

Recovery Outline  
for the  
Island of O‘ahu



July 2018

**Scientific Name/ Common Name**

**PLANTS**

*Bidens amplexans*/ Ko‘oko‘olau  
*Cyanea calycina*/ Hāhā  
*Cyanea lanceolata*/ Hāhā  
*Cyanea purpurellifolia*/ Hāhā  
*Cyrtandra gracilis*/ Ha‘iwale  
*Cyrtandra kaulantha*/ Ha‘iwale  
*Cyrtandra sessilis*/ Ha‘iwale  
*Cyrtandra waiolani*/ Ha‘iwale  
*Doryopteris takeuchii*/ No common name  
*Korthalsella degeneri*/ Hulumoa  
*Melicope christophersenii*/ Alani  
*Melicope hiiaekae*/ Alani  
*Melicope makahae*/ Alani  
*Platydesma cornuta* var. *cornuta*/ No common name  
*Platydesma cornuta* var. *decurrens*/ No common name  
*Pleomele forbesii*/ Hala pepe  
*Polyscias lydgatei*/ No common name  
*Pritchardia bakeri*/ Baker’s Loulu  
*Psychotria hexandra* subsp. *oahuensis*/ Kōpiko  
*Pteralyxia macrocarpa*/ Kaulu  
*Stenogyne kaalae* subsp. *sherffii*/ No common name  
*Zanthoxylum oahuense*/ Mānele

**ANIMALS**

*Hylaeus kuakea*/ Hawaiian yellow-faced bee  
*Hylaeus mana*/ Hawaiian yellow-faced bee  
*Megalagrion nigrohamatum nigrolineatum*/  
Blackline Hawaiian damselfly  
*Megalagrion leptodemas*/ Crimson Hawaiian  
damselfly  
*Megalagrion oceanicum*/ Oceanic Hawaiian  
damselfly

**Listing Status and Date** Endangered; September 18, 2012 (77 FR 57648) and September 30, 2015 (80 FR 58820)

**Lead Agency/Region** U.S. Fish and Wildlife Service, Region 1

**Lead Field Office** Pacific Islands Fish and Wildlife Office  
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Honolulu, Hawai‘i 96850,  
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**Purpose of the Recovery Outline:** This document lays out a preliminary course of action for the survival and recovery of 20 plants and 3 damselflies endemic to the island of O‘ahu, all of which were listed endangered under the Endangered Species Act (ESA) in 2012; and 2 plants and 2 Hawaiian yellow-faced bees also endemic to the island of O‘ahu, listed as endangered under the ESA in 2016 (USFWS 2012b, 2016b). Recovery outlines include background information about the species, previous conservation efforts, and a list of recovery actions needed to meet recovery criteria. This recovery outline will address the recovery needs of these 27 species. These species will be included in a comprehensive recovery plan addressing the needs of all listed taxa found on O‘ahu.

This outline is meant to serve as interim guidance to direct recovery efforts and inform consultation and permitting activities until the comprehensive recovery plan has been completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (Service); formal public participation will be invited with the release of the draft recovery plan and the Service will consider any new information during the recovery planning process. For more information on Federal recovery efforts for the 27 recently listed species endemic to the island of O‘ahu, or to provide comments, interested parties may contact the lead field office for these species at the above address and telephone number.

**Scope of Recovery and Available Information:** The scope of this effort is at the island level. This recovery outline is based on best available scientific data contained in the proposed and final listing and critical habitat rules for the 27 recently listed species endemic to the island of O‘ahu, the previously listed species that currently occur on or are historic to O‘ahu, and the species for which critical habitat is newly designated or is revised (USFWS 2012a, 2012b, 2016a, 2016b). Most of the major threats to these species are well understood and involve introduced species such as feral ungulates, invasive plants, and nonnative invertebrates. While some research has been conducted on how to manage and control these threats, information is limited on the effects of other threats on these species (for example, the impact of climate change on the habitats and the distribution of the species). The Recovery Strategy will include recommendations to

address these uncertainties associated with specific habitat needs and the biology of the species, and will contribute to adaptive management methods.

## I. Overview

### A. BIOLOGICAL ASSESSMENT

#### 1. Species Description and Life History

Species descriptions and life history information for the 27 recently listed species are contained in the proposed and final listing and critical habitat rules (USFWS 2012b, 2016b).

#### 2. Historical and Current Population Status

Historical and current population status accounts also are contained in the proposed and final listing and critical habitat rules for these species (USFWS 2012a, 2012b, 2016a, 2016b). Table 1 provides a summary of the current status and distribution by habitat type of the species, and Map 1 in the Appendix shows the species' distributions by habitat type.

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Table 1–Current status and distribution of the 27 recently listed species endemic to O‘ahu.

Scientific Name	Common Name	# Populations	# Individuals	Habitat Types						
				Coastal	Lowland Dry	Lowland Mesic	Lowland Wet	Montane Wet	Dry Cliff	Wet Cliff
<b>PLANTS</b>										
<i>Bidens amplexans</i>	Ko‘oko‘olau	1	< 1,000	X	X					
<i>Cyanea calycina</i>	Hāhā	40	325–339			X	X	X		X
<i>Cyanea lanceolata</i>	Hāhā	4	< 60			X	X			
<i>Cyanea purpurellifolia</i>	Hāhā	5	ca 20				X			X
<i>Cyrtandra gracilis</i>	Ha‘iwale	1	6–8				X			
<i>Cyrtandra kaulantha</i>	Ha‘iwale	5	28				X			X
<i>Cyrtandra sessilis</i>	Ha‘iwale	4	83				X			X
<i>Cyrtandra waiolani</i>	Ha‘iwale	0	0**				X			
<i>Doryopteris takeuchii</i>	No common name	1	160–200		X					
<i>Korthalsella degeneri</i>	Hulumoa	1	> 100						X	
<i>Melicope christophersenii</i>	Alani	3	ca 250					X		X
<i>Melicope hiiakae</i>	Alani	10	< 60				X			
<i>Melicope makahae</i>	Alani	4	< 200			X			X	
<i>Platydesma cornuta</i> var. <i>cornuta</i>	No common name	10	48				X			
<i>Platydesma cornuta</i> var. <i>decurrens</i>	No common name	15	259–309			X			X	
<i>Pleomele forbesii</i>	Hala pepe	19	290–307		X	X			X	
<i>Polyscias lydgatei</i> listed as <i>Tetraplasandra lydgatei</i> *	No common name	2	8			X				
<i>Pritchardia bakeri</i>	Baker’s Loulu	1	100			X				
<i>Psychotria hexandra</i> subsp. <i>oahuensis</i>	Kōpiko	3	< 10				X			X

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Scientific Name	Common Name	# Populations	# Individuals	Habitat Types						
				Coastal	Lowland Dry	Lowland Mesic	Lowland Wet	Montane Wet	Dry Cliff	Wet Cliff
<i>Pteralyxia macrocarpa</i>	Kaulu	40	291–347			X	X		X	X
<i>Stenogyne kaalae</i> subsp. <i>sherffii</i>	No common name	0	0**				X			
<i>Zanthoxylum oahuense</i>	Mānele	5	21–25				X			
<b>ANIMALS</b>										
<i>Hylaeus kuakea</i>	Hawaiian yellow-faced bee	2	> 4			X				
<i>Hylaeus mana</i>	Hawaiian yellow-faced bee	4	> 5			X				
<i>Megalagrion nigrohamatum nigrolineatum</i>	Blackline Hawaiian damselfly	17	< 1,000				X			
<i>Megalagrion leptodemas</i>	Crimson Hawaiian damselfly	3	> 3				X			X
<i>Megalagrion oceanicum</i>	Oceanic Hawaiian damselfly	12	> 12			X	X			X

\* Taxonomy of *Tetraplasandra* genus changed to *Polyscias*, 80 FR 35860; Tuesday, June 23, 2015.

\*\* There are propagules in *ex situ* collections and/or *in situ* outplantings.

