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# Keālia and Moloa‘a Forest Reserves

## Management Plan

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January 2013

Prepared by:

State of Hawai‘i  
Department of Land and Natural Resources  
Division of Forestry and Wildlife  
Forest Management Section

## EXECUTIVE SUMMARY

This management plan for Keālia and Moloa‘a Forest Reserves on Kaua‘i is one in a series of site-specific plans to be prepared by the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) for individual forest reserves in the State of Hawai‘i. These plans present a brief history of the specific forest reserve, a complete record of land transactions and boundary changes over time, a description of cultural and natural resources, as well as an account of infrastructure and intended use(s) of the area. Plans will serve to: (1) assist in preparation of regulatory compliance documents required to implement management actions outlined in the plan; (2) support DOFAW efforts to secure funding for plan objectives; (3) prioritize implementation of management objectives; and (4) solicit requests for proposals or bids to implement plan objectives.

Keālia Forest Reserve was established by Governor’s Proclamation in 1906 for the purpose of protecting the forest on the mountain slopes and in the upper valleys of the watershed and to assist in maintaining regular stream flow. Moloa‘a Forest Reserve was established by Governor’s Proclamation in 1909; this reserve completed the ring of forest reserve land around Mount Wai‘ale‘ale, an area that provides most of the water used by the residents of Kaua‘i. Both reserves are generally characterized by steep, wet, forested slopes, with high tree canopy in the upper areas. Vegetation is primarily alien forest, although some native ecosystems remain in mauka areas.

DOFAW’s current management activities within Keālia and Moloa‘a Forest Reserves include hunting management, forest health monitoring, seabird research and surveys, and maintenance of Nā Ala Hele trails.

Management priorities were divided into eight categories and ranked on a qualitative basis. Summaries of general management actions for the Keālia and Moloa‘a Forest Reserve are as follows:

1. Watershed Values – Erosion reduction and prevention; Monitoring forest composition.
2. Native Ecosystems – Determine landscape level needs; Protect native dominated ecosystems.
3. Invasive Species Control – Manage incipient and established invasive plants and animals.
4. Resource Protection – Reduce impact of fire, insects and disease on forest resources.
5. Additional Public Activity – Acquire and secure additional management and/or public access.
6. Threatened and Endangered (T&E) Species Management – Protect occurrences of rare and endangered plants and animals.
7. Game Animal Management – Promote public hunting through amendments to Hawai‘i Administrative Rules (HAR) Chapter 123.
8. Commercial Activity – Generate income from commercial activities in the reserves.

Details of specific tactical goals and action items can be found in Table 8 on page 30 of this plan.

This plan is intended to describe short-term (approximately 5 to 10 years) resource management planning and implementation strategies, as well to serve as a basis for future updates and modifications to accommodate evolving or adaptive objectives such as fencing and improving access and facilities for Keālia and Moloa‘a Forest Reserves.



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KEĀLIA AND MOLOA‘A FOREST RESERVES  
MANAGEMENT PLAN SIGNATURE PAGE

Kaua‘i District certification: This plan was prepared by a team of Division of Forestry and Wildlife (DOFAW) staff to provide a management framework for Keālia and Moloa‘a Forest Reserves.

  
\_\_\_\_\_  
Galen Kawakami – DOFAW Kaua‘i Branch Manager

1/16/2013  
\_\_\_\_\_  
Date

DOFAW Administrator’s approval: I have reviewed the enclosed Forest Reserve Management Plan and concur with the recommendations herein. I agree that resource management implementation will follow those specified in the Management Plan for Keālia and Moloa‘a Forest Reserves.

  
\_\_\_\_\_  
Randall W. Kennedy – DOFAW Acting Administrator

1/14/13  
\_\_\_\_\_  
Date

Department of Land and Natural Resources Board approval: This plan meet the criteria established for State Forest Reserve Management Plans as mandated by Chapter 183, Section 16.5, Hawai‘i Revised Statutes.

  
\_\_\_\_\_  
William J. Aila, Jr. – BLNR Chairperson

Approved by the Board  
of Land and Natural  
Resources at its meeting  
held Jan 11, 2013

## DEVELOPMENT PROCESS TIMELINE

Keālia and Moloa‘a Forest Reserves, Kaua‘i

Stage of Development	Date Achieved	Comments
Branch review	March 2011	Incorporated
DOFAW review	April 2011	Incorporated
Partner agency consultation	July 2011	Incorporated
Public consultation	November 2011	Incorporated
DOFAW approval	January 2013	None
BLNR approval	January 2013	None

## I. INTRODUCTION

The Division of Forestry and Wildlife (DOFAW) conducts on-going planning efforts to develop and update management plans for all forest reserves across the State. These efforts, to be consistent across the State, serve to organize field management, assist in budgeting and funding concerns, and make the process transparent for partner organizations and the public. These plans also help to fulfill certain recommendations made in the Hawai'i Tropical Forest Recovery Action Plan, which came about as a result of the 1992 Federal Hawai'i Tropical Forest Recovery Act.

Each Branch office of the Division will have a comprehensive management plan that addresses overall Forest Reserve System issues, goals and objectives for that Branch. In addition, management plans will be developed for each individual forest reserve, which will in part reflect the Division's management guidelines specific to that area. This document represents the management plan for the Keālia and Molokaʻa Forest Reserves, which fits under the comprehensive forest reserve management plan for Kauaʻi Branch. It addresses concerns and strategies only on the public lands within Keālia and Molokaʻa Forest Reserves.

This management plan for the Keālia and Molokaʻa Forest Reserves was developed using a variety of methods. Initial development consisted of reviewing and analyzing DOFAW historic and current files (both at the Administrative and Kauaʻi Branch office) and documents obtained from other State agencies including the Department of Land and Natural Resources Land Division and Bureau of Conveyances, the Department of Accounting and General Services Survey Division, as well as the State Archives. State of Hawai'i Geographic Information Systems (GIS) map layers relating to biological, historical, and environmental resources were referenced extensively to develop this plan. Additional resources utilized for the development of this plan included other plans that identified the Forest Reserve or the area. Examples of other plans referenced during this process include the Hawaiian Forester and Agriculturalist, the Hawai'i Biodiversity and Mapping Program, Hawai'i's Comprehensive Wildlife Conservation Strategy, U.S. Fish and Wildlife Service Recovery Plans and others. The plan then evolved into its final iteration through discussions with Division staff from all program areas both at the Branch and Administrative offices, other Divisions and State agencies, DOFAW partners, and the public.

Once finalized by DOFAW this Keālia and Molokaʻa Forest Reserves Management Plan will be submitted for review and approval by the Board of Land and Natural Resources. If approved by the board the following actions may be triggered:

1. Preparation of regulatory compliance documents as required for implementation of management actions as outlined in the plan.
2. DOFAW efforts to secure operational and planning funding for plan objectives.
3. Prioritized implementation of plan objectives by DOFAW.
4. Periodic solicitation of requests for proposals or bids for implementation of plan objectives, including issuance of permits, licenses, or contracts (Hawai'i Administrative Rules §13-104-22), as necessary.

## II. KEĀLIA/MOLOA‘A FOREST RESERVES DESCRIPTION

**A. Location and Description:** Keālia and Moloa‘a Forest Reserves (FR) together comprise approximately 10,505 acres of public land (Tables 1 and 2) and are located in northeast Kaua‘i (Figure 1). Moloa‘a FR lies immediately to the north of Keālia FR, the latter of which is separated by privately-held lands into two non-contiguous sections. These reserves are mostly bounded by private land, with the exception of the south section of Keālia FR, which borders Līhu‘e-Kōloa FR. The area is on the windward side of Kaua‘i and is generally steep, wet, and forested with high tree canopy in the upper areas. The communities served by these FRs include Kilauea to south Anahola and Kapa‘a.

**Table 1.** Government Tax Map Key (TMK) parcels currently comprising public lands of Keālia Forest Reserve. Some TMKs have areas both inside and outside the FR boundary.

TMK Number	Owner	Tax Acres (entire TMK)	GIS Acres (entire TMK)	GIS Forest Reserve Acres
446001001	State of Hawai‘i	2335.0	2332.8	2332.8
446008032	State of Hawai‘i	30.3	32.5	32.5
446008033	State of Hawai‘i	47.0	38.2	38.2
446008034	State of Hawai‘i	2.4	1.4	1.4
447001002	State of Hawai‘i	416.6	409.4	409.4
447001003	State of Hawai‘i	252.2	246.0	246.0
447001004	State of Hawai‘i	5.2	5.2	5.2
448001001	State of Hawai‘i	3486.6	3685.6	3685.6
448001002	State of Hawai‘i	4.4	4.9	4.9
TOTAL				6756.0

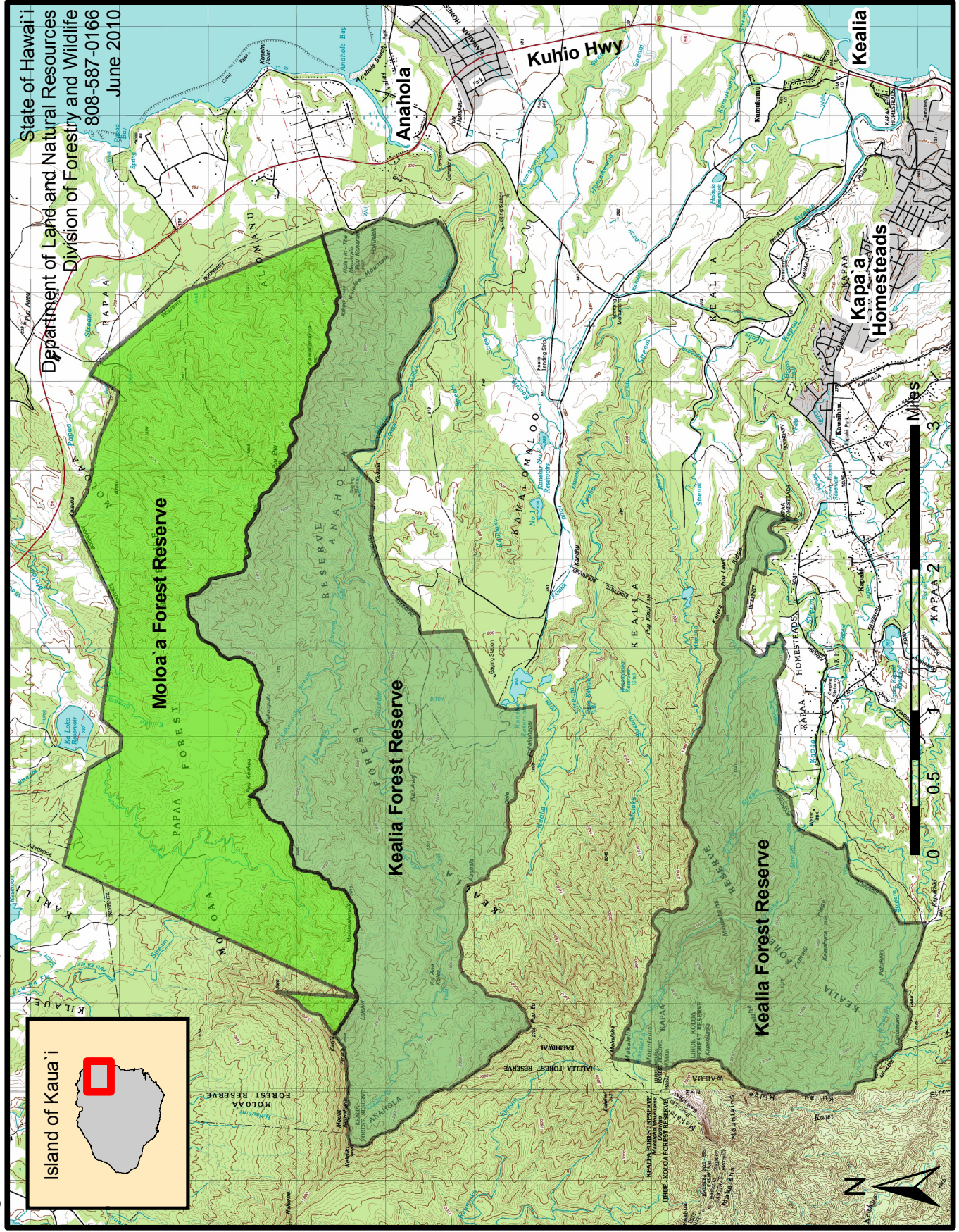
**Table 2:** Government Tax Map Key (TMK) parcels currently comprising public lands of Moloa‘a Forest Reserve. Some TMKs have areas both inside and outside the FR boundary.

