Bulbophyllum guamense
(Siboyan halom tano; Siboyas halumtano)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, HI

5-YEAR REVIEW

Species reviewed: *Bulbophyllum guamense* (Siboyan halom tano; Siboyas halumtano)

TABLE OF CONTENTS

5-YEAR REVIEW
Bulbophyllum guamense

1.0 GENERAL INFORMATION

1.1 Reviewers

Toni Mizerek, Biologist, Pacific Islands Fish and Wildlife Office (PIFWO)
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Lead Regional or Headquarters 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 (USFWS), beginning in January 2020. The review was based on the final rule listing this species; peer reviewed scientific publications; unpublished field observations by the USFWS, Territory of Guam and the Commonwealth of the Northern Mariana Islands (CNMI) and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information.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 completed by Toni Mizerek, 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. 2015. 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 83(88): 20088–20092, May 7, 2018.

1.3.2 Listing history

Original Listing
FR notice: [USFWS] U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Endangered Status for 16 Species and Threatened Status for 7 Species in Micronesia; Final Rule. Department of the Interior, Federal Register 80 (190): 59424-59497, October 1, 2015.

Date listed: October 1, 2015
Entity listed: *Bulbophyllum guamense*
Classification: Threatened

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 this species. *Bulbophyllum guamense* is an epiphytic orchid that was listed as threatened on October 1, 2015 (80 FR 59424). Critical habitat has not been designated for this species. The draft recovery plan for this species is in preparation.

1.3.5 Species' Recovery Priority Number at start of this 5-year review
8

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Recovery Outline for 23 Mariana Island Species
Date issued: February 3, 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[1] 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 criteria?

____ ***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, C, and D) affecting this species is presented in section 2.3.2 and Table 2. Listing Factor B (overutilization for commercial, recreational, scientific, or educational purposes) and Listing Factor E (other species-specific threats) are not known to be a threat to this species.

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 Mariana Island 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 plant species in the Mariana Islands are at very low numbers or declining rapidly, so the USFWS 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 USFWS 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.

Bulbophyllum guamense is a short-lived epiphytic perennial. To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (e.g., fenced and free of pests) 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 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, reproducing individuals per population.

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

Interim Stage

To meet the interim stage of recovery of *Bulbophyllum guamense*, 300 mature, reproducing individuals are needed in each of three populations, with at least one population on each island from which the species was known historically, as long as suitable habitat exists. All major threats must be controlled around the populations designated for recovery at this stage. There should also be demonstrated regeneration of seedlings 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) 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

As *B. guamense* is currently listed as Threatened, no species-specific downlisting criteria are provided.

Delisting Criteria
In addition to achieving 5 to 10 populations with 500 mature, reproducing individuals per population and all of the goals of the interim stabilization stage, 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 three populations 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. Delisting 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 delist. 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. 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:
Bulbophyllum guamense is an epiphytic orchid (family Orchidaceae) characterized by leaf-bearing pseudobulbs that are spaced or clustered on a

creeping or mat-like formation of fiber-covered rhizomes or "stems" (Raulerson and Rinehart, 1992). Many orchids, including numerous species within the genus *Bulbophyllum*, require the presence of a microbial partner (e.g., mycorrhizal fungi) for seed germination. Flowering occurs almost year-round. The life stages (seed, seedlings, vegetative, and flowering plants) of *B. guamense* require very similar resources, as well as some more specific to epiphytic plants. At the seed stage, the seeds disperse from the fruit that is located on the mother plant, and the seeds are deposited onto a surface of a host tree. Seedlings of *B. guamense* likely require the presence of one or more species of microbes to successfully germinate and grow to adult plants. It is unknown whether *B. guamense* is self-compatible (when flowers are able to pollinate themselves or other flowers on the same plant and produce viable seeds) or relies all or in part on outcrossing (where flowers on one plant receive pollen from a flower on a different plant of the same species), or whether it requires a pollinator (and if so, the degree of specificity regarding species).

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:
At the time of listing in 2015, there were fewer than 250 individual *Bulbophllum guamense* in 3 occurrences on Guam and at least 261 individuals in nine occurrences on Rota. In the absence of consistent surveying throughout the known range, we are unable to determine the true current number of populations or individuals for *B. guamense* at this time. Data suggest *B. guamense* occurs in somewhat niched forest habitat as it is often observed to occur in a patchwork like distribution-with clusters in areas with specific elevation, moisture, and light conditions, and absent across large segments of the forested habitat. Existing survey data regarding the current estimated number and size of extant *Bulbophyllum guamense* populations suggest minimum population size of 426 individuals in five populations on Guam and 261 in four populations on Rota (UOG 2019 in litt; NBG 2019; Davis 2020 pers comm; JRM 2019; USFWS 2015).

