Calamagrostis hillebrandii
(no common name)

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: *Calamagrostis hillebrandii* (no common name)

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1.0 GENERAL INFORMATION

1.1 Reviewers:

Cheryl Phillipson, Biologist, Pacific Islands Fish and Wildlife Office (PIFWO)
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
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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on the final rule listing this species; the final critical habitat designation; peer reviewed scientific publications; unpublished field observations and species status report by the Service, State of Hawai‘i, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information.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. 2013. Endangered and threatened wildlife and plants; determination of endangered status for 38 species on Molokaʻi, Lānaʻi, and Maui. Department of the Interior, Federal Register 78(102): 32014-32065, May 28, 2013.

Date listed: May 28, 2013
Entity listed: *Calamagrostis hillebrandii*
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:

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokaʻi, Lānaʻi, Maui, and Kahoʻolawe for 135 species; final rule. Department of the Interior, Federal Register 81(61): 17790–18110, March 30, 2016.

Critical habitat was designated on west Maui for *Calamagrostis hillebrandii*, totaling two units in the montane wet ecosystem (598 ha; 1,479 ac).

1.3.4 Review History:

This is the first 5-year review for *Calamagrostis hillebrandii*.

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

2

1.3.6 Current Recovery Plan or Outline:

Name of plan or outline: Recovery Outline for the Islands of Maui, Molokaʻi, Kahoʻolawe, and Lānaʻi (Maui Nui), 29 pp. + maps

Date issued: October 2019
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.

Calamagrostis hillebrandii is a short-lived perennial grass. 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 should be documented on Maui where they now occur or occurred historically. Each of these populations must be naturally reproducing (i.e., viable seeds, seedlings) with a minimum of 50 mature individuals per population.

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

Interim Stage
To meet the interim stage of recovery of *Calamagrostis hillebrandii*, 300 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. 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 500 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. 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 500 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. 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:

Calamagrostis hillebrandii is a slender, short-rhizomatous perennial grass with erect, tufted, glabrous (without hairs) culms (aerial stems) 30 to 50 cm (12 to 20 in) tall. Sheaths (tubular structure surrounding the culm) are glabrous, longer than the internodes, with tightly overlapping margins, 10 to 15 cm (12 to 20 in) long, and 2 to 4 millimeters (m) (0.08 to 0.2 in) wide. Inflorescences are paniculate (branched with flowers borne upon the secondary branches), ovate (egg-shaped), 5 to 30 cm (2 to 12 in) long, 3 to 7 cm (1 to 3 in) wide, with branches ascending to spreading, pubescent (with hairs) near the base, the lower half of the branches without spikelets (an ultimate flower cluster). The rachilla (axis of the spikelet) are 1.5 to 2 mm (0.06 to 0.08 in) long, silky villous (long, soft, often bent or curved but not matted hairs), with an awn (slender, terminal or dorsal stiff hair) up to 4 mm (0.2 in) long. Fruits have not been described (O'Connor 1990, pp. 1509–1511).

Calamagrostis hillebrandii can be confused with *Deschampsia nubigena* and *Agrostis sandwicensis*. The differences between *C. hillebrandii* and *D.*

nubigena are that *Deschampsia* has only "one floret and a subapically instead of dorsally attached awn" (O'Connor 1990, p. 1509). The difference between *C. hillebrandii* and *A. sandwicensis* is that *Agrostis* has a well-developed, long and pubescent rachilla (O'Connor, p. 1511). Therefore, if the plants are not fruiting or flowering, it is difficult to confirm identification of an individual of *C. hillebrandii.*

Pollination and seed dispersal of this species is likely by wind (Oppenheimer 2019, pers. comm.). Breezy conditions occur throughout its bog habitat (Oppenheimer 2019, pers. comm.), which suggests that pollination and dispersal throughout the range of this species can occur. In addition, based on studies by Sakai et al. (1995, p. 2527), the presumed pollination mechanism is wind and seed dispersal mechanism may also be by attachment of its barbed fruit to birds for the colonizing species of the lineage of *Calamagrostis hillebrandii*.

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, *Calamagrostis hillebrandii* was found "at the top of Mount Eeka" in the west Maui mountains (Smithsonian Department of Botany 2020). Hitchcock (1922, pp. 148–149) reported a collection made from central Moloka'i; but this specimen was never reviewed by taxonomists and is considered invalid (O'Connor 1990, pp. 1509–1511). Currently, there are approximately 100 individuals in each of three locations: the Kahakuloa section of the West Maui Natural Area Reserve (NAR) including 'Eke crater; the Honokōwai section of the West Maui NAR; and at Pu'u Kukui (HBMP 2010; Oppenheimer 2010, in litt.; Oppenheimer 2019, pers. comm.).

