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# Līhu‘e-Kōloa Forest Reserve Management Plan

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September 2010

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 Līhu‘e-Kōloa Forest Reserve 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.

The Līhu‘e-Kōloa Forest Reserve was established by Governor’s Proclamation in 1909 for the purpose of protecting watershed areas vital to the lowland agricultural economy. It is located in east Kaua‘i and consists of over 12,500 acres of public land in two separate areas: Wailua and Kalāheo. The area is mostly wet and mountainous. Vegetation is largely exotic in lower regions, although good quality native forest, complete with rare plants and animals, is present in mauka areas. Exotic timber plantations exist in both sections of the Reserve. Infrastructure consists primarily of Na Ala Hele Trails, rough roads, and picnic facilities. The Reserve’s Keāhua Arboretum is a popular day-use area. Public hunting (mammals only) is allowed in Līhu‘e-Kōloa Forest Reserve; camping is not.

DOFAW’s current principle objective for the management of Līhu‘e-Kōloa Forest Reserve is to maintain the area for multiple uses, including watershed protection, recreation (especially hiking, horseback riding, hunting, fishing, four-wheel driving, and commercial ecotourism), maintenance of the Keāhua Arboretum, and possible timber and/or biomass plant production. Management priorities were divided into eight categories and ranked on a qualitative basis. Summaries of management priorities and State funds budgeted for planned management projects in Līhu‘e-Kōloa Forest Reserve are as follows:

1. Watershed Values - \$60,000 one-time costs plus management and staff costs;
2. Additional Public Activity - \$41,000 annual costs plus management and staff costs;
3. Native Ecosystems - \$60,000 one-time costs plus management and staff costs;
4. Invasive Species Control - \$30,000 annual costs, \$82,500 one-time costs, plus management and staff costs;
5. Game Animal Management - \$20,000 one-time costs plus management and staff costs;
6. Commercial Activity - \$5,000 one-time costs plus management and staff costs;
7. Resource Protection - Management and staff costs only;
8. T&E Species Management - \$137,000 annual costs.

Details of these priorities and costs can be found in Table 6 on page 34 of the plan.

This plan is intended to describe short-term resource management planning and implementation strategies, as well to serve as a basis for future updates to accommodate evolving or additional objectives such as additional fencing projects and developing improved access and facilities for the Forest Reserve.

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LĪHU'E-KŌLOA FOREST RESERVE  
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 Līhu'e-Kōloa Forest Reserve.

  
\_\_\_\_\_  
Galen Kawakami – Acting DOFAW Kaua'i Branch Manager

8/17/10  
\_\_\_\_\_  
Date

DOFAW Administrator's approval: I have reviewed the enclosed Forest Reserve Management Plan and concur with the recommendations herein. I agree that this Management Plan will serve as a guiding document for the resource management of Līhu'e-Kōloa Forest Reserve.

  
\_\_\_\_\_  
for Paul J. Conry – DOFAW Administrator

9/22/10  
\_\_\_\_\_  
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 16-4, Hawai'i Revised Statutes.

  
\_\_\_\_\_  
Laura H. Thielen – BLNR Chairperson

Approved by the Board  
of Land and Natural  
Resources at its meeting  
held 9/22, 2010



## DEVELOPMENT PROCESS TIMELINE

Līhu'e-Kōloa Forest Reserve, Kaua'i

| Stage of Development        | Date Achieved  | Comments   |
|-----------------------------|----------------|--|
| Branch review               | August 2009    | Incorporated   |
| DOFAW review                | September 2009 | Incorporated   |
| Partner agency consultation | October 2009   | Two responses received from partners and other government agencies |
| Public consultation         | July 2010      | One comment received   |
| DOFAW approval              | September 2010 | None   |
| BLNR approval               | September 2010 | 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 aim to make the process transparent for partner organizations and the public.

Each Branch office of the Division will have one comprehensive management plan that addresses overall Forest Reserve System issues, goals and objectives for that Branch. In addition, management plans will be developed for individual forest reserves, which will in part reflect the Division's management guidelines specific to that area. This document represents the comprehensive management plan for Līhu'e-Kōloa Forest Reserve, which fits under the overall forest reserve management plan for Kaua'i District. It addresses concerns and strategies only on the public lands in Līhu'e-Kōloa Forest Reserve.

This management plan for the Līhu'e-Kōloa Forest Reserve was developed using a variety of methods. Initial development consisted of reviewing and analyzing DOFAW historic and current files (both at the Administrative and Kaua'i Branch office) and documents obtained from the Land Division, Survey Division, Bureau of Conveyances, as well as State Archives. State of Hawai'i Geographic Information Systems (GIS) map layers relating to biological, historical, and environmental resources were referenced to develop this plan. Additional resources utilized included other plans that identified the Forest Reserve or the area. Examples 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.

Approval of this Līhu'e-Kōloa Forest Reserve Management Plan by the Chairperson of the Board of Land and Natural Resources may trigger the following actions:

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. LĪHU'E-KŌLOA FOREST RESERVE DESCRIPTION**

Līhu'e-Kōloa Forest Reserve currently encompasses approximately 12,500 acres of Government land (Table 1). The Reserve was created in 1909 for the purpose of watershed protection. Streams in the area, notably Wahiawa, Lāwa'i, Kōloa, Hulē'ia and the North and South Forks of the Wailua River, were being used for "irrigation and other economic purposes" (Hosmer 1909).

Sustained flow of these streams was viewed as essential to the development of lower lands for crops, and permanent managed protection of the forest cover in this area was viewed as a direct economic necessity. Initial boundaries of the Reserve included both private and Government lands; one hundred years later, the amount of land within Līhu‘e-Kōloa Forest Reserve that is subject to State protection remains largely unchanged. Today, the area still remains important for water supply on the island of Kaua‘i; in addition to the aquifer recharge provided by this wet, mountainous Forest Reserve, many streams, including the Wailua River, originate here.

DOFAW’s current principle objective for the management of Līhu‘e-Kōloa Forest Reserve is to maintain the area for multiple uses, including watershed protection, recreation (especially hiking, horseback riding, hunting, fishing, four-wheel driving, and commercial ecotourism), maintenance of the Keāhua Arboretum, and possible timber and/or biomass plant production.

