

## 5-YEAR REVIEW

### Short Form Summary

**Species Reviewed:** *Hibiscus brackenridgei* (ma‘o hau hele)

**Current Classification:** Endangered

#### **Federal Register Notice 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.

#### **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 2020. The review was based on a review of current, available information since the last 5-year review for *Hibiscus brackenridgei* (USFWS 2013). 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](http://ecos.fws.gov/tess_public)).

#### **Review Analysis:**

Please refer to the previous 5-year reviews for *Hibiscus brackenridgei* in the Federal Register on July 29, 2009 and August 19, 2013 (available at [https://ecos.fws.gov/docs/tess/species\\_nonpublish/1409.pdf](https://ecos.fws.gov/docs/tess/species_nonpublish/1409.pdf) and [https://ecos.fws.gov/docs/tess/species\\_nonpublish/2077.pdf](https://ecos.fws.gov/docs/tess/species_nonpublish/2077.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 *H. brackenridgei*.

This short-lived perennial shrub in the Malvaceae (mallow) family is endangered and occurs on the islands of O‘ahu, Lāna‘i, Maui, and Hawai‘i, and is historically known from Kaua‘i, Moloka‘i, and possibly Kaho‘olawe. The status and trends for *Hibiscus brackenridgei* are provided in the tables below.

#### New Status Information:

- In 2012, critical habitat was designated on O‘ahu for *Hibiscus brackenridgei* in nine units in the lowland dry and lowland mesic ecosystems (2,565 hectares [ha], 6,340 acres [ac]) (77 FR 57648, September 18, 2012).
- In 2016, critical habitat was designated for *Hibiscus brackenridgei* on the islands of Maui Nui, including on Moloka‘i in nine units in the coastal and lowland dry ecosystems (1,810 ha, 4,467 ac), on Maui in six units in the lowland dry ecosystem (8,392 ha, 20,740 ac), and on Kaho‘olawe in two units in the lowland dry ecosystem (1,791 ac, 4,425 ha) (81 FR 17790, March 30, 2016). Critical habitat was proposed for *H. brackenridgei* on Lāna‘i in five units in the coastal and lowland dry ecosystems (4,690 ha, 11,589 ac) but was excluded in the final rule.
- In 2018, there were nine populations totaling 88 individuals of *Hibiscus brackenridgei* statewide, on O‘ahu, Lāna‘i, Maui, and Hawai‘i (Keir 2018). Currently, *Hibiscus brackenridgei* subsp. *mokuleianus* occurs on O‘ahu in five populations totaling 59 mature and 121 immature wild individuals (ANRP 2020). The last four wild individuals of *Hibiscus brackenridgei* subsp. *brackenridgei* on Lāna‘i died in 2016, one recruit appeared later that year at Kānepu‘u. On Maui, there are 5 mature and 13 immature *Hibiscus brackenridgei* subsp. *brackenridgei* at Pōhākea (PEPP 2021). In 2014, on the island of Hawai‘i, there were three wild individuals at Pu‘uwa‘awa‘a, and in 2017 there were 10 individuals at Pu‘uanahulu (PEPP 2014, 2017).

#### New Threats:

- 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 concluded that *Hibiscus brackenridgei* is vulnerable to the impacts of climate change with a vulnerability score of 0.382 (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.

#### New Management Actions:

- Surveys and monitoring—
  - The Plant Extinction Prevention Program (PEPP) surveys and monitors wild and reintroduced populations of *Hibiscus brackenridgei* subsp. *brackenridgei* on Lāna‘i and Maui, and repaired a water catchment at Pōhākea (Maui) (PEPP 2013, 2014, 2015, 2016, 2017, 2019, 2020, 2021). In addition, PEPP reported approximately 13 wild individuals on the island of Hawai‘i (PEPP 2014, 2017).
  - The Army’s Natural Resources Program (ANRP) monitors populations of *H. brackenridgei* subsp. *mokuleianus* on O‘ahu (ANRP 2020, appendices).