### 3. Habitat Description and Landownership

The 22 plants, 3 damselflies, and 2 yellow-faced bees are known from 7 terrestrial habitats on O‘ahu: coastal, lowland dry, lowland mesic, lowland wet, montane wet, dry cliff, and wet cliff. In addition, the damselflies have the species-specific requirement of fast-moving or slow-moving water in streams, ponds, and pools found within the lowland mesic, lowland wet, or wet cliff habitats (see Table 1 and Map 1—O‘ahu Species Ecosystems). These species and their habitats occur on Federal, State, County, and private lands (USFWS 2012b, 2016b). Map 2 illustrates the occurrences of these 27 species and designated critical habitat for 23 of these species and all previously-listed species on O‘ahu. Four of the 27 species (the plants *Pritchardia bakeri* and *Stenogyne kaalae* subsp. *sherffii*, and the yellow-faced bees *Hylaeus kuakea* and *H. mana*.) do not have designated critical habitat at this time.

### 4. Summary Biological Assessment

The 27 recently listed species in this recovery outline are endangered throughout their entire range. With extensive habitat management and additional species-specific management, these species have a high to moderate potential for recovery. Habitat management on other Hawaiian islands has shown that the potential for recovery is high if major threats are controlled. The threats with the largest impact to listed plant species are habitat modification and destruction by introduced ungulates, invasive plants, and fires, the effects of climate change including increased temperatures and reduced precipitation, herbivory by rats and nonnative invertebrates such as snails and slugs, competition with invasive plant species, natural catastrophes, and genetic consequences of small population sizes. Additional threats to the three damselflies include stream alterations, water removal, and predation by introduced fish. Additional threats to the yellow-faced bees include loss of host plants; competition with other bees, ants, and wasps; and predation by ants and wasps.

In Hawai‘i, management of ecosystem-level threats such as those caused by ungulates and invasive plants has been shown to be successful in many different habitats. As an example of ecosystem level habitat management, an ungulate exclosure on the island of Hawai‘i demonstrated that release from goat pressure by fencing resulted in a rapid recovery in height, growth, and numbers of vegetative re-sprouts of *Acacia koa* (koa) (Spatz and Mueller-Dombois 1973). After the removal of grazing animals at Pu‘u Wa‘awa‘a in 1985, *Acacia koa* and *Metrosideros polymorpha* (ohia) seedlings germinated by the thousands (Hawaii Department of Land and Natural Resources 2002). Loope *et al.* (1991) found that native plant cover increased from 6 to 95 percent 6 years after excluding pigs from a montane bog on Maui. In Hawai‘i Volcanoes National Park,

herbicide control of the invasive grass *Pennisetum clandestinum* (kikuyu grass) decreased cover from nearly 100 percent to less than 10 percent, and most native species survived the treatment and often proliferated (Gardner and Kageler 1983). Cabin *et al.* (2000) documented an increase in native seedlings and ground cover in a dry forest after the removal of *Pennisetum setaceum* (*Cenchrus setaceus*; fountain grass). Adaptive management methods, such as slow removal of *Morella faya* (faya tree) by girdling resulted in better recovery of native plant species, as measured by recovery of a more diverse suite of species and a decrease of introduced plant species compared to clear cut areas after 3 years (Loh and Daehler 2007, 2008).

The management of additional threats, such as rats and slugs, is possible and research is under way to determine the most efficient and effective control methods. Research is also in progress concerning the best cross-pollination, propagation, and reintroduction methods to use to increase the success of reestablishment of individuals and populations of plant species. Construction and maintenance of predator-proof enclosures to protect populations of *Achatinella* tree snails and native plants is currently in progress (Rohrer *et al.* 2016). Artificial nesting materials for yellow-faced bees are being tested in the field to help establish additional populations (Graham *in* Sandlin 2017, *in litt.*).

While the best available scientific information indicates the current and known historical distribution of many of these species is relatively small, it is very likely that many were much wider ranging prior to human colonization of the Hawaiian Islands (Burney *et al.* 2001, USFWS 2006a). Further systematic surveys are needed to assess the current distribution of these species and their habitat requirements so recovery areas can be expanded beyond their current distributions into additional areas. Modeling based on habitat requirements and known distributions will assist in selecting additional areas needed for recovery. Models incorporating climate change projections have been developed that map potential future distributions for most Hawaiian plant species and is currently being further refined (Fortini *et al.* 2013).

The Pacific Islands Fish and Wildlife Office’s Strategic Plan (USFWS 2011a) identifies Priority Ecosystem Conservation Areas (or Priority Landscapes) on O‘ahu. Priority Ecosystem Conservation Areas encompass key native ecosystems that, when properly managed, may provide for the long-term viability of entire native biotic communities, and thus, multiple native species. These areas were developed based, in part, on designated critical habitat, forest bird recovery areas, plant essential habitats (Price *et al.* 2007), information in the Recovery Plan for Hawaiian Waterbirds (USFWS 2011b), and other surveys and conservation planning documents (see Map 3). The Priority Landscape map for O‘ahu will be used in development of the O‘ahu Recovery Plan.

## 5. Revision of Existing Recovery Plans

To ensure that the recovery plan is inclusive and functions as an island-wide plan, all listed species endemic to O‘ahu will be included. The recovery plan will therefore include additional species totaling 61 plants, the entire genus of *Achatinella* tree snails, 6 picture-wing flies, and 2 forest birds (Table 2). These species have approved recovery plans; however, all are more than 10 years old. In addition, the revised recovery plan will address O‘ahu-specific management actions needed for previously listed species found on O‘ahu but also on other islands (i.e., species not endemic to O‘ahu) that may or may not have recovery plans in place. These species include: 62 plants, 4 water birds, 2 seabirds, 5 Hawaiian yellow-faced bees, and 2 Hawaiian damselflies (Table 3). Recovery actions specific to O‘ahu and how they will benefit these species will be included in the recovery plan (Table 4). Any recovery criteria for these species that require revision will be addressed in a separate multi-island recovery plan to be developed after all single-island endemic recovery plans are completed.

Table 2–Oahu endemic taxa to be included in the O‘ahu recovery plan by revision.

Scientific Name	Common Name	Listing Status Endangered or Threatened	Date Listed (FR citation)	Date Recovery plan
<b>PLANTS</b>				
<i>Abutilon sandwicense</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Asplenium dielfalcatum</i> listed as <i>Diella falcata</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Asplenium unisorum</i> listed as <i>Diella unisora</i>	No common name	E	06/27/1994 USFWS 1994d	08/10/1998 USFWS 1998a
<i>Cyanea acuminata</i>	Hāhā	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyanea crispa</i>	Hāhā	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	Hāhā	E	06/27/1994 USFWS 1994d	08/10/1998 USFWS 1998a
<i>Cyanea humboldtiana</i>	Hāhā	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyanea koolauensis</i>	Hāhā	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyanea longiflora</i>	Hāhā	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyanea pinnatifida</i>	Hāhā	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Cyanea st.-johnii</i>	Hāhā	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyanea superba</i>	Hāhā	E	09/11/1991 USFWS 1991a	08/10/1998 USFWS 1998a
<i>Cyanea truncata</i>	Hāhā	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a

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<i>Cyrtandra crenata</i>	Ha‘iwale	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Cyrtandra dentata</i>	Ha‘iwale	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyrtandra polyantha</i>	Ha‘iwale	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Cyrtandra subumbellata</i>	Ha‘iwale	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Cyrtandra viridiflora</i>	Ha‘iwale	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Delissea subcordata</i>	‘Ōhā	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Dubautia herbstobatae</i>	Na‘ena‘e	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Eragrostis fosbergii</i>	Fosberg’s lovegrass	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Euphorbia celastroides</i> var. <i>kaenana</i> listed as <i>Chamaesyce celastroides</i> var. <i>kaenana</i>	‘Akoko	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Euphorbia deppeana</i> listed as <i>Chamaesyce deppeana</i>	‘Akoko	T	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Euphorbia herbstii</i> listed as <i>Chamaesyce herbstii</i>	‘Akoko	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Euphorbia kuwaleana</i> listed as <i>Chamaesyce kuwaleana</i>	‘Akoko	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Euphorbia rockii</i> listed as <i>Chamaesyce rockii</i>	‘Akoko	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Euphorbia scottsbergii</i> var. <i>scottsbergii</i>	‘Akoko	E	08/24/1982 USFWS 1982	10/05/1993 Draft RP USFWS 1993b
<i>Gardenia mannii</i>	Nānū	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Kadua degeneri</i> listed as <i>Hedyotis degeneri</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Kadua parvula</i> listed as <i>Hedyotis parvula</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Labordia cyrtandrae</i>	Kāmakahala	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Lepidium arbuscula</i>	‘Ānaunau	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Lipochaeta lobata</i> var. <i>leptophylla</i>	Nehe	E	10/29/1991 USFWS 1991c	08/12/1995 USFWS 1995a
<i>Lobelia koolauensis</i> listed as <i>Lobelia gaudichaudii</i> subsp. <i>koolauensis</i>	No common name	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Lobelia monostachya</i>	No common name	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Lobelia oahuensis</i>	No common name	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a

