tinged. Leaves consist of two forms: scale-like or foliaceous, these elliptic to oblanceolate, 10 to 14 millimeter (mm) (0.4 to 0.5 inch (in)) long, 3 to 6 mm (0.1 to 0.2 in) wide. Flowers are perfect with five red petals 3 mm (0.1 in) long. Drupes are reddish brown to red at maturity, ellipsoid to narrowly ovoid, 7 to 10 mm (0.3 to 0.4 in) long with a small terminal beak partially embedded in a yellow, fleshy receptacle (Wagner et al 1999, p. 1218).

Little is known about the life history of *Exocarpos menziesii*. This species has been observed flowering and fruiting in April and July (NTBG 2020).

Its pollination vectors, seed dispersal agents, specific environmental requirements, and limiting factors are unknown.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:
Historically, *Exocarpos menziesii* occurred on Lānaʻi and the island of Hawaiʻi (Bishop Museum 2014). At the time of listing in 2016, there were no known occurrences of this species on Lānaʻi (Wagner et al 1999, p. 1218; Bishop Museum 2014) and seven scattered occurrences on the island of Hawaiʻi (PEPP 2013, pp. 10, 33; Thomas 2014, in litt.; Evans 2015, in litt.; Orlando 2015, in litt.; Perry 2015, in litt.).

Currently, approximately 1,983 to 2,431 individuals of *E. menziesii* are known from the island of Hawaiʻi: between 1,844 to 2,292 individuals at the Pōhakuloa Training Area (PTA) and 139 individuals at Hawaiʻi Volcanoes National Park (HVNP) (Center for Environmental Management of Military Lands (CEMML) 2021a, p. 10; HVNP 2020 GIS data, unpublished).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):
N/A

2.3.1.4 Taxonomic classification or changes in nomenclature:
The type for *Exocarpos menziesii* was described by Stauffer (1959). *Exocarpos menziesii* is recognized as a distinct taxon in the 1999 update to the Manual of Flowering Plants of Hawaii and is the currently accepted taxonomy (Wagner et al. 1999, p. 1218).

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):
See section 2.3.1.2 and 2.3.1.4 above for spatial distribution of the species.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):
Exocarpos menziesii occurs in mesic and dry shrubland and forest in the PTA consisting of a'a and pahoehoe lava flows with sparse vegetation or dominated by the native plant species *Metrosideros* (ʻōhiʻa) at 1,434 to 2,432 m (4,705 to 7,979 ft) (CEMML 2019, p. 10). Rainfall ranges from 453 to 1,724 mm (18 to 68 in) annually (USFWS 2020 GIS data, unpublished). At HVNP, *E. menziesii* occurs in subalpine areas on younger a'a lava flows with scattered native *Metrosideros* and native

shrubs. Vegetation on older pahoehoe is and mix of *Metrosideros* and *Sophora chrysophylla* (ʻōhiʻa and māmane) woodland with understory of native shrubs and grasses including *Vaccinium* spp. (ʻōhelo), *Leptecophylla tameiameiae* (pūkiawe), *Dodonaea viscosa* (ʻaʻaliʻi), and *Deschampsia nubigena* (no common name). Vegetation in the Kahuku Unit is similar but depauperate in diversity because of four decades of browsing by mouflon (HVNP 2007, pp. 11–12; NPS 2015, p. 474).

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range (Factor A):

Ungulate destruction and degradation of habitat—Feral sheep (*Ovis aries*), mouflon (*Ovis orientalis*), and goats (*Capra hircus*) modify and degrade habitat by disturbing and destroying vegetative cover, trampling plants and seedlings, reducing or eliminating plant regeneration by damaging seeds and seedlings, and increasing erosion by creating large areas of bare soil (USFWS 2015, in litt.; Loope 1998, pp. 747–774; van Riper and van Riper 1982, pp. 34–35). These ungulates are present at PTA and HVNP and negatively impact habitat for all populations of *Exocarpos menziesii*.

Established ecosystem-altering invasive plant modification and degradation of habitat—Invasive introduced plant species modify habitats occupied by native plant species by changing the availability of light, altering soil-water regimes, modifying nutrient cycling, and changing the fire characteristics of the native plant community (Cuddihy and Stone 1990, p. 74). Habitat modification and destruction by invasive nonnative plants negatively affects all occurrences of *Exocarpos menziesii* (D'Antonio and Vitousek 1992, p. 73; HVNP 2019, p. 1). The nonnative plant with the greatest impact on *Exocarpos menziesii* is *Cenchrus setaceus* (fountain grass) (CEMML 2018, 14 pp.).