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:
Calamagrostis hillebrandii was first described as *Deyeuxia hillebrandii* by Hillebrand in 1888 ((Munro ex Hillebr.) Hitchcock 1922) and *C. hillebrandii* is the currently accepted taxonomy for this species (O'Connor 1990, pp. 1509–1511).

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):

Calamagrostis hillebrandii grows in montane bogs at 1,372 to 1,764 meters (m) (4,500 to 5,788 feet (ft)) in areas receiving 5,264 to 9,296 millimeters (mm) (247 to 366 inches (in)) annual rainfall (Gagne and Cuddihy 1990, p. 103; O'Connor 1990, pp. 1509–1511; Giambelluca et al. 2013). The associated native species include *Agrostis sandwicensis* (bentgrass), *Argyroxiphium caliginis* (ʻEke silversword), *Calamagrostis expansa*, *Dicranopteris* spp. (uluhe), *Dubautia laxa* (naʻenaʻe pua melemele), *Eragrostis grandis*, *Geranium hillebrandii* (nohoanu), *Freycinetia arborea* (ʻieʻie), *Huperzia haleakalae*, *Hydrangea arguta* (kanawao), *Ilex anomala* (kāwaʻu), *Keysseria mavaiensis* (hōwaiaula), *Labordia hedyosmifolia* (kāmakahala), *Leptecophylla tameiameiae* (pūkiawe), *Lycopodium venustulum*, *Melicope clusiifolia* (kūkaemoa), *M. orbicularis* (alani), *Metrosideros polymorpha* (ʻōhiʻa), *Palhinea cernua* (wāwaeʻiole), *Peperomia eekana* (ʻalaʻala wai nui), *Plantago pachyphylla* (laukahi kuahiwi), *Sanicula purpurea*, and *Viola maviensis*.

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 ungulates 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 (Loope 1998, pp. 747–774; van Riper and van Riper 1982, pp. 34–35). Currently, the bog habitat on the west Maui mountains is free of feral pigs and is protected by fencing and management activities (DLNR 2017, pp. 7, 16–18; Puʻu Kukui Watershed Preserve 2020). Fences are monitored and maintained to prevent incursion by feral pigs.

Established ecosystem-altering invasive plant modification and degradation of habitat—Invasive introduced plant species modify habitat 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 *Calamagrostis hillebrandii* (Browning et al. 2019, p. 14). The nonnative plants with the greatest impacts on *C. hillebrandii* include *Tibouchina herbacea* (cane tibouchina, glory bush), *Ageratina adenophora* (Maui pāmakani) and the bog rush species *Juncus effusus*, *J. ensifolius*, and *J. planifolius* (Browning et al. 2019, p. 14).

Climate change loss or degradation of habitat—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 *Calamagrostis hillebrandii* is highly vulnerable to the impacts of climate change with a vulnerability score of 0.712 (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.

Tropical cyclone frequency and intensity are projected to change as a result of climate change over the next 100 to 200 years (Vecchi and Soden 2007, p. 4317; Emanuel *et al.* 2008, p. 348; Yu *et al.* 2010, pp. 1369–1372). In the central Pacific, modeling projects an increase of up to two additional tropical cyclones per year in the main Hawaiian Islands by 2100 (Murakami *et al.* 2013, pp. 1–6). Hurricanes pose an ongoing and ever-present threat because they can happen at any time. A destructive hurricane holds the potential of driving a localized endemic species to extinction in a single event.

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 pigs are present in the mountains of west Maui. Feral pigs have been observed browsing on young shoots, leaves, and fronds of a wide variety of native plants. A stomach-content analysis showed that most of the pigs' food source consisted of the endemic *Cibotium* (hāpu'u) tree fern and other native species in the genera *Clermontia*, *Coprosma*, *Kadua*, *Psychotria*, and *Scaevola* (Diong 1982, p. 144). Currently, *Calamagrostis hillebrandii* occurs in fenced areas that are managed; however, exclosures must be monitored and maintained to prevent incursion (DLNR 2017, pp. 7, 16–18; Pu‘u Kukui Watershed Preserve 2020).

2.3.2.4 Inadequacy of existing regulatory mechanisms (Factor D):
Nonnative feral ungulates are an ongoing threat to *Calamagrostis hillebrandii* through destruction and modification of habitat and direct predation. Public hunting areas are not fenced and game mammals have unrestricted access for most areas across the landscape, regardless of underlying land use designation; therefore, any unfenced populations of *C. hillebrandii* are at risk (DLNR 2010).

