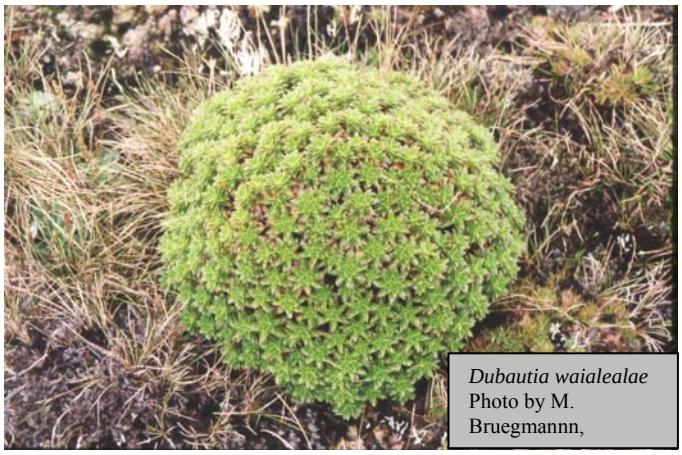
U.S. Fish & Wildlife Service

Recovery Outline for the Kauai Ecosystem



Dubautia waialealae Photo by M. Bruegmannn,

June 2010

Scientific Name/ Common Name

Plants

Astelia waialealae/ painiu
Canavalia napaliensis/ Awikiwiki
Chamaesyce eleanoriae/ Akoko
Chamaesyce remyi var. *kauaiensis*/ Akoko
Chamaesyce remyi var. *remyi*/ Akoko
Charpentiera densiflora/ Papala
Cyanea dolichopoda/ Haha
Cyanea eleeleensis/ Haha
Cyanea kolekoleensis/ Haha
Cyanea kuhihewa/ Haiwale
Cyrtandra oenobarbara/ Haiwale
Cyrtandra paliku/ Haiwale
Diellia mannii/ No common name
Doryopteris angelica/ No common name
Dryopteris crinalis var. *podosorus*/ Palapalai aumakua
Dubautia imbricata ssp. imbricata/ Naenae
Dubautia kalalauensis/ Naenae
Dubautia kenwoodii/ Naenae
Dubautia plantaginea ssp. *magnifolia*/ Naenae
Dubautia waialelae/ Naenae
Geranium kauaiense/ Nohoanu
Keysseria erici/ No common name
Keysseria helenae/ No common name
Labordia helleri/ Kamakahala
Labordia pumila/ Kamakahala
Lysimachia daphnoides/ Lehua makanoe
Lysimachia iniki/ No common name
Lysimachia pendens/ No common name
Lysimachia scopulens/ No common name
Lysimachia venosa/ No common name
Melicope degeneri/ Alani
Melicope paniculata/ Alani
Melicope puberula/ Alani
Myrsine knudsenii/ Kolea
Myrsine mezii/ Kolea
Phyllostegia renovans/ No common name
Pittosporum napaliense/ Hoawa
Platydesma rostrata/ Pilo kea lau lii
Pritchardia hardyi/ Loulu
Psychotria grandiflora/ Kopiko
Psychotria hobdyi/ Kopiko
Schiedea attenuata/ No common name
Stenogyne kealiae/ No common name
Tetraplasandra bisattenuata/ No common name
Tetraplasandra flynnii/ No common name

ANIMALS

Loxops caeruleirostris/ Akekee (honeycreeper)
Oreomystis bairdi/ Akikiki (honeycreeper)

Listing Status and Date Endangered; April 13, 2010 (75 Federal Register 18960)

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

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Purpose of the Recovery Outline: This document lays out a preliminary course of action for the survival and recovery of 45 endangered plants and 2 endangered forest birds endemic to the island of Kauai, Hawaiian Islands. One species of picture-wing fly, *Drosophila attigua*, was also included in the Kauai ecosystem listing rule and will be incorporated in the Kauai ecosystem recovery plan by reference; however, this recovery outline will not address *D. attigua* because the species is included in the *Drosophila* recovery plan currently under development. This document is meant to serve as interim guidance to direct recovery efforts and inform consultation and permitting activities until a comprehensive recovery plan has been completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (USFWS), and formal public participation will be invited upon the release of the draft recovery plan. However, we will consider any new information or comments that members of the public may wish to offer in response to this outline during the recovery planning process. For more information on Federal survival and recovery efforts for the 45 endangered plants and two endangered forest birds endemic to the island of Kauai, Hawaiian Islands, or to provide additional comments, interested parties may contact the lead field office for this species at the above address and telephone number.

Scope of Recovery and Available Information: The recovery effort is based on a two-pronged approach, at the levels of the ecosystem and of specific species. This recovery outline is based on the best available scientific data contained in the listing decision (USFWS 2010) and the proposed listing rule (USFWS 2008) for the 45 endangered plants and 2 endangered birds. Critical habitat for the 45 plants and 2 bird species was designated on April 13, 2010 (USFWS 2010). Most of the major threats to these species are well understood and involve introduced species, including ungulates and invasive plants. While some research has been conducted on the 2 forest birds, for most of the 45 plants little information is available beyond current status and existing threats. Additional research is needed to fully understand what is required for the recovery of these species, especially with regard to the impact of climate change on distribution and range and changes in ecosystems. Uncertainties associated with the specific habitat needs and biology of the 45 plant and 2 bird species will be resolved to the extent possible through the course of the recovery process and will likely result in modifications to the recovery program over time.

I. Overview

A. BIOLOGICAL ASSESSMENT

1. Species Description and Life History

The species descriptions and life history information for the 45 plants and 2 forest birds are contained in the listing decision (USFWS 2010) and the proposed listing rule (USFWS 2008).

2. Historical and Current Population Status

The historical and current population status for the 45 plants and 2 forest birds are contained in the listing decision (USFWS 2010) and the proposed listing rule (USFWS 2008). Table 1 provides a summary of the current status and distribution of the species and Appendix 1 provides maps showing the species' distributions.

Table 1. Current status and distribution of the 45 plants and two forest birds.

			Ecosystem Types					
Species	# pops	# inds	Lowland Mesic	Lowland Wet	Montane Mesic	Montane Wet	Dry Cliff	Wet Cliff
PLANTS								
Astelia waialealae	3	13				X		
Canavalia napaliensis	5	106-206	X					
Chamaesyce eleanoriae	3	>50	X				X	
Chamaesyce remyi var. *kauaiensis*	5	920-1000		X				X
Chamaesyce remyi var. *remyi*	10	350	X	X	X	X		X
Charpentiera densiflora	7	400	X	X				
Cyanea dolichopoda	0	0						X
Cyanea eleeleensis	0	0		X				
Cyanea kolekoleensis	0	0		X				
Cyanea kuhihewa	0	0		X				
Cyrtandra oenobarbara	8	270-450		X				X
Cyrtandra paliku	1	10						X
Diellia mannii	1	1			X			
Doryopteris angelica	5	29-54	X					
Dryopteris crinalis var. *podosorus*	3	32-47				X		
Dubautia imbricata ssp. *imbricata*	3	1400		X				
Dubautia kalalauensis	1	26				X		
Dubautia kenwoodii	1	1	X					

			Ecosystem Types					
Species	# pops	# inds	Lowland Mesic	Lowland Wet	Montane Mesic	Montane Wet	Dry Cliff	Wet Cliff
Dubautia plantaginea ssp. *magnifolia*	1	100						X
Dubautia waialelae	2	3000				X		
Geranium kauaiense	3	140				X		
Keysseria erici	3-4	sev 1000				X		
Keysseria helenae	?	300				X		
Labordia helleri	10	350-550	X	X	X	X		
Labordia pumila	3	500				X		
Lysimachia daphnoides	3	200-300				X		
Lysimachia iniki	1	40						X
Lysimachia pendens	1	8						X
Lysimachia scopulens	2	40-55					X	
Lysimachia venosa	0	0						X
Melicope degeneri	2	11				X		
Melicope paniculata	6	200	X					
Melicope puberula	3	900		X		X		
Myrsine knudsenii	3	30			X			
Myrsine mezii	2	5			X	X		
Phyllostegia renovans	4	30		X		X		
Pittosporum napaliense	3	160-200	X					
Platydesma rostrata	6	100	X	X	X	X		X
Pritchardia hardyi	2	300				X		
Psychotria grandiflora	10	16-30			X	X		
Psychotria hobdyi	10	120	X					
Schiedea attenuata	1	10					X	
Stenogyne kealiae	5	100-300		X	X		X	
Tetraplasandra bisattenuata	2	37	X	X				
Tetraplasandra flynnii	1	3			X	X		
ANIMALS								
Akekee	1	1312			X	X		
Akikiki*	1	3536				X		

*Included in recovery plan for Hawaiian forest birds (USFWS 2006a).

