U.S. Fish & Wildlife Service

Hakalau Forest National Wildlife Refuge

Land Protection Plan and Environmental Assessment

Land Protection Plan and Environmental Assessment
for the Proposed Additions to
Hakalau Forest National Wildlife Refuge

Hawai'i County, Hawai'i

July 2012

Prepared By:
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Approved by:

Acting _____ August 9, 2012
Regional Director, Pacific Region — Date
U.S. Fish and Wildlife Service

Concurrence:

Signed by Dan Ashe _____ July 10, 2012
Director — Date
U.S. Fish and Wildlife Service

CITATION. U.S. Fish and Wildlife Service. 2012. Land Protection Plan, Proposed Additions to Hakalau Forest National Wildlife Refuge. U.S. Fish and Wildlife Service, Pacific Region, Portland, Oregon. 25 pp.

Finding of No Significant Impact
for the
Land Protection Plan and Environmental Assessment
for the Proposed Additions to
Hakalau Forest National Wildlife Refuge

Hawai'i County, Hawai'i

U.S. Department of the Interior
Fish and Wildlife Service
Pacific Region
Portland, Oregon

The U.S. Fish and Wildlife Service (Service) has completed the *Land Protection Plan, Conceptual Management Plan, and Environmental Assessment for Additions to the Hakalau Forest National Wildlife Refuge.* The Environmental Assessment, prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), discloses the environmental consequences of protecting and restoring up to 29,973 acres of fish and wildlife habitat in Hawai'i County, Hawai'i. The Land Protection Plan complements the Environmental Assessment by providing information on the project, threats to or status of the resources we seek to protect, the purpose of our expansion, our biological standards including our approach to strategic habitat conservation, and our land protection priorities. The Conceptual Management Plan provides a general description of the interim management of any acquired land until a formal management plan is completed.

The Service has selected Alternative B, our preferred alternative, for implementation because it best furthers the Service's general goals identified in the Comprehensive Conservation Plan (CCP) for the Hakalau National Wildlife Refuge (Refuge) which are to:

- Protect, maintain, and restore subtropical rainforests on the windward slope of Mauna Kea as habitat for all life-history needs of endangered species.

- Protect and maintain wetland and aquatic habitats, including streams and their associated riparian corridors, ponds, and bogs on the Hakalau Forest Unit.

- Protect, maintain, and restore subtropical rainforests on the leeward slope of Mauna Loa as habitat for all life-history needs to promote the recovery of endangered species.

- Protect and maintain lava tube and lava tube skylight habitat with special emphasis on their unique and endemic flora and fauna on the Kona Forest Unit.

In addition, Alternative B, implements objectives 1.5 and 5.3 of the CCP to investigate and initiate landscape-level conservation measures for the Kona Forest Unit and Hakalau Forest Unit, respectively. The strategies identified to achieve these objectives include: identify habitat to support focal species; develop protection and management strategies; and work with partners, neighbors, and private landowners to meet conservation goals and develop specific proposals for

land acquisition, cooperative agreements, or conservation easements. Alternative A, the no action alternative provides little likelihood that these important wildlife habitats would be protected, restored, and managed.

Public input was solicited throughout the entire planning process, including the decision-making process. The Service identified issues and concerns relating to the project through a public scoping period that began in July 2011 when the public was notified of the project through a news release and planning update distributed to 292 individuals, agencies, and organizations. The Refuge Manager also presented information on the Refuge proposal at an open house in Hilo held on August 17, 2011. Twenty-two community member attendees were presented with an overview of the proposed study area, and their comments were recorded. Written comments were also solicited and received during the scoping period which ended September 16, 2011.

The public identified a range of issues regarding the proposed land acquisitions and their management by the Refuge if they were acquired. Specifically, public concerns were expressed regarding the effects of the project including: acquisition and management costs and funding; access and public use; invasive species management; removal of land from agricultural and livestock use; water rights; short-term versus long-term conservation benefits; and public education. These issues were addressed in the Draft Land Protection Plan and Environmental Assessment released to the public on February 15, 2012. The release of this document was announced through a news release and planning update and initiated a 30-day public review and comment period that ended on March 16, 2012.

Several letters of support were received on our proposal. No new issues or concerns were raised during the public review and comment period. No additional analysis was required as a result of the comments received. Our responses to the comments received were primarily to reiterate or clarify content in the public review document. Several minor inaccuracies regarding land status or management were noted and have been corrected.

As described in detail in the Environmental Assessment, the potential additions to the Refuge would benefit wildlife and habitat protection efforts on the Island of Hawai'i and further recovery efforts for endangered species. Because of the intensive restoration and management needs and the ongoing challenges of endangered species recovery, invasive species control, and climate change, these benefits are likely to accrue slowly over the long-term. Other beneficial effects include enhanced water supply protection and replenishment and the preservation of cultural or historic resources that may occur on any acquired land. The boundary expansion is also consistent with the State of Hawai'i's "Rain Follows the Forest" watershed protection and restoration initiative. Acquisition of these lands would preclude their use for alternative purposes, including timber harvest and residential development. However, it is the Service's policy to acquire land only from willing sellers.

In determining whether this project is a major action significantly affecting the quality of the human environment, we looked at both the context and intensity of the action (40 CFR § 1508.27, 40 CFR § 1508.14) as required by NEPA. The project will be implemented over time dependent upon the Service's ability to obtain the funding needed for fee-title acquisition, which is limited under this boundary expansion to 29,973 acres. Because the human environment

includes the natural and physical environment and the relationship of people with that environment (40 CFR § 1508.14), we also assessed the social and economic conditions on the Island of Hawai'i and found no significant impacts from the proposed boundary expansion.

Based on my review and evaluation of the information contained in the supporting references, I have determined that expanding the Refuge boundary to protect and restore up to an additional 29,973 acres of fish and wildlife habitat in Hawai'i County, Hawai'i, is not a major Federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(C)(c) of NEPA. Accordingly, the preparation of an Environmental Impact Statement is not required.

The Finding of No Significant Impact, the Environmental Assessment, and other supporting documents are available for public inspection upon requires by contacting U.S. Fish and Wildlife Service, Division of Planning, Visitor Services, and Transportation, 911 NE 11th Avenue, Portland, Oregon, 97232, and are posted on the Internet at http://www.fws.gov/hakalauforest.

Acting Regional Director, Pacific Region
Portland, Oregon

August 9, 2012
Date

Supporting References

U.S. Fish and Wildlife Service. 2012. *Land Protection Plan, Conceptual Management Plan, and Environmental Assessment for Additions to the Hakalau Forest National Wildlife Refuge.* Portland, Oregon.

U.S. Fish and Wildlife Service. 2011. *Comprehensive Conservation Plan for the Hakalau Forest National Wildlife Refuge*. Portland, Oregon.

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Citation: U.S. Fish and Wildlife Service. 2012. Land Protection Plan and Environmental Assessment for the proposed additions to Hakalau Forest National Wildlife Refuge, Hawai‘i County, Hawai‘i. Pacific Region, Portland, Oregon. 26 pp., plus appendices.

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1.1 Introduction

In this Land Protection Plan (LPP), the U.S. Fish and Wildlife Service (Service) describes the habitat protection methods that could take place for lands within Alternative B (Preferred Alternative) described in the Environmental Assessment (EA) for the Proposed Additions to the Hakalau Forest National Wildlife Refuge (NWR or Refuge). The plan also includes a priority listing of private lands to be considered for acquisition within the proposed boundary.

1.2 Project Description

The Refuge is located on the Island of Hawai‘i, which comprises Hawai‘i County, Hawai‘i (Figure 1). It has two units, the Hakalau Forest Unit and the Kona Forest Unit. The Hakalau Forest Unit (HFU) includes 33,946 acres (ac) on the wetter, windward side of Mauna Kea and was established in 1985. The Kona Forest Unit (KFU), established in 1997, includes 5,300 acres on the drier, leeward side of the island. The Service is proposing to protect additional habitat for endangered forest birds, waterbirds, plants, and other native species and special habitats by expanding the Refuge acquisition boundary by up to 29,973 acres of land to the HFU and KFU (Table 1). Lands under consideration for addition to the HFU include the 13,130-acre Koa Forest property, the 2,230-acre Maulua Gulch property, and the 4,469-acre Kūka‘iau Ranch property. Lands under consideration for addition to the KFU include the Honokua and Kahuku lots of the McCandless Ranch, a total of 10,143 acres.

Table 1. Land proposed for addition to Hakalau Forest National Wildlife Refuge.

Hakalau Forest Unit Parcels	
Parcel Name	**Acres Based on County Assessor Records**
Koa Forest Property	13,130
Maulua Gulch	2,230
Kūka‘iau Ranch	4,469
Hakalau Forest Unit Subtotal	**19,829**
Kona Forest Unit Parcels	
McCandless Ranch Honokua Lots	3,887
McCandless Ranch Kahuku Lots	6,256
Kona Forest Unit Subtotal	**10,143**
Proposed Expansion Total	**29,973**

[1] Total differs from combined subtotals due to rounding.

The proposed action would further several Hakalau Forest Refuge goals identified in its Comprehensive Conservation Plan (CCP) (Service 2011), including:

Pahuhopu 1: E ho‘opalekana, mālama, a ho‘ōla hou i ka waonahele ma Mauna Loa ma ke ‘ano he wahi noho no nā mea a pau i mea e kū‘ono‘ono hou ai ka nohona o nā mea ‘ane make loa ‘o ia nō ‘o ‘oe ‘o nā manu, nā ‘ōpe‘ape‘a, nā mea kanu, a me nā mea kolokolo ‘āina.

Goal 1: Protect, maintain, and restore subtropical rainforest community on the leeward slope of Mauna Loa as habitat for all life-history needs to promote the recovery of endangered species (e.g., forest birds, ‘ōpe‘ape‘a, plants, and invertebrates).

Pahuhopu 2: E hoʻopalekana a mālama i nā ana kahe pele a me ke ola i ka puka mālamalama o nā ana kahe pele ma ka waonahele o Kona, e kālele ana hoʻi i ke ola o nā lāʻau ʻōiwi.

Goal 2: Protect and maintain lava tube and lava tube skylight habitat throughout the Kona Forest Unit, with special emphasis on their unique and endemic flora and fauna.

Pahuhopu 3: E hoʻopalekana, mālama, a hōʻola hou i ka waonahele ma ka ʻaoʻao koʻolau o Mauna Kea ma keʻano he wahi noho no nā mea a pau a me ko lākou pono ʻoia nō ʻoeʻo nā manu, nā ʻōpeʻapeʻa, nā mea kanu, a me nā mea kolokoloʻāina.

Goal 3: Protect, maintain, and restore subtropical rainforest community on the windward slope of Mauna Kea as habitat for all life-history needs of endangered species (e.g., forest birds, ʻōpeʻapeʻa, plants, and invertebrates).

Pahuhopu 4: E hoʻopalekana a mālama i kaʻāina nenelu ma Hakalau.

Goal 4: Protect and maintain wetland and aquatic habitats (e.g., streams and their associated riparian corridors, ponds, and bogs) on the Hakalau Forest Unit.

The proposed action would implement objectives 1.5 and 5.3 of the CCP to investigate and initiate landscape-level habitat conservation measures for the KFU and HFU, respectively. The strategies to achieve these objectives include: identify habitat to support focal species; develop protection and management strategies; and work with partners, neighbors, and private landowners to meet conservation goals and develop specific proposals for land acquisition, cooperative agreements, and/or conservation easements (Service 2011).

1.3 Threat to or Status of the Resource

Native Hawaiian ecosystems face many threats including habitat loss, degradation, and fragmentation, invasive plant and animal species, and climate change. Native species are directly and indirectly affected by these threats, as well as infectious diseases such as avian pox and malaria to which most native birds have no resistance. These factors, all of which are operative on the Island of Hawaiʻi and affect the resources that the Refuge was established to protect, are discussed.

1.3.1 Habitat Loss, Degradation, and Fragmentation. The ecology of Hawaiʻi's native ecosystems has been severely altered. Native plants and animals are generally absent and exotics predominate in nearly all low-elevation areas except for a few relatively undisturbed beach strands, steep-sided gulches, and lava tube skylights, etc., that excluded ungulates. Large areas of native forest at all elevations have been cleared for crop agriculture and livestock grazing.

1.3.2 Invasive Plant and Animals Species. The intentional and accidental introduction of alien plants and animals to Hawaiʻi has been ongoing for over 1,000 years. Significant changes occurred from Polynesian settlement, but since the arrival of Europeans, an estimated 12,000 plant species have been introduced to the Hawaiian Islands, compared with the 27 or so that the Polynesians brought with them. Feral pigs destroy understory vegetation and spread alien weeds. They consume groundcover plants and significantly contribute to erosion, stream sedimentation, and sediment transfer to the ocean that can smother coral reefs. The intentional introductions were accompanied by accidental species introductions such as the Polynesian rat, which, due to its high reproductive rate,

had a devastating effect on ground-nesting birds, native land snails, and some tree species (Burney 2001). Other stowaways have included the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), various geckos and skinks, land snails, various arthropods such as rat parasites, and other mosquitoes (genera *Culex, Aedes,* and *Wyeomyia).*

1.3.3 Infectious Diseases. Pigs also facilitate mosquito-breeding through their rooting and wallowing. Hawai‘i has no native mosquitoes, but the Southern house mosquito (*Culex quinquefasciatus*) was introduced from Mexico in 1826 by the crew of the whaling vessel, *Wellington*, while replenishing their water barrels in freshwater streams on Maui. This introduction has devastated endemic bird species by spreading avian malaria and avian pox, diseases to which they have no natural immunity (Henshaw 1902).

1.3.4. Climate Change. Small island groups are particularly vulnerable to climate change due to their small land area compared to the large expanses of surrounding ocean; limited natural resources; high susceptibility to natural disasters; and inadequate funds to mitigate impacts (IPCC 2001). Thus, Hawai‘i is considered to have a limited capacity to adapt to future climate changes.

Recent changes in the climate of Hawai‘i include a rise in air and sea surface temperatures, decreases in rainfall and stream flow, and increases in rain intensity, sea level, and ocean acidification (Fletcher 2010). Changes due to increased air and sea surface temperatures and decreased precipitation are most likely to directly affect the Refuge and the study areas.

An analysis of temperature changes in the Hawaiian Islands for the past approximately 85 years based on an index of 21 stations has shown a relatively rapid rise in surface temperature in the last approximately 30 years, with stronger warming at the higher elevations. Minimum temperatures increased about three times as much as maximum temperatures, resulting in a narrower range of daily temperatures; the warming trend was greater at higher elevations (Giambelluca and others 2008). The average ambient temperature at sea level is projected to increase by about 4.1^{o}F by 2100 (IPCC 2007). These changes would increase the monthly average temperature to between 77^{o}F and 86^{o}F. The rate of increase at low elevation (0.16^{o}F per decade) is below the observed global temperature rise of 0.32^{o}F per decade (IPCC 2007). However, a recent analysis of high elevation temperature data collected at the Mauna Loa Observatory between 1959 and 2006 has shown higher warming trends in mean annual and December air temperatures by 0.47^{o}F and 0.79^{o}F per decade, respectively (Juvik and others 2011). Warming temperatures would also tend to increase atmospheric stability and strengthen the trade wind inversion (Cao and others 2007).

Precipitation in Hawai‘i has declined by about 15 percent over the last 15-20 years (Diaz and others 2005, Chu and Chen 2005). Stream flow has also been in steady decline since in the early 1940s (Oki 2004). However, rain intensity, which contributes to stream overflow and flooding and is not beneficial for aquifer replenishment, increased by about 12 percent between 1958 and 2007 (Fletcher 2010). Global climate models project that net precipitation at sea level near the Hawaiian Islands will decrease in winter by about 4-6 percent, with no significant change during summer (IPCC 2007). Downscaling of global climate models suggest that wet-season (winter) precipitation will decrease by 5 to 10 percent, while dry-season (summer) precipitation will increase by about 5 percent by the end of the century under a moderate emissions scenario (Timm and Diaz 2009).

Most climate projections suggest that more intense wind speeds and precipitation amounts will accompany more frequent tropical typhoons/cyclones and increased tropical sea surface temperatures

in the next 50 years. The intensity of tropical cyclones is likely to increase by 10-20 percent in the Pacific region when atmospheric levels of CO_2 reach double pre-industrial levels (McCarthy and others 2001).

Climate change has the potential to influence two interrelated ecological issues in the State of Hawai‘i: endangered species and pest species. Species response to climate change will depend on the life history, distribution, dispersal ability, and reproduction requirements of the species (DBEDT and DOH 1998, Middleton 2006, Giambelluca 2008). Climate change may exacerbate pest species issues because alterations in the environment may increase the dispersal ability of introduced weeds or animals, including infectious disease vectors such as mosquitoes.

1.4 Purpose of the Proposed Expansion

The Service identifies the purpose(s) of a refuge when it is established or when new land is added to an existing refuge. The purposes of the proposed Hakalau Forest NWR additions reflect the core mission of the Service to protect wildlife resources of national importance and the purposes for which the units of the existing Refuge were established.

Under National Wildlife Refuge System (Refuge System) policy, lands acquired for an existing refuge must incorporate the primary purposes for which the existing refuge was established. Thus, the primary purposes for the Hakalau Forest NWR would also apply to the proposed additions, if they are acquired by the Service. The purposes of Hakalau Forest NWR, established on October 29, 1985, are ". . . to conserve (A) fish or wildlife which are listed as endangered species or threatened species . . . or (B) plants . . ." (Endangered Species Act of 1973, as amended, 16 U.S.C. 1534).

Acquisition of the currently proposed lands would have additional benefits including:

- Conservation, enhancement, and restoration of aquatic resources, including streams and bogs;
- Protection, enhancement, and restoration of other native habitats, including lava tubes and lava tube skylights; and
- Potential enhancement of opportunities for compatible wildlife-dependent visitor uses.

Conservation of lowland coastal habitats would also help maintain the rural character of Hawaii's north shore by precluding subdivision and development of the lands that are ultimately purchased for inclusion in the Refuge.

The Refuge expansion would protect, enhance, and restore native montane forests, bogs, streams, lava tubes, and lava tube skylights in perpetuity. Protection and management of these areas would allow the Service to contribute to the recovery of endangered and threatened species and to support other native plants and animals.

1.5. Biological Standards

1.5.1 Conservation of Priority Conservation Targets. The priority conservation targets for this LPP are endangered forest birds, endangered waterbirds, an endangered mammal, an endangered invertebrate, and endangered, threatened, and candidate plant species. A summary of these species and their historical, known, and potential occurrence on the properties proposed for acquisition is provided in Table 1.

Table 2. Priority conservation species, their status, and likelihood of occurrence within study areas.

	Status	Koa Forest	Maulua Gulch	Kūkaʻiau Ranch	McCandless Ranch
Birds					
ʻAkiapōlāʻau (*Hemignathus munroi*)	E			N	H
Hawaiʻi ʻākepa (*Loxops coccineus coccineus*)	E				H
Hawaiʻi creeper (*Oreomystis mana)*	E				P
ʻŌʻū (*Psittirostra psittacea*)	E	H			N
ʻAlalā (*Corvus hawaiiensis*)	E				N
ʻIo (*Buteo solitarius*)	E	P	P	P	P
Palila *(Loxioides bailleui)*	E			N,C	
Nēnē (*Branta sandvicensis*)	E			P	
Koloa maoli (*Anas wyvilliana*)	E	P	P	P	
ʻAlae keʻokeʻo (*Fulica alai*)	E	P	P	P	
Mammals					
ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*)	E	P	P	P	P
Plants					
Asplenium peruvianum var. *insulare (=A. fragile* var. *insulare)*	E				P
Clermontia lindseyana	E				
Clermontia peleana	E	A	A		
Cyanea hamatiflora ssp. *carlsonii*	E				A
Cyanea platyphylla	E	P	A		
Cyanea shipmanii	E				
Cyanea stictophylla	E				H
Nothocestrum breviflorum	E				H
Phyllostegia racemosa	E				
Phyllostegia velutina	E	H			H
Portulaca sclerocarpa	E				A
Sicyos macrophyllus	C			P,A	A
Silene hawaiiensis	T			A	A
Invertebrates					
Drosophila heteroneura	E				A

Status: E = Endangered; T = Threatened; C = Federal candidate; P = likely present; H = historically occurred (up to the mid-1970s), no recent observations, but may still be present; N = historically occurred (up to the mid-1970s) but no longer present; A = known to occur in adjacent areas of similar habitat; C = critical habitat

1.5.2 Provides Habitat Connections. There is an extensive network of managed lands on Hawaiʻi Island (Figure1). Although fish and wildlife conservation is not the priority use of some of these managed areas, due to the predominance of federally listed plant and animal species on many of the managed areas, habitat conservation is typically taken into consideration, especially on Federal lands. The proposed acquisitions would all provide habitat connectivity among managed areas. The addition of the Koa Forest property to the HFU would extend the current Refuge boundary makai (toward the sea) to include lower montane wet and mesic forest, as well as lower reaches of major streams that

flow from the HFU. The Maulua Gulch property, if acquired, would extend Refuge protection makai to sea level. Upslope from the HFU, the lands are managed by the Department of Hawaiian Home Lands (DHHL). The ʻĀina Mauna Legacy Program, which provides management guidance for this area, includes areas that will be managed for native forest as well as the Kanekaleonui Bird Corridor and the Wailuku River Corridor, both of which provide direct habitat connectivity mauka (toward the mountain) between the HFU and the higher elevation māmane forest that provided potential habitat for the endangered palila (DHHL 2011). The Kūkaʻiau Ranch property, if acquired, would be added to the HFU; it is also an important tract of land for recovery of the palila and lies between State lands that are also being restored to provide for palila recovery. At McCandless Ranch, the higher elevation Kahuku lots provide direct habitat connectivity between the KFU and the mauka Hawaiʻi Volcanoes National Park. All of these properties, therefore, would provide migratory corridors for priority conservation targets, including endangered forest birds, waterbirds, and plants.

1.5.3 Promotes Biological Integrity. The properties proposed for acquisition, if acquired, would nearly double the total area of lands protected by the Refuge for priority conservation targets, including endangered forest birds, waterbirds, and plants. They would also extend the elevation gradient of Refuge lands, both makai and mauka by several thousand feet. The Refuge has demonstrated that forest restoration is both possible and effective in increasing the availability and use by endangered forest birds. Although the endangered forest birds may be limited makai by the infectious diseases spread by introduced mosquitoes, at least one native forest bird has shown resistance to avian malaria. Aquatic habitats within the Koa Forest and Maulua Gulch properties also provide migratory, resting, and feeding habitat for endangered waterbirds, including the koloa maoli and the ʻalae keʻokeʻo. Protection of all of these properties would prevent their development for uses that could impact the existing Refuge, such as commercial timber operations and incompatible grazing practices. They would also provide a buffer area in which ongoing efforts to control invasive species, including plants and ungulates, could be extended, thereby decreasing the likelihood of reinvasion of the core areas of the Refuge once control efforts have succeeded there.

1.5.4 Invests in Healthy Lands. There are no known contaminant issues on any of the properties under consideration. No nearby contaminated sites were found in a records search of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) database for the Island of Hawaiʻi. All of these areas are relatively remote with difficult access and are highly unlikely to have contaminant issues.

1.5.5 Anticipates or Responds to Climate Change. All of the proposed additions anticipate or respond to the potential effects of climate change. As explained above, they all increase habitat connectivity and enhance migratory corridors. The Koa Forest, Maulua Gulch, and McCandless Ranch properties increase the spatial extent of protected native forests and over the long-term will provide additional habitat into which propagated endangered plants can be outplanted, thereby increasing population sizes, extending spatial distribution, and increasing the resiliency of these plants to the effects of climate change. Koa Forest and Maulua Gulch would also increase the protection of aquatic ecosystems that provide habitat for endangered waterbirds. Protection of these areas also maintains their ecological functions within the watershed by enhancing water quality and aquifer recharge. They also serve as buffer areas to the current Refuge. The Kūkaʻiau Ranch and McCandless Ranch properties both include higher elevation habitats above the current Refuge boundaries that will allow for the migration of species if climate change causes the inversion layer to shift the higher precipitation zones upward or temperature increases result in the upward migration of avian disease-carrying mosquitoes.

1.5.6 Provides Adequate Water. No additional water resources are likely to be needed for any of the proposed Refuge additions. Catchment ponds are known to exist on the Kūkaʻiau Ranch and the Koa Forest properties. Streams on the wetter side of the island, within the study areas adjacent to the HFU, are intermittent but channel large amounts of water during the rainy season. Even during the dry season, spring-fed pools and rock ledges hold water and provide aquatic habitat and sources of water for wildlife, including endangered waterbirds. Protection of these lands would also benefit downstream water uses. The McCandless Ranch properties have no surface water. Conservation of all these parcels would also contribute to recharge of local aquifer systems.

1.5.7 Urban Refuges. The Refuge is not located in an urban area. One of the proposed additions, the Maulua Gulch property, is located next to the coast highway on the Hāmākua Coast of Hawaiʻi Island. It, therefore, could provide opportunities for public education and interpretation that the otherwise remote Refuge units do not.

1.6 Strategic Habitat Conservation. Strategic Habitat Conservation (SHC) is a science-based framework for making management decisions about where and how to deliver conservation efficiently to achieve specific biological outcomes and focuses on the ability of the landscape to sustain species as expressed in measurable objectives. Developing a strategy to attain a biological outcome, such as a population objective, requires documented and testable assumptions to determine whether the objective is met (National Ecological Assessment Team (NEAT) 2006)). This is an iterative process of developing and refining a conservation strategy, making efficient management decisions, and using research and monitoring to assess accomplishments and inform future iterations of the conservation strategy (Service 2008a).

Land protection planning includes both biological planning and conservation design. Biological planning is the systematic application of scientific knowledge about species and habitat management and requires that we articulate measurable population objectives for selected species, consider what may be limiting populations to less than objective levels, and compile models that describe how populations are expected to respond to habitat management. Conservation design is predicated on the belief that the potential to affect populations varies in space in response to site characteristics and landscape context. Accurate maps that predict patterns in the ecosystem are critical to conservation design because maps that are not based on the systematic application of science can be misleading and may impede conservation success. Maps used in SHC apply empirical or experience-based models to spatial data. Such maps represent spatially-explicit models that relate species to limiting habitat factors and are the essence of the SHC framework (Service 2008b).

Because the Hakalau Forest NWR was established to protect endangered species, in particular, forest birds and plants, endangered species comprise our priority conservation targets (Table 2). The Hawaiian Forest Bird Survey began in 1976 with the objectives of determining the distribution, population size, density by vegetation type and elevation, habitat response, and geographical areas where more detailed studies were needed to clarify distributional anomalies and to identify limiting factors of various species (Scott and others 1986). The study area on the Island of Hawaiʻi included montane forests on all but the northern slopes of Mauna Loa and Mauna Kea, including the Hāmākua and Kona areas where the HFU and KFU, respectively, are located. All of the listed forest birds that are the priority conservation targets were included in this study as well as the non-listed native forest birds. The results of this study showed that the native avifauna on the Island of Hawaiʻi was most intact in four refugia: the Mauna Kea māmane/naio woodland, the windward rainforest, the Kaʻu

forest, and the mesic forest on the north slopes of Hualālai. They also noted that the main population of the ālāla (at the time) and very low populations of other endangered species inhabit the mesic to wet forest of central Kona. Among the top priorities identified for endangered forest bird conservation on the Island of Hawai‘i was a recommendation to secure ownership of, conservation easements to, or management agreement for these koa/‘ōhi‘a forest areas that were essential for the survival of the alāla, ʻakiapōlā‘au, Hawai‘i creeper, and Hawai‘i ‘ākepa (Scott and others 1986). It was on the basis of these studies and recommendations that the HFU and KFU, located within the windward rainforest and the mesic to wet forest of central Kona, were established (Service 1985, Service 1997).

Twenty-five years have now passed and much has changed. On the Island of Hawai‘i, endemic passerine populations and efforts to recover them are mostly restricted to montane and higher elevation forest because lowland areas have less remaining native habitat and more problems associated with alien species and disease (Scott and others 1986, van Riper III and others 1986). Therefore, opportunities for avian recovery have been limited to areas that for many species represent the upper range of their historical distribution. Some of these areas may be marginal due to cooler temperatures and lower richness of food resources. The limiting factors are well understood and include habitat changes, human predation, nonhuman predation, avian competition, avian parasites and diseases, and abiotic factors (van Riper III and Scott 2001).

Based on the Revised Recovery Plan for Hawaiian Forest Birds (Service 2006), the primary recovery objectives for each avian taxon are to:

1. Restore populations to levels that allow the taxon to persist despite demographic and environmental stochasticity and that are large enough to allow natural demographic and evolutionary processes to occur;
2. Protect enough habitat to support these population levels; and
3. Identify and remove the threats responsible for its decline.

The forest bird recovery plan includes goals and objectives for ‘ō‘ū, palila, ʻakiapōlā‘au, Hawai‘i creeper, and Hawai‘i ‘ākepa. Specific population objectives have not been identified for the forest birds (Service 2006). Recovery criteria for these birds focus on the interim objective of stabilization of current populations with a shift to recovery of viable, self-sustaining populations once stabilization has been achieved. Survey efforts for forest birds are constrained by their breeding season, which is limited to only a few months each year, and the limited number of personnel trained to survey them. For these reasons, forest bird surveys are conducted on only one of the five main Hawaiian Islands each year. The Island of Hawai‘i is divided in halves because of its larger size, so it takes two years to survey. It is anticipated that after 15 years, this survey schedule will produce four data points on each island which is the minimum required to conduct a meaningful population trend analysis.

The original range maps based on survey data and habitat response models for Hawaiian birds (Scott and others 1986) have been updated and incorporated as recovery areas into the revised forest bird recovery plan (Service 2006). Recovery areas in this plan are defined as those areas that will allow for the long-term survival and recovery of endangered Hawaiian forest birds. The identification of recovery areas is the result of an evaluation of habitat that is potentially important for the recovery of Hawaiian forest birds from a biological standpoint only. Recovery areas are intended to help guide recovery efforts to emphasize those areas with the greatest potential to achieve recovery.

The foremost consideration in identifying recovery areas for the majority of endangered Hawaiian forest birds is existing habitat and restorable habitat at higher elevations, because the cooler temperatures at these elevations are less suitable for the parasite that causes avian malaria and the introduced mosquito that is the primary vector of malaria and pox virus. Recovery areas in most cases encompass existing endangered forest bird populations, as well as habitat areas from which these species have disappeared in the recent past, but which still provide or could provide the conditions and resources necessary to support populations of endangered forest bird species. The elevation boundaries of recovery areas were based on the need to include areas that lie above the mosquito zone and within elevations that can be expected to support suitable forest habitat. Acquisition of the Kūkaʻiau Ranch property is most likely to directly benefit the priority avian species included in the revised forest bird recovery plan. The Kūkaʻiau Ranch property includes designated critical habitat for palila. This property is located at a higher elevation and, once restored, should also provide suitable habitat for ʻōʻū, ʻakiapōlāʻau, Hawaiʻi creeper, and Hawaiʻi ʻākepa.

Bird surveys at HFU from 1987 to 2007 have shown stable or increasing trends for ʻelepaio, ʻōmaʻo, Hawaiʻi ʻamakihi, ʻakiapōlāʻau, Hawaiʻi creeper, Hawaiʻi ākepa, ʻiʻiwi, and ʻapapane over that time span, although there were short-term trajectories in the densities of five native species in open forests and three native species in closed forests from 1999 to 2007 (Camp and others 2010). The cause of the recent decline and its significance for interpreting the long-term trend are disputed (Camp and others 2010, Freed and Cann 2010). More importantly from a land acquisition and forest restoration perspective is the finding that in areas that were pasture in 1987, but have been the focus of ongoing reforestation, the Hawaiʻi ʻamakihi, ʻapapane, and ʻiʻiwi show strong or very strong evidence of increasing densities (Camp and others 2010). Also of note is the finding that, in general, bird populations appear to be doing better at the HFU than elsewhere on Hawaiʻi Island (Camp and others 2010).

The Service has also produced a Revised Recovery Plan for the ʻAlalā (Service 2009c). Because much of the biological and demographic data necessary to determine the population size and parameters needed for recovery of the species do not exist, the recovery plan establishes only general recovery criteria. The ultimate recovery goal is to restore multiple self-sustaining populations within the historical range, and subsequently to delist the ʻalalā. Because recovery will be based on releases of captive-bred ʻalalā to the wild, quantitative determination of the population sizes and parameters necessary to consider downlisting and delisting cannot be accomplished until more complete data on the species' biology and threats are generated as part of a future release program. No ʻalalā remain in the wild, although captive propagation has been successful. However, to sufficiently increase the size of the captive population, restore habitat at repatriation sites, successfully repatriate birds to the wild, and manage and monitor the repatriated population so that recovery criteria are met will require at least several decades. So, although captive breeding has proven successful, repatriation protocols remain experimental. The recovery plan specifies that release sites must be at least 2,471 acres, making the current KFU nearly twice the minimum size required. The acquisition of the Honokua lots of the McCandless Ranch would add about 3,887 acres of montane forest to the Refuge, thereby potentially benefiting the ʻalalā as well as ʻōʻū, ʻakiapōlāʻau, Hawaiʻi creeper, and Hawaiʻi ʻākepa, all of which occurred there historically.

The direct value of the Koa Forest and Maulua Gulch properties to endangered forest birds is uncertain. Much of these properties lie at lower elevation, and therefore are more suitable for the parasite that causes avian malaria and the introduced mosquito that is the primary vector of malaria and pox virus. There is evidence, however, that some lower elevation populations of a more common

forest bird, the ʻamakihi, are tolerant to malaria, which suggests that the future of its populations lies in the resurgence of low-elevation populations (Foster and others 2007). Both properties, however, provide suitable habitat for endangered waterbirds, including the koloa maoli and ʻalae keʻokeʻo as well as habitat for the endangered ʻio and ʻōpeʻapeʻa. The addition of these lower elevation areas to the Refuge would also provide indirect benefits to forest birds on the current Refuge by allowing for management and control of invasive species in a contiguous source area for such species.

All of the properties under consideration also provide additional opportunity for the recovery of endangered plant species. Recovery goals and objectives for listed plant species on the Island of Hawaiʻi are identified in the Recovery Plan for the Big Island Plant Cluster (Service 1996) and the Addendum to the Recovery Plan for the Big Island Plant Cluster (Service 1998). The interim objective is to stabilize all existing plant populations. To be considered stable, the following conditions must be met:

- Each taxon must be managed to control threats (e.g., fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection.
- In addition, a minimum total of three populations of each taxon should be documented on the Island of Hawaiʻi, and, if possible, at least one other island where they now occur or where they occurred historically.
- Each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population (minimum of 75 mature plants) for long-lived perennials, and a minimum of 50 mature individuals per population (minimum of 150 mature plants) for short-lived perennials.

Hakalau Forest NWR has a highly successful propagation and outplanting program for endangered plant species; they have outplanted almost 4,000 endangered plants on the HFU since 1987. Nearly 25 percent of which were outplanted in 2007 alone (Service 2011). No outplantings have been conducted on the KFU due to the lack of ungulate control. The KFU is currently being fenced and once ungulates have been controlled, it is likely that similar recovery efforts for listed plants will be directed there. Over time, we anticipate that recovery efforts, including ungulate control and outplanting, will be extended to any lands acquired and added to the Refuge. The biological outcomes will depend on the extent to which the requisite habitat requirements for each species are present on a particular acquisition. This will require extensive survey to document the presence and abundance, or potentially suitable habitat for each target plant species.

In summary, spatially-explicit models for priority forest birds are available and were the basis for locating the existing HFU and KFU (Figure 4; Camp and others 2010, Scott and others 1986). The McCandless Ranch property is contiguous with the KFU and has long been known to have documented high biological values and was identified as a potential expansion area for the KFU. The Kukaʻiau Ranch property includes designated critical habitat for the palila, as well as high potential for forest restoration that would benefit endangered forest birds. The Koa Forest and Maulua Gulch properties, while mostly too low in elevation for endangered forest birds due to the presence of mosquitos, would benefit other endangered birds and plants. Insufficient biological data exists to extrapolate from the existing habitat models to specific population outcomes. The experience at the HFU over the past 25 years, however, has demonstrated that when native forest canopy is restored, along with management to control other limiting factors, forest bird populations can be stabilized and, in some cases, show a positive trend (Service 2008a). Similar success has been demonstrated by the HFU endangered plant restoration program (Service 2011).

1.7 Land Protection Alternatives

1.7.1 Willing Seller Policy. It is the policy of the Service to acquire land only from willing sellers under general authorities such as the Endangered Species Act, the Migratory Bird Conservation Act, the Fish and Wildlife Act of 1956, and the Emergency Wetland Resources Act. Landowners within the approved acquisition boundary who do not wish to sell their property or any other interest in their property are under no obligation to negotiate with or sell to the Service. In all acquisitions, the Service is required by law to offer 100 percent of fair market value, as determined by an approved appraisal that meets professional standards and Federal requirements.