TMK Number	Owner	Tax Acres (entire TMK)	GIS Acres (entire TMK)	GIS Forest Reserve Acres
449001001	State of Hawai‘i	2183.0	2231.4	2231.4
451001001	State of Hawai‘i	1410.9	1464.6	1464.6
451001002	State of Hawai‘i	7.1	6.2	6.2
451002006	State of Hawai‘i	27.0	26.1	5.2
452001002	State of Hawai‘i	41.0	41.9	41.9
TOTAL				3749.3

**B. Geographic Site Data:** Kaua‘i is the oldest of the main Hawaiian Islands and was formed approximately five million years ago by at least one extinct volcano (Juvik and Juvik 1998). A second, smaller volcano may have formed the southeast part of the island, but erosion, weathering, landslides, and rejuvenated flows have made it difficult to ascertain the island’s history. An enormous caldera complex and the lack of rift zones make the geology of Kaua‘i unique among the Hawaiian Islands. Kaua‘i is known for its deeply weathered mountains and associated landscapes (e.g. Waimea Canyon and the Nāpali coast) and its wet climate. Kawaikini peak is the highest point on Kaua‘i’s Mount Wai‘ale‘ale; with an annual rainfall of over 450 inches, it is arguably the wettest place on Earth.



Figure 1: Current extent of public lands of Kealia and Moloaʻa Forest Reserves





**C. Physical Site Data:** Keālia and Moloa‘a Forest Reserves currently occupy lands in the ahupua‘a of Ko‘olau, Kāhili, Waiakalua, Moloa‘a, Pāpa‘a, ‘Aliomanu, Anahola, Keālia, and Kapa‘a. Elevation and rainfall vary through the reserves; the mauka boundaries of the area reach approximately 3000 feet in elevation and have over 120 inches of annual precipitation (Figure 2). Makai regions slope down to below 400 feet and have less than 60 inches of annual rainfall. Rainfall received in the Keālia and Moloa‘a FRs charges two aquifers: Kilauea and Anahola. Soils in both reserves are predominantly classified as Highly Erodible Land as defined by the United States Department of Agriculture’s Natural Resource Conservation Service. This agency provides online soil maps and data at <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>.

Keālia FR contains all or part of the following features in its northern section: Kekōiki summit, Mount Namahana, Kāhili summit, Leleiwi summit, Ke Ana Kōlea, Pu‘u ‘eu summit, Mālamalamaiki summit, Anahola summit, Kapa‘a Stream, Anahola Stream (falls), ‘Ōhi‘a summit, Pu‘u awa, Pu‘u keakea, Kaho‘opulu Stream and summit, Keao‘opu Stream (falls), Pu‘u ehū, Kiokala cliff, Kawaiumakua summit, Kiko‘o summit, Hole-in-the-Mountain, Pu‘u konanae, and Hokualele summit. Keālia’s southern section contains all or part of these features: Makaleha mountains, peak, and stream, Kapehua‘ala summit, Pōhākupili summit, Kamali‘i Ridge, Kamahuna summit, Pōhāki‘iki‘i summit, Kuilau Ridge, Kainamanu summit, Kapahi Stream, Moalepe Stream, Keiwa Ridge, and Pu‘u Lawi‘i (State of Hawai‘i Kaua‘i DRG GIS layer). All streams in Keālia Forest Reserve are ranked as outstanding aquatic resources (State of Hawai‘i and National Park Service 1990).

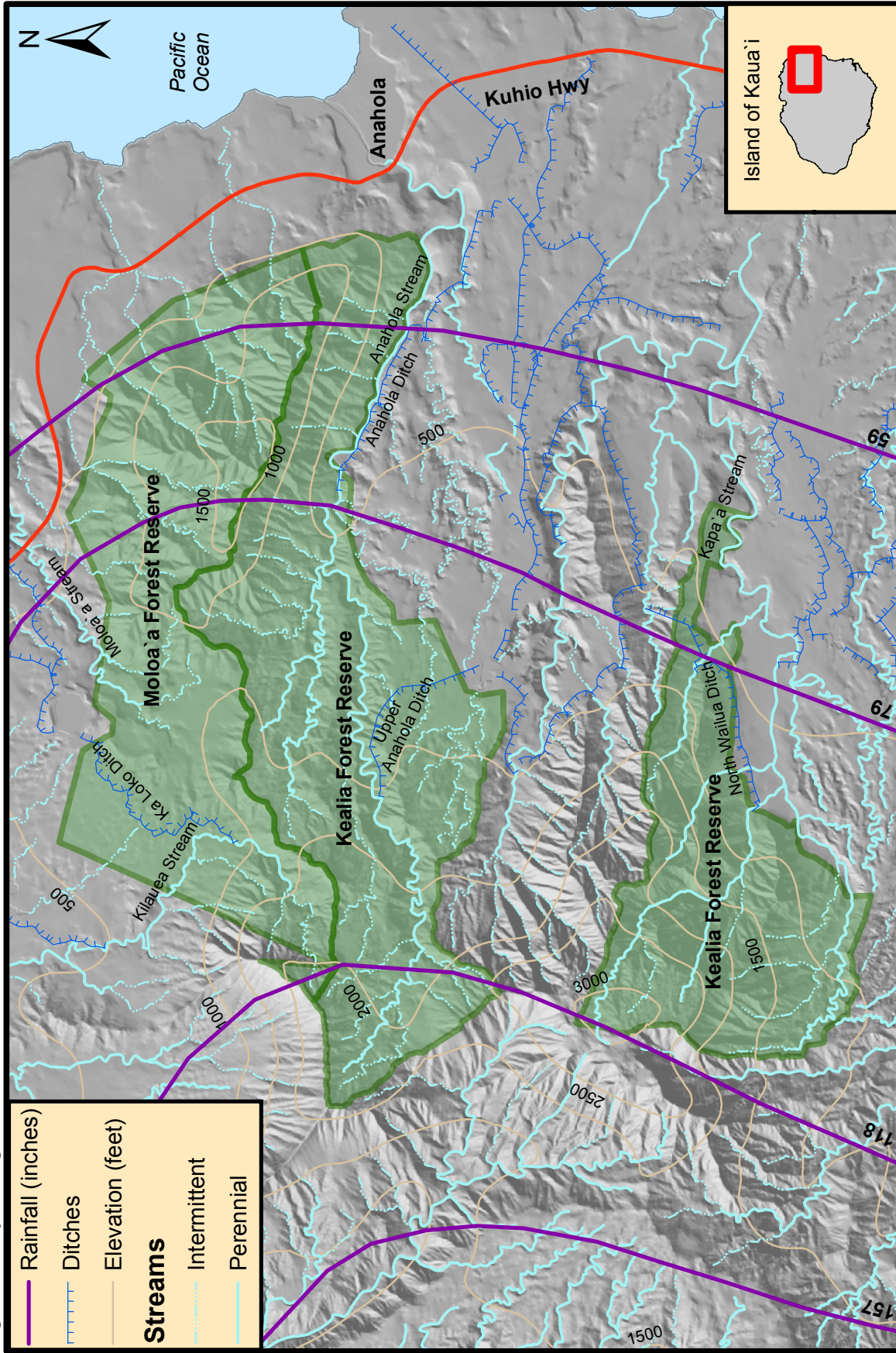
Moloa‘a FR contains all or part of the following features: Kāhili summit, Leleiwi summit, Kilauea Stream, Pu‘u ka ‘Ele Stream, Moloa‘a Stream, Mālamalamaiki summit, Pu‘u keakea, Kaho‘opulu summit, Kalua‘a Stream, Kalaina cliff, Amu summit, Papa‘a Stream, Pu‘u ehū, Kawaiumakua summit, and ‘Aliomanu Stream. Moloa‘a Forest Reserve has two perennial streams that are included in the Hawai‘i Stream Assessment Report; Kilauea Stream is ranked as moderate and Moloa‘a Stream is ranked as outstanding.

**D. Pre-Reserve and Early Use History:** Both forest reserves were created by Governor’s Proclamation; Keālia in 1906 and Moloa‘a in 1909. According to the report that preceded the 1906 Proclamation, “The object of the proposed Kealia Forest Reserve is by protecting the forest on the mountain slopes and in the upper valleys of the watershed, to assist in maintaining the present desirable conditions of regular flow in the streams and the retention of at least a part of the storm water” (Hosmer 1906). Boundaries were drawn with the expressed intent to exclude any lands that were suitable for agriculture or grazing.

In regards to the Moloa‘a FR, “the object of this reserve is protect and preserve the forest on the steep slopes that can be used to better economic advantage for growing forest than for any other economic purpose. There is not much water on these slopes, but what there is, is of high value” (Hosmer 1909). It is noted that Moloa‘a “rounds out the block of forest land on the north side of Kauai and completes the chain of reserves around Mt. Waialeale.” Over the years, the boundaries of both reserves have undergone changes (Tables 3 and 4, Figures 3 and 4).

By the time Keālia and Moloa‘a Forest Reserves were established, irrigation ditches developed by Lihue Plantation and Kilauea Sugar were already widespread in northwest Kaua‘i (Wilcox 1996). Although most of these ditches were located on private lands, some reached up into the government forest reserves (Figure 2). Ditches that were located in the public lands of Keālia

Figure 2: Hydrological features of Kealia and Moloa'a Forest Reserves



State of Hawai'i  
 Department of Land and Natural Resources  
 Division of Forestry and Wildlife  
 808-587-0166  
 June 2010



Figure 3: Historical changes to Kealia Forest Reserve. Year of addition/withdrawal and ahupua`a indicated.