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<i>Melanthera tenuifolia</i> listed as <i>Lipochaeta tenuifolia</i>	Nehe	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Melicope lydgatei</i>	Alani	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Melicope saint-johnii</i>	Alani	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Myrsine juddii</i>	Kōlea	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Neraudia angulata</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Phyllostegia hirsuta</i>	No common name	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Phyllostegia kaalaensis</i>	No common name	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Phyllostegia mollis</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Phyllostegia parviflora</i> var. <i>lydgatei</i>	No common name	E	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Polyscias gymnocarpa</i> listed as <i>Tetraplasandra gymnocarpa</i>	‘Ohe‘ohe	E	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Pritchardia kaalae</i>	Loulu	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Sanicula mariversa</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Schiedea adamantis</i>	Diamond Head chiedea	E	02/17/1984 USFWS 1984	02/02/1994 USFWS 1994b
<i>Schiedea kaalae</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Schiedea kealiae</i>	Mā‘oli‘oli	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Schiedea nuttallii</i>	No common name	E	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Schiedea obovata</i> listed as <i>Alsinidendron obovatum</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Schiedea trinervis</i> listed as <i>Alsinidendron trinerve</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Silene perlmantii</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Stenogyne kanehoana</i>	No common name	E	5/13/1992 USFWS 1992c	08/10/1998 USFWS 1998a
<i>Tetramolopium filiforme</i>	No common name	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Trematolobelia singularis</i>	No common name	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<i>Urera kaalae</i>	Ōpuhe	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>	Pāmakani	E	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a

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<i>Viola oahuensis</i>	No common name	E	10/10/1996 USFWS 1996b	08/10/1998 USFWS 1998a
<b>ANIMALS</b>				
<i>Achatinella</i> spp.	O‘ahu tree snails	E	01/13/1981 USFWS 1981	06/30/1992 USFWS 1992b
<i>Chasiempis ibidis</i> listed as <i>Chasiempis sandwichensis ibidis</i>	O‘ahu ‘Elepaio	E	04/18/2000 USFWS 2000a	09/22/2006 USFWS 2006b
<i>Drosophila aglaia</i>	Hawaiian picture-wing fly	E	05/09/2006 USFWS 2006a	Recovery Outline Aug 2006 USFWS 2006c
<i>Drosophila hemipeza</i>	Hawaiian picture-wing fly	E	05/09/2006 USFWS 2006a	Recovery Outline Aug 2006 USFWS 2006c
<i>Drosophila montgomeryi</i>	Hawaiian picture-wing fly	E	05/09/2006 USFWS 2006a	Recovery Outline Aug 2006 USFWS 2006c
<i>Drosophila obatai</i>	Hawaiian picture-wing fly	E	05/09/2006 USFWS 2006a	Recovery Outline Aug 2006 USFWS 2006c
<i>Drosophila substenoptera</i>	Hawaiian picture-wing fly	E	05/09/2006 USFWS 2006a	Recovery Outline Aug 2006 USFWS 2006c
<i>Drosophila tarphytrichia</i>	Hawaiian picture-wing fly	E	05/09/2006 USFWS 2006a	Recovery Outline Aug 2006 USFWS 2006c
<i>Paroreomyza maculata</i>	O‘ahu creeper	E	10/13/1970 USFWS 1970	09/22/2006 USFWS 2006b

Table 3—Multi-island species which occur on O‘ahu (with or without previous recovery plans) to be included in the O‘ahu recovery plan.

Scientific Name	Common Name	Listing Status Endangered or Threatened	Island Distribution*	Date Listed (FR citation)	Date Recovery plan
<b>PLANTS</b>					
<i>Abutilon menziesii</i>	Ko‘oloa‘ula	E	H, M, L, O	09/26/1986 USFWS 1986a	09/29/1995 USFWS 1995b
<i>Achyranthes splendens</i> var. <i>rotundata</i> , listed as <i>Achyranthes rotundata</i>	Round-leaved chaff-flower	E	LX, MoX, O	03/26/1986 USFWS 1986b	10/05/1993 Draft Recovery Plan USFWS 1993b
<i>Adenophorus periens</i>	Pendant kihi fern	E	H, MX, LX, MoX, OX, K	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Alectryon macrococcus</i>	Mahoe	E	Mo, O, K	05/15/1992 USFWS 1992a	07/29/1997 USFWS 1997
<i>Asplenium dielirectum</i> listed as <i>Diellia erecta</i>	Asplenium- leaved diellia	E	HX, M, LX, Mo, O, KX	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Bonamia menziesii</i>	No common name	E	H, M, MoX, O, K	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Cenchrus agrimonoides</i>	Kāmanomano	E	M, LX, O, LaX, KuX, MiX	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Cyclosorus boydiae</i>	Kupukupu makali‘i	E	HX, O, M	09/30/2016 USFWS 2016	N/A
<i>Colubrina oppositifolia</i>	Kauila	E	H, M, O	03/04/1994 USFWS 1994e	09/26/1996 USFWS 1996d
<i>Ctenitis squamigera</i>	Pauoa	E	HX, M, LX, MoX, O, K	09/26/1994 USFWS 1994f	04/10/1998 USFWS 1998b
<i>Cyanea grimesiana</i> subsp. <i>grimesiana</i>	Hāhā	E	MoX, OX	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Cyperus pennatiformis</i> listed as <i>Mariscus</i> <i>pennatiformis</i>	No common name	E	H, KX, OX, M, La	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Cyperus trachysanthos</i>	Pu‘uka‘a	E	LX, MoX, O, K, NiX	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Diplazium molokaiense</i>	No common name	E	KX, OX, MoX, LX, M	09/26/1994 USFWS 1994f	04/10/1998 USFWS 1998b
<i>Eugenia koolauensis</i>	Nīoi	E	O, MoX	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a

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Scientific Name	Common Name	Listing Status Endangered or Threatened	Island Distribution*	Date Listed (FR citation)	Date Recovery plan
<i>Euphorbia haeleleana</i>	‘Akoko	E	O, K	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Flueggea neowawraea</i>	Mēhamehame	E	H, M, MoX, O, K	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Gardenia brighamii</i>	Nā‘ū, Hawaiian gardenia	E	HX, MX, L, MoX, O	08/21/1985 USFWS 1985a	09/30/1993 USFWS 1993a
<i>Gouania meyenii</i>	No common name	E	O, K	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Gouania vitifolia</i>	No common name	E	H, MX, O	06/27/1994 USFWS 1994d	08/10/1998 USFWS 1998a
<i>Hesperomannia arborescens**</i>	No common name	E	M, Mo, LX, O	03/28/1994 USFWS 1994c	8/10/1998 USFWS 1998a
<i>Hesperomannia arbuscula**</i>	No common name	E	O, M	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Hibiscus brackenridgei</i>	Ma‘o hau hele, native yellow hibiscus	E	H, M, KaX, L, MoX, O, KX	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Huperzia nutans</i> listed as <i>Phlegmariurus nutans</i>	Wāwae‘iole	E	O, KX	03/28/1994 USFWS 1994c	08/10/1998 USFWS 1998a
<i>Ischaemum byrone</i>	Hilo ischaemum	E	HX, M, Mo, OX, K	03/04/1994 USFWS 1994c	09/26/1996 USFWS 1996d
<i>Isodendron laurifolium</i>	Aupaka	E	O, K	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Isodendron longifolium</i>	Aupaka	T	O, K	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Isodendron pyrifolium</i>	Wahine noho kula	E	H, MX, LX, MoX, OX, NiX	03/04/1994 USFWS 1994e	09/26/1996 USFWS 1996d
<i>Joinvillea ascendens</i> subsp. <i>ascendens</i>	‘Ohe	E	H, M, Mo, O, K	09/30/2016 USFWS 2016	N/A
<i>Kadua coriacea</i>	Kio‘ele	E	H, MX, OX	05/15/1992 USFWS 1992a	07/29/1997 USFWS 1997
<i>Kadua fluviatilis</i>	Kamapua‘a	E	O, K	09/30/2016 USFWS 2016	N/A
<i>Kanaloa kahoowawensis</i>	Kohe malama malama o kanaloa	E	KX, OX, MX, KaX	09/03/1999 USFWS 1999b	09/19/2002 USFWS 2002