**Table 1.** Government Tax Map Key (TMK) parcels currently comprising public lands of Līhu‘e-Kōloa Forest Reserve.

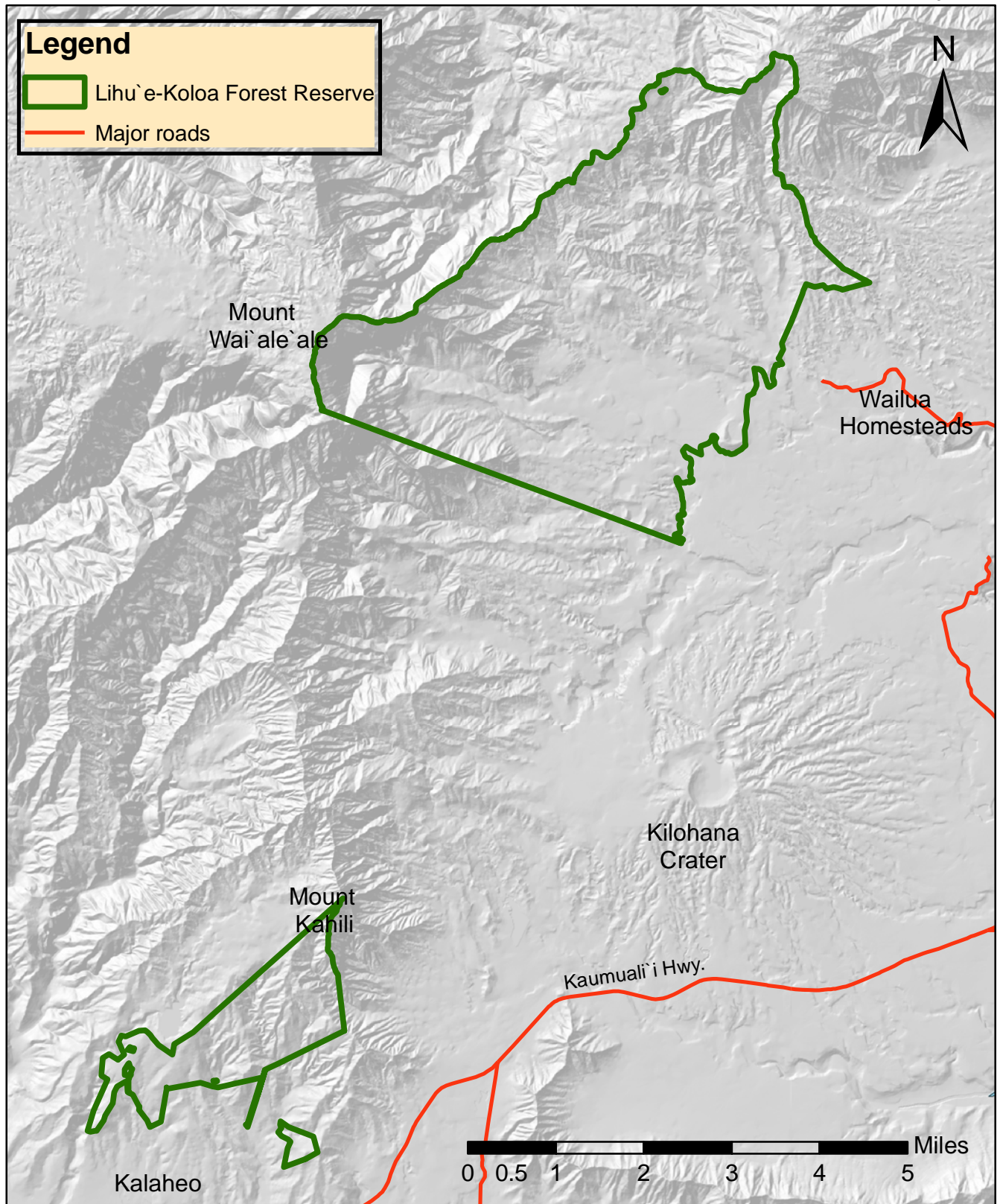
| <b>TMK Number</b> | <b>Owner</b>     | <b>Tax Acres<br/>(entire TMK)</b> | <b>GIS Acres<br/>(entire TMK)</b> | <b>GIS Forest<br/>Reserve Acres</b> |
|-------------------|------------------|-----------------------------------|-----------------------------------|-------------------------------------|
| 442001011         | State of Hawai‘i | 0.441                             | 0.393                             | 0.393                               |
| 442001002         | State of Hawai‘i | 7,395.559                         | 7,287.690                         | 7,287.690                           |
| 439001001         | State of Hawai‘i | 2,889.135                         | 2,863.760                         | 2,863.760                           |
| 439001003         | State of Hawai‘i | 411.000                           | 400.979                           | 400.979                             |
| 439001002         | State of Hawai‘i | 847.605                           | 825.907                           | 262.298                             |
| 424009003         | State of Hawai‘i | 1,602.308                         | 1,587.360                         | 1,587.360                           |
| 424009007         | State of Hawai‘i | 0.161                             | 0.190                             | 0.190                               |
| 424008029         | State of Hawai‘i | 2.380                             | 2.495                             | 2.495                               |
| 424008002         | State of Hawai‘i | 39.320                            | 36.825                            | 36.825                              |
| 424008007         | State of Hawai‘i | 0.990                             | 1.111                             | 1.111                               |
| 424008015         | State of Hawai‘i | 0.130                             | 0.102                             | 0.102                               |
| 425001005         | State of Hawai‘i | 75.610                            | 75.598                            | 75.598                              |
|                   |                  |                                   |                                   | <b>12,518.801</b>                   |

**A. Location and Description:** Līhu‘e-Kōloa Forest Reserve is located in east Kaua‘i and consists of two separate areas of land: Wailua and Kalāheo (Figure 1). Both sections of the Forest Reserve are wet and mountainous with steep valleys.

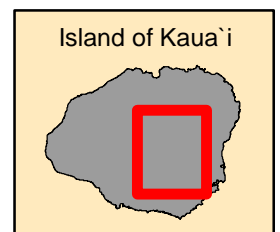
The Wailua section is largely formed by the portion of the ahupua‘a of Wailua that lies mauka to Kuilau Ridge. This section is bounded by the Nature Conservancy’s Wainiha Preserve at Mount Wai‘ale‘ale and by Halelea Forest Reserve along its mauka border, which follows the boundary separating the districts of Hanalei and Kawaihau. Kealia Forest Reserve and the Wailua Game Management Area (GMA) border this section on part of the makai side; private lands make up the remainder of adjacent lands.

The Kalāheo section consists of the mauka portion of the ahupua‘a of Kalāheo, in addition to smaller areas in the ahupua‘a of Wahiawa and Lāwa‘i. This section is surrounded by private

Figure 1: Current extent of Lihū'e-Koloa Forest Reserve - Government lands



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lands, although the Nature Conservancy's Kanaele Preserve is lies within a few hundred yards of the Forest Reserve west of the mauka part of this section.

**B. Geographic Site Data:** Kaua'i is the oldest of the 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. Mount Wai'ale'ale, on the west edge of Līhu'e-Kōloa Forest Reserve's Wailua section, is arguably the wettest place on Earth, with an annual rainfall of over 450 inches.

**C. Physical Site Data:** Because Līhu'e-Kōloa Forest Reserve is comprised of two sections of land that are separated by over five miles distance, physical site data varies between the mauka Wailua and makai Kalāheo sections. Annual rainfall illustrates this point; ranging from 79 inches to 394 inches in the Wailua section, yet only 59 to 118 inches in the Kalāheo section (Figure 2). The Wailua aquifer system is fed by lands in the Wailua section, while the Hanamā'ulu and Kōloa aquifer systems are fed by lands in the Kalāheo section.

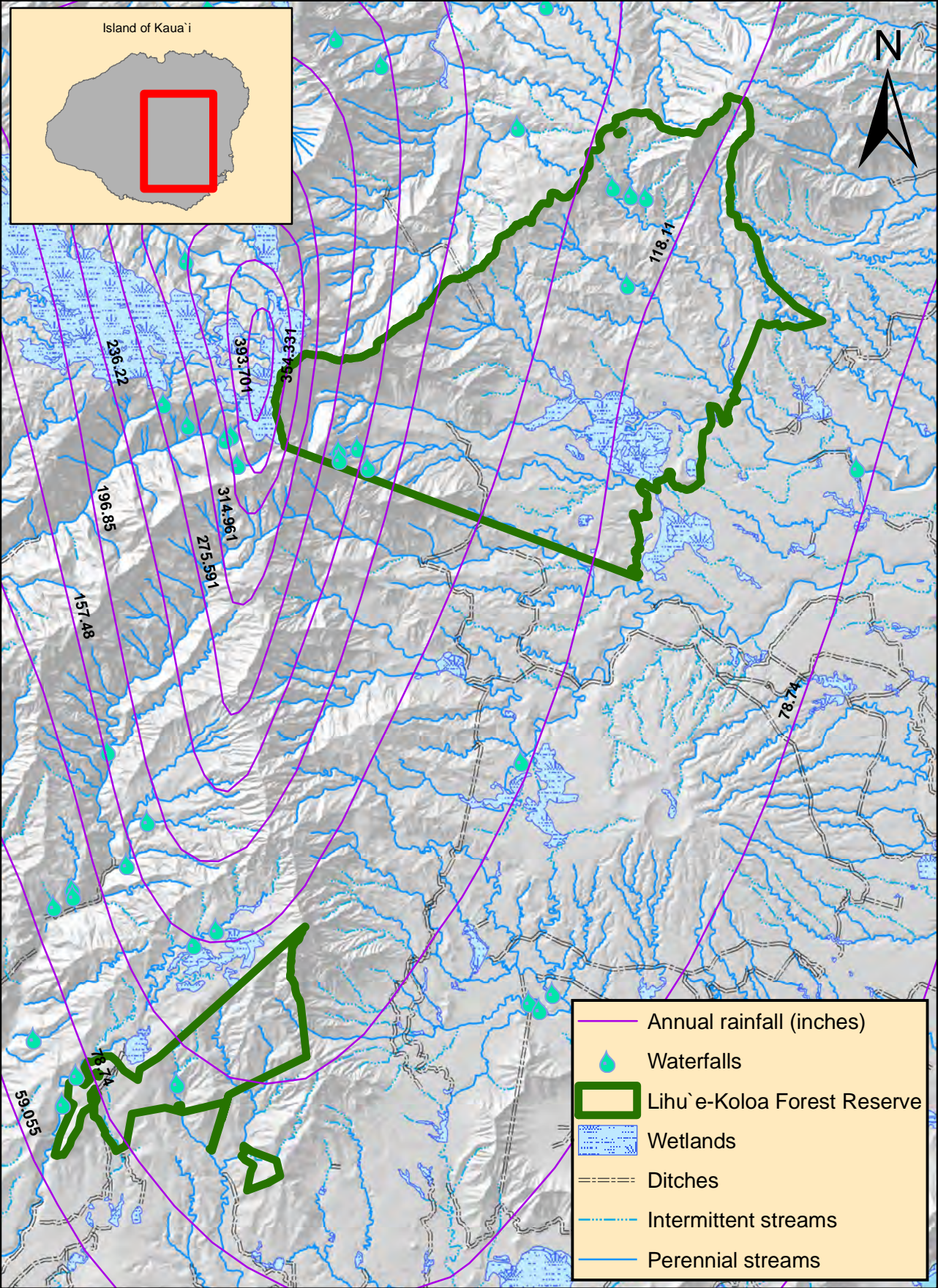
The Wailua section, whose elevation ranges from approximately 500 to 5100 feet, contains all or part of the following geographic features: the Makaleha Mountains, Kuilau Ridge, Kualapa Peak (2128 ft.), Kāwī Stream, Keāhua Stream (Kapaka Nui and Kapaka Iki Falls), Uha'u'iole Stream and Falls, Maheo Peak, Kamo'oho'opulu Ridge, the North Fork of the Wailua River, Hanahanapuni Hill, Waikoko Stream, Pōhaku Pele Peak, Mount Wai'ale'ale (5148 ft.), and Mauna'ou Peak (USGS topographical DRG maps, State GIS layers). The Kalāheo section, whose elevation ranges from approximately 700 to 3000 feet, contains all or part of the following geographic features: Kāhili Peak (3089 ft.), Lāwa'i Stream, Ahua Peak, Lokoawa Stream, Kahuamoia Peak (1267 ft.), and Wahiawa Stream (Kaukiuki and Waiolue Falls).