Species for which the numbers of populations and individuals are zero are not in controlled propagation and are not currently known from the wild but may be detected with further surveys

3. Habitat Description and Landownership

The 45 plants and 2 forest birds are known from 6 of the 8 native ecosystems on Kauai: lowland mesic, lowland wet, montane mesic, montane wet, dry cliff, and wet cliff (Table 1). These species and their ecosystems occur on Federal, State, and private lands (USFWS 2008, 2010).

4. Summary Biological Assessment

The 45 plants and 2 forest birds to be included in this recovery plan are endangered throughout their entire range. With extensive ecosystem-level and species-specific management, these species have a high to moderate potential for recovery. A combination of species-specific and ecosystem-level management on other islands in the Hawaiian archipelago shows that the potential for species recovery is high if the major threats to the ecosystem are controlled. The threats with the largest impact are introduced ungulates and invasive introduced plant species.

Management of ecosystem-level threats such as ungulates and invasive introduced plants has been shown to be successful in many different ecosystems in the Hawaiian Islands. For example, an exclosure on the island of Hawaii demonstrated that using fencing to protect the site from goat grazing 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 Puu Waawaa in 1985, *Acacia koa* and *Metrosideros polymorpha* (ohia) seedlings were observed germinating by the thousands (Hawaii Department of Land and Natural Resources 2002). After pigs were excluded from a montane bog on Maui for a period of 6 years, native plant cover increased from 6 to 95 percent (Loope *et al*. 1991). In Hawaii Volcanoes National Park, herbicide control of *Pennisetum clandestinum* was very successful, decreasing cover from nearly 100 percent to less than 10 percent; most of the native species in the plots survived the treatment and often proliferated and generated new growth after 6 months (Gardner and Kageler 1983). Native seedlings and ground cover increased after removal of *Pennisetum setaceum* (fountain grass) in a dry forest (Cabin *et al.* 2000). Slowly removing *Morella faya* (faya tree) by girdling resulted, after 3 years, in better recovery of native plant species with a more diverse suite of species and less increase in introduced plant species by comparison to clearcut areas (Loh and Daehler 2007, 2008).

The management of additional threats, such as rodents and slugs, will be possible but will first require research to determine the most efficient and effective methods and potentially the registration of new pesticides and herbicides for use in native forested areas. Controlled propagation and reintroduction will also be needed for several species to increase the numbers of individuals and populations within the appropriate ecosystems.

While the best available scientific information indicates the current and known historical distribution of many of these species is relatively limited, it is very likely that these species were much wider-ranging in the past (Burney *et al.* 2001; USFWS 2006a). Further systematic surveys are needed to assess the current distribution of the species and

their ecosystem requirements, so areas for recovery can be expanded beyond the historical range into additional areas within appropriate ecosystems. Modeling based on existing suitable ecosystems and known distributions will assist in projecting additional appropriate areas for recovery. Climate change models need to be developed for Hawaii to address a finer scale of microclimate and map potential future distribution based on existing distributions and projected climate changes.

5. Revision of Existing Recovery Plans

To make the Kauai ecosystem recovery plan inclusive and functional as an ecosystem plan, all listed species that are endemic to Kauai and do not currently have taxonomic issues requiring reclassification will be included in the recovery plan. The recovery plan will therefore constitute a recovery plan revision for an additional 52 plants, 5 birds, and 4 invertebrate species also, endemic to Kauai (Table 2). These species were listed previously and all have approved recovery plans; however, many of these plans are at least 10 years old. Seven of the previously listed plant species and the two cave invertebrates occur in coastal and lowland dry ecosystems. Therefore, the Kauai ecosystem recovery plan will include these two additional ecosystems found on the island of Kauai, as well as the six ecosystems included in the Kauai ecosystem listing decision (USFWS 2010). In addition, the recovery plan will include by reference the newly listed *Drosophila attigua*, which is being incorporated into the draft *Drosophila* recovery plan currently in preparation. The Kauai ecosystem recovery plan will also address the threat of climate change as it applies to all of these species. Climate change was not addressed in the original recovery plans for many of these species.

This recovery plan will also address management actions needed for those previously listed species and any candidate species that are found on multiple islands including Kauai, thereby addressing Kauai recovery needs for an additional 37 listed and 8 candidate plants, 9 listed and 1 candidate bird, and 1 listed and 2 candidate invertebrate species (Table 3). Recovery actions specific to Kauai and their expected benefits for these species will be included in this 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. Species to be included by revision.

Scientific Name	Common Name	Listing Status	Date Listed (FR citation)	Date of Recovery plan
PLANTS				
Alsinidendron lychnoides	Kuawawaenohu	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Alsinidendron viscosum	No common name	Endangered	10/10/1996 USFWS 1996c	08/23/1998a USFWS 1998a
Chamaesyce halemanui	No common name	Endangered	05/13/1992 USFWS 1992a	09/20/1995 USFWS 1995
Cyanea asarifolia	Haha	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Cyanea recta	Haha	Threatened	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Cyanea remyi	Haha	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Cyanea undulata	No common name	Endangered	09/20/1991 USFWS 1991b	05/31/1994 USFWS 1994b
Cyrtandra cyanaeoides	Mapele	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Cyrtandra limahuliensis	Ha`iwale	Threatened	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Delissea rivularis	Oha	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Diellia pallida	No common name	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Dubautia latifolia	Na`ena`e	Endangered	05/13/1992 USFWS 1992a	09/20/1995 USFWS 1995
Dubautia pauciflorula	Na`ena`e	Endangered	09/20/1991 USFWS 1991b	05/31/1994 USFWS 1994b
Exocarpos luteolus	Heau	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Hedyotis st.-johnii	Na Pali beach hedyotis	Endangered	09/30/1991 USFWS 1991c	09/20/1995 USFWS 1995
Hesperomannia lydgatei	No common name	Endangered	09/20/1991 USFWS 1991b	05/31/1994 USFWS 1994b
Hibiscadelphus distans	Kauai hau kuahiwi	Endangered	04/29/1986 USFWS 1986a	06/05/1996 USFWS 1996a
Hibiscadelphus woodii	Hau kuahiwi	Endangered	10/10/1996 USFWS 1996c	08/23/1998a USFWS 1998a
Hibiscus clayi	Clay's hibiscus	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Hibscus waimeae ssp. *hannerae*	Koki`o ke`oke`o	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Kokia kauaiensis	Koki`o	Endangered	10/10/1996 USFWS 1996c	08/23/1998a USFWS 1998a
Labordia lydgatei	Kamakahala	Endangered	09/20/1991 USFWS 1991a	05/31/1994 USFWS 1994b
Labordia tinifolia var. *wahianaensis*	Kamakahala	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Lipochaeta fauriei	Nehe	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Lipochaeta micrantha	Nehe	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995

Scientific Name	Common Name	Listing Status	Date Listed (FR citation)	Date of Recovery plan
Lipochaeta waimeaensis	Nehe	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Melicope haupuensis	Alani	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Melicope quadrangularis	Alani	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Munroidendron racemosum	No common name	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Myrsine linearifolia	Kolea	Threatened	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Nothocestrum peltatum	`Aiea	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Phyllostegia knudsenii	No common name	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Phyllostegiea waimeae	No common name	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Phyllostegia wawrana	No common name	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Poa mannii	Mann's bluegrass	Endangered	11/10/1994 USFWS 1994c	09/20/1995 USFWS 1995
Poa sandwicensis	Hawaiian bluegrass	Endangered	05/13/1992 USFWS 1992a	09/20/1995 USFWS 1995
Poa siphonoglossa	No common name	Endangered	05/13/1992 USFWS 1992a	09/20/1995 USFWS 1995
Pritchardia napaliensis	Lo`ulu	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Pritchardia viscosa	Lo`ulu	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Pteralyxia kauaiensis	Kaulu	Endangered	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Remya kauaiensis	No common name	Endangered	01/14/1991 USFWS 1991a	09/20/1995 USFWS 1995
Remy montgomeryi	No common name	Endangered	01/14/1991 USFWS 1991a	09/20/1995 USFWS 1995
Schiedea apokremnos	Ma`oli`oli	Endangered	09/30/1991 USFWS 1991c	09/20/1995 USFWS 1995
Schiedea helleri	No common name	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Schiedea kauaiensis	No common name	Endangered	10/10/1996 USFWS 1996b,c	08/23/1998 USFWS 1998a
Schiedea membranacea	No common name	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Schiedea stellarioides	Laulihilihi	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Stenogyne campanulata	No common name	Endangered	05/13/1992 USFWS 1992a	09/20/1995 USFWS 1995
Viola helenae	No common name	Endangered	09/20/1991 USFWS 1991b	05/31/1994 USFWS 1994b
Viola kauaiensis ssp. *wahiawaensis*	Nani wai`ale`ale	Endangered	10/10/1996 USFWS 1996c	08/23/1998 USFWS 1998a
Wilkesia hobdyi	Dwarf iliau	Endangered	06/22/1992 USFWS 1992b	09/20/1995 USFWS 1995