Many invasive nonnative plants established on Maui have currently limited but expanding rages and are of concern, especially with the limited resources available. Most control efforts for invasive plants are focused on a few species that cause significant economic or environmental damage. Invasion of the State of Hawai‘i by invasive nonnative plant species and other pests is a threat to native species. Pests have caused the extinction of native species, the destruction of native forests, and the spread of disease. Interstate commerce provides the pathway for invasive species and commodities infested with non-Federal quarantine pests to enter the State of Hawai‘i. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine is authorized to prevent the introduction or dissemination of animal and plant diseases and pests on all ships, aircraft, and their cargo and baggage arriving in the U.S. and its territories. Federal import regulations do not address many species that could be pests in Hawai‘i (CGAPS 2009; Ikuma *et al.* 2002, pp. 23–24).

2.3.2.5 Other natural or manmade factors affecting its continued existence (Factor E):
Not a threat.

Current Management Actions:

- Surveys and monitoring—Monitoring of *Calamagrostis hillebrandii* continues to be conducted by the Maui Plant Extinction Prevention Program (PEPP) staff (Oppenheimer 2019, pers. comm.). Observations and monitoring information of *C. hillebrandii* are rare because it is difficult to identify this species in the field unless it is flowering, as it closely resembles *Deschampsia nubigena* (Oppenheimer 2019, pers. comm.). In addition, due to fragile bog habitat where this species occurs, monitoring is not conducted on a regular basis because managers do not want to disturb the extremely sensitive bog habitat by trampling and creating open areas for nonnative plants to invade the area. The bogs are very wet and marshy, therefore, each step into the area causes a person to sink into the water, along with the vegetation. These disturbances to the vegetation in the bogs have a slow rate of recovery, therefore, the benefits of monitoring and management within bog habitat are often weighed against the likelihood for degradation.
- Ungulate control—All occurrences of *Calamagrostis hillebrandii* are fenced and monitored (DLNR 2017, pp. 7, 16–18; Pu‘u Kukui Watershed Preserve 2020).
- Ecosystem-altering invasive nonnative plant control—Nonnative plants are controlled within Pu‘u Kukui Watershed Preserve.
- Captive propagation for genetic storage and reintroduction—Lyon Arboretum Seed Conservation Laboratory reports 196 seeds in storage representing 10 founders from Honokōhau (Lyon Arboretum 2020).

Table 1. Status and trends of *Calamagrostis hillebrandii* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Preventing Extinction Criteria identified by HPPRCC	Preventing Extinction Criteria Completed?
2013 (listing)	few 100	0	All threats managed in all 3 populations	Partially, area fenced and managed
			Complete genetic storage	No
			3 populations with 50 mature individuals each	Yes
2016 (critical habitat)	few 100	0	All threats managed in all 3 populations	Partially, area fenced and managed
			Complete genetic storage	No
			3 populations with 50 mature individuals each	Yes
2021 (5-year review)	300	0	All threats managed in all 3 populations	Partially, area fenced and managed
			Complete genetic storage	No
			3 populations with 50 mature individuals each	Yes
			Each population naturally reproducing	Not reported but likely

Table 2. Threats to *Calamagrostis hillebrandii* and ongoing conservation efforts.

Threat	Listing Factor	Current Status	Conservation/Management Efforts
Destruction and degradation of habitat by ungulates	A	Ongoing	Yes, area fenced and managed
Destruction and degradation of habitat by established ecosystem-altering invasive plants	A	Ongoing	Partial, some nonnative plant control
Climate change degradation or loss of habitat, including hurricanes	A	Ongoing	None

Inadequacy of regulatory mechanisms	D	Ongoing	Partial, area fenced and managed

2.4 Synthesis

There are approximately 300 wild individuals of *Calamagrostis hillebrandii* on west Maui. 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 *C. hillebrandii* is highly vulnerable to the effects of climate change. The area on west Maui where *C. hillebrandii* occurs is fenced and managed for ungulates and some nonnative plant control is ongoing. There are seeds representing at least 10 founders in storage.

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 should be documented on Maui where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds or seedlings) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met as, although there are approximately 300 wild individuals in three populations there is uncertainty regarding how many of those individuals are reproductive, only partial *ex situ* genetic representation exists for one population (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Calamagrostis hillebrandii* 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 monitor and inventory *Calamagrostis hillebrandii* in known locations and in 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 *C. hillebrandii*.
- 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 propagation and reintroduction to increase numbers of populations and individuals in suitable habitat to build resiliency and redundancy and reduce the impacts of climate change.
- 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 *Calamagrostis hillebrandii*
(no common name)

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 09:57:45 -10'00'

for _____

Field Supervisor, Pacific Islands Fish and Wildlife Office