The Service, like other Federal agencies, has the power of eminent domain. Eminent domain allows the use of condemnation to acquire land and other interest in land, such as easements, for the public good. The Service very rarely uses this power. The Service normally acquires land from willing participants and is seldom compelled to buy specific habitats within a rigid time frame.

Under the Uniform Relocation Assistance and Real Property Acquisition Policies Act, landowners who sell their property to the Service may be eligible for the following benefits and payments:

- Reimbursement of reasonable moving and related expenses.
- Replacement housing payment benefits under certain conditions.
- Relocation assistance services and counseling to help locate replacement housing, farmland, or businesses.
- Reimbursement of certain necessary and reasonable expenses incurred in selling real property to the Federal government, such as certain escrow and closing costs, proration of property taxes, and conveyance taxes.
- Relocation benefits to eligible tenants.

1.7.2 Habitat Protection Methods. A variety of habitat protection methods could be used to conserve fish and wildlife habitat. The actual method selected for any individual parcel will depend on what the landowner and the Service agree upon. If a mutual agreement cannot be reached, the landowner retains full use, control, and responsibility for the property.

Cooperative Agreements. The Service can enter into cooperative agreements with landowners to improve wildlife habitat management. Cooperative agreements may specify shared responsibilities, or a transfer of funds from the Service to another entity or vice-versa for management purposes. Cooperative agreements could be applied to land under any type of ownership in the study area.

Conservation Easements. Conservation easements are a type of acquisition where the landowner permanently transfers some, but not all, property rights to the Service as specified by mutual agreement. Under a conservation easement, a landowner would still hold title to the land with certain restrictions on his/her use of that land, spelled out in the easement language. The Service can acquire easements through purchase, donation, or exchange, depending on the terms of the easement. The property owner pays any applicable property taxes.

Fee Title Acquisition. A fee title interest is normally acquired when (1) the fish and wildlife resources on a piece of property require permanent protection that is not otherwise available; (2) the property is needed for development associated with public use; (3) a pending land use could

otherwise harm wildlife habitats; or (4) purchase is the most practical and economical way to assemble small tracts into a manageable unit. Fee title acquisition transfers any property rights owned by the landowner, including mineral and water rights, to the Federal government. A fee title interest may be acquired by purchase, donation, or exchange.

1.8 Land Protection Priorities. Our land protection priorities within the proposed expansion areas are provided in Table 3, which includes Service tract numbers, ownership information, acreage based on the Hawai‘i County Assessor records, Tax Map Key (TMK) numbers, and our preferred means of land protection. Landowners within the proposed boundary expansion may or may not wish to participate in the Service's habitat protection objectives. For this reason, the final configuration of the acquisition boundary may change. Because the parcels have been identified and the potential effects of bringing those lands into the Refuge System have been assessed in the accompanying EA (Appendix A), the proposed expansion boundary will provide the Service with future habitat protection options if willing sellers and available funds present themselves in the future. The properties proposed for acquisition are shown in Figure 3.

Table 3. Lands proposed for inclusion within the approved acquisition boundary of the Refuge arranged by their priority for acquisition.

Figure 3 ID Number	Priority	Tract Name	Owner	TMK No.	Acres	Preferred Protection Method
Proposed Additions to the Kona Forest Unit						
1	1	Honokua Lot 5	McCandless Land and Cattle Co.	386001001	641	Fee Title
2	1	Honokua Lot 7	McCandless Land and Cattle Co.		641	Fee Title
3	1	Honokua Lot 10	McCandless Land and Cattle Co.		1,344	Fee Title
4	1	Honokua Lot 11	McCandless Land and Cattle Co.		1,261	Fee Title
5	1	Kahuku Lot 2	McCandless Land and Cattle Co.	392001077	1,439	Fee Title
6	1	Kahuku Lot 3	McCandless Land and Cattle Co.	392001078	1,689	Fee Title
7	1	Kahuku Lot 1	McCandless Land and Cattle Co.	392001003	1,439	Fee Title
8	1	Kahuku Lot 4	McCandless Land and Cattle Co.	392001079	1,689	Fee Title
Proposed Additions to the Hakalau Forest Unit						
1	2	Kūkaʻiau Ranch	Kūkaʻiau Ranch LLC	342008008	2,524	Fee Title
2	2	Kūkaʻiau Ranch	Kūkaʻiau Ranch LLC	342008021	1,945	Fee Title
5	2	Koa Forest	Finance Factors Limited	328001002	1,735	Fee Title
6	2	Koa Forest	Finance Factors Limited	327001001	11,395	Fee Title
3	3	Maulua Gulch	Maulua Investments LLC	334002004	1,237	Fee Title
4	3	Maulua Gulch	Maulua Investments LLC	337001011	994	Fee Title

1.9 Coordination. This document was prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.). The Service worked closely with a number of government agencies, nongovernmental conservation organizations, affected landowners, Refuge neighbors, and other interested stakeholders and citizens to identify issues and develop this proposal.

In July 2011, a planning update was distributed to 292 interested parties. This mailing was accompanied by a press release. The planning update informed members of the public about the project and solicited their comments. The planning update also provided a map of the study areas and described potential management actions.

The Refuge Manager presented information on the Refuge proposal at an open house in Hilo held on August 17, 2011. Twenty-two community member attendees were presented with an overview of the proposed study, and their comments were recorded. In addition, comments from the public were submitted by e-mail during the scoping period, which ended September 16, 2011. The public identified a range of issues regarding the proposed land acquisitions and their management by the Hakalau Forest NWR if the lands were acquired. Specifically, public concerns were expressed regarding the effects of the acquisition on the following:

- Acquisition and management costs and funding;
- Access and public use;
- Invasive plant and species management;
- Removal of land from agricultural and livestock use;
- Water rights;
- Short-term versus long-term conservation benefits; and,
- Public education.

These issues and the effects of the land acquisition on other features of the affected environment, including endangered species and other native wildlife, the local economy, and conceptual management of any acquired lands are addressed in the draft EA and Conceptual Management Plan that accompanies this LPP.

Our EA considered the effects of a no action alternative under which the Refuge acquisition boundary would not be expanded, and a full protection alternative which would expand the acquisition boundary to include the Koa Forest, Maulua Gulch, Kūkaʻiau Ranch, and McCandless Ranch properties. We propose that with the acquisition of at least two key additional tracts at the KFU. a new Kona Forest National Wildlife Refuge would be established, thus providing a more significant management presence and capacity for addressing habitat and species management issues.

1.10 Socioeconomic Impacts. The analysis in our EA shows that property tax losses to the County of Hawaiʻi would largely be offset by payments to the County through the Refuge Revenue Sharing Act. The Environmental Impact Statement prepared for the proposed commercial timber operation on the Koa Forest property projected that it would produce $12.3 million per year in direct and indirect economic activity, about 49 direct and indirect jobs with a payroll of $1.6 million per year, and tax revenues to the State of Hawaiʻi of about $263,000 per year (Koa Timber, Inc. 2003). The value of koa and ʻōhiʻa timber on the 10,143 acres at the McCandless Ranch is estimated at $7,915,914 (McCandless Ranch 2010). We have no information on the value of the timber on the approximately 700 forested acres at Maulua Gulch. The Kūkaʻiau Ranch property has little, if any, commercial timber value. Acquisition of these lands would preclude their use for alternative purposes, including timber harvest and residential development. The additions to the Refuge would benefit wildlife and habitat protection efforts on the Island of Hawaiʻi and further recovery efforts for endangered species, thereby satisfying the purpose and need of our proposed action. Because of the intensive restoration and management needs and the ongoing challenges of endangered species recovery, invasive species control, and climate change, these benefits are likely to accrue slowly over the long-term. Other beneficial effects of the proposed Refuge expansion include enhanced water supply protection and replenishment and the preservation of cultural or historic resources that may occur on any acquired land. The benefits to water supply would further a new plan to replenish the State's sources of water through invasive species control and reforestation (DLNR 2011).

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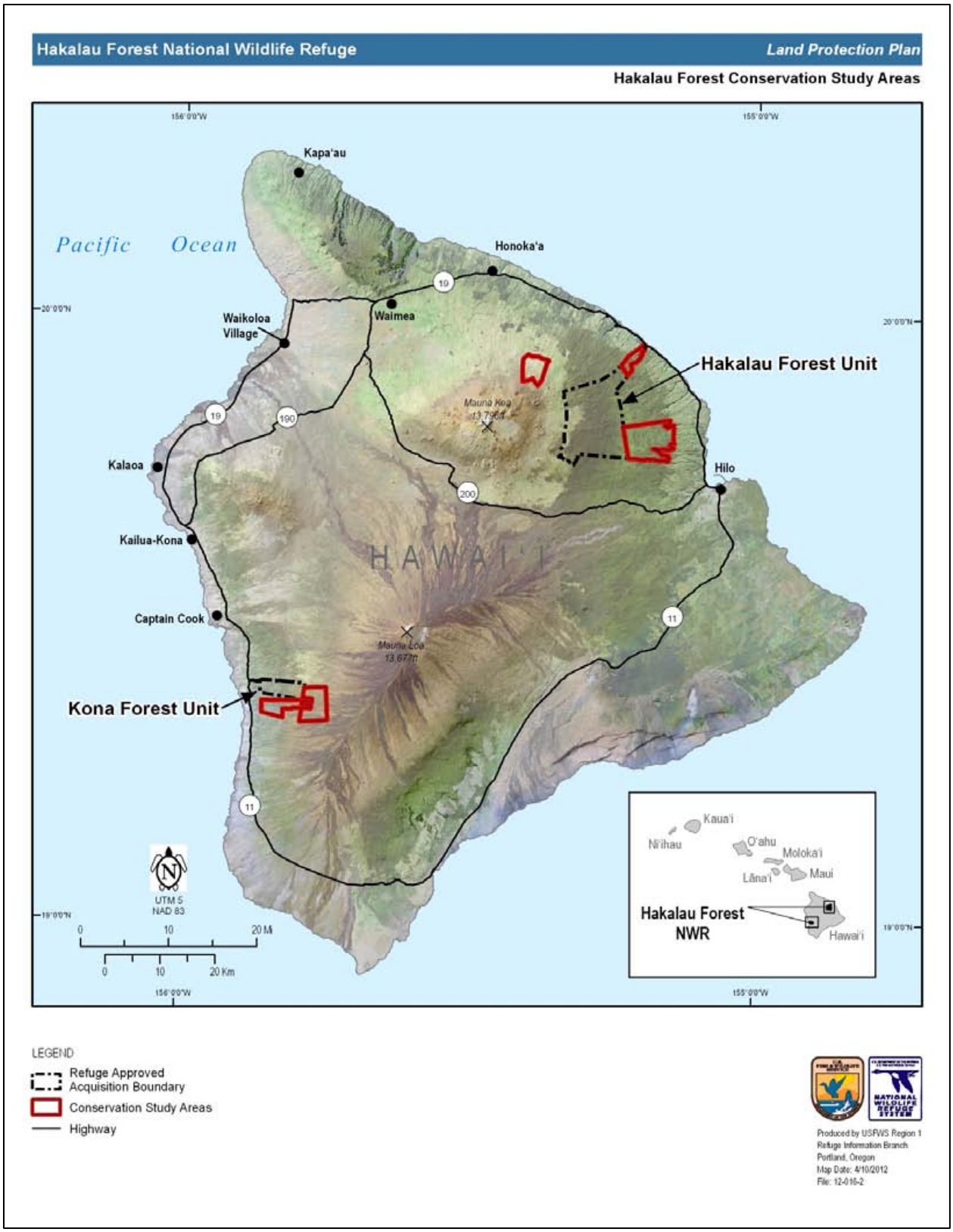

Figure 1. Location of areas proposed for addition to the Hakalau Forest and Kona Forest Units of Hakalau Forest National Wildlife Refuge.

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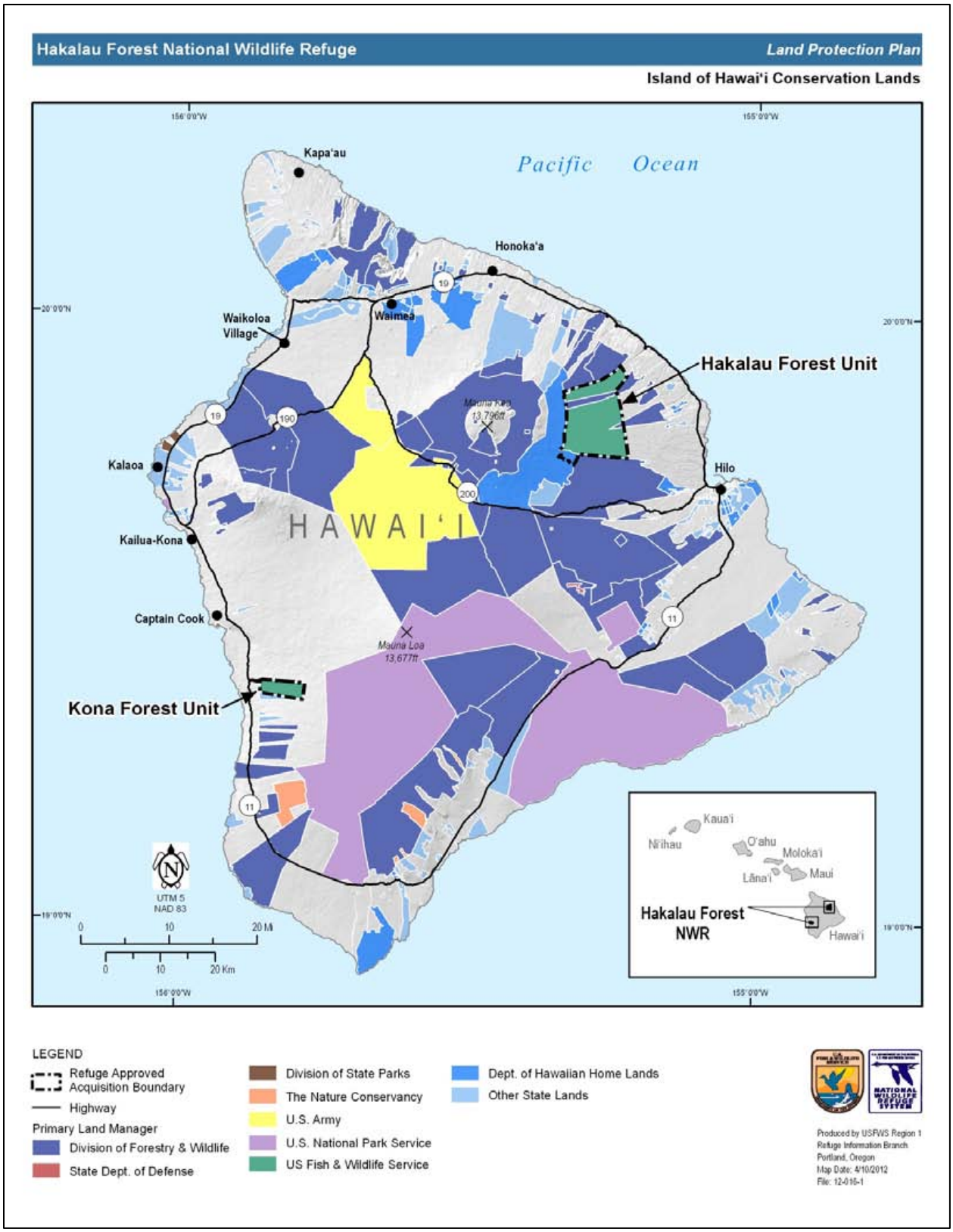

Figure 2. Lands managed, in part, for conservation on the Island of Hawai'i. Not all managed areas shown have fish, wildlife, and plant conservation as their highest priority.

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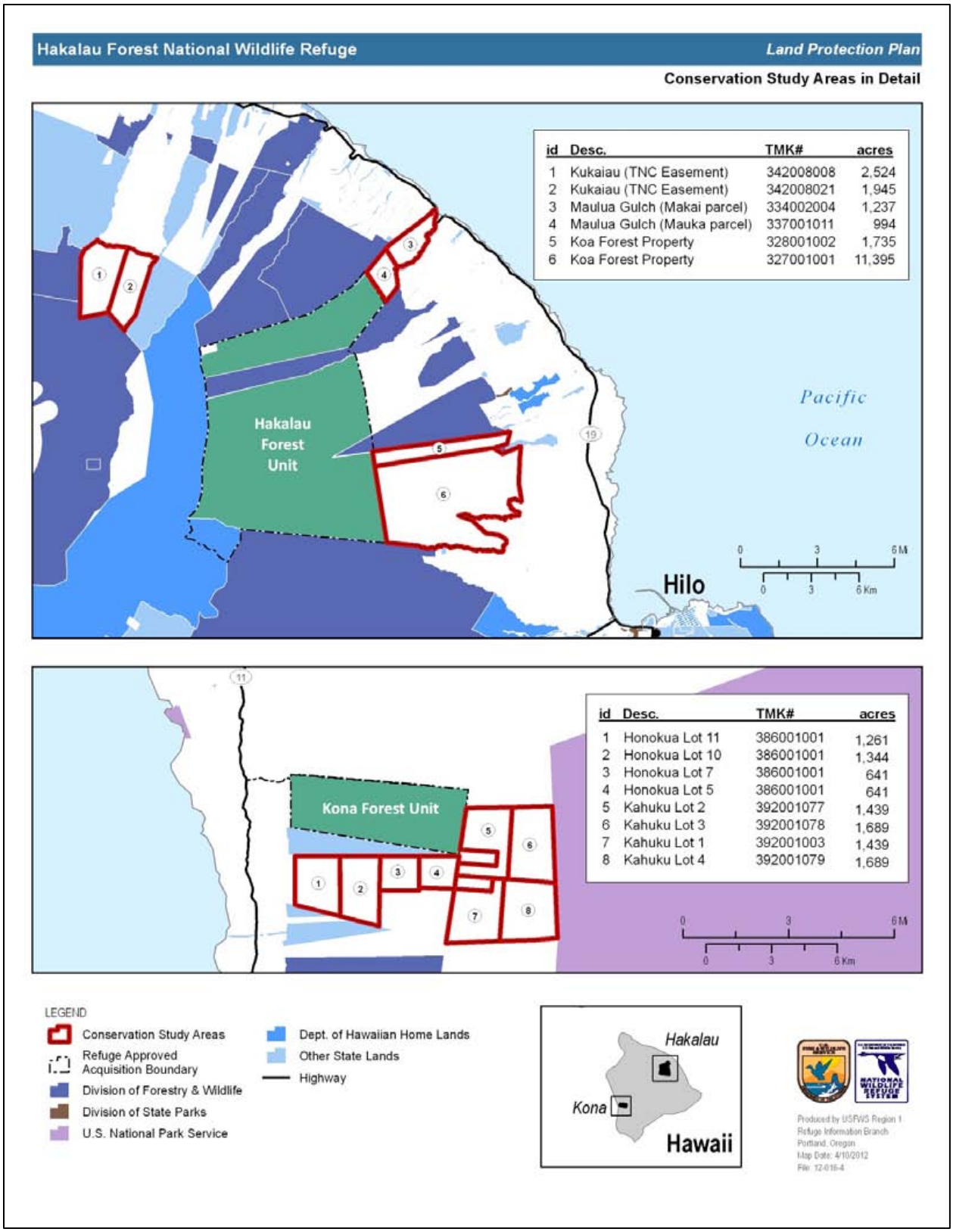

Figure 3. Lands proposed for acquisition in vicinity of the HFU (top) and at McCandless Ranch adjacent to the KFU (bottom) for addition to Hakalau Forest National Wildlife Refuge.

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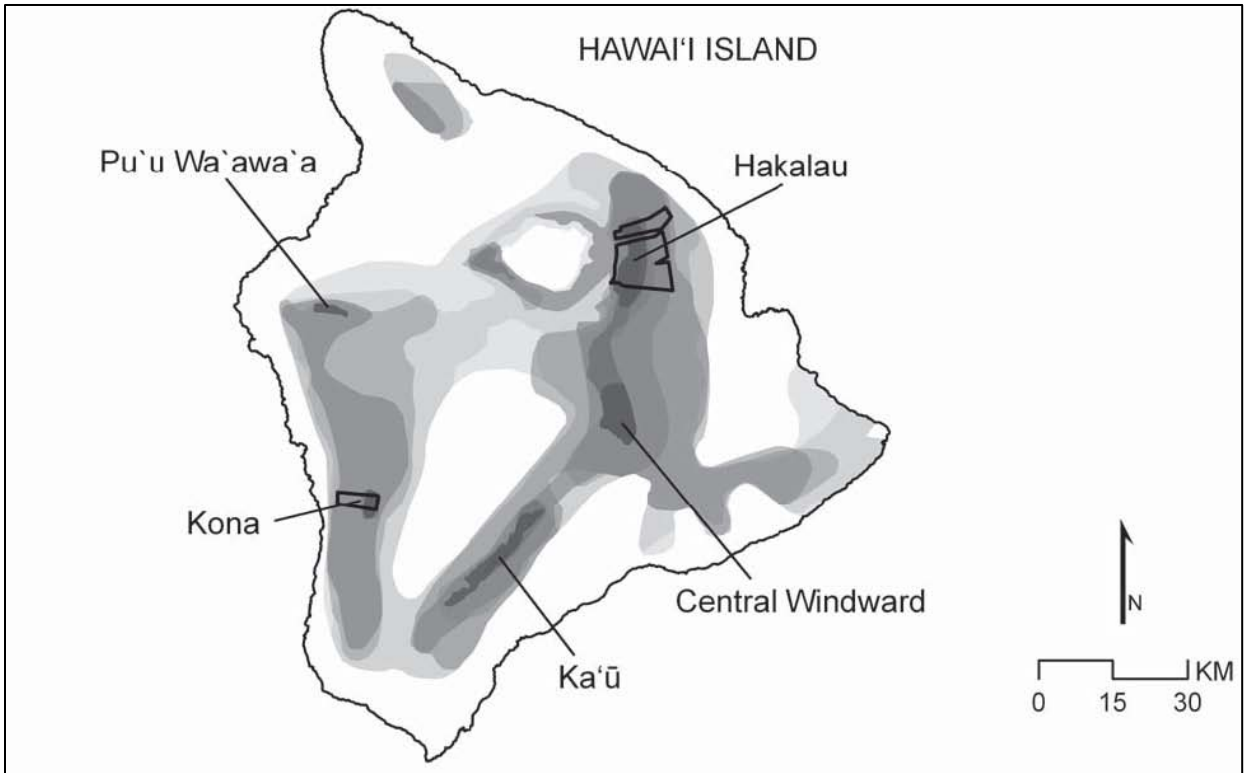

	Hakalau Forest NWR	Central Windward	Kaʻū	Kona Forest Unit HFNWR	Puʻu Waʻawaʻa Wildlife Sanctuary
ʻElepaio	▲	▼?	▼?	▼?	▼?
ʻŌmaʻo	S or ▲	▼?	S	X	X
Hawaiʻi ʻAmakihi	S	S	S	▲?	▲?
ʻAkiapōlāʻau	▲	▼?	▼?	X	X
Hawaiʻi Creeper	▲	?	▼	X	▼
Hawaiʻi ʻĀkepa	S or ▲	▼?	▼	▼	▼
ʻIʻiwi	S	S	▼?	▼?	▼?
ʻApapane	S	▲?	▲	▲	S?

Figure 4. Predicted native forest passerine richness on Hawaiʻi Island near the HFU and KFU.

Darker shading indicates higher richness; also shown are the long-term trends based on monitoring from 1987-2007 (from Camp and others 2010). Upward- and downward-pointing triangles indicate increasing or decreasing trends, respectively; d, S=stable, X=recent extirpation, and a ? indicates uncertainty due to high variability in density estimates.

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APPENDIX A

Conceptual Management Plan

Proposed Additions to Hakalau Forest National Wildlife Refuge

Hawai‘i County, Hawai‘i

April 2012

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Conceptual Management Plan

Proposed Additions to Hakalau Forest National Wildlife Refuge

Hawai‘i County, Hawai‘i

April 2012

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1.0 INTRODUCTION

This Conceptual Management Plan (CMP) provides a general description of the management approaches being considered for the 29,973-acre Hakalau Forest Conservation Study Area (HFCSA), a potential boundary expansion of Hakalau Forest National Wildlife Refuge (NWR or Refuge) (Figure 1). The U.S. Fish and Wildlife Service (Service) developed this CMP during the planning process to provide landowners, governmental agencies, and the interested public with a general understanding of anticipated management approaches for the proposed boundary expansion. The purpose of this CMP is to present a broad overview of the Service's proposed management of wildlife and habitats, public uses, law enforcement, facilities, interagency coordination, and public outreach.

The Service has prepared a Land Protection Plan (LPP) (Service 2012a) and an Environmental Assessment (EA) (Service 2012b) for the HFCSA. The LPP describes habitat protection methods and lists private lands to be considered for acquisition. The EA analyzes the environmental consequences of protecting fish and wildlife habitat by expanding the Refuge boundary.

The Service has completed a Comprehensive Conservation Plan (CCP) for (Service 2011). The CCP details Refuge operations, specifies the types and locations of public use activities, strategies for monitoring and recovery of endangered and rare species, and other operational needs. The proposed boundary expansion would further several Refuge goals identified in the CCP and follows the management direction in that document.

2.0 NATIONAL WILDLIFE REFUGE SYSTEM

The National Wildlife Refuge System (Refuge System) is the world's largest network of public lands and waters set aside specifically for conserving wildlife and protecting ecosystems. From its inception in 1903, the Refuge System has grown to encompass 556 national wildlife refuges in all 50 states, 4 U.S. territories, and a number of unincorporated U.S. possessions, and waterfowl production areas in 10 states, covering more than 154 million acres of public lands. It also manages four marine national monuments in the Pacific in coordination with the National Oceanic and Atmospheric Administration (NOAA) and affected state/territories. More than 40 million visitors annually fish, hunt, observe and photograph wildlife, or participate in environmental education and interpretive activities on these refuges.

Refuges are guided by various Federal laws and Executive orders, Service policies, and international treaties. Fundamental are the mission and goals of the Refuge System and the designated purposes of the refuge unit as described in establishing legislation, Executive orders, or other documents establishing, authorizing, or expanding a refuge.

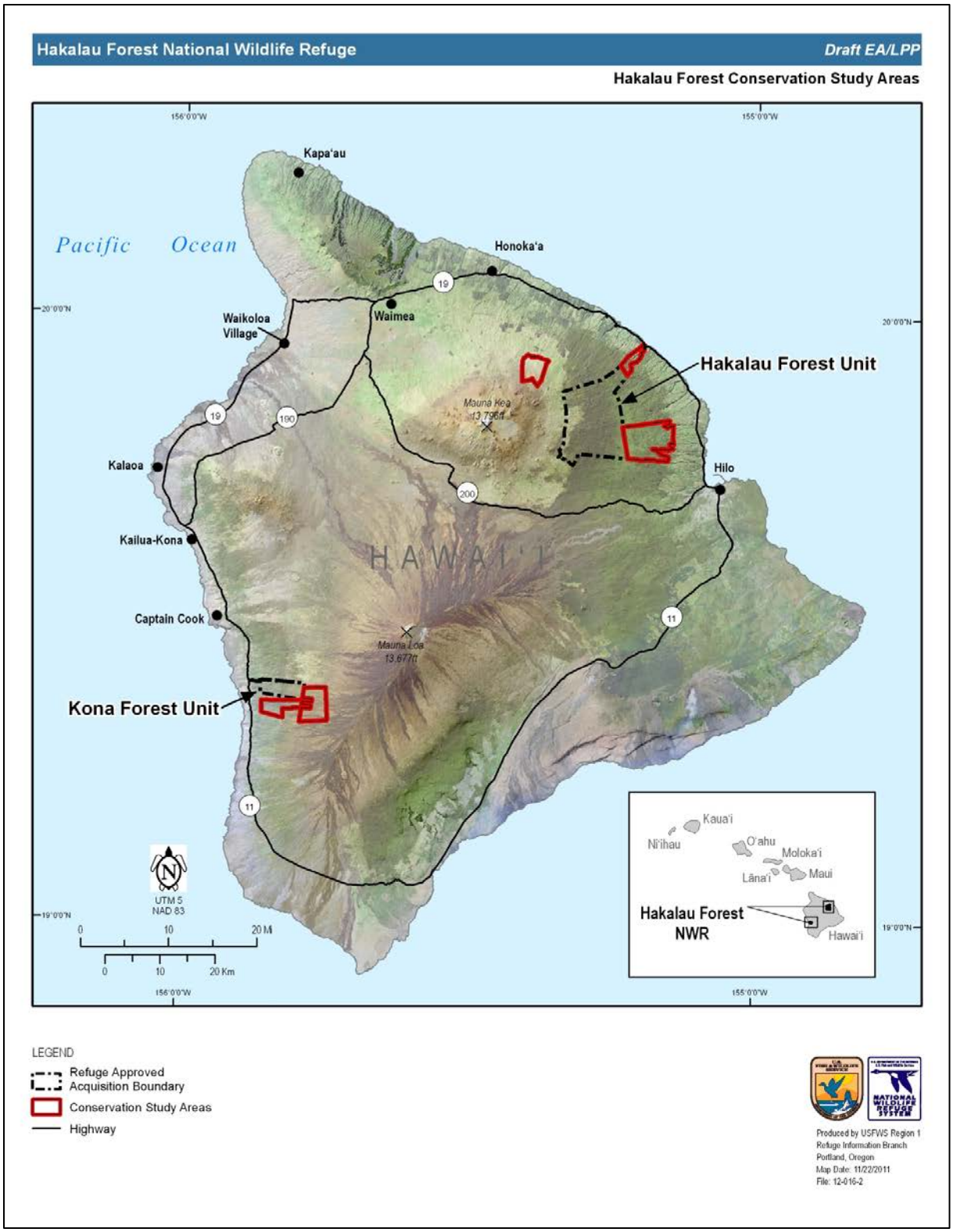

Figure 1. Location of areas proposed for addition to the Hakalau Forest and Kona Forest Units of the Hakalau Forest National Wildlife Refuge.

Key concepts and guidance for the Refuge System derive from the National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd)(Administration Act), the Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended, Title 50 of the Code of Federal Regulations (CFR), and the Fish and Wildlife Service Manual. The Administration Act is implemented through regulations covering the Refuge System, published in Title 50, subchapter C of the CFR. These regulations govern general administration of units of the Refuge System.

2.1 Mission of the National Wildlife Refuge System

The mission of the Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (Administration Act).

2.2 Guiding Principles of the National Wildlife Refuge System

- Fish and wildlife will not prosper without high-quality habitat, and without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.
- The Refuge System provides important opportunities for compatible wildlife-dependent public use activities, including wildlife observation and photography, environmental education and interpretation, fishing, and hunting.
- America's fishing and hunting enthusiasts were among the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other Federal, state, and local government agencies, tribes, non-profit organizations, private industries, businesses, and members of the general public can make significant contributions to the growth and management of the Refuge System.
- The public should be given a full and open opportunity to participate in decisions regarding acquisition and management of our national wildlife refuges.

2.3 Goals of the National Wildlife Refuge System

Wildlife conservation is the fundamental mission of the Refuge System. The goals of the Refuge System, as articulated in the Mission, Goals, and Refuge Purposes Policy (601 FW1) are:

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered;
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life-history needs of these species across their ranges;
- Conserve those ecosystems, plant communities, wetlands of national or international significance and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts;
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); and
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

2.4 Purpose and Goals of the Hakalau Forest National Wildlife Refuge

2.4.1 Hakalau Forest National Wildlife Refuge Purposes

Established on October 29, 1985, the purposes of Hakalau Forest National Wildlife Refuge are "… to conserve (A) fish or wildlife which are listed as endangered species or threatened species. . . or (B) plants . . ." (Endangered Species Act of 1973, as amended, 16 U.S.C. 1534).

2.4.2 Overall Refuge Goals

The following goals were developed during the planning process for Hakalau Forest NWR's recently completed CCP. These goals enable the Refuge to identify and focus management priorities, resolve issues, and tie into Refuge purposes, Service policy, and the Refuge System mission.

Pahuhopu 1: E hoʻopalekana, mālama, a hoʻōla hou i ka waonahele ma Mauna Loa ma ke ʻano he wahi noho no nā mea a pau i mea e kūʻonoʻono hou ai ka nohona o nā mea ʻane make loa ʻo ia nō ʻo ʻoe ʻo nā manu, nā ʻōpeʻapeʻa, nā mea kanu, a me nā mea kolokolo ʻāina.

Goal 1: Protect, maintain, and restore subtropical rainforest community on the leeward slope of Mauna Loa as habitat for all life-history needs to promote the recovery of endangered species (e.g., forest birds, ʻōpeʻapeʻa, plants, and invertebrates).

Pahuhopu 2: E hoʻopalekana a mālama i nā ana kahe pele a me ke ola i ka puka mālamalama o nā ana kahe pele ma ka waonahele o Kona, e kālele ana hoʻi i ke ola o nā lāʻau ʻōiwi.

Goal 2: Protect and maintain lava tube and lava tube skylight habitat throughout the Kona Forest Unit, with special emphasis on their unique and endemic flora and fauna.

Pahuhopu 3: E hoʻopalekana, mālama, a hōʻola hou i ka waonahele ma ka ʻaoʻao koʻolau o Mauna Kea ma ke ʻano he wahi noho no nā mea a pau a me ko lākou pono ʻoia nō ʻoe ʻo nā manu, nā ʻōpeʻapeʻa, nā mea kanu, a me nā mea kolokolo ʻāina.

Goal 3: Protect, maintain, and restore subtropical rainforest community on the windward slope of Mauna Kea as habitat for all life-history needs of endangered species (e.g., forest birds, ʻōpeʻapeʻa, plants, and invertebrates).

Pahuhopu 4: E hoʻopalekana a mālama i ka ʻāina nenelu ma Hakalau.

Goal 4: Protect and maintain wetland and aquatic habitats (e.g., streams and their associated riparian corridors, ponds, and bogs) on the Hakalau Forest Unit.

Pahuhopu 5: E hoʻopalekana a mālama i ka ʻāina mauʻu i mea e kākoʻo ai i ka hoʻōla hou ʻana i ka hui manu nēnē.

Goal 5: Protect and maintain grassland habitat to support nēnē population recovery.

Pahuhopu 6: E ʻohiʻohi i ka ʻikepili ʻepekema (waihona ʻike, nānā pono, ʻimi noiʻi, ana ʻike) e pono ai ka hoʻoholo ʻana i ke ʻano o ka hoʻokele ʻana iā Hakalau ma Mauna Kea a me Mauna Loa.

Goal 6: Collect scientific information (inventories, monitoring, research, assessments) necessary to support adaptive management decisions on both units of the Hakalau Forest NWR.

Pahuhopu 7: E kipa mai ka poʻe malihini a me ka poʻe makaʻāinana no ka hana manawaleʻa ʻana i mea e kamaʻāina ai lākou i ka nohona o ka waonahele a me ka ʻoihana mālama ma Hakalau.

Goal 7: Visitors, with a special emphasis on experience gained through volunteer work groups and local residents, understand and/or value the native forest environment and management practices at Hakalau Forest NWR.

Pahuhopu 8: E hoʻopalekana a mālama i nā kumu waiwai a me nā wahi pana Hawaiʻi no ka hoʻonaʻauao ʻana i nā hanauna o kēia wā a me ka wā e hiki mai ana.

Goal 8: Protect and manage cultural resources and historic sites for their educational and cultural values for the benefit of present and future generations of Refuge users and communities.

3.0 REFUGE ADMINISTRATION

As lands are acquired from willing sellers, funding for the operations and maintenance of these new lands would be needed. Management funds would be needed for new staff, administrative support, program and facilities development, and maintenance. The development of Refuge staff, programs, and facilities would be phased in over time as the land base and management responsibilities expand. Refuge program and staff development are expected to take several years and would reflect the availability of funds appropriated by Congress to support the Refuge. Because of the lag time between acquisition and funding for Refuge operations and maintenance, it may appear that the Service is more interested in acquiring land than implementing programs for wildlife stewardship and public use. However, the interim start-up period provides both the Service and the public with an opportunity to ensure that the Refuge is developed with sound planning to conserve wildlife and to meet community and national long-term expectations for quality programs.

The budget for the Hakalau Forest NWR, including the newly acquired lands, will include funds for salaries, facilities, capital improvements, equipment and infrastructure maintenance, biological surveys, habitat restoration, and supplies. The Refuge is part of the Big Island National Wildlife Refuge Complex, whose staff would be available to provide administrative, biological, law enforcement, public use, environmental education, and maintenance expertise. Whenever possible, the talents and skills of volunteers would be used for specific Refuge management projects.

A visitor contact station and educational facilities may be developed in one of the newly acquired parcels. The Service may seek to build a visitor kiosk, a loop trail, or other suitable structures to provide environmental education, interpretation, and wildlife viewing opportunities.