Scientific Name	Common Name	Listing Status	Date Listed (FR citation)	Date of Recovery plan
Xylosma crenatum	No common name	Endangered	05/13/1992 USFWS 1992a	09/20/1995 USFWS 1995
ANIMALS				
Hemignathus lucidus hanapepe	Kaua`i nukupu`u	Endangered	03/11/1967 USFWS 1967	10/16/2006 USFWS 2006a
Hemignathus procerus	Kaua`i `akialoa	Endangered	03/11/1967 USFWS 1967	10/16/2006 USFWS 2006a
Moho braccatus	`ō`ō `ā`ā, Kaua`i `ō`ō	Endangered	03/11/1967 USFWS 1967	10/16/2006 USFWS 2006a
Myadestes myadestinus	Large Kauai thrush, kāma`o	Endangered	03/11/1967 USFWS 1967	10/16/2006 USFWS 2006a
Myadestes palmeri	Small Kauai thrush, puaiohi	Endangered	10/13/1970 USFWS 1970	10/16/2006 USFWS 2006a
Spelaeorchestia koloana	Kauai cave amphipod	Endangered	01/14/2000 USFWS 2000a	4/28/2006 USFWS 2006d
Adelocosa anops	Kauai cave spider	Endangered	01/14/2000 USFWS 2000a	4/28/2006 USFWS 2006d
Drosophila attigua	Picture-winged fly	Endangered	04/13/2010 USFWS 2010	In preparation
Drosophila musaphilia	Unnamed pomace fly	Endangered	05/09/2006 USFWS 2006c	In preparation
Erinna newcombi	Newcomb's snail	Endangered	01/26/2000 USFWS 2000b	05/04/2006 USFWS 2006b

Table 3. Multiple-island species which occur on Kauai that will benefit from recovery actions

Scientific Name	Common Name	Listing Status	Island Distri-bution*	Date Listed (FR citation)	Date of Recovery plan
PLANTS					
Acaena exigua	Lili wai	Endangered	KX, MX	05/13/1992 USFWS 1992c	07/29/1997 USFWS 1997
Achyranthes mutica	No common name	Endangered	KX, H	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999
Adenophorus periens	Fern, pendant kihi	Endangered	K, OX, LX, Mo, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Alectryon macrococcus	Mahoe	Endangered	K, O, Mo, H	05/13/1992 USFWS 1992c	07/29/1997 USFWS 1997
Bonamia menziesii	No common name	Endangered	K, O, L, MoX, M, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Brighamia insignis	Olulu	Endangered	K, NiiX	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Caesalpinia kavaiensis	Uhiuhi	Endangered	KX, O, LX, MoX, MX, H	07/08/1986 USFWS 1986b	05/06/1994 USFWS 1994d

Scientific Name	Common Name	Listing Status	Island Distri-bution*	Date Listed (FR citation)	Date of Recovery plan
Canavalia pubescens	`Awikiwiki	Candidate	KX, NiX, L, M	N/A	N/A
Centaurium sebaeoides	`Awiwi	Endangered	K, O, L, Mo, M	10/29/1991 USFWS 1991d	07/10/1999 USFWS 1999
Ctenitis squamigera	Pauoa	Endangered	KX, O, L, Mo, M	09/26/1994 USFWS 1994f	04/10/1998 USFWS 1998c
Cyperus trachysanthos	Pu`uka`a	Endangered	K, NiX, O, LX, MoX	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999
Diellia erecta	Diellia, asplenium-leaved	Endangered	KX, O, LX, Mo, M, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Diplazium molokaiense	No common name	Endangered	KX, OX, LX, MoX, M	09/26/1994 USFWS 1994f	04/10/1998 USFWS 1998c
Euphorbia haeleeleana	`Akoko	Endangered	K, O	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999
Flueggea neowawraea	Mehamehame	Endangered	K, O, MoX, M, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Gardenia remyi	Nanu	Candidate	K, Mo, M, H	N/A	N/A
Gouania meyenii	No common name	Endangered	O, K	10/29/1991 USFWS 1991d	08/10/1998b USFWS 1998b
Hedyotis cookiana	Awiwi	Endangered	K, HX	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Hibiscus brackenridgei	Ma`o hau hele, (=native yellow hibiscus)	Endangered	KX, O, L, MoX, M, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Hedyotis fluviatilis	Kamapuaa	Candidate	K, O	N/A	N/A
Huperzia mannii	Wawae`iole	Endangered	KX, M, HX	05/13/1992 USFWS 1992c	07/29/1997 USFWS 1997
Huperzia nutans	Wawae`iole	Endangered	KX, O	03/28/1994 USFWS 1994g	08/10/1998b USFWS 1998b
Ischaemum byrone	Ischaemum, Hilo	Endangered	K, O, Mo, M, H	03/04/1994 USFWS 1994h	09/26/1996 USFWS 1996e
Isodendrion laurifolium	Aupaka	Endangered	K, O	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999
Isodendrion longifolium	Aupaka	Threatened	K, O	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999

Scientific Name	Common Name	Listing Status	Island Distri-bution*	Date Listed (FR citation)	Date of Recovery plan
Joinvillea ascendens spp. *ascendens*	`Ohe	Candidate	K, O, Mo, M, H	N/A	N/A
Lobelia niihauensis	No common name	Endangered	K, NiX, O	10/29/1991 USFWS 1991d	08/10/1998b USFWS 1998b
Lysimachia filifolia	Kamakahala	Endangered	K, O	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Mariscus pennatiformis	No common name	Endangered	KX, OX, M	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Melicope knudsenii	Alani	Endangered	K, M	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Melicope pallida	Alani	Endangered	K, OX	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Myrsine fosbergii	Kolea	Candidate	K, O	N/A	N/A
Nothocestrum latifolium	`Aiea	Candidate	K, O, Mo, L, M	N/A	N/A
Panicum niihauense	Lau `ehu	Endangered	K, NiX	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999
Peucedanum sandwicense	Makou	Threatened	K, O, Mo, M	02/25/1994 USFWS 1994a	09/20/1995 USFWS 1995
Plantago princeps	Kuahiwi laukahi	Endangered	K, O	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Platanthera holochila	No common name	Endangered	K, OX, Mo, MX	10/10/1996 USFWS 1996c	07/10/1999 USFWS 1999
Ranunculus mauiensis	Makou	Candidate	K, O, Mo, M, H	N/A	N/A
Scaevola coriacea	Naupaka, dwarf	Endangered	KX, NiX, OX, LX, Mo, M, HX	05/16/1986 USFWS 1986c	07/29/1997 USFWS 1997
Sesbania tomentosa	`Ohai	Endangered	K, NiX, O, Ka, L, Mo, M, H, Nh, Ne	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Silene lanceolata	No common name	Endangered	KX, O, LX, Mo, H	10/08/1992 USFWS 1992d	09/26/1996 USFWS 1996d