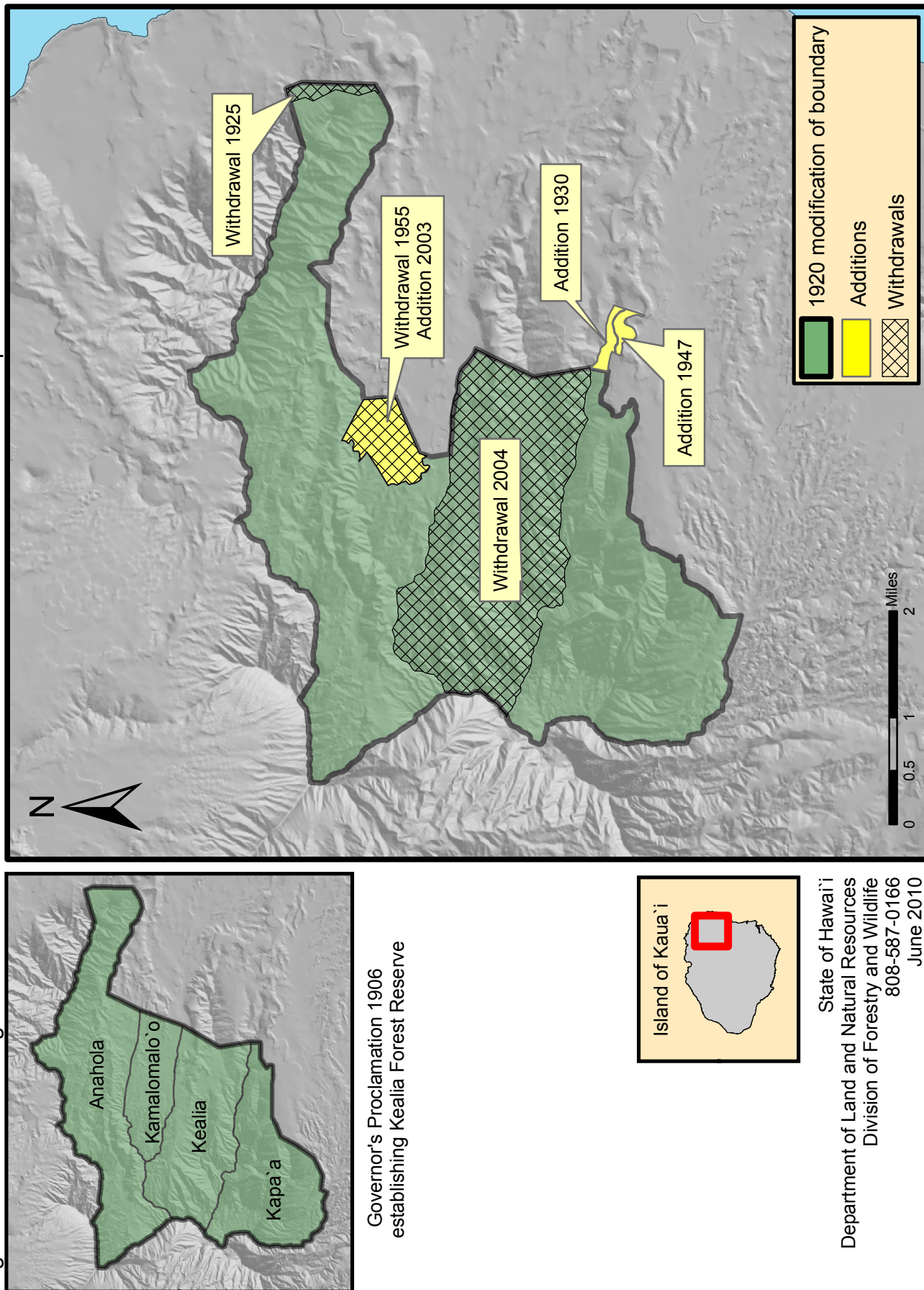
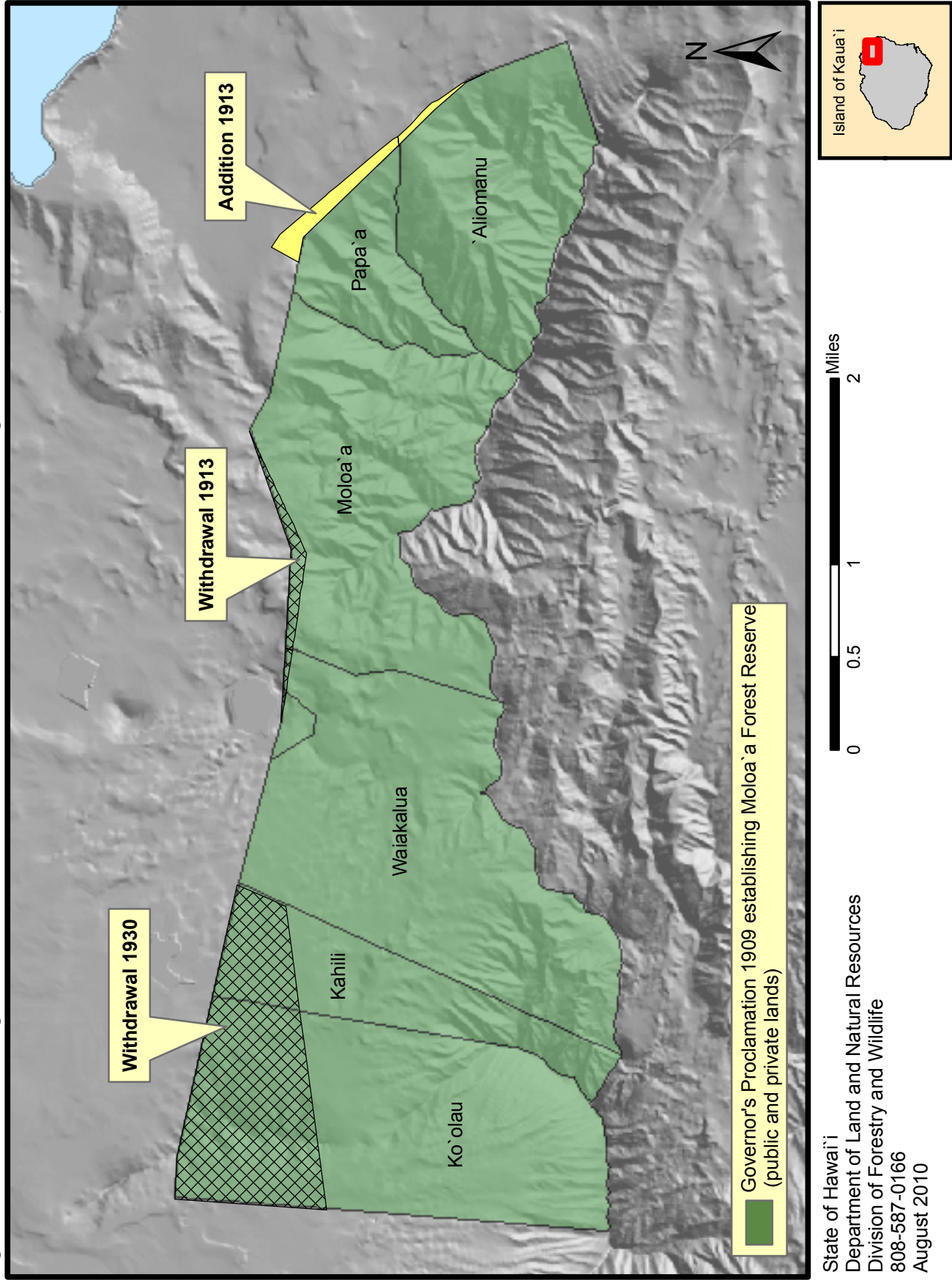


Figure 4: Historical changes to Molokaʻa Forest Reserve boundaries. Year of change and ahupuaʻa indicated.



FR include the Anahola and Upper Anahola Ditches and the North Wailua Ditch; these were constructed by Lihue Plantation, which eventually took over Makee Plantation, another sugar grower in the area. The Ka Loko Ditch and Moloa‘a Ditch were built in Moloa‘a FR by Kilauea Sugar Company in the early 1900’s. A revocable permit was issued for Ka Loko Ditch in 1985 (Table 5), but Moloa‘a Ditch remains un-permitted. Unless a third party comes forward to obtain the proper permits and licenses to operate and maintain Moloa‘a ditch, DOFAW is in favor of decommissioning the diversion.

DOFAW’s historical files for the two reserves contain a variety of entries. Adjacent landowners often failed to maintain fence lines, allowing cattle access to the forest. Multiple requests from agricultural companies (Hawaiian Canneries, Kilauea Sugar Plantation Company) were made through the first half of the twentieth century for the lease of forest reserve land for pineapple cultivation or pasturage; none of these lease requests were granted but boundaries of both forest reserves were modified over the years to eliminate lands that were suitable for agricultural purposes. Water was diverted from Pāpa‘a Stream in Moloa‘a FR for use in the nearby Hawaiian Canneries labor camp. A right-of-way was granted to Makee Sugar Company for a railroad across part of Keālia Forest Reserve near the Kapa‘a Homesteads. In 1944, the Lihue Plantation Company, Ltd. surrendered the “care, custody and control” of 2,470 acres of land to the Keālia FR for a period of 20 years, in return they were exempt from paying taxes for that property for the duration of the surrender agreement. The U.S. Army and Marine Corps burned approximately 45 acres north of Moalepe Stream in Keālia FR, during the use of the land as a heavy artillery impact area and for bazooka practice during WWII. In 1968, 106 acres of land burned at Kamali‘i Ridge in Keālia FR; the fire was caused by a lessee on adjacent State land who was burning cut brush piles. A portion of Keālia FR came under jurisdiction dispute with the Department of Hawaiian Homelands in the 1990s; it was ultimately determined that the land in question was a part of the forest reserve and therefore unavailable for Hawaiian Homeland use. In 2006, an unauthorized tour helicopter landing site and two accompanying structures were discovered in Moloa‘a FR. The Department of Water conducted emergency repairs of a pipeline from Moalepe Stream 2009. Recent issues in the area include illegal dirt biking, hunting, and marijuana cultivation.

**Table 3:** Summary of public land additions and withdrawals (A/W) for Keālia Forest Reserve. See Figure 3 for map descriptions. Portions of TMKs are denoted with (por.). Data relating to these items are filed at the DOFAW Administrative Office and the State Survey Office.

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Governor’s Proclamation	09-Mar-1906	A	Land set aside for establishment of Keālia Forest Reserve (includes private lands at Keālia)	9935	1646	452001004 (por.) 446001001 447001001 447001002 447001003 447001004 447002004 (por.) 447002005 448001001 448001002 448002001 (por.)