4.0 KEY AREAS OF MANAGEMENT FOCUS

The key management focus area for the lands within the boundary expansion would be habitat and wildlife management. The Service's primary goal for a majority of these lands would be to protect

wildlife and restore forest bird habitat through active restoration of native plant communities and controlling threats such as feral ungulates, invasive weed species, predator mammals, and other pests.

Other key areas of management focus could include monitoring wildlife and plant populations, wildlife-dependent recreational activities, interagency and public coordination, law enforcement, and facilities development and management.

4.1 Habitat Management

Active management of invasive species within all of the parcels in the study area would be needed to conserve and enhance native habitats. Plant surveys would be conducted to provide distribution and abundance patterns for rare, endangered, threatened, and/or common native plants. Wildlife management could include surveys to determine baseline distribution, abundance, and population trends of forest birds and invertebrates. Surveys would also need to be conducted to collect data on the occurrence of invasive plants and animals. Monitoring of populations of native and non-native species could be accomplished through additional systematically scheduled surveys. These data could then be used to develop strategies and set management priorities.

Two key components of habitat management for HFU and KFU are fencing and ungulate removal. Foraging activity by non-native ungulates (cattle, pigs, sheep, etc.) has contributed to significant degradation of native forest habitat quality and impacted populations of rare species. Presence of ungulates on the landscape is detrimental to the recovery of threatened and endangered species, for which the Refuge was established. Management units of $\leq$ 2,000 acres are typically established in forested habitat through construction of ungulate-proof fencing, and subsequent eradication of ungulates. Thereafter, regular fence checks and repairs are required as well as a vigilant, systematic ungulate control scheme due to eventual ingress from surrounding unmanaged or less intensively managed landscapes. Breaches in fences are common due to tree and limb falls in forested areas, constant pressure from remaining ungulates outside fencelines, as well as vandalism. In managed units, natural or assisted revegetation by native plant understory species quickly improves the habitat quality in the absence of grazing and foraging pressures.

Ungulate removal and fence maintenance also limit the establishment of larval mosquito microhabitats created by pig foraging behavior when native hāpuʻu ferns are toppled and eaten, leaving standing water in the remaining tree trunk. Avian malaria can quickly decimate native forest bird populations where it is present, so minimizing this threat by maintaining pig-free areas is a key recovery strategy.

Our expectation is to expand upon the Hakalau Forest NWR management model with regard to establishing ungulate management units through fencing and removal, as well as appropriate habitat restoration work in establishing native forest understory and canopy species on any new lands acquired or managed in cooperation with other land management partners within the HFCSA. Traditionally this has been accomplished through a mixture of staff, contractor, partner, and volunteer efforts.

Habitat types within the HFCSA.

Island of Hawai‘i habitats are determined primarily by elevation, temperature, and rainfall. As noted previously, all habitats have been affected to some degree by agriculture, logging, ungulates, and cattle ranching. Lower elevation habitats are highly degraded due to the presence of an array of nonnative species and coastal development, while the higher elevations have been used for ranching, logging, and agricultural experimentation, and subsequently these altered habitats have been degraded by ungulates. Despite this habitat degradation, numerous native species persist. Pockets of intact forest are interspersed within degraded habitat. Both the HFU and KFU lie between 2,000 and 6,500 feet (ft) and are predominantly forested. Habitats that occur above 9,500 ff are not addressed in the following discussion because they are outside of our study areas. Because the Koa Forest and Maulua Gulch study areas extend makai to 1,500 feet and sea level, respectively, lower elevation habitats are discussed.

Windward Slope of Mauna Kea Habitats. Five main habitats characteristic of the windward, wetter, eastern side of the island occur in this area, which includes the HFU and the Koa Forest, Maulua Gulch, and Kūka‘iau Ranch study areas. From lowest to highest elevation, they are:

Coastal Communities (Sea level–2,500 ft): Subject to marine influences, these communities can be dry, mesic, or wet and include stream outlets. The lower edge of the Koa Forest property lies at 1,500 ft. It has been cleared and was used as farmland (Koa Timber, Inc. 2003). Between 1,500 and 3,000 ft, the Koa Forest property is a sub-montane rain forest dominated by ‘ōhi‘a and koa, with koa occupying only the better drained positions, often heavily invaded by strawberry guava (Koa Timber, Inc. 2003). Maulua Gulch extends makai from the current Refuge boundary to sea level; the lower portion consists largely of agriculture lands with open pasture and lower-elevation forest that is largely comprised of invasive species. Native wildlife includes terrestrial invertebrates and waterbirds.

Montane wet ‘ōhi‘a/‘uluhe forest (2,500–4,000 ft): This area is characterized by gently sloping hills and steep streams. Poorly drained volcanic soils and bogs also occur here. This low-elevation area is the most comprised of nonnative plant and animal species, especially mosquitoes and pigs. Historically, this forest type supported native birds, many of which have been eliminated by avian malaria and pox. The koloa maoli still frequents the bogs. Other common groundcover plants include ferns, sedges, and sphagnum moss. Portions of the Koa Forest property extending upwards to its boundary with the Refuge at about 3,600 feet are described as dominated by ‘ōhi‘a trees and large patches of ‘uluhe fern (Koa Timber, Inc. 2003). Upper portions of the Maulua Gulch property and the lowest portions of the HFU are within this ecological zone.

Montane wet ‘ōhi‘a forest (4,000–5,000 ft): The ‘ōhi‘a forest occurs on more moderate slopes than the lower elevation forest and has intermittent streams. It has more native bird diversity because it is above the range of most mosquitoes. A mature closed canopy of ‘ōhi‘a reaches 60 to 90 feet above a middle canopy of trees and tree ferns. The understory is dominated by shrubs, mixed ferns, and sphagnum moss. This forest type predominates in lower portions of the HFU and remnants may exist in the upper portions of the Maulua Gulch and Koa Forest properties.

Montane wet koa/‘ōhi‘a forest (5,000–6,000 ft): The koa/‘ōhi‘a forest is characterized by moderate slopes, intermittent streams, and substantial native and endangered species populations. Much of this

habitat has been used for grazing. Trees, shrubs, and mixed ferns dominate below a mixed age-class forest canopy of koa and ʻōhiʻa. The wet koa/ʻōhiʻa forest is potential habitat for koloa maoli, ʻōpeʻapeʻa, and most species of native forest birds. This forest type generally occurs above the elevation of the Maulua Gulch and Koa Forest properties but it may occur in ravines and protected sites.

Montane mesic koa forest (6,000–6,600 ft): Much of this forest has been converted to nonnative grassland, where historically it was composed of koa, shrubs, ferns, epiphytes, and native grasses. This type dominated the upper portion of the HFU and has been the focus of forest restoration efforts. It provides potential habitat for nēnē (Hawaiian goose), ʻōpeʻapeʻa, and ʻio (Hawaiian hawk). Several species of native forest birds are found in the reforested areas. This forest type is above the elevation of the Maulua Gulch and Koa Forest properties, but was likely a dominant type on the lower portions of the Kūkaʻiau Ranch study area, an area that was cleared for rangeland and planted to non–native pasture grasses. However, at Kūkaʻiau Ranch, remnant koa trees occur in ravines and would provide a local seed source for forest restoration. Much of the lower elevation pasture is infested with Madagascar ragwort (*Senecio madagascariensis*); restoration efforts are likely to be complicated by this invasive weed that is poisonous to livestock (Motooka and others 2004).

Māmane forest (5,900–9,500 ft): The māmane forest, occurring on Mauna Kea, supports the palila, a federally endangered bird. This rare forest type is threatened by ungulates. Minor amounts of māmane forest occur on the HFU, and the palila is not currently known from the HFU. The upper part of the western parcel at Kūkaʻiau Ranch between 5,900 and 8,400 feet has māmane forest; upper areas of both parcels are currently dominated by Kikuyu grass (*Pennisetum clandestinum*) and are potentially restorable to māmane forest. Remnant māmane trees would provide a local seed source for restoration, and a viable seed bank likely remains in the soil (Pacific Forestry Consultants 2010).

Leeward Slope of Mauna Loa Habitats. Three main habitats characteristic of the leeward, drier, western side of the island occur in this area, which includes the KFU and the McCandless Ranch study area. From lowest to highest elevation, they are:

Montane wet ʻōhiʻa forest (2,000–3,000 ft and 3,500–4,500 ft): This forest type occurs in two elevation bands which differ in three main respects. The upper band receives less rainfall, has higher plant diversity in the mid–canopy, and the ground cover is dominated by grasses, compared to herbs in the lower band. Due to the lack of mosquitoes and increased plant diversity, the upper portion of this forest type supports a diverse native forest bird community. The ʻōpeʻapeʻa and several endangered plants occur in this forest habitat (Service 2011).

Montane mesic koa/ʻōhiʻa forest (4,500–5,800 ft): Forest habitat in this elevation range is dominated by mixed age trees of koa and ʻōhiʻa. The middle canopy is dominated by a mix of trees; ferns, tree ferns, and epiphytes also occur (Service 2011). The montane mesic forest provides potential habitat for several endangered species including ʻōpeʻapeʻa, the ʻalalā (Hawaiian crow), picture-wing flies, and various plants (Service 2011).

Native dry koa/ʻōhiʻa/māmane forest (5,800–6,100 ft): This dry forest occurs at the upper elevations of the KFU on Honokua lot 4 and on the Kahuku lots mauka of the unit. It is potential habitat for the ʻalalā, ʻōpeʻapeʻa, endangered plants, and endangered invertebrates. Native birds including the ʻakiapōlāʻau, Hawaiʻi ʻākepa, and Hawaiʻi creeper occur in this habitat (Service 2011).

Lava Tubes and Lava Tube Skylights (subterranean): While not known to have any endangered obligate species, lava tubes and skylights contain ferns, birds, mammals, and rare invertebrates. These habitats are less susceptible to non–native species because of the specialization required to exist in them, but the entrance and twilight zones are still affected by non–native species (Service 2011).

Conservation Study Area Habitat Types: Virtually all of the 13,130 acres of the Koa Forest property are forested with the lower portion being a mixed koa/ʻōhiʻa forest and the upper portion being predominantly ʻōhiʻa forest. About one-third, or about 700 acres, of the Maulua Gulch property is forested, with the remaining makai 1,400 acres having been cleared for agriculture (Figure 6). The Kūkaʻiau Ranch parcels were largely cleared of trees when it was converted to pasture, although about 250 acres of a lower-stature ʻōhiʻa forest with koa and māmane remains mauka, primarily in the uppermost paddock (Figure 6, Pacific Forestry Consultants 2010). In addition, patches of trees remain in gulches throughout both parcels. At McCandless Ranch, all of the Honokua lots, in total about 3,887 acres, are heavily forested with either ʻōhiʻa or a mixed koa/ʻōhiʻa forest. The mauka Kahuku lots, about 6,256 acres in total, at McCandless Ranch include dry subalpine koa/ʻōhiʻa/māmane forest mixed with a native shrubland with sparse ʻōhiʻa. At the highest elevations on the Kahuku lots, vegetation is very sparse to absent, especially on the lava flows.

4.2 Population Monitoring

The HFCSA encompasses a variety of habitats that support a number of endangered, threatened, or rare plant and animal species. One of the goals of the boundary expansion is to protect, restore, and enhance native habitats for the conservation and recovery of endangered, threatened, and rare species. To help achieve this goal, biological surveys will be conducted to:

- Determine the abundance and distribution of endangered, threatened, and rare plant and animal species;
- Establish baseline population information for forest birds, vegetation, and invertebrates; and,
- Monitor resource responses to restoration and management, both in the short- and long-term.

These surveys would create opportunities for partnership with other Federal and State agencies, non-profit groups such as The Nature Conservancy, Three Mountain Alliance, universities, local school groups, and volunteers.

4.3 Public Use and Wildlife-Dependent Recreational Activities

All public entry and use of refuge lands is at the discretion of the Refuge Manager. Wildlife-dependent public use is generally encouraged on national wildlife refuges, as long as those uses are compatible with the primary purposes of the refuge and those uses are consistent with other management programs and uses.

We expect to develop programs for public involvement on any new lands acquired or cooperatively managed through partnerships in a manner consistent with the established programs at Hakalau Forest NWR, which have relied heavily on volunteer support through work programs contributing to reforestation and greenhouse operations under the direction of Refuge staff. Other public involvement is offered through membership in the Friends of Hakalau Forest NWR, a non-profit

citizen support group, and through special use permitting for guided tours provided on a limited basis by commercial entities.

4.3.1 Refuges are Primary-Use Areas

Units of the Refuge System are managed as primary-use areas; that is, primarily for the benefit of fish, wildlife, and their habitats. In addition, refuges are closed to other uses unless specifically and formally opened. This contrasts with units of other Federal land management systems that are managed under a multiple-use mandate (e.g., national forests administered by the U.S. Forest Service and public lands administered by the U.S. Bureau of Land Management). Hunting, fishing, wildlife observation and photography, and environmental education and interpretation are priority public uses of the Refuge System. These uses must receive enhanced consideration over other uses in refuge planning and management when determined to be compatible with the purpose(s) for which a refuge was established.

4.3.2 The Compatibility Standard

Before any uses are allowed on a national wildlife refuge, Federal law requires a formal compatibility determination. A compatible use is defined as a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purpose(s) of the affected refuge. Sound professional judgment is defined as a decision that is consistent with the principles of fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), adherence to the requirements of the Administration Act, and other applicable laws. If resources are not available to design, operate, and maintain an activity, the refuge manager will take reasonable steps to obtain outside assistance from the state and other conservation interests. If adequate funding or staffing assistance cannot be identified, then the activity cannot be allowed.

4.3.3 Interim Compatibility Determination

The Service is required by the Administration Act to identify, prior to acquisition of new refuges or refuge additions, existing owner-authorized, wildlife-dependent recreational activities that would be allowed to continue on an interim or temporary basis following Service acquisition. The Service is not required to complete interim compatibility determinations for uses that did not previously exist and were not owner-authorized on the proposed refuge. We are not aware of any such uses.

4.4 Law Enforcement

Enforcement of Federal and State laws on the refuges is important to conserve and protect natural resources, safeguard visitors, staff, and protect public and private property. Refuge Law Enforcement works cooperatively with local law enforcement agencies to control trespass, violations of wildlife laws, and other violations of law on refuge lands.

4.5 Facilities Development and Management

Any land acquired within the boundary expansion would be administered as part of the Big Island National Wildlife Refuge Complex headquartered in Hilo, Hawai‘i. The development of the Refuge facilities, program, and staff would be phased in over time as the land base and management responsibilities expand. Refuge program and staff development are expected to take several years

and would reflect the availability of funds appropriated by Congress to support the Hakalau Forest NWR. Boundaries of any lands acquired by the Service will be posted with refuge signs at regular intervals to provide the public knowledge of specific boundary locations.

4.6 Interagency and Public Coordination

The lands within the potential boundary expansion area lie adjacent to private, State, and federally owned or managed lands, creating a unique opportunity to work closely with private landowners, various public groups, and other agencies to initiate a coordinated resource management approach. Opportunities include, but are not limited to, cooperative research activities, public education and interpretation programs, and other public use-oriented programs.

Established watershed-based partnerships on Hawai‘i Island, such as the Mauna Kea Watershed Alliance and Three Mountain Alliance, include many of the neighboring land management agencies and provide a forum for communication and awareness of needs across larger landscapes. Our participation in these groups helps to foster and coordinate joint conservation efforts across jurisdictional boundaries and helps to promote public and agency awareness.

The Service will pursue additional partnerships with local communities, other Federal, State, and local agencies, conservation and nonprofit groups, and private landowners to meet mutual goals and objectives whenever possible.

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U.S. Fish and Wildlife Service. 2012b. Environmental Assessment, Proposed Additions to Hakalau Forest National Wildlife Refuge. U.S. Department of the Interior, Fish and Wildlife Service, Pacific Region, Portland, Oregon. 77 pp.

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APPENDIX B

Environmental Assessment

Proposed Additions to Hakalau Forest National Wildlife Refuge

Hawai‘i County, Hawai‘i

February 2012

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CITATION. U.S. Fish and Wildlife Service. 2012. Environmental Assessment, Proposed Additions to Hakalau Forest National Wildlife Refuge. U.S. Department of the Interior, Fish and Wildlife Service, Pacific Region, Portland, Oregon. 77 pp.

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Errata Sheet
April 2012

Page 3, Figure 1. Lands managed, in part, for conservation on the Island of Hawaiʻi.
An area of 11,288 acres located roughly within a 2.5 mile radius of the summit of Mauna Kea is managed by the University of Hawaiʻi as the Mauna Kea Science Reserve. The Master Plan for this area includes a 10,760 acre Natural and Cultural Preservation Area with the remaining 525 acres designated as an Astronomy Project.

Page 19, Section 2.2 Alternatives Considered but Excluded from Detailed Study

Add:

Range of Action Alternatives

The Service considered including a range of intermediate action alternatives between the No Action and Full Protection (Preferred) Alternative. We rejected this approach because all of the properties had resource values of interest. Moreover, the Preferred Alternative can be modified in our final decision should we choose to exclude some properties from our proposed boundary.

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The following references, missing from the public draft, have been added.

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In addition, the References Cited section from the public release Environmental Assesement has been separated into specific references for the Final Land Protectino Plan, Final Conceptual Management Plan, and the Environmental Assessment.

Numerous other minor corrections have been made to the text of the Environmental Assessment.

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CHAPTER 1. PURPOSE AND NEED FOR ACTION

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) is the primary Federal agency responsible for conserving and enhancing the Nation's fish and wildlife populations and their habitats. Although the Service shares this responsibility with other Federal, state, tribal, territorial, local, and private entities, the Service has specific trust responsibilities for migratory birds, federally listed threatened and endangered species, and certain anadromous fish and marine mammals. Service efforts over the last 100 years to protect wildlife and their habitats have resulted in a network of protected areas that form the National Wildlife Refuge System (Refuge System). This network of protected areas is the largest and most diverse in the world. Refuge System lands provide essential habitat for numerous wildlife species, wildlife-dependent recreational opportunities for the public, and a variety of benefits to local communities.

1.2 Proposed Action

The Service proposes to expand the Hakalau Forest National Wildlife Refuge (NWR or Refuge), located on Hawai‘i Island, in Hawai‘i County, in the State of Hawai‘i. The Service is reviewing lands in the vicinity of the Refuge's two units with high wildlife conservation values and the potential for contributing to established Refuge management goals. The lands under consideration for acquisition or cooperative management will be limited to those described where participation is voluntary and willing sellers or partners are identified. The entire area described for the proposed boundary expansion is termed the Hakalau Forest Conservation Study Area (HFCSA). In this draft Land Protection Plan/Environmental Assessment (LPP/EA), the Service describes the purpose and need for protecting the wildlife and habitat associated with the proposed Hakalau Forest NWR expansion and analyzes the consequences of a range of alternatives for Refuge expansion. This document was prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.).

The proposed action to expand Hakalau Forest NWR would further several Refuge goals identified in the Comprehensive Conservation Plan (CCP) (Service 2011), including:

Pahuhopu 1: E ho‘opalekana, mālama, a ho‘ōla hou i ka waonahele ma Mauna Loa ma ke ‘ano he wahi noho no nā mea a pau i mea e kū‘ono‘ono hou ai ka nohona o nā mea ‘ane make loa ‘o ia nō ‘o ‘oe ‘o nā manu, nā ‘ōpe‘ape‘a, nā mea kanu, a me nā mea kolokolo ‘āina.

Goal 1: Protect, maintain, and restore subtropical rainforest community on the leeward slope of Mauna Loa as habitat for all life-history needs to promote the recovery of endangered species (e.g., forest birds, ‘ōpe‘ape‘a (*Lasiurus cinereus semotus)*, plants, and invertebrates).

Pahuhopu 2: E ho‘opalekana a mālama i nā ana kahe pele a me ke ola i ka puka mālamalama o nā ana kahe pele ma ka waonahele o Kona, e kālele ana ho‘i i ke ola o nā lā‘au ‘ōiwi.

Goal 2: Protect and maintain lava tube and lava tube skylight habitat throughout the Kona Forest Unit, with special emphasis on their unique and endemic flora and fauna.

Pahuhopu 3: E hoʻopalekana, mālama, a hōʻola hou i ka waonahele ma ka ʻaoʻao koʻolau o Mauna Kea ma ke ʻano he wahi noho no nā mea a pau a me ko lākou pono ʻoia nō ʻoe ʻo nā manu, nā ʻōpeʻapeʻa, nā mea kanu, a me nā mea kolokolo ʻāina.

Goal 3: Protect, maintain, and restore subtropical rainforest community on the windward slope of Mauna Kea as habitat for all life-history needs of endangered species (e.g., forest birds, ʻōpeʻapeʻa, plants, and invertebrates).

Pahuhopu 4: E hoʻopalekana a mālama i ka ʻāina nenelu ma Hakalau.

Goal 4: Protect and maintain wetland and aquatic habitats (e.g., streams and their associated riparian corridors, ponds, and bogs) on the Hakalau Forest Unit.

The proposed action would implement objectives 1.5 and 5.3 of the CCP to investigate and initiate landscape-level habitat conservation measures for the Kona Forest Unit (KFU) and Hakalau Forest Unit (HFU), respectively. The strategies to achieve these objectives include: identify habitat to support focal species; develop protection and management strategies; and work with partners, neighbors, and private landowners to meet conservation goals and develop specific proposals for land acquisition, cooperative agreements, and/or conservation easements (Service 2011).

1.3 Purpose of Proposed Action

The Service identifies the purpose(s) of a refuge when it is established or when new land is added to an existing refuge. The purposes of the proposed Hakalau Forest NWR additions reflect the core mission of the Service to protect wildlife resources of national importance and the purposes for which the units of the existing Refuge were established.

Under Refuge System policy, lands acquired for an existing refuge must incorporate the primary purposes for which the existing refuge was established. Thus, the primary purposes for the Hakalau Forest NWR would also apply to the proposed additions, if they are acquired by the Service. The purposes of Hakalau Forest NWR, established on October 29, 1985, are ". . . to conserve (A) fish or wildlife which are listed as endangered species or threatened species . . . or (B) plants . . ." (Endangered Species Act of 1973, as amended, 16 U.S.C. 1534).

The Refuge is comprised of two units, the HFU and the KFU (Figure 1). The acquisition boundary of the HFU was originally approved to include 33,446 acres (ac) (Service 1985) and it was subsequently expanded by 500 acres (Service 1995) for a total of 33,946 acres. The acquisition boundary of the KFU is 5,300 acres (Service 1997). The total area within the current approved acquisition boundary of the Refuge, therefore, is 39,246 acres.

In addition to implementing objectives from the CCP, acquisition of the currently proposed lands would have additional benefits, including:

- Conservation, enhancement, and restoration of aquatic resources, including streams and bogs;
- Protection, enhancement, and restoration of other native habitats, including lava tubes and lava tube skylights; and
- Potential enhancement of opportunities for compatible wildlife-dependent visitor uses.

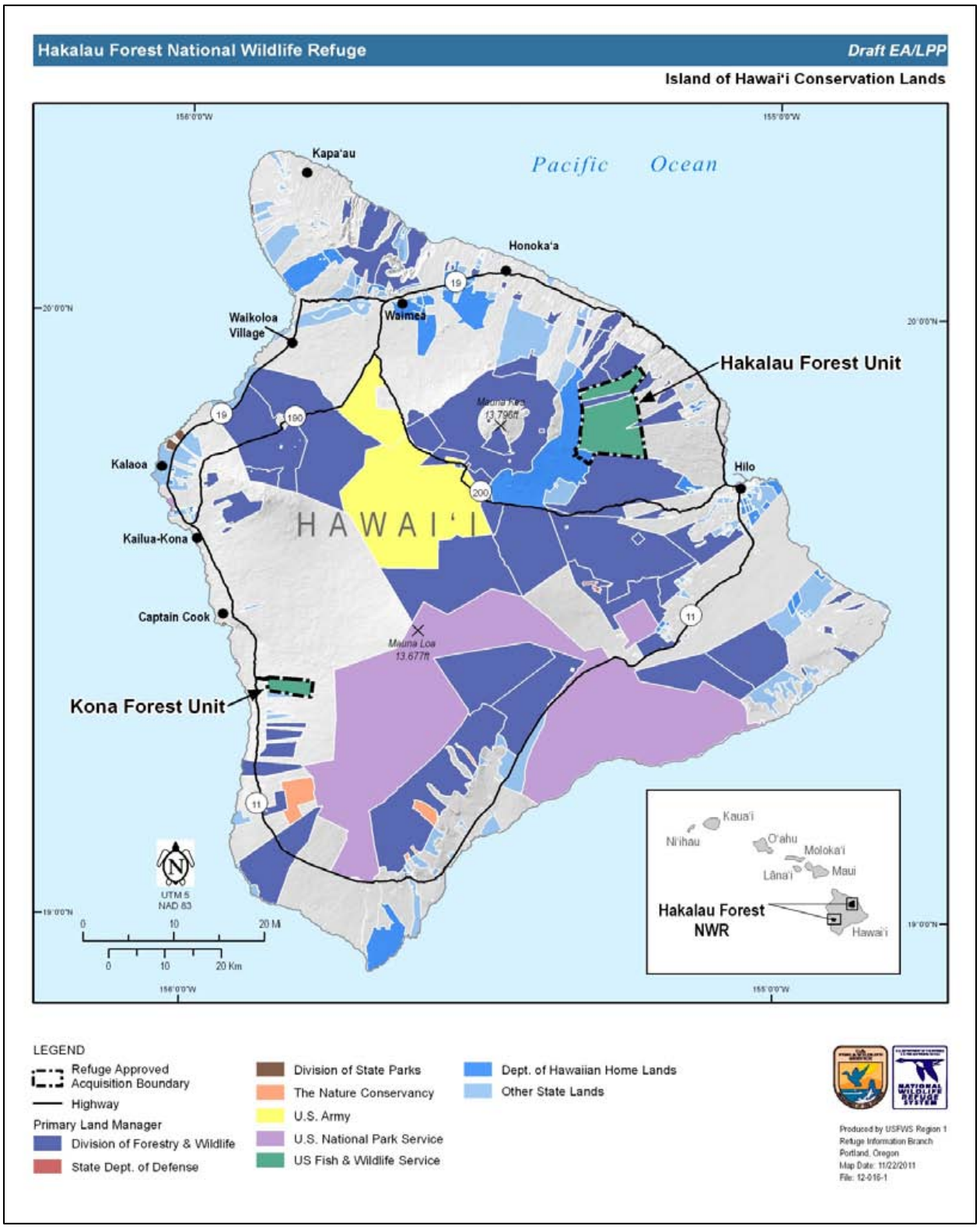

Figure 1. Lands managed, in part, for conservation on the Island of Hawai'i. Not all managed areas shown have fish, wildlife, and plant conservation as their highest priority.

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Protection and management of these areas would allow the Service to contribute to the recovery of endangered or threatened species and to support other native plants and animals. The lands identified for addition to the Refuge include mid- and low-elevation habitats on the windward slope of Mauna Kea, and mid-elevation slopes on the leeward slope of Mauna Loa (Figure 2).

1.4 Need for Proposed Action

The native flora and fauna of the State of Hawai‘i are largely endemic to the islands. One-third of all birds listed under the Endangered Species Act occur in Hawai`i, more than anywhere else in the United States. Populations of all native Hawaiian forest birds are declining, and 73 percent of their current range is on public lands. Eighty-five percent of State land in Hawai`i is open to uses incompatible with bird conservation, undermining efforts to manage, protect, and restore critically important habitat for endangered birds (North American Bird Conservation Initiative, U.S. Committee 2011).

Habitats on the Island of Hawai‘i range from coastal to alpine, and this study area encompasses montane mesic, montane wet, and montane dry forests. Human land use practices and introduced ungulates have drastically changed the native landscape, allowing invasive plants such as strawberry guava (*Psidium cattleianum*) and gorse (*Ulex europaeus*) to succeed in the disturbed areas. Much of the land on Hawai‘i Island has been converted for either agricultural uses or cattle ranching; 42 percent of the island has been converted for a variety of human uses. The proposed Refuge additions have the potential to serve as much-needed protected habitat that would benefit a number of endangered or threatened Hawaiian species and ecosystems, including:

- Habitat for threatened and endangered birds such as the ‘akiapōlā‘au (*Hemignathus munroi*), Hawai‘i ‘ākepa (*Loxops coccineus coccineus*), Hawai‘i creeper (*Oreomystis mana)*, ‘ō‘ū (*Psittirostra psittacea*–Hawaiian honeycreeper), nēnē (*Branta sandvicensis*–Hawaiian goose), koloa maoli (*Anas wyvilliana*–Hawaiian duck), ‘alalā (*Corvus hawaiiensis*–Hawaiian crow), and ‘io (*Buteo solitarius*–Hawaiian hawk); the State’s only native land mammal, ‘ōpe‘ape‘a (*Lasiurus cinereus semotus*–Hawaiian hoary bat); and several invertebrates;
- Habitat for threatened and endangered plants such as the ‘oha wai (*Clermontia* spp.), hāhā (*Cyanea shipmanii*), and ha‘iwale (*Cyrtandra tintinnabula*), among others;
- Two of the highest quality streams on the island, the Hanawī Stream and Honoli‘i Stream; and,
- Opportunities to create and enhance partnerships that will help connect and improve the mosaic of conservation lands across the island.

Our proposal stems from recognition that habitat connectivity and complete ecosystems are essential to the recovery of endangered species on the Island of Hawai‘i. While the current network of lands managed to various extents for conservation on Hawai‘i Island helps to protect these rare species and ecosystems (Figure 1), further land protection efforts are needed to help ensure and speed recovery, especially in light of the potential impacts of global climate change. By allowing us or our partners to secure and/or manage key habitats in the proposed HFCSA through cooperative arrangements, conservation easements, and/or fee title acquisition, we could strengthen the resiliency of existing lands in conservation and provide for wildlife movement and adaptation in the face of nonnative species invasion, global climate change, and other impacts to native ecosystems.

1.5 Study Areas

Our current study areas encompass 5 parcels of land totaling 29,973 acres (Figure 2; Table 1). About two-thirds of these lands are near or adjacent to the HFU, while the remaining lands are adjacent to the KFU.

Table 1. Land under consideration for addition to Hakalau Forest National Wildlife Refuge.

Hakalau Forest Unit Parcels	
Parcel Name	**Acres Based on County Assessor Records**
Koa Forest Property	13,130
Maulua Gulch	2,230
Kūkaʻiau Ranch	4,469
Hakalau Forest Unit Subtotal	**19,829**
Kona Forest Unit Parcels	
McCandless Ranch Honokua Lots	3,887
McCandless Ranch Kahuku Lots	6,256
Kona Forest Unit Subtotal	**10,143**
Proposed Expansion Total	**29,973**[1]

[1] Total differs from combined subtotals due to rounding.

1.6 Related Actions

The HFU and KFU are part of a much larger landscape that includes lands on the Island of Hawaiʻi that are managed to various degrees for conservation of native Hawaiian ecosystems and species. In addition to the Service, other major Federal land managers include the National Park Service and the Department of Defense; numerous State and private lands also contribute to the overall conservation landscape on the island (Figure 1).

The Department of Hawaiian Home Lands (DHHL) administers 56,200 acres of land contiguous with the HFU (Figure 3; DHHL 2011). These lands are the largest contiguous parcel of land under DHHL jurisdiction and comprise 28 percent of the 200,000 acres set aside by Congress in 1921 as a land trust for Native Hawaiians. About 10,000-13,000 acres in the vicinity of the Refuge are heavily infested with gorse. This invasive shrub forms impenetrable thickets that crowd out native vegetation and grow outward, creating a center of dead vegetation. The high oil content of the plants also creates a major fire hazard. DHHL and the Refuge have collaborated on mechanical removal of gorse and reforestation on buffer strips of DHHL land adjacent to the Refuge (K2 and K3 in Figure 3).

DHHL has developed a management plan for these lands known as the ʻĀina Mauna Legacy Program, which proposes actions to restore native forest, including seed collection, outplanting, site preparation, maintenance, and monitoring (Figure 3; DHHL 2011). The intent of the areas conserved as native koa (*Acacia koa*) or koa/ʻōhiʻa (*Meterosideros polyphylla*) forest (R3 and R4 in Figure 3) would not be commercially harvested on a large scale and are instead managed for their habitat and biodiversity values. Two additional corridors (R1 and R2 in Figure 3) would also be managed for these values and, when restored, would provide habitat connectivity to native mamane forest at higher elevations on Mauna Kea. Other areas are designated for sustainable koa forestry (K1-K5 in Figure 3). A portion of DHHL land lies within the southwest boundary of the Refuge.

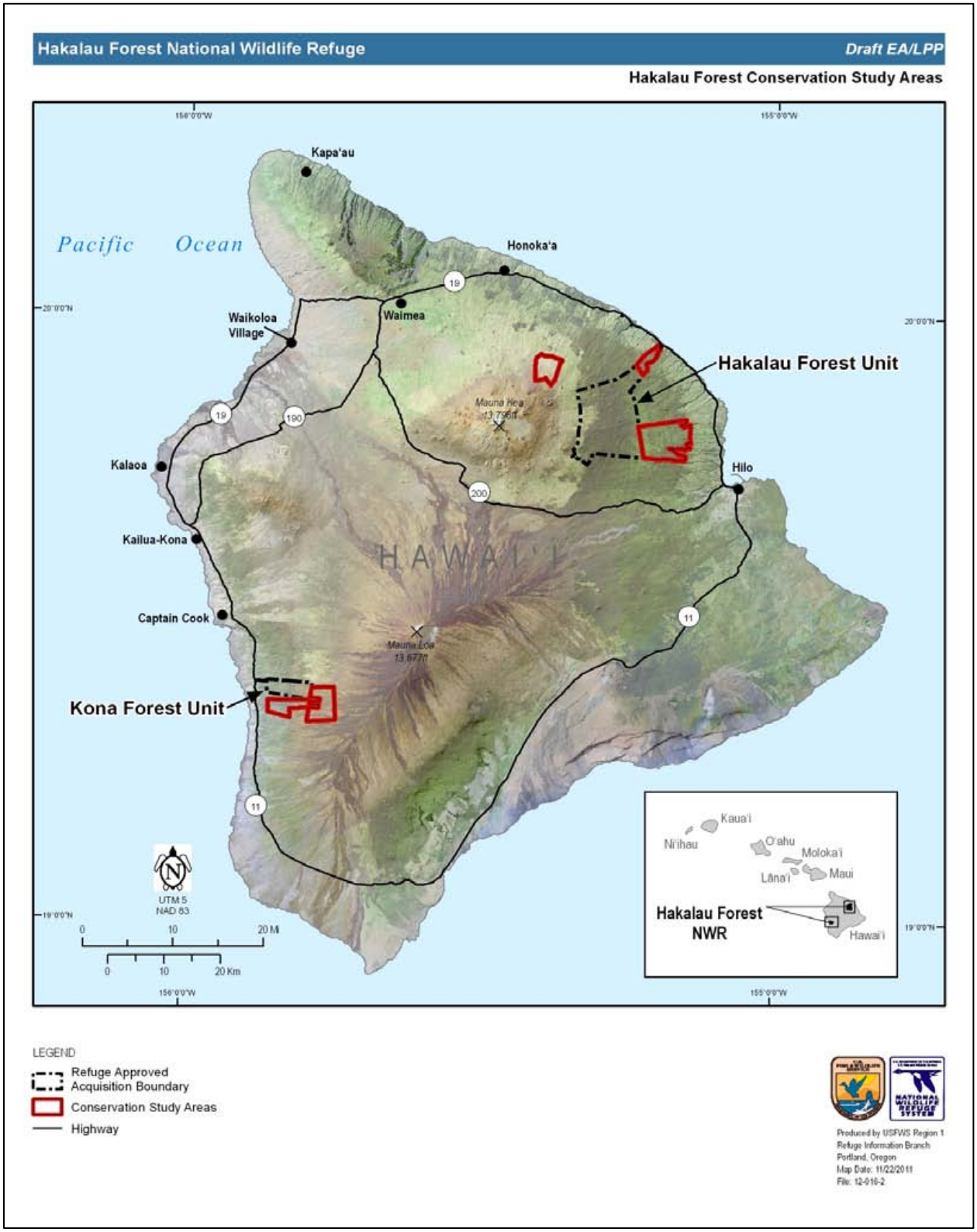

Figure 2. Areas under consideration for addition to the Hakalau Forest and Kona Forest Units of Hakalau Forest National Wildlife Refuge.