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:
In 1822, the eminent French botanist Louis-Marie Aubert du Petit-Thouars first formally described the genus name *Bulbophyllum* from the Greek word *bulbos* = bulb and *phyllum* = leaf (Thouars 1822). *Bulbophyllum guamense*, or wild onion (siboyas halumtanu or siboyan halom tano in Chamorro), was first described on Guam by Ames (1914).

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.):
On Guam, small populations of *B. guamense* primarily occur at relatively high elevations in the native limestone and mixed/secondary forest habitat. On northern Guam, small populations of *B. guamense* occur on remnant native limestone forest patches interwoven with developed lands. On southern Guam, small populations of *B. guamense* occur on the mountainous slopes within native limestone forest habitat (*e.g.* Mt. Lamlam and Mt. Almagosa) as well as in ravine mixed/secondary forest on the mountainous slopes within native volcanic forest habitat (i.e., Mt. Bolanos) (Harrington et al.2012, in litt.; USFWS 2012, in litt.; USFWS 2015; NBG and Sundance-EA Associates 2019, in litt.; UOG 2019, in litt.; NBG and Sundance-EA Associates 2019, in litt.). There are also likely small populations and/or remnant individuals scattered along the tall, steep forested seaside cliffs surrounding Guam (e.g., Haputo Ecological Reserve and the adjacent NBGTCS) (Harrington et al. 2012, in litt.; USFWS 2012, in litt.; USFWS 2015; Siers et al. 2017; UOG 2019, in litt.). On Rota, several small populations of *B. guamense* occur along the slopes of the Rota Sabana, primarily above 980 ft (300 m) elevation (Zarones et al. 2015, in litt.).

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):
Bulbophyllum guamense is endemic to the forest habitat on the islands of Guam, Rota, Saipan, and Pagan, but currently is only known from Guam and Rota (USFWS 2015). *Bulbophyllum guamense* primarily grows on native trees and tall shrubs in native limestone forest and mixed introduced forest subtypes (Willsey et al. 2019; Zarones et al. 2015, in litt.). However, *B. guamense* has also been observed growing on nonnative trees and tall shrubs in the mixed introduced forest subtype, sometimes with a greater number of orchids on them (e.g., *Areca catechu* or betelnut) (Willsey et al. 2019; Zarones et al. 2015, in litt.). Occasionally *B. guamense* is observed growing on unidentified dead trees (Zarones et al. 2015, in litt.). Native host tree species include *Hernandia labyrinthica*, *Elaeocarpus joga*, and *Pisonia umbellifera* (Zarones et al. 2015, in litt.). Non-native host tree species include *Persea americana* (avocado), and *Areca catechu* (betelnut) (Zarones et al.2015, in litt.). On Rota, *B. guamense* was primarily found on *H. labyrinthica*, *E. joga* and *A. catechu* (Zarones et al. 2015, in litt.). For more information regarding the structure and composition of the forest habitat on Guam and Rota, please see Willsey et al. (2019).

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:
Agricultural, military training and urban development loss of degradation of habitat—More than 20% of the islands of Saipan and Guam are developed while approximately 6% of Tinian and Rota are developed (Spies et al. 2019). These are

the more developed islands across the species' range, reducing the available habitat for *B. guamense*. Ongoing military training also contributes to reduced available or less suitable habitat, primarily with the establishment of Marine Corps Base Blaz (USFWS 2015). The buildup associated with establishing this Base will result in a loss of approximately 1,219 acres of limestone forest, 613 acres of herbaceous scrub and 3,221 acres of developed/barren land.