The soils in Līhu'e-Kōloa Forest Reserve are varied, with 39 different types represented (Foote et al. 1965). Sixteen of these soil types are classified as HEL (highly erodible land), sixteen are potentially HEL, and seven are not HEL (Figure 3). Both sections of the Reserve are dominated by the same two soil types: rRR (Rough broken land) and rRT (Rough mountainous land). rRR land is classified as HEL and consists of very steep land broken by numerous intermittent streams. In most places it is not stony. The slope is 40 to 70 percent. Runoff is rapid, and geologic erosion is active. Soil depth varies from 20 to over 80 inches. Small areas of rock outcrop, stones, and soil slips are common. rRT soil is also HEL and is common in mountainous areas on all islands. This soil also occurs on very steep land broken by numerous intermittent streams. The soil mantle is very thin, ranging from one to ten inches over soft and permeable saprolite. Rock land, rock outcrop, soil slips, and eroded spots make up 20 to 40 percent of the acreage.

**D. Pre-Reserve and Early Use History:** The entire region of Wailua was considered sacred by ancient Hawaiians; heiau are built in an arc starting from the Wailua River on the east side of the island, up to Wai'ale'ale, and down again to the west side. Holoholoku was an important



Figure 2: Hydrological features of Lihu`e-Koloa Forest Reserve



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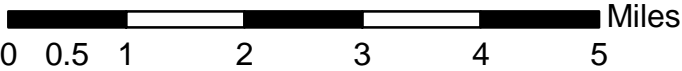
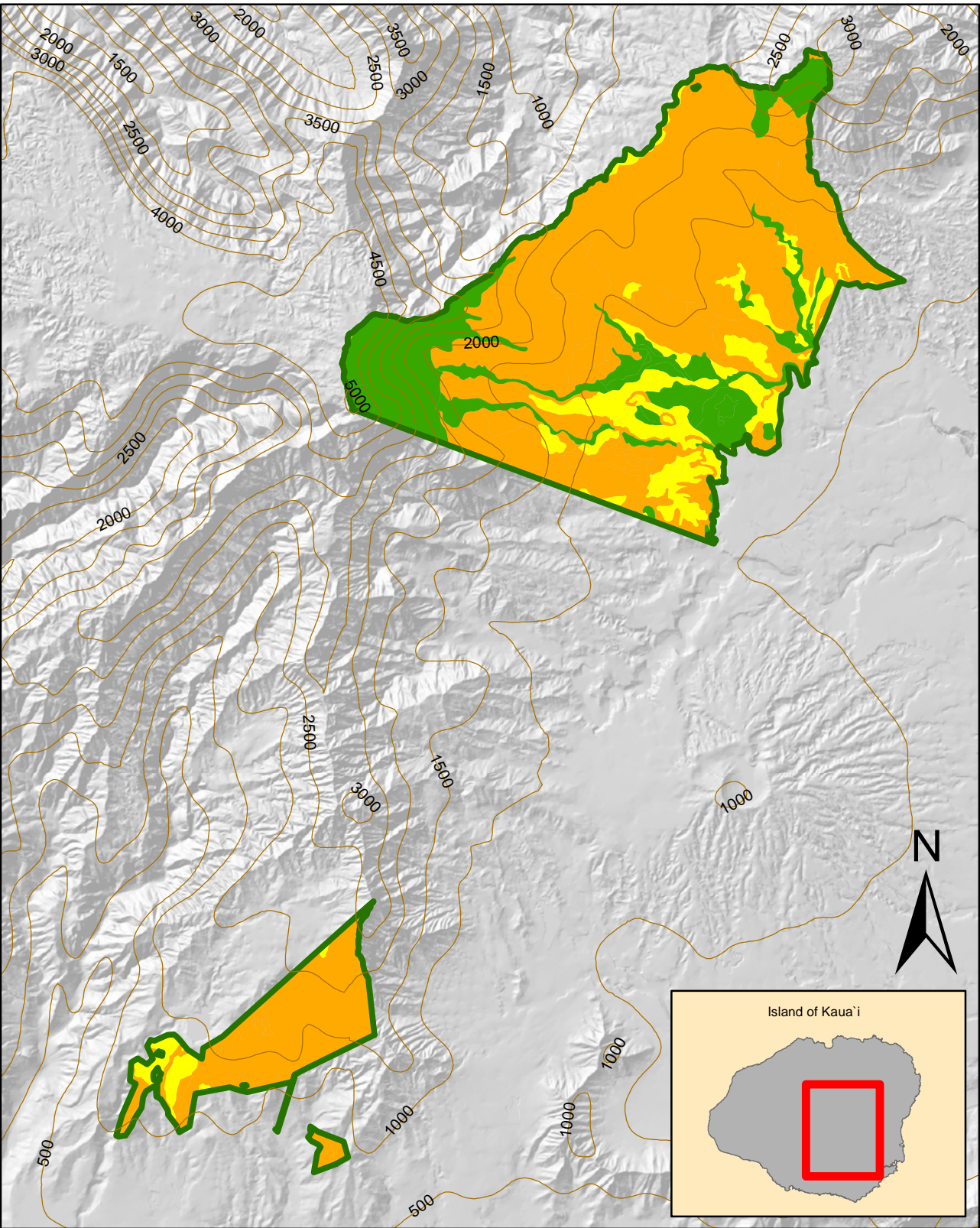




Figure 3: Soils at Lihu`e-Koloa Forest Reserve



0 0.5 1 2 3 4 5 Miles

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- Not highly erodible land
- Potentially highly erodible land
- Highly erodible land
- 500 ft. elevation contours
- Lihu`e-Koloa Forest Reserve

birthplace for the ali‘i, both from Kaua‘i and other islands. King Kaumuali‘i, the last king of Kaua‘i, was born here. In 1778, Captain James Cook and his ships, Resolution and Discovery, landed at Waimea, marking the first Western contact with the Hawaiian people, and ushering in an era of great change; missionaries, businessmen, and imported laborers were soon to follow.