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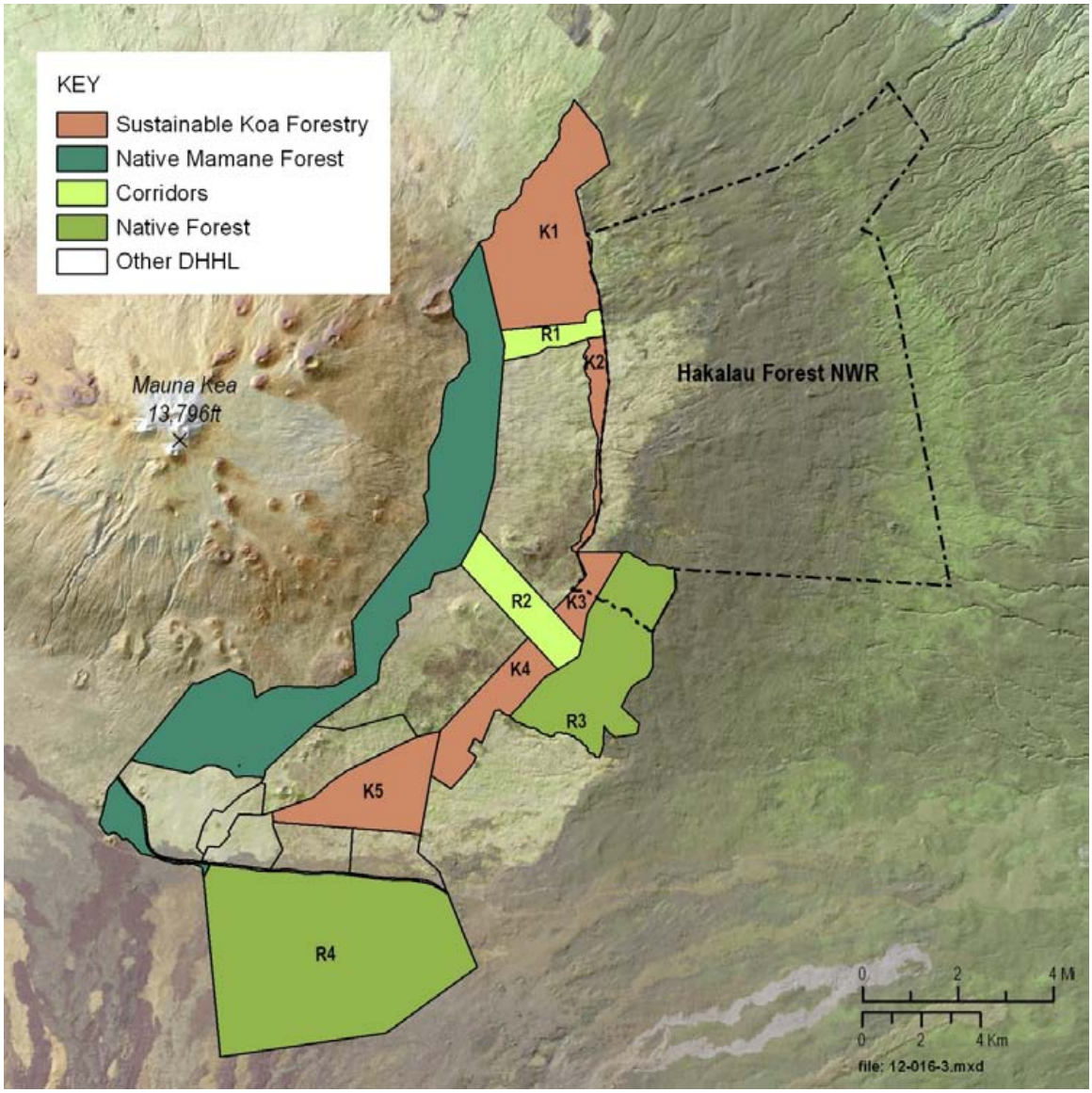

Figure 3. Department of Hawaiian Home Lands property adjacent to the HFU showing proposed management of key areas under the ʻĀina Mauna Legacy Program (DHHL 2011). See text for explanation of coded areas.

The Kūkaʻiau Ranch parcels have an existing conservation easement held by The Nature Conservancy of Hawaiʻi (TNC). Makai (toward the ocean) of the study parcels, Hawaiian Hardwoods Legacy is implementing a reforestation project on 2,672 acres of the ranch. These acres are contiguous with the parcels we are considering. The State Division of Forestry and Wildlife has also submitted a proposal to the Service for a Recovery Land Acquisition grant to acquire the two Kūkaʻiau Ranch parcels we are studying. However, the proposal was not funded in 2011.

The State of Hawaiʻi has recently released The Rain Follows the Forest, a plan to replenish their sources of water (Department of Land and Natural Resources (DLNR) 2011a). The priority actions

identified in the plan include managing invasive species, increasing the State's ability to withstand impacts from climate change, and seeking increased DLNR funding to restore their management capabilities. The plan identifies priority watersheds and outlines actions and projects to protect and sustain their critical water sources. It emphasizes that in order to be successful, the actions must occur on a large scale across ownership boundaries through agreements and leveraged funds provided by statewide watershed partnerships.

The Mauna Kea Watershed Alliance (MKWA) works in areas adjacent to the HFU. The goal of the MKWA is to improve water and environmental quality by enabling comprehensive and sustainable watershed management projects that address current threats, maintain the watershed's integrity, and protect its economic, socio-cultural, and ecological resources. Funding was secured for the development of the MKWA in 2006. A management plan will be drafted to describe the watershed resources and associated values, to identify threats to the resources, and direct the activities of the MKWA toward their protection. Once finalized, the land area of the MKWA will likely include over 50,000 acres of forest and grasslands that includes tracts of privately owned land, the HFU, three State Forest Reserves, two State Natural Area Reserves, the federally owned Pōhakuloa Training Area, and a proposed U.S. Forest Service Experimental Forest (Service 2010a).

Lands within and adjacent to the Kona Forest Unit are included within the largest watershed partnership in Hawai‘i, the Three Mountain Alliance (TMA). The overall goal of TMA is to sustain the multiple ecosystem benefits of the three mountains of Kīlauea, Mauna Loa, and Hualālai by responsibly managing the watershed areas, native habitats and species, and historical, cultural, and socio-economic resources for all who benefit from the continued health of the three mountains (TMA 2007). TMA partners include the Service, Hawai‘i Volcanoes National Park, U.S. Geological Survey Pacific Island Ecosystems Research Center, State of Hawai‘i Department of Land and Natural Resources and Department of Public Safety, U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), U.S. Forest Service (USFS), Kamehameha Schools, and TNC. Other contributors include the Hawaiian Silversword Foundation and the University of Hawai‘i Pacific Cooperative Studies Unit. In 2009, TMA was presented with the Partners in Conservation Award by the Secretary of the Interior for its achievements.

1.7 Decisions to be Made

Based on the analysis documented in this LPP/EA, the Director of the Service will determine whether or not to expand the boundaries of Hakalau Forest NWR. If the Director determines that expanding the Refuge is appropriate, a decision will also be made regarding the boundaries of the Refuge and whether the selected boundaries would have significant impacts on the quality of the human environment.

The authorities for this habitat protection effort are the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee) (Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997; Endangered Species Act of 1973 (16 U.S.C. § 1531-1544 as amended) (ESA); and the Fish and Wildlife Act of 1956 (16 U.S.C. § 742a-742j) as amended. The Administration Act authorizes the acquisition and management of land for the Refuge System. The ESA authorizes the acquisition of land for the conservation of listed species with Land and Water Conservation Fund (LWCF) monies. The Fish and Wildlife Act authorizes the acquisition of refuge lands for development, advancement, management, conservation, and protection of fish and wildlife resources with LWCF monies.

1.8 Public Involvement and Identification of Issues

The Service worked closely with a number of government agencies, nongovernmental conservation organizations, affected landowners, Refuge neighbors, and other interested stakeholders and citizens to identify issues and develop this proposal.

In July 2011, a planning update was distributed to 292 interested parties, accompanied by a press release. The planning update informed members of the public about the project and solicited their comments. The planning update also provided a map of the study areas and described potential management actions.

The Refuge Manager presented information on the Refuge proposal at an open house in Hilo on August 17, 2011. Attendees were presented with an overview of the proposed study areas, and their comments were recorded. In addition, public comments were submitted by e-mail during the scoping period, which ended September 16, 2011. The public identified a range of issues regarding the proposed land acquisitions and their management if they were acquired by the Refuge. Specifically, public concerns were expressed regarding the effects of the acquisition on the following:

- Acquisition and management costs and funding;
- Access and public use;
- Invasive species management;
- Removal of land from agricultural and livestock use;
- Water rights;
- Short-term versus long-term conservation benefits; and
- Public education.

These issues and the effects of the land acquisition on other features of the affected environment, including endangered species and other native wildlife, the local economy, and conceptual management of any acquired lands, are considered in this LPP/EA.

1.9 National Wildlife Refuge System and Authorities

The Hakalau Forest NWR is managed as part of the Refuge System within a legal and policy framework. The Refuge is guided by the mission and goals of the Refuge System and the purposes of the Refuge as described in its acquisition authorities. Management programs are developed and conducted in compliance with international treaties, applicable Federal laws and Executive orders, and Service policy.

The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

1.10 Acquisition Policies

The Service's land protection policy is to acquire land only when other protective means to achieve program goals (such as zoning or regulation) are not appropriate, available, or effective. When lands are to be acquired, the minimum interest necessary to reach management objectives is acquired or retained. The Service strives to reduce costs by acquiring land through donation, exchange, transfer, withdrawal, permit, and by cooperative agreements with landowners. When the Service determines it is necessary to acquire land, it acquires fee title (control of all property rights) only if acquisition of lesser property interest (such as easements or leases) is not available or would not achieve its conservation objectives.

It is Service policy to acquire lands from willing sellers and to offer fair market value for the land. Public Law 91-646, the Uniform Relocation Assistance and Real Property Acquisition Policies Act, as amended, requires that the Service offer a landowner 100 percent of fair market value of the property (as determined by an approved appraisal) and provide certain benefits and payments to persons displaced by the acquisition of land.

It is Service policy to acquire lands that are not contaminated. No Superfund sites are identified in the County of Hawai‘i based on a search of the Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System database (EPA 2011). Site specific Pre-Acquisition Level I Contaminant Surveys would be conducted for each parcel prior to completion of acquisition.

1.11 Land Acquisition Process

The Service acquires land for national wildlife refuges in a manner consistent with legislation or other congressional guidelines and Executive orders. The Service can protect habitat through various means, such as (1) the purchase of fee title or conservation easements, (2) transfers of other Federal lands, (3) donations, (4) exchanges, and (5) cooperative management agreements.

Acquisition funding may be made available through the LWCF or other sources to acquire lands, waters, or interest therein for fish and wildlife conservation purposes. The Federal monies used to acquire private lands through the LWCF are derived primarily from oil and gas leases on the outer continental shelf, and motorboat fuel tax revenues.

The basic considerations in acquiring land are (1) biological significance of the land, (2) existing and anticipated threats to wildlife resources, and (3) landowners' willingness to sell or otherwise make property available to the project. The purchase of lands proceeds according to the willingness of sellers and availability of funds.

The Service has no authority to acquire land except within an approved refuge acquisition boundary. An approved refuge boundary authorizes the Service to acquire an interest in real property, such as fee title or a conservation easement, from landowners who are willing sellers.

1.12 Refuge Revenue Sharing Act of 1935, as Amended

Under provisions of the Refuge Revenue Sharing Act (16 U.S.C. 715s) (RRSA), the Service would make an annual payment to Hawai‘i County to help offset property tax revenue lost as a result of acquisition of private property. This law states that the Secretary of the Interior (Secretary) will pay to each county in which an area acquired in fee title is situated the greater of the following amounts:

- An amount equal to 75 cents per acre for that portion of the fee area which is located within such county;
- An amount equal to 3/4 of 1 percent of the fair market value, as determined by the Secretary, for that portion of the fee area that is located within such county; or
- An amount equal to 25 percent of the net receipts generated and collected on the Refuge.

If these funds are insufficient to make full payments to the counties, Congress is authorized to appropriate funds to make up any shortfall. When Congress does not appropriate sufficient funds, counties receive a pro-rata reduction in their RRSA disbursement.

RRSA also requires that Service lands be reappraised every five years to ensure that payments to local governments remain equitable. Payments would be made only on lands that the Service acquires in fee title. On lands where the Service acquires only partial interest through easement, all taxes would remain the responsibility of the individual landowner.

1.13 Compliance

The proposed acquisition will be in compliance with Service policies and the following laws and regulations: National Environmental Policy Act of 1969, as amended; Executive Order 12372 (Intergovernmental Review of Federal Programs); Executive Order 11988 (Floodplain Management) and 11990 (Protection of Wetlands); ESA; Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally Assisted Programs (Uniform Act of 1970), as amended; Executive Order 11593 (Protection of Historical, Archaeological, and Scientific Properties) including the National Historic Preservation Act of 1966 (NHPA), as amended; the Archaeological Resources Protection Act; the Native American Graves Protection and Repatriation Act of 1990; Coastal Zone Management Act of 1972, as amended; Executive Order 12996 (Management and General Public Use of the National Wildlife Refuge System); Secretary’s Order 3127 (Contaminants and Hazardous Waste); the Administration; and other applicable laws.

1.14 Scope of the Environmental Assessment

This LPP/EA evaluates the environmental effects of adding and managing new Refuge lands. The LPP is included as Appendix A. While this LPP/EA does not cover the details of future Refuge management for the proposed expanded Refuge, conceptual management actions are described to indicate potential management direction until such time as the CCP (Service 2011) for Hakalau Forest NWR is amended. A draft Conceptual Management Plan is included as Appendix B.

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CHAPTER 2. ALTERNATIVES

2.1 Land Selection

Although several alternatives for land protection were considered, only two alternatives, including no action, have been carried forward for detailed study. The action alternative includes four properties for potential addition to the Refuge. These properties are described in more detail below. Key biological features of each property are discussed in Chapter 3, Affected Environment. These properties are included because they have value as wildlife habitat, and therefore complement the Service's mission and Hakalau Forest NWR purposes; the lands are in close proximity or contiguous with the existing Refuge and other areas managed for conservation; the landowners have expressed an interest in selling the lands; and some of the parcels contain habitat not well represented within the Refuge System. The expansion would enhance the recovery of up to eight federally listed endangered or threatened species, reduce habitat fragmentation, and increase connectivity among existing conservation areas on the Island of Hawai‘i. Expansion, enhancement, and restoration of areas managed for Hawai‘i's endangered and native wildlife and for the enjoyment of the American people will increase the resiliency of island ecosystems, which are highly vulnerable to climate change (Intergovernmental Panel on Climate Change (IPCC) 2001).

Koa Forest. The Koa Forest property is comprised of two tax lots contiguous with the southern portion of the makai boundary of the HFU (Figure 4). The larger of the two lots (Tax Map Key (TMK) No. (3) 2–7–001–001) is 11,395 acres and is zoned conservation (10,115 acres) and agricultural (1,280 acres) (County of Hawai‘i 2011a). The second lot (TMK No. (3) 2–8–001–002) is 1,735 acres and lies adjacent to the northern boundary of the larger lot and is zoned conservation (County of Hawai‘i 2011). Most of the property retains a native forest tree canopy although invasive plants dominate the understory at lower elevations (Terry 2002). The two lots were proposed for commercial koa harvest in the past decade (Koa Timber Inc. 2003) but were sold at auction in 2010. The Koa Forest property is currently for sale.

Maulua Gulch. The Maulua property is also comprised of two tax lots, one of which is contiguous with the northern portion of the lower boundary of the HFU (Figure 4). The makai lot (TMK No. (3) 3–4–002–004), at 1,237 acres, is the larger of the two lots and is zoned agricultural. The mauka (toward the mountain) lot (TMK No. (3) 3–7–001–011) is 994 acres and is zoned conservation (County of Hawai‘i 2011a). Both lots are currently for sale.

Kūka‘iau Ranch. The Kūka‘iau Ranch property includes two tax lots roughly bordered on the northern edge by Mana (Keanakolu) Road and on the southern edge by Mauna Kea Forest Reserve (Figure 4). To the east and west of the lots are conservation lands leased by the State of Hawai‘i to provide habitat for the endangered palila (*Laxoides bailleui*) and other species (State of Hawai‘i 2009). The larger lot (TMK No. (3) 4–2–008–008) is 2,524 acres and zoned as agricultural. The second lot (TMK No. (3) 4–2–008–021) is contiguous with the east side of the larger parcel and is 1,945 acres; it is also zoned agricultural, with the exception of the uppermost paddock which is zoned conservation (County of Hawai‘i 2011a, State of Hawai‘i 2009). The lower elevation portions of the two lots have been cleared and the current vegetation is predominantly pasture grasses, although some koa trees remain in the ravines. An estimated 250 acres of subalpine forest of ‘ōhi‘a, koa, and māmane (*Sophora chrysophylla*) occurs at higher elevations on the western parcel primarily within the paddock zoned for conservation (Pacific Forestry Consultants 2010).

These two lots, comprising 4,469 acres, are included within a perpetual and transferable conservation easement that is held by TNC. The property-wide purpose of the easement is to conserve its productive capacity for sustainable human use and ecological and watershed function, and to maintain natural values associated with its open-space condition (State of Hawai‘i 2009). Specific purposes vary among four zones identified in the easement. In Zone 1 (1,050 acres), protection of natural habitat and cultural resources is the priority purpose and no use or activity is permitted that would impair these resources. In Zone 2 (845 acres), preservation and protection of natural habitat and agricultural values are co-equal purposes but, if a significant conflict between these purposes arises, protection of natural habitat values will take priority. In Zone 3 (1,343 acres), protection of natural habitat and agricultural values are co-equal purposes but, if a significant conflict between these purposes arises, agricultural use for production of food and fiber will take priority. In Zone 4 (1,231 acres), the primary purpose is agricultural use for production of food and fiber and no use or activity that would impair this purpose is permitted. The grantee, TNC, has rights of preservation and protection of conservation values, reasonable access, and enforcement of terms of the easement. Specific uses and activities inconsistent with the purposes of the agreement and the grantor's reserved uses and activities consistent with the purpose are also identified (State of Hawai‘i 2009).

The State of Hawai‘i recently submitted a proposal to the Service for a Recovery Land Acquisition Grant for the two Kūka‘iau Ranch lots (DLNR 2011b). The upper portion of the two parcels is within designated critical habitat for the endangered palila (42 Federal Register (FR) 40685). The objective of the proposal was to acquire the 4,469-acre property with the Hawaiian Islands Land Trust as fee title owner. Management of the land would be conducted in partnership with the State of Hawai‘i, the Service, other non-profit organizations, and community groups for the purposes of endangered species recovery and native species habitat restoration. However, the proposal was not funded in fiscal year 2011.

Another interesting aspect of the Kūka‘iau Ranch lots is that 2,700 acres of the Kūka‘iau Ranch makai of these lots are planned for reforestation by Hawaiian Legacy Hardwoods (HLH), LLC, a sustainable koa forestry business. Although most of the reforested areas will be harvested, HLH has donated 1,000 acres to their Hawaiian Legacy Reforestation Initiative (HLH 2011a). Their hope, inspired by the reforestation project at the Refuge, is to plant 1.3 million koa trees through the sale of legacy, fundraiser, and endowment trees. These legacy trees will not be harvested. The trees for outplanting are grown in a nursery on the Kūka‘iau Ranch. Each tree has a radio frequency identification tag with GPS tracking that provides a unique signature and includes the sponsor's name, honoree, date planted, and the location of the tree (HLH 2011a). This effort has recently been furthered by a partnership with the Four Seasons Resort, Hualālai, which has joined with HLH, TNC, the Boy Scouts of America, and government agencies to plant 200,000 legacy trees (HLH 2011b; TNC 2011).

McCandless Ranch. The McCandless Ranch property includes four lots in the Ahupua‘a (a traditional Hawaiian subdivision of land) of Honokua south of the KFU and four lots in the Ahupua‘a of Kahuku mauka of the KFU and the Honokua lots. The KFU and the two ahupua‘a share a common boundary point that is also the mauka endpoint of the Waimea Tract, a 1,258-acre parcel of land owned by the State of Hawai‘i and leased to the McCandless Ranch on a month-to-month basis (Figure 4). The State has had access difficulties to the Waimea Tract which is landlocked by the McCandless Ranch. An access road to mauka lots on the McCandless Ranch weaves in and out of the Waimea Tract. The McCandless Ranch recently constructed a road entirely on their property to ensure permanent access to two 250-acre Kahuku lots to remain in their ownership.

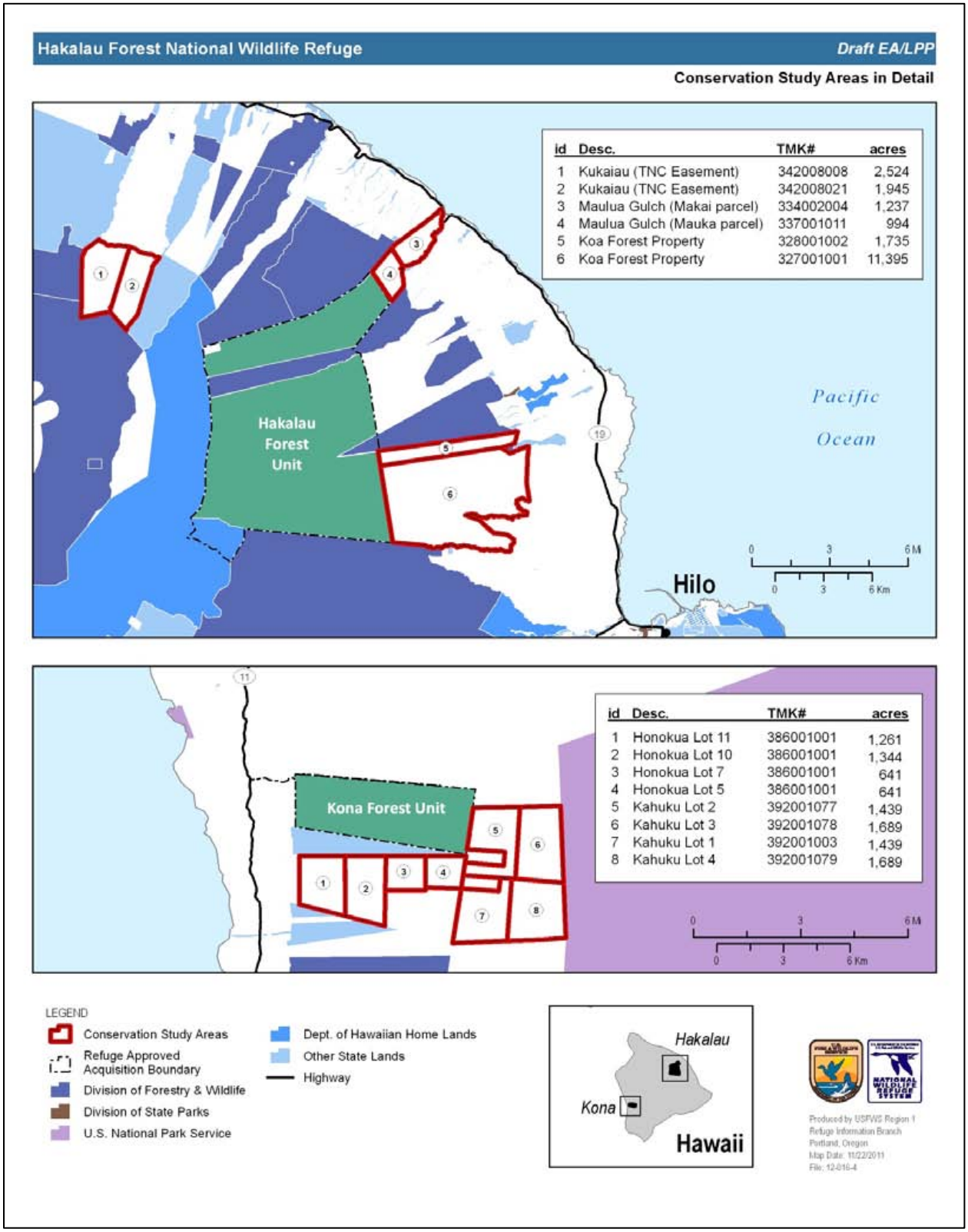

Figure 4. Lands under consideration for addition to the Hakalau Forest National Wildlife Refuge in the vicinity of the HFU (top) and at McCandless Ranch nearo the KFU (bottom).

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The four Honokua lots under consideration include lot 5 (641 acres), lot 7 (641 acres), lot 10 (1,344 acres), and lot 11 (1,261 acres), for a total of 2,604 acres, all within TMK No. (3) 8–6–001–001 and zoned agricultural (McCandless Ranch 2010, County of Hawai‘i 2011a). The Honokua lots span the same general elevation range as the KFU, about 2,000-6,000 feet (ft). Lower and middle elevations therefore are closed canopy forest dominated by ‘ōhi‘a, increasing amounts of koa with elevation gain, and patches of dry subalpine ‘ōhi‘a and māmane woodlands at the uppermost end of the property.

Kahuku lots 1 (TMK No. (3) 9–2–001–003) and 2 (TMK No. (3) 9–2–001–077) are both 1,439 acres and zoned agricultural (McCandless Ranch 2010; County of Hawai‘i 2011). Kahuku lot 3 (TMK No. (3) 9–2–001–078) and lot 4 (TMK No. (3) 9–2–001–079) are both 1,689 acres and also zoned agricultural (McCandless Ranch 2010; County of Hawai‘i 2011a). The Kahuku lots lie mauka of both the KFU and the Honokua lots and, therefore, are covered primarily with dry subalpine ‘ōhi‘a and māmane woodlands. McCandless Ranch sold a perpetual conservation easement on 3,128 acres of Kahuku lots 3 and 4 to USFS (Henshaw 2011).

2.2 Alternatives Considered but Excluded from Detailed Study

Protection by State Land Use District Classification and County Zoning

All of the lands under consideration are within State Districts classified as either agricultural or conservation. The use of such lands is limited as set forth in Hawai‘i Revised Statute (HRS) Chapter 205. In general, lands classified as agricultural can be used for crop and livestock production, and related agricultural activities; biofuel and wind energy production for public, private, and commercial use is also allowable (HRS Chapter 205-2(d)). Conservation districts include areas necessary for protecting watersheds and water resources; preserving scenic and historic areas; providing park lands, wilderness, and beach reserves; conserving indigenous or endemic plants, fish, and wildlife, including those that are threatened or endangered; preventing floods and soil erosion; forestry; open space areas whose existing openness, natural condition, or present state of use, if retained, would enhance the present or potential value of abutting or surrounding communities or would enhance or maintain the conservation of natural or scenic resources; areas of value for recreational purposes or other related activities; and other permitted uses not detrimental to a multiple use concept (HRS Chapter 205-2(e)). Geothermal resource subzones may be designated and geothermal development may be permitted within both agricultural and conservation districts (HRS Chapter 205-5.1).

Counties have been granted powers to govern zoning within agricultural districts; in general, uses remain limited to those specified in HRS Chapter 205-2, but counties may further define agricultural uses and services (HRS Chapter 205-5(b)). Agricultural lands can be subdivided and sold subject to a review and approval process (County of Hawai‘i 2006). The County zoning designation sets a theoretical limit on the minimum lot size. The makai portions of the Koa Forest and Maulua Gulch properties fall within the agricultural classification and are zoned A20a and could therefore be subdivided into a minimum lot size of 20 acres. The Kūka‘iau Ranch parcels are zoned A40a indicating a minimum lot size of 40 acres. The Honokua lots at McCandless Ranch are zone A6a indicating a minimum lot size of 6 acres. The Kahuku lots at McCandless Ranch are zoned A20a indicating a minimum lot size of 20 acres, although the conservation easement on lots 2 and 3 would preclude their development.

Conservation districts are governed solely by the DLNR and are further subdivided into main four subzones which are, from most to least restrictive: protective, limited, resource, and general (County of Hawai‘i 2006). Only a limited range of uses are allowed and most uses require a conservation district use permit (CDUP) from the Board of Land and Natural Resources, a seven-member board appointed by the governor. In addition, depending on the subzone, permit approval includes an extensive public review and hearing process and may require an EA and/or Environmental Impact Statement (EIS). Over the past few years, CDUPs have been administered for open ocean aquaculture projects; telescopes on top of Mauna Kea and Haleakalā; major power line projects on scenic ridges; telecommunication facility projects; single family residences; parks; commercial forestry projects; and other projects (DLNR 2011c).

The Koa Forest, Maulua Gulch, and Kūka‘iau Ranch properties all have portions that lie within a conservation district. The Koa Forest property is in a resource subzone which has commercial forestry as an identified use (Koa Timber Inc. 2003). A helicopter koa logging operation was proposed within 10,000 acres of the 13,129 acres of the property in 2000. A draft EA was published in March 2001 but was withdrawn after a public hearing the following month in favor of an EIS. A final EIS for the project was submitted in 2003 (Koa Timber Inc. 2003). The project proponent withdrew his application in 2007. No permit for commercial logging has been issued since the 1970s, although the high value of koa wood continues to make commercial harvest appealing (Dietz 2010).

Because of the ability to use agricultural classified land for crop and livestock production, and potentially to subdivide large parcels into substantially smaller lots for sale, sufficient protection of the lands under consideration through State and County zoning alone cannot meet our purpose and goals as described in Chapter 1. Likewise, numerous use authorizations are possible on lands classified as conservation district that would be contrary to our purpose and needs. Moreover, although permits for commercial logging operations are difficult to obtain, the issuance of such permits remains possible under the existing rules governing conservation district lands. Because of the importance of koa forests to native species, including endangered forest birds and plants, and the threats that other identified uses, if permitted, pose, conservation district classification is also not sufficient to achieve our purpose and needs. If added to the Refuge, State and County classification and zoning would no longer apply and these lands would be managed for the long-term conservation of endangered species, which is the primary purpose of our proposed action.

Protection through Recovery Land Acquisition Grant. As noted previously, a proposal was submitted by the State to the Service for a grant to acquire and restore the two Kūka‘iau Ranch parcels under consideration for recovery of the endangered palila (DLNR 2011b). This is a highly competitive grant process and the proposal was not funded in fiscal year 2011. While the proposal could be resubmitted in subsequent years, future funding is not assured. Because of the great conservation value of this parcel, we believe that it is prudent to pursue an alternative to the Recovery Land Acquisition process that would ensure long-term protection and management of these parcels by adding them to the Refuge. This would further the collaborative effort to recover the palila while satisfying the purpose and needs of our assessment.

2.3 Alternatives Considered in Detail

2.3.1 Alternative A – No Action

Under Alternative A, the No Action Alternative, no new acreage would be added to the Refuge. There would be no additional long-term commitments by the Refuge to recover endangered species in these areas. The lands under consideration would remain private and available for agricultural, residential, commercial, or industrial development, subject to any existing deed and land-use restrictions or permitting requirements. No cultural sites or resources present on the parcels under consideration would be included in the Refuge. Private landowners would continue to control access across and use of private lands, subject to any deed restrictions on parcels with existing conservation easements. Private landowners would continue to pay taxes on these lands. No public funds would be expended for the purchase of additional property or for Refuge operations and maintenance of new property.

2.3.2 Alternative B – Full Land Protection

Under Alternative B, our preferred alternative, the approved acquisition boundary of the Refuge would be expanded by up to 29,973 acres to include the Koa Forest, Maulua Gulch, Kūkaʻiau Ranch, and McCandless Ranch properties, as described above. An LPP for these properties is required by Refuge System policy and is included as Appendix A. The Refuge would make additional long-term commitments to recover endangered species in these areas, including invasive species control and habitat restoration. Management of acquired land would be consistent with the Refuge CCP (Service 2011), which would be amended to incorporate newly acquired land. A Conceptual Management Plan (CMP) for the proposed additions is included as Appendix B.

Any land acquired would become part of the Refuge System and be unavailable for agricultural, residential, commercial, or industrial development. All cultural sites or resources present on lands acquired would be included in the Hakalau Forest NWR; any future ground-disturbing activities would require compliance with the NHPA. Access and public use would be controlled by the Refuge in compliance with appropriate laws and policies. Under current law, tax losses would likely be largely offset by payments authorized by the RRSA. Acquisition costs, estimated to be $120,000,000, or about $4,000 per acres for all parcels, would be requested over time from the LWCF. Additional costs for Refuge operations and maintenance of new property will be incurred.

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CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Overview of the Study Area

The Island of Hawai‘i is one of eight main islands in the Hawaiian Archipelago, located near the middle of the Pacific Ocean, just south of the Tropic of Cancer. The Hawaiian Archipelago is the world’s most isolated group of islands, lying approximately 2,400 miles southwest of San Francisco. Hawai‘i Island is located on the southeastern end of the main island chain. It is the youngest and largest of the islands in the chain.

Hakalau Forest National Wildlife Refuge is comprised of two management units: the HFU on the wetter, windward side of the island east of Mauna Kea summit, and the KFU on the drier, leeward side of the island, west of Mauna Loa summit. The proposed expansion areas lie near or adjacent to these existing management units. Similarities and differences between the study areas and HFU and KFU are discussed below.

3.2 Physical Environment

This section describes the topography, geology and soils, climate, and hydrology of the Island of Hawai‘i and the immediate vicinity of the HFU, KFU, and lands under consideration.

3.2.1 Topography

Hawai‘i is one of the highest oceanic islands in the world, peaking at 13,796 feet on the summit of Mauna Kea. Eighty-eight percent of the island is above 500 feet. About 70 percent of the island has a slope of less than 10 percent (Hawai‘i Department of Business, Economic Development, and Tourism (DBEDT) 2007), although the topography varies locally depending on the age of the volcano that formed the particular piece of land.

Hawai‘i Island has a land area of about 4,038 square miles and is 93 miles long and 76 miles wide (Service 1995). The extinct Kohala volcano, the oldest on Hawai‘i, is on the northwestern portion of the island. The volcanoes of Mauna Kea, Mauna Loa, and Kīlauea run north to south, forming the bulk of the landmass. Hualālai, a volcano on the western coast, is surrounded by Mauna Loa to the north, east, and south.

The HFU is located on Mauna Kea, a relatively young volcano that does not contain the deep valleys and high cliffs distinctive of some of the other volcanoes on the island. The lower elevations have deeper gulches and steeper slopes than higher elevations, but the topography overall is relatively gentle. The prevailing aspect of the slopes is east. Cinder cones, built by lava fountains or erupting magma foam, are scattered throughout the area (Service 2011). Elevation within the HFU ranges from about 2,600 to 6,600 feet. The Koa Forest and Maulua Gulch study areas are contiguous with the lower boundary of the HFU. The potential Koa Forest addition extends downslope to about 1,000 feet while the proposed Maulua Gulch addition extends to sea level along State Highway 19 near Weloka. The potential Kūka‘iau Ranch addition is located to the northwest about 5 air miles from the existing Refuge boundary and lies at slightly higher elevations above Keanakolu (Mana) Road.

The KFU, on the west slopes of Mauna Loa, slopes toward the southwest. The entire area has an average slope of 20 percent, decreasing to less than 10 percent at upper elevations. Elevation within the unit ranges from about 2,000 to 6,000 feet. The surface of the KFU is rocky, irregular, and undulating. Lava tubes and shallow gulches dissect the overlapping ʻaʻā (lava with a rough, jagged and clinkery surface) and pāhoehoe (lava with a smooth, billowy, ropy surface) flows, creating uneven topography (Raymond and Valentine 2007). The Honokua portion of the McCandless Ranch study area, which lies south of the KFU and is contiguous at one corner (Figure 4), encompasses a similar elevation range. The Kahuku portion of the McCandless Ranch study area is mauka of the KFU boundary and the proposed Honokua addition. It ranges in elevation from about 6,000 to 7,000 feet, connecting to the lower boundary of Hawaiʻi Volcanoes National Park.

3.2.2 Geology and Soils

Volcanic eruptions are the primary geological forces on the Island of Hawaiʻi (Service 1995). The Island of Hawaiʻi is comprised of five volcanoes of varying ages (Juvik and Juvik 1998). Hualālai, Mauna Loa, and Kīlauea are all active volcanoes. Mauna Loa, in the southern portion of the island, erupted in March 1984. Kīlauea, on the eastern portion of the island, became active in 1983 and continues to erupt through the present day. Mauna Kea is considered dormant and Kohala is extinct. Various soil types have developed as the basaltic lavas and volcanic ash from these volcanoes weathered and decomposed (Service 2011).

All of the soil series in the HFU were formed from volcanic ash (Service 2011). The organic soils are fairly well-developed and continuous with bedrock composed of old lava (Service 1985). Above 5,000 feet, the soils are classified as well-drained silt loams, while lower portions of the HFU are overlain by silty clay loams (Service 2011). They are typically well-drained and pose only a slight erosion hazard. Soils below about 5,000 feet are included in the ʻAkaka series, which within the HFU comprises moderately well-drained silty clay loams on gentle to moderate slopes dissected by small steep drainages; small swampy areas of shallow soils underlain by pāhoehoe bedrock also occur in this series (Natural Resource Conservation Service (NRCS) 2011a). The ʻAkaka series extends downslope where it overlies the potential Koa Forest addition and the most of the mauka portion of the proposed Maulua Gulch addition. The makai portion of the proposed Maulua Gulch addition is covered by silty clays and silty clay loams of the Honokaa, Kaiwiki, and Ookala soil series (NRCS 2011b). Soils on the Kūkaʻiau Ranch property are comprised primarily of the Apakuie, Hanipoe, Umikoa, and Huikau series, which include deep, well-drained to excessively well-drained soils that formed from volcanic ash, pumice, sand, or cinders over lava (NRCS 2011c).