- Ungulate control—
  - The ANRP manages ungulates at Kea‘au, Mākua, Manuwai, and Waialua (ANRP 2020, appendices).
  - PEPP retrofitted a fence at Pōhākea (Maui) for exclusion of deer (PEPP 2020).
- Ecosystem-altering invasive nonnative plant control—
  - The ANRP manages nonnative plants where *H. brackenridgei* subsp. *mokuleianus* occurs at ‘Ōhikilolo, Kea‘au, Mākua, Haili to Kawaiū, and Manuwai (ANRP 2020, Appendix 3-12).
  - Pūlama Lāna‘i conducts nonnative plant control at the Keōmoku exclosure on Lāna‘i (Bogner et al. 2021, p. 16).
  - PEPP conducts weed control at Puumaiekahi and Kānepu‘u (Lāna‘i) and at Pōhākea and ‘Āhihi-Kīnau (Maui) (PEPP 2013, 2016, 2017, 2019, 2020, 2021).
- Fire protection—The ANRP conducts fire prevention activities at Mākua and Waialua (ANRP 2020, appendices).
- Rodent control—Pūlama Lāna‘i reports implementation of mouse control (using repeater traps) at the Keōmoku exclosure to prevent damage and destruction of plants (Bogner et al. 2021, pp. 15–16).
- Collection and propagation for genetic storage and reintroduction—
  - The Lyon Seed Conservation Laboratory reported collection and storage of over 10,000 seeds of *H. brackenridgei* subsp. *brackenridgei* representing 24 founders from 4 populations on Maui, over 2,000 seeds from at least 5 founders on Lāna‘i, over 1,000 seeds collected for research purposes from subsp. *brackenridgei* and 155 seeds from subsp. *mokuleianus*, both from living collections at Koko Crater Botanical Garden, O‘ahu (Lyon Arboretum 2020).
  - The State’s Kōke‘e Rare Plant Facility reports four plants in refugia representing one individual within an exclosure on Kaua‘i (Kōke‘e 2019).
  - The ANRP has met storage goals for *H. brackenridgei* subsp. *brackenridgei* at Kea‘au and Wai‘alua and has nearly completed stability and genetic storage goals for plants at Mākua and Haili to Kawaiū (ANRP 2020, Appendix 4-1).
  - The Maui Nui Botanical Garden (MNBG) reports thousands of seeds in storage representing more than 18 wild *H. brackenridgei* subsp. *brackenridgei* at Pu‘uokali, Maui (MNBG 2020).
  - The National Tropical Botanical Garden (NTBG) maintains living collections of *Hibiscus brackenridgei* subsp. *brackenridgei* and subsp. *mokuleianus* at their gardens. More than 130 seeds from subsp. *brackenridgei* are in storage and 25 plants of subsp. *mokuleianus* have been propagated from a living collection (NTBG 2020).
  - For the subsp. *brackenridgei*, the Olinda Rare Plant Facility (ORPF) reports 21 plants propagated representing three founders from Pōhākea and seven plants propagated representing one founder from Waikapū (both on Maui), and two plants propagated representing one founder from Kānepu‘u (Lāna‘i) (ORPF 2020). For the subsp. *mokuleianus*, ORPF