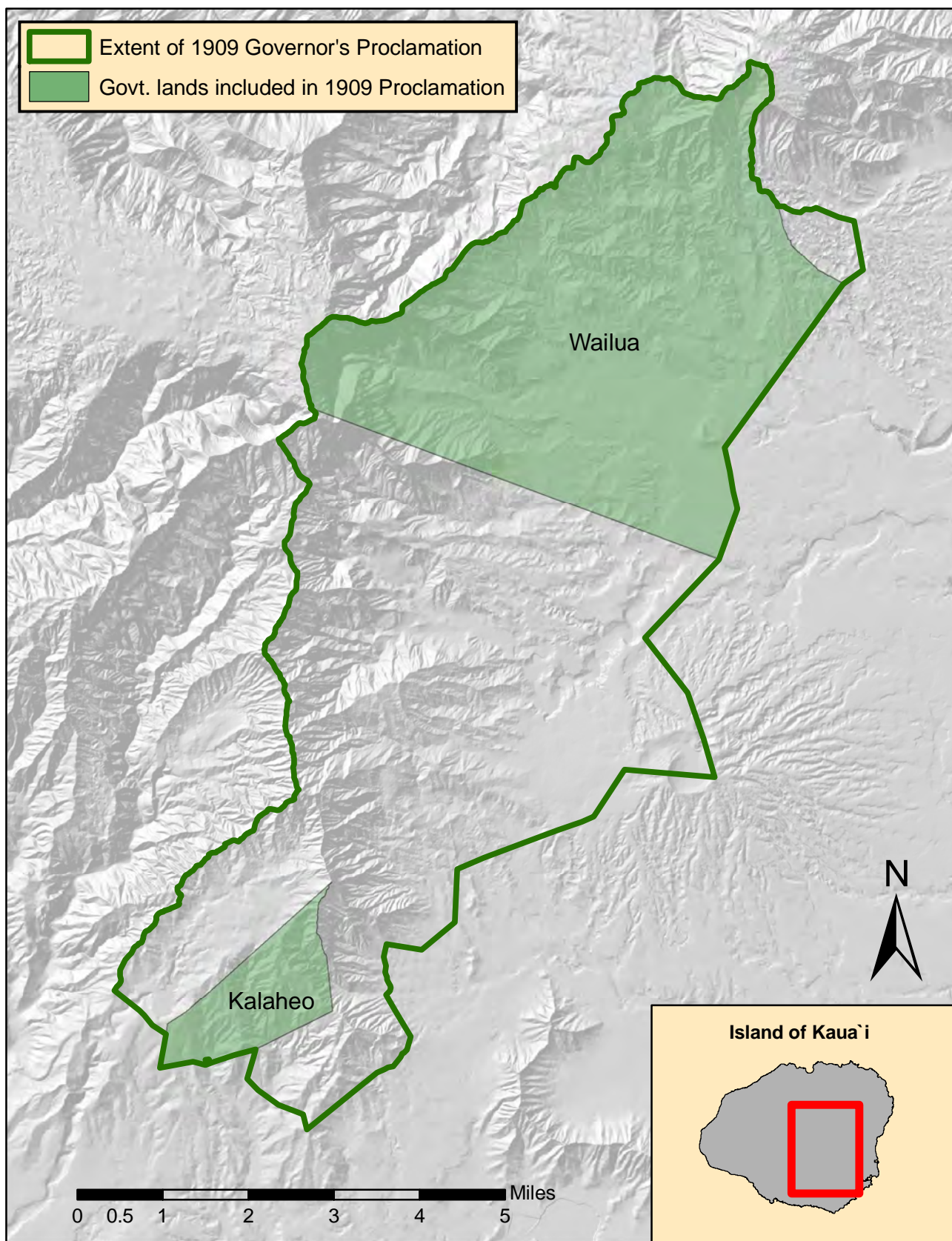
The plantation era arrived early in Kaua‘i; Kōloa Plantation started the first successful commercial sugar milling operation in all of Hawai‘i in 1835 (Kaua‘i Historical Society 2003) and Līhu‘e Plantation constructed Hawai‘i's earliest sugar irrigation ditch in 1856 (Wilcox 1996). From the time of its establishment, Līhu‘e-Kōloa Forest Reserve included both private and public lands (Figure 4); much of the private lands were held by sugar planters and ranchers, who understood the value of protecting the forested uplands for the water that originated there. In a 1909 report that accompanies the Governor’s Proclamation establishing Līhu‘e-Kōloa Forest Reserve, Ralph S. Hosmer, the Territorial Superintendent of Forestry, gave praise to Līhu‘e Sugar Plantation Company, McBryde Sugar Company, and Mr. G. N. Wilcox for building and maintaining fences across their mauka lands to keep cattle out of the Reserve. Forest planting with trees of economic value is also referred to; those mentioned include Grove Farm, McBryde and Kōloa Plantations, and Līhu‘e Plantation, who had planted over 1100 acres of trees since 1882. Plantations also developed significant irrigation infrastructure across east Kaua‘i, much of it prior to 1900. The Ka‘āpoko and Hanalei tunnels both have intakes in the Wailua section of the Forest Reserve and a ditch taking water from the Alexander Reservoir runs across the Kalāheo section (Wilcox 1996).

A 33,000-volt electric line was built across parts of the future Forest Reserve in 1906. This line stretched 33 miles from McBryde’s power plant at Wainiha to Hanapēpē to provide electricity to Kaua‘i Electric Company distribution systems, Līhu‘e Plantation, and Grove Farm. It was completely rebuilt between 1937 and 1940, when steel towers were installed and power was increased to 57,000 volts. Permanent trails and access roads were built to service the line; upgrades continued, and this line is still active today. In 1910, the private Forest Reserve lands at North Olohena and Waipouli were acquired by the Territorial government.

In 1914, the Territorial Board of Agriculture and Forestry contracted the services of Mr. Kaina Lovell of Anahola to construct a cattle-proof fence across Wailua, between Hanahanapuni Hill and Olohena – this project connected the existing forest fences built by Līhu‘e Plantation Company and Makee Sugar Company. This fence was constructed somewhat mauka of the original Forest Reserve boundary as described by the original survey. In 1920, the Forest Reserve boundary was modified to reflect this new fence. Reports of cattle trespass in several areas of the Forest Reserve were a regular occurrence through the 1920s. Territorial foresters made requests for repair of private fence lines and to shoot cattle that strayed into the Reserve. The Civilian Conservation Corps planted trees at Kalāheo in the 1930s. Other interesting points in DOFAW’s historical files include enquiries from 1956 about an easement across Wailua for a proposed aerial tramway to the top of Mount Wai‘ale‘ale; 1970s plans for a State Park at Kaukiuki Falls on Wahiawa Stream, complete with campsites, picnic areas, swimming, and stables; and 1980s plans to construct a hydroelectric plant at Wailua; none of these projects came to pass. The Keahua Arboretum was started in the 1960s as a project to demonstrate exotic timber species. Today, it provides a popular picnic and recreation area for both residents and tourists.



Figure 4: Original extent of Lihū'e-Koloa Forest Reserve



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In 2003, the Kaua‘i Watershed Alliance (KWA) was formed, bringing together nine private and public major landowners of conservation lands on Kaua‘i. DLNR is a member of the KWA and Līhu‘e-Kōloa Forest Reserve lies within the KWA boundaries.

**Table 2:** Summary of public land additions and withdrawals (A/W) for Līhu‘e-Kōloa Forest Reserve. See Figures 5 and 6 for map descriptions. 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   | Established for the purpose of watershed protection | 29,260<br>*/1 | 1966                           | 418001001<br>418002002<br>417001001<br>438001001<br>425001005<br>425001006<br>425001011<br>425002014<br>424003019<br>439001001<br>439001002<br>439001003<br>439002001<br>439002015<br>439002029<br>424008016<br>424009001<br>424009003<br>424009006<br>424009007<br>427001002<br>427001003<br>434005003<br>434001001<br>434001002<br>434001003<br>438002002<br>442001001<br>442001002<br>442001005<br>442001011<br>444001002<br>446001001<br>452001004<br>454001001<br>458001001 |