Mauna Loa lava flows of the Kaʻū Basalt series cover the surface of the KFU and adjacent areas. Lava flows in the northern two-thirds of the unit are older, ranging between 1,500 and 3,000 years old, while the southern portion is estimated to be between 750 and 1,500 years old. A small area in the central region of the KFU is covered by flows between 3,000 and 5,000 years old. Twentieth century lava flows are present south of the KFU; a thin layer of organic soil covers the highly permeable basalt (Service 2011). In general, the lava substrate creates extremely well-drained soils with few surface drainages (Service 1995). The soils on the McCandless Ranch are similar to those covering the southern third of the KFU; mauka of the KFU on the Kahuku lots, thin soils overlie a mosaic of younger ʻaʻā and pāhoehoe lava flows (Service 2011). The majority of the soils are extremely stony or rocky mucks of the Keei, Kekake, Kiloa, or Kona series (NRCS 2011d).

3.2.3 Climate

The climate of Hawai‘i is generally constant throughout the year, with only minor periods of seasonal variability. Temperatures during the summer season (May-September) are warm and dry with trade winds originating from the northeast direction. Winter months (October-April) have higher precipitation and less equable winds. At lower elevations the mean annual temperature is about 65˚F, and higher elevations are about 53˚F. Average daily humidity varies between 70 percent in the winter and 85 percent during the spring and summer (Juvik and Juvik 1998).

A noteworthy feature of the Hawai‘i climate is a persistent subsidence inversion caused by the tradewinds. This inversion occurs between 4,000 and 8,000 feet, where descending dry air meets a well-mixed layer of moist air in equilibrium with the ocean surface flowing toward the equator. The inversion modifies air circulation by strongly inhibiting vertical motion and affecting spatial patterns of cloudiness, rainfall, solar radiation, temperature, and humidity. The inversion also makes the climate of the contact zone extremely variable. The natural vegetation and wildlife of these areas are vulnerable to long-term shifts in the inversion height that may accompany global climate change (Giambelluca and Nullet 1991). This contact zone coincides with the elevation range of the Refuge.

The Koa Forest, Maulua Gulch, and Kūka‘iau Ranch study areas are on the east side of Mauna Kea, and extend from sea level to over 8,000 feet. Moderate temperatures and wet conditions prevail. Precipitation caused by the northeasterly trade winds average between 85 and 300 inches annually with less precipitation falling at higher elevations. Precipitation can be augmented by fog drip, which results when the condensation of fog or cloud water vapor on surface areas, such as leaves, becomes saturated and drips to the ground surface. Fog drip can increase precipitation by as much as 30 inches per year; the type and density of forest cover may have more influence on fog drip than changes in the surrounding ocean or global climate (Hardy 1996).

The McCandless Ranch study area is located on the west side of Hawai‘i Island, just south of the town of Captain Cook. This leeward area is drier, with average annual precipitation at the KFU ranging from 65 inches at 2,000 feet to 25 inches at 6,000 feet. Moisture patterns result primarily from daytime surface heating and upslope winds that yield convective rainfall between 2,000 and 5,000 feet. During winter, occasional intense storms (known as Kona storms) produce heavy rain, hail, and flash floods with associated landslides. Summer is the rainy season with average rainfall that varies from 5.6 inches at lower elevations to 2.0 inches at higher elevations. This area is affected by volcanic gases and particulates (vog) released from the nearby active Kīlauea volcano (U.S. Geological Survey 2000). Fog drip is a major source of moisture between 3,000 and 6,500 feet (Service 2011).

3.2.4 Climate Change

Small island groups are particularly vulnerable to climate change due to their small land area compared to the large expanses of surrounding ocean, limited natural resources, high susceptibility to natural disasters, and inadequate funds to mitigate impacts (IPCC 2001). Thus, Hawai‘i is considered to have a limited capacity to adapt to future climate changes.

Recent changes in the climate of Hawai‘i include a rise in air and sea surface temperatures, decreases in rainfall and stream flow, and increases in rain intensity, sea level, and ocean acidification (Fletcher

2010). Changes due to increased air and sea surface temperatures and decreased precipitation are most likely to directly affect the Refuge and the study areas.

An analysis of temperature changes in the Hawaiian Islands for the past approximately 85 years, based on an index of 21 stations, has shown a relatively rapid rise in surface temperature in the last approximately 30 years, with stronger warming at the higher elevations. Minimum temperatures increased about three times as much as maximum temperatures, resulting in a narrower range of daily temperatures; the warming trend was greater at higher elevations (Giambelluca and others 2008). The average ambient temperature at sea level is projected to increase by about 4.1°F by 2100 (IPCC 2007). These changes would increase the monthly average temperature to between 77°F and 86°F. The rate of increase at low elevation (0.16°F per decade) is below the observed global temperature rise of 0.32°F per decade (IPCC 2007). However, a recent analysis of high elevation temperature data collected at the Mauna Loa Observatory between 1959 and 2006 has shown higher warming trends in mean annual and December air temperatures by 0.47°F and 0.79°F per decade, respectively (Juvik and others 2011). Warming temperatures would also tend to increase atmospheric stability and strengthen the tradewind inversion (Cao and others 2007).

Precipitation in Hawai‘i has declined by about 15 percent over the last 15-20 years (Diaz and others 2005, Chu and Chen 2005). Stream flow has also been in steady decline since in the early 1940s (Oki 2004). However, rain intensity, which contributes to stream overflow and flooding and is not beneficial for aquifer replenishment, increased by about 12 percent between 1958 and 2007 (Fletcher 2010). Global climate models project that net precipitation at sea level near the Hawaiian Islands will decrease in winter by about 4 to 6 percent, with no significant change during summer (IPCC 2007). Downscaling of global climate models suggest that wet-season (winter) precipitation will decrease by 5 to 10 percent, while dry-season (summer) precipitation will increase by about 5 percent by the end of the century under a moderate emissions scenario (Timm and Diaz 2009).

Most climate projections suggest that more intense wind speeds and precipitation amounts will accompany more frequent tropical typhoons/cyclones and increased tropical sea surface temperatures in the next 50 years. The intensity of tropical cyclones is likely to increase by 10-20 percent in the Pacific region when atmospheric levels of CO_2 reach double preindustrial levels (McCarthy and others 2001).

Climate change has the potential to influence two interrelated ecological issues in Hawai‘i: endangered species and pest species. Species response to climate change will depend on the life history, distribution, dispersal ability, and reproduction requirements of the species (Middleton 2006, Giambelluca and others 2008). Climate change may exacerbate pest species issues because alterations in the environment may increase the dispersal ability of introduced weeds or animals, including infectious disease vectors such as mosquitoes.

3.2.5 Hydrology

Hawaiian island hydrology is largely influenced by geological features associated with lava flows. Watersheds are typically small, and streams are steep with numerous waterfalls. Many streams in Hawai‘i have lengthy dry reaches due to the high permeability of the underlying lava flows (Service 2011).

Rainfall is the greatest source of freshwater on Hawai‘i, and groundwater is the primary water resource. The island is particularly vulnerable to flooding because it is relatively young and water courses are generally not well-defined. The HFU and KFU, as well as all of the study areas, are outside of the 500-year floodplains (Service 2011). Gulches and ravines allow for intermittent surface water flow following periods of heavy or continuous rain. Some of the streams within the HFU boundary are considered perennial at lower elevations, and two of the highest quality streams on the island, the Hanawī Stream and the Honoli‘i Stream, are located within the potential HFU expansion area (Service 2011).

The Refuge, as well as the Koa Forest, Maulua Gulch, and Kūka‘iau Ranch properties, all fall within the East Mauna Kea Aquifer Sector Area (East Mauna Kea ASEA) (Fukunaga and Associates 2010). More perennial streams are located in the East Mauna Kea ASEA than on the rest of the island. About 77 percent of the water use in this ASEA is for agriculture, with municipal, industrial, and domestic use accounting for the rest (Fukunaga and Associates 2010). The sustainable yield of the East Mauna Kea ASEA is 388 million gallons per day (mgd) which is the third highest of all sectors on the island. Full build-out water demands based on county zoning are sustainable even when worst case agricultural demands are considered; however, full build-out demands based on the County General Plan exceed the sustainable yield under the worst case agricultural demand scenario (Fukunaga and Associates 2010).

Due to the extremely permeable lava and well-drained soils, there are no perennial surface waters or drainages on the KFU. The Refuge area functions as an important groundwater recharge area for Kona as a result of the porous substrate and relatively high moisture conditions from rainfall in the lower elevations and fog drip in the higher (Service 2008a).

The KFU and McCandless Ranch fall within the Southwest Mauna Loa ASEA which has a sustainable yield of 130 mgd, or about one-third of the East Mauna Kea ASEA (Fukunaga and Associates 2010). There are no streams classified as perennial in the area. Agriculture accounts for about 54 percent of the water use, with municipal, domestic, and irrigation use comprising the rest (Fukunaga and Associates 2010). However, agriculture uses more than three times as much water in the Southwest Mauna Loa ASEA (9.6 mgd) than it does in the East Mauna Kea ASEA (3.0 mgd) (Fukunaga and Associates 2010). As in the East Mauna Kea ASEA, full build-out water demands based on county zoning are sustainable even when worst case agricultural demands are considered but full build-out demands based on the County General Plan exceeds the sustainable yield under the worst case agricultural demand scenario (Fukunaga and Associates 2010).

3.2.6 Environmental Contaminants

As of November 2011, none of the study areas are on the EPA National Priority List or in their Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) information system (EPA 2011). Under Service policy, we are required to conduct a Pre-acquisition Level I Contaminant Survey for each parcel prior to completion of acquisition. At this time, we are not aware of any contaminants on any of the study areas, although potential pollutants on lands used for agriculture could include fertilizers, pesticides, herbicides, or animal waste.

3.3 Social and Economic Setting

I3.3.1 Populations and Local Communities

The Island of Hawai‘i had a population of 185,079 people in 2010, which is 13.6 percent of the statewide population. This represents a 24.5 percent increase from the 2000 census. Population projections for the island in 2020 range from 213,452 to 237,323, an increase of 15.3 to 28.2 percent (County of Hawai‘i 2005).

Hilo is the nearest large Census Designated Place[1] (CDP) to the HFU and had a population of 43,262 in an area of 54.3 square miles (sq. mi.), a density of 796.7 persons per sq. mi. (Table 2; County of Hawai‘i 2011b). There are several smaller CDPs to the north of the Hilo CDP that are closer to the HFU with much smaller populations but higher population densities (County of Hawai‘i 2011b). The Hōnaunau-Nāpō‘opo‘o CDP is the closest to the KFU and has a population of only 2,567 within an area of 38 sq. mi, resulting in a density of 67.5 persons per sq. mi. (Table 2). Numerous CDPs lie to the north along the western coast of the island from Captain Cook to Kalaoa; most of these have larger populations and higher population densities than that of the Hōnaunau-Nāpō‘opo‘o CDP (County of Hawai‘i 2011b). The sex ratios, median ages, and ethnicity of the populations also differs between the Hilo and Hōnaunau-Nāpō‘opo‘o CDPs (Table 2; County of Hawai‘i 2011b).

Table 2. Demographic Profiles of Hilo and Hōnaunau-Nāpō‘opo‘o Census Designated Places, Hawai‘i (U.S. Census Bureau 2011)

Demographics	Hilo CDP	Hōnaunau-Nāpō‘opo‘o CDP
Total Population	43,262	2,567
Population Density	796.7 (54.3 sq. mi.)	67.5 (38.0 sq. mi)
Male	48.8 %	52.7 %
Female	51.2 %	47.3 %
Median Age	40.5	45
Race		
White	17.6%	39.5 %
American Indian	0.3%	0.2 %
Black or African American	0.5%	0.3 %
Asian	34.3 %	15.1 %
Chinese	1.5 %	0.0 %
Japanese	22.1 %	7.8 %
Korean	1.0 %	0.3 %
Filipino	6.1 %	4.9 %
Vietnamese	0.2 %	0.1 %
Asian Indian	0.1 %	0.0 %
Other Asian	3.3 %	1.5 %
Native Hawaiian/Pacific Islander	14.2 %	13.1 %
Two or More Races	32.5 %	24.7 %

[1] A Census Designated Place is defined by the U.S. Census Bureau as a “densely settled concentration of population not within an incorporated place.”

3.3.2 Island Economy and Employment

Tourism is the major economic driver on Hawai‘i Island, as is true throughout the Hawaiian Islands. In 2007, about 1,622,400 individuals visited the Island of Hawai‘i, an increase of more than 30 percent from 2001. Tourism dropped off in 2008 and 2009 due to the recession in the United States and Japan and the departure of two inter-island cruise lines, but was recovering by the end of 2009 (University of Hawai‘i Economic Research Organization (UHERO) 2011). The State of Hawai‘i’s tourism sector has continued positive growth that started in the third quarter of 2009. Domestic visitor arrivals have increased while international arrivals decreased due to the negative impacts of the Tōhoku earthquake and tsunami. The decrease in international arrivals almost offset the increase in domestic arrivals in the quarter. Due to longer lengths of stay, the growth rate of daily visitors was higher than the growth rate of visitor arrivals. In addition, since visitors spent more on a daily basis during the second quarter, the growth rate of total visitor spending was significantly higher than the growth rate of daily visitors (DBEDT 2011). In 2010, a total of 1,289,300 visitors arrived on the island with 41 percent and 28 percent arriving from the west and east coasts of the United States, respectively; visitors from Japan and Canada comprised 21 percent (UHERO 2011).

Agriculture is prevalent on the island with important products including beef, Kona coffee, macadamia nuts, papaya, and tropical flowers. The County of Hawai‘i has more farms and farmland than any other county in the State. In 2007, the most recent year for which county-level data is available, there were 4,650 farms on the island and 683,819 acres of farmland. The average farm size was 147 acres, while the median size was only 6 acres (National Agricultural Statistics Service (NASS) 2007). In that same year, Hawai‘i led the Nation in production of coffee and macadamia nuts (NASS 2007). Fruits, berries, flowers and nursery products, and sugarcane for sugar are also important crops. Seventy percent of the State’s livestock are raised and nearly half of its aquaculture operations are located on the island. The total market value of agricultural products from the island in 2007 was $202,572,000, with about 75 percent coming from crops, including nursery and greenhouse crops, and the remaining 25 percent from livestock, poultry, and their products (NASS 2007).

In 2009, government, retailers, and tourism made up the top ten employers on the Island of Hawai‘i (Table 3, County of Hawai‘i 2011b). Although governments are the top individual employers on the island, the government workforce comprises only about 16 percent of the total workforce. The University of Hawai‘i Hilo is the primary employer for the eastern side of the island (Service 2011).

Table 3. Top ten employers on the Island of Hawai‘i in 2009 (County of Hawaii, 2011b)

Rank	Company	Employees	Business
1	State of Hawai‘i	8,265	Government[1]
2	County of Hawai‘i	2,275	Government[1]
3	United States	1,359	Government[1]
4	Hilton Waikoloa Village	900	Tourism
5	Wal-Mart	830	Retailer
6	KTA Superstores	750	Retailer
7	Four Seasons Resort Hualālai	625	Tourism
8	The Fairmont Orchid, Hawai‘i	574	Tourism
9	Mauna Lani Resort, Inc.	557	Tourism
10	Hapuna Beach Prince Hotel at Mauna Kea Resort	450	Tourism

[1]Average annual job counts

Accommodation and food services, retailers, and health care and social assistance are the top three types of employment on the island (Table 4, U.S. Census Bureau 2011). Construction jobs, a mainstay of the Hawaiian economy fueled largely by offshore demand for second and vacation homes, have decreased by nearly 40 percent since a housing market downturn that began in 2006 (UHERO 2011). Construction remains the highest paid industry (Table 4). Many local jobs are in businesses that purchase labor and supplies to meet the increase in demand for additional services desired by the island's tourists. Wildlife-related recreation in Hawai'i generated approximately $373,778,000 in 2006, with roughly $210,414,000 attributed to wildlife watching (Service 2007).

Table 4. Hawai'i County Industry Job Counts and Average Monthly Wages (U.S. Census Bureau, Local Employment Dynamics 2011b)

Industry	Jobs (Q2 2009-Q2 2010)	Average Monthly Wage ($)
Accommodations & Food Services	10,529	2,311
Retail Trade	8,727	2,395
Health Care & Social Assistance	5,912	3,429
Construction	3,518	4,367
Administration & Support Services	2,784	2,450
Transportation & Warehousing	2,154	3,124
Agriculture, Forestry, Fishing, & Hunting	2,106	2,292
Arts, Entertainment, Recreation	1,868	2,877
Other Services, Exc. Public Administration	1,805	2,523
Public Administration	1,451	3,748
Wholesale Trade	1,440	3,342
Manufacturing	1,356	2,840
Finance and Insurance	1,086	3,820
Educational Services	1,064	2,709
Information	647	3,940
Utilities	614	5,364
Mining, Quarrying, Oil, and Gas Extraction	18	5,459

3.3.3 Tax Revenues

The parcels being considered in the study areas are currently zoned either agricultural or conservation and are therefore assessed at $8.35 or $9.85 per $1,000 Net Assessed Valuation for land (Table 5). We are not aware of any taxable buildings on any of the properties.

Table 5. 2010 Tax Rates for the County of Hawai'i (County of Hawai'i 2011a)

(per $1,000 Net Assessed Valuation)	**Building ($)**	**Land ($)**
Affordable Rental Housing	5.55	5.55
Residential	9.10	9.10
Apartment	9.85	9.85
Commercial	9.10	9.10
Industrial	9.10	9.10
Agricultural and Native Forest	8.35	8.35
Conservation	9.85	9.85
Hotel/Resort	9.85	9.85
Homeowner	5.55	5.55

The actual 2010 tax bills for the tracts under consideration are provided in Table 6 (County of Hawai‘i 2011). The 29,973 acres produced a combined tax of $68,944.12 in 2010, the most recent year for which these data are available (County of Hawai‘i 2011).

Table 6. 2010 Tax Bills for Potential Additions to Hakalau Forest NWR (Hawai‘i County 2011a)

Tract	Assessor Acres	TMK#	Zoning	2010 Tax ($)
Potential HFU Additions				
Kūka‘iau Ranch 1	2,524	342008008	Agricultural	295.59
Kūka‘iau Ranch 2	1,945	342008021	Agricultural	603.71
Maulua Gulch (makai)	1,237	334002004	Agricultural	2593.51
Maulua Gulch (mauka)	994	337001011	Conservation	1,174.12
Koa Forest 1	1,735	328001002	Conservation	8,544.88
Koa Forest 2	11,395	327001001	Agricultural	53,574.72
Potential KFU Additions				
Honokua Lot 11	1,269	386001001	Agricultural	1,421.17
Honokua Lot 10	1,331			
Honokua Lot 7	699			
Honokua Lot 5	621			
Kahuku Lot 2	1,439	392001077	Agricultural	167.84
Kahuku Lot 3	1,689	392001078	Agricultural	197.06
Kahuku Lot 1	1,439	392001003	Agricultural	174.52
Kahuku Lot 4	1,689	392001079	Agricultural	197.00

3.3.4 Contribution of Hakalau Forest NWR to the Island Economy

Although the HFU and KFU are generally not open to the public, the Hakalau Forest NWR does contribute to the local economy through recreational expenditures. The total annual recreational expenditure is estimated at $56,400 from 1,323 visitors (Carver and Caudill 2007). About 90 percent of these expenditures are from non-residents. Birding and other wildlife observation were the main activities (Service 2011). The KFU is currently closed to the public due to legal access issues and the presence of highly sensitive species. Fencing of the unit is in progress. The Refuge hopes to provide opportunities for the public to enjoy nature observation in the KFU at an appropriate level after management efforts have begun (Service 2011).

In addition to recreational expenditures, additional revenues to the local economy are derived from local taxes, employment income, and annual Federal payments to the County of Hawai‘i authorized by the RRSA. The amount authorized is approximately 0.75 percent of the fair market value of fee lands, although the actual amount appropriated is usually less. In 2009, $66,557 was paid to Hawai’i County for the 38,005 acres of Hakalau Forest NWR owned in fee title.

3.4 Historic and Present Land Use, Development, and Public Use Setting

3.4.1 Historic Use

At the time of Captain Cook's arrival to the Hawaiian Islands in 1778, Hawai'i's lowland ecosystem was significantly altered by well over 1,000 years of Polynesian/Hawaiian settlement (Kane 1997). The Polynesians are believed to have discovered Hawai'i during open water exploration from the Marquesas and Tahitian Islands sometime before 1,900 years ago (Kane 1997). The Polynesians brought about 27 species of useful plants to Hawai'i, which included taro (kalo) (*Colocasia esculenta*) – their most important crop, breadfruit ('ulu) (*Artocarpus altilis*), ti (kī) (*Cordyline fruticosa*), paper mulberry (wauke) (*Broussonetia papyrifera*), coconut palms (*Cocos nucifera*), sweet potato ('uala) (*Ipomoea batatas*), yams (uhi) (*Dioscorea spp.*), banana (mai'a) (*Musa acuminata* hybrids), turmeric ('olena) (*Curcuma domestica*), sugar cane (kō) (*Saccharum officinarum*), shampoo ginger ('awapuhi) (*Zingiber zerumbet*), candlenut tree (kukui) (*Aleurites moluccana*), kava ('awa) (*Piper methysticum*), noni (*Morinda citrifolia*), and other edible and useful plant species. The People of Old (Ka Po'e Kahiko), as they are sometimes called, preferred to cultivate fertile valleys with permanent water sources, such as the Kīlauea River valley. They also used fire to encourage growth of thatching grasses and cut trees for firewood, commerce in sandalwood, and for construction purposes (Kirsh 1982).

Along with plants, the Polynesians brought pigs, dogs, and fowl. These animals have had a negative impact on the natural flora and fauna of the Hawaiian Islands, especially the pig when it was later subsumed by the larger European breeds introduced to the archipelago after Captain Cook's arrival. Accompanying the introductions came stowaways such as the Polynesian rat (*Rattus exulans*), which did major damage by eating ground-nesting birds and their eggs (Finney 2003).

3.4.2 Present Land Use, Development, and Public Uses

Tourism and outdoor recreation are some of the largest economic drivers on Hawai'i, and a large percentage of the land on the Hawai'i Island is set aside accordingly. The largest National Park in the State, Hawai'i Volcanoes National Park, is mauka of the KFU. The State of Hawai'i Forest Reserve System manages 448,000 acres throughout the state for camping, gathering, harvest, hunting, and other uses. Fifteen State parks are scattered across the Island of Hawai'i, allowing public access and requiring permits for larger gatherings. The County manages another 137 smaller parks on the island (Service 2011). Hunting is allowed, in accordance with State regulations, throughout the County. The private properties being considered for acquisition in this proposed expansion have historically been ranches or in agricultural production with restricted public use.

The KFU is closed to the public due to rough terrain and vulnerable species, and the HFU is only open to a limited number of permitted users, or through a variety of Refuge-led outings (Service 2011). The McCandless Ranch study area has been assessed for logging and subdivision, but the current use is limited to a few permitted guide services. Kahuku lots 2 and 3 are included in a conservation easement held by USFS.

The Koa Forest property, makai of the HFU, is primarily zoned for conservation with its lower limits in an agricultural zone. The property has been promoted in the recent past for potential timber harvest. Maulua Gulch is currently in agricultural production with open pasture at the lower

elevations and forested habitats above. Mauka portions of Maulua Gulch have been used for grazing in the past but retain a canopy of native forest.

Kūkaʻiau Ranch has been a ranch for over a century, as well as historically supporting sugarcane farming. The upper portions of the Ranch, including the two tracts being considered for potential addition to the Refuge, are included within a conservation easement held by TNC. These parcels have several human-made structures, including reservoirs, water tanks, a cabin with a small kitchen house, roads and fences, and an FM tower, repeater, and three cellular towers (Pacific Forestry Consultants 2010).

Many areas on Hawaiʻi Island are open to public recreation, including hunting (Figure 5; Service 2011). Public hunting areas include the Hilo Forest Reserve portions which are contiguous to the Refuge, as well as the Koa Forest and Maulua Gulch properties, and the Mauna Kea Forest Reserve, which is contiguous to the Kūkaʻiau Ranch property (Figure 5, Service 2011).

Boundary commission testimonies dating to the 1870s and 1880s describe activities conducted in the Koa Forest area as including bird-catching, canoe-building, bullock hunting, and gathering of olonā and pulu with associated temporary settlements by bird catchers and canoe makers whose permanent homes were close to the coast (Koa Timber, Inc. 2003). Three trails associated with bird-catching and canoe-building following ahupuaʻa boundaries were described in Boundary Commission testimony; current residents of the area who were interviewed had little or no knowledge of the uppermost ahupuaʻa boundaries and their testimonies suggested that the trails described in the late 1800s were no longer in use (Koa Timber, Inc. 2003).

3.5 Archaeological and Historic Resources

No records searches or ground surveys have been conducted by the Service as part of the proposed land acquisition. Because of the interrelationship of natural and cultural resources in Hawaiʻi, we recognize the importance of identifying cultural resources. We are currently drafting a scope of work for a records search. The records search, and other requirements in compliance with Section 106 of the NHPA, would be conducted subject to funding availability after land is acquired and prior to any specific management activities.

In addition, Article XII, Section 7, of the State Constitution protects all rights, customarily and traditionally exercised for subsistence, cultural, and religious purposes and possessed by ahupuaʻa tenants who are descendants of Native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights. The exercise of such rights is a complex legal arena but, in general, a Native Hawaiian practitioner has the burden of showing that his or her conduct is a constitutionally protected, traditional or customary practice (State v. Hanapi, 89 Hawaiʻi 177, 970 P.2d 485 (1998)). The practitioner must establish three prongs: (1) the practitioner must be a "Native Hawaiian"; (2) the claimed right is constitutionally protected as a customary or traditional Native Hawaiian practice under the three sources of law; and (3) the exercised right occurred on undeveloped or less than fully developed property. Id. at 816-87, 970 P.2d at 494-95. Finally, the exercise of constitutionally protected rights must be reasonable. Id. at 184-85, 970 P.2d at 492-93 (Hawaiʻi Legal News 2010).

3.5.1 Previously Recorded Sites and Cultural Practices

Cultural resources of the Koa Forest property were studied and summarized for the environmental documents for the timber operation proposed for this property (Koa Timber, Inc. 2003). According to the documents, their study did not identify any traditional Hawaiian practices still being conducted on the property. Cultural practices were identified makai and outside of the property, including leina (jumping off point at Makahanaloa), Kane stone, and ʻaumākua worship (shark feeding at Kahaliʻi). The document states that the only people that use the site today are pig hunters who also occasionally gather fern shoots, freshwater shrimp, hīhīwai, prawns, and other food resources while hunting. No gathering was done for cultural reasons or on a regular basis, and no one interviewed knew of anyone who accesses the property for cultural reasons. The document also notes that Boundary Commission records from the 19th Century indicate the area was heavily used by Hawaiians for activities such as gathering pulu, olonā, and especially for bird hunting and canoe-building materials, and that there would have been traditional cultural practices associated with these activities. The disappearance of these cultural practices is attributed to changes brought about by the sugar plantation industry that dominated the agriculture and land use since the mid-19th Century (Koa Timber, Inc. 2003).

Hawaiian rock walls and trees enclosed in rock walls have been reported from the mauka area of the Kūkaʻiau Ranch (Pacific Forestry Consultants 2010). Pacific Forestry Consultants (2009) also reports that a number of documents refer to areas on or near the property as being important burial sites and other cultural gathering sites, although they cautioned that they could not definitively deny or substantiate these claims. A cabin and small kitchen house and other agricultural facilities also occur on the property (Pacific Forestry Consultants 2010).

3.6 Biological Resources

3.6.1 Natural Communities

The ecology of Hawaiʻi's native ecosystems has been severely altered. Native plants and animals are generally absent and exotics predominate in nearly all low-elevation areas except for a few relatively undisturbed beach strands, steep-sided gulches, lava tube skylights, and similar features that exclude ungulates. The intentional and accidental introduction of alien plants and animals to Hawaiʻi has been ongoing for over 1,000 years. Significant changes occurred from Polynesian settlement, but since the arrival of Europeans, an estimated 12,000 plant species have been introduced to the Hawaiian Islands, compared with the 27 or so that the Polynesians brought with them.

Feral pigs destroy understory vegetation and spread alien weeds. They consume groundcover plants and significantly contribute to erosion, stream sedimentation, and sediment transfer to the ocean that can smother coral reefs. Pigs also facilitate mosquito-breeding through their rooting and wallowing. Hawaiʻi has no native mosquitoes, but the Southern house mosquito (*Culex quinquefasciatus*) was introduced from Mexico in 1826 by the crew of the whaling vessel, *Wellington*, while replenishing their water barrels in freshwater streams on Maui. This introduction has devastated endemic bird species by spreading avian malaria and avian pox, diseases to which they have no natural immunity (Henshaw 1902).

The intentional introductions were accompanied by accidental species introductions such as the Polynesian rat, which due to its high reproductive rate, had a devastating effect on ground-nesting birds, native land snails, and some tree species (Burney 2001). Other stowaways have included the

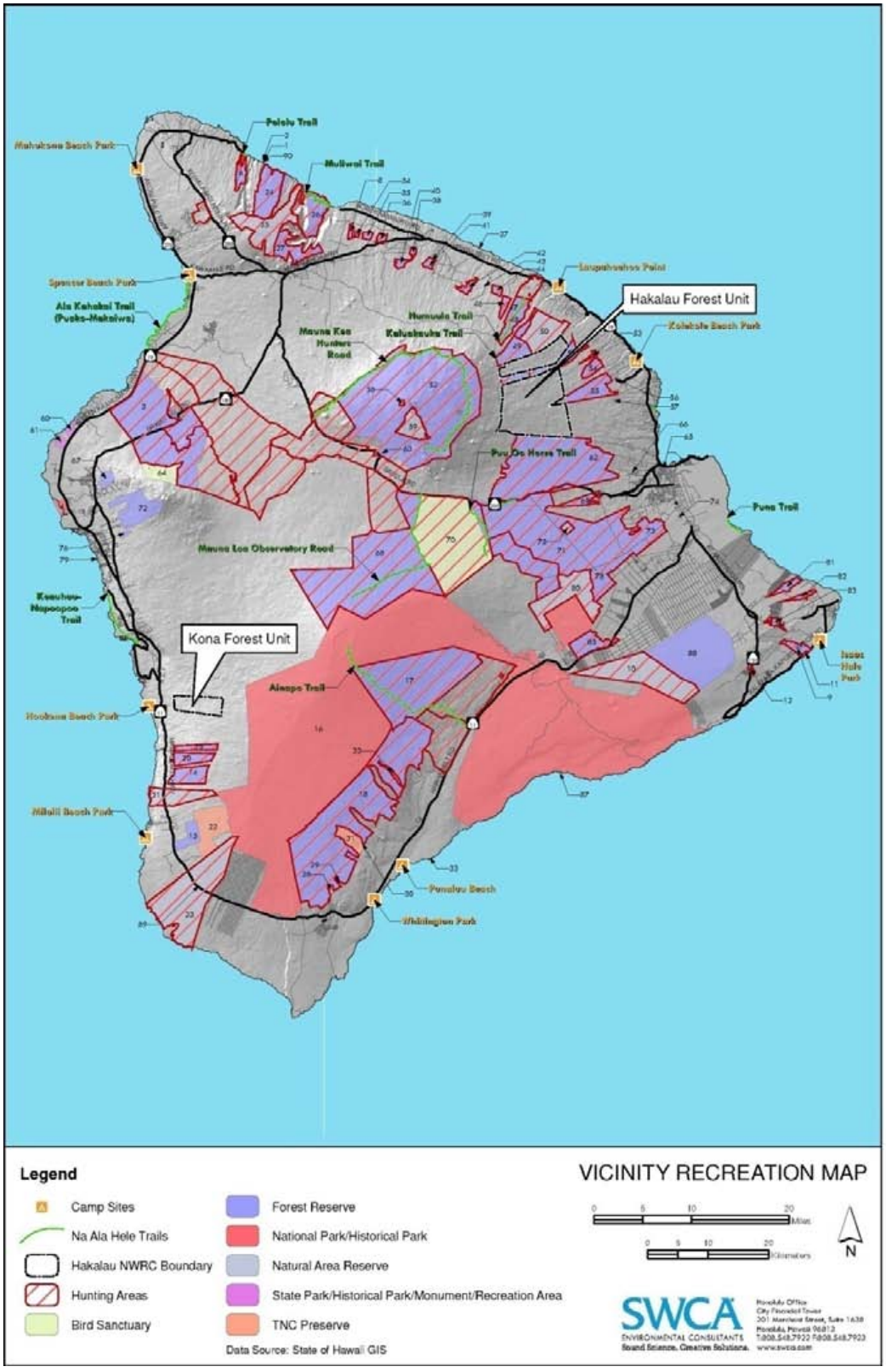

Figure 5. Recreational opportunities on the Island of Hawai‘i (Service 2011).

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black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), various geckos and skinks, land snails, various arthropods such as rat parasites, and other mosquitoes (genus *Culex, Aedes,* and *Wyeomyia).*

It is within this context that one must view the "natural" communities of both the existing Refuge and the study areas. The Refuge is home to an array of endemic native species, including forest birds and plants, many of which are endangered. Most of the native bird species were historically found in many forest types, despite differences in elevation and rainfall. Populations today are more fragmented and largely missing from lower elevations. Higher elevation montane forests are wetter and sustain a slightly different bird assemblage.

The tropical climate, abundant food resources, and ample water supply make the HFU an attractive home to many native species, despite nonnative species and habitat degradation in portions of the area. The Refuge provides habitat for 11 endangered animals (6 forest birds, 3 waterbirds, 1 invertebrate, and 1 mammal) and 16 endangered plants. Many other native forest birds prefer the intact forest in the HFU. Endangered waterbirds use the high quality streams in the HFU. The last wild habitat of the ʻalalā was in the KFU, and as restoration progresses, repatriation of ʻalalā may be considered in the area (Service 2009c). An endangered picture-wing fly (*Drosophila* spp.) is found in areas of the KFU.

All of the study areas border Refuge lands, State conservation lands, or the Hawaiʻi Volcanoes National Park. Enhanced connectivity and restoration of these large blocks of habitat could create a significant expansion of contiguous forest for the recovery of endangered plants and animals. More detail on the habitat values of the Refuge and study areas is provided in the next section.

3.6.2 Habitats

Island of Hawaiʻi habitats are determined primarily by elevation, temperature, and rainfall. As noted previously, all habitats have been affected to some degree by agriculture, logging, feral ungulates, and cattle ranching. Lower elevation habitats are highly degraded due to the presence of an array of nonnative species and coastal development, while the higher elevations have been used for ranching, logging, and agricultural experimentation, and subsequently these altered habitats have been degraded by feral ungulates. Despite this habitat degradation, numerous native species persist. Pockets of intact forest are interspersed within degraded habitat. Both the HFU and KFU lie between 2,000 and 6,500 feet and are predominantly forested. Habitats that occur above 9,500 feet are not addressed in the following discussion because they are outside of our study areas. Because the Koa Forest and Maulua Gulch study areas extend makai to 1,500 feet and sea level, respectively, lower elevation habitats are discussed.

Windward Slope of Mauna Kea Habitats. Five main habitats characteristic of the windward, wetter, eastern side of the island occur in this area, which includes the HFU and the Koa Forest, Maulua Gulch, and Kūkaʻiau Ranch study areas. From lowest to highest elevation, they are:

Coastal Communities (Sea level–2,500 ft): Subject to marine influences, these communities can be dry, mesic, or wet and include stream outlets. The lower edge of the Koa Forest property lies at 1,500 feet. It has been cleared and was used as farmland (Koa Timber, Inc. 2003). Between 1,500 and 3,000 feet, the Koa Forest property is a sub-montane rain forest dominated by ʻōhiʻa and koa, with

koa occupying only the better drained positions, often heavily invaded by strawberry guava (Koa Timber, Inc. 2003). Maulua Gulch extends makai from the current Refuge boundary to sea level; the lower portion consists largely of agriculture lands with open pasture and lower-elevation forest that is largely comprised of invasive species. Native wildlife includes terrestrial invertebrates and waterbirds.

Montane wet ʻōhiʻa/ʻuluhe forest (2,500–4,000 ft): This area is characterized by gently sloping hills and steep streams. Poorly drained volcanic soils and bogs also occur here. This low-elevation area is mostly comprised of nonnative plant and animal species, especially mosquitoes and pigs. Historically this forest type supported native birds, many of which have been eliminated by avian malaria and pox. The koloa maoli still frequents the bogs. Other common groundcover plants include ferns, sedges, and sphagnum moss. Portions of the Koa Forest property extending upwards to its boundary with the Refuge at about 3,600 feet are described as dominated by ʻōhiʻa trees and large patches of ʻuluhe fern (*Sticherus owhyhensis*) (Koa Timber, Inc. 2003). Upper portions of the Maulua Gulch property and the lowest portions of the HFU are within this ecological zone.