Invasive animal destruction and degradation of habitat – Feral ungulates trample vegetation, contribute to erosion, graze often to the point of clearing understory vegetation and prevent regeneration by damaging or eating seeds or seedlings (USFWS 2015). Recent studies on Guam indicate that while pigs and deer consume seed, pigs disperse many seeds while deer did not. Additionally, deer seem to have a disproportionate effect on seedlings compared to pigs (Gawel *et al.* 2018). Plant regeneration is also impacted by rats that eat fleshy fruits, seeds, flowers, stems, leaves, roots, and other plant parts (USFWS 2015). The introduction of the brown tree snake to Guam resulted in the loss or severe reduction of native birds that dispersed native seeds or pollinated native plants (USFWS 2015). This steady, ongoing habitat degradation results in less available quality forest habitat, including native forest and mixed/secondary forest subtypes of the forest habitat on which *B. guamense* depends. Subsequently, the range for *B. guamense* has diminished.

Established ecosystem-altering invasive plant modification and degradation of habitat – Non-native plants degrade native habitats through a variety of processes including modifying: light availability, soil-water regimes, nutrient cycling and fire regimes and converting the plant communities from native to non-native dominated (USFWS 2015). Although *B. guamense* has adapted to utilize some nonnative species as host trees (e.g., betelnut), changes in forest composition and species diversity impact the availability of physical and biological resources. Subsequent cascading impacts include reduced recruitment, reduced population sizes, and reduced connectivity.

Fire destruction or degradation of habitat – Fire threatens native species and native ecosystems, particularly on Guam (USFWS 2015). Fire can destroy individual plants. Successive fires burn farther and farther into native habitat and alter microclimate conditions to further alter habitat conditions to favor nonnative plants. Nonnative plants convert native plant communities to nonnative dominated plant communities (D'Antonio and Vitousek 1992; Tunison *et al*. 2002). As of February 2020, 396 wildfires burned approximately 9,421-acres of private, Government and Federal lands (6.9% total area burned island-wide), which is a 2% increase from the previous year (FSRD 2020).

Typhoons and climate change degradation or loss of habitat – The Mariana Islands lie in the world's most prolific typhoon basin. Typhoons cause a number of impacts to native species and native ecosystems. Disturbed or destroyed vegetation due to typhoons modifies light availability and creates space for

invasion by nonnative pest species and nonnative plant species that compete for space, water, and nutrients, and alter basic water and nutrient cycling processes (USFWS 2015). The impacts of climate change on *B. guamense* are not well understood but climate change has had impacts in the tropical Pacific generally. Anticipated weather regime changes are likely to be one of the direct climate change impacts to *B. guamense* as well as possibly exacerbating the effects of other threats.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:
N/A

2.3.2.3 Disease or predation:
Slug Herbivory – *Bulbophyllum guamense* is at risk of slug herbivory. The Cuban slug (*Veronicella cubensis*) is a recent introduction to the Micronesian islands. These terrestrial mollusks are generalist feeders, and can attack a wide variety of plants, and switch food preferences if potential food plants change (Robinson and Hollingsworth 2006).

2.3.2.4 Inadequacy of existing regulatory mechanisms:
The Territory of Guam's Endangered Species Act (ESA) does not recognize *Maesa walkeri* as threatened, but the Commonwealth of the Northern Mariana Islands' ESA does. In addition, besides work regarding the brown tree snake, regulations surrounding the introduction, control, and eradication of other invasive species are lacking. Therefore, existing regulatory mechanisms in both Guam and the CNMI are inadequate to address threats imposed upon the species, especially loss of habitat due to development, invasive plants and non-native animals.

2.3.2.5 Other natural or manmade factors affecting its continued existence:
N/A

Current Management Actions:

- Surveys and inventories:
    - *Bulbophyllum guamense* are surveyed for in suitable habitat that may be cleared or degraded for various projects.
    - Joint Region Marianas (JRM) surveyed for ESA-listed species, including *B. guamense*, at the Naval Munitions Site (NMS) and Naval Base Guam Telecommunication Site. Surveys were conducted to document locations and estimate population densities in sites that are proposed for ungulate exclusion and forest restoration (JRM 2019).
- Captive propagation for genetic storage: The Guam Plant Extinction Prevention Program (GPEPP) stores propagules of *B. guamense* to preserve genetic variability and protect the species from catastrophic events that may result in the species' extinction. Currently, GPEPP has approximately 13,000

B. guamense seedlings in flasks. Germination of *B. guamense* via tissue culture has been more successful than establishing individuals in the nursery.