Scientific Name	Common Name	Listing Status	Island Distri-bution*	Date Listed (FR citation)	Date of Recovery plan
Solanum incompletum	Popolo ku mai	Endangered	KC, LX, MoX, MX, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Solanum nelsonii	Popolo	Candidate	KX, Nii, OX, Mo, MX, H, Mi, Nh, PH, La		
Spermolepis hawaiiensis	No common name	Endangered	K, O, L, MoX, M, H	11/04/1994 USFWS 1994e	07/10/1999 USFWS 1999
Zanthoxylum hawaiiense	A`e	Endangered	K, LX, Mo, M, H	03/04/1994 USFWS 1994h	09/26/1996 USFWS 1996e
ANIMALS					
Anas wyvilliana	Duck, Hawaiian; Koloa maoli	Endangered		03/11/1967 USFWS 1967	05/15/2005 USFWS 2005a
Branta sandvicensis	Goose, Hawaiian; Nene	Endangered	K, M, H	03/11/1967 USFWS 1967	09/24/2004 USFWS 2004
Fulica alai	Coot, Hawaiian; `Alae ke`oke`o	Endangered	K, O, Mo, L, M, H	03/11/1967 USFWS 1967	05/15/2005 USFWS 2005a
Gallinula chloropus sandvicensis	Moorhen, Common; Hawiian gallinule; `Alae `ula	Endangered	K, O, MoX, MX, HX	03/11/1967 USFWS 1967	05/15/2005 USFWS 2005a
Himantopus mexicanus knudseni	Stilt, Black-necked; Hawaiian stilt; Ae`o	Endangered	K, O, Mo, L, M, H	03/11/1967 USFWS 1967	05/15/2005 USFWS 2005a
Lasiurus cinereus semotus	Hawaiian hoary bat, `Ope`ape`a	Endangered	K, O, M, H	10/13/1970 USFWS 1970	05/11/1998 USFWS 1998d
Oceanodroma castro	Band-rumped storm-petrel (Hawaii Distinct Population Segment)	Candidate	K, L, Ka, M, H, Le	N/A	N/A
Psittirostra psittacea	`O`u	Endangered	KX, OX, LX, MoX, MX, HX	03/11/1967 USFWS 1967	10/16/2006 USFWS 2006a
Pterodroma phaeopygia sandwichensis	Petrel, Dark-rumped; Hawaiian Petrel; `Ua`u	Endangered	K, L, M, H	03/11/1967 USFWS 1967	04/25/1983 USFWS and Telfer 1983

Scientific Name	Common Name	Listing Status	Island Distri-bution*	Date Listed (FR citation)	Date of Recovery plan
Puffinus auricularis	Shearwater, Newell's	Endangered	K, O, H	09/25/1975 USFWS 1975	04/25/1983 USFWS and Telfer 1983
Manduca blackburni	Blackburn's sphinx moth	Endangered	KX, OX, MoX, LX, M, H	02/01/2000 USFWS 2000c	09/28/2005 USFWS 2005b
Megalagrion pacificum	Pacific damselfly	Candidate	K, O, L, Mo, M, H	N/A	N/A
Megalagrion xanthomelas	Orangeblack Hawaiian damselfly	Candidate	KX, O, L, Mo, M, H	N/A	N/A

*Island distribution – K-Kauai, Ni-Niihau, O-Oahu, L-Lanai, Mo-Molokai, M-Maui, Ka- Kahoolawe, H-Hawaii, Nh-Nihoa, Ne-Necker, La-Laysan, PH-Pearl and Hermes, Mi-Midway, Le-Lehua. X indicates species believed to be extirpated on a given island.

Table 4. Incorporation of listed endemic and multi-island species into the recovery plan.

	Description of threats, recovery actions needed, and conservation benefits	Recovery criteria
Kauai endemic newly listed species (Table 1)	Fully addressed	Fully addressed
Kauai endemic previously listed species (Table 2)	Revise as needed	Revise as needed if data available
Multi-island listed species (Table 3)	Elucidate as apply to Kauai	Revise in multi-island recovery plan
Multi-island candidate species (Table 3)	Elucidate as apply to Kauai	TBD in multi-island recovery plan, pending listing

B. THREATS ASSESSMENT

1. Listing Factors/Primary Threats to the Species

As identified in the final rule (USFWS 2010), the primary threats to the 45 endangered plant and 2 endangered bird species and their ecosystems are ungulates, invasive introduced plant species, and climate change, which impact all species. In addition, rodents threaten the plants and birds, slugs and landslides threaten many of the plants, avian disease threatens the birds, and fire threatens the species occurring in lowland mesic and montane mesic ecosystem types. A description of each of these threats is presented in the final listing rule (USFWS 2010); each is classified according to the five listing/delisting factors identified in section 4 of the Endangered Species Act

("Act"; 16 USC 1531 *et seq*.). Table 5 provides a summary of the threats to each of the species.

2. Summary Threats Assessment

No new threats have been identified since the listing rule was published. Any additional threats that affect the previously listed and candidate species on Kauai will be addressed in the recovery plan. The recovery plan will comprehensively address climate change, as it will incorporate the 48 newly listed species endemic to Kauai, as well as 118 other species, occurring in part on Kauai, that are listed but are currently covered under existing recovery plans or are candidates for listing. The species include cave invertebrates; stream-dependent damselflies and a snail; plants restricted to dry, mesic, and wet habitats; seabirds; forest birds; and a bat. Most of the species have specialized microhabitat requirements and/or limited opportunity or ability to disperse, making them vulnerable to climate change, and several of the bird species are currently undergoing range contractions consistent with warming temperatures. Applying climate envelope modeling and other tools to recovery planning will help prioritize habitat protection actions, promote linkages between current and future habitat, and focus actions on potential climate refugia. Because of the taxonomic and geographic breadth of this recovery plan, it will act as a template for climate change planning and recovery throughout the Hawaiian Islands.

C. CONSERVATION ASSESSMENT

1. Conservation Efforts

Numerous conservation efforts are occurring on Kauai that benefit some or all of the 45 plants and 2 birds, but most of these operate at relatively small scales and need additional funding to effectively contribute to recovery of the species.

The Plant Extinction Prevention Program focuses on those plant species with fewer than 50 individuals remaining in the wild. The goal of the program is to achieve the general interim recovery guidelines set by the Hawaii and Pacific Plants Recovery Coordinating Committee (1994), which are: 3 populations of 25 (long-lived species), 50 (short-lived), or 100 (annual) mature, reproducing individuals; all threats to those populations being managed; and all individuals are represented in genetic storage. The Plant Extinction Prevention program has had a Kauai island coordinator only since 2008, and to date has monitored populations of *Astelia waialealae*, *Diellia mannii*, *Melicope degeneri*, *Myrsine knudsenii*, *Pritchardia napaliensis*, *Psychotria grandiflora*, *Tetraplasandra flynii*; collected seeds of *Melicope degeneri*, *Myrsine knudsenii*, and *Pritchardia napaliensis*; surveyed for additional populations of *Doryopteris angelica*, *Dryopteris crinalis* var. *podosorus*, and *Stenogyne kealiae*; and conducted management

Table 5. Summary of threats affecting the 47 species.

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Astelia waialealae	MW (bogs only)	X	X	X			X		X					LN, NR
Canavalia napaliensis	LM	X		X		X	X		X			X	X	
Chamaesyce eleanoriae	LM, DC	X		X			X	L	X		X	X		LN
Chamaesyce remyi var. *kauaiensis*	LW, WC	X	X				X	L	X		X			
Chamaesyce remyi var. *remyi*	LM, LW, MM, MW, WC	X	X	X	X		X	L	X		X	X	X	
Charpentiera densiflora	LM, LW	X		X		X	X	L, F	X		X	X	X	
Cyanea dolichopoda	WC	X					X	L	X				X	NW

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Cyanea eleeleensis	LW	X	X				X	L	X		X	X	X	NW
Cyanea kolekoleensis	LW	X	X				X	F	X			X	X	NW
Cyanea kuhihewa	LW	X	X				X	L	X		X	X	X	NW
Cyrtandra oenobarba	LW, WC	X	X	X			X	L, F	X		X	X	X	
Cyrtandra paliku	WC	X					X	L	X					LN
Diellia mannii	MM	X	X		X	X	X	L	X		X			LN
Doryopteris angelica	LM	X	X	X	X		X		X			X		LN
Dryopteris crinalis var. *podosorus*	MW	X	X				X		X					LN

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Dubautia imbricata ssp. *imbricata*	LW	X	X				X		X		X			
Dubautia kalalauensis	MW	X					X		X					LN
Dubautia kenwoodii	LM	X	X	X			X	FR	X					FR, LN
Dubautia plantaginea ssp. *magnifolia*	WC	X	X				X	L	X					
Dubautia waialealae	MW (bogs only)	X	X	X			X		X		X			
Geranium kauaiense	MW (bogs only)	X	X				X		X		X			
Keysseria erici	MW (bogs only)	X	X				X		X		X			
Keysseria helenae	MW (bogs only)	X	X				X		X		X			