- reports propagation of 35 plants representing 17 founders from Mākua (O‘ahu) (ORPF 2020).
- The State’s Pahole Rare Plant Facility (PRPF) reports one plant, subsp. *mokuleianus*, in inventory (PRPF 2019).
  - In 2018, Pu‘uwa‘awa‘a reported collection of 250 cuttings from wild *Hibiscus brackenridgei* subsp. *brackenridgei* and propagation of at least one individual (Pu‘uwa‘awa‘a 2019).
  - In 2015, the Volcano Rare Plant Facility (VRPF) reported 81 plants in inventory representing two founders of subsp. *brackenridgei* from Lālāmilo, and in 2016, there were eight plants representing one founder from Pu‘uwa‘awa‘a in inventory (VRPF 2020).
  - From 2013 to 2018, the Waimea Valley Arboretum held in inventory between 29 and 52 plants/seeds/propagules representing nine founders of subsp. *brackenridgei* from Lāna‘i, Maui, and Hawai‘i, and between 16 to 65 plants/seeds representing 21 founders of subsp. *mokuleianus* from O‘ahu (Waimea Arboretum 2013, 2014, 2015, 2017, 2018).
  - PEPP collects seeds from plants at Kānepu‘u (Lāna‘i), Pu‘uokali and Pōhākea (Maui), and at Wai‘aka-Pu‘ukawaiwai-Koai‘e (Hawai‘i) (PEPP 2013, 2014, 2016, 2019).
  - Reintroduction and translocation implementation—
    - The State’s draft Habitat Conservation Plan for Pu‘uwa‘awa‘a and Puu Anahulu (Hawai‘i) will provide for creation and maintenance of populations of *H. brackenridgei* subsp. *brackenridgei* (DLNR 2015, p. 145).
    - In 2016 on the island of Hawai‘i, there were more than 70 reintroduced *H. brackenridgei* subsp. *brackenridgei* at Pu‘uwa‘awa‘a Mauka, 18 plants at Wai‘aka to Pu‘ukawaiwai (PEPP 2019).
    - On O‘ahu, the ANRP reported outplanting 183 mature and 2 immature *H. brackenridgei* subsp. *mokuleianus* to four locations in the Wai‘anae mountains (ANRP 2020).
    - Pūlama Lāna‘i reported propagation and reintroduction of 15 *H. brackenridgei* subsp. *brackenridgei* to an enclosure at Maunalei, bringing the total outplants within the enclosure to 23 (Bogner et al. 2021, pp. 15–16).
    - Pu‘uwa‘awa‘a outplanted one *Hibiscus brackenridgei* subsp. *brackenridgei* to the Hauaina Reservoir Paddock in 2018 (Pu‘uwa‘awa‘a 2019).
    - In 2016, the VRPF reintroduced 76 *Hibiscus brackenridgei* subsp. *brackenridgei* representing two founders from Lālāmilo to Koholālele, and seven subsp. *brackenridgei* representing one founder from Lālāmilo to Kipāhoehoe, and 64 subsp. *brackenridgei* representing two founders from Pu‘uwa‘awa‘a were provided to the State (VRPF 2020). An additional eight plants representing the same founder from Pu‘uwa‘awa‘a were provided to the State in 2017 (VRPF 2020).
    - With the support of Moloka‘i PEPP, Moloka‘i Land Trust (MLT) reported an introduction of 33 plants to their Anapuka enclosure of *H.*

*brackenridgei* subsp. *mokuleianus* stock from Mākua Valley on O‘ahu (MLT 2021).

- Population biology research—
  - Comparison of current and future models of changes in the potential niche of *H. brackenridgei* on O‘ahu suggests that predicted changes in climate may not significantly impact its future distribution on O‘ahu (Rovzar et al. 2013, p. 1). This study suggested that the areas in the northwestern Wai‘anae mountains (O‘ahu) be prioritized for restoration efforts (Rovzar et al. 2013, pp. 14–15).
  - Leaf material was collected from reintroduced plants at Wai‘aka to Pu‘ukawaiwai (Hawai‘i) for genetic studies (PEPP 2019). PEPP collected leaf material for genetic analysis from plants at Pu‘uanahulu (Hawai‘i) (PEPP 2016).
  - A study conducted in 2018 found that there are three genetic clusters of *H. brackenridgei* in the islands of Hawai‘i. These include plants from Hawai‘i, O‘ahu (keeping those from Mākua Valley separate), and from Lāna‘i. The Hawai‘i plants are distinct from those on other islands genetically and have an extensive level of genetic diversity; however, plants within same site have little variation. Two very different genetic types of plants represent O‘ahu. This study suggests that for long-term survival of the species in naturally reproducing populations, it is imperative that individual variability be increased as it is probable that plants are becoming inbred and could lead to inbreeding depression. In particular, the Pu‘uanahulu population should be maintained as a living repository of natural genetic diversity (Morden and Yorkston 2018 in PEPP 2019).