| Action                  | Date        | A/W | Description   | Acres                            | Copy of Survey Furnished (CSF) | Tax Map Key  |
|-------------------------|-------------|-----|---|----------------------------------|--------------------------------|--|
| Governor's Proclamation | 21-Jun-1920 | W   | Modification of Forest reserve boundary; new boundary to follow new fenceline   | 657.65<br>*/2                    | 1966                           | 438002002<br>438001001<br>439002001<br>439002001<br>439002015<br>439002029<br>442001001<br>442001005 |
| Governor's Proclamation | 24-Dec-1926 | A   | Addition of Government land at Wahiawa Mountain House Lots; to curb erosion that was silting up nearby reservoirs */3 | 303.66                           | 4514                           | 424009003  |
| Governor's Proclamation | 22-Dec-1928 | A   | Addition of land owned by McBryde Sugar Co. Ltd. at Wahiawa   | 161.40                           | 4708                           | 424009001  |
| Governor's Proclamation | 13-Apr-1932 | A   | Addition of 3 Lāwa'i Homestead Government lots; too steep to lease  | 75.61                            | 5728                           | 425001005  |
| Executive Order 965     | 16-Dec-1941 | W   | Withdrawal required by the Hawai'i National Guard for establishment of the Hanahanapuni Target Range Site             | 150.60                           | 9612                           | 439001002  |
| Executive Order 1082    | 30-Oct-1944 | W   | Withdrawal to protect the title conveyed by Land Patent No. 9710 to McBryde Sugar Co. Ltd.                            | 2.16                             | 8906                           | 424008001  |
| Executive Order 1083    | 30-Oct-1944 | A   | Addition of the remainder of Wahiawa Mountain House Lots */4  | 40.44                            | 8908                           | 424009003<br>424008002<br>424008015<br>424008007<br>424008999  |
| Executive Order 1104    | 18-Dec-1944 | A   | Addition of YWCA (Kaua'i Branch) Summer Camp at Wahiawa   | 2.38                             | 4037                           | 424008029  |
| Executive Order 1631    | 03-Jun-1954 | W   | Removal of swamp lands previously considered to be of no agricultural value by Līhu'e Plantation Co.                  | 1,150.0                          | 11848                          | 439001003<br>439001002<br>438001001  |
| Executive Order 3118    | 01-Feb-1982 | A   | Addition of lands at Wailua   | 411.0                            | 16617                          | 439001003  |
| Executive Order 3143    | 13-Oct-1982 | A   | Addition of lands at Kalāheo  | 17.5                             | 19420                          | 424009003  |
| Executive Order 3213    | 31-Oct-1983 | W   | Withdrawal of lands at Wailua on request of the Hawaiian Telephone Co.  | 0.03<br>(1,485 ft <sup>2</sup> ) | 19735                          | 442001002  |

| Action               | Date        | A/W | Description   | Acres | Copy of Survey Furnished (CSF) | Tax Map Key |
|----------------------|-------------|-----|---|-------|--------------------------------|-------------|
| Executive Order 3804 | 14-Jan-2000 | A   | Addition of Government lands at Wailua; Hanahanapuni Crater | 203.0 | 22682                          | 439001002   |

\*1 12,945 acres Government Land (1,275 acres at Kalāheo and 11,670 acres at Wailua); remainder was private land. Ownership as follows: 10 acres at Hanapēpē (Messrs. Gay & Robinson); 2075 acres at Wahiawa and 350 acres at Lāwa‘i (McBryde Sugar Co.); 980 acres at Kōloa (Mrs. V. Knudsen); 2900 acres at Ha‘ikū (Mr. G. L. Wilcox); 9580 acres at Hanamā‘ulu (Līhu‘e Sugar Plantation Co.); 150 acres at North Olohena and 270 acres at Waipouli (Makee Sugar Co.).

\*2 Removed 230.40 acres and added 11.60 acres at Hanamā‘ulu, removed 438.85 acres at Wailua. Addition to original description of 1909: “Excepting and reserving therefrom the bottom lands along the North Fork of the Wailua River which are suitable for agricultural purposes;” etc.

\*3 Excepting the Reservoir Lot situated within the Forest Reserve.

\*4 Excepting portion of Grant 9710, Parcel C to McBryde Sugar Company, Limited.

**Kuleana Parcels:** Kuleana parcels are a class of land conveyance that was awarded by the Land Commission between 1850 and 1855. The intent was to grant Western-style individual title to lands that were currently under cultivation by their Hawaiian tenants. One kuleana parcel exists within the Forest Reserve; it is a 0.5 acre parcel located along Lāwa‘i Stream below the summit of Ahua at Kalāheo.

**Documented Activities/Leases/Deeds/Permits:** Several land use agreements between the State and other parties have occurred over the years (Table 3), mostly involving rights of way for water and/or electrical services.

**Table 3.** Land use agreements associated with Līhu‘e-Kōloa Forest Reserve.

| Type of Action      | Action Number | Duration                           | Description   | Acres | Copy of Survey Furnished (CSF) | Tax Map Key<br>*/1 |
|---------------------|---------------|------------------------------------|---|-------|--------------------------------|--------------------|
| Surrender Agreement | unknown       | unknown                            | McBryde Sugar Co.; Omao   | 844.3 | unknown                        | unknown            |
| Surrender Agreement | unknown       | ?<br>to<br>31-Dec-1945             | Lāwa‘i; for watershed   | 817   | unknown                        | unknown            |
| General Lease       | 2458          | 10-July-1937<br>to<br>09-July-1952 | Līhu‘e Plantation; lands at Wailua, North and South Olohena, Waipouli, and Kapa‘a                                 | 2340  | 3796                           | not noted          |
| General Lease       | 2586          | 20-Aug-1937<br>to<br>10-July-1952  | John G. Abreu; Kuwaawaa Pasture Reserve at Kalāheo  | 183   | 3381                           | not noted          |
| General Lease       | 2594          | 01-Sept-1937<br>to<br>31-Aug-1952  | McBryde Sugar Co.; 60 ft. easement - 10.2673 miles at Hanalei, Wailua, and Kalāheo – electrical transmission line | 74.48 | 8593<br>8594<br>8596           | not noted          |

| Type of Action      | Action Number | Duration  | Description  | Acres              | Copy of Survey Furnished (CSF) | Tax Map Key<br>*/1               |
|---------------------|---------------|---|--|--------------------|--------------------------------|----------------------------------|
| General Lease       | 2723          | 01-July-1940<br>to<br>30-June-1956                      | Līhu'e Plantation Co.;<br>Wailua   | 6,201              | 9305                           | 4-3-9-02<br>4-4-2-03             |
| Surrender Agreement | unknown       | 05-Sept-1944<br>to<br>04-Sept-1964                      | Līhu'e Plantation Co.;<br>land of Hanamaulu<br>within FR boundaries  | 9,525              | unknown                        | 438001001                        |
| General Lease       | 3546          | 25-June-1946<br>to<br>30-Jun-1971                       | Līhu'e Plantation Co.;<br>renewal of GL 2723<br>plus addition of extra<br>cane lands   | 7,384              | unknown                        | 4-3-9-02<br>4-4-2-03             |
| General Lease       | 3940          | 16-Nov-1965<br>to<br>15-Nov-2030                        | Kaua'i Island Utility<br>Co-op; renewal of<br>GL 2594  | 74.48              | 8593<br>8594<br>8596           | not noted                        |
| General Lease       | 4412          | 31-Oct-1974<br>to<br>31-Dec-2000                        | Līhu'e Plantation;<br>renewal of GL 3546   | 6,543.7            | 16,618                         | 4-3-9-01<br>4-3-9-02<br>4-3-9-06 |
| General Lease       | 4856          | 01-Oct-1981<br>to<br>30-Sept-2046                       | Hawaiian Telephone<br>Company; Mt. Kahili<br>communications<br>reflector site  | 0.1610             | 19,433                         | 424009003<br>(portion)           |
| General Lease       | 5193          | 26-Jul-1990<br>to<br>17-Jul-2001                        | Island Power<br>Company; sale of<br>easements and water<br>license for<br>hydroelectric plan<br>operations. Document<br>never executed.            | n.a                | none                           | 439001001                        |
| General Lease       | 5208          | 14-Jun-1985<br>to<br>13-Jun-2025                        | Princeville<br>Communications Co.;<br>transferred to Kaua'i<br>Cablevision in 1992,<br>cancelled by the State<br>in 2003 for default of<br>payment | 0.393              | 20,254                         | 442001011                        |
| Revocable Permit    | 7340          | 01-Jan-2003<br>to<br>present                            | Kaua'i Island Utility<br>Cooperative; Blue<br>Hole diversion &<br>portion of water<br>transmission system  | n/a;<br>structural | none                           | 439001001                        |
| Special Use Permit  | n.a.          | 14-Jul-2006<br>to<br>13-Jul-2007;<br>see<br>description | Mid-Pacific<br>Communications, Inc.;<br>has been renewed<br>annually – current<br>expiration is<br>13-Jul-2010                                     | 0.393              | 20,254                         | 442001011                        |

\*/1 TMK formatting is sometimes not specific or consistent in historical documents

**E. Vegetation:** The vegetative cover in Līhu'e-Kōloa Forest Reserve is varied, with a general pattern of more intact native vegetation in mauka areas and more alien vegetation makai (Figure



Figure 5: Historical additions to Lihue-Koloa Forest Reserve (year of addition shown)