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
						448002002 448002003 448005024 448005030 (por.) 448005031 (por.) 448005032 448005033 (por.) 448005034 (por.) 448005036 448005037 448005039 (por.) 448005041 448005045 (por.) 448005046 (por.) Portions of Kapa'a homestead lots
Governor's Proclamation	21-Jun-1920	W	Modification of Boundary – Withdrawal of Government lands suitable for agriculture and grazing (includes private lands at Keālia)	9050	2475	446001001 447001001 447001002 447001003 447001004 448001001 448001002 448005024 448005030 (por.) 448005031 (por.) 448005032 448005033 (por.) 448005034 (por.) 448005036 448005037 448005039 (por.) 448005041 448005045 (por.) 448005046 (por.) 452001004 (por.)
Governor's Proclamation	20-May-1925	W	Withdrawal of Government lands at Anahola for pineapple cultivation	62.22	4273	448005024 448005030 (por.) 448005031 (por.) 448005032 448005033 (por.) 448005034 (por.) 448005036 448005037 448005039 (por.) 448005041 448005045 (por.) 448005046 (por.)
Governor's Proclamation	25-Mar-1930	A	Addition of steep land at Kapa'a after expiration of General Lease No. 951	44.81	5514	446008033

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Executive Order 1205	25-Jun-1947	A	Addition of lands at Kapa'a Homesteads	32.69	10405	446008032
Executive Order 1678	22-Mar-1955	W	Withdrawal of lands at Anahola and Kamalomalo	253.0	12105	447001003
Executive Order 4064	07-Sep-2003	A	Addition of lands at Anahola and Kamalomalo	253.00	23501	447001003
Executive Order 4081	03-Nov-2004	W	Withdrawal of private lands at Keālia	2416.0	23817	447001001

**Table 4:** Summary of public land additions and withdrawals (A/W) for Molokaʻa Forest Reserve. See Figure 4 for map descriptions. Portions of TMKs are denoted with (por.). Data relating to these items are filed at the DOFAW Administrative Office and the State Survey Office.

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Governor's Proclamation	05-Jun-1909	A	Land set aside for Molokaʻa Forest Reserve (includes private lands at Kīlauea, Kāhili, Pāpaʻa, Pīlaʻa, Lepeuli, Molokaʻa, and ʻAliomanu)	5670.0	1961	449001001 (por.) 449010002 (por.) 449003002 (por.) 449010001 (por.) 449010006 (por.) 451001001 451001002 452001001 452001002 452001005 451002002 (por.) 451002005 (por.) 451002006 (por.) 452002011 (por.) 452003001 (por.) 452022025 (por.)
Governor's Proclamation	13-Oct-1913	W	Modification of boundary – withdrawal of grazing land (Government and private)	83.0	2431	449001001 449003002 (por.) 449010001 (por.) 449010006 (por.) 451001001 451001002 452001001 452001002 452001005 451002005 (por.) 451002006 (por.) 452002011 (por.) 452003001 (por.) 452022025 (por.)

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Governor's Proclamation	17-Oct-1930	W	Modification of boundary – withdrawal of private sugar lands at Kīlauea, Pīla'a, Moloa'a, Pāpa'a, and 'Aliomanu	521.0	5515	452001001 (por.) 452001005 (por.)

**Kuleana Parcels:** None.

**Documented Activities/Leases/Deeds/Permits:** Over the years, the occasional land use agreement had been issued for lands in the Moloa'a and Keālia FRs (Table 5). Most of these were related to agricultural use or water access. No current agreements exist in these reserves.

**Table 5:** Historical land use agreements in Keālia and Moloa'a Forest Reserves.

Type of Action	Action Number	Duration	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key */1
License	n/a	18-May-1918 Duration not specified	Keālia FR – To Makee Sugar Co. for railroad right-of-way across Kapahi, Kapa'a	0.29	Govt. Survey Registered Map No. 2449	Not specified
Agreement of Surrender	n/a	5-Sept-1944 to 5- Sept-1964	Keālia FR – Lihue Plantation sets aside land inside FR	2,470	n/a	447001001
Lease	n/a	?	Kilauea Sugar? For Kaloko Ditch right-of-way – renewal approved in 1953	n/a	n/a	451001001
Right-of-Entry Permit	n/a	2-Feb-1961 Duration not specified	Moloa'a FR - Right-of-entry to East Kaua'i Water Company, Ltd. For Groundwater exploration at Kuiliki and Pahulohu Streams	n/a	n/a	Not specified
n/a	n/a	12-Dec-1961	Moloa'a FR – Letter granting permission to American Factors Ltd. To drill water wells near Kuiliki and Pahulohu Streams	n/a	n/a	Not specified
n/a	n/a	1982	Keālia FR - DLNR Division of Water and Land Development; Exploratory well	n/a	n/a	446001001
Revocable Permit	S-6240	1-Nov 1985 To 28-Sept-2007	Moloa'a FR – Kilauea Irrigation Co. Inc. for water development	n/a	n/a	451001002 (por.)



Type of Action	Action Number	Duration	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key */1
License	n/a	18-May-1918 Duration not specified	Keālia FR – To Makee Sugar Co. for railroad right-of-way across Kapahi, Kapa‘a	0.29	Govt. Survey Registered Map No. 2449	Not specified
Right-of-Entry Permit	n/a	28-Jan-2003; valid for 30 days	Keālia FR – Kaua‘i island Utility Cooperative and Kaua‘i County Water Dept. – service of water tank	n/a	n/a	446004: Piliamo‘o road right of way to Keālia FR
Right-of-Entry Permit	n/a	15-Oct-2007 to 15-Dec-2007	Keālia FR - SSFM International; surveys for renovation of Akulikuli Tunnel	n/a	n/a	446001001

**E. Vegetation:** Most of the area in Keālia and Moloa‘a Forest Reserves is dominated by alien forest (albizia (*Falcateria moluccana*), strawberry guava (*Psidium cattleianum*), and java plum (*Syzygium cumini*)), shrubland (lantana (*Lantana camara*)), and grassland (guinea grass (*Urochloa maxima*)) (Figure 5). There are areas, however, where native forest persists in mauka regions, particularly in the ahupua‘a of Moloa‘a, Ko‘olau, and Kapa‘a. DOFAW’s 2001 Draft Management Guidelines consist of four vegetation classifications: V-1 Highest Quality Native Ecosystems, V-2 Predominantly Native Areas, V-3 Considerably Disturbed Areas, and V-4 Badly Degraded Areas. The vegetation in Keālia and Moloa‘a Forest Reserves is classified V-3 and V-4 (Figure 6). V-3 areas are managed to prevent activities or intensities of use that result in degradation of unique native species and secondary forest resources (water supply, erosion control and aesthetic values). Permitted activities may have high levels of disturbance, as long as they don’t negatively impact remaining native plant populations and have an eventual net benefit to other resources like water or an improved vegetative cover. Native plant conservation may be focused at a species, rather than an ecosystem level. There are approximately 1201 acres of V-3 managed land in Moloa‘a FR and 3787 acres in Keālia FR. Management objectives for V-4 areas are to prevent activities or intensities of use that result in degradation of watershed cover or soils. These areas are where the most disruptive activities would be allowed, such as large-scale commercial forestry, game habitat manipulation, etc. Native plant conservation is mainly focused at the species level. There are approximately 2468 acres of V-4 managed land in Moloa‘a FR and 2296 acres in Keālia FR. DOFAW is in the process of updating its Management Guidelines.

**Rare Plants:** Kaua‘i has a high level of biological endemism (Mitchell et al. 2005) and has many rare plants, some of which may be found within Keālia and Moloa‘a Forest Reserves (Table 6 and Figure 7). Rare species in Hawai‘i may be listed with the Federal Endangered Species Act (US-ESA) and/or with the local Plant Extinction Prevention Program (PEP), whose mission is to protect Hawai‘i’s rarest native plants from extinction. PEP works to reverse the trend toward extinction by managing wild plants, collecting seeds and establishing new populations with a focus on species that have fewer than 50 individual plants remaining. Funding for the PEP Program is provided by DOFAW, US Fish and Wildlife Service (USFWS) and other federal, state, and private partners. Members of the Hawai‘i Rare Plant Restoration Group, of which DOFAW is a founding member, provides oversight to PEP and provides

Figure 5: Vegetative cover at Kealia and Moloa'a Forest Reserves (Hawai'i GAP Analysis Program 2005)

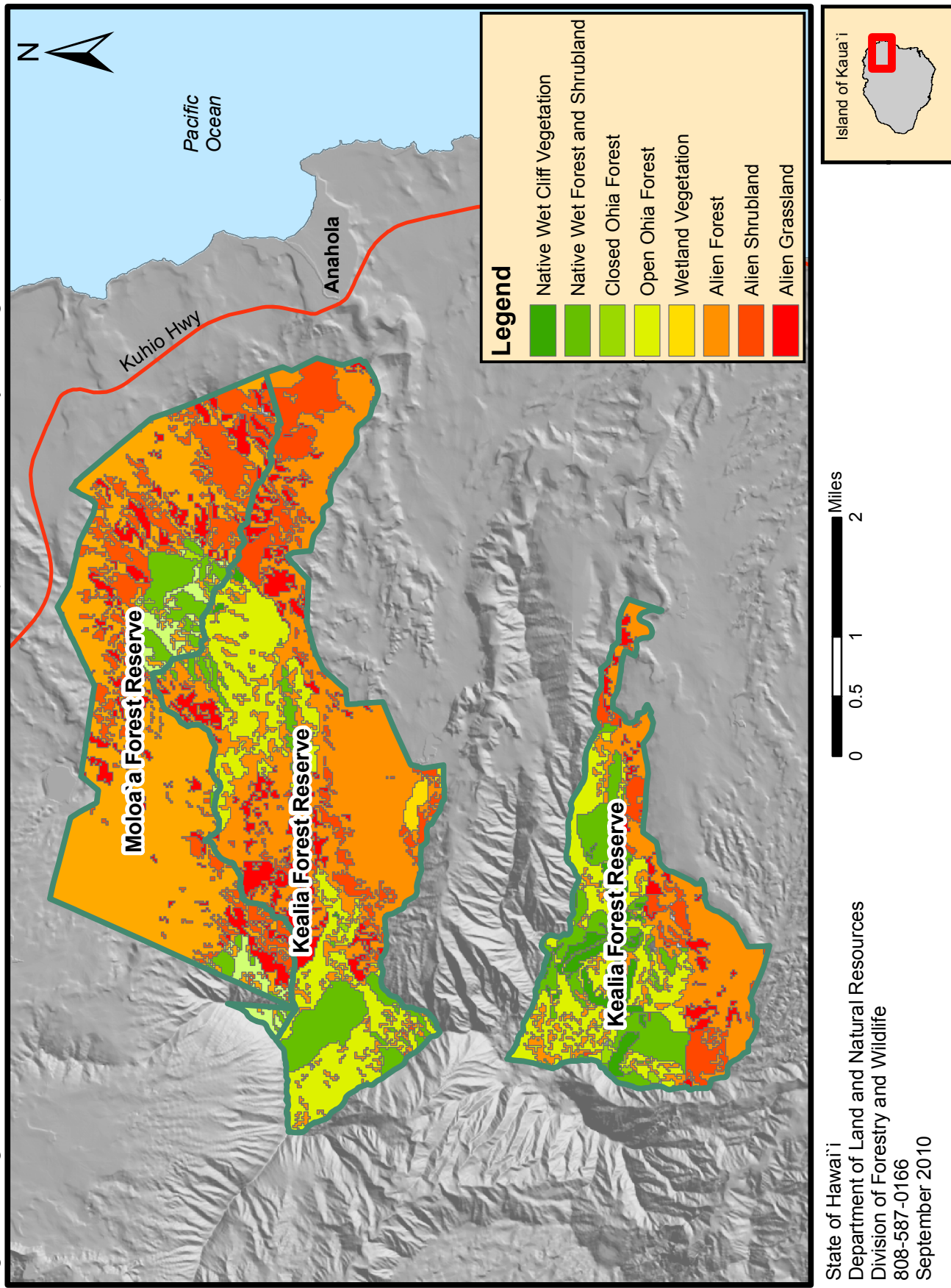




Figure 6: DOFAW's 2001 Draft Management Guidelines for Kealia and Moloa'a Forest Reserves (FR)