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1994 (listing)	subsp. <i>mokuleianus</i> 6–8 (O‘ahu) subsp. <i>brackenridgei</i> 5–6 (Lāna‘i) ca 42 (Maui) 5 (Hawai‘i)	25	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No

1999 (recovery plan)	subsp. <i>mokuleianus</i> 153–203 (O‘ahu) subsp. <i>brackenridgei</i> 8–9 (Lāna‘i) 114–129 (Maui) 9 (Hawai‘i)	2	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2003 (critical habitat)	subsp. <i>mokuleianus</i> <206 (O‘ahu) subsp. <i>brackenridgei</i> unknown # (Lāna‘i) 40 (Maui) <20 (Hawai‘i)	Unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2009 (5-year review)	subsp. <i>mokuleianus</i> 63 (O‘ahu) subsp. <i>brackenridgei</i> 182 (Lāna‘i, Maui, Hawai‘i) ca 245 total	315 survive	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2012 (critical habitat, O‘ahu)	subsp. <i>mokuleianus</i> 79–82 (O‘ahu)	Unknown	All threats managed in all 3 populations	Partially, ANRP management

			Complete genetic storage	Partially
			3 populations with 50 mature individuals	No
2013 (5-year review)	subsp. <i>mokuleianus</i> 260 (O'ahu) subsp. <i>brackenridgei</i> 76 total	subsp. <i>mokuleianus</i> 41 (O'ahu) subsp. <i>brackenridgei</i> ca 300 total	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals	No
2016 (critical habitat, Maui Nui)	subsp. <i>brackenridgei</i> 3 (Lāna'i) ca 15 (Maui)	subsp. <i>brackenridgei</i> 9 (Maui) >150 (Hawai'i)	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals	No
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2021 (5-year review)	subsp. <i>mokuleianus</i> 59 mature, 121 immature (O'ahu) subsp. <i>brackenridgei</i> 1? (Lāna'i) 5 mature, 13 immature (Maui) ca 13 (Hawai'i)	subsp. <i>mokuleianus</i> 183 mature, 2 immature (O'ahu) subsp. <i>brackenridgei</i> 23 (Lāna'i) <10 (Hawai'i)	All threats managed in all 3 populations	Partially, ungulate control O'ahu, Maui; nonnative plant control O'ahu, Maui, Lāna'i; rodent control Lāna'i

			Complete genetic storage	Partially, subsp. <i>mokuleianus</i> , goals met for 2 populations Partially, subsp. <i>brackenridgei</i> 1,000s seed in storage representing a couple dozen founders; ca 270 plants propagated representing 17 founders
			Natural reproduction at all 3 populations	Partially, recruitment observed on Lānaʻi
			3 populations with 50 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 *Hibiscus brackenridgei* and ongoing conservation efforts.**

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, ungulate control Oʻahu, Lānaʻi, Maui
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control Oʻahu, Lānaʻi, Maui
Degradation and destruction by fire	A	Ongoing	Partial, fire management plan for Oʻahu
Predation and herbivory by rodents	C	Ongoing	Partial, rodent control on Lānaʻi
Predation and herbivory by feral ungulates	C	Ongoing	Partial, ungulate control Oʻahu, Lānaʻi, Maui
Predation and herbivory by invertebrates	C	Ongoing	None



Reduced viability due to low numbers	E	Ongoing	Partial, seed collection, propagation, and reintroduction
Hybridization	E	Ongoing	Partial, genetic study to determine extent of unique populations
Road construction—O‘ahu	E	Potential	None
Climate change	E	Ongoing	Partial, one study’s results suggest an area on O‘ahu for restoration of subsp. <i>mokuleianus</i>

### Synthesis:

Currently there are 59 mature and 121 immature wild individuals of *Hibiscus brackenridgei* subsp. *mokuleianus* on O‘ahu. *Hibiscus brackenridgei* subsp. *brackenridgei* occurs on Lāna‘i (possibly 1 wild individual), Maui (19 mature and 13 immature wild individuals), and Hawai‘i (ca 13 wild individuals). Ungulate exclosures protect four areas on O‘ahu, two areas on Lāna‘i, and one area on west Maui. Nonnative plant control is ongoing on O‘ahu, Lāna‘i, and Maui. Seeds and propagules are in storage and used in reintroductions on O‘ahu, Lāna‘i, Maui, and Hawai‘i. Rodent control is conducted at one occurrence on Lāna‘i. A fire management plan is implemented on O‘ahu. A genetic study showed the importance of prevention of hybridization and of protection of unique qualities of populations on O‘ahu and Hawai‘i, and results of a study of the possible effects of climate change suggest a priority area for restoration of subsp. *mokuleianus* on O‘ahu.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Multi-Island Plants (USFWS 1999) 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.