Montane wet ʻōhiʻa forest (4,000–5,000 ft): The ʻōhiʻa forest occurs on more moderate slopes than the lower elevation forest and has intermittent streams. It has more native bird diversity because it is above the range of most mosquitoes. A mature closed canopy of ʻōhiʻa reaches 60 to 90 feet above a middle canopy of trees and tree ferns. The understory is dominated by shrubs, mixed ferns, and sphagnum moss. This forest type predominates in lower portions of the HFU and remnants may exist in the upper portions of the Maulua Gulch and Koa Forest properties.

Montane wet koa/ʻōhiʻa forest (5,000–6,000 ft): The koa/ʻōhiʻa forest is characterized by moderate slopes, intermittent streams, and substantial native and endangered species populations. Much of this habitat has been used for grazing. Trees, shrubs, and mixed ferns dominate below a mixed age-class forest canopy of koa and ʻōhiʻa. The wet koa/ʻōhiʻa forest is potential habitat for koloa maoli, ʻōpeʻapeʻa, and most species of native forest birds. This forest type generally occurs above the elevation of the Maulua Gulch and Koa Forest properties but it may occur in ravines and protected sites.

Montane mesic koa forest (6,000–6,600 ft): Much of this forest has been converted to nonnative grassland, where historically it was composed of koa, shrubs, ferns, epiphytes, and native grasses. This type dominated the upper portion of the HFU and has been the focus of forest restoration efforts. It provides potential habitat for nēnē (Hawaiian goose), ʻōpeʻapeʻa, and ʻio (Hawaiian hawk). Several species of native forest birds are found in the reforested areas. This forest type is above the elevation of the Maulua Gulch and Koa Forest properties, but was likely a dominant type on the lower portions of the Kūkaʻiau Ranch study area, an area that was cleared for rangeland and planted to nonnative pasture grasses. However, at Kūkaʻiau Ranch remnant koa trees occur in ravines and would provide a local seed source for forest restoration. Much of the lower elevation pasture is infested with Madagascar ragwort (*Senecio madagascariensis*); restoration efforts are likely to be complicated by this invasive weed that is poisonous to livestock (Motooka and others 2004).

Māmane forest (5,900–9,500 ft): The māmane forest, occurring on Mauna Kea, supports the palila, a federally endangered bird. This rare forest type is threatened by ungulates. Minor amounts of māmane forest occur on the HFU and the palila is not currently known from the HFU. The upper part of the western parcel at Kūkaʻiau Ranch property between 5,900 and 8,400 feet has māmane forest; upper areas of both parcels are currently dominated by Kikuyu grass (*Pennisetum clandestinum*) and

are potentially restorable to māmane forest. Remnant māmane trees would provide a local seed source for restoration and a viable seed bank likely remains in the soil (Pacific Forestry Consultants 2010).

Leeward Slope of Mauna Loa Habitats. Three main habitats characteristic of the leeward, drier, western side of the island occur in this area, which includes the KFU and the McCandless Ranch study area. From lowest to highest elevation, they are:

Montane wet ʻōhiʻa forest (2,000–3,000 ft and 3,500–4,500 ft): This forest type occurs in two elevation bands which differ in three main respects. The upper band receives less rainfall, has higher plant diversity in the mid-canopy, and the ground cover is dominated by grasses compared to herbs in the lower band. Due to the lack of mosquitoes and increased plant diversity, the upper portion of this forest type supports a diverse native forest bird community. The ʻōpeʻapeʻa and several endangered plants occur in this forest habitat (Service 2011).

Montane mesic koa/ʻōhiʻa forest (4,500–5,800 ft): Forest habitat in this elevation range is dominated by mixed age trees of koa and ʻōhiʻa. The middle canopy is dominated by a mix of trees; ferns, tree ferns, and epiphytes also occur (Service 2011). The montane mesic forest provides potential habitat for several endangered species including ʻōpeʻapeʻa, the ʻalalā, picture-wing flies, and various plants (Service 2011).

Native dry koa/ʻōhiʻa/māmane forest (5,800–6,100 ft): This dry forest occurs at the upper elevations of the KFU on Honokua lot 4, and also on the Kahuku lots mauka of the unit. It is potential habitat for the ʻalalā, ʻōpeʻapeʻa, endangered plants, and endangered invertebrates. Native birds including the ʻakiapōlāʻau, Hawaiʻi ʻākepa, and Hawaiʻi creeper occur in this habitat (Service 2011).

Lava Tubes and Lava Tube Skylights (subterranean): While not known to have any endangered obligate species, lava tubes and skylights contain ferns, birds, mammals, and rare invertebrates. These habitats are less susceptible to nonnative species because of the specialization required to exist in them, but the entrance and twilight zones are still affected by nonnative species (Service 2011).

Conservation Study Area Habitat Types: Virtually all of the 13,130 acres of the Koa Forest property are forested with the lower portion being a mixed koa/ʻōhiʻa forest and the upper portion being predominantly ʻōhiʻa forest (Figure 6). About one-third, or about 700 acres, of the Maulua Gulch property is forested, with the remaining makai 1,400 acres having been cleared for agriculture (Figure 6). The Kūkaʻiau Ranch parcels were largely cleared of trees when it was converted to pasture, although about 250 acres of a lower-stature ʻōhiʻa forest with koa and māmane remains mauka, primarily in the uppermost paddock (Figure 6, Pacific Forestry Consultants 2010); in addition, patches of trees remain in gulches throughout both parcels. At McCandless Ranch, all of the Honokua lots, in total about 3,887 acres, are heavily forested with either ʻōhiʻa or a mixed koa/ʻōhiʻa forest. The mauka Kahuku lots, about 6,256 acres in total, at McCandless Ranch include dry subalpine koa/ʻōhiʻa/māmane forest mixed with a native shrubland with sparse ʻōhiʻa. At the highest elevations on the Kahuku lots, vegetation is very sparse to absent, especially on the lava flows (Figure 6).

3.6.3 Endangered Species

3.6.3.1 Endangered Forest Birds

All federally listed forest birds that occur within the HFU or KFU are endangered and include ʻakiapōlāʻau, Hawaiʻi ʻākepa, Hawaiʻi creeper, ʻōʻū, ʻalalā, and ʻio. None of the endangered forest birds have designated critical habitat.

ʻAkiapōlāʻau (*Hemignathus munroi*). The ʻakiapōlāʻau is a medium-sized, stocky, short-tailed Hawaiian honeycreeper endemic to the Island of Hawaiʻi. It was listed on March 11, 1967 (32 FR 4001). It was once distributed virtually island-wide, but by the 1970s it was found only in five disjunct populations (Scott and others 1986). The largest population is thought to be in the North Hāmākua area where the HFU protects about 50 percent of the estimated local population of 1,600 birds (Camp and others 2003). The highest densities of ʻakiapōlāʻau are at upper elevation areas with high-stature koa forest and heterogeneous habitats along the forest margins (Camp and others 2003). Despite the availability of apparently suitable habitat, ʻakiapōlāʻau are absent from most areas below 4,500 feet, where mosquitoes are common (Service 2006). The dispersal behavior of ʻakiapōlāʻau is poorly known, but habitat fragmentation may isolate populations, decrease the effective population size, and hinder recolonization of areas previously inhabited (Service 2006). ʻAkiapōlāʻau were observed on McCandless Ranch in 1998 (Jacobi and Bruegmann 1998), but were not detected in recent field surveys in central Kona (Service 2008a).

Hawaiʻi ʻākepa (*Loxops coccineus coccineus*). The Hawaiʻi ʻākepa is a small Hawaiian honeycreeper endemic to the Island of Hawaiʻi. It was listed on October 13, 1970 (35 FR 16047-16048). This species is an obligate cavity nester with most nests placed in natural cavities found in old-growth ʻōhiʻa and koa trees. It is currently known from five disjunct populations; an estimated 8,300 birds occur in the North Hāmākua area with 72 percent of these protected by the HFU where they are locally common (Service 2011). Breeding densities at HFU appear to be limited by the availability of nest sites (Hart 2000) and the population may be at or near carrying capacity with respect to food availability (Fretz 2002). The species is not found below 4,300 feet, presumably due to the presence of mosquitoes (van Riper III and others 1986, van Riper III and Scott 2001). Hawaiʻi ʻākepa were observed on McCandless Ranch (Jacobi and Bruegmann 1998) and birds have been regularly detected on the KFU since 1999 (Service 2008a).

Hawaiʻi creeper (*Oreomystis mana).* This bird is a small, inconspicuous honeycreeper endemic to the Island of Hawaiʻi. It was listed on October 28, 1975 (40 FR 17590-17591). Hawaiʻi creepers were known historically from ʻōhiʻa and ʻōhiʻa/koa forests throughout the island, usually above 3,600 feet in elevation (Service 2011). By 1979, this bird was confined to four disjunct populations with two near Kona, one near Kaʻū, and the fourth on the Hāmākua Coast; the latter population is the largest with an estimated 17,800 birds (Camp and others 2003), of which 49 percent are protected within the HFU where it occurs in montane wet ʻōhiʻa forest, mesic koa/ʻōhiʻa forest, and dry koa/ʻōhiʻa/māmane forest. Its densities are highest in the upper elevation high-statureʻōhiʻa forest (Service 2011). The Hawaiʻi creeper was present on McCandless Ranch in 1998 (Jacobi and Bruegmann 1998) and has been detected at the KFU as recently as 2006; no population or density estimates are available (Service 2011).

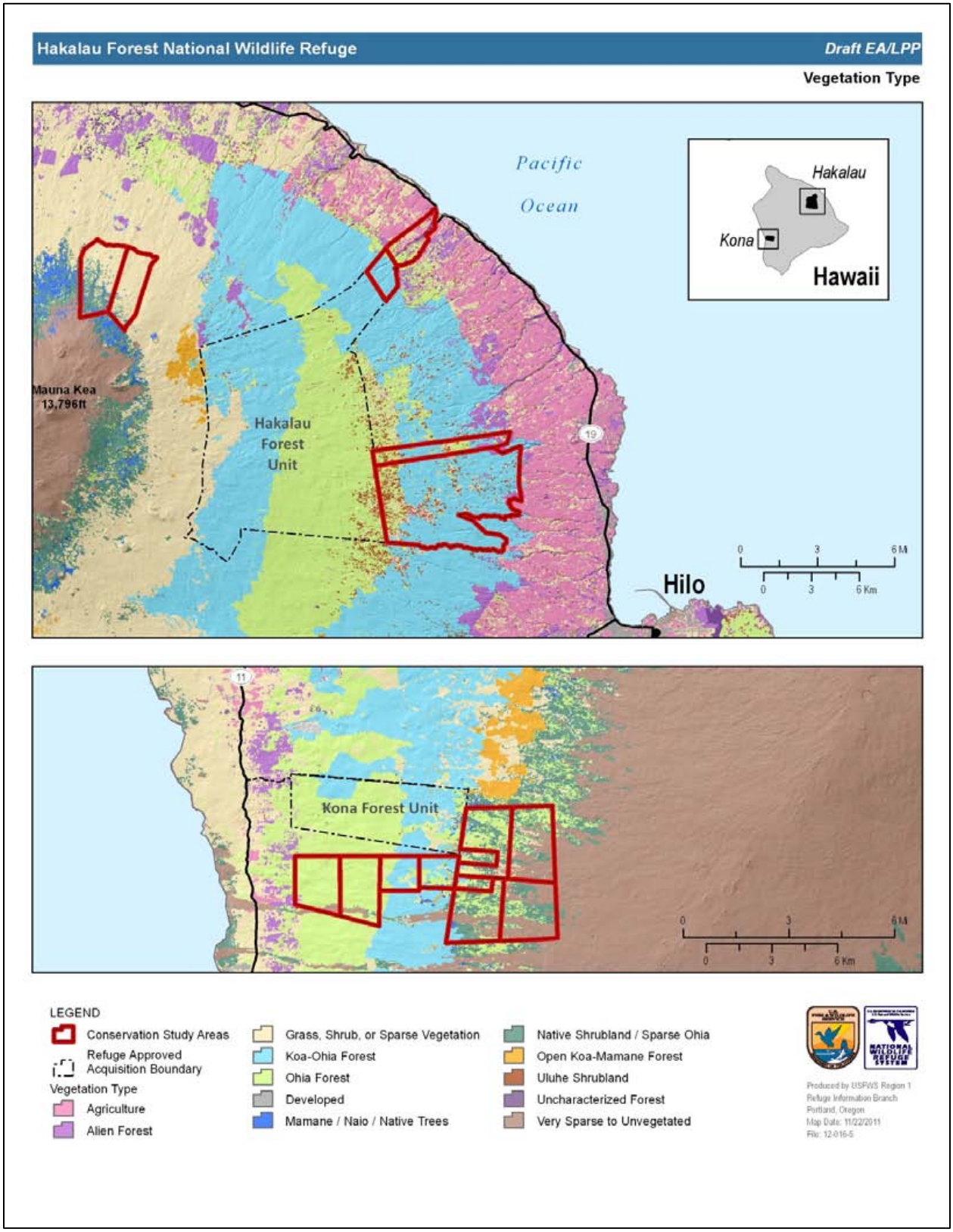

Figure 6. Vegetation of the HFU, KFU, and the study areas.

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ʻŌʻū (*Psittirostra psittacea*). The ʻōʻū is a heavy-bodied Hawaiian honeycreeper that was listed on March 11, 1967 (32 FR 4001). It was common historically on many of the larger islands of Hawaiʻi but is now one of the rarest birds and may be extinct, although survey efforts have been insufficient to determine its status (Service 2006). The ʻōʻū occurred in a wide range of forest types, but dense ʻōhiʻa forests with ʻieʻie (*Freycinetia arborea*) were considered to be preferred habitat (Service 2006, Snetsinger and others 1998). A few ʻōʻū were observed on the HFU during the 1977 bird survey in the lower reaches of the Refuge in montane wet ʻōhiʻa and mesic koa/ʻōhiʻa forests. Unconfirmed detections have been reported since that time, including a possible sighting in the mid-1990s and a possible audio detection 4 to 5 years ago (Service 2011). ʻŌʻū are not known from the KFU (Service 2011).

ʻAlalā (*Corvus hawaiiensis*). The ʻalalā is a medium-sized crow endemic to the Island of Hawaiʻi. It was listed on March 11, 1967 (32 FR 4001). It was historically restricted to a belt of dry woodlands and mesic ōhiʻa and ōhiʻa/koa forests at mid-elevations on the western and southern sides of the island where it occurred in large numbers. The last wild ʻalalā was observed in 2002 (Service 2009c), and it is believed to persist only in captivity. All captive ʻalalā are maintained by the San Diego Zoological Society in facilities on the Islands of Hawaiʻi and Maui. About 77 birds are currently in captivity and repatriation into the wild is being considered. The KFU is one of the areas being considered for repatriation. McCandless Ranch was home to the last wild population of ʻalalā.

ʻIo (*Buteo solitarius*). The ʻio is a small, broad-winged hawk endemic to the Hawaiian Islands and known historically only from the Island of Hawaiʻi. It was listed on March 11, 1967 (32 FR 4001); at that time, its population was thought to number in the low hundreds due to extensive destruction of native forests. In a 2007 island-wide survey, the ʻio was estimated to have a population of more than 3,000 birds. ʻIo have been recorded nesting in both the HFU and KFU (Service 2011) and were reported from the McCandless Ranch (Jacobi and Bruegmann 1998). In 2009, the Service proposed to delist the ʻio due to evidence that the hawk is broadly distributed throughout the Island of Hawaiʻi, its numbers had been stable for more than 20 years, it nests and forages successfully in native and disturbed habitats, large areas of habitat have been protected, and the hawk was not otherwise been threatened with extinction (73 FR 45687). A post-delisting monitoring plan has been drafted and public comments have been solicited and received. Delisting is currently under review (Service 2011). ʻIo are also frequently seen hunting on the Kūkaʻiau Ranch (DLNR 2011b). ʻIo have also been observed flying above upper portions of the Koa Forest property (Terry 2002).

Palila *(Loxioides bailleui).* The palila is one of the larger Hawaiian honeycreepers. It was listed on March 11, 1967 (32 FR 4001). Although fossil remains found on Oʻahu suggest that it was once more widespread, the palila is known historically only from the Island of Hawaiʻi where it is restricted to māmane/naio (*Myoporum sandwicense*) dry forest on the upper slopes of Mauna Kea. It feeds almost exclusively on the immature seeds of the māmane tree. Annual monitoring of the species began in 1980. An estimated population size of 5,337 birds in 2005 had declined to 2,640 in 2008 (Service 2009d). From 2003 to 2007 the estimated number of birds on the southwestern slope of Mauna Kea had declined by 58 percent, the first statistically significant decline since monitoring began (Service 2009d). Palila are not known to occur on either the HFU or KFU. But the upper portion of the tracts under consideration at Kūkaʻiau Ranch is within federally designated critical habitat for the palila (DLNR 2011b).

3.6.3.2 Endangered Waterbirds

All federally listed waterbirds that occur within the HFU or KFU are endangered and include nēnē, koloa maoli, and ʻalae keʻokeʻo. None of the endangered waterbirds has designated critical habitat.

Nēnē (*Branta sandvicensis*). The nēnē is a medium-sized goose endemic to the Hawaiian Islands. It was listed on March 11, 1967 (32 FR 4001). In 1951, the wild nēnē population was estimated at 30 individuals, but all populations have been augmented by captive-bred birds. As of 2009, the total population was estimated between 1,877 and 1,927 birds with 446 birds on the Island of Hawaiʻi (Service 2011). At the HFU, the 2007 population was estimated to be about 200 birds. They prefer lowland dry forests, shrublands, grasslands, and montane dry forests. Nēnē are found at higher elevations of the HFU in pastures around the cattle ponds and in the vicinity of the administrative site. Nēnē do not occur at the KFU (Service 2011).

Koloa maoli (*Anas wyvilliana*). The koloa maoli is a small duck endemic to the Hawaiian Islands. It was listed on March 11, 1967 (32 FR 4001). Once extirpated from the Island of Hawaiʻi, it is now estimated that 200 of the statewide population of 2,200 birds occur there. The koloa maoli is found up to 10,000 feet in elevation and inhabits and breeds in streams and ponds on the HFU. Due to lack of surface water at the KFU, it is not likely to occur there (Service 2011).

ʻAlae keʻokeʻo (*Fulica alai*). The ʻalae keʻokeʻo, or Hawaiian coot, is a small waterbird endemic to Hawaiʻi. It was listed on October 13, 1970 (35 FR 16047-16048). The population is estimated to be 2,000 to 4,000 individuals and is considered stable. Eighty percent of the population occurs on Kauaʻi. They use freshwater and brackish wetlands, which can include agricultural wetlands and aquaculture ponds; they also graze on grass adjacent to the wetlands. Although rare, ʻalae keʻokeʻo are known from ponds on the HFU (Service 2011). They are not likely to occur on the KFU due to lack of surface water.

3.6.3.3 Endangered Mammal

ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*). The Hawaiian hoary bat was listed on October 13, 1970 (35 FR 16047-16048). The abundance of this endangered mammal is unknown, although there are regular sightings on the Islands of Hawaiʻi, Kauaʻi, and Maui. The ʻōpeʻapeʻa feeds on night-flying insects, including moths, beetles, crickets, mosquitoes, and termites. ʻŌpeʻapeʻa have been sighted everywhere from sea level to 13,000 feet, and are thought to migrate to high elevations January through April, then give birth at lower elevations during the summer months. Within the HFU, bats are found at Pua ʻĀkala, Maulua, and Upper Maulua Pond (Service 2011). Echolocation data show that the HFU is an important foraging site for the ʻōpeʻapeʻa (Menard 2001, Bonaccorso 2008). ʻŌpeʻapeʻa have also been seen within the KFU, although little is known about their foraging or roosting habits there (Service 2008a). It is probable that ʻōpeʻapeʻa utilize resources within the Koa Forest property on at least a seasonal basis (David 2002).

3.6.3.4 Endangered and Threatened and Candidate Plants

Fourteen federally endangered plants, one federally threatened plant, and one federal candidate plant are known to occur on the Refuge. Of the 14 endangered plants, half are members of a group collectively known as the Hawaiian lobeliads. These are members of the Bluebell Family (Campanulaceae), of which three are in the endemic genus *Clermontia* and the remaining four are in

the endemic genus *Cyanea*, that represent one of the most spectacular examples of adaptive radiation (Givnish and others 2009, Lammers and Freeman 1986). In general, lobeliads are shrubs or single-stemmed plants capped by rosettes of leaves that are often large and strap-like; the flowers are showy and have floral tubes that are usually long and curved. They include high-elevation bog rosettes, cliff succulents, forest and bog shrubs and trees, and a few epiphytes and vine-like species that vary strikingly in floral form and leaf shape (Givnish and others 2009). All *Clermontia* are shrubs or shrublike and tend to cluster around natural openings in wet forests, which makes them more susceptible to disturbance by ungulates. Most *Cyanea* have single, unbranched stems, and some are tall and palm-like in appearance (Sohmer and Gustafson 1987). Two others of the 14 endangered plants are in the endemic Hawaiian genus *Phyllostegia* of the mint family (Lamiaceae) and have flowers associated with insect pollination (Lindqvist and Albert 2002, Lindqvist and others 2003).

***Asplenium peruvianum* var. *insulare* (=*A. fragile* var. *insulare*).** This short-lived perennial fern was listed as endangered on September 26, 1994 (59 FR 49025). It occurs in ʻōhiʻa dry forest, ʻaʻaliʻi (*Dodonea viscosa*) dry montane shrubland, naio-māmane dry montane forest, and koa/ʻōhiʻa forest, as well as subalpine dry forest and shrubland. It grows almost exclusively in large, moist lava tubes from 10 to 15 feet in diameter, pits, deep cracks, and lava tree molds, with at least a moderate soil or ash accumulation, associated with mosses and liverworts (68 FR 39666-39667, July 2, 2003). The single unit of critical habitat designated for this species on the Island of Hawaiʻi lies outside of the study areas on the southeastern slope of Mauna Loa (68 FR 39647, 39666). At the time critical habitat was designated, however, there were 36 known occurrences of *Asplenium peruvianum* var. *insulare* on the Island of Hawai'i (68 FR 39625). Known occurrences range between 5,413 and 7,218 feet in elevation (Palmer 2003). It is known to occur on the KFU (Service 2011) and has been found at higher elevations on McCandless Ranch (Jacobi and Bruegmann 1998).

Clermontia lindseyana. This is a branched shrub or small tree endemic to the Islands of Hawaiʻi and Maui that was listed as endangered on March 4, 1994 (59 FR 10305-10325). The common name often used for species in this genus is ʻoha wai. It is typically 8 to 20 feet in height, and grows from the ground or as an epiphyte. At the time that the recovery plan was released, 11 populations with a total of 86 individuals were known to occur between 4,860 and 6,200 feet on the Island of Hawaiʻi (Service 1996). At the HFU, wild individuals occur in the Upper Maulua, Lower Honohina Tract, and the Hakalau Tract; in addition, an estimated 988 propagated individuals were outplanted between 1998 and 2008 (Service 2011). Of the 10,459 acres of designated critical habitat for *C. lindseyana*, 2,202 acres are within the HFU (68 FR 39623-39672).

Clermontia peleana. This is an epiphytic shrub or small tree endemic to the Islands of Hawaiʻi and Maui (where it is now presumed extirpated) that was listed as endangered on March 4, 1994 (59 FR 10305-10325). It is typically 5 to 20 feet tall. At the time of listing, six wild populations with a total of about eight individuals were known to occur in montane wet ōhiʻa forests on the Island of Hawaiʻi; only a single wild individual is now known (Service 2008b). One unit of the 38,664 acres of designated critical habitat for *C. peleana* lies mostly within the HFU, but no wild individuals are known to occur there. In December 2008, in coordination with the Plant Extinction Prevention Program, over 800 propagated individuals were outplanted at about 5,000 feet in six areas of the HFU (Service 2011).

Clermontia pyrularia. This is a terrestrial tree endemic to the Islands of Hawaiʻi and Maui (where it is now presumed extirpated) that was listed as endangered on March 4, 1994 (59 FR 10305-10325). It is 9.8 to 13 feet in height. It was known from montane wet and mesic ʻōhiʻa and koa forests in

North Hilo, including on State land at Pīhā adjacent to the HFU. Subalpine dry forests dominated by ōhi‘a can also provide suitable habitat. It grows best between 3,000 and 7,000 feet. Much of the 6,823 acres of designated critical habitat for *C. pyrularia* lies within the HFU, but no wild individuals were known to occur there at the time of designation. A total of 846 propagated individuals have been outplanted within the HFU (Service 2011).

Cyanea hamatiflora* ssp. *carlsonii. This is a palm-like tree, 9.8 to 26 feet tall, endemic to the Island of Hawai‘i that was listed as endangered on March 4, 1994 (59 FR 10305-10325). At the time of listing, it was known from only 2 populations with an estimated total of 19 individuals on the western and southwestern slopes of Mauna Loa. The populations were in degraded montane wet koa/‘ōhi‘a forests between 4,000 and 5,700 feet in elevation and have since declined in size and are comprised primarily of mature individuals (Service 2009a). Although no plants have been found on the KFU, it is key potential habitat for reintroduction. Of the 2,583 acres of critical habitat designated for the species, 57 percent (1,475 acres) lies within the KFU (68 FR 39624-39761).

Cyanea platyphylla. This is an unbranched, palm-like shrub, 3 to 10 feet tall, endemic to the Island of Hawai‘i that was listed as endangered on October 10, 1996 (61 FR 53137-53153). At the time of listing, only a single population with five mature individuals and two juveniles was known to exist. The habitats for this species are lowland and montane koa forests between 390 and 3,000 feet. At the time two units of critical habitat comprising 7,234 acres were designated, six occurrences were known (68 FR 39624-39761). No individuals are known from the Refuge.

Cyanea shipmanii. This is a short-lived, unbranched or few-branched shrub endemic to the Island of Hawai‘i that was listed as endangered on March 4, 1994 (59 FR 10305-10325). At the time of listing, fewer than 50 wild individuals were known. The range of this species is centered on the eastern slope of Mauna Kea in montane wet ‘ōhi‘a and mesic koa/‘ōhi‘a and koa forests from 5,400 to 6,200 feet. By 2008, only four individuals remained in the wild (Service 2009b). Of the 6,088 acres of critical habitat that has been designated for *C. shipmanii*, over 64 percent occurs within the HFU. From 1999 to 2008, 711 propagated individuals were outplanted within the HFU (Service 2011).

Cyanea stictophylla. This is a shrub or tree 2 to 20 feet tall endemic to the Island of Hawai‘i that was listed as endangered on March 4, 1994 (59 FR 10305-10325). At the time of listing, it was known from 3 populations with a total of 15 individuals in montane wet ‘ōhi‘a and mesic koa/‘ōhi‘a forests between 2,500 and 6,400 feet. Two individuals were known to occur on the KFU, but were thought to have died from rat damage in 2007 (Service 2011). Four critical habitat units have been designated for a total of 95,484 acres (68 FR 39624-39761). It has also been documented on McCandless Ranch (Jacobi and Bruegmann 1998).

Cyrtandra tintinnabula. Commonly known as ha‘iwale, this is a shrub in the Gesneriad Family (Gesneriaceae), 3.6-6.6 feet tall, endemic to the northern to eastern slopes of Mauna Kea that was listed as endangered on March 4, 1994 (59 FR 10305-10325). At the time of listing, 3 populations were known with about 18 individuals. It typically grows in lowland wet koa and ‘ōhi‘a forests with hāpu‘u (tree fern). Two critical habitat units comprising 6,672 acres have been designated for this species (68 FR 39624-39761). Efforts to germinate seeds and propagate this species at the Refuge greenhouse have not been successful (Service 2011).

Nothocestrum breviflorum. This is a long-lived tree in the Nightshade Family (Solanaceae) endemic to the Island of Hawai‘i that was listed as endangered on March 4, 1994 (59 FR 10305-10325). At

the time of listing, it was known from 3 populations with an estimated total of 53 individuals. In 1996 there were an estimated six populations restricted to the western side of the island with few individuals in each population. By the time critical habitat was designated in 2003, it was known from 66 occurrences (68 FR 39646). It typically grows in koa and ʻōhiʻa lowland dry or montane dry or mesic forests. Three critical habitat units totaling 12,708 acres have been designated for this species (68 FR 39624-39761). It is not known to occur on the KFU but has been documented to occur on McCandless Ranch (Jacobi and Bruegmann 1998).

Phyllostegia racemosa. Commonly known as kīponapona, this climbing vine in the Mint Family (Lamiaceae) endemic to the Island of Hawaiʻi was listed as endangered on October 10, 1996 (61 FR 53137-53153). At the time of listing there were 3 populations with a total of 25-45 individuals on the eastern slopes of Mauna Kea and Mauna Loa, where it occurs in montane wet or mesic koa and ʻōhiʻa forests with hāpuʻu between 4,650 and 6,070 feet in elevation. Over 2,317 acres of critical habitat has been designated on the HFU. Over 1,043 propagated individuals of kīponapona have been outplanted at the HFU (Service 2011).

Phyllostegia velutina. Like the previous species, this climbing vine in the Mint Family (Lamiaceae) is endemic to the Island of Hawaiʻi and was listed as endangered on October 10, 1996 (61 FR 53137-53153). At the time of listing, 2 populations were known with a total of 25 to 50 individuals. It occurs on various eastern slopes of Mauna Kea and on the southern slopes of Hualālai. It occurs in montane wet or mesic koa and ʻōhiʻa forests between 4,900 and 6,000 feet in elevation. Ten populations with 63 to 116 individuals were known in 2003 when 9,009 acres of critical habitat was designated (68 FR 39623-39672). A single wild plant is known to occur in a gulch on the HFU, where 112 propagated plants were outplanted from 1999 to 2007 (Service 2011). It was documented on the McCandless Ranch (Jacobi and Bruegmann 1998) and may occur on the KFU. A single individual of this species was encountered in 2001 on the Koa Forest property during vegetation surveys (Koa Timber, Inc. 2003). No critical habitat has been designated at either Refuge unit.

Portulaca sclerocarpa. This perennial herb with succulent leaves in the purslane family (Portulacaceae), known by the common name poʻe, occurs on the Island of Hawaiʻi and in one population on Lānaʻi. It was listed as endangered on March 4, 1994 (59 FR 10305-10325). At that time, there were 11 populations with an estimated 72-122 individuals known from the Island of Hawaiʻi. It grows in weathered Mauna Kea soils, on cinder cones, or on younger lavas. There are currently an estimated 24 occurrences of poʻe on Hawaiʻi Island. One population in Hawaiʻi Volcanoes National Park (HVNP) is estimated to have 900 individuals (68 FR 39624). The critical habitat unit for poʻe includes 10,848 acres of HVNP, but no critical habitat has been designated at either Refuge unit. No poʻe have been found at the KFU although it is known from an adjacent area (Service 2011).

Sicyos macrophyllus. This perennial vine, with stems up to 49 feet, known as ʻanunu, is a candidate species for Federal listing with a listing priority number of 2 (Service 2010b). It was historically known to occur on the Islands of Hawaiʻi and Maui. All 10 populations currently known are from Hawaiʻi Island and have an estimated total of 24-26 individuals. Its typical habitat is wet ʻōhiʻa forest and subalpine mamāne-naio forests at elevations between 4,000 and 6,600 feet (75 FR 69280). One population is known from the KFU (Service 2010). ʻAnunu may also occur on the Kūkaʻiau Ranch parcels under consideration (DLNR 2011b).

Silene hawaiiensis. This sprawling shrub endemic to the Island of Hawai‘i was listed as threatened on March 4, 1994 (59 FR 10305-10325). At the time of listing, it was known to occur in 17 populations with an estimated total of 2,600-2,700 individuals. In 2003, 156 occurrences had been documented, including an estimated 5,651-5,751 individuals in HVNP, where 6,908 acres of critical habitat were designated. No critical habitat has been designated at either Refuge unit. It typically occurs within montane and subalpine dry shrubland on weathered lava, various aged lava flows, and cinder substrates (68 FR 39623-39672). No individuals are known from the Refuge, although it is known to occur at 7,000-10,000 feet in elevation mauka of the HFU.

3.6.3.5 Endangered and Threatened and Candidate Invertebrates

Of more than 600 species of the genus *Drosophila* (picture-wing flies) endemic to Hawai‘i, 11 are federally listed as endangered, 1 is federally listed as threatened, and 1 is a Federal candidate species. Two of the endangered flies, the threatened fly, and the candidate are known to occur on the Island of Hawai‘i. One of the endangered picture-wing flies, *D. heteroneura,* is known to occur on the Refuge and is discussed in more detail below. The other three picture-wing flies could potentially occur on the Refuge.

Drosophila heteroneura. This picture-wing fly is endemic to the Island of Hawai‘i and was listed as endangered on May 9, 2006 (73 FR 73794-73895). It is restricted to montane wet ‘ōhi‘a forests on the west side of the island. *Drosophila* surveys were conducted in 1999 and 2000 at the KFU and 37 percent were identified as *D. heteroneura*, making it the most abundant picture-wing fly on the Refuge unit. The population of *D. heteroneura* on the KFU is the only known extant population of this species (Haines and Foote 2005). Five critical habitat units comprising a total of 4,582 acres have been designated for this species (73 FR 73794-73895). Of these total acres, nearly 80 percent (3,604 acres) are within the KFU.

3.6.4 Other Native Species and Special Ecosystems

Forest Birds. In addition to the federally listed bird species described above, Hawai‘i Island has a diverse population of other native forest birds. Other native birds include the ‘i‘iwi (*Vestiaria coccinea*), common ‘amakihi (*Hemignathus virens*), ‘apapane (*Himatione sanguine*), Hawai‘i ‘elepaio (*Chasiempis sandwichensis*), ‘ōma‘o (*Myadestes obscurus*), and pueo (*Asio flammeus sandwichensis*). While most of the native birds have historic ranges including most of the island, native birds now rarely live below an elevation of 4,500 feet because of the presence of nonnative mosquitoes and associated diseases. However, certain native forest birds, particularly the common ‘amakihi, are developing a resistance to avian malaria and are expanding their habitat to include the lower elevations of their old range. Many of the native birds join interspecies foraging flocks, including the ‘akiapōlā‘au, Hawai‘i creeper, Hawai‘i ‘ākepa, Hawai‘i ‘amakihi, and palila. The forest birds feed on a variety of forest resources including nectar, fruits, sap, and invertebrates. Some birds, such as the common ‘apapane and ‘elepaio, still survive in habitat modified by nonnative plants. The ‘i‘iwi and common ‘amakihi avoid nonnative forests, and the ‘apapane migrates throughout the area, following the ‘ōhi‘a bloom. The pueo hunts in grasslands.

‘Apapane, ‘ōma‘o, and ‘elepaio were seen or heard during invertebrate surveys of the Koa Forest property in 2002 (Montgomery 2002). The Kūka‘iau Ranch parcels are home to ‘amakihi, pueo, and kolea (*Pluvialis fulva,* Pacific golden plover) (DLNR 2011b). ‘Apapane, ‘elepaio, ‘amakihi, and

ʻiʻiwi were reported to occur on McCandless Ranch; of these, ʻapapane and ʻamakihi were most common (Jacobi and Bruegmann 1998).

Invertebrates. Invertebrates include a variety of groups including snails (Gastropoda) and arthropods (Arthropoda) such as beetles (Coleoptera), true bugs (Hemiptera and Homoptera), and moths/butterflies (Lepidoptera). The State of Hawaiʻi is home to over 5,000 endemic insects, including over 600 species of picture-wing flies. The majority of the 5,732 native arthropod species are insects. Most of these insects are beetles and flies.

Many endemic invertebrate species have been found on the HFU, including the koa bug (*Coleothichus blackburniae*, Heteroptera: Scutellaridiae) (a species of concern), at least 50 species of arthropods, 4 damselfly species (Genus *Megalagrion*, Odonata: Coenagrionidae), 23 species of weevils (Genus *Proterhinus*, Coleoptera: Aglycyderidae), 3 species of long-horned beetles (*Plagithmysus*, Coleoptera: Cerambycidae), 8 species of inchworm (*Scotorythra*, Lepidoptera: Geometridae), 10 yellow-faced bee species (*Hylaeus*, Hymenoptera: Colletidae), and 2 native mollusks (*Succinea cf. ceputlla*, Succindidae, and *Tornatellides* sp., Achatinellidae) (Service 2011).

Surveys of the KFU have found six species of picture-wing flies; the cave carabid ground beetle, root moths, and a fruit moth in lava caves; five species of weevils, three species of long-horned beetles, eight species of moths, a click beetle (*Eopenthes cf cognatus*, Coleoptera: Elateridae), and ten yellow-faced bees species (Service 2011). It should be noted that these were only partial surveys and the total number of endemic invertebrates on the Refuge is likely to be much higher.