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Labordia helleri	LM, LW, MM, MW	X	X	X	X		X		X		X	X		
Labordia pumila	MW (bogs only)	X	X				X		X		X			
Lysimachia daphnoides	MW (bogs only)	X	X				X		X		X			
Lysimachia iniki	WC	X					X	L	X					LN
Lysimachia pendens	WC	X	X				X	L	X					LN
Lysimachia scopulensis	DC	X	X	X			X	L	X					LN
Lysimachia venosa	WC	X					X	L	X					NW
Melicope degeneri	MW	X	X	X			X		X				X	LN, NR

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Melicope paniculata	LW	X	X	X			X	L	X				X	
Melicope puberula	LW, MW	X	X	X			X		X		X		X	
Myrsine knudsenii	MM	X	X	X	X		X		X			X		LN
Myrsine mezii	MM, MW	X	X	X			X	L	X		X			LN
Phyllostegia renovans	LW, MW	X	X	X			X	L	X		X	X		LN
Pittosporum napaliense	LM	X		X			X		X		X	X		
Platydesma rostrata	LM, LW, MM MW, WC	X	X	X	X		X	L	X		X	X	X	
Pritchardia hardyi	LW, WC	X	X	X			X		X	X	X	X		

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Psychotria grandiflora	MM, MW	X	X	X	X		X		X		X	X		LN, NR
Psychotria hobdyi	LM	X	X	X	X	X	X		X		X	X	X	
Schiedea attenuata	DC	X		X		X	X	L	X		X			LN, NR
Stenogyne kealiae	LW, MM, DC	X	X	X	X	X	X	L	X		X	X		
Tetraplasandra bisattenuata	LM, LW	X	X				X		X			X		LN
Tetraplasandra flynnii	MM, MW	X		X			X		X					LN
Animals														
Akekee	MM, MW	X	X	X			X		X			X		AD, PCO

Species	Ecosystem	Factor A								Factor B	Factor C			Factor E
		Nonnative plants	Pigs	Goats	Deer	Fire	Hurricanes	Landslides or Flooding	Climate Change	Illegal collection	Predation by ungulates	Predation by rats	Predation by nonnative invertebrates (e.g. slugs)	Other species-specific threats
Akikiki	MM, MW	X	X	X			X		X			X		AD, PCO

LM = Lowland Mesic LW = Lowland Wet MM = Montane Mesic MW = Montane Wet DC = Dry Cliff WC = Wet Cliff

L = Landslides F = Flooding LN = Limited numbers ≤ 50 individuals NR = No reproduction FR = Falling rocks NW = Not extant in wild

AD = Avian diseases PCO = Predation by feral cats, nonnative owls

Factor A - Habitat Modification Factor B - Overutilization Factor C - Disease or Predation Factor E - Other

actions for *Astelia waialealae* (Plant Extinction Prevention Program 2008a,b,c; 2009a,b,c,d).

USFWS and the Hawaii Division of Forestry and Wildlife have fenced 9 montane bogs in the Alakai Plateau, totaling approximately 40 hectares (100 acres). These fenced bogs contain all populations of *Geranium kavaiense*, all but one population of *Astelia waialealae*, roughly half of the *Lysimachia daphnoides* and *Dubautia waialealae* individuals, and some scattered individuals of *Keysseria erici*, *K. helenae*, *Labordia pumila*, and *Melicope puberula* (Bruegmann 2002; Perlman and Wood 1995). Weed control and monitoring is ongoing within the fences (Bruegmann 2002; Bruegmann 2008).

The following plant species are currently in controlled propagation for genetic storage and/or reintroduction efforts: *Astelia waialealae*, *Canavalia napaliensis*, *Charpentiera densiflora*, *Cyanea kuhihewa*, *Dubautia imbricata* ssp. *imbricata*, *D. plantaginea* ssp. *magnifolia*, *D. waialealae*, *Geranium kavaiense*, *Labordia helleri*, *L. pumila*, *Lysimachia daphnoides*, *L. iniki*, *L. pendens*, *L. scopulens*, *Melicope degeneri*, *M. paniculata*, *M. puberula*, *Myrsine knudsenii*, *M. mezii*, *Pittosporum napaliensis*, *Platydesma rostrata*, *Pritchardia hardyi*, *Psychotria grandiflora*, *P. hobdyi*, *Schiedea attenuata*, *S. kealiae*, *Tetraplasandra bisattenuata*, and *T. flynnii* (Harold L. Lyon Arboretum Micropropagation Laboratory 2008; Hawaii Division of Forestry and Wildlife 2008; National Tropical Botanical Garden 2008a; Waimea Botanical Garden 2008; University of California, Irvine 2008; Center for Conservation and Research Training's Seed Storage Facility 2008; Volcano Rare Plant Facility 2008).

A fence has been constructed around 24 hectares (58 acres) of Kanaele Bog, the only low-elevation bog in Hawaii (The Nature Conservancy in Hawaii, Kauai Program 2008). Since the fence was constructed, The Nature Conservancy of Hawaii and their partners control invasive introduced plants such as *Melastome* spp. and *Psidium cattleianum* (strawberry guava) on a monthly basis and check the fence line (M. Clark, USFWS, pers. comm. 2009a). While none of the 45 plant species in this recovery plan currently occur in this site, several could be reintroduced into this ecosystem.

The Nature Conservancy of Hawaii has been working with the University of Hawaii's College of Tropical Agriculture and Human Resources and developed a new method of controlling *Sphaeropteris cooperi* (Australian tree fern), a highly invasive introduced plant that is spreading throughout the wet forests of Kauai. Initial field trials were very successful. Having mapped locations of adult *S. cooperi* from helicopter surveys, The Nature Conservancy is now using this data to kill individual trees from helicopters (The Nature Conservancy, Kauai Program 2009).

In upper Limahuli Valley, the National Tropical Botanical Garden has constructed a small fence around the last known, and only known, site of *Cyanea kuhihewa* (National Tropical Botanical Garden 2009). The National Tropical Botanical Garden has received additional funding for a larger fence enclosing 400 hectares (1,000 acres), currently under construction, and is controlling invasive plants in the area and reintroducing rare and

endangered plants (National Tropical Botanical Garden 2006, 2008b). This site will benefit endangered plant species from the montane and lowland wet ecosystem.

The National Tropical Botanical Garden has also worked with the Hawaii Division of Forestry and Wildlife to manage five small fenced areas in Mahanaloa Valley (National Tropical Botanical Garden 2009). These fenced areas could be used for the reintroduction of endangered plant species from montane mesic ecosystems. The Hawaii Division of Forestry and Wildlife is also in the process of fencing approximately 60 hectares (150 acres) in Mahanaloa Valley (USFWS 2009), which could also be used for the reintroduction of montane mesic species.

The Kauai Watershed Alliance has developed a management plan for the watershed areas of the island of Kauai, covering approximately 12,000 hectares (30,000 acres). Three areas are high priority areas for management: the eastern Alakai, upper Wainiha Valley, and upper Lumahai Valley. In total, these three areas encompass approximately 2,700 hectares (6,700 acres) of montane and lowland wet ecosystem types (Kauai Watershed Alliance 2005). The Nature Conservancy of Hawaii is in the process of constructing barrier fences in strategic areas to eliminate the movement of ungulates into 1,340 hectares (3,350 acres) of Wainiha Valley (T. Menard, The Nature Conservancy of Hawaii, pers. comm. 2009), and will control the most invasive introduced plants in this area. Management of this site will benefit lowland and montane wet species. The Kauai Watershed Alliance is currently seeking funding to fence 800 hectares (2,000 acres) in the eastern Alakai.

Kokee Resource Conservation Program controls the invasive introduced plant species *Sphaeropteris cooperi*, *Psidium cattleianum* (strawberry guava), and *Hedychium gardnerianum* (Kahili ginger) in the Kokee and Alakai regions of Kauai. These three invasive species have not spread throughout the two regions, and the goal is to control them before they have overgrown acres of mesic and wet montane ecosystems on the island of Kauai (M. Clark, pers. comm. 2009b).