*Hibiscus brackenridgei* is a short-lived perennial shrub with two extant subspecies and one likely extinct subspecies (*molokaiana*). 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 a total of three populations should be documented on O‘ahu for *H. brackenridgei* subsp.

*mokuleianus*, and for *H. brackenridgei* subsp. *brackenridgei* on Moloka‘i, Lāna‘i, Maui, 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), with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There are fewer than 60 wild mature individuals of *H. brackenridgei* subsp. *mokuleianus* on O‘ahu and fewer than 20 wild individuals of *H. brackenridgei* subsp. *brackenridgei* on Lāna‘i, Maui, and Hawai‘i, and numbers continue to decline. More than 200 individuals of each subspecies have been reintroduced since the previous 5-year review, but these populations are not recruiting to be self-sustaining (Table 1). Implementation of a fire plan is only conducted on O‘ahu, and implementation of rodent control is only conducted on Lāna‘i. There are some ungulate exclosures and nonnative plant control conducted within exclosures, but not at all occurrences. Threats including predation of seeds by invertebrates and climate change are not addressed (Table 2). Therefore, *Hibiscus brackenridgei* meets the definition of Endangered as it remains in danger of extinction throughout its range.

#### **Recommendations for Future Actions:**

We are not aware of any new threats or significant new information regarding the species’ biological status since the last 5-year review in 2013. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2021.

- Surveys and inventories—Continue to survey geographical and historical range for a current assessment of the species’ status and that of possible additional populations.
- Ungulate monitoring and control—Continue to construct ungulate exclosures or strategic fencing where possible to protect all occurrences from the impacts of feral ungulates, including browsing.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species at all wild and reintroduced populations.
- Fire monitoring and control—Develop and implement fire management plans for all wild and reintroduced populations.
- Predator and herbivore monitoring and control—
  - Implement effective rodent control methods at populations to improve viable seed production.
  - Assess damage caused by the rose beetle and the scentless plant bug and determine if control is necessary, develop and implement effective control methods.
- Captive propagation for genetic storage and reintroduction—Continue collection of genetic resources for storage, propagation, and reintroduction.
- Reintroduction and translocation—
  - Continue reintroductions and augmentations into suitable habitat within historical range in areas that are managed for known threats.
  - Increase numbers of populations and individuals to reduce impacts from stochastic events including climate change.

- Population viability monitoring and research—Implement conservation measures as suggested by the results of genetic research.
- Climate change adaptation strategy—Research suitability of habitat for reintroduction of this species in the future due to impacts of climate change.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this taxon.

## References:

- [ANRP] Army Natural Resources Program. 2020. Appendices to the Status report for the Mākua and O‘ahu Implementation Plans, Army Natural Resources Program, O‘ahu, Office of the Vice President for Research and Innovation, University of Hawai‘i. Appendix 3-12 and 4-1.
- Bognar, K. R. Sprague, and J. Sprague. 2021. 2020-2021 Pūlama Lāna‘i annual rare plant report. 32 pp.
- Fortini L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044, Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawai‘i. 134 pp.
- [HPPRCC] Hawaii and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Keir, M. 2018. *Hibiscus brackenridgei*. The IUCN Red List of Threatened Species 2018: e.T62743A78757481. <http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T62743A78757481.en>.
- Lyon Arboretum. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- [MNBG] Maui Nui Botanical Garden. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- [MLT] Moloka‘i Land Trust. 2021. Moloka‘i Land Trust Threatened and Endangered Plant Species Permit 2021 Annual Report, Permit No. I2575. 4 pp.
- Morden, C. and M. Yorkston. 2018, in PEPP 2019. Investigating genetic variation in *Hibiscus brackenridgei* (Malvaceae) populations from the Hawaiian Islands using SRAP markers, final report for *Hibiscus brackenridgei*. A component of the

project Hawai‘i & Kaua‘i: Molecular Genetics to Inform Conservation Planning. Pacific Cooperative Studies Unit, Department of Botany, University of Hawai‘i at Mānoa, Honolulu. Pp. 27–42.