Fire destruction and degradation of habitat—*Exocarpos menziesii* is at risk of negative impacts caused by fire because it occurs within a military training area (PTA) with use of live-fire artillery and mortar firing points and occurs in or near areas that were burned in previous fires (CEMML 2018, 14 pp.; CEMML 2021a, p. 2). In 2018, a wildland fire ignited in the PTA Training Area 19 and spread to the adjacent training areas (18 and 22) taking nearly two weeks to contain (CEMML 2018, 14 pp.). These areas contain high densities of invasive grasses including the nonnative *Cenchrus setaceus*. The fire burned 585 hectares (1,446 acres). The largest population of *Exocarpos menziesii* occurs in Training Area 22; however, no damage was reported for this species. Fire damages and destroys native vegetation, including dormant seeds, seedlings, juvenile and adult plants. Many nonnative invasive plants, particularly fire-tolerant grasses,

outcompete native plants and inhibit their regeneration (D'Antonio and Vitousek 1992, pp. 70, 73–74; Tunison et al. 2002, p. 122). Successive fires burn farther into native habitat and alter microclimatic conditions creating conditions favorable to nonnative plants. The threat from fire is unpredictable but is increasing in frequency in ecosystems that have been invaded by nonnative plants and fire-tolerant nonnative grasses.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes (Factor B):
Not a threat.

2.3.2.3 Disease or predation (Factor C):
Herbivory and predation by feral ungulates—Feral sheep, mouflon, and goats are a threat to any unfenced areas where *Exocarpos menziesii* occurs (National Park Service (NPS) 2015, pp. 8, 38, 41). These animals damage and destroy plants by direct herbivory, bark stripping, and trampling. Feral goats forage in areas of extremely rugged terrain and are instrumental in the decline of native vegetation (Cuddy and Stone 1990, p. 64; van Riper and van Riper 1982, pp. 34–35; Tomich 1986, pp. 153–156). These activities also promote the invasion of nonnative plants that outcompete *E. menziesii* for space, water, light and nutrients.

2.3.2.4 Inadequacy of existing regulatory mechanisms (Factor D):
Lack of adequate hunting regulations—Nonnative feral ungulates pose a major ongoing threat to native species through destruction and modification of habitat, and by direct herbivory or predation. Management of game animals by the State ranges from providing maximal sustained public hunting opportunities and benefits (i.e., sustained yield) in some areas, with one animal allowed per day; to other areas with as few as one animal allowed per year (DLNR 2010). The only known populations of *Exocarpos menziesii* occur adjacent to State hunting areas. The occurrences are protected by exclosures and are monitored and maintained to limit incursion. In addition, public hunting areas are not fenced and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land use designation; therefore, any unfenced populations are at risk.

2.3.2.5 Other natural or manmade factors affecting its continued existence (Factor E):
Reduced viability due to low numbers—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 (Barrett and Kohn 1991, pp. 3,7; Newman and Pilson 1997, pp. 354–355). 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, such as anthropogenic impacts like habitat loss from human development or predation by nonnative species. Very small plant populations may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. While there are several large populations units, there are also 13 locations with 1 to 23 individuals each. There are currently no known individuals of *Exocarpos menziesii* on Lānaʻi.

Climate change loss or degradation of habitat—Fortini et al. (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi 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 concluded that *Exocarpos menziesii* is vulnerable to the impacts of climate change with a vulnerability score of 0.356 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions may be needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.

Current Management Actions:

- Surveys and monitoring—The PTA Botanical Program implements conservation measures for *Exocarpos menziesii* including surveying and monitoring (PTA 2020, p. 56; CEMML 2021a, p. 7). The National Park Service (NPS) surveys and monitors populations in the Kahuku Unit (NPS 2015, pp. 8, 38, 41).
- Ungulate control—The PTA has fenced occurrences of *E. menziesii* in the training area and these areas have been ungulate-free since 2017 (CEMML 2021a, p. 4).
- Ecosystem-altering invasive nonnative plant control—PTA monitors and removes nonnative plants (CEMML 2021a, p. 4).
- Fire management—PTA and HVNP have both developed and implement fire management plans.
- Management of predation and herbivory by sheep, mouflon, and goats—PTA has fenced occurrences of *E. menziesii* in the training area and these areas have been ungulate-free since 2017 (CEMML 2021a, p. 4). The NPS monitors and removes feral ungulates from managed areas in HVNP.
- Captive propagation for genetic storage and reintroduction—The PTA Botanical Program reports collection of 766 fruit representing more than nine founders for storage and propagation and reports 31 plants in accessions (PTA 2020, p. 35; CEMML 2021b, p. 30).
- Population biology research—PTA Botanical Program reports conducting 16 seed germination trials using 278 seeds with production of 27 seedlings (PTA 2020, p. 40).