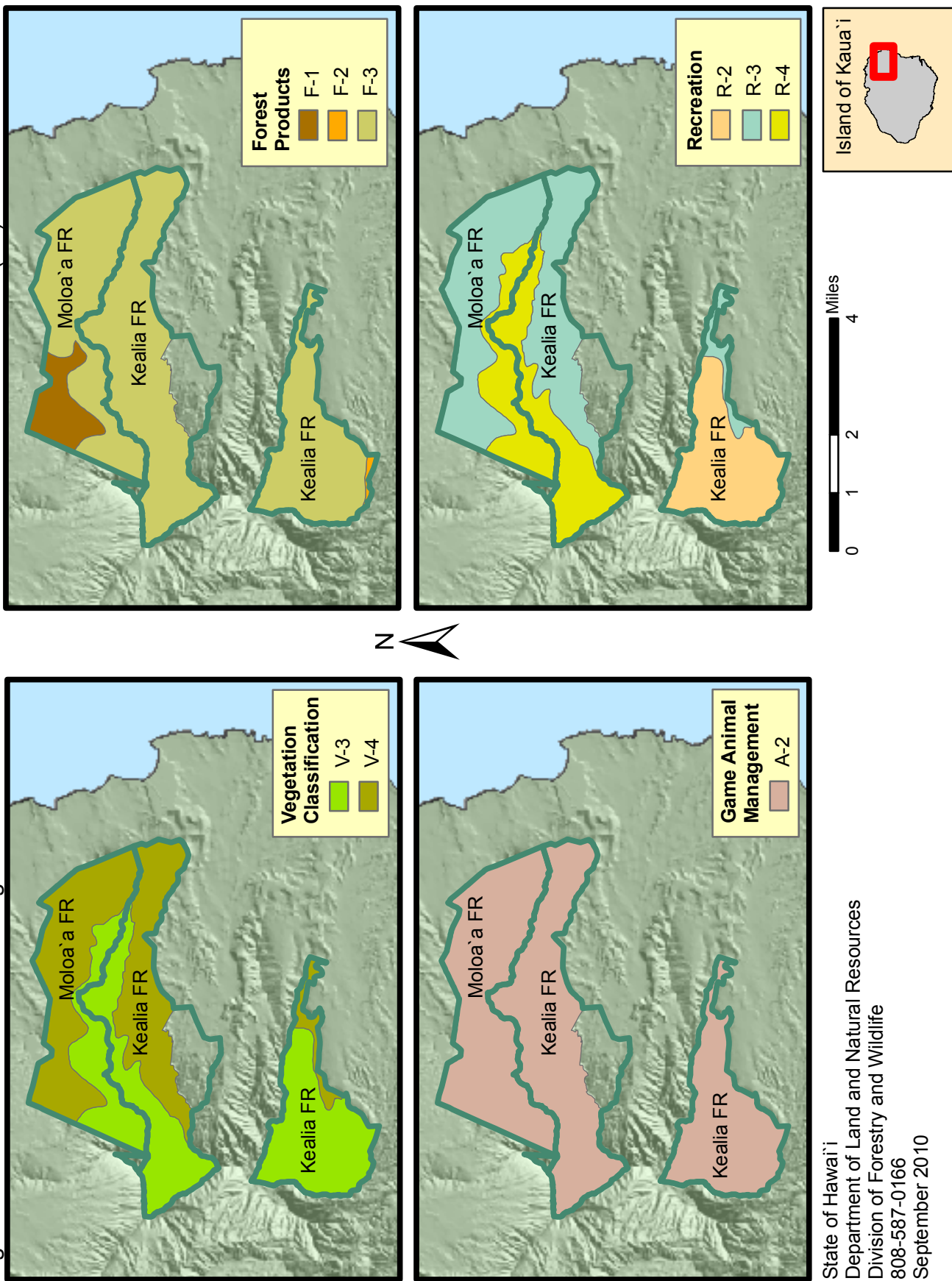
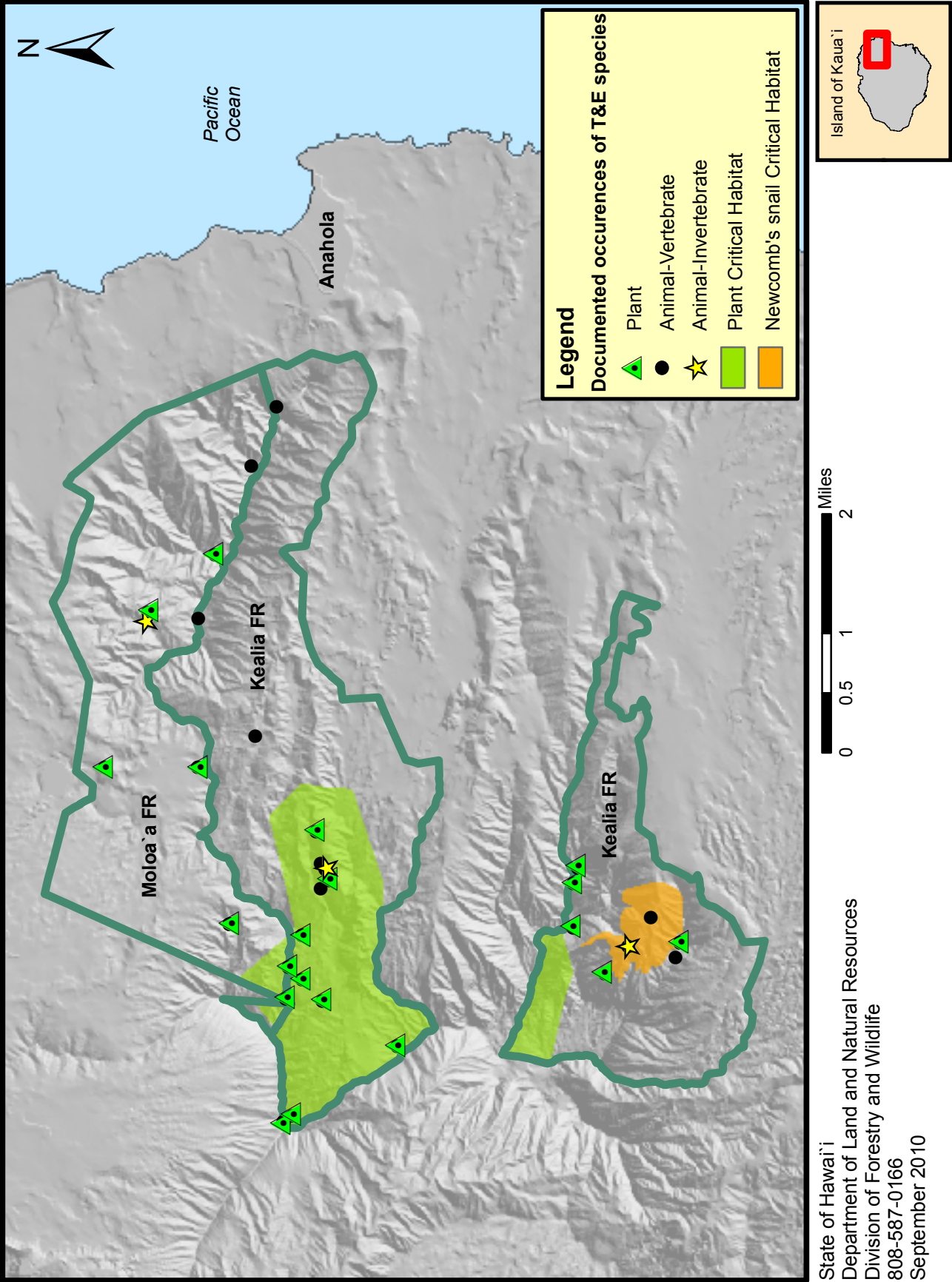


Figure 7: Threatened and Endangered (T&E) Species and Critical Habitat in Kealia and Moloa`a Forest Reserves (FR)  
Also see Table 4. (Hawai`i Biodiversity and Mapping Program 2008)



botanical expertise when necessary. PEP regularly collaborates with over 60 conservation partners and landowners to protect the species under their jurisdiction.

**Table 6:** Rare and endangered plants and animals observed within Keālia and Moloa‘a FRs (Hawai‘i Biodiversity and Mapping Program 2008). Species listed may have more than one observation. An observation is considered historical if it occurred more than 30 years ago. Also see Figure 7.

	Species	Current/ Historical	US-ESA Listing Status	PEP Species
<b>Plants</b>	<i>Adenophorus periens</i>	Current	Endangered	Yes
	<i>Bonamia menziesii</i>	Historical	Endangered	No
	<i>Chamaesyce remyi</i> var. <i>remyi</i> (‘akoko, koko, kokomalei)	Historical/ Current	Endangered	No
	<i>Cyanea asarifolia</i> (‘oha, haha, ‘oha wai)	Historical	Endangered	Yes
	<i>Cyanea recta</i>	Current	Threatened	No
	<i>Cyrtandra kealiae</i> subsp. <i>kealiae</i> (ha‘iwale, kanawao ke‘oke‘o)	Historical/ Current	Threatened	No
	<i>Cyrtandra oenobarba</i> (ha‘iwale, kanawao ke‘oke‘o)	Historical	Candidate	No
	<i>Cyrtandra pickeringii</i> (ha‘iwale, kanawao ke‘oke‘o)	Current/ Historical	Species of Concern	No
	<i>Dubautia knudsenii</i> subsp. <i>filiformis</i> (na‘ena‘e)	Historical/ Current	Species of Concern	No
	<i>Exocarpus luteolus</i> (heau)	Historical	Endangered	No
	<i>Gardenia remyi</i> (nanu, na‘u)	Historical	Candidate	No
	<i>Hibiscus clayi</i> (koki‘o, ‘ula‘ula)	Historical	Endangered	Yes
	<i>Joinvillea ascendens</i> subsp. <i>ascendens</i> (‘ohe)	Historical	Candidate	No
	<i>Labordia lydgatei</i> (kamakahala)	Current	Endangered	Yes
	<i>Phyllostegia helleri</i>	Current	Species of Concern	No
	<i>Pteralyxia kauaiensis</i> (kaulu)	Current/ Historical	Endangered	No
	<i>Schiedea kauaiensis</i>	Historical	Endangered	Yes
	<i>Stenogyne kealiae</i>	Historical/ Current	Endangered	No
<b>Animals</b>	<i>Anas wyvilliana</i> (koloa, Hawaiian duck)	Current	Endangered	n/a
	<i>Atyoida bisulcata</i> (‘opaekala‘ole)	Historical	n/a	
	<i>Awaous guamensis</i> (‘o‘opu nakea)	Historical	n/a	
	<i>Carelia dolei</i>	Historical	Species of Concern	
	<i>Carelia olivacea</i> (Amastrid land snail)	Historical	Species of Concern	
	<i>Erinna newcombi</i> (Newcomb’s snail)	Current	Threatened	
	<i>Lasiurus cinereus semotus</i> (‘ōpe‘ape‘a, Hawaiian Hoary Bat)	Current	Endangered	