The Kauai Invasive Species Committee, a voluntary partnership of government, private and non-profit organizations, and concerned individuals, works to prevent, control, or eliminate the most threatening invasive introduced plant and animal species before they become widespread and difficult to control, and often before they spread to the remaining native ecosystems. Currently, the group is targeting 12 species, including several species that could significantly alter the composition of ecosystems (*Senecio madagascarensis* [fireweed], *Pennisetum setaceum* [fountain grass], *Miconia calvescens* [miconia]), and the Indian mongoose (*Herpestes javanicus*), which is a major predator of native bird eggs (Kauai Invasive Species Committee 2009).

The Hawaii Division of Forestry and Wildlife has established over 20 small-scale exclosures, largely in lowland and montane mesic ecosystems, and continues to control invasive introduced plants within them. While these fenced areas are extremely small, they have allowed for small-scale protection of remaining wild populations and reintroductions of several species included in this recovery plan, preventing their

extinction (Hawaii Division of Forestry and Wildlife 2005, The National Tropical Botanical Garden 2007). Species that have been outplanted include *Canavalia napaliensis*, *Melicope paniculata*, *Myrsine knudsenii*, *Phyllostegia renovans*, and *Psychotria hobdyi* (Hawaii Division of Forestry and Wildlife 2009).

Recovery efforts for birds in the Alakai Plateau have focused primarily on population monitoring, augmentation of the critically endangered puaiohi by captive propagation and introduction, and avian disease research (USFWS 2006a).

3. Summary Conservation Assessment

Overall, the population status of the 45 plants and 2 bird species is declining. However, the recovery prognosis for these species is thought to be positive because the populations are either still of sufficient size to allow for successful management or can be reintroduced to increase numbers and distribution, and many of the threats to the species may be addressed by relatively straightforward means such as control of ungulates, invasive introduced plants, and predators.

In summary, the populations of the 45 plants and 2 bird species are declining and their ranges are highly restricted. However, with early intervention the population trends can be reversed and recovery can be achieved for most species. Several small scale efforts are ongoing on the island of Kauai, but these need to be expanded to much larger, ecosystem-level scales to be effective for recovery. Key challenges will be developing and implementing predator control methods for rodents and slugs and methods to limit avian diseases. In addition, coordinating an effective recovery effort and obtaining sufficient funding to implement required actions will be important for recovery.

II. Preliminary Recovery Strategy

A. RECOVERY PRIORITY NUMBER

Cyrtandra oenobarbara, *Dubautia waialealae*, *Geranium kauiense*, *Keysseria erici*, *Kysseria helenae*, *Labordia helleri*, *Labordia pumila*, *Lysimachia daphnoides*, *Pittosporum napaliense*, *Pritchardia hardyi*, and *Stenogyne kealiae* are assigned a recovery priority number of 2 on a scale of 1C (highest) to 18 (lowest; the "C" indicates the potential for conflict with human economic activities), based on the high degree of threat, a high potential for recovery with threats that are well understood and easily alleviated, and their status as full species (USFWS 1983a,b). *Chamaesyce remyi* var. *kauaiensis*, *Dubautia imbricata* spp. *imbricata*, *Dubautia plantaginea* ssp. *magnifolia* 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 easily alleviated, and their status as subspecies or varieties. *Astelia waialealae*, *Canavalia napaliensis*, *Chamaesyce elenoriae*, *Charpentiera densiflora*, *Cyanea dolichopoda*, *Cyanea eleeleensis*, *Cynea kolekoleensis*, *Cyanea kuhihewa*, *Cyrtrandra paliku*, *Diellia mannii*, *Doryopteris angelica*, *Dubautia kalalauensis*, *Dubautia kenwoodii*, *Lysimachia iniki*, *Lysimachia pendens*, *Lysimachia scopulens*, *Lysimachia venosa*, *Melicope degeneri*, *Melicope paniculata*, *Melicope puberula*, *Myrsine knudsenii*, *Myrsine mezii*, *Phyllostegia renovans*, *Platydesma rostrata*, *Psychotria grandiflora*, *Psychotria hobdyi*, *Schiedea attenuata*, *Tetraplasandra bisattenuata*, *and Tetraplasandra flynii*, and the two birds (akekee and akikiki) are assigned a recovery priority number of 5, 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 their status as full species. *Chamaesyce remyi* var. *remyi* and *Dryopteris crinalis* var. *podosorus* are assigned a recovery priority number of 6, 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 their status as varieties.

B. RECOVERY GOAL AND OBJECTIVES

The goal of the recovery program is to establish a framework within which recovery actions are undertaken to ensure the long-term survival of the 45 plants and 2 birds, and to control or reduce the threats to these species to the extent that they no longer require the protections afforded by the Endangered Species Act and therefore warrant delisting. Although subject to change, full recovery of the 47 species is currently envisioned as follows: viable populations will persist on protected and managed habitat throughout the species' historical range on Kauai. Threats to the species, primarily habitat loss and degradation and predation by introduced species, and, for the two bird species, avian disease, will be sufficiently abated to ensure the high probability of survival for at least 100 years. In keeping with the ecosystem approach to recovery for these 45 endangered plant and 2 endangered bird species, we will also develop recovery objectives for each ecosystem type in the recovery plan.

C. INITIAL ACTION PLAN

The goal of the initial phase of recovery is to arrest and reverse the general population declines and increase the range occupied by the 45 plants and 2 bird species. The primary objectives of the initial phase of recovery will be to:

1. Protect ecosystems and control threats

    1.1. Identify and survey remaining extant populations for all species and the ecosystems in which they occur

    1.2. Develop finer-scale microclimate models for Hawaii to analyze potential future distribution based on existing distributions and projected climate changes

    1.3. Identify areas within each ecosystem necessary for recovery, including critical habitat, and develop management units

    1.4. Ensure long-term protection of ecosystems

        1.4.1. Identify threats to the ecosystems within management units

        1.4.2. Within identified management units, construct and maintain fencing around those areas containing ecosystems needed for the recovery of all species and remove ungulates

        1.4.3. Control habitat-modifying invasive introduced plant species

        1.4.4. Develop and implement a rodent control program

        1.4.5. Provide wildfire protection as necessary

            1.4.5.1. Develop fire management plans within mesic ecosystems

            1.4.5.2. Assess necessity for fire management plans within wet ecosystems with climate change

        1.4.6. Protect management units from human disturbance as necessary

        1.4.7. Control other threats as appropriate

    1.5. Monitor success of management actions and use results to adapt management actions

2. Control species-specific threats

2.1. Develop and implement control methods for slugs

2.2. Develop and implement control methods for avian diseases

2.3. Control other threats as appropriate

2.4. Monitor results of management actions 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, including climate change

3.1. Select current populations for augmentation or sites for reintroduction

3.2. Prepare sites within management units

3.3. Propagate genetically appropriate individuals for genetic storage (for plants) and augmentation or reintroduction

3.4. Release (for birds) or outplant (for plants) genetically appropriate individuals

3.5. Monitor results of release or outplanting and use results to adapt management actions

4. Control new threats before they become widespread

4.1. Conduct surveys throughout the island, especially in areas of likely influx of invasive species, and control any new pest or invasive species before they infest recovery areas

4.2. Improve border security to prevent the influx of new pests and invasive species into the State and the island of Kauai.

5. Conduct additional research essential to recover the species and ecosystems

5.1. Conduct studies on the range, demography, and dispersal of each species

5.2. Evaluate research results and implement adaptive management as necessary

6. Develop and implement a detailed monitoring plan for each species and ecosystem

7. Develop and initiate a public information program for the 45 plants and 2 birds

8. Develop downlisting and delisting criteria at both the species and ecosystem level as necessary to achieve recovery 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:

- Assess the distribution, current status, and potential future distribution of existing ecosystems and determine the most important sites for ecosystem management. Make use of landscape modeling, spatial analysis, remote sensing technology, and existing survey data to better understand species distributions and priority ecosystem areas for targeting future surveys.
- Initiate control of ecosystem-modifying threats, such as ungulates and invasive introduced plant species, as soon as possible within the highest priority management units.
- Stabilize and protect remaining extant populations of the 45 plants and 2 bird species. Conduct systematic, island-wide surveys 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.
- Restore and maintain multiple viable populations of the 45 plants and 2 bird species by protecting, restoring, and maintaining existing habitats or areas with potential for restoration that are within their historical range.
- Conduct research on control methods for introduced slugs and avian malaria.
- Develop an augmentation plan to collect and propagate seed from the 45 plant species that can later be utilized for population restoration, augmentation, and reintroduction.
- Identify threats and prioritize which ones to address first for the two birds.
- Determine if a captive propagation program for the two birds is necessary; if so, develop a captive propagation program.
- Prevent the influx of new pests and invasive species into recovery areas. Increase the efforts of the Kauai Invasive Species Committee and improve border security.
- Prioritize research studies that will provide information and tools aiding in the mitigation of known threats and limiting factors of the species and ecosystems.
- Increase outreach effort and coordination with State agencies and private landowners regarding ecosystem conservation. Promote opportunities to assist in the recovery of these species through Habitat Conservation Plans, Safe Harbor Agreements, 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 45 endangered plants and 2 endangered bird species listed on April 13, 2010, will be prepared by Pacific Islands Fish and Wildlife Office staff, pursuant to section 4 (f) of the Endangered Species Act. A recovery plan is already under development for *Drosophila attigua* as well as 12 other pomace flies that were listed in 2006.