Among the invertebrate species of interest on the Koa Forest property are evidence of all three native genera of long-horned beetles, including the native monotypic beetles *Parandra puncticeps* and *Megopsis reflexa.* The distinctive tunnels of *Plagithmysus* sp., grubs and a native sphingid moth (*Hyles wilsoni wilsoni*) endemic to the Island of Hawaiʻi were also found (Montgomery 2002). Rare invertebrate species believed to occur on the Koa Forest property, because of similarity of habitats to known areas of occurrences, include *Drosophila mulii*, *Nesotocus munroi*, and *Plagithmysus claviger*; in addition, a rare native terrestrial mollusk *Succinea* cf. *thaanumi* was reported from the Koa Forest property (Montgomery 2002).

Rare native invertebrates to be expected on the parcels based on their known presence in similar habitat on the adjacent Mauna Kea Forest Reserve include an undescribed damsel bug (*Nabis* n. sp.), a flightless brown lacewing (*Micromus usingeri*), a fruit fly (*Trupanea* nr. Pantosticta), a mirid bug (*Engyatatus* sp.), a stink bug (*Oechalia* sp.), and yellow-faced bees (*Hylaeus* spp.) (Pacific Forestry Consultants 2010). Other native arthropods observed on the Kūkaʻiau Ranch parcels include Blackburn's butterfly (*Udara blackburnii*), mirid bugs (*Orthotylus sophorae*), and exit holes of the long-horned beetle (*Plagithmysus blackburnii*) (Pacific Forestry Consultants 2010).

Surveys in other areas of the island have found that the optimal range for native arthropods is between 3,500 and 4,000 feet, which is lower in elevation than the majority of the HFU (Service 2011). The Koa Forest and Maulua Gulch properties, therefore, are likely to have a greater diversity of arthropods than the HFU. Native arthropod diversity tended to be highest at middle elevations of the KFU (Service 2011), suggesting that acquisition of the Honokua lots of McCandless Ranch, which include an elevation range comparable to the KFU, may enhance protection of native arthropods on the western side of the island.

Native Plants. Habitats on the Refuge conserve many native and indigenous plants with at least 87 and 35 species documented from the HFU and KFU, respectively; a list of native plants on the HFU and KFU can be found in Appendix A of the Hakalau Forest National Wildlife Refuge CCP (Service 2011). Among these are the dominant forest canopy species koa, ʻōhiʻa, and māmane. Moreover, the extensive restoration outplantings conducted over the past two decades have augmented not just endangered plant populations, but more common species as well. The outplantings have included more than 400,000 koa, 30,000 ʻōhiʻa, and many thousands of other tree, shrub, and vine species (Service 2011). Outplanting of propagated plants continues to this day and is a major strategy furthering the goals of the Refuge identified in the CCP (Service 2011). Rare native plants that are reported from the Kūkaʻiau Ranch include *Coprosma montana* (pilo), *Stenogyne microphylla* (Hawaiian mint), *Chamaesyce lolowaluana* (ʻakoko), *Dubautia arborea* (naʻenaʻe), *Bidens campylotheca* (koʻokoʻolau), *Chenopodium oahuense* (ʻāweoweo), *Argemone glauca* (pua kala), and (*Asplenium trichomanes* (ʻoāliʻī) (D:NR 2011b). Native plant species identified as rare that occur on the McCandless Ranch include *Cyanea marksii* (hāhā), *Cyrtandra menziesii* (haʻiwale), *Cystopteris douglasii* (no common name), *Phytolacca sandwicensis* (pōpolo kū mai), *Rubus macraei* (ʻākala), *Sanicula sandwicensis* (no common name), *Stenogyne macrantha* (no common name), *S. scrophularioides* (mōhihi), *Fragaria chilensis* ssp. *sandwicensis* (ʻōhelo papa), *Platydesma spathulata* (pilo kea), *Tetraplasandra hawaiiensis* (ʻohe), *Urera glabra* (ōpuhe), and *Xylosma hawaiiense* (maua) (Jacobi and Bruegmann 1998).

Aquatic Ecosystems. Gulches and ravines on the HFU have intermittent surface water flow following periods of heavy or continuous rain. Twelve streams have been identified on the HFU, some of which are perennial at lower elevations (Service 2011). Because the Koa Forest property is makai of the southernmost portion of the HFU, the lower reaches of four of these streams (Honoliʻi, Pāhoehoe, Kapue, and Kawainui) were included in an aquatic organism study conducted by the Hawaiʻi Biological Survey of the property (Englund and others 2002). Honoliʻi Stream was the largest stream examined in this study and includes large, deep pools intermixed with riffles and cascades and a waterfall at least 50 feet high. Numerous standing water habitats occur due to many seeps and springs that flow from the sides of the incised canyon. The upper portion of Pāhoehoe Stream flows through a forest of ʻōhiʻa and koa with many deep pools interspersed along a mostly lava bedrock channel. In contrast to most of the other sites surveyed, the upper Pāhoehoe stream had several smaller tributaries and streamlets that had habitats that differed from those of the main channel. The lower reach of Pāhoehoe Stream was large and had deep pools. The upper Kapue Stream passes through a diverse old growth ʻōhiʻa and koa forest and has rock ledges adjacent to the stream channel with standing water that provides ideal habitat for aquatic insects. The lower reach of Kapue Stream lies below a 100-foot waterfall, one of the tallest observed in the study. Near the boundary with conservation district land there is a large diversion, but the destination of the diverted water was unknown. Kawainui Stream was one of the smaller watersheds in the study area; it had a series of riffles and stairstep cascades about 8–10 feet high and a small channel only 2–3 feet wide in the shallow run and riffle areas.

The investigators found no federally listed or candidate aquatic animals in or around any of the major stream ecosystems they examined. They found, however, that the aquatic habitats in the area were some of the most pristine that remained in the State of Hawaiʻi and noted that the lack of any major alien aquatic fauna within these habitats was unusual. Moreover, they stated that the high percentage of native aquatic fauna, great densities of native aquatic species, and the high diversity of native taxa indicated that the aquatic habitats within the Koa Forest property contain some of the best remaining examples of endemic native Hawaiian aquatic biodiversity within the archipelago (Englund and

others 2002). The lower reaches of the streams that pass through the Refuge are also known to support native fishes (Tate 1996, Nishimoto and Kuamoʻo 1997).

As noted previously, there is no surface water on the KFU. The Kūkaʻiau Ranch parcels lie too high in the watershed to have more than intermittent surface flow during periods of high rainfall. Four prominent gulches cross the property with seasonal flow that contributes to subsurface flow and recharges groundwater (Pacific Forestry Consultants 2010). The upper reaches of Maulua Stream flow through the northernmost portion of the HFU and the stream itself forms one boundary of the Maulua Gulch parcels under consideration for potential acquisition.

Lava Tubes and Lava Tube Skylights. Special ecological features of the KFU and the adjacent McCandless Ranch property are lava tubes and lava tube skylights. Lava tubes are subterranean channels created by flowing molten lava, particularly pāhoehoe lava. When sections of lava tube roofs collapse, vertical-walled openings called skylights are created; the skylights serve as natural refugia where endangered or rare plants may persist without being damaged by herbivores (Service 2011). The cave environments are characterized by relatively moderate temperature and a light gradient that ranges from open sunlight at the entrance, through twilight and transition zones, to total darkness; each zone has unique biological characteristics (Howarth 1973).

3.6.5 Introduced Species

As noted previously, numerous species of mammals, birds, insects, reptiles, amphibians, plants, and other taxa have been introduced to the Hawaiian Islands, many of which are invasive. A thorough discussion of the introduced species and the threats they pose to the Refuge can be found in the CCP (Service 2011); a list of all native and nonnative plants and animals known from the Refuge can be found in Appendix A of the CCP (Service 2011). Most, if not all, of these same species are likely to occur on the tracts under consideration for potential addition to the Refuge. Numerous invasive plants have been documented to occur on the Koa Forest (Terry 2002), Kūkaʻiau Ranch (DLNR 2011b), and McCandless Ranch (Jacobi and Bruegmann 1998) properties. As is the case on the existing Refuge lands, any additions will require intensive control and management of invasive species, and thus will require additional operating funds to achieve land management goals.

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CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

4.1 Alternative A (No Action).

Under Alternative A, our no action alternative, no additional land would be added to the Refuge. A complete description of the no action alternative is provided in Chapter 2 of this document. A summary comparison of the no action alternative and the preferred alternative (Alternative B) is provided in Table 8.

4.1.1 Effects on the Physical Environment

4.1.1.1 Soils. Under Alternative A, existing uses of the proposed lands will continue with minimal to moderate adverse effects on soils. On lands zoned for agriculture, soil impacts such as compaction, trampling, and erosion will continue from use by farming equipment, cattle grazing, and vehicle use on range lands. Additionally, some development may occur with minimal to moderate adverse effects. Compaction, trampling, and soil erosion are expected at sites that are developed. The degree of impact would depend on the specific actions, size, and mitigation of any developments. For example, the timber operation on the Koa Forest property, which proposed only helicopter logging, stated that the only ground-disturbance would occur in staging areas which would be located on lands zoned for agriculture and that best management practices would be implemented to control erosion (Koa Timber, Inc. 2003). The no action alternative would not affect soils on the Refuge.

4.1.1.2 Hydrology and Water Resources. Not increasing land protection could result in less aquifer recharge within the East Mauna Kea and Southwest Mauna Loa ASEAs if the private lands under consideration are not owned or acquired by other entities interested in increased conservation management. If the currently forested areas of the Koa Forest, Maulua Gulch, and McCandless Ranch were to be used for timber production, surface runoff would likely increase and result in less water infiltration to recharge the groundwater. Although the parcels under consideration at Kūkaʻiau Ranch are included within a perpetual conservation easement, the terms of the easement allow for continued agricultural use. The portion of Maulua Gulch that is zoned for agriculture is currently fallow, but agricultural use could be renewed. Renewed agricultural use on the Maulua Gulch property or ongoing agricultural use on Kūkaʻiau Ranch could reduce infiltration and groundwater recharge if the existing vegetation is disturbed or removed. Such activities are likely to have minimal to moderate effects depending on the severity of the impact and any actions taken to mitigate the impact. The no action alternative would not affect the hydrology and water resources of the Refuge.

4.1.2 Effects on the Social and Economic Environment. Not expanding the Refuge acquisition boundary to include the lands under consideration is likely to have minimal effects on the social and economic environment of the Island of Hawaiʻi and local communities.

4.1.3 Cultural Resources. Cultural resources on the lands under consideration would remain subject to State and local regulation and permitting. Cultural resources could be adversely affected by various land uses or development. Activities not requiring permits could contribute to loss or damage of cultural resources, especially if they have not been identified. The effects would likely range from minimal to moderate, although losses of cultural resources could be permanent. The no action alternative would not affect cultural resources on the Refuge.

4.1.4 Recreation. Public access to the properties under consideration would not be affected by the no action alternative. Recreational public uses on the existing Refuge will continue to be managed in accordance with the recently completed CCP (Service 2011). At HFU, only the Upper Maulua Tract is open to the public on weekends and holidays by reservation for self-guided wildlife observation, birding, and photography. The HFU also hosts an annual open house, a 1-day public event celebrating the Refuge System, and the unit issues a limited number of special use permits (SUPs) each year for commercial wildlife observation opportunities. The KFU has never been opened to the public.

4.1.5 Effects on the Biological Environment

4.1.5.1 Endangered, Threatened, and Candidate Species. Most endangered, threatened, and candidate species face numerous threats including habitat loss, degradation, and fragmentation, among other factors. Additional land protection measures are a primary action identified in the recovery plans for most such species. As noted previously, the State submitted a grant proposal for the Kūkaʻiau Ranch parcels, but it was not funded. Under the no action alternative, this parcel could be resubmitted for funding or acquired by another entity. We are not aware of any alternative protection efforts for the other lands under consideration for addition to the Refuge in the foreseeable future. Time is critical to the recovery of listed species, many of which are now restricted to a portion of their former range and have much reduced populations. We conclude, therefore, that the no action alternative would have moderate adverse effects on the ability to recover these species.

4.1.5.2 Other Native Species and Ecosystems. Under Alternative A, no additional lands would be added to the Refuge. The parcels under consideration for acquisition are mostly undeveloped, but there is no commitment for protection or restoration of these areas. The lands would remain private and available for agricultural, residential, commercial, or industrial development activities that would negatively impact native species and ecosystems occurring there. Even if development did not occur, under this alternative there would not likely be any management to protect or restore habitats. Without management, the value of these lands for native species would decrease due to the increasing occurrence of nonnative plants and animals and loss of native habitats. Over time, this would have a moderate adverse effect on native species and ecosystems.

4.1.5.3 Habitat Protection and Open Space Preservation. When Hakalau Forest NWR was created in 1985 to conserve endangered animals and plants, the lands had been degraded from cattle grazing and logging. Most of the Refuge still had closed-canopy forest, with the most intact areas at lower elevations. Under the closed canopy forest, certain sections of the understory had also been disturbed by cattle, pigs, and rats. The mesic koa/ʻōhiʻa and koa/māmane forests were the most severely degraded. About 5,000 acres of forest, mostly above 6,000 feet, had been converted into open woodland and pasture dominated by introduced grasses. The last cattle permitted to graze at the Refuge were removed in 1996.

The primary focus for management of Hakalau Forest NWR lands is driven by the need to conserve the Refuge's forest, subterranean, riparian, aquatic, and grassland habitats that are in various stages of (1) degradation by pest plants and animals (most notably ungulates and invasive plants), (2) recovery from cattle grazing activities by past owners, and (3) restoration by Refuge staff. A strategic approach that also provides for watershed protection and connectivity to adjacent conservation lands is anticipated by the Refuge CCP (Service 2011). Under the no action alternative, Refuge lands will continue to be managed with an eye towards landscape level efforts by neighbors and agency

partners, but activities beyond the Refuge boundary will be less of a priority, and a lesser role for Refuge staff and resources is anticipated.

The initial management actions implemented by the Refuge included surveys (forest bird, native plant, weed, and ungulate), construction of ungulate-proof fences, ungulate removal, weed control, and reforestation (outplanting of koa) and reforestation research focused on techniques (mainly with assistance of the USFS Institute of Pacific Islands Forestry (IPIF). Due to the remote location of the Refuge, a cabin and storage building as well as water catchment systems had to be constructed to support Refuge operations. Over the years, other parcels of the Refuge (Pua ʻĀkala, Middle Papaikou, Middle Hakalau, and other lands) were acquired so that today the HFU is 33,946 acres. Refuge infrastructure includes existing ranch sites and structures present at acquisition, an administrative area with staff cabins, volunteer quarters, a greenhouse for propagation of native forest plants for outplantings, a garage/tool shed, and a maintenance storage facility.

In 1997, the KFU was established when 5,300 acres were purchased, bringing the total Refuge acreage to 39,246 acres. The KFU was established specifically for the endangered ʻalalā, as well as other listed species (Service 1997). Cattle grazing had created pastures in some of the upper elevations. Above the 6,000-foot elevation, the native forest was characterized by a mixed māmane-sandalwood (*Santalum ellipticum*) and dryland koa or ʻōhiʻa communities, with ground cover of nonnative grasses and native shrubs. Current Refuge management for both the HFU and KFU focuses on maintaining and constructing new fencing, controlling pest species (plants and animals), native forest restoration, reforestation, and threatened and endangered species management. Under the no action alternative, these management activities would continue on existing Refuge lands but would not expand beyond the current boundaries. No additional habitat would be protected or managed by the Refuge.

Landscape-scale conservation efforts underway on Hawaiʻi Island include various interagency efforts among both public and private land managers. Coordinated management across this landscape is critical to sustain adequate quality and quantity of water and to provide important habitat for a wide diversity of native plants and animals, including endangered species. In addition, the health of these lands is strongly connected with the quality of life for people and local communities. Cooperating in the areas of staff expertise and funding to conserve native ecosystems for over a decade has significantly reduced the threats of invasive ungulates and weeds on Federal, State, and private lands. The Refuge participates in several existing partnership agreements and cooperative management efforts described under Related Actions in Chapter 1.

Under the no action alternative, Refuge staff would continue to work with current partners, such as U.S. Geological Survey-Biological Resources Discipline (USGS-BRD), USFS, National Park Service (NPS), DHHL and DOFAW, the TMA and MKWA, as well as adjoining landowners on any future opportunities within and adjacent to the existing Refuge. Within current funding and staffing levels,the Refuge will also seek new partnerships to restore habitats, improve the volunteer program, and identify to what extent improvements or alterations should be made to existing visitor programs. These activities will allow Refuge staff to ensure the biological integrity, diversity, and environmental health of the HFU and KFU are effectively restored or maintained. However, the scope of these partnerships would be less and result in fewer benefits than under the preferred alternative (described in section 4.2).

4.1.6 Climate Change. Not expanding the Refuge boundary to include the identified lands would not have an appreciable effect on global or regional climate. It would, however, have adverse effects on the ability of the Refuge to increase the resiliency of native Hawaiian species and ecosystems to adapt to a changing climate. It could also adversely affect mitigation efforts by restricting local options to conserve and store carbon through additional land protection and habitat restoration.

4.1.7 Introduced Species. Under the no action alternative, the Refuge would not have the ability to expand its efforts to control nonnative invasive species. This would have moderate adverse effects on native species and ecosystems. Water quantity would also be adversely affected as some invasive plant species have been shown to lower the proportion of rainfall reaching the forest floor and becoming available for groundwater recharge (Takahashi and others 2010).

4.2 Alternative B – Full Land Protection (Preferred Alternative)

4.2.1 Effects on the Physical Environment

4.2.1.1 Soils. Habitat management actions under Alternative B that might be considered include removal of invasive plants and animals, and where possible, restoration or enhancement of native wildlife habitat. Thus, implementation of this alternative would likely result in long-term, moderate, beneficial effects. A long-term commitment to maintenance of the vegetative cover with minimal soil disturbance would conserve local micro-climate patterns and soil processes.

4.2.1.2 Hydrology and Water Resources. Increasing land protection is likely to result in more aquifer recharge within the East Mauna Kea and Southwest Mauna Loa ASEAs. The currently forested areas of the Koa Forest, Maulua Gulch, and McCandless Ranch properties would be protected in perpetuity from timber harvest, and deforested areas would be replanted with trees over time. This would allow surface runoff to infiltrate and recharge the groundwater. Protection of existing forest cover would also facilitate stem flow and fog drip, which results when the condensation of fog or cloud water vapor on surface areas, such as leaves and trunks, drips to the ground surface. Fog drip can increase precipitation by as much as 30 inches per year; the type and density of forest cover may have more influence on fog drip than changes in the surrounding ocean or global climate (Hardy 1996).

Parcels under consideration at Kūkaʻiau Ranch and Maulua Gulch that are currently zoned for agricultural use would be fully protected and managed with fish, wildlife, and plant habitat as the priority. Removal of invasive plant species and restoration with native plants could also increase the quantity of water available in the watersheds; studies at HVNP have shown that invasions by strawberry guava had lower cloud water interception than native ʻōhiʻa stands, resulting in a lower proportion of rainfall reaching the forest floor and becoming available for groundwater recharge (Takahashi and others 2010).

Acquisition of these properties, therefore, is likely to have moderate beneficial effects to water supplies within the watersheds in which they occur. Acquisition of these properties would not affect any existing water rights or water uses other than any acquired water rights appurtenant to acquired lands.

4.2.2 Effects on the Social and Economic Environment. Acquisition of the properties under study could have minimal to moderate adverse social and economic effects. Proponents of the timber

operation on the 13,000 forested acres of the Koa Forest property projected that it would produce $12.3 million per year in direct and indirect economic activity, about 49 direct and indirect jobs with a payroll of $1.6 million per year, and tax revenues to the State of Hawai‘i of about $263,000 per year (Koa Timber, Inc. 2003). The value of koa and ‘ōhi‘a timber on the 10,143 acres at McCandless Ranch is estimated at $7,915,914 (McCandless Ranch 2010). We have no information on the value of the timber on the approximately 700 forested acres at Maulua Gulch. The Kūka‘iau Ranch property has little, if any, commercial timber value. Acquisition of these properties would preclude commercial timber harvest. Although commercial timber harvest remains a possibility on lands designated for conservation, which includes 90 percent (11,850 acres) of the Koa Forest property and 45 percent (994 acres) of the Maulua Gulch property, permits are by no means assured and none have been issued since the early 1970s (Dietz 2010). Acquistion of these properties, therefore, is likely to have minimal adverse effects. The acquisition of McCandless Ranch would preclude commercial timber harvest and would have a moderate adverse economic effect.

Acquisition by the Refuge would also preclude their use for agriculture. According to the County General Plan, 1,184,999 acres of land on the island are within the State Land Use Agricultural District (SLUAD); about 227,177 acres zoned agricultural are located in the North Hilo/Hāmakua districts where the HFU, Koa Forest, Maulua Gulch, and Kuka‘iau Ranch properties are located (County of Hawai‘i 2005). Only 1,280 acres of the Koa Forest property, 1,280 of the Maulua Gulch property, and all 4,469 acres of the Kūka‘iau Ranch are zoned for agricultural, or about 3 percent of the total agricultural district land. All of the soils within the Koa Forest, Kūka‘iau Ranch, and Maulua Gulch properties are considered to have severe limitations which reduce the choice of plants or require special conservation practices or very careful management, or that limit their use mainly to pasture range, forestland, or wildlife food and cover (NRCS 2010a,b,c,d). Within the North and South Kona districts, where the KFU and McCandless Ranch property are located, there are 280,937 acres within the SLUAD; 279,466 acres of which are zoned agricultural by the county including all 10,143 acres of the McCandless Ranch property (County of Hawai‘i 2005, 2011a). All of the soils underlying the McCandless Ranch parcels have severe limitations that restrict their use mainly to pasture range, forestland, or wildlife food and cover (NRCS 2010d). Acquisition of these agricultural lands, therefore, which are primarily suited for pastures or forestry, is likely to have minimal adverse economic effects.

Maintaining and restoring forest cover on these lands, however, would conserve the values that healthy forests contribute to water quantity and quality, air quality, and other ecosystem functions. A study of Ko‘olau forests on O‘ahu determined the ecosystem services provided by these forests to have a net value of between $7.4 and $14 billion, with about half of this value attributed to ground and surface water quality and quantity; other watersheds across the State were estimated at comparable value (DLNR 2011a). In addition, forest cover contributes to carbon sequestration, thereby providing partial mitigation to the effects of climate change. These beneficial effects offset, in part, the economic impacts of removing these lands from commercial forestry or agricultural uses. The net effect to the social and economic environment from the proposed action, therefore, is likely to be minor, especially when the long-term benefits from maintaining and enhancing ecosystem services are considered. In addition, the ability to control invasive plants on newly acquired lands has an economic benefit (DLNR 2011a). In a public awareness study conducted to determine the willingness of Hawaiians to support watershed protection, 59 percent of respondents indicated an urgent need to increase the protection of the upland forest sources of the fresh water supply (DLNR 2010c). Acquisition of these properties would also the recently released State of Hawai‘i The Rain Follows the Forest Plan to replenish their sources of water (DLNR 2011a). The priority actions

identified in the plan include managing invasive species, increasing the State's ability to withstand impacts from climate change, and seeking increased DLNR funding to restore their management capabilities. The plan identifies priority watersheds and outlines actions and projects to protect and sustain their critical water sources. It emphasizes that in order to be successful, the actions must occur on a large scale across ownership boundaries through agreements and leveraged funds provided by statewide watershed partnerships.

4.2.3 Cultural Resources. As a Federal agency, the Service is required to comply with numerous laws pertaining to cultural resources, including the NHPA (16 U.S.C. 470 et seq; Pub. Law 89-665); the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-470mm; Pub. Law 96-95), as amended; and the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.; Pub. Law 101-601). Because of these requirements, which may not apply or be fully effective in protecting cultural resources on private land, the preferred alternative provides moderate benefits to cultural resources when compared to the no action alternative.

4.2.4 Recreation. Recreation and public use opportunities under the preferred alternative will be consistent with the Refuge CCP (Service 2011), as summarized under the no action alternative above. The Maulua Gulch property presents some potential for an enhanced level of public contact due to its proximity to a paved highway (State Route 19). The accessibility this provides could give the Hakalau Forest NWR a public contact and environmental education capability that is currently limited for the existing units due to their remoteness. The establishment of public access infrastructure here could greatly increase the Refuge's visitor contact numbers and the ability to connect the public to the very remote Lower Maulua unit. Overall, the benefits to recreation from expanding the Refuge are likely to be minor over the short-term. Over the longer term, appropriate recreational benefits could increase depending on ease of access, sensitivity of resources, funding, and the capabilities of Refuge staff to oversee additional uses.

4.2.5 Effects on the Biological Environment

4.2.5.1 Endangered and Threatened and Candidate Species. The effects on endangered, threatened, and candidate species of expanding the Refuge boundary vary by the property under consideration (Table 7). This is because of differences in species' ranges, their habitat affinities and restrictions, and elevation ranges, including the upper limit of mosquito-borne infectious diseases. The potential direct and indirect effects on these species are discussed by property below.

Koa Forest Property. The Koa Forest property includes historical habitat for the ʻoʻū and the likely presence of habitat to support ʻio, koloa maoli, ʻalae keʻokeʻo, and the ʻōpeʻapeʻa. In addition to these animals, the property has historical habitat for *Phyllostegia velutina* and likely provides suitable habitat for *Clermontia peleana* and *Cyanea platyphylla.* In the short-term, addition of the Koa Forest property to the Refuge would have minor direct benefits to all of these species. Over the long-term, however, with habitat management including the control of invasive species, forest restoration, and plant augmentations and reintroductions, the direct benefits to endangered animal and plant species would be moderate to major. Because the Koa Forest property is contiguous with the current makai boundary of the Refuge, the ability to control invasive species in this area would also have long-term benefits to the conservation of endangered species and their habitats within the existing Refuge. Acquisition of the Koa Forest property would also provide habitat continuity through the current Refuge to higher elevations on Mauna Kea along the Wailukia River Corridor

proposed in the ʻĀina Mauna Legacy Program (DHHL 2011). This is a major long-term benefit that will allow for species migration as the climate changes.

Maulua Gulch Property. The Maulua Gulch property likely provides habitat to support ʻio, koloa maoli, ʻalae keʻokeʻo, and the ʻōpeʻapeʻa. In addition to these animals, the property also is likely to provide suitable habitat for *Clermontia peleana* and *Cyanea platyphylla.* In the short-term, addition of the Koa Forest property to the Refuge would have minor direct benefits to all of these species. Over the long-term, however, with habitat management including the control of invasive species, forest restoration, and plant augmentations and repatriations, the direct benefits to endangered animal and plant species would be moderate to major. Because the Maulua Gulch property is contiguous with the current makai boundary of the Refuge, the ability to control invasive species in this area would also have long-term benefits to the conservation of endangered species and their habitats within the existing Refuge. Acquisition of the Maulua Gulch property would also provide habitat continuity from sea level through the current Refuge to higher elevations on Mauna Kea along the Kanekaleonui Bird Corridor proposed in the ʻĀina Mauna Legacy Program (DHHL 2011). This is a major long-term benefit that will allow for species migration as the climate changes.

Table 7. Status of Endangered, Threatened, and Candidate Species and their potential habitat on the Koa Forest, Maulua Gulch, Kūkaʻiau Ranch, and McCandless Ranch properties (also shown is designated critical habitat for palila at Kūkaʻiau Ranch)

	Status	Koa Forest	Maulua Gulch	Kūkaʻiau Ranch	McCandless Ranch
Birds					
ʻAkiapōlāʻau (*Hemignathus munroi*)	E			N	H
Hawaiʻi ʻākepa (*Loxops coccineus coccineus*)	E				H
Hawaiʻi creeper (*Oreomystis mana)*	E				P
ʻŌʻū (*Psittirostra psittacea*)	E	H			N
ʻAlalā (*Corvus hawaiiensis*)	E				N
ʻIo (*Buteo solitarius*)	E	P	P	P	P
Palila *(Loxioides bailleui)*	E			N, CH	
Nēnē (*Branta sandvicensis*)	E			P	
Koloa maoli (*Anas wyvilliana*)	E	P	P	P	
ʻAlae keʻokeʻo (*Fulica alai*)	E	P	P	P	
Mammals					
ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*)	E	P	P	P	P
Plants					
Asplenium peruvianum var. insulare	E				P
Clermontia lindseyana	E				
Clermontia peleana	E	A	A		
Cyanea hamatiflora ssp. carlsonii	E				A
Cyanea platyphylla	E	P	A		
Cyanea shipmanii	E				
Cyanea stictophylla	E				H
Nothocestrum breviflorum	E				H
Phyllostegia racemosa	E				
Phyllostegia velutina	E	H			H
Portulaca sclerocarpa	E				A

Sicyos macrophyllus	C			P, A	A
Silene hawaiiensis	T			A	A
Invertebrates					
Drosophila heteroneura	E				A

Status: E = Endangered; T = Threatened; C = Federal candidate; P = likely present; H = historically occurred (up to the mid-1970s), no recent observations, but may still be present; N = historically occurred (up to the the mid-1970s) but no longer present; A = known to occur in adjacent areas of similar habitat; CH = critical habitat

Kūkaʻiau Ranch Property. The Kūkaʻiau Ranch property includes designated critical habitat for the palila, as well as suitable or restorable habitat for the ʻakiapōlāʻau, ʻio, nēnē, koloa maoli, ʻalae keʻokeʻo and the ʻōpeʻapeʻa. In addition to these animals, this property likely provides suitable habitat for *Sicyos macrophyllus* and *Silene hawaiiensis*. In the short-term, addition of the Kūkaʻiau Ranch property to the Refuge would have minor direct benefits to all of these species. Over the long-term, however, with habitat management including the control of invasive species, forest restoration, and plant augmentations and repatriations, the direct benefits to endangered animal and plant species would be moderate to major. Because the Kūkaʻiau Ranch property is contiguous with lands managed by the State of Hawaiʻi with the intention of palila reintroduction, the ability to control invasive species and conduct habitat restoration in this area would also have major long-term benefits to the conservation of the palila and endangered species and their habitats. In addition, long-term benefits would derive from the reforestation of adjacent makai land through the Hawaiian Legacy Reforestation Initiative (HHL 2011a).

McCandless Ranch Property. The McCandless Ranch property was the site of the last known wild population of the ʻalalā and is suitable for its repatriation with proper management and restoration. The property also includes historical habitat for the ʻakiapōlāʻau and Hawaiʻi ʻākepa, and suitable habitat for the Hawaiʻi creeper, ʻoʻū , ʻio, the ʻōpeʻapeʻa and the endangered invertebrate, *Drosophila heteroneura*. In addition to these animals, the McCandless Ranch property includes historical habitat for the plants *Cyanea stictophylla, Nothocestrum breviflorum,* and *Phyllostegia velutina.* It also likely includes suitable habiatat for *Asplenium peruvianum* var. *insulare*, *C. hamatiflora* ssp. *carlsonii, Portulaca sclerocarpa, Sicyos macrophyllus* and *Silene hawaiiensis*. In the short-term, addition of the McCandless Ranch property to the Refuge would have minor direct benefits to all of these species. Over the long-term, however, with habitat management including the control of invasive species, forest restoration, plant augmentations and repatriations, and repatriation of the ʻalalā, the direct benefits to endangered animal and plant species would be moderate to major. Because the McCandless Ranch property is contiguous to the HVNP, the addition of these lands to the Refuge would provide habitat continuity through the current Refuge to higher elevations on Mauna Loa. This is a major long-term benefit that will allow for species migration as the climate changes.

4.2.5.2 Other Native Species. Under Alternative B, the Service proposes to protect wildlife and habitat on up to 29,973 acres of mostly undeveloped land. In addition to endangered species, these lands support native forest birds, plants, and invertebrates. Habitats that would be protected from development in these lands include coastal, wet, mesic, dry and montane forests. Because these parcels are adjacent to existing conservation lands, including the Refuge, acquisition would enhance connectivity with habitats, resulting in a significant expansion of contiguous forests being managed for the conservation of native species and ecosystems.

Native birds that would benefit from the additional conservation efforts provided by acquiring these lands include the ʻiʻiwi, Hawaiʻi ʻamakihi, ʻapapane, Hawaiʻi ʻelepaio, ʻōmaʻo, pueo, and kolea. Some of the non-endangered native plants, many of which are rare, that would be conserved and restored include, koa, ʻōhiʻa, māmane, pilo, haʻiwale, Hawaiian mint, ʻakoko, naʻenaʻe, koʻokoʻolau, ʻāweoweo, pua kala, ʻoāliʻī, pōpolo kū mai, ʻākala, ʻōhelo, ʻohe, ōpuhe, and maua. Conservation of these habitats would benefit many species of native invertebrates, including long-horned beetles, sphingid moths, Blackburn's butterflies, picture–wing flies, damselflies, lacewings, fruit flies, mirid bugs, stink bugs, yellow-faced bees, and terrestrial mollusks.

Acquisition of coastal habitats in the Maulua Gulch property would preserve ʻōhiʻa and koa forest and benefit the terrestrial invertebrates and waterbirds that use these habitats. Acquisition of the Koa Forest, upper reaches of the Maulua Gulch, and McCandless Ranch properties would protect vast expanses of montane wet forests, preserving ʻōhiʻa, koa and ʻuluhe ecosystems. Conservation of these habitats would be beneficial to native forest birds, particularly at the higher elevation areas of the parcels. Acquisition of the Kūkaʻiau Ranch property would allow for conservation and restoration of mesic koa and māmane forests.

Management of these lands could enhance populations of native shrubs, ferns, epiphytes, and grasses, which would benefit native forest birds and invertebrates. Areas of māmane forests on Hawaiʻi have been greatly reduced. Conservation and restoration of lands at Kūkaʻiau Ranch would help preserve this rare ecosystem. Māmane also occurs in the dry koa/ʻōhiʻa/māmane forest found at the upper reaches of the McCandless Ranch property. Acquisition of the McCandless Ranch parcel would also conserve rare native plant and animal communities found in lava tubes and lava tube skylight ecosystems, including ferns, birds, and invertebrates.

Overall, the addition of these properties would have minor benefits to native species and ecosystems in the short-term, but with habitat management, including invasive species control and native plant restoration, the benefits would be moderate to major over the long-term.

4.2.5.3 Habitat Protection and Open Space Preservation. The expansion of the Refuge acquisition boundary to encompass up to 29,973 additional acres of land on the windward and leeward sides of Hawaiʻi Island will hold great potential to further the conservation of biological diversity across a larger landscape when opportunities arise from willing sellers or through existing partners. Addition of the Koa Forest and Maulua Gulch properties to the HFU would protect lower elevation rainforest, subject to high levels of disturbance and invasion by alien species. The Kūkaʻiau Ranch property includes higher elevation habitats containing remnant open koa-māmane forest that can be restored using a model similar to the HFU.

Beyond the conservation benefits expected under the CCP, described above under the no action alternative, connecting additional habitats to existing Refuge units and incorporating them under Refuge management guided by statutes, policies, and management plans will enhance landscape level efforts to recover endangered species and preserve and restore native forests. Additional lands described in this assessment, if acquired by the Refuge, would largely be managed in a similar fashion as that described in the CCP for the existing Refuge (Service 2011) and for the same purposes. Habitat protection, enhancement, and restoration would serve to preserve native plants and animal communities as a primary purpose.

All of the properties would connect to existing land divisions now under conservation management, creating corridors for wildlife extending mauka to makai in traditional ahupua‘a’s. These include the DHHL Humu‘ula/Pi‘ihonua tracts adjacent mauka to the HFU, State of Hawai‘i land managed for palila recovery adjacent to the Kūka‘iau Ranch property, and the HVNP and KFU adjacent to the Kahuku lots of the McCandless Ranch (Figures 1-3).

Refuge expansion under the preferred alternative would enhance opportunities to coordinate management across this landscape with appreciable benefits to all partners. Our coordination with DHHL would be enhanced by expansion of the HFU. In particular, acquisition of the Koa Forest and Maulua Gulch properties would provide connectivity from lower elevation forests and, in the case of Maulua Gulch, the seacoast, through the current HFU and the Wailuku River Corridor and Kanekaleonui Bird Corridor, provided for in the Legacy Program, to upper–elevation native māmane forests (Figure 3).

Under the preferred alternative, Refuge staff would expand coordination efforts with existing partners on both the HFU and the KFU to seek input on potential Refuge involvement in area conservation efforts and needs beyond our current boundaries in order to determine a desired goal and appropriate role for the Refuge. A landscape approach on the slopes of Mauna Kea and Mauna Loa will allow staff to focus efforts and work with partners to ensure that habitat needs are met over a larger area. Expansion of the Refuge would also increase the area available for researchers and provide additional opportunities for landscape-scale scientific investigations. Enhanced coordination with Refuge partners in conservation management on the Island of Hawai‘i would have moderate to major benefits over the long-term.