18

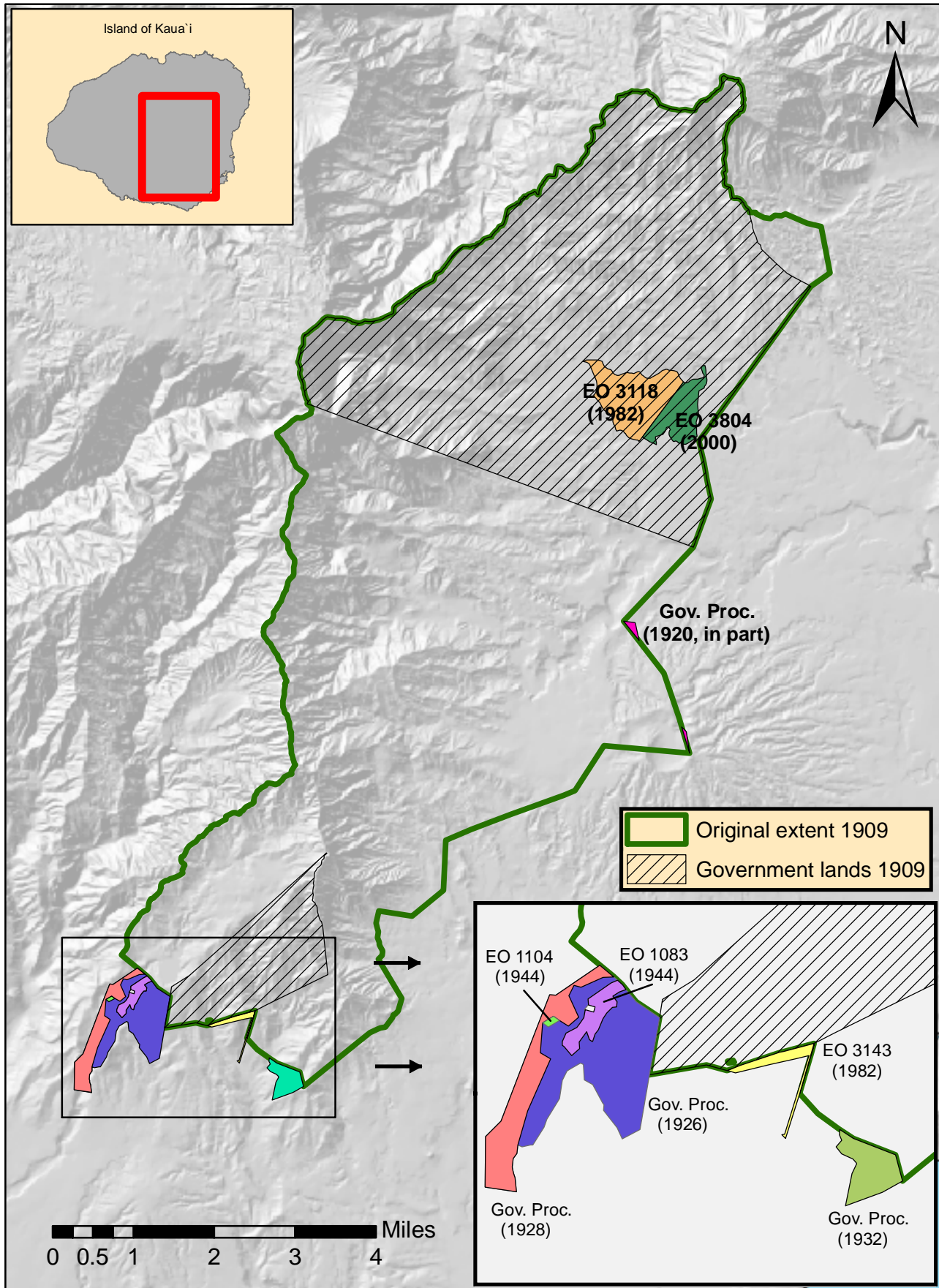


Figure 6: Historical withdrawals from Lihue-Koloa Forest Reserve (year of withdrawal shown)

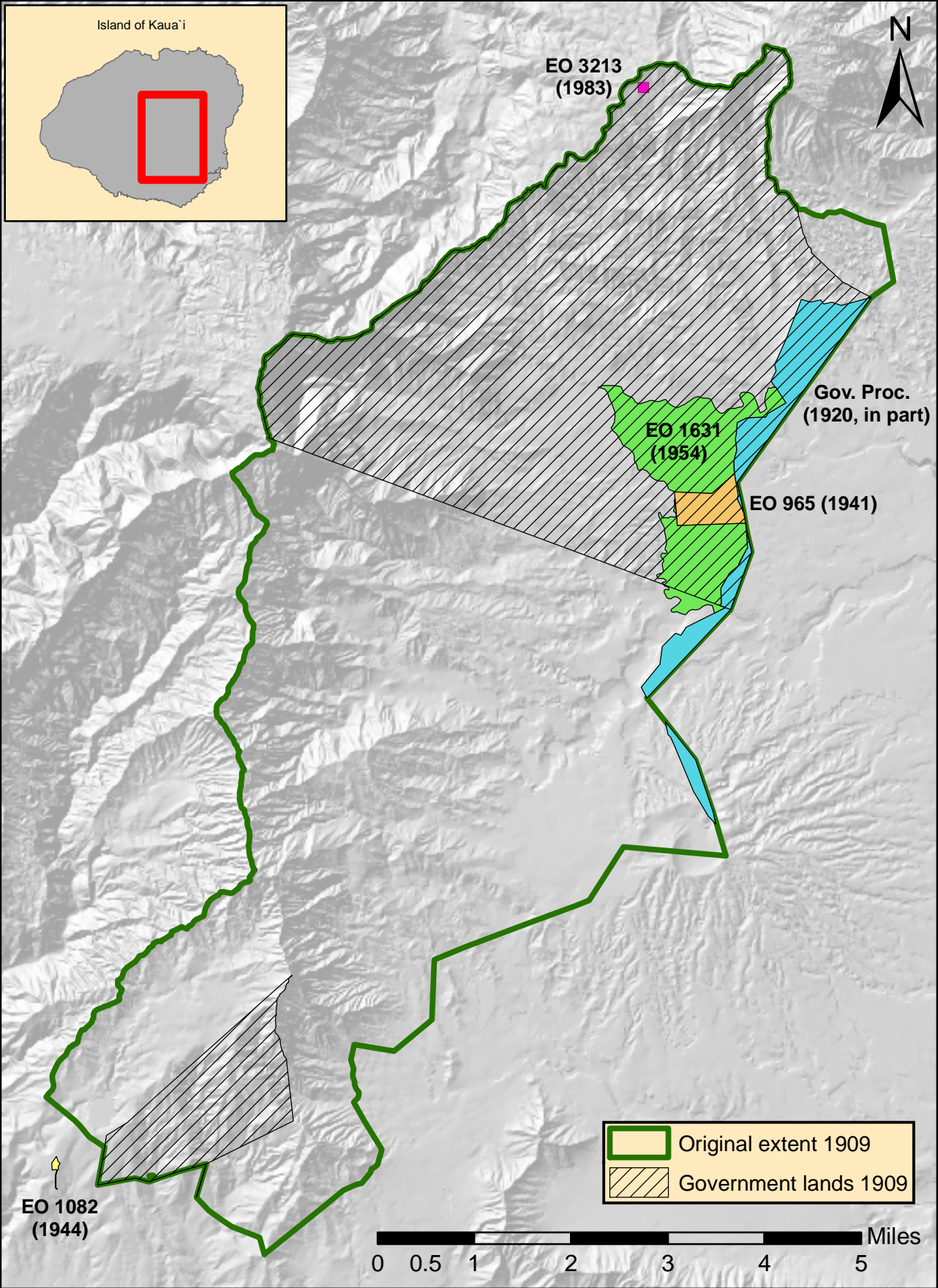
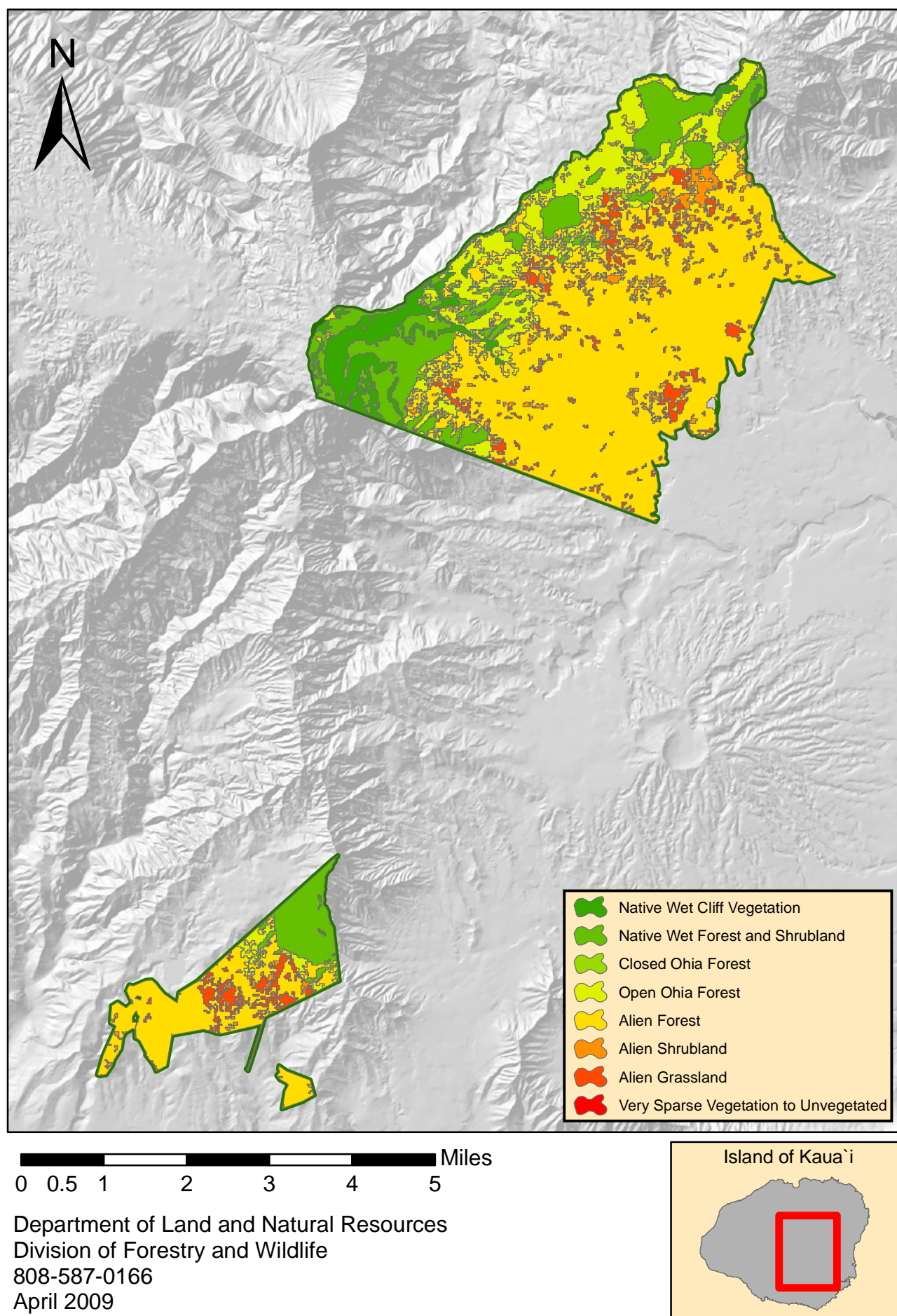