A new approach will be attempted for the Kauai ecosystem recovery plan. The Service is planning to develop a dynamic and searchable electronic document on the Service web site. In this document, it will be possible to search by species, threat, or geographic area, to determine what management actions need to occur as well as where they need to occur.

B. INFORMATION MANAGEMENT

All information relevant to the recovery of the 45 endangered plants and 2 endangered bird species listed on April 13, 2010, will be housed in the Pacific Islands Fish and Wildlife Office's administrative files. Our lead biologist will be responsible for maintaining a full administrative record for the recovery planning and implementation process for the species.

C. RECOVERY PLAN SCHEDULE

Regional Office Review Draft	July 2011
Public Review Draft	August 2011
Public Comment Period	60 days
Final Recovery Plan	September 2012

D. STAKEHOLDER INVOLVEMENT

Key stakeholders:

- Private landowners who own lands occupied currently or historically by any of the 45 plants and 2 bird species or with ecosystem types suitable for establishing new populations
- Local entities and State and Federal agencies that own and/or manage lands occupied currently or historically by any of the 45 plants and 2 bird species or with ecosystem types suitable for establishing new populations
- Native Hawaiian groups
- Conservation organizations
- The University of Hawaii researchers
- The Nature Conservancy of Hawaii
- U.S. Geological Survey, Biological Resources Discipline

- State of Hawaii Department of Lands and Natural Resources, Division of Forestry and Wildlife

E. STAKEHOLDER INVOLVEMENT STRATEGY

Landowners and land managers who may contribute to or be affected by the listing and recovery of the 45 plants and 2 bird species will be invited to participate in the recovery planning process. Stakeholder involvement for the Kauai ecosystem recovery plan will include many of the same participants as for the *Drosophila* recovery plan (currently under development). The USFWS will work together with stakeholders to streamline this process. A mailing list will be maintained and the Pacific Islands Fish and Wildlife Office will attempt to foster open and ongoing communications with all interested parties. Field biologists working on the 45 plants, 2 birds, and other Kauai resource management issues will continue to develop strong one-on-one working relationships with interested parties. Early in the recovery planning process, a meeting with interested stakeholders will be held to exchange status information, identify recovery issues, and to identify additional cooperators in recovery efforts for these species. The information emanating from this discussion will provide the initial platform for proceeding with recovery planning. It will also help identify private landowners who could participate in recovery efforts. Interested stakeholders will then be asked to participate on an ongoing basis in the recovery planning and implementation effort. As needed, additional meetings and/or conference calls will be held to discuss particular issues, and stakeholders will be invited to participate as warranted by the purposes of the meeting. Advantage will be taken of all opportunities to interact with stakeholders in a productive and meaningful way.

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 may also 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 and developed over time with new stakeholders.

Approved:

Carolyn A. Bohan 6/17/10

Acting Regional Director, Region 1 Carolyn A. Bohan Date
U.S. Fish and Wildlife Service

Citation

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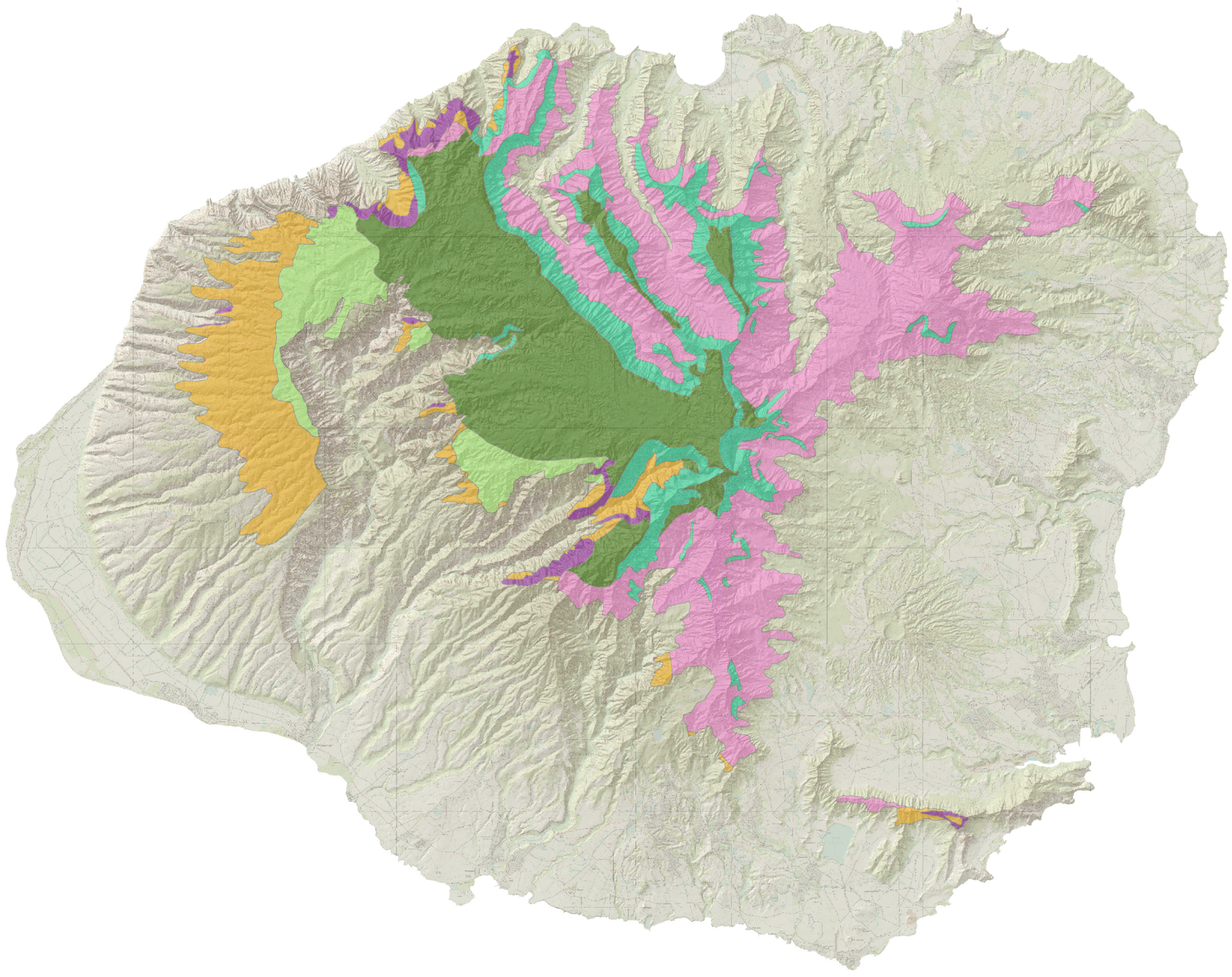
Map 1.

Island of Kauai
Native Ecosystems

The Nature Conservancy of Hawaii, 2007

- Lowland Mesic Forest & Shrubland
- Lowland Wet Forest & Shrubland
- Montane Mesic Forest & Shrubland
- Montane Wet Forest & Shrubland
- Dry Cliff
- Wet Cliff
- Nonnative



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0 2.5 5 Kilometers

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1:176,000
UTM Zone 4 NAD 1983

Prepared by U.S. Fish & Wildlife Service, Pacific Islands Office
December 2009

Map 2.