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Scientific Name	Common Name	Listing Status Endangered or Threatened	Island Distribution*	Date Listed (FR citation)	Date Recovery plan
<i>Lobelia niihauensis</i>	No common name	E	O, K, NiX	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Lysimachia filifolia</i>	Kāmakahala	E	O, KX	02/25/1994 USFWS 1994h	09/20/1995 USFWS 1995c
<i>Marsilea villosa</i>	‘Ihi ‘ihi	E	Mo, O, Ni?	06/22/1992 USFWS 1992d	04/18/1996 USFWS 1996a
<i>Melicope pallida</i>	Alani	E	OX, K	02/25/1994 USFWS 1994h	09/20/1995 USFWS 1995c
<i>Mezoneuron kavaense</i> listed as <i>Caesalpinia kavaensis</i>	Uhiuhi	E	H, MX, LX, MoX, O, KX	07/08/1986 USFWS 1986d	05/06/1994 USFWS 1994a
<i>Microlepia strigosa</i> var. <i>mauiensis</i>	Palapalai	E	H, M, O	09/30/2016 USFWS 2016	N/A
<i>Myrsine fosbergii</i>	Kōlea	E	K, O	09/30/2016 USFWS 2016	N/A
<i>Nothocestrum latifolium</i>	‘Aiea	E	M, LX, Mo, O	09/30/2016 USFWS 2016	N/A
<i>Nototrichium humile</i>	Kulu‘i	E	MX, O	10/29/1991 USFWS 1991c	8/10/1998 USFWS 1998a
<i>Panicum fauriei</i> var. <i>carteri</i> listed as <i>Panicum carteri</i>	Carter’s panicgrass	E	MX, Mo, O	10/12/1983 USFWS 1983d	05/23/1994 USFWS 1994i
<i>Peucedanum sandwicense</i>	Makou	T	M, Mo, O, K	02/25/1994 USFWS 1994h	09/20/1995 USFWS 1995c
<i>Phyllostegia parviflora</i> var. <i>parviflora</i>	No common name	E	MX, O	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Plantago princeps</i>	Laukahi kuahiwi	E	HX, M, MoX, O, K	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Platanthera holochila</i>	No common name	E	M, Mo, OX, K	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Portulaca villosa</i>	‘Ihi	E	H, M, Ka, LX, Mo, OX, Kl?, Le?, Ni?	09/30/2016 USFWS 2016	N/A
<i>Pseudognaphalium sandwicense</i> var. <i>molokaiense</i>	‘Ena‘ena	E	M, LX, Mo, OX	09/30/2016 USFWS 2016	N/A
<i>Pteris lidgatei</i>	No common name	E	M, Mo, O	09/26/1994 USFWS 1994f	04/10/1998 USFWS 1998b

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Scientific Name	Common Name	Listing Status Endangered or Threatened	Island Distri- bution*	Date Listed (FR citation)	Date Recovery plan
<i>Ranunculus mauianus</i>	Makou	E	HX, M, MoX, OX, K	09/30/2016 USFWS 2016	N/A
<i>Sanicula purpurea</i>	No common name	E	M, O	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Scaevola coriacea</i>	Dwarf naupaka	E	HX, M, Mo, LX, OX, KX, NiX	05/16/1986 USFWS 1986c	07/29/1997 USFWS 1997
<i>Schenkia sebaeoides</i> listed as <i>Centaurium sebaeoides</i>	‘Āwiwi	E	M, L, Mo, O, K	10/29/1991 USFWS 1991c	08/12/1995 USFWS 1995a
<i>Schiedea hookeri</i>	No common name	E	MX, O	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999a
<i>Sesbania tomentosa</i>	‘Ōhai	E	H, M, Ka, LX, Mo, OX, K, NiX, Nh, Ne	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Sicyos lanceoloideus</i>	‘Ānunu	E	O, K	09/30/2016 USFWS 2016	N/A
<i>Silene lanceolata</i>	No common name	E	H, LX, Mo, O, KX	10/08/1992 USFWS 1992e	09/26/1996 USFWS 1996e
<i>Solanum nelsonii</i>	Pōpolo	E	H, MX, Mo, NiX, Nh, La, PH, Mi, Ku	09/30/2016 USFWS 2016	N/A
<i>Solanum sandwicense</i>	Pōpolo ‘aiakeakua	E	OX, K	02/25/1994 USFWS 1994h	09/20/1995 USFWS 1995c
<i>Spermolepis hawaiiensis</i>	No common name	E	H, M, L, Mo, O, K	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<i>Tetramolopium lepidotum</i> subsp. <i>lepidotum</i>	No common name	E	LX, O	10/29/1991 USFWS 1991c	08/10/1998 USFWS 1998a
<i>Vigna o-wahuensis</i>	No common name	E	H, M, Ka, LX, Mo, OX	11/10/1994 USFWS 1994g	07/10/1999 USFWS 1999a
<b>ANIMALS</b>					
<i>Anas wyvilliana</i>	Koloa maoli, Hawaiian duck	E	H, M, MoX, O, K, Ni	03/11/1967 USFWS 1967	10/28/2011 USFWS 2011b

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Scientific Name	Common Name	Listing Status Endangered or Threatened	Island Distribution*	Date Listed (FR citation)	Date Recovery plan
<i>Fulica alai</i> listed as <i>Fulica americana alai</i>	‘Alae ke‘oke‘o, Hawaiian coot	E	H, M, L, Mo, O, K, Ni	10/13/1970 USFWS 1970	10/28/2011 USFWS 2011b
<i>Gallinula galeata sandvicensis</i> listed as <i>Gallinula chloropus sandvicensis</i>	‘Alae‘ula, Hawaiian common gallinule	E	HX, MX, MoX, O, K	03/11/1967 USFWS 1967	10/28/2011 USFWS 2011b
<i>Himantopus mexicanus knudseni</i>	Ae‘o; Hawaiian stilt	E	H, M, L, Mo, O, K, Ni	10/13/1970 USFWS 1970	10/28/2011 USFWS 2011b
<i>Hylaeus anthracinus</i>	Hawaiian yellow-faced bee	E	H, M, Ka, LX, Mo, O	09/30/2016 USFWS 2016	N/A
<i>Hylaeus assimulans</i>	Hawaiian yellow-faced bee	E	M, Ka, L, OX	09/30/2016 USFWS 2016	N/A
<i>Hylaeus facilis</i>	Hawaiian yellow-faced bee	E	MX, LX, Mo, O	09/30/2016 USFWS 2016	N/A
<i>Hylaeus hiliaris</i>	Hawaiian yellow-faced bee	E	MX, LX, Mo	09/30/2016 USFWS 2016	N/A
<i>Hylaeus longiceps</i>	Hawaiian yellow-faced bee	E	M, L, Mo, O	09/30/2016 USFWS 2016	N/A
<i>Megalagrion pacificum</i>	Pacific Hawaiian damselfly	E	H, M, LX, Mo, OX, KX	06/24/2010 USFWS 2010	N/A
<i>Megalagrion xanthomelas</i>	Orangeblack Hawaiian damselfly	E	H, M, L, Mo, O, KX	09/30/2016 USFWS 2016	N/A
<i>Pterodroma sandwichensis</i> listed as <i>Pterodroma phaeopygia sandwichensis</i>	‘Ua‘u, Hawaiian petrel	E	H, M, KaX, L, MoX, OX, K	03/11/1967 USFWS 1967	04/25/1983 USFWS 1983a
<i>Puffinus auricularis newelli</i>	Newell’s shearwater	T	H, M, MoX, OX, K	10/28/1975 USFWS 1975	04/25/1983 USFWS 1983a

\*Island distribution—H-Hawai‘i, M-Maui, Ka-Kaho‘olawe, L-Lāna‘i, Mo-Moloka‘i, O-O‘ahu, K-Kaua‘i, Ni-Ni‘ihau, Le-Lehua, KI-Ka‘ula, Nh-Nihoa, Ne-Necker, La-Laysan, Ku-Kure, PH-Pearl and Hermes, Mi-Midway, X-Extirpated; N/A–Not Applicable; ?–Unknown

\*\* *Hesperomannia arborescens* is now recognized to be only on Maui; individuals on O‘ahu are now either *H. oahuensis* or *H. swezyi*, *H. arbuscula* is no longer a valid species.

