Psychotria grandiflora
(Kōpiko)

5-Year Review
Summary and Evaluation

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

5-YEAR REVIEW

Species reviewed: *Psychotria grandiflora* (Kōpiko)

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5-YEAR REVIEW
Psychotria grandiflora (Kōpiko)

1.0 GENERAL INFORMATION

1.1 Reviewers:

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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 June 2016. The review was based on the final rule listing this species; the final critical habitat designation; the recovery outline; peer reviewed scientific publications; unpublished field observations by the USFWS, State of Hawaii, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information.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 of Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, Conservation and Restoration Team Manager.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2015. Endangered and threatened wildlife and plants; 5-year status reviews of 133 species in Hawaii, Oregon, Idaho, and Washington. Federal Register 80(30): 8100–8103.

1.3.2 Listing history:

Original Listing
FR notice: USFWS. 2010a. Endangered and threatened wildlife and plants; determination of endangered status for 48 species on Kauai and designation of critical habitat, final rule. Federal Register 75(70): 18960–19165.
Date listed: April 13, 2010
Entity listed: Species
Classification: Endangered

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

1.3.3 Associated rulemakings:

N/A

1.3.4 Review History:

This is the first 5-year review for this species. *Psychotria grandiflora* is a small tree or shrub that was listed as endangered, with designation of critical habitat, on April 13, 2010 (USFWS 2010a). The recovery outline for *P. grandiflora* is included in the recovery outline for the Kauai Ecosystem, published in 2010 (USFWS 2010b). A draft recovery plan is in preparation.

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

At the start of the 5-year review, the Recovery Priority Number proposed for *Psychotria grandiflora* is 5 (using the USFWS scale of 1 to 18), based on the high degree of threat, a moderate potential for recovery with some threats that are well understood and easily alleviated and others that are currently difficult to alleviate, and its status as a full species (USFWS 2010b).

1.3.6 Current Recovery Plan or Outline:

Name of plan or outline: USFWS. 2010b. Recovery outline for the Kauai ecosystem. U.S. Fish and Wildlife Service, Portland, Oregon. 43 pp.
Date issued: June 17, 2010
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 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 (Factors A, B, C, D, and E) affecting this species is presented in section 2.3.2.

The recovery plan is currently being drafted. However, the Hawaii 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 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, 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. A species with a narrow extant range is one currently known from one or two adjacent gulches or ridges within the same mountain range. Some species have historically been known from only one population. For these species, given the limited information known of their habitat requirements, the number of mature individuals needed to prevent extinction was doubled within the known population rather than expanding the known range of the species for preventing extinction and the interim stage. 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

To prevent extinction of *Psychotria grandiflora* (a long-lived small tree or shrub with functionally unisexual flowers) the species needs a minimum of three

populations consisting of 50 mature individuals per population. In addition to achieving the numbers of reproducing individuals, all major threats must be controlled in the immediate vicinity of the populations, each population must show evidence of some stage of natural reproduction (*i.e.*, viable seeds or seedlings), and 50 mature individuals from each of three populations, or the total number of individuals if fewer than 50 exist in a population, must be represented in an *ex situ* collection that is secure and well managed.

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

Interim Stage

To meet the interim stage of recovery of *Psychotria grandiflora*, 200 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). 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 400 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 400 mature individuals per populations 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:

Psychotria grandiflora and *P. hobdyi* were the only two Hawaiian *Psychotria* taxa that exhibited floral monomorphy (two sexes are phenotypically indistinguishable). The restricted distribution of the *P. grandiflora* and *P. hobdyi* clade to oldest part of the oldest island in the Hawaiian chain provides two equally likely hypotheses of breeding system evolution. One implies ancestral floral monomorphy and two transitions to gynodioecy (male sterile individuals (*i.e.,* females) coexist with hermaphroditic individuals in populations) and the other assumes ancestral gynodioecy with a single reversal to homomorphy (all flowers have exactly the same structure) (Nepokroeff 1997).

Nepokroeff *et al.* (2003) investigated the systematic and biogeographical relationships within the Hawaiian *Psychotria* (Rubiaceae) using ribosomal DNA. Phylogenetic analyses strongly suggest that the Hawaiian *Psychotria* are monophyletic and the result of a single introduction to the Hawaiian Islands with a pattern of colonization from oldest to youngest islands. Additionally, a much higher incidence of intra-island versus interisland speciation was inferred.