	Species	Current/ Historical	US-ESA Listing Status	PEP Species
	<i>Lentipes concolor</i> (‘o‘opu alamo‘o)	Current	n/a	
	<i>Pterodroma sandwichensis</i> (Hawaiian petrel)	Current	Endangered	
	<i>Puffinus auricularis newelli</i> (‘a‘o, Newell’s shearwater)	Current	Threatened	

**Plant Critical Habitat:** As defined by the US-ESA, Critical Habitat is defined as “specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and that have been formally designated by rule.” (US Fish and Wildlife Service 2004). Keālia Forest Reserve contains Critical Habitat for nine plant species (*Adenophorus periens*, *Cyanea asarifolia*, *C. recta*, *C. remyi*, *Cyrtandra cyanoides*, *C. limahuliensis*, *Hibiscus clayi*, *Labordia lydgatei*, and *Phyllostegia wawrana*) totaling 1,634 acres, in addition to 234 acres of Newcomb’s snail critical habitat (Figure 7). Moloa‘a Forest Reserve contains Critical Habitat for fifteen plant species (*Adenophorus periens*, *Chamaesyce remyi* var. *kauaiensis*, *C. remyi* var. *remyi*, *Cyanea asarifolia*, *C. dolichopoda*, *C. oenobarbara*, *C. recta*, *Cyrtandra limahuliensis*, *Dubautia plantaginea* ssp. *magnifolia*, *Hibiscus clayi*, *Labordia lydgatei*, *Lysimachia iniki*, *L. pendens*, *L. venosa* and *Platydesma rostrata*) totaling approximately 105 acres.

**Timber Species:** Large scale harvesting of the Hawaiian forests began in 1791 with the sandalwood trade; this ultimately led to Hawaii’s first conservation law in 1839, restricting the cutting of sandalwood (Nelson 1967). Forest loss continued due to cattle grazing and the need for fuel wood on whaling ships and in sugar mills. Eventually, sugar plantations began replanting efforts to replace the forests that provided a steady source of water. The Territorial government also took an interest in exotic and native tree planting throughout the Hawaiian Islands, both for reforestation purposes and to conduct trials with commercially valuable timber species. Keālia and Moloa‘a Forest Reserves together have four plantation plots encompassing approximately 90 acres located in widespread areas (Figure 8) (Klingensmith 1967); most of these were planted prior to 1957 (Honda et al. 1967).

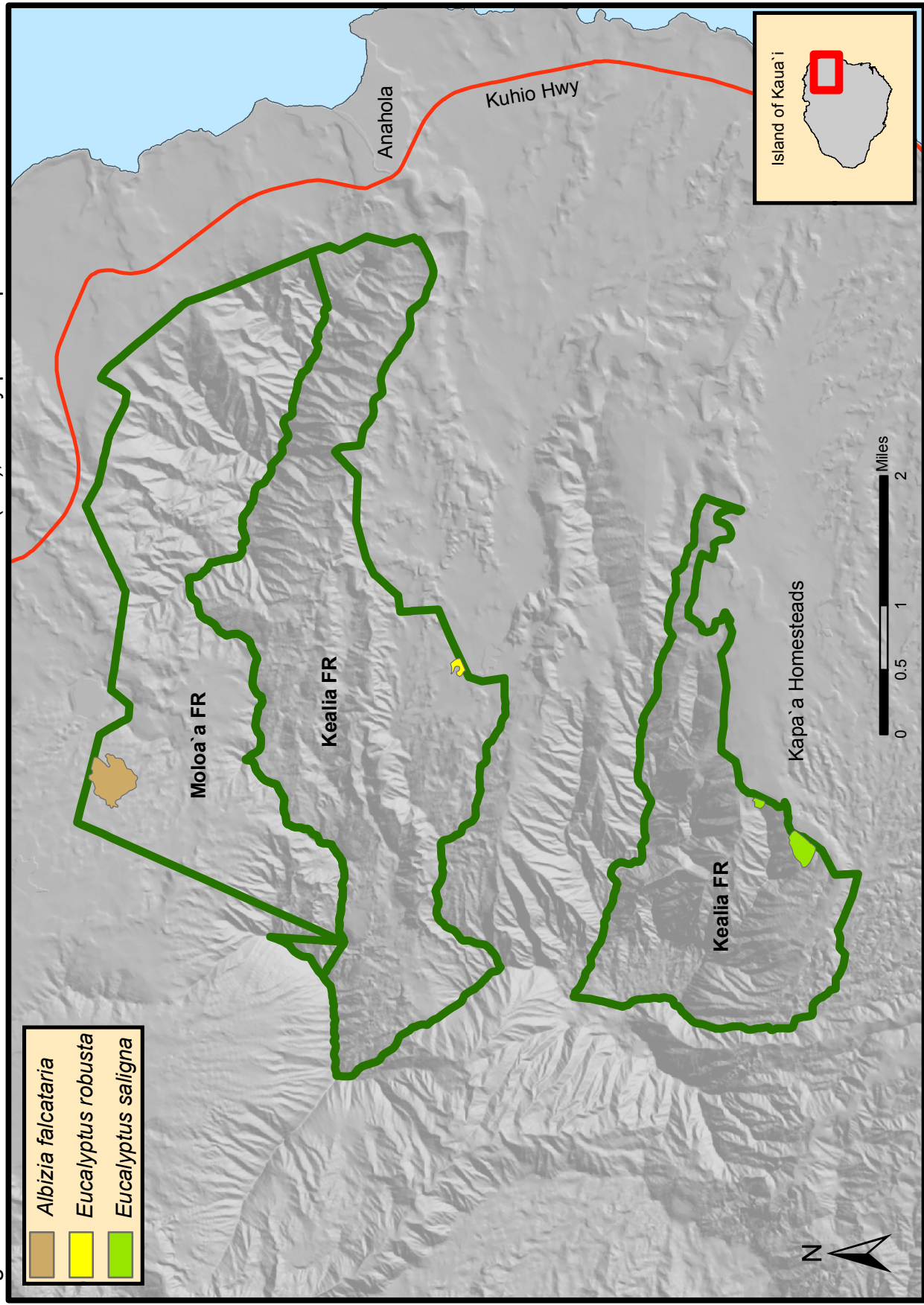
DOFAW’s Draft Management Guidelines designate Moloa‘a FR as containing two of four levels of forest products classification (Figure 6): Primary (F-1, forest products are a primary objective, 763 acres) and Personal (F-3, small scale non-commercial harvesting or salvage is allowed, 2,906 acres). Keālia FR also contains two levels of such classification: Secondary (F-2, limited small scale harvesting or salvage is allowed, 62 acres) and Personal (6,021 acres). All classification levels have restrictions regulated by DOFAW and require appropriate permits and/or licenses. DOFAW is in the process of updating its Management Guidelines.

**Invasive plant species:** Large areas of both Keālia and Moloa‘a FRs are comprised of alien vegetation, much of which is considered invasive. Species in the FRs that fall under this category include:

- *Ardisia elliptica* (shoebutton ardisia)
- *Caesalpinia decapetala* (catsclaw)
- *Casuarina equisetifolia* (ironwood)
- *Chrysophyllum oliviforme* (satin leaf)



Figure 8: Plantation timber stands in Kealia and Moloa'a Forest Reserves (FR), mostly planted prior to 1957.



- *Citharexylum caudatum* (juniper berry)
- *Clidemia hirta* (clidemia)
- *Clusia rosea* (autograph tree)
- *Falcataria moluccana* (albizia)
- *Hedychium coronarium* (white ginger)
- *Lantana camara* (lantana)
- *Melastoma malabathricum* (melastoma)
- *Psidium cattleianum* (strawberry guava, waiawi)
- *Rhodomyrtus tomentosa* (Isenberg bush)
- *Rubus rosifolius* (thimbleberry)
- *Schinus terebinthifolius* (Christmas berry)
- *Spathodea campanulata* (African tulip)
- *Sphaeropteris cooperi* (Australian tree fern)
- *Syzygium cumini* (Java plum)
- *Urena lobata* (aramina)
- *Urochloa maxima* (guinea grass)

## **F. Wildlife:**

**Native Wildlife:** A variety of native wildlife, including rare and/or endangered species may be found within Keālia and Moloa‘a Forest Reserves (Table 6, Figure 7).

Auditory surveys conducted by the Kaua‘i Endangered Seabird Recovery Project have shown the presence of seabirds at several locations (Nick Holmes, personal communication, unreferenced). The endangered Newell’s shearwater (‘a‘o, *Puffinus auricularis newelli*) has active, inactive, and historical breeding sites in mountainous areas spread through both forest reserves; the most active area for these birds is in the Makaleha Mountains in the south section of Keālia FR. Calls of the endangered Hawaiian petrel (‘ua‘u, *Pterodroma sandwichensis*) have also been detected and the Hawaiian duck (koloa, *Anas wyvilliana*) has been observed. The endangered Hawaiian Hoary Bat (‘ōpe‘ape‘a, *Lasiurus cinereus semotus*) was also detected by the auditory surveys in both forest reserves.

As both Keālia and Moloa‘a Forest Reserves have outstanding quality streams, native aquatic wildlife may be found in the area, including the fishes o‘opu akupa (*Eleotris sandwicensis*), o‘opu nakea (*Awaous guamensis*), and aholehole (*Kuhlia sandwicensis*), and the shrimps opae ‘oeha‘a (*Macrobrachium grandimanus*) and opae kala‘ole/kuahiwi (*Atyoida bisulcata*) (GAP Kaua‘i aquatic species distribution GIS layer).

The native Newcomb’s snail (*Erinna newcombi*) may be found in the reserves. Historically, the Amastrid land snails *Carelia dolei* and *C. olivacea* were observed here as well, although both are now likely extinct. Native and endemic insects are also present in the forest reserve; habitat may also exist for the extremely rare Fabulous green sphinx moth (*Tinostoma smaragditi*), which has only been found on Kaua‘i and was once thought to be extinct. It is possible that there are insects and invertebrates that are unique to Keālia and Moloa‘a FRs, however these types of organisms are generally not well studied and it is expected that many remain to be described.

**Animal Critical Habitat:** Approximately 234 acres of Critical Habitat for Newcomb’s snail (*Erinna newcombi*) exist in the southern section of Keālia FR (Figure 7).