Figure 7: Vegetative cover in Lihū'e-Koloa Forest Reserve  
(Hawai'i Biodiversity and Mapping Program 2005)





7). In the Wailua section, native wet cliff vegetation and native wet forest and shrubland predominate on the eastern slopes of Mount Wai‘ale‘ale with open ‘ōhi‘a and native wet forest and shrubland most common across the rest of the mauka slopes. The Kalāheo section has mostly native wet forest and shrubland with small areas of native wet cliff vegetation and open ‘ōhi‘a forest on the mauka slopes towards Kahili and La‘auhiha‘iha‘i. The makai areas of both sections are covered predominantly with alien forest.

According to DOFAW’s 2001 Draft Management Guidelines, Līhu‘e-Kōloa Forest Reserve contains all four levels of vegetation classification (Figure 8): Highest Quality Native Ecosystems (V-1), Predominantly Native Areas (V-2), Considerably Disturbed Areas (V-3), and Badly Degraded Areas (V-4). V-1 units consist of the highest quality native ecosystems and communities, having minimal disturbance and low levels (less than 10%) of non-native plants in any vegetative layer. V-2 units consist of areas in which native plants predominate in communities that are relatively intact and are minimally disturbed. They have a significant component of non-native plants (more than 10%). V-3 units consist of areas that have a considerable amount of disturbance. The vegetation in these areas does not reflect a naturally evolved species composition, but rather a mixture of small remnant patches dominated by native plants, patches of largely invasive weedy alien plants, and areas of mixed native and non-native plants. V-4 units are areas that are severely degraded or highly altered from their natural state. They may be lands that were cleared for other uses, or are currently eroded, forest plantations, or are dominated by non-native species.

The Wailua section of the Forest Reserve has V-1 and V-2 areas along its mauka boundary, with vegetation transitioning to V-3 and eventually V-4 in the southeast corner. The entire Kalāheo section is classified as V-4. DOFAW is in the process of updating its Management Guidelines.

Management objectives for exceptional quality V-1 areas are to protect and perpetuate them by preventing non-sustainable activities or intensities of use. Permitted activities in these areas are minimally disruptive, and will be focused on ecosystem restoration. Management of V-2 areas is intended to prevent activities or intensities of use that create further significant degradation of native plant or animal communities and encourage activities or intensities of use that are beneficial to those communities. Permitted activities may have a higher level of disturbance than in V-1 areas, provided they remain within sustainable levels. 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 & 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 for other activities. Native plant conservation may be focused at a species, rather than an ecosystem level. 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.

**Rare Plants:** Kaua‘i has a high level of biological endemism (Mitchell et al. 2005) and has many rare plants, some of which are found within Līhu‘e-Kōloa Forest Reserve (Table 4 and Figure 9).

Figure 8: DOFAW's 2001 Draft Management Guidelines for Lihū'e-Koloa Forest Reserve<sup>22</sup>