Recent research into the breeding system of *Psychotria grandiflora* showed that this species is bird-pollinated, probably by native honeycreepers such as the anianiau (*Magumma parva*), and possibly by the nonnative Japanese white-eye (mejiro, *Zosterops japonicas*), or by moths (PEPP 2016). This is the first *Psychotria* known to be bird-pollinated.

Little else is known about the life history of *Psychotria grandiflora*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown.

Psychotria grandiflora is a small tree or shrub in the coffee family (Rubiaceae), which can reach up to 5 meters (16 feet) tall. Leaves are usually tinged red, leathery, obovate, and have revolute (curled under) margins. Flowers are functionally unisexual. This species is distinguished from other species of *Psychotria* by the pendent waxy flowers and white corollas (Wagner *et al.* 1999).

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, this species was known from collections at Waimea, Kokee, and Kalalau, all from the northwestern area of Kauai (Fosberg 1964). At the time of listing, 10 small populations of *Psychotria grandiflora* were found within Kokee State Park (SP), and were estimated to total between 16 and 30 individuals (Arnold 2007, in litt.; HBMP 2010; Perlman 2007, in litt.; Tangalin 2007, in litt.). In 2014, PEPP reported that, with more surveys, there were 14 populations totaling 58 individuals, all within the same area of Kokee SP and the adjacent Na Pali-Kona Forest Reserve (PEPP 2014). However, there are currently only 10 sites with live trees, totaling 42 trees, with the largest population having fewer than 20 trees (PEPP 2017).

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

No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature:

Psychotria grandiflora was described by H. Mann (1867–1868) from a type specimen collected in the mountains above Waimea on Kauai. This species is recognized as a distinct taxon by Wagner *et al.* (1999), the most recently accepted Hawaiian plant taxonomy.

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 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):

Psychotria grandiflora is found in *Acacia koa* (koa)–*Metrosideros polymorpha* (ohia) montane mesic to wet forest between the elevations of 3,400 and 4,100 feet (1,128 and 1,250 meters) (Nepokroeff 1997; HBMP 2010; TNCH 2007). Associated native plant species include *Bidens cosmoides* (poola nui), *Bobea brevipes* (ahakea lau lii), *Broussaisia arguta* (kanawao), *Charpentiera elliptica* (papala), *Cheirodendron trigynum* (olapa), *Cyrtandra longifolia* (haiwale), *Dianella sandwicensis* (ukiuki), *Dicranopteris linearis* (uluhe), *Diplazium sandwichianum* (hoio), *Dodonaea viscosa* (aalii), *Elaeocarpus bifidus* (kalia), *Ilex anomala* (kawau), *Kadua affinis* (manono), *Leptecophylla tamaeiameiae* (pukiawe), *Melicope anisata* (mokihana), *Perrottetia sandwicensis* (olomea), *Planchonella sandwicensis* (alaa), *Polyscias waimeae* (ohe kikoola), *Psychotria* spp. (kopiko), *Scaevola procera* (naupaka kuahiwi), *Stenogyne purpurea* (NCN), *Vaccinium calycinum* (ohelo), and *Xylosma hawaiiense* (maua) (HBMP 2010).

2.3.1.7 Other:

N/A

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 degradation of habitat—Feral pigs (*Sus scrofa*), goats (*Capra hircus*), and black-tailed deer (*Odocoileus hemionus*), 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. Habitat destruction and erosion caused by feral pigs, goats, and black-tailed deer are noted to be a threat to all occurrences of *Psychotria grandiflora* (HBMP 2010; NTBG 2009, 2011, 2016; PEPP 2010, 2012).

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. Invasive introduced plants with the greatest impacts on *Psychotria grandiflora* are: *Adiantum hispidulum* (rough maidenhair fern), *Axonopus fissifolius* (narrow-leaved

carpetgrass), *Blechnum appendiculatum* (NCN), *Ehrharta stipoides* (meadow ricegrass), *Erigeron karvinskianus* (daisy fleabane), *Eucalyptus robusta* (swamp mahogany), *Hedychium gardnerianum* (kahili ginger), *Holcus lanatus* (common velvet grass), *Kalanchoe pinnata* (air plant), *Lantana camara* (lantana), *Lonicera japonica* (Japanese honeysuckle), *Ludwigia palustris* (marsh purslane), *Morella faya* (firetree), *Passiflora tarminiana* (banana poka), *Psidium cattleianum* (strawberry guava), *Ricinus communis* (castor bean), *Rubus argutus* (prickly Florida blackberry), *R. rosifolius* (thimbleberry), and *Sphaeropteris cooperi* (Australian tree fern) (HBMP 2010; NTBG 2011, 2016).