- Habitat protection:
    - An island-wide Habitat Conservation Plan for Guam, that would provide a collaborative and comprehensive approach to endangered species conservation on non-federal lands, is beginning to be developed (USFWS 2020).
    - A 2020 Memorandum of Understanding between JRM and the USFWS outlined a mutual understanding regarding the intentions and future considerations of a Department of Defense Readiness and Environmental Protection Integration Initiative (REPI) to address conservation of upland vegetation communities (DON and USFWS 2020).
    - Native forest ecosystems are being restored in multiple plots on the NMS within fenced areas where ungulates and invasive plants have been removed (JRM 2019).
    - Plans to exclude deer and pigs from 165 acres of North Haputo Ecological Reserve Area with ungulate fencing have been developed (USFWS 2017).
- Habitat protection/Ordnance: Range Fire Management Plan for Marine Corps Ranges on Guam. A range fire management plan to reduce range/wildfire potential, protect and enhance natural and cultural resources, integrate applicable permit and reporting requirements and implement ecosystem management goals, sustainable training, and objectives already supported on existing Marine Corps installations is being drafted.

Table 1. Status and trend of *Bulbophyllum guamense* from listing through 5-year review.

Date	No. wild individuals	Preventing Extinction Criteria identified by HPPRCC	Preventing Extinction Criteria Completed?
2015 (listing)	~ 500	All threats managed in all three populations	No
		Complete genetic storage	No
		3 populations with 50 mature individuals each	Unknown
2020	~ 700 (>426 in 5 populations on Guam and >261 in 4 populations on Rota)	All threats managed in all three populations	No, a few ungulate exclusion areas are planned
		Complete genetic storage	Partial
		3 populations with 50 mature individuals each	Partial, 1 population has >50 individuals

			but reproduction is unknown

Table 2: Threats to *B. guamense* and ongoing conservation efforts.

Threat	Listing Factor	Current Status	Conservation / Management Efforts
Agricultural, military training and urban development loss of degradation of habitat	A	Ongoing	Partial, development of HCP, REPI habitat protection
Invasive animal destruction and degradation of habitat	A	Ongoing	Partial, establishing ungulate fenced areas and eradication in progress
Established ecosystem-altering invasive plant modification and degradation of habitat	A	Ongoing	Partial, fenced plots with invasive plant removal established is planned in the Naval Magazine Site.
Fire destruction or degradation of habitat	A	Ongoing	None
Typhoons and climate change degradation or loss of habitat	A	Ongoing	None
Slug herbivory	C	Ongoing	None
Inadequate existing regulatory mechanisms	D	Ongoing	None

2.4 Synthesis

There are approximately nine populations of *Bulbophyllum guamense* of 700 individuals on both Guam and Rota. There is seed collection effort, but propagation has been challenging, and no outplantings have been conducted to date. There is some ongoing ungulate control for a small portion of individuals and there are plans in development for additional ungulate control, but the majority of populations have no ongoing threat control.

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 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 (Table 1), although there are more than three populations on each of Guam and Rota, there is only one wild

population with more than 50 individuals, and it is unknown whether they are mature, and the genetic storage goals have not been met. Recruitment has not been documented. In addition, all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Bulbophyllum guamense* meets the definition of Threatened as it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ **Delist** (Indicate reasons for delisting per 50 CFR 424.11):
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
_x__ No change is needed

3.2 New Recovery Priority Number

No change
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 survey for *B. guamense* in historical locations and potentially suitable habitat.
- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species and those that compete with *B. guamense* or modify their habitat.
- Fire monitoring and control—Develop and implement fire prevention management plans.
- Captive propagation for genetic storage and reintroduction—Collect seeds for storage and propagation efforts for maintenance of genetic stock.
- Ungulate predation or herbivory—Construct ungulate exclosures, or erect strategic fencing, around naturally occurring *B. guamense* populations to protect this species and associated habitat from feral ungulates.

- Climate change adaptation strategy—Research suitability of habitat in the future due to the impacts of climate change
- Alliance and partnership development—Initiate planning and contribute to implementation of ecosystem-level restoration and management, especially between Guam and the CNMI to benefit this taxon.
- Research life history and habitat associations to better identify information that will help guide recovery, for example: specific micro-habitat conditions, pollinators, reproduction, etc.

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U.S. FISH AND WILDLIFE SERVICE 5-YEAR REVIEW of *Bulbophyllum guamense*

Current Classification: Threatened

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

FIELD OFFICE APPROVAL:

for MEGAN LAUT Digitally signed by MEGAN LAUT Date: 2020.09.28 11:55:37 -10'00' Date _____

Field Supervisor, Fish and Wildlife Service