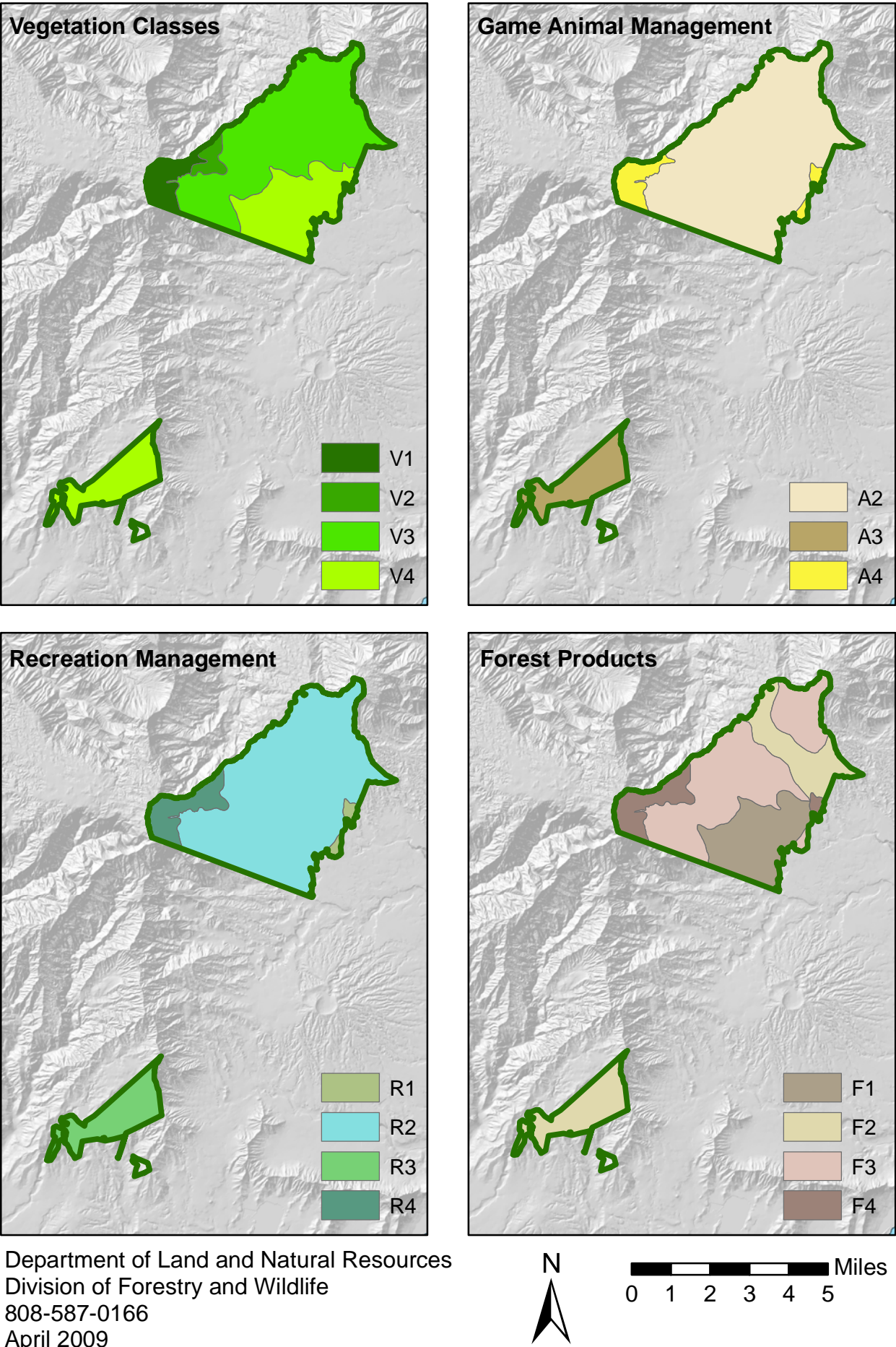
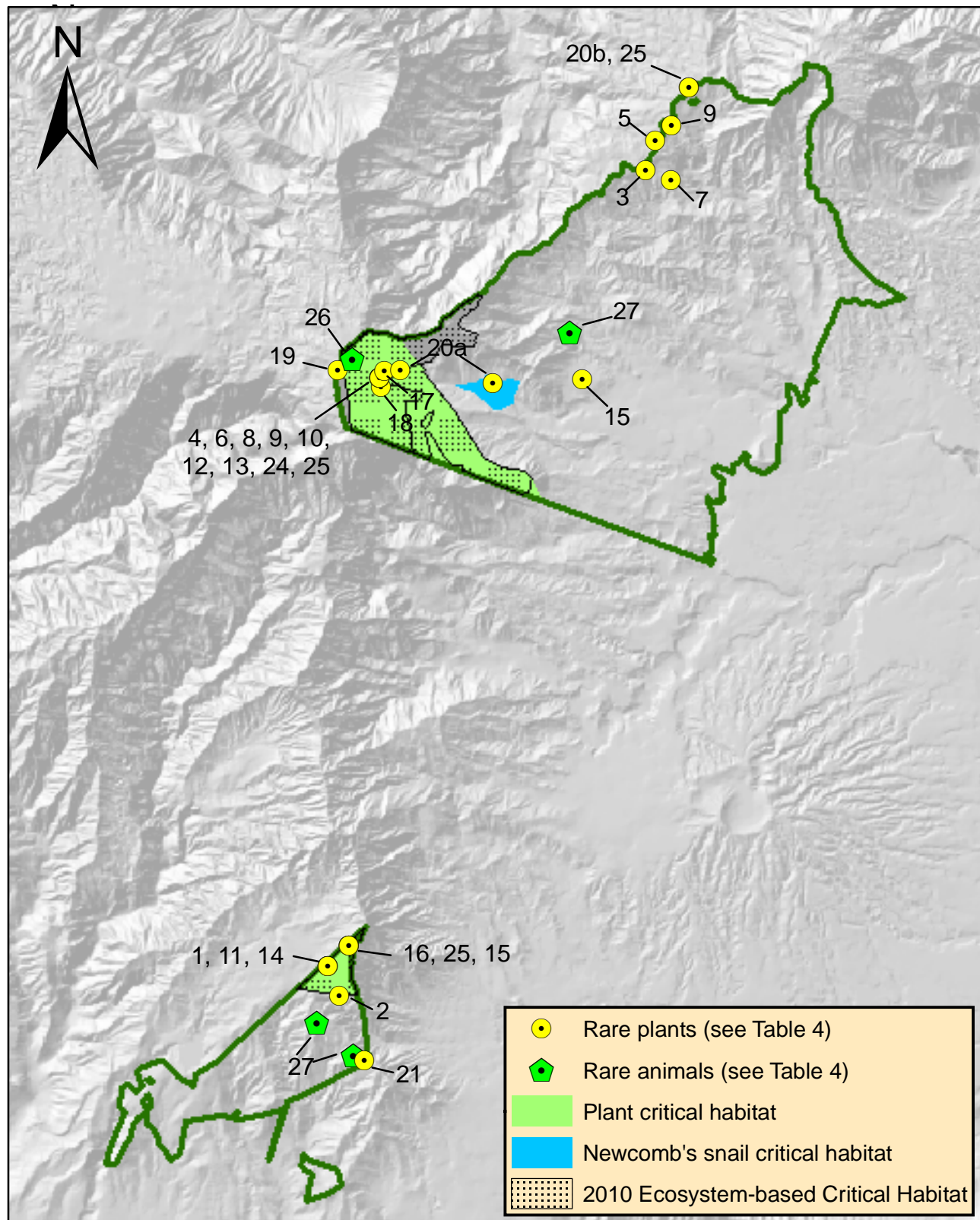
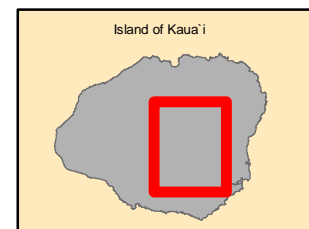


Figure 9: Lihū'e-Koloa Forest Reserve rare species and critical habitat - see Table 4 for 23 details (Hawai'i Biodiversity and Mapping Program 2008)



0 1 2 3 4 5 Miles

Department of Land and Natural Resources  
Division of Forestry and Wildlife  
808-587-0166  
April 2009



**Table 4:** Rare and endangered plants and animals observed within Līhu‘e-Kōloa Forest Reserve (Hawai‘i Biodiversity and Mapping Program 2008)

| Map Number<br>(Figure 9) | Species  | Current/Historical<br>(not seen for<br>>30 yr.) | US-ESA<br>Listing<br>Status |
|--------------------------|--|---|-----------------------------|
| 1                        | <i>Bidens forbesii</i> subsp. <i>kahiliensis</i><br>(ko‘oko‘olau, koko‘olau)   | Current   | n/a                         |
| 2                        | <i>Bonamia menziesii</i>   | Current   | Endangered                  |
| 3                        | <i>Chamaesyce remyi</i> var. <i>hanaleiensis</i><br>(‘akoko, koko, kokomalei)  | Historical                                      | Species of<br>Concern       |
| 4                        | <i>Chamaesyce remyi</i> var. <i>kauaiensis</i> (‘akoko,<br>koko, kokomalei)    | Current   | Candidate                   |
| 5                        | <i>Chamaesyce remyi</i> var. <i>remyi</i> (‘akoko, koko,<br>kokomalei)         | Current   | Candidate                   |
| 6                        | <i>Cyanea asarifolia</i> (‘oha, haha, ‘oha wai)                                | Current   | Endangered                  |
| 7                        | <i>Cyanea recta</i> (‘oha, haha, ‘oha wai)                                     | Current   | Threatened                  |
| 8                        | <i>Cyanea remyi</i> (‘oha, haha, ‘oha wai)                                     | Current   | Endangered                  |
| 9                        | <i>Cyrtandra kealiae</i> subsp. <i>Kealiae</i> (ha‘iwale,<br>kanawao ke‘oke‘o) | Current   | Threatened                  |
| 10                       | <i>Cyrtandra oenobarba</i> (ha‘iwale, kanawao<br>ke‘oke‘o)                     | Current   | Candidate                   |
| 11                       | <i>Dubautia pauciflorula</i> (na‘ena‘e)  | Current   | Endangered                  |
| 12                       | <i>Dubautia plantaginea</i> subsp. <i>magnifolia</i><br>(na‘ena‘e)             | Current   | Candidate                   |
| 13                       | <i>Hedyotis elatior</i>  | Current   | n/a                         |
| 14                       | <i>Hibiscus kokio</i> subsp. <i>kokio</i> (koki‘o ‘ula‘ula)                    | Current   | Species of<br>Concern       |
| 15                       | <i>Joinvillea ascendens</i> subsp. <i>ascendens</i><br>(‘ohe)                  | Current   | Candidate                   |
| 16                       | <i>Lysimachia daphnoides</i> (kolokolo kuahiwi)                                | Historical                                      | Candidate                   |
| 17                       | <i>