**Non-Native Wildlife:** A wide variety of introduced songbirds exist across the island of Kauaʻi; some of these provide competition for resources and serve as reservoirs for diseases that affect native bird populations. Mosquitoes, especially *Culex quinquefasciatus*, are a concern due to their status as disease vectors. Rats (*Rattus* spp.) eat fruits of native plants and can be vectors for Leptospirosis, a zoonotic disease. Feral cats (*Felis catus*) may prey on nesting native seabirds and forest birds and can be vectors for Toxoplasmosis. Introduced game animals, which also have negative impacts on native ecosystems, include feral goats (*Capra hircus hircus*) and pigs (*Sus scrofa scrofa*). Other non-native wildlife that may commonly be found in the area include the bull frog (*Rana catesbeiana*), neotropical toad (*Bufo marinus*), tree gecko (*Hemiphyllodactylus typus*), metallic skink (*Leiopisma metallicum*), and mouse (*Mus musculus*). Introduced stream fauna also exists; platyfish and swordtails (*Xiphophorus* spp.) are present throughout both reserves and smallmouth bass (*Micropterus dolomieu*) may be found in Kilauea Stream in Moloaʻa FR.

**G: Access:** Only the southern section of Keālia Forest Reserve has public access (Figure 9). Moloaʻa Forest Reserve and the adjacent northern section of Keālia Forest Reserve have no official public access points.

**Vehicular Access:** There are no roads within Keālia or Moloaʻa FRs, but the boundary of Keālia FR can be reached by public roads at two locations: Piliamoʻo Road and Kahuna Road (Figure 9). Piliamoʻo Road heads north off Kahuna Road in the Kapaʻa Homesteads. At the end of Kahuna Road near a water tank, pedestrian access is also available up an old dirt road (Awakea Road) that runs along Moalepe Stream.

**Trails:** Nā Ala Hele, the State of Hawaiʻi's trail and access system (<http://hawaiiitrails.ehawaii.gov/>), has two trails that allow access to the southern edge of Keālia Forest Reserve: Moalepe and Kuilau (Figure 9). Both trails are primarily located within the Līhuʻe-Kōloa FR. The Moalepe Trail starts in the Wailua Homesteads at the end of the pavement on Olohena Road. It begins as a right-of-way crossing a pasture lease within the Wailua Game Management Area. The trail enters the Keālia Forest Reserve at about one mile. It joins the Kuilau Trail at 2.25 miles. The Kuilau trail travels approximately two miles from Highway 580 (Kuamoʻo Rd) near the Keāhua Arboretum in Līhuʻe-Kōloa Forest Reserve to meet up with the Moalepe Trail. Both trails are of moderate difficulty; pedestrian, equestrian, and bicycle uses are approved.

**Designated Helicopter Landing Zones:** None.

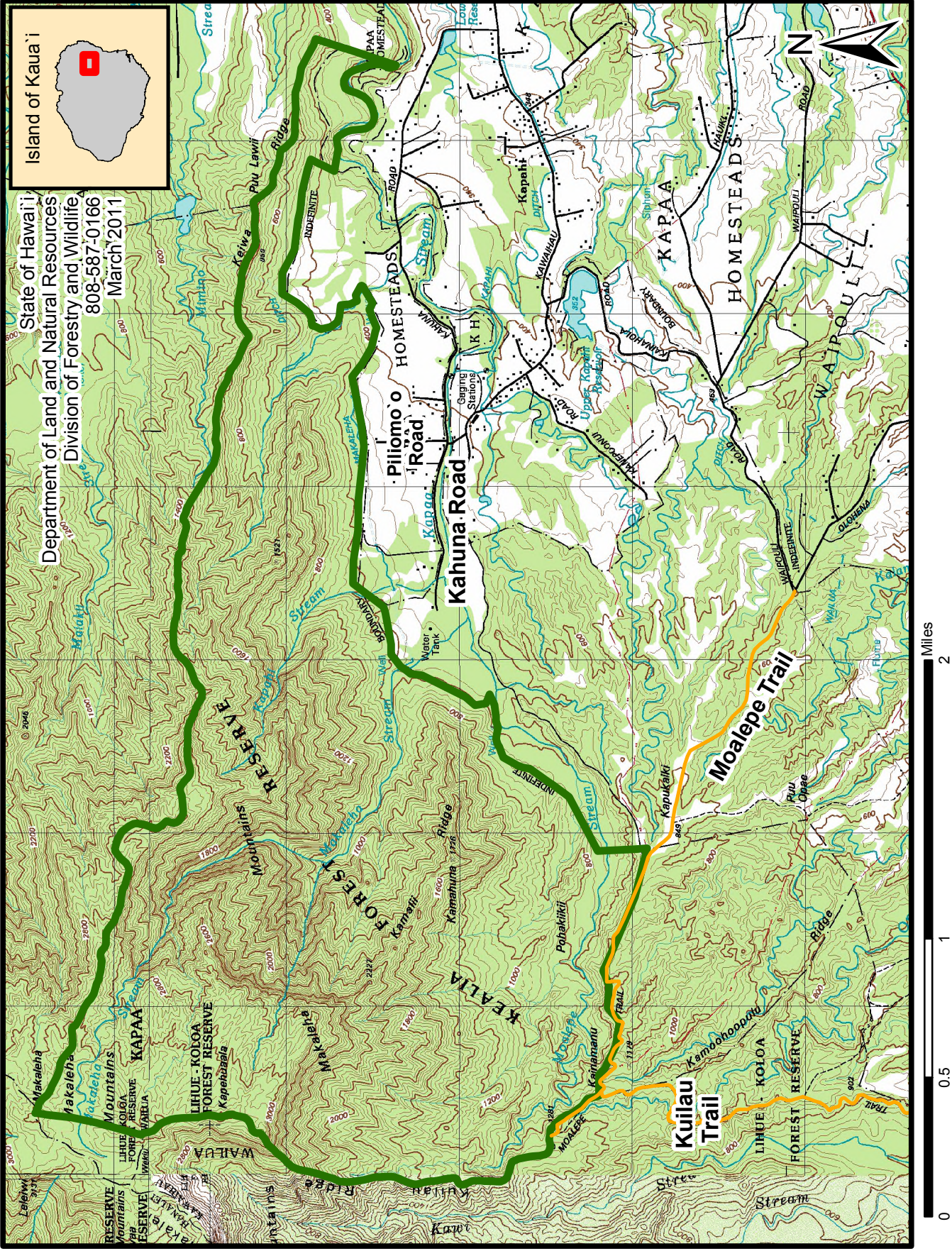
**Restricted Watershed:** No restricted watershed areas exist on the island of Kauaʻi.

**H: Infrastructure:** Infrastructure in Keālia and Moloaʻa FRs is minimal and mostly water-related. The Kauaʻi Department of Water has a water pipeline at Moalepe, the United States Geological Service maintains stream gauges at Moalepe and Anahola streams, and there is a diversion at Kilauea and Kaluaʻa Stream. A fence line also exists along the boundary between the Kapaʻa Homesteads and Keālia FR.

**I: Archaeological and Historical Sites:** The makai regions of the Moloaʻa and the adjacent northern section of Keālia Forest Reserves contain several documented archaeological sites, including loʻi (taro terraces), a walled enclosure, Kaluakehulu and Pohakuokalani heiau, an



Figure 9: Four public access routes to Kealia Forest Reserve, south section. There are currently no public access points to the north section of Kealia FR or Moloa'a FR.





unidentified heiau (Bennett 1931) and three additional unidentified sites. The southern section of Keālia Forest Reserve also contains a lo‘i site along the Makaleha Stream.

### **J. Additional Public Use:**

**Hunting:** DOFAW manages public hunting on all forest reserve lands on Kaua‘i by the regulation of hunting seasons, bag limits, and hunting methods. As a part of Hunting Unit C, mammal hunting is allowed in Keālia and Moloa‘a Forest Reserves but game bird hunting is not. General hunting regulations can be found in Hawai‘i Revised Statutes (HRS) Title 13 Chapter 121. DLNR’s Division of Conservation and Resources Enforcement (DOCARE) enforces hunting regulations (Chapter 123 Rules Regulating Game Mammal Hunting).

Keālia and Moloa‘a Forest Reserves contain only one of four possible Game Animal management classes (Figure 6) according to DOFAW’s 2001 Draft Management Guidelines: A-2: Mixed Game and Other Uses. Approximately 3,669 acres of A-2 managed area exists in Moloa‘a FR and 6,083 acres in Keālia FR. In A-2 areas, game management is an objective integrated with other uses; habitat may be manipulated for game enhancement and game populations are managed to acceptable levels using public hunting. Habitat is not presently manipulated in either reserve. It is the Division’s current policy that if an area designated as A-2 contains critical habitat, game enhancement will not be implemented. DOFAW is currently in the process of updating its Management Guidelines; both reserves will be changed to the A-3: Game Control (public) management class to allow for more liberal hunting. In A-3 areas, resource protection is the primary objective, with emphasis on native plant communities and watersheds. Seasons and bag limits are designed for public hunting to reduce impacts to native resources.

Although not located within either of the forest reserves, four hunter checking stations are available in the area at Moloa‘a, Keālia, Moalepe, and Kondo Gate.

**Camping:** Camping is not allowed in either Keālia or Moloa‘a Forest Reserve.

**Fishing:** Fishing opportunities exist in most streams for Tahitian prawn (*Macrobrachium* spp.) and o‘opu (*Lentipes concolor*). Hawai‘i Fishing Regulations can be obtained through the DLNR’s Division of Aquatic Resources.

**Hiking:** There are no hiking trails within Keālia or Moloa‘a Forest Reserves, however two Nā Ala Hele trails, Moalepe and Kuilau, reach the southern boundary of Keālia Forest Reserve. See section [G: Access](#) above for more details.

**Horseback Riding:** Horseback riding is not allowed within the Reserves, however it is allowed on the two Nā Ala Hele trails that reach the southern boundary of Keālia Forest Reserve. See section [G: Access](#) above for more details.

**Dirt Bikes, All Terrain Vehicles (ATVs) and Mountain Bikes:** Dirt bikes and ATVs are not allowed in either Keālia or Moloa‘a Forest Reserve; mountain bikes may be used on Moalepe and Kuilau Trails.

**Non-Timber Forest Product Collection:** Non-timber forest products may be collected within the Reserve. Examples include but are not limited to:

- a. Ferns
- b. Flowers
- c. Fruits
- d. *Psidium* spp. (guava) poles
- e. *Alyxia stellata* (maile)
- f. *Melicope anisata* (mokihana)
- g. Bamboo

Gathering of material from plant species that are not on Federal or State threatened and endangered species lists is permitted and regulated by DOFAW through standard Forest Reserve System permit procedures as described in HAR §13-104. Gathering of non-listed species or common materials are requested in quantities which are determined by DLNR as representing personal use, is regulated through issuance of a Collection Permit free of charge. If quantities are determined to represent commercial use, a Commercial Harvest Permit may be issued at a fee. Consult the Forest Products Fee Schedule for information on personal versus commercial use quantities, as well as current commercial use pricing:

<http://hawaii.gov/dlnr/dofaw/forestry/forest-products-fees.pdf>

Gathering of:

- 1. Listed threatened, endangered, or other rare species.
- 2. Common invertebrate species.
- 3. Any migratory bird species.

may be allowed if individuals have obtained an appropriate permit by applying to the “Administrator,” at the DOFAW Honolulu office. In these cases a separate Access Permit may be required which is obtained through the Branch Manager at the DOFAW Kaua‘i office. Both addresses follow:

Administrator  
Division of Forestry and Wildlife  
1151 Punchbowl Street, Room 325  
Honolulu, HI 96813  
Phone (808) 587-0166

Kaua‘i Branch Manager  
Division of Forestry and Wildlife  
3060 Eiwa Street, Room 306  
Lihue, HI 96766  
Phone (808) 274-3433.