[NTBG] National Tropical Botanical Garden. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

[ORPF] Olinda Rare Plant Facility. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

[PRPF] Pahole Rare Plant Facility. 2019. Pahole Rare Plant Facility Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

[PEPP] Plant Extinction Prevention Program. 2013. PEPP annual report fiscal year 2013 (July 1, 2012-June 30, 2013). 207 pp.

[PEPP] Plant Extinction Prevention Program. 2014. PEPP annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 pp.

[PEPP] 2015. PEPP annual report fiscal year 2015 (July 1, 2014-June 30, 2015). 179 pp.

[PEPP] 2016. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.

[PEPP] 2017. Plant Extinction Prevention Program FY 2017 annual report (Oct 1, 2016-Sep 30, 2017), US FWS CFDA program #15.657; Endangered species conservation-recovery implementation funds, Cooperative Agreement F14AC00174, December 12, 2017, UH Manoa, PCSU, PEPP. 235 pp.

[PEPP] 2019. Plant Extinction Prevention Program, FY 2019 Annual Report (Oct 1, 2018-Sep 30, 2019), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F18AC00502, December 26, 2019, UH Manoa, PCSU, PEPP. 192 pp. + appendices.

[PEPP] 2020. Interim PEPP reports for 2020. Excel table.

[PEPP] 2021. Interim PEPP reports for 2021. Excel table.

- Pu‘uwa‘awa‘a. 2019. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- Rovzar, C. T.W. Gillespie, K. Kawelo, M McCain, E.C. Riordan, and S. Pau. 2013. Modeling the potential distribution of endangered, endemic *Hibiscus brackenridgei* on Oahu to assess the impacts of climate change and prioritize conservation efforts. *Pacific Conservation Biology* 19(2): 156–168, DOI: 10.1071/PC130156.
- [USFWS] U.S. Fish and Wildlife Service. 1999. Recovery plan for the multi-island plants. USFWS Region 1, Portland, OR. 206 pp. + appendices.
- [USFWS] 2009. *Hibiscus brackenridgei* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.  
[https://ecos.fws.gov/docs/tess/species\\_nonpublish/1409.pdf](https://ecos.fws.gov/docs/tess/species_nonpublish/1409.pdf).
- [USFWS] 2012. Endangered and threatened wildlife and plants; endangered status for 23 species on Oahu and designation of critical habitat for 124 species. 77 FR 57648, September 18, 2012.
- [USFWS] 2013. *Hibiscus brackenridgei* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.  
[https://ecos.fws.gov/docs/tess/species\\_nonpublish/2077.pdf](https://ecos.fws.gov/docs/tess/species_nonpublish/2077.pdf).
- [USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, and Kahoolawe for 135 species; final rule. 81 FR 17790, March 30, 2016.
- [USFWS] 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.
- [VRPF] Volcano Rare Plant Facility. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- Waimea Arboretum. 2013. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- Waimea Arboretum. 2014. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted

to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office,  
Honolulu, Hawai'i.

Waimea Arboretum. 2015. Report on controlled propagation of listed species, as  
designated under the U.S. Endangered Species Act. Unpublished report submitted  
to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office,  
Honolulu, Hawai'i.

Waimea Arboretum. 2017. Report on controlled propagation of listed species, as  
designated under the U.S. Endangered Species Act. Unpublished report submitted  
to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office,  
Honolulu, Hawai'i.

Waimea Arboretum. 2018. Report on controlled propagation of listed species, as  
designated under the U.S. Endangered Species Act. Unpublished report submitted  
to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office,  
Honolulu, Hawai'i.

**U.S. FISH AND WILDLIFE SERVICE**

SIGNATURE PAGE for 5-YEAR REVIEW of *Hibiscus brackenridgei*  
(ma‘o hau hele)

**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 \_\_\_\_\_