Table 1. Status and trends of *Exocarpos menziesii* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Preventing Extinction Criteria identified by HPPRCC	Preventing Extinction Criteria Completed?
2016 (listing)	ca 1,800	0	All threats managed in all 3 populations	Partially, occurrences at PTA within exclosures; ungulate control at HVNP
			Complete genetic storage	Partially, more than 9 founders represented in seed storage and accessions
			3 populations with 25 mature individuals each	Partially, 2 extended populations
2021 (5-year review)	1,983–2,431 (Hawai‘i) 0 (Lāna‘i)	0	All threats managed in all 3 populations	Partially, occurrences at PTA within exclosures; ungulate control at HVNP
			Complete genetic storage	Partially, more than 9 founders represented in seed storage and accessions
			3 populations with 25 mature individuals each	Yes
			Each population naturally reproducing	Unknown, natural recruitment not reported

Table 2. Threats to *Exocarpos menziesii* and ongoing conservation efforts.

Threat	Listing Factor	Current Status	Conservation/Management Efforts
Destruction and degradation of habitat by ungulates	A	Ongoing	Partial, ungulate exclosures and control at PTA and HVNP
Destruction and degradation of habitat by established ecosystem-altering invasive plants	A	Ongoing	Partial, nonnative plant control at PTA and HVNP

Ungulate predation and herbivory	C	Ongoing	Partial, ungulate exclosures and control at PTA and HVNP
Inadequacy of regulatory mechanisms	D	Ongoing	Partial, ungulate exclosures and control at PTA and HVNP
Climate change degradation or loss of habitat	E	Ongoing	None
Low numbers	E	Ongoing	Partial, seed storage, propagation trials ongoing

2.4 Synthesis

There are between 1,983–2,431 wild individuals of *Exocarpos menziesii* on the island of Hawai‘i; however, this species is extirpated from its former range on Lāna‘i. 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 *E. menziesii* is vulnerable to the effects of climate change. Most individuals are within exclosures for protection from ungulates and fencing must be monitored and maintained to limit incursion. There are seeds and propagules in collections representing at least nine founders.

Preventing extinction, interim stabilization, downlisting, and delisting objectives are provided in HPPRCC's Revised Recovery Objective Guidelines (2011). To prevent extinction, which is the first step 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 an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations total should be documented on the islands of Lāna‘i and/or Hawai‘i where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, or saplings) with a minimum of 25 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met as, although the number of wild individuals is between 1,983–2,431, there is only partial genetic representation (nine founders) (Table 1) and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Exocarpos menziesii* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.1 Recommended Classification:

____Downlist to Threatened
____Uplist to Endangered
____Delist
____Extinction
____Recovery
____Original data for classification in error
__X__No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number:____
Reclassification (from Endangered to Threatened) Priority Number:____
Delisting (regardless of current classification) Priority Number:____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Surveys and inventories—Continue to conduct surveys for *Exocarpos menziesii* in historical locations and potentially suitable habitat.
- Ungulate monitoring and control—Continue to construct and maintain fenced exclosures to protect individuals from the negative impacts of feral ungulates.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species and those that compete with *E. menziesii*.
- Fire management—Continue to implement a fire management plan for all wild and reintroduced populations, and develop and implement a wildland fire management plan for Lānaʻi.
- Climate change adaptation strategy—Research suitability of habitat in the future due to the impacts of climate change.
- Captive propagation for genetic storage and reintroduction—Continue to collect seeds for storage and propagation efforts for maintenance of genetic stock.
- Reintroduction and translocation—Begin reintroduction efforts to increase numbers of populations and individuals in suitable habitat to build resiliency and redundancy and reduce the impacts of fire and climate change.
- Population biology research—Monitor populations to determine vigor, fecundity, population structure, and phenology of *E. menziesii*.

- Alliance and partnership development—Continue to contribute to planning and implementation of ecosystem-level restoration and management to benefit this taxon.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Exocarpos menziesii*
(heau)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____Downlist to Threatened
____Uplist to Endangered
____Delist
_X__No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:
Cheryl Phillipson, Fish and Wildlife Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Conservation and Restoration Team Manager, PIFWO

FIELD OFFICE APPROVAL:

MEGAN LAUT Digitally signed by MEGAN LAUT
Date: 2021.07.27 11:51:58 -10'00'

for _____

Field Supervisor, Pacific Islands Fish and Wildlife Office