Hurricanes—Loss and degradation of habitat—In November 1982, Hurricane Iwa struck the Hawaiian Islands, with wind gusts exceeding 100 miles per hour (mph) (161 kilometers per hour (kph)), causing extensive damage, especially on the islands of Niihau, Kauai, and Oahu (Businger 1998). In September 1992, Hurricane Iniki, a category 4 hurricane with maximum sustained wind speeds recorded at 140 mph (225 kph), passed directly over the island of Kauai. Many forest trees were destroyed (Perlman 1992), which opened the canopy and facilitated the invasion of nonnative plants (Kitayama and Mueller-Dombois 1995). A destructive hurricane holds the potential of driving a localized endemic species to extinction in a single event. Hurricanes pose an ongoing and ever-present threat because they can happen at any time, although their occurrence is not predictable. 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; Emanuel *et al.* 2008; Yu *et al.* 2010). 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).

Climate change loss or degradation of habitat—Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii 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. This assessment concluded that *Psychotria grandiflora* is highly vulnerable to the impacts of climate change with a vulnerability score of 0.909 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future.

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):

Ungulate predation or herbivory—Herbivory by feral pigs, goats, and black-tailed deer is a potential threat to all occurrences of *Psychotria grandiflora* (HBMP 2010; NTBG 2009, 2011, 2016; PEPP 2010, 2012).

Rodent predation or herbivory—Herbivory by rats (*Rattus* spp.) has been noted as a threat to all occurrences of *Psychotria grandiflora* (HBMP 2010; NTBG 2009, 2011, 2016; PEPP 2010, 2012). Rats eat virtually every part of plants and at every stage: fleshy fruits, seeds, flowers, stems, leaves, shoots, seedlings, and roots (Russell 1980; Cuddihy and Stone 1990). The effects on plants range from reduced vigor and decreased reproduction to mortality of individuals and complete lack of recruitment.

Invertebrate predation or herbivory—Herbivory or predation by insects is reported to be a threat to *Psychotria grandiflora* at the Awaawapuhi, Kalalau, Kumuwela, and Berry Flats occurrences (PEPP 2010, 2012, 2014).

2.3.2.4 Inadequacy of existing regulatory mechanisms (Factor D):

Lack of adequate hunting regulations—The Nualolo and Awaawapuhi occurrences of *Psychotria grandiflora* are within a State hunting area. Habitat modification and destruction by feral pigs, goats, and black-tailed deer is noted to be a threat to *P. grandiflora*. Nonnative feral ungulates pose a major ongoing threat to native species through destruction and modification of habitat, and by direct herbivory. Public hunting areas are not fenced and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land use designation; therefore, all populations are at risk (DLNR 2010).

Lack of adequate biosecurity legislation—Introduction of invasive nonnative plant and animal species to the State of Hawaii and destruction of habitat and competition by nonnative plants are threats to *Psychotria grandiflora*. 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 pests on all ships, aircraft, and their cargo and baggage arriving in the U.S. and its territories; however, Federal import regulations do not address many species that could be pests in Hawaii (CGAPS 2009; Ikuma *et al.* 2002).

2.3.2.5 Other natural or manmade factors affecting its continued existence (Factor E):

Invasive species—Established invasive plant species

competition—Nonnative plant species including *Axonopus fissifolius*, *Erigeron karvinskianus*, *Eucalyptus robusta*, *Hedychium gardnerianum*, *Kalanchoe pinnata*, *Lantana camara*, *Passiflora tarminiana*, *Psidium cattleianum*, *Rubus argutus*, *R. rosifolius*, and *Sphaeropteris cooperi* compete with *Psychotria grandiflora* for space, water, light, and nutrients (HBMP 2010; NTBG 2011, 2016).

Stochastic events—Reduced viability due to low numbers—Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species' capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (Barrett and Kohn 1991; Newman and Pilson 1997). The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as anthropogenic impacts like habitat loss from human development or predation by nonnative species. Very small plant populations may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. Lack of pollination may be a cause of low reproduction (Perlman 2007, in litt.). PEPP hand-pollinates individuals of *Psychotria grandiflora* to address occurrences with distances between them too great between them for genetic exchange to occur (PEPP 2016). There are only 42 individuals of *Psychotria grandiflora*, therefore, loss of reproductive vigor is a risk (PEPP 2011, 2014).