Table 4–Incorporation of listed endemic and multi-island species into the revised O‘ahu recovery plan.

	<b>Threats and actions needed</b>	<b>Benefits to accrue (as identified in step-down outline, implementation schedule)</b>	<b>Recovery criteria</b>
O‘ahu endemic recently listed species (Table 1)	Fully addressed	Fully addressed	Fully addressed
O‘ahu endemic listed species (Table 2)	Revise as needed	Revise as needed	Revise as needed if data available
Multi-island listed species (Table 3)	Elucidate as applies to O‘ahu	Elucidate as applies to O‘ahu	Revise in multi-island recovery plan

## **B. THREATS ASSESSMENT**

### **1. Listing Factors/Primary Threats to the Species**

As identified in the final listing rules (USFWS 2012b, 2016b), the primary threats to the 27 recently listed O‘ahu endemic species and their habitat are: habitat loss due to ungulates, invasive plants, and fire; predation and herbivory by ungulates and nonnative invertebrates; stream alterations (including dewatering); stochastic events such as hurricanes; and the effects of climate change. These threats can mostly be addressed by ecosystem-level management. Damage and diseases, including those resulting from nonnative invertebrates such as introduced slugs, leaf hoppers, and twig borers, are species-specific, however, and additional research will be required to develop tools to address these threats. A description of each threat is presented in the final listing rules (USFWS 2012b, 2016b) and each is classified according to the five listing and delisting factors identified in section 4 of the Endangered Species Act (16 USC 1531 *et seq.*). Table 5 summarizes the known threats to each of the 27 species.

Table 5–Summary of threats affecting the 27 recently listed species endemic to O‘ahu.

Species	Ecosystem	Factor A								Factor C		Factor D	Factor E
		Nonnative plants	Pigs	Goats	Fire	Urban Development	Stochastic Events	Stream Alterations	Climate Change	Predation by nonnative vertebrates	Predation by nonnative invertebrates	Inadequate existing regulatory mechanisms	Other species-specific threats
<b>PLANTS</b>													
<i>Bidens amplexans</i>	C, LD	X	X	X	X		H		X	U		X	
<i>Cyanea calycina</i>	LM, LW, MW, WC	X	X	X	X				X	U, R	S	X	T
<i>Cyanea lanceolata</i>	LM, LW	X	X				L, RF		X	U, R	S	X	
<i>Cyanea purpurellifolia</i>	LW, WC	X	X						X	U	S	X	LN
<i>Cyrtandra gracilis</i>	LW	X	X						X	U, R	S	X	LN
<i>Cyrtandra kaulantha</i>	LW, WC	X	X				L, RF, H		X	U	S	X	LN
<i>Cyrtandra sessilis</i>	LW, WC	X	X				L, RF, FL, H		X	U	S	X	T
<i>Cyrtandra waiolani</i>	LW	X	X						X	U	S	X	LN
<i>Doryopteris takeuchii</i>	LD	X			X		L, RF		X			X	T
<i>Korthalsella degeneri</i>	DC	X	X	X	X				X	U		X	LHP
<i>Melicope christophersenii</i>	MW, WC	X	X				H		X	U		X	
<i>Melicope hiakae</i>	LW	X	X				H		X	U, R	BTB	X	LN, T
<i>Melicope makahae</i>	LM, DC	X	X	X			L, RF		X	U	BTB	X	NR
<i>Platydesma cornuta</i> var. <i>cornuta</i>	LW	X	X				H		X	U		X	LN

Species	Ecosystem	Factor A								Factor C		Factor D	Factor E
		Nonnative plants	Pigs	Goats	Fire	Urban Development	Stochastic Events	Stream Alterations	Climate Change	Predation by nonnative vertebrates	Predation by nonnative invertebrates	Inadequate existing regulatory mechanisms	Other species-specific threats
<i>Platydesma cornuta</i> var. <i>decurrens</i>	LM, DC	X	X	X			L, RF		X	U		X	
<i>Pleomele forbesii</i>	LD, LM, DC	X	X	X	X		X		X	U	TSL	X	NR
<i>Polyscias lydgatei</i> -listed as <i>Tetraplasandra lydgatei</i>	LM	X	X						X	U		X	LN
<i>Pritchardia bakeri</i>	LM	X	X				H		X	R		X	LN
<i>Psychotria hexandra</i> subsp. <i>Oahuensis</i>	LW, WC	X	X				L, RF, FL, H		X	U, R		X	LN
<i>Pteralyxia macrocarpa</i>	LM, LW, DC, WC	X	X	X	X				X	U	TSL	X	
<i>Stenogyne kaalae</i> subsp. <i>sherffii</i>	LW	X	X						X			X	LN
<i>Zanthoxylum oahuense</i>	LW	X	X						X	U	TSL	X	LN
<b>ANIMALS</b>													
<i>Hylaeus kuakea</i>	LM	X	X		X		D, H		X		A, W	X	LN, LHP, B, W
<i>Hylaeus mana</i>	LM	X	X		X		D, H		X		A, W	X	LN, LHP, B, W
<i>Megalagrion leptodemas</i>	LW, WC				X, St	X	D, L, RF, FL, H	X	X	FI, BF	A	X	LND

Species	Ecosystem	Factor A								Factor C		Factor D	Factor E
		Nonnative plants	Pigs	Goats	Fire	Urban Development	Stochastic Events	Stream Alterations	Climate Change	Predation by nonnative vertebrates	Predation by nonnative invertebrates	Inadequate existing regulatory mechanisms	Other species-specific threats
<i>Megalagrion nigrohamatum nigrolineatum</i>	LW					X, St	D, FL, H	X	X	FI, BF	A	X	LND
<i>Megalagrion oceanicum</i>	LW, LM, WC					X, St	D, L, RF, FL, H	X	X	FI, BF	A	X	LND

Factor A = Habitat Modification; Factor C = Disease or Predation; Factor D = Inadequacy of Regulatory Mechanisms; Factor E = Other Species-Specific Threats.

Ecosystem: C= Coastal, LD=Lowland Dry, LM = Lowland Mesic, LW = Lowland Wet, MW = Montane Wet, DC = Dry Cliff, WC = Wet Cliff

Threat Type: A = Ants, B = Nonnative Bees, BF = Bullfrogs, BTB = Black Twig Borer, D = Drought, FI = Fish, FL = Flooding, H = Hurricanes, L = Landslides, LHP = Loss of Host Plants, LN = Limited Numbers ( $\leq 50$  individuals), LND = Limited Numbers Damselflies ( $\leq 20$  populations), NR = No Regeneration, R = Rats, RF = Rockfall, S = Slugs, St = Stream and aquatic alteration, T = Trampling, TSL = Two-Spotted Leafhopper, U = Ungulates, W = Wasps

## 2. Summary Threats Assessment

No new threats have been identified since the listing rules were published (see Table 5). The recovery plan will comprehensively address the 27 recently listed species endemic to O‘ahu, and will include multi-island species that may or may not have existing recovery plans. These species include aquatic habitat dependent damselflies; tree snails; yellow-faced bees; plants restricted to dry, mesic, and wet habitats; birds restricted to coastal, forest and wetland habitats; and picture wing flies. Most of the species are habitat specialists, have small ranges, or have limited dispersal abilities or opportunities. Together these traits make these species vulnerable to climate change (Fortini *et. al.* 2013). Several species are currently undergoing range contractions consistent with warming temperatures. Thus it will be important to consider climate change as part of the threat analyses for the covered species. Applying climate envelope modeling and other tools to recovery planning will identify climate refugia and dispersal corridors between current and future habitat. This information will help identify management priorities for areas necessary for recovery in a warming climate. Because of the taxonomic and geographic breadth of this recovery plan, it will serve as a template for listed species recovery and climate change planning throughout the Hawaiian Islands.