Island of Kauai

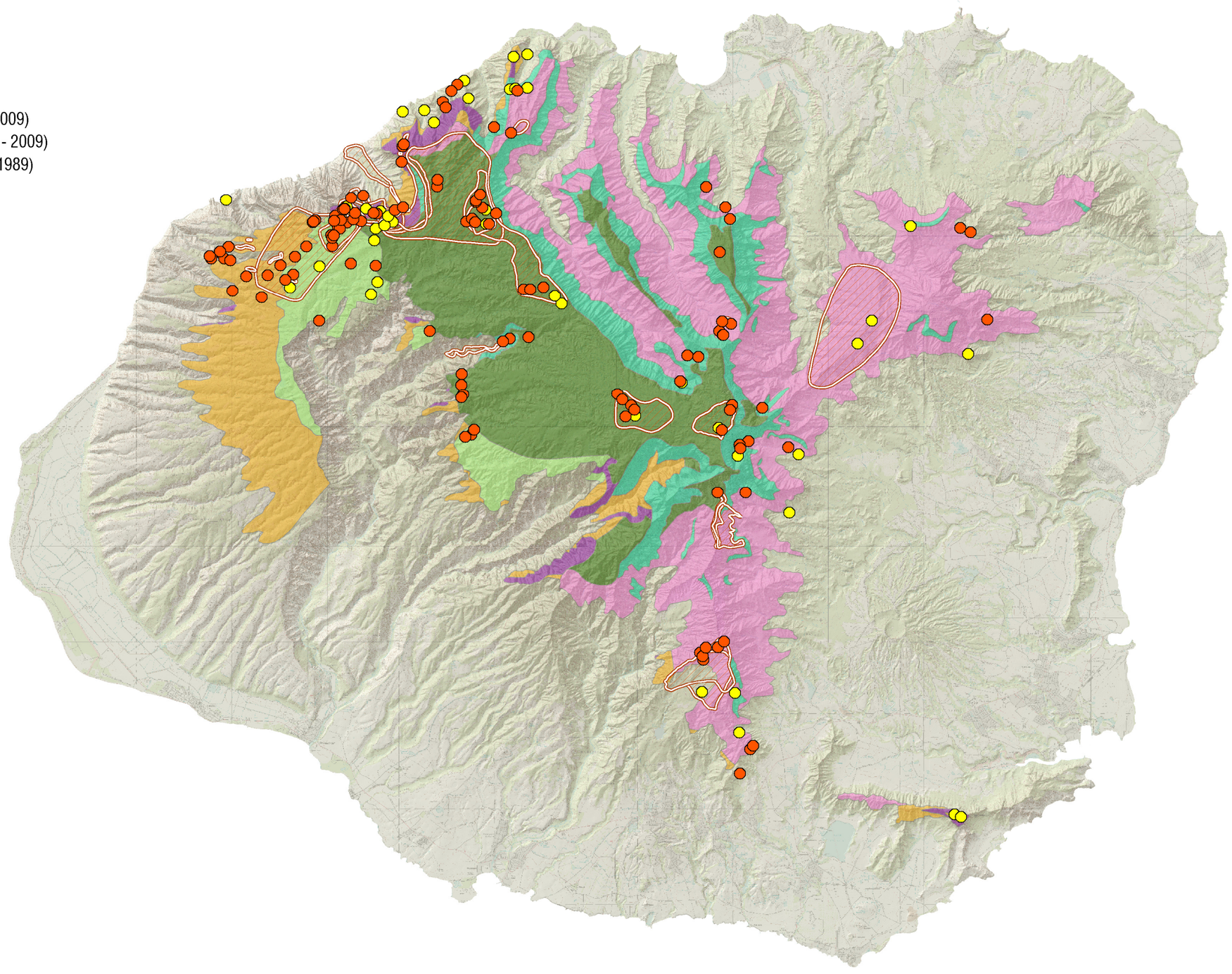
Species Observations

- Current point occurrences (1989 - 2009)
- Current polygon occurrences (1989 - 2009)
- Historic point occurrences (prior to 1989)

Native Ecosystem

The Nature Conservancy of Hawaii, 2007

- Lowland Mesic Forest & Shrubland
- Lowland Wet Forest & Shrubland
- Montane Mesic Forest & Shrubland
- Montane Wet Forest & Shrubland
- Dry Cliff
- Wet Cliff
- Nonnative



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UTM Zone 4 NAD 1983

Prepared by U.S. Fish & Wildlife Service, Pacific Islands Office
April 2010

Map 3.

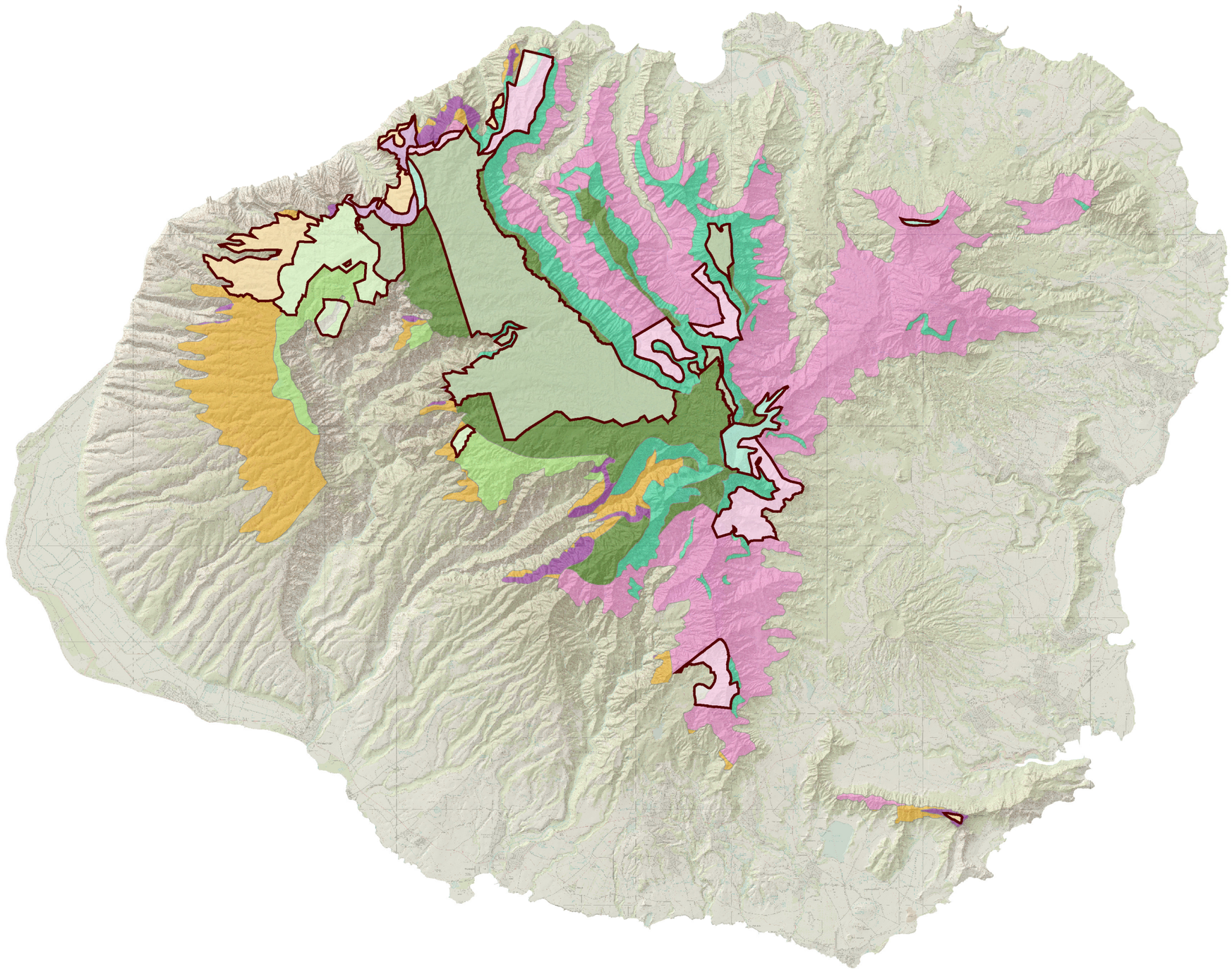
Island of Kauai

Kauai Ecosystem Critical Habitat

Native Ecosystem

The Nature Conservancy of Hawaii, 2007

- Lowland Mesic Forest & Shrubland
- Lowland Wet Forest & Shrubland
- Montane Mesic Forest & Shrubland
- Montane Wet Forest & Shrubland
- Dry Cliff
- Wet Cliff
- Nonnative



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Prepared by U.S. Fish & Wildlife Service, Pacific Islands Office
April 2010