Current Management Actions:

- Surveys and inventories—Surveys are ongoing to locate additional individuals of this species (PEPP 2010, 2011, 2012, 2014, 2015).
- Ungulate monitoring and control—DOFAW has constructed a 0.008 hectare (0.02 acre) and a 0.02 hectare (0.6 acre) fence around two groups of individuals of *Psychotria grandiflora* at Kahuamaa Flats in Kokee SP (DOFAW 2005).
- Captive propagation for genetic storage and reintroduction—Collection of seeds and cuttings is ongoing (PEPP 2016). A large hand pollination effort in 2016, under the guidance of Kenta Watanabe, a professor at Okinawa College studying breeding systems in Rubiaceae, produced dozens of seeds that have been given to NTBG nursery, Lyon Arboretum Micropropagation Lab, and Kokee Rare Plant Facility (DOFAW 2016, Lyon Arboretum 2017, NTBG 2017). This effort continues in 2017 (Kishida 2017, pers. comm.).
- Stochastic events—Reduced viability due to low numbers—PEPP continues to monitor populations (PEPP 2010, 2011, 2012, 2014,

2016). Research was conducted to determine pollinators for this species (PEPP 2016).

Table 1. Status and trends of *Psychotria grandiflora* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Preventing Extinction Criteria identified by HPPRCC	Preventing Extinction Criteria Completed?
2010 (listing and critical habitat)	16–30	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2016 (5-year review)	58	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Reproduction (*i.e.*, viable seeds, seedlings) at all three populations	Unknown
			Three populations with 50 mature individuals each	No

Table 2. Threats to *Psychotria grandiflora* and conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partially, two small exclosures
Established ecosystem-altering invasive plant modification and degradation of habitat	A	Ongoing	None
Hurricane destruction and degradation of habitat	A	Ongoing	None
Climate change loss or degradation of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partially, two small exclosures
Rodent predation or herbivory	C	Ongoing	None

Invertebrate predation or herbivory	C	Ongoing	Partially, pesticide treatment
Inadequacy of existing regulatory mechanisms—Lack of adequate hunting regulations	D	Ongoing	None
Inadequacy of existing regulatory mechanisms—Lack of adequate biosecurity legislation	D	Ongoing	None
Invasive species—Established invasive plant species competition	E	Ongoing	None
Human disturbance—Hiking and fruit collection	E	Ongoing	None
Stochastic events—Reduced viability due to low numbers	E	Ongoing	Partially, seed collection and pollinator study

2.4 Synthesis

There are currently 42 wild individuals of *Psychotria grandiflora* in 10 subpopulations or sites in the Kokee region of Kauai. Seed collection efforts and pesticide treatments are ongoing. Two small exclosures have been constructed to protect a few individuals.

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 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 seed bank) collection. In addition, a minimum of three populations should be documented on Kauai 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 individuals per population.

The preventing extinction goals for this species have not been met, as currently no single populations of 50 mature individuals exist, genetic representation is incomplete (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Psychotria grandiflora* 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 survey for populations of *Psychotria grandiflora* in areas of potentially suitable habitat.
- Ungulate monitoring and control—Protect all occurrences against browsing and disturbances from feral ungulates. Continue to construct and maintain fenced exclosures around existing populations to prevent imminent extinction.
- Invasive plant monitoring and control
    - Control established ecosystem-altering nonnative invasive plant species around all populations.
    - Control invasive nonnative plant species around all populations that compete with the species.
- Rodent predation or herbivory control—Implement effective measures to control rodents around all populations.
- Invertebrate predation or herbivory control—Study *Psychotria grandiflora* populations to determine level of threat from invertebrate predation or herbivory and effective control actions.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock.
- Reintroduction and translocation—Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Population biology research—Study *Psychotria grandiflora* populations to determine viable population size and structure, geographical distribution, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Stochastic events—Build resilience and redundancy—

    - Increase numbers of populations and individuals scattered throughout historic range to reduce impacts from lack of pollination.
    - Increase numbers of populations and individuals scattered through historic range to reduce impacts from landslides and storms.
- Human disturbance—Protect occurrences along hiking trails and popular fruit collection sites.
- Based on the recovery criteria above, consider development of a recovery plan.

5.0 REFERENCES

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SIGNATURE PAGE for 5-YEAR REVIEW of *Psychotria grandiflora* (Kōpiko)

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

Appropriate Listing/Reclassification Priority Number, if applicable:_____

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

GREGORY KOOB Digitally signed by GREGORY KOOB
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