## C. CONSERVATION ASSESSMENT

### 1. Conservation Efforts

Numerous conservation efforts are occurring on O‘ahu that benefit some or all of the 27 recently listed species, but most are relatively small in scale and underfunded. The O‘ahu Army Natural Resources Program, which concentrates on listed species affected by U.S. Army training regimes, is the one exception. Although this program does not specifically focus on the 27 species addressed in this outline, many of the actions accomplished by this program benefit these species. Management actions accomplished by Army personnel, in cooperation with Hawai‘i’s Division of Forestry and Wildlife (DOFAW) and other landowners, includes fencing and restoring native areas, and monitoring and controlling invasive plants and invertebrates. For example, the Army’s O‘ahu Natural Resources Program (ONRP) is controlling *Morella faya* (firetree), an invasive tree capable of modifying a wide range of forest habitats in the Wai‘anae Mountains. The areas where firetree is being controlled is important habitat for *Bidens amplexans*, *Cyanea calycina*, *Korthalsella degeneri*, *Melicope christophersenii*, *Melicope makahae*, *Platydesma cornuta* var. *decurrens*, *Pleomele forbesii*, *Pteralyxia macrocarpa*, the three damselflies and both Hawaiian yellow-faced bees. The ONRP manages conservation efforts for an endemic forest bird, the O‘ahu ‘elepaio, in the

Waianae Mountains by conducting rat control (trapping, pneumatic traps, baiting) in areas of active nest sites (ONRP 2016). Results of these efforts have shown a subsequent 65 percent increase in reproduction of the O‘ahu ‘elepaio. The ONRP is monitoring populations of three endemic picture-wing flies, *Drosophila montgomeryi*, *D. obatai*, and *D. substenoptera*, that occur on Army lands (ONRP 2016). The program is augmenting occurrences of the picture-wing flies’ host plant, *Urera kaalae*, in management units. In addition, the program supports research on control methods for nonnative insects, slugs, snails, and chameleons. Other research relevant to the recently listed species includes developing seed storage protocols for rare plant species as well as their breeding biology and genetics (ONRP 2016).

Artificial nesting materials for Hawaiian yellow-faced bees are being tested in the field to help establish additional populations (Graham *in* Sandlin 2017, *in litt.*).

There are several plant propagation facilities in Hawai‘i; those on O‘ahu include the Lyon Arboretum Micropropagation Laboratory and Seed Storage Facility, Koko Crater Botanical Garden, Waimea Arboretum, and small plant nurseries run by the O‘ahu Army Natural Resources Program and DOFAW. The following species are currently in micropropagation, living material collections, or seed collections for genetic storage or reintroduction efforts: *Bidens amplexans*, *Cyanea calycina*, *C. lanceolata*, *C. purpurellifolia*, *Cyrtandra gracilis*, *C. kaulantha*, *C. sessilis*, *Melicope christophersenii*, *Platydesma cornuta* var. *cornuta*, *P. cornuta* var. *decurrens*, *Pleomele forbesii*, *Polyscias lydgatei*, and *Zanthoxylum oahuense* (PEPP 2017).

The O‘ahu Invasive Species committee (OISC) works to prevent the establishment of incipient invasive species on the island of O‘ahu (OISC 2012). Current priority species include the ecosystem-modifying weeds *Rubus discolor* (Himalayan blackberry), *Miconia calvescens* (miconia), and *Cenchrus setaceus* (fountain grass). The latter creates an abundance of fine fuel and poses a major fire threat to many of Hawai‘i’s natural areas and OISC is working to prevent its establishment in the Wai‘anae Mountains.

The Ko‘olau Mountain Watershed Partnership (a partnership of 25 landowners and land managers on O‘ahu) focuses management efforts on ecosystem protection, including control of feral ungulates, invasive plants and insects, and fire prevention. Examples include mapping invasive weed distributions across the summits of the Ko‘olau Mountains, establishing ungulate transects, constructing and maintaining pig traps, and controlling invasive plant species such as *Leptospermum flavescens* and *L. scoparium* (Australian tea) in native areas.

The Plant Extinction Prevention Program (PEPP) focuses on monitoring those plant species with fewer than 50 individuals remaining in the wild. The goal of the program is to achieve general interim recovery guidelines set by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (established in 1994) which are: having or establishing three populations of 25 (long-lived species), 50 (short-lived), or 100 (annual)

mature, reproducing individuals; ensuring that all threats to those populations are being managed; and maintaining collections of all species in genetic storage. The PEPP has monitored, accomplished threat management, and collected specimens or genetic material from *Cyanea purpurellifolia*, *Cyrtandra gracilis*, *C. kaulantha*, *C. sessilis*, *Platydesma cornuta* var. *cornuta*, *Polyscias lydgatei*, and *Zanthoxylum oahuense* (PEPP 2011, 2012, 2017; ONRP 2016).

## **2. Summary Conservation Assessment**

Overall, populations of all the 27 recently listed species are declining and their ranges are highly restricted. However, the recovery prognosis for these species is thought to be positive because the populations are either of sufficient size to allow for successful management or can be reintroduced to increase numbers and distribution. Many of the threats to the species can be addressed by well-developed management actions such as fencing and controlling ungulates, invasive plants, and predators.

By mitigating the previously mentioned threats and initiating research to provide much needed life history information, population trends can be reversed and recovery can be achieved. Refining protocols to minimize disturbance to sensitive areas, developing cost effective strategies, coordinating efforts among partners, and obtaining sufficient funding are critical to the recovery of these species.

## II. Preliminary Recovery Strategy

### A. RECOVERY PRIORITY NUMBER

Recovery priority numbers are based on a scale of 1C (highest, “C” indicating the potential for conflict with human economic activities) to 18 (lowest); based on the degree of threat, the potential for recovery, and their status as full species, subspecies, or variety (USFWS 1983b, 1983c).

Table 6–Recovery Priority Number

Degree of Threat	Recovery Potential	Taxonomy	Priority Number	Conflict
High	High	Monotypic genus	1	1C
	High	Species	2	1 2C
	High	Subspecies	3	2 3C
	Low	Monotypic genus	4	3 4C
	Low	Species	5	4 5C
	Low	Subspecies	6	5 6C
Moderate	High	Monotypic genus	7	6 7C
	High	Species	8	7 8C
	High	Subspecies	9	8 9C
	Low	Monotypic genus	10	9 10C
	Low	Species	11	10 11C
	Low	Subspecies	12	11 12C
Low	High	Monotypic genus	13	12 13C
	High	Species	14	13 14C
	High	Subspecies	15	14 15C
	Low	Monotypic genus	16	15 16C
	Low	Species	17	16 17C
	Low	Subspecies	18	17 18C

*Bidens amplexans*, *Doryopteris takeuchii*, and *Korthalsella degeneri* are assigned a recovery priority number of 2 based on the high degree of threat, a high potential for recovery with threats that are well understood and can be alleviated, and their status as full species. *Platydesma cornuta* var. *decurrens* and *Psychotria hexandra* subsp. *oahuensis* are assigned a recovery priority number of 3, based on the high degree of threat, a high potential for recovery with threats that are well understood and can be alleviated, and their status as a subspecies or variety. *Cyanea calycina*, *C. lanceolata*, *C. purpurellifolia*, *Cyrtandra gracilis*, *C. kaulantha*, *C. sessilis*, *C. waiolani*, *Hylaeus kuakea*, *H. mana*, *Megalagrion leptodemas*, *Megalagrion oceanicum*, *Melicope christophersenii*, *M. hiiakae*, *M. makahae*, *Pleomele forbesii*, *Pritchardia bakeri*, *Pteralyxia macrocarpa*, *Polyscias lydgatei*, and *Zanthoxylum oahuense* are assigned a recovery priority number of 5, based on a high degree of threat, a low potential for recovery due to the small number of individuals with some threats that are well understood and easily alleviated while others are currently difficult to alleviate, and their status as a full species. *Megalagrion nigrohamatum nigrolineatum*, *Platydesma cornuta* var. *cornuta*, and *Stenogyne kaalae* subsp. *sherffii* are assigned a recovery priority number of 6, based on a high degree of threat, a low potential for recovery due to the small number of individuals with some threats that are well understood and easily alleviated while others are currently difficult to alleviate, and their status as a subspecies or variety.