**General Recreation:** Moloa‘a Forest Reserve contains two of four possible Recreation Management classes according to DOFAW’s 2001 Draft Management Guidelines (Figure 6): R-3 (Light Use Areas, approximately 2,468 acres), and R-4 (Restricted Areas, 1,201 acres). Keālia FR, in addition to R-3 (2,296 acres) and R-4 (1,700 acres) areas, contains one additional class: R-2 (Medium Use Areas, 2,087 acres). R-2 areas are where outdoor recreation is limited or controlled, or where it may be integrated with other uses. Facilities are not highly developed and include trails, rustic shelters, or unimproved campsites. R-3 designates areas where recreation is limited to certain areas or to occasional use due to impacts on resources or programs. Trails are

the main recreational feature, and their use may be restricted. In R-4 areas, outdoor recreation is heavily restricted or controlled, if permitted at all. Trails would be the main feature considered. Areas may be classified “restricted” due to hazardous conditions, fragile ecosystems, limited accessibility or other management practices incompatible with recreational activities. These Draft Management Guidelines are currently being updated.

### **K. Threats:**

**Plants:** Invasive, weedy plants that have some of the greatest potential to disrupt the ecosystem in Keālia and Moloa‘a FRs include:

- *Clidemia hirta* (clidemia)
- *Chrysophyllum oliviforme* (satin leaf)
- *Falcataria moluccana* (albizia)
- *Lantana camara* (lantana)
- *Psidium cattleianum* (strawberry guava, waiawī)
- *Sphaeropteris cooperi* (Australian tree fern)

**Animals:** Animals that may pose threats to the resources in Keālia and Moloa‘a FRs include:

- Cats (prey on native seabirds and forest birds and are a source of toxoplasmosis)
- Feral ungulates (cattle, sheep, pigs – destroy vegetation and cause erosion)
- Barn owls (prey on native seabirds and forest birds)
- Rose-ringed parakeet (may feed on native plants)

**Fire:** As much of the vegetation in Keālia and Moloa‘a FRs consists of alien forest with a grassy understory, fire is a risk in the area. There have been fires in Keālia FR in the past.

**Flooding:** Anahola and Kapa‘a streams have a history of flooding.

**Other:** Other current threats in the reserves include the illegal cultivation of marijuana and damage of resources by off-road vehicles.

### **L. Revenue:**

According to HRS §183.5, the department shall:

(5) Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part.

There are no current revenue sources within Keālia and Moloa‘a FRs. A potential future source of revenue may be from the provision of water.

## **III. MANAGEMENT**

**A. Past Planning:** The Kaua‘i Watershed Alliance (KWA) published the Kaua‘i Watershed Management Plan in 2005 ( [http://www.Kaua'iwatershed.org/KWA\\_management\\_plan.pdf](http://www.Kaua'iwatershed.org/KWA_management_plan.pdf) ). The KWA was formed in 2003 as a partnership between the major landowners, both public and private, of mauka conservation lands for the purpose of providing long-term protection of Kaua‘i’s upper watershed. The lands of Keālia and Moloa‘a Forest Reserves are included in this

plan as Core 3 areas, which provide important buffer zones for KWA's higher priority Core 1 and 2 management areas.

**B. Summary of Existing Management Activities:** Current management activities within Keālia and Moloa'a FRs include hunting management, forest health monitoring, seabird research and surveys, and maintenance of Nā Ala Hele trails.

**C. Management Objectives and Goals:** In the Draft Umbrella Management Plan for each Branch of the Division, broad management priorities for each forest reserve were derived from the mandates that regulate DOFAW activities, including the Draft Management Guidelines and Administrative Rules, as well as input from Branch staff. These management priorities were divided into eight categories:

- Watershed Values (aquifer recharge and erosion control)
- Native Ecosystems (landscape level protection)
- Resource Protection (fire, insects, and disease)
- Invasive Species Control (incipient and established plants and animals)
- Threatened and Endangered (T&E) Species Management (Federally listed, State listed, and rare plants and animals)
- Additional Public Activity (non-income generating uses, such as recreation, cultural activities, personal gathering, educational or research activities, and events among others)
- Game Animal Management (areas managed for public hunting and/or habitat enhancement for game animals)
- Commercial Activity (income generating activities such as timber, tours, etc.)

Each category has been ranked on a qualitative scale of 1 to 8 with 1 as higher priority and 8 as lower priority. Table 7 is an excerpt from the Kaua'i Forest Reserves Draft Umbrella Management Plan and lists qualitative rankings of the management priority categories for Keālia and Moloa'a Forest Reserves.

**Table 7:** Keālia and Moloa'a Forest Reserves and associated management priority categories.

Forest Reserve Section Name	Resource Protection	Watershed Values	Invasive Species Control	T&E Species Mgmt.	Native Ecosystems	Game Animal Mgmt.	Commercial Activity	Additional Public Activity
Keālia	3	1	4	5	2	7	8	6
Moloa'a	2	1	3	6	4	7	8	5

Table 8 expands on these management priority categories, listing general management actions to address the objectives, along with tactical goals, action items, and estimated cost associated with these actions. As the two Forest Reserves are contiguous and their management priorities are similar, they are treated as one in the following table.

**Table 8:** Management objectives and associated plans for Keālia and Moloa‘a Forest Reserves.  
Estimated cost refers to State funds.

Management Priority	General Management Action	Tactical Goals	Action Items	Estimated Cost
<b>Watershed Value</b>	Reduce the threat and impact of erosion on reserve resources	Maintain forest cover on watershed lands to provide high quality water for residents	Re-establishment of appropriate vegetative cover	\$10K/year + staff costs
	Monitor forest composition over time to determine landscape level needs	Determine permanent systematic monitoring protocol	Establish survey plots and transects.	\$30K/year
<b>Native Ecosystems</b>	Determine landscape level needs	Protect remaining native-dominated ecosystems	Fencing, weed control, etc. as described in other management priorities	\$50K (cost reflects initial costs and monitoring, repairs and maintenance for following years)
<b>Invasive Species Control</b>	Manage incipient and established invasive plants and animals	Collaborate with partners to support ongoing research for invasive species control	Annual support for <i>Clidemia hirta</i> research conducted by the HI Dept. of Agriculture	\$10K/year
		Incipient species monitoring in remaining native ecosystem areas	Control of incipient species – chemical and mechanical	\$50K/yr + staff costs
			Collaborate with KWA to perform ground and aerial surveys	\$50K/yr + staff costs
			Contract satellite/aerial imagery for detection	\$53K
<b>Resource Protection</b>	Reduce impact of fire, insects, and disease on forest resources	Support biological control research	Implement science-based biological control when approved for use	TBD
		Fire presuppression and prevention	Educate public on defensible spaces, esp. near residential areas (Keālia and Anahola, Moloa‘a, Kapa‘a)	Staff & mgmt costs only
			Compose and submit annual report of forest pests surveys to Forest Health Coordinator	Staff & mgmt costs only
<b>Additional Public Activity</b>	Acquire and secure additional management and/or public access	Purchase needed lands through land acquisition programs	Initiate discussions with adjacent landowners Anahola near DHHH/McCluskey lands. Initiate discussion for Waipake northern access.	Based on land assessment value + staff costs
		Obtain access easements	Work with landowners in areas where needed	Staff & mgmt costs only

<b>Management Priority</b>	<b>General Management Action</b>	<b>Tactical Goals</b>	<b>Action Items</b>	<b>Estimated Cost</b>
	Public information	Update informational signage	Sign installation and replacement as needed	\$10K/year + staff costs
<b>T&amp;E Species Management</b>	Protect occurrences of listed and rare plants and animals	Determine specific areas and species of interest	Build fence and maintain exclosures around wild populations of rare plants	\$25K each
			Acquire T&E survey docs from National Tropical Botanical Gardens	Staff & mgmt costs only
		Predator control	Rats – rodenticide stations Cats – trapping Barn Owls - trapping	\$60K/year + additional new staff
		Conduct surveys for presence, location, and population estimates of rare animals	Shearwater, petrels (upper Makalea, upper Moloa'a), Hawaiian Hoary Bat	\$40K/year
<b>Game Animal Management</b>	Promote public hunting through Chapter 123	Amendments to HAR Chapter 123	Increase hunter days and bag limits	Staff & mgmt costs only
		Improve hunter access	Acquire land and/or easements see above	Based on land assessment value + staff costs
		Update Draft Management Guidelines	Change Animal Management from A2 to A3	Staff & mgmt costs only
		Continue animal surveys	Determine hunter pressure and harvest success	Staff and mgmt costs only
		Public education	Continue hunter education program, other public outreach as required	Staff & mgmt costs only
<b>Commercial Activity</b>	Generate income from commercial activities in the Forest Reserve	Determine future income possibilities – water leases/licenses, biofuel salvage, film permits, others?	Determine protocol to manage fee collection	Staff & mgmt costs only

## D. Overall Measures of Success

Measures of success for individual forest reserve management plans can be derived from the State of Hawai‘i’s annual variance reports. Initial measures of success that may be applicable to Keālia/Moloa‘a Forest Reserves include:

- Number of volunteer service projects
- Number of game mammals harvested
- Number of hunter trips made
- Acres of accessible public hunting grounds
- Acres of noxious plants controlled
- Acres of fire protection area
- Miles of fence constructed
- Miles of fence maintained
- Acres of exclosure developed
- Acres of exclosure maintained
- Number of rare, threatened, or endangered plant/animal species protected
- Number of commercial leases/licenses/permits issued
- Number of signs replaced
- Number of appurtenant features maintained

## IV. FUTURE RECOMMENDATIONS

**A. Desired Outcome for the Forest Reserve:** Protection and enhancement of water quality and quantity provided by the lands of Keālia and Moloa‘a FRs is essential. This may be accomplished by maintaining a healthy forest and preserving those areas of native ecosystems that still exist. Protect known populations of threatened and endangered species. Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part. Develop a diversified revenue stream to maintain long term management goals and to implement adaptive management actions.

**B. Future Recommendations:** Pursuing public access agreements, whether through land acquisition or securing easements, should be considered a priority for Keālia and Moloa‘a FRs. If at all possible, public access should be made available both to the northern section of Keālia FR and to Moloa‘a FR. Also of considerable value is the investigation of deriving revenue for the management of the reserves through the provision of water to downstream users.

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