4.2.6 Climate Change. Expanding the Refuge boundary to include the identified lands would not have an appreciable effect on global or regional climate. It would, however, have positive effects on the ability to increase the resiliency of native Hawaiian species and ecosystems to adapt to a changing climate by increasing available and potential habitat, reducing habitat fragmentation, and increasing habitat connectivity. It would also positively affect climate change mitigation efforts by conserving carbon sequestration. Over the long-term, invasive species control, habitat restoration, and habitat management will enhance the resiliency of native species and ecosystems and increase carbon sequestration.

4.2.7 Invasive Species. The preferred alternative would also allow the Refuge to control invasive species on any acquired lands. This would have moderate beneficial effects on native species and ecosystems. It would also have benefiical effects to water quantity since some invasive species have been shown to lower the proportion of rainfall reaching the forest floor and becoming available for groundwater recharge (Takahashi and others 2010). Control of invasive species on acquired lands would also have moderate beneficial effects to those lands by reducing the source populations of invasive species on properties adjacent to existing conservation lands.

4.2.8 Unavoidable Adverse Effects. Expanding the Refuge could have unavoidable minimal to moderate adverse effects on the local economy by precluding commercial timber operations in forested areas and the removal of grazing from other agricultural land. However, these impacts would be offset by protecting these areas from adverse impacts to watersheds, which are important to acquifer recharge and water quality, and from further degradation or loss of native Hawaiian ecosystems.

4.2.8.1 Cumulative Impacts. The proposed action would expand the Hakalau Forest NWR by up to 29,973 acres and would potentially result in additional habitat being protected, restored, and managed in perpetuity. The Service would manage any acquired lands to provide for the recovery of endangered Hawaiian forest birds, waterbirds, and plants; the long-term conservation of lowland and montane wet and mesic koa and ʻōhiʻa forests and high elevation māmane woodlands; the preservation of water quality and aquifer recharge; the protection of cultural resources; and, where appropriate, opportunities for wildlife-dependent public recreation and conservation partnerships. Management actions, such as invasive and introduced species control, would benefit not only newly acquired lands, but also the existing Refuge and contribute to efforts to control the spread of these species to adjacent properties managed for conservation.

4.2.9 Comparison of the Effects of the Alternatives and Rationale for the Preferred Alternative. A comparison of the no action and preferred alternatives is provided in Table 8. The no action alternative provides little assurance that additional protection and restoration of habitat important to the recovery of endangered forest birds, waterbirds, and plants or further protection of native Hawaiian species and ecosystems would occur. The no action alternative, therefore, does not meet the purpose nor address the need as described in Chapter 1 of this document. Alternative B, by providing for both the short-term stabilization and long-term recovery of endangered species, meets the purposes and need of the proposed action.

Table 8. Summary Comparison of the Effects of the Alternatives.

Environmental Factor	Alternative A No Action	Alternative B Full Land Protection
Physical Environment		
Soils	Potential for minimal to moderate adverse effects due to soil erosion or compaction depending on type and size of any development and mitigation actions.	Long-term, moderate, beneficial effects.
Hydrology and Water Resources	Minimal to moderate adverse effects on water infiltration, groundwater recharge, and water quality depending on severity of impact and mitigation actions.	Land acquired would become part of the National Wildlife Refuge System and be unavailable for agricultural, residential, commercial, or industrial development.
Social and Economic Environment		
Socio-Economic	Commercial timber operations and agricultural uses potentially allowed under existing landownership; minor short-term beneficial social and economic effects.	Commercial timber operations and agricultural uses would be precluded on any acquired lands.
Cultural Resource Protection	No cultural sites or resources on the parcels under consideration would be included in the Refuge. Minimal to moderate adverse effects but cultural resource losses could be permanent.	All cultural sites or resources present on lands acquired would be included in the Refuge; any future ground-disturbing activities would require compliance with the NHPA.
Public Access and Recreation	Private landowners would continue to control access across and use of private lands subject to any deed restrictions on parcels with existing conservation easements. No effect on current Refuge management, but public access to land not acquired could be constrained.	Initially, no public access to acquired lands, but programs for public involvement or cooperative management would be developed consistent with established programs at the Refuge.

Environmental Factor	Alternative A No Action	Alternative B Full Land Protection
Biological Environment		
Endangered Species Habitat	No additional habitat protection by the Hakalau Forest NWR. Endangered species management, including invasive species control and habitat restoration, would focus primarily within the current Refuge. Moderate adverse effects on the ability to recover listed species. Long-term moderate adverse effects on native species and ecosystems.	Minimal short-term to moderate long-term benefits due to: Addition of up to 19,579 acres of occupied, potential, or restorable montane koa /ʻōhiʻahabitat for endangered forest birds and plants to the HFU. Addition of an estimated 250 acres of potential or restorable higher elevation ʻōhiʻa and māmane/naio forest for endangered palila to the HFU. Addition of up to 3,887 acres of occupied, potential, or restorable montane ʻōhiʻa-koa habitat for endangered forest birds and plants to the KFU. Addition of up to 6,256 acres of occupied, potential, or restorable higher elevation ʻōhiʻa and māmane/naio forest for endangered forest birds to the KFU. Increased habitat connectivity between HFU and KFU and other conservation lands. Endangered species management, including invasive species control and habitat restoration, would continue within the current Refuge and be expanded to any acquired lands after necessary regulatory compliance has been completed.
Other Native Species Habitat	No additional habitat protection by the Hakalau Forest NWR. Habitat management, including invasive species control and restoration actions, would continue within the current Refuge. Long-term moderate adverse effect impact on native species and ecosystems.	Addition of up to 19,579 acres of montane and lowland koa/ʻōhiʻa habitat for native wildlife and plants to HFU. Addition of an estimated 250 acres of potential or restorable higher elevation ʻōhiʻa and māmane/naio to the HFU. Addition of up to 25 stream miles of aquatic and riparian habitat to the HFU. Addition of up to 3,887 acres of montane koa/ʻōhiʻa habitat for native wildlife and plants to KFU. Addition of up to 6,256 acres of subalpine ʻōhiʻa and māmane/naio forest to the KFU. Addition of lava tubes, lava tube skylights,

Environmental Factor	Alternative A No Action	Alternative B Full Land Protection
		and associated native wildlife to KFU. Habitat on acquired land would be managed to benefit native species.
Effect on County Taxes	No effect.	Under current law, property tax losses would likely be largely offset by payments authorized by the RRSA.
Estimated Land Purchase Costs	None.	Acquisition costs are estimated at $120,000,000, to be requested over time from the LWCF.
Estimated Annual Operations and Maintenance Costs	None.	Annual operations and maintenance costs estimated at $650,000.

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CHAPTER 5. COORDINATION, CONSULTATION, AND COMPLIANCE

5.1 Public Involvement

The proposed expansion of Hakalau Forest National Wildlife Refuge has been discussed with landowners; neighbors; conservation organizations; Federal, State, and County governments; local organizations and interested groups; and individuals.

The Service invited and encouraged public participation throughout the public involvement process. Outreach consisted of public notices and meetings with potentially affected landowners, government agencies, private organizations, and individuals. The Refuge Manager gave a presentation on August 17, 2011, at a public meeting at Refuge Headquarters in Hilo. A planning update was distributed in July 2011, and another will be published with the release of this document in February 2012. The Service will provide a summary of issues raised by the public in our February 2012 Planning Update 2, as well as announce the availability of the LPP/EA, describe the No Action and the Preferred Alternatives, provide a summary of their environmental effects, and announce a 30-day review and comment period. The planning update will be distributed to the contacts listed in Appendix D, as well as posted on the Service's Regional website.

As part of the public notice and review process, the LPP/EA is available for a 30-day review and comment period February 15, 2012 to March 16, 2012.

5.2 Environmental Review and Consultation

In expanding the Refuge, the Service would comply with Federal laws, regulations, and Executive orders. The following section describes specifically how expanding the Refuge is in compliance with the National Environmental Policy Act (NEPA), NHPA, ESA, and other relevant Federal laws, regulations, and Executive orders.

5.2.1 National Environmental Policy Act

As a Federal agency, the Service must comply with provisions of NEPA, as amended (42 U.S.C. 4321-4347). An environmental analysis is required under NEPA to evaluate reasonable alternatives that will meet stated objectives and to assess the possible environmental, social, and economic impacts to the human environment. The EA serves as the basis for determining whether implementation of the proposed action would constitute a major Federal action significantly affecting the quality of the human environment. The environmental assessment facilitates the involvement of government agencies and the public in the decisionmaking process.

5.2.2 National Historic Preservation Act

The Service would follow established procedures for protecting cultural resources if the Refuge is expanded. This includes complying with the NHPA of 1966 (16 U.S.C. 469) and other cultural resource preservation laws, and consulting with the State Historic Preservation Office and

appropriate Native American governments, if applicable, for any future restoration and management actions which may have the potential to affect historic properties.

5.2.3 Endangered Species Act

Expanding an approved refuge boundary does not represent a Federal action which would affect species listed under the ESA. The Service would conduct consultation under Section 7 for any Hakalau Forest NWR management program actions which have the potential to affect listed species.

5.2.4 Other Federal Laws, Regulations, and Executive Orders

In implementing the proposed action, the Service would comply with the following Federal laws, Executive orders, and legislative acts: Intergovernmental Review of Federal Programs (Executive Order 12372); Protection of Historical, Archaeological, and Scientific Properties (Executive Order 11593); Floodplain Management (Executive Order 11988); Protection of Wetlands (Executive Order 11990); Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 U.S.C. 9601 et seq.); Management and General Public Use of the National Wildlife Refuge System (Executive Order 12996); Departmental Policy on Environmental Justice (Executive Order 3127); Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970, as amended; Refuge Recreation Act of 1962, as amended; and Consultation and Coordination with Indian Tribal Governments (Executive Order 13175).

5.3 Distribution and Availability

Copies of the February 2012 LPP/EA are being distributed to Federal and State elected officials, native Hawaiian organizations, county governments, affected landowners, private groups, and other interested individuals (see Appendix D, Notification List). Copies of the document are available by contacting the Hakalau Forest NWR, 60 Nowelo Street, Hilo, Hawai‘i, 96720, 808-443-2300. The documents can also be viewed and downloaded from the Service’s website at http://www.fws.gov/hakalauforest/planning.html.

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APPENDIX D

Notification List for Draft Land Protection Plan and Environmental Assessment Proposed Additions to Hakalau Forest National Wildlife Refuge Hawai‘i County, Hawai‘i

Federal and State Elected Officials

Federal
Honorable Daniel K. Akaka, United States Senator
Honorable Daniel K. Inouye, United States Senator
Honorable Mazie Hirono, United States House of Representatives
Honorable Colleen Hanabusa, United States House of Representatives

State
Honorable Neil Abercrombie, Governor of Hawai‘i
Honorable Gilbert Kahele, Hawai‘i State Senate, 2nd Senatorial District
Honorable Josh Green, Hawai‘i State Senate, 3rd Senatorial District
Honorable Malama Solomon, Hawai‘i State Senate, 1st Senatorial District
Honorable Jerry L. Chang, Hawai‘i State, 2nd Representative District
Honorable Denny Coffman, Hawai‘i State, 6th Representative District
Honorable Cindy Evans, Hawai‘i State, 7th Representative District
Honorable Robert N. Herkes, Hawai‘i State, 5th Representative District
Honorable Mark M. Nakashima, Hawai‘i State, 1st Representative District
Honorable Clift Tsuji, Hawai‘i State, 3rd Representative District

County
Honorable William P. Kenoi, Mayor
Honorable Dominic Yagong, Hawai‘i County Council
Honorable Donald Ikeda, Hawai‘i County Council
Chairman J Yoshimoto, Hawai‘i County Council
Honorable Dennis Oishi, Hawai‘i County Council
Honorable Fred Blas, Hawai‘i County Council
Honorable Brittany Smart, Hawai‘i County Council
Honorable Brenda Ford, Hawai‘i County Council
Honorable Angel Pilago, Hawai‘i County Council
Honorable Pete Hoffman, Hawai‘i County Council

Federal Agencies

Environmental Protection Agency, Office of Research and Development

Department of the Interior
- National Park Service
- U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office
- U.S. Fish and Wildlife Service, Pacific Islands Conservation Cooperative
- U.S. Geological Survey, Biological Resources Division
- U.S. Geological Survey, Pacific Island Ecosystems Research Center

Department of Defense
U.S. Army

Department of Agriculture
Animal and Plant Health Inspection Service (APHIS)
Natural Resources Conservation Service
U.S. Forest Service, Institute of Pacific Islands Forestry

State of Hawai‘i Agencies

Department of Agriculture

Department of Hawaiian Home Lands
East Hawai‘i District Office
West Hawai‘i District Office

Department of Land & Natural Resources
Division of Aquatic Resources
Division of Forestry and Wildlife
Division of Lands
Division of State Parks
State Historic Preservation Officer
Historic Preservation Division, Hawai‘i Island Burial Council

Department of Transportation

Hawai‘i State Coastal Zone Management Program
Office of Environmental Quality Control
Office of Hawaiian Affairs

County of Hawai‘i

Department of Water Supply
Big Island Visitors Bureau
Hawai‘i County Planning Department

Working Groups

Big Island Invasive Species Committee
Firewise
Hawai‘i Volcanoes Rare Plant Facility
Hawai‘i Wildlife Center
Keauhou Bird Conservation Center
Kohala Watershed Partnership
Mauna Kea Watershed Alliance
Plant Extinction Prevention Program-Hawai‘i Island
Plant Extinction Prevention Program-Statewide
Three Mountain Alliance

Organizations

American Bird Conservancy
American Birding Association
Association of Fish and Wildlife Agencies
Association of Hawaiian Civic Clubs
Cave Conservancy of Hawai‘i
Conservation Council for Hawai‘i
Council for Native Hawaiian Advancement
Edith Kanaka‘ ole Foundation
Friends of Hakalau Forest NWR
Hawai‘i Audubon Society
Hawai‘i Entomological Society
Hawai‘i Hunting Advisory Council
Hawai‘i Island Chamber of Commerce
Hawai‘i Island Economic Development Board
Hawai‘i Forest and Trail
Hawaiian Civic Club of Hilo
Hawaiian Environmental Alliance
Hoopuloa Hawaiian Civic Club
Hui Kakoo ‘Āina Hoopulapula
Hui Malama I Na Kupuna O Hawai`i Nei and Hui Ho'oniho
Island Transitions
KAHEA
Kama‘ā inas United for the Protection of the ‘Āina
Kanu o ke ‘Āina learning ohana
Kona Hawaiian Civic Club
Kona Outdoor Circle
Kona-Kohala Chamber of Commerce
Kuakini Hawaiian Civic Club of Kona
Land Trust Alliance, National Headquarters
Land Trust Alliance, Western Office
Mālama O Puna
Na Kuauhau O Kahiwakaneikopolei
National Audubon Society, National Office
National Fish and Wildlife Foundation, National Headquarters
National Fish and Wildlife Foundation, Western Partnership Office
National Wildlife Federation
National Wildlife Refuge Association
Native Hawaiian Chamber of Commerce
Native Hawaiian Economic Alliance
Native Hawaiian Legal Corporation
Natural Resources Defense Council
Pig Hunters of Hawai‘i
Royal Hawaiian Academy of Traditional Arts
Sierra Club, Moku Loa Chapter
Silversword Foundation
Society of American Foresters, Hawai‘i Chapter
The I Mua Group
The Nature Conservancy of Hawai‘i

The Outdoor Circle
The Wildlife Society, Hawai‘i Chapter
Trust for Public Land
Waimea Hawaiian Civic Club

Local Research and Education Institutions

Hawai‘i Biodiversity and Mapping Program
Hawai‘i Nature Center
University of Hawai‘i, Office of Mauna Kea Management
Bishop Museum
Bishop Museum Entomology Department
Hawai‘i Agricultural Research Center
Hawai‘i Pacific University
University of Hawai‘i Manoa, Pacific Cooperative Studies Unit
University of Hawai‘i Field Station
University of Hawai‘i Hilo
University of Hawai‘i Hilo Beaumont Research Center
University of Hawai‘i Hilo Library
University of Hawai‘i Manoa
University of Hawai‘i-CTAHR

Libraries
Bond Memorial Public Library, Kapa‘au, HI
Hilo Public Library, Hilo, HI
Holualoa Public Library, Holualoa, HI
Honoka‘a Public Library, Honoka‘a, HI
Kailua-Kona Public Library, Kailua-Kona, HI
Kea‘au Public Library, Kea‘au, HI
Kealakekua Public Library, Kealakekua, HI
Laupāhoehoe Public and School Library, Laupāhoehoe, HI
Main Hawai‘i State Library, Honolulu, HI
Mountain View Public and School Library, Mountain View, HI
Na‘ālehu Public Library, Na‘ālehu, HI
National Conservation Training Center Library, Shepherdstown, WV
Pāhala Public and School Library, Pāhala, HI
Pāhoa Public and School Library, Pāhoa, HI

Businesses
BBC
Hawai‘i Nature Explorers
Hawaiian Sailing Canoe Association
Jack Jeffrey Photography
Jay Harada Productions
Kai Malino Ranch
Kamehameha Schools
Keālia Ranch
Kūka‘iau Ranch
Les Marks Trust
Mark A. Robinson Trust

McCandless Ranch
Pacific Pan Properties, Inc.
Pacific Rim Conservation, Inc.
Parker Ranch
Pono Pacific Land Management, LLC
Rana Biological Consulting, Inc.
Terran Tours
Tradewinds Hawaiian Woods
Waipono Investment Corporation

Private Individuals
Landowners
Private Citizens

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APPENDIX C

List of Preparers and Reviewers

Author's Name	Position	Work Unit
Steve Caicco	Conservation Planner	U.S. Fish and Wildlife Service, Pacific Region, Division of Planning, Visitor Services, and Transportation, Portland, OR
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Cashell Villa	Wildlife Refuge Specialist	U.S. Fish and Wildlife Service, Hakalau Forest National Wildlife Refuge, Hilo, HI
Steve Kendall	Wildlife Biologist	U.S. Fish and Wildlife Service, Hakalau Forest National Wildlife Refuge, Hilo, HI
Liz Cruz	Geographic Information System Specialist / Analytical Geographer	U.S. Fish and Wildlife Service, Pacific Region, Refuge Information Branch, Portland, OR
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Reviewer's Name	Position	Work Unit
Charles Houghten	Chief	U.S. Fish and Wildlife Service, Pacific Region, Division of Planning, Visitor Services, and Transportation, Portland, OR
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Christine Ogura	Natural Resource Planner	Hawaiian & Pacific Islands National Wildlife Refuge Complex, Honolulu, HI
Barry Stieglitz	Project Leader	Hawaiian & Pacific Islands National Wildlife Refuge Complex, Honolulu, HI
Don Palawski	Deputy Project Leader	Hawaiian & Pacific Islands National Wildlife Refuge Complex, Honolulu, HI
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Charles Parrott	Realty Specialist	U.S. Fish and Wildlife Service, Pacific Region, Realty Branch, Portland, OR
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APPENDIX D

Responses to Public Comments

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Responses to Public Comments on the Proposed Additions to Hakalau Forest National Wildlife Refuge Draft Land Protection Plan (LPP) and Environmental Assessment (EA)

The Service received seven letters on the Draft LPP and EA during the comment period which ended on March 16, 2012. Four of the letters support our proposed action and three expressed interest in collaboration on our shared conservation goals. Several issues were also identified. These issues are summarized and our responses to them are provided below. Minor corrections noted by commenters are addressed in an Errata Sheet included in the EA.

Range of Alternatives

Comment. One commenter expressed the belief that it would have been useful to consider a "mid-range" alternative that focused only on the highest priority parcels.

Response. Although not documented in the EA, we did consider having a range of alternatives beyond the No Action and Preferred Alternative. We rejected this approach because all of the properties had resource values of interest. Moreover, the Preferred Alternative can be modified in our final decision should we choose to exclude some properties from our proposed boundary. An Errata/Modification Sheet has been appended to our EA to note that an intermediate alternative was considered but excluded from detailed study for these reasons.

Land Protection Methods

Comment. The same commenter also felt it would have been useful for the Service to consider other land protection methods than fee-title acquisition, such as conservation easements or land exchanges.

Response. Because of the intensive management that will be required on any acquired lands, our preferred method of land protection is fee-title acquisition. While fee-title acquisition remains our preferred method of habitat protection for the proposed additions, other habitat protection methods are not precluded. The range of possible habitat protection methods are described in Section 1.7.2 of the LPP. The actual method selected for any individual parcel will depend on what the landowner and the Service agree upon.

Acquisition Priorities

Comment. The commenter also thought it would be useful to breakdown the individual parcels into a wider array of priorities and questioned the inclusion of the lower elevation Maulua subparcel which they felt would not meet the conservation-related acquisition criteria and appeared to have been proposed largely to provide potential access to the higher elevation subparcel.

Response. The Service typically assigns a priority of 1 through 3 to parcels as a general indication of our protection priority. We are not, however, strictly bound by these priorities. In practice, land acquisition involves factors that are largely beyond our control such as the timing and availability of funding, a willing seller, and a fair-market value appraisal, which is

required by law. Our offer also must be acceptable to the seller. Additional "fine-tuning" of these priorities, therefore, provides little added value to land protection.

The lower Maulua Gulch parcel, which is zoned as agricultural and has been used for agriculture in the past, is a lower resource priority. While access to, and perhaps through, the upper Maulua parcel was certainly a consideration, that is not the only reason to include it within our expanded acquisition boundary. For example, the accessibility of the parcel to existing public transportation (a paved highway) in combination with its connectivity to higher elevation refuge lands could provide a valuable opportunity for visitor services (public environmental education and increased visitation in a developed site) along with watershed protection values. If it were not to be included within the proposed expanded boundary and the seller would only consider selling the two parcels together, we would not be able to acquire the upper parcel without additional (and largely redundant) compliance to extend the boundary to include it.

Acquisition Priority Criteria

Comment. The same commenter stated that the prospect of a warming climate argues for assigning higher priority to higher elevation land, not lower elevation lands.

Response. We agree with this argument as a general rule and, in particular, as it applies to the potential for mosquito-borne avian diseases to spread to higher elevation as the climate warms. Climate change, however, is a complex process and may not affect all resources of interest in the same way. Little is known, for example, about how endangered plants species which may occur, or be repatriated to lower elevations will respond to a changing climate. Some indications of apparent resistance to avian malaria in native forest birds also lend support to the potential for further repatriation of lowland forest habitats. The lower elevation properties also contain high value aquatic ecosystems, including some of the highest quality stream systems identified in the Hawaiian Islands that will continue to transport water from the mountain to the ocean into the foreseeable future. Moreover, a very strong argument can be made that it is better to have these downslope habitats managed to increase their resiliency than to have them unmanaged or converted to timber or residential uses. These additional considerations were identified in Section 1.5.5 of the draft LPP.

Acquisition Costs

Comment. Concerns were expressed regarding the cost to the taxpayers of land acquisition and the usefulness of having a further breakdown of the estimated acquisition costs by parcel.

Response. Land acquisition funding will be requested from the Land and Water Conservation Fund, a dedicated account established by Congress to provide funds for State and Federal land acquisition and development for the benefit of all Americans. The primary source of these funds is fees on offshore oil and gas drilling. Our land acquisitions costs are based on a general estimate of $4,000 per acre. Given that land values fluctuate, the Service has not had formal appraisals made of any of these properties, are subject to negotiations with willing sellers, and funding is likely to be available over decades, we do not consider it practical or informative to estimate the value of any specific parcel of land.

Refuge Operations and Maintenance

Comment. Concern was expressed over the absence of any analysis of the potential impacts of additional land acquisition on existing refuge programs, especially efforts to control feral pigs and maintain the integrity of existing fenced units, and the potential consequences of acquiring lands that will not be aggressively managed in the short term on public perception and support of the Service.

Response. The inherent tension between funds for land acquisition and funding for refuge operations and maintenance is a challenge faced throughout the National Wildlife Refuge System (NWRS). Additional lands are often needed to fulfill the mission of the NWRS, which is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans," as well as the goals of an individual refuge as stated in their Comprehensive Conservation Plan. Land acquisition funding, as noted above, comes from a dedicated source and does not directly affect refuge operations and maintenance appropriation. Although operations and maintenance costs increase with the size of the managed area, this increase is not proportional. This is because costs do not double to manage twice as much land since administrative costs are relatively stable and neither staff nor equipment costs double.

Weighing land acquisition against operational costs requires consideration of the costs of not acquiring land. This includes the possibility of lost conservation value both should the lands be converted to residential or commercial forestry uses which could also negatively impact the existing refuge. This weighing also includes consideration of the effects of appreciation in land values should the lands remain of high conservation value but acquisition is postponed until some indefinite future time. For example, the current refuge, most of which was acquired over 20 years ago, was obtained for an average of $700 per acre, or less than 20 percent of what the same land might cost today. Twenty years from now, we may regret not acquiring more land at today's prices.

Proposed Acquisition Boundary

Comment. One commenter noted that there were additional privately owned parcels in the vicinity of the two Refuge units that would likely meet our acquisition criteria in the future and that the possibility of future consideration of additional lands should be mentioned in the LPP. The commenter also noted that two parcels owned and managed by State agencies within the current Refuge boundary have significant conservation value and should be considered for future acquisition or land transfer. In addition, a representative for one property within our proposed acquisition boundary has requested that it be withdrawn.

Response. Any decision with respect to this LPP does not preclude future consideration of other land with high conservation values for addition to the Refuge. With approval, future detailed planning could be undertaken at any time should new information come to our attention and would require additional compliance. Land within the current Refuge boundary has already been approved for acquisition, whether it be through fee-title, donation, easement, or cooperative agreement. There is renewed interest within the Department of Hawaiian Homelands for possible exchange or management agreement of the parcel under their administration.

The property that was requested to be withdrawn from our proposal has high resource values for endangered species and includes some of the most pristine freshwater aquatic ecosystems remaining in Hawai‘i. Conservation management of this property would also enhance our ability to manage the existing Hakalau Forest Unit and further the State of Hawai‘i‘s watershed protection goals under their Rain Follows the Forest Initiative. Due to the high resource values and no direct conflict with disposition of the property, we have decided to keep the parcel with the expanded boundary, if approved.

State of Hawai‘i Historic Preservation Division and Native Hawaiian Consultation

Comment. We received one letter encouraging us to conduct additional consultation with the State of Hawai‘i Historic Preservation Division and related Native Hawaiian entities on the subject of public access for the purpose of customary and traditional Native Hawaiian practices. The commenter noted that the potential transfer of land from private to public ownership may prompt cultural practitioners to seek access for customary and traditional practices. A second commenter also identified cultural uses such as gathering as important to Native Hawaiian culture.

Response. Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. Section 470f, requires Federal agencies to take into account the effects of their undertakings on historic properties and provide the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on those undertakings. The ACHP has issued the regulations implementing Section 106 (Section 106 regulations), 36 CFR Part 800, “Protection of Historic Properties.” The NHPA requires that, in carrying out the requirements of Section 106, each federal agency must consult with any Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by the agency’s undertakings. As noted in the EA, the expansion of a Refuge boundary is not considered an undertaking. The Service takes its responsibilities with regard to Native Hawaiian consultation seriously but many of these properties may not be acquired for many years or, lacking a willing seller, may not ever be acquired. The public scoping process and review of draft planning documents has provided the opportunity for all interested parties to bring any traditional use or claim to our attention for the record prior to any appropriation of funds or direct negotiations to acquire property. The Service has no authority to make commitments on private land. The Hawai‘i Constitution addresses access to lands for customary and traditional practices, and discussions about how, when, and where that access may occur should be reserved until after any lands are acquired and the Service has obtained a robust understanding of the natural and cultural resources present on these lands.

Other Issues

Comment. One commenter provided an extensive critique of Service management of the Refuge, in general, and efforts to recovery the ʻalalā.

Response. These issues are beyond the scope of the proposed action and, with respect to the ʻalalā, recovery efforts are not managed by the Refuge. These comments have been provided to the National Wildlife Refuge System and Ecological Services Programs.

APPENDIX E

Other Compliance Documents

U.S. Fish and Wildlife Service
Region 1
Portland, Oregon

ENVIRONMENTAL ACTION STATEMENT

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the act of expanding the acquisition boundary of the Hakalau Forest National Wildlife Refuge;

___ is a categorical exclusion as provide by 516 DM 2, Appendices 1 and 2, and 516 DM 6, Appendix 1. No further documentation will be made.

_X_ is found not to have significant environmental effects as determined by the attached Finding of No Significant Impact and Environmental Assessment.

___ is found to have special environmental conditions as described in the attached Environmental Assessment. The attached Finding of No Significant Impact will not be final nor any actions taken pending a 30-day period for public review [40CFR 1501.4(e)(2)].

___ is found to have significant effects and, therefore, a notice of intent to prepare and Environmental Impact Statement will be published in the Federal Register before the project is considered further.

___ is denied because of environmental damage, Service policy, or mandate.

___ is an emergency situation. Only those actions necessary to control the immediate impacts of the emergency will be taken. Other related actions remain subject to NEPA review.

Other supporting document(s):

Draft Land Protection Plan and Environmental Assessment, Proposed Additions to Hakalau Forest National Wildlife Refuge, Hawai'i County, Hawai'i (February 2012)

Chief, Division of Refuge Planning,
Visitor Services, and Transportation
Region 1

4-11-12
Date

STATEMENT OF COMPLIANCE FOR ACQUISITION OF ADDITIONS TO THE HAKALAU FOREST NATIONAL WILDLIFE REFUGE

The following executive orders and legislative acts have been reviewed as they apply to the proposed action. The Service will conduct all realty actions in conformance with the Uniform Relocation Assistance and Real Property Acquisition Policies.

1. **National Environmental Policy Act (1969).** The acquisition planning process has been conducted in accordance with 602 DM 2 and Service procedures and has been performed in coordination with the affected public. Based on the analysis in the 2012 *Additions to the Hakalau Forest National Wildlife Refuge Land Protection Plan and Environmental Assessment*, the Service has prepared a Finding of No Significant Impact, in accordance with the National Environmental Policy Act, for the proposed action of adding 29,973 acres to the Hakalau Forest National Wildlife Refuge, Hawai'i County, Hawai'i.

2. **National Historic Preservation Act of 1966 (NHPA), as amended (Sections 106 and 110) (16 U.S.C. 470-470x).** Expansion of a Refuge boundary is not considered an undertaking. The Service will comply with the NHPA if any proposed management actions have the potential to affect any historic properties which may be present.

3. **National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee).** No existing wildlife-dependent public use activities occur on any of the proposed additions. The Service is not proposing to allow any wildlife-dependent public use activities at this time. Therefore, a pre-acquisition compatibility determination is not required. Future acquisition of the property will require the Refuge Manager to a) amend the Refuge Comprehensive Conservation Plan and/or other management plans; b) to address additional compliance requirements for management of the property; and c) for any new or expanded use consider amending or issuing new compatibility determinations. The Refuge will provide public notice of this decision and subsequent actions via the Refuge website, press release, and/or direct contact with stakeholders.

4. **Executive Order 11988. Floodplain Management.** Most streams on the proposed additions have only seasonal flow and are deeply incised into steep gorges with no defined floodplains. Consistent with Executive Order 11988, the Service would protect any floodplains from adverse impacts, modifications, or destruction.

5. **Executive Order 11990. Protection of Wetlands.** The proposed action is consistent with Executive Order 11990 because the Service would protect existing wetlands.

6. **Executive Order 12372. Intergovernmental Review.** Coordination and consultation with affected local and State governments, Native Hawaiian organizations, other Federal agencies, and the landowners has been completed by the Hakalau Forest National Wildlife Refuge Manager or the Pacific Islands Refuge Supervisor.

7. **Executive Order 12898. Federal Actions to Address Environmental Justice in Minority and Low-Income Populations.** All Federal actions must address and identify, as appropriate, disproportionally high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Indian Tribes in the United States. The proposed action was evaluated and no adverse human health or environmental effects were identified for minority or low-income populations, Native Hawaiians, or anyone else.

8. **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Secretarial Order 3127.** Several of the properties proposed for acquisition have been used as pasture for domestic livestock and associated agriculture operations. Some limited timber harvest has occurred. Because of the size of the properties and access difficulties, pre-acquisition Level 1 Contaminants Survey has been deferred and will be completed prior to acquisition.

9. **Endangered Species Act of 1973 (ESA), as amended.** Establishment of an approved refuge boundary is not a Federal action which would affect species listed under the Endangered Species Act. The purposes of the Hakalau Forest National Wildlife Refuge are " . . . to conserve (A) fish or wildlife which are listed as endangered species or threatened species . . . or (B) plants . . ." Fulfilling these refuge purposes will require intensive management actions once the land has been acquired. The Service will conduct consultation under Section 7 of the ESA for any refuge management actions which have the potential to affect listed species. . The purpose for this acquisition and conservation management, of this property is fully expected to benefit listed species. Future acquisition of the property will require the Refuge Manager to amend the Refuge Comprehensive Conservation Plan and/or other management plans for the Refuge and document any additional compliance requirements with Section 7 of the ESA.

I hereby certify that all requirements of the law, rules, and Service regulations or policies applicable to planning and compliance for the above project have been met.

Chief, Division of Planning, Visitor Services and Transportation, Region 1 — Date: 4/11/12

Project Leader, Hakalau Forest NWR — Date: 4/5/12

APPENDIX F

Director's Approval

United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE 11th Avenue
Portland, Oregon 97232-4181

In Reply Refer to:
FWS/R1/NWRS/PVST/051300

APR 18 2012

Memorandum

To: Director, Fish and Wildlife Service
Washington, DC

From: Regional Director, Region 1
Portland, Oregon

Subject: Approval to Proceed with Publication and Distribution of Final Planning Documents for the Proposed Additions to the Hakalau Forest National Wildlife Refuge

ACTION: Chief, Branch of Conservation Planning

We request your approval to proceed with the publication and distribution of the final planning documents for the proposed additions to the Hakalau Forest National Wildlife Refuge (Refuge). These documents describe a proposal to expand the approved boundary of the Refuge by 29,973 acres. We also request your approval that establishment of a new Kona Forest National Wildlife Refuge be timed with the acquisition of at least two key additional tracts at the Kona Forest Unit, thus providing a more significant management presence and capacity for addressing habitat and species management issues.

A Preliminary Project Proposal was approved on December 16, 2010 to conduct detailed planning within the 40,000 acre Hakalau Forest Conservation Study Area. Our planning process included planning updates and an open house held at the Refuge in August of 2011. We released a draft Land Protection Plan, draft Conceptual Management Plan, and Environmental Assessment for public review and comment on February 15, 2012.

The proposed land protection project is Region 1's highest priority among all existing and proposed projects. The total acquisition cost is $120,000,000, based on an estimate of $4,000 per acre. The annual operating cost when all land has been acquired is estimated to be $650,000. The project has been submitted for funding consideration from the Land and Water Conservation Fund in FY2014. It has a Land Acquisition Priority System score of 590.

Refuge staff intends to strengthen existing partnerships and develop new long-term partnerships with local landowners; Federal, State, and local agencies; and non-profit organizations to accomplish habitat restoration and land protection within the proposed expansion area.

A Land Conservation Plan, Conceptual Management Plan, Environmental Assessment, Environmental Action Statement, Statement of Compliance, unsigned Finding of No Significant Impact, and our responses to public comments are attached.

Please contact Scott McCarthy, Chief, Refuge Planning Branch at (503) 231-2232, or Jim Kraus, Project Leader, Hakalau Forest National Wildlife Refuge at (808) 443-2300 if you have questions.

Attachments

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

JUL 10 2012

In Reply Refer To:
FWS/ANRS/NRCP/051300

Memorandum

To: Regional Director, Region 1

From: Director

Subject: Approval to Proceed with Publication and Distribution of the Final Planning Documents for the Expansion of the Hakalau Forest National Wildlife Refuge, Hawai'i County, Hawai'i.

I approve your request dated April 18, 2012, to expand the Hakalau Forest National Wildlife Refuge on the Island of Hawai'i, Hawai'i County, Hawai'i.

The Decision Package you submitted for my consideration demonstrates the application of Strategic Habitat Conservation and uses spatially explicit decision support tools for targeting conservation delivery. It also contains an Environmental Assessment, Finding of No Significant Impact, and other related documents indicative of detailed planning. These documents comply with the requirements of the Director's land acquisition planning procedures memo dated August 11, 2000.

The lands targeted for protection will conserve up to 29,973 acres of habitat for endangered forest birds, waterbirds, and plants; other native species and special habitats; buffer against the adverse impacts associated with a variety of environmental stressors; and ensure progress in achieving the mission of the National Wildlife Refuge System.

Attachments

Hakalau Forest National Wildlife Refuge
60 Nowelo Street, Suite 100
Hilo, Hawai‘i 96720
Phone: 808/443-2300
Fax: 808/443-2304

http://www.fws.gov/hakalauforest

National Wildlife Refuge System Information
1 800/344 WILD

July 2012

Front Cover Photos:
Pueo
‘Ākepa
Ōpe‘ape‘a
Nēnē/USFWS

Back Cover Photo:
‘Apapane