## **B. RECOVERY GOAL AND OBJECTIVES**

The goal of the recovery plan is to establish a framework within which recovery actions are undertaken to ensure the long-term survival of the 27 recently listed species, as well as the other 145 listed species that will be included, and to control or reduce the threats to these species to the extent that they no longer require the protections afforded by the ESA and therefore warrant delisting. Although subject to change, full recovery of the 27 species is currently envisioned as follows: viable populations that will persist on protected and managed habitat throughout the species' historical ranges on O‘ahu. Threats to the plant species, three Hawaiian damselflies, and two Hawaiian yellow-faced bees, primarily habitat loss and degradation and predation by introduced species, will be sufficiently controlled to ensure a high probability of survival for at least 100 years. In keeping with the island-wide approach to recovery for these 27 endangered species, the Service also will develop recovery objectives for each habitat management unit.

## C. INITIAL ACTION PLAN

The goal of the initial phase of recovery will be to arrest and reverse the general population declines and increase the range occupied by the 27 species. The primary recovery actions to be taken during the initial phase of recovery are:

1. Protect ecosystems and control threats
  - 1.1. Identify and survey remaining extant populations for all species and the habitats in which they occur
  - 1.2. Develop fine-scale climate models for these species to identify future suitable habitat based on existing and historical distributions as well as projected climate conditions
  - 1.3. Identify areas in each habitat necessary for recovery and delineate representative management units
  - 1.4. Ensure long-term protection of management units
    - 1.4.1. Identify threats specific to the management units
    - 1.4.2. Within management units, construct and maintain fencing and remove ungulates from high priority areas needed for the recovery of all species
    - 1.4.3. Eradicate habitat-modifying invasive plants from management units
    - 1.4.4. Develop and implement a rodent control program within management units
    - 1.4.5. Provide wildfire protection as necessary
      - 1.4.5.1. Develop management-unit specific fire management plans that incorporate management actions to reduce the likelihood of fire, especially for those management units in dry and mesic habitats
      - 1.4.5.2. Assess the need for additional fire management plans in all habitats
    - 1.4.6. Protect aquatic features (streams, pools, ponds) within habitats
      - 1.4.6.1. Secure adequate instream flows

- 1.4.7. Protect management units from human disturbance as necessary
- 1.4.8. Control other threats as appropriate
- 1.5. Monitor management and use results to adapt management actions
2. Control species-specific threats
  - 2.1. Develop and implement control for slugs
  - 2.2. Develop and implement control for rodents
  - 2.3. Develop and implement control for non-native fish and amphibians (for damselflies)
  - 2.4. Develop and implement control for ants and wasps (for Hawaiian yellow-faced bees)
  - 2.5. Control other threats as appropriate
  - 2.6. Monitor management and use results to adapt management actions
3. Expand the range (distribution) of existing wild populations and establish additional populations to increase numbers for resilience to threats
  - 3.1. Develop habitat and climate models to identify areas within management units appropriate for establishing or augmenting populations
  - 3.2. Select populations for augmentation or sites for reintroduction
  - 3.3. Prepare reintroduction sites
  - 3.4. Propagate genetically appropriate individuals for genetic storage (for plants) and augmentation or reintroduction
  - 3.5. Release (for damselflies or yellow-faced bees) or outplant (for plants) genetically appropriate individuals
  - 3.6. Monitor success of release or outplanting and use results to adapt management actions
4. Control new threats before they become wide-spread

- 4.1. Conduct surveys for invasive species in areas of likely influx, and proactively control any newly discovered pest or invasive species
- 4.2. Improve border security to prevent the influx of new pests and invasive species into the State and the island of O‘ahu
5. Conduct additional research essential to recover species and restore the habitats on which they depend
  - 5.1. Conduct studies on the range, demography, and dispersal of each species
  - 5.2. Conduct population viability analyses (PVA) for each species as data becomes available
  - 5.3. Evaluate research results and implement adaptive management as necessary
6. Develop and implement a detailed monitoring plan for each species and ecosystem
7. Develop downlisting and delisting criteria at the species and habitat level as necessary to validate recovery objectives
8. Partner with key stakeholders to develop and accomplish above objectives

#### **D. RECOVERY ACTIONS**

The recovery effort should build upon ongoing conservation and monitoring efforts described above. Specific actions that should be undertaken or at least initiated early in the process include the following:

- Confirm the distribution and the current status, and assess the potential future distribution of existing habitat and determine the most important sites for management. Make use of landscape modeling, spatial analysis, remote sensing technology, and existing survey data to better understand species distributions and priority areas for targeting future surveys for habitat.
- Prioritize and initiate control of habitat-modifying threats, such as ungulates and invasive plant species, as soon as possible within the highest priority management units.
- Protect all remaining extant populations by controlling species-specific threats (as indicated above in section C. Initial Action Plan, #2). Conduct systematic surveys in areas of suitable habitat for additional populations. Make use of

landscape modeling, spatial analysis, remote sensing technology, and existing survey data to better understand distributions and priority areas for targeting future surveys for the species.

- Prevent the influx of new pests and invasive species into recovery areas. Increase the efforts of the O‘ahu Invasive Species Committee and promote secure funding for the program to improve border security.
- Prioritize research studies that will provide information and tools that will aid in ameliorating known threats and limiting factors of the species and habitats.
- Increase outreach effort and coordination with State agencies, private landowners, and the military regarding habitat conservation. Promote opportunities to assist in the recovery of these species through habitat conservation plans, safe harbor agreements, and integrated natural resources management plans, and through various conservation partnerships funded by State and Federal agencies and private organizations.

### III. Preplanning Decisions

#### **A. PLANNING APPROACH**

A recovery plan for the 22 endangered plants, 3 damselflies, and 2 Hawaiian yellow-faced bee species that were listed in September 2012 and September 2016 will be prepared pursuant to section 4(f) of the Endangered Species Act. Plan preparation will be conducted by the Pacific Islands Fish and Wildlife Office.

#### **B. INFORMATION MANAGEMENT**

All information relevant to the recovery of the 27 endangered species listed in September 2012 and September 2016 will be housed in the Pacific Islands Fish and Wildlife Office’s administrative files. The Recovery Program will be responsible for maintaining a full administrative record for the recovery planning and implementation process for the species.

### **C. RECOVERY PLAN SCHEDULE**

Final Rules (FR) for O‘ahu and Multi-island Listing	September 2012 and September 2016
Recovery Outline Approved	July 2018
Public Review-Draft Recovery Plan (per recovery workplan)	2025
Public Comment Period	60 days
Final Recovery Plan (per recovery workplan)	2026

### **D. STAKEHOLDER INVOLVEMENT**

Key stakeholders:

- Private landowners who own property currently or historically occupied by any of the 27 species or with habitat types suitable for establishing new populations
- Local entities and County, State, and Federal agencies that own or manage lands occupied currently or historically by any of the 27 species or with habitat types suitable for establishing new populations
- Organizations representing native Hawaiians
- Conservation organizations
- University of Hawai‘i researchers
- U.S. Geological Survey, Pacific Islands Ecosystems Research Center
- State of Hawai‘i Department of Lands and Natural Resources, Division of Forestry and Wildlife
- State of Hawai‘i Department of Lands and Natural Resources, Division of Aquatic Resources
- Outdoor sports and recreation organizations

### **E. STAKEHOLDER INVOLVEMENT STRATEGY**

Landowners and land managers that may be affected by the listing and recovery of the 27 species will be invited to participate in the recovery planning process. A mailing list will be maintained and the Pacific Islands Fish and Wildlife Office will foster open and ongoing communications with all interested parties. Service field biologists managing one or more of the 27 species, and other O‘ahu resources will continue to develop strong one-on-one working relationships with interested parties. Early in the recovery planning process, meetings with interested stakeholders will be held to exchange status information, identify recovery issues, and to identify additional cooperators. Information gathered from these meetings will provide the initial platform

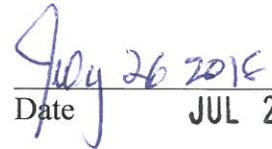
for proceeding with recovery planning. This information will help identify private landowners who could participate in recovery efforts. Interested stakeholders will then be invited to participate in a productive and meaningful way as warranted by the purposes of the meeting.

Stakeholders will be afforded an opportunity to review and comment on a draft of the recovery plan in conformance with the Endangered Species Act. Stakeholders also may be asked to contribute directly in developing recovery implementation strategies for planned actions. Strong, one-on-one working relationships with experts and stakeholders will be maintained for existing relations and developed over time with new stakeholders.

Approved:



Regional Director, Region 1  
U.S. Fish and Wildlife Service

  
Date JUL 26 2018

**Citation**

U.S. Fish and Wildlife Service. 2018. Recovery Outline for the Island of Oahu.  
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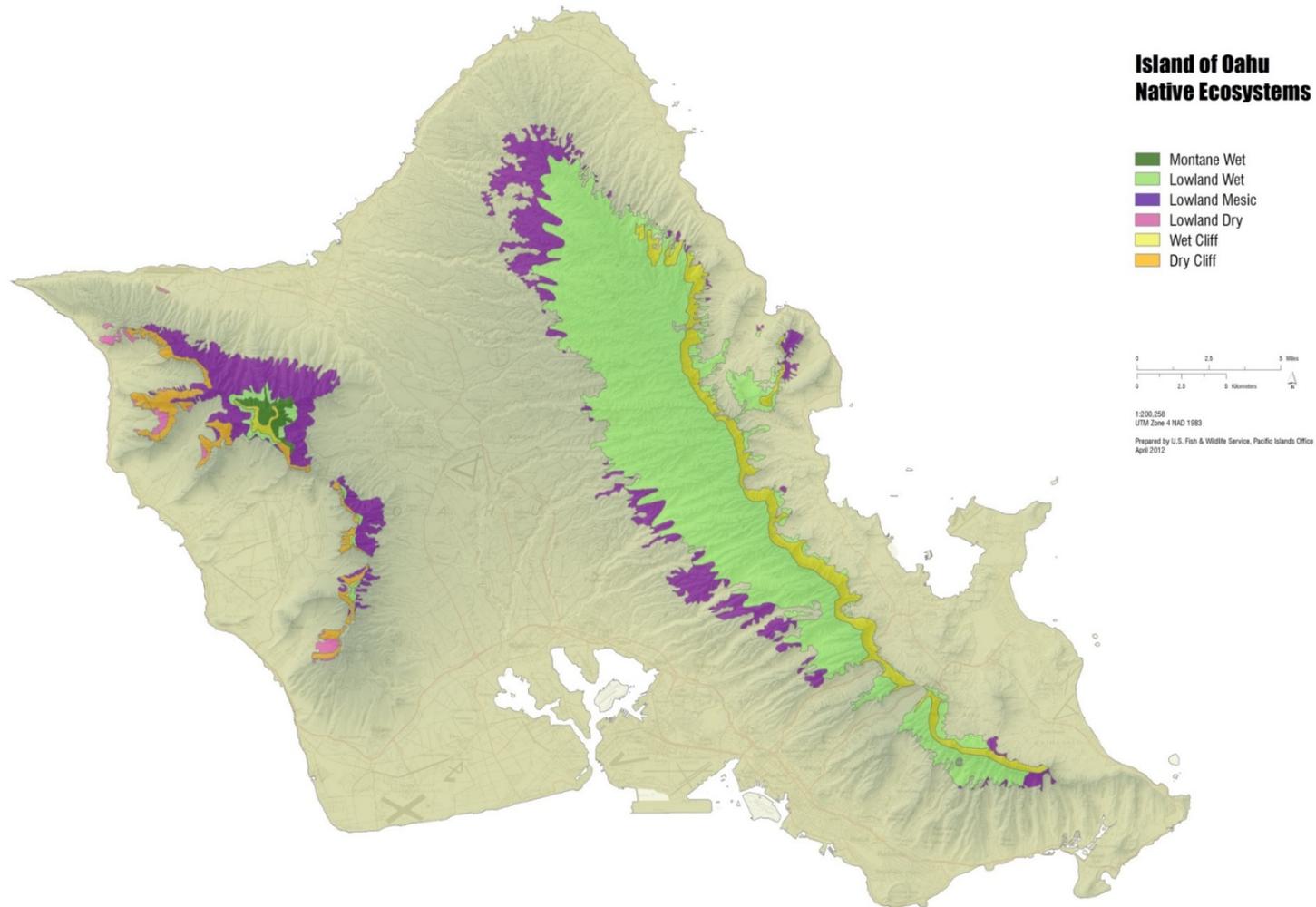
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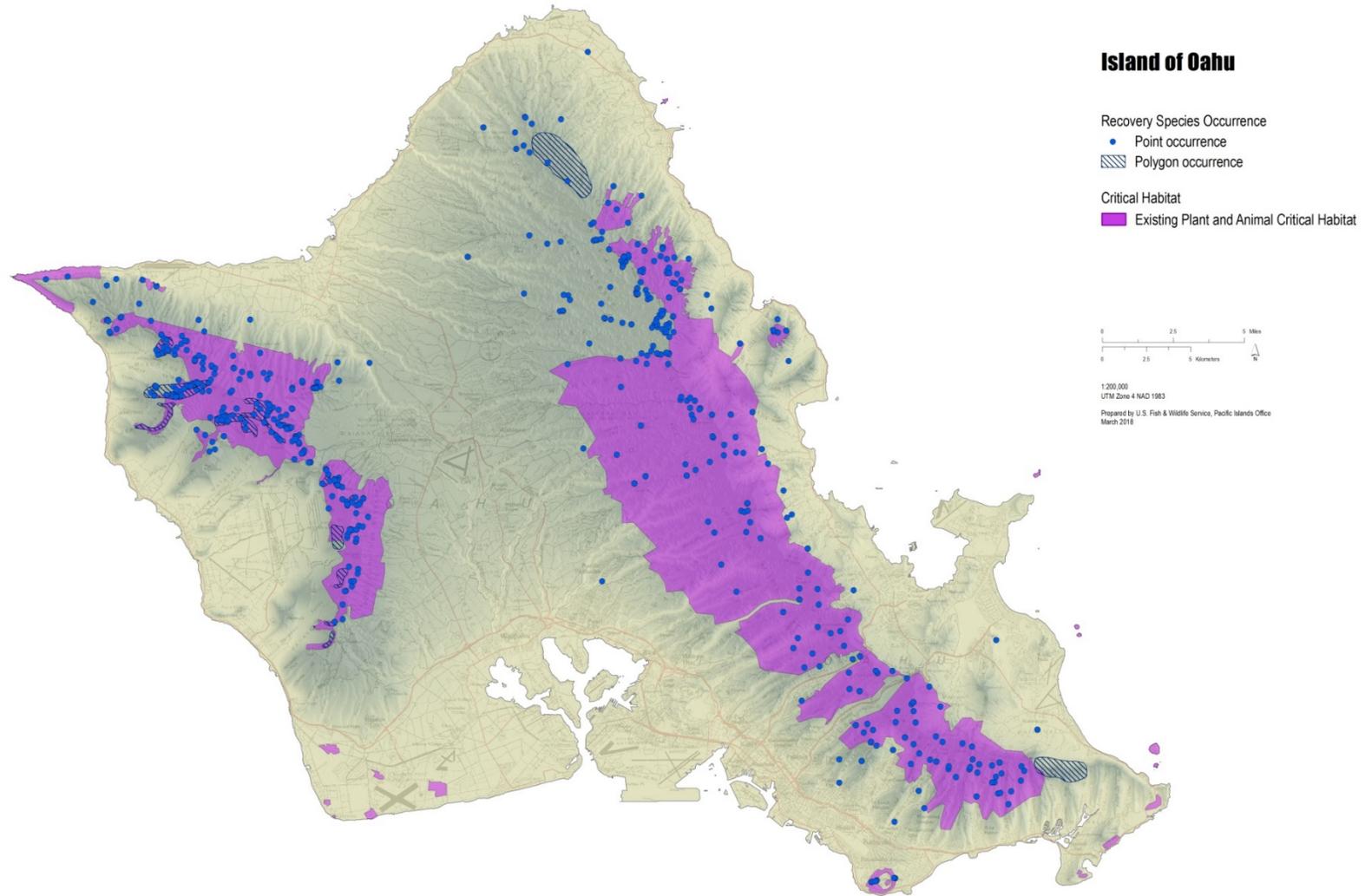
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# Map 1



## Map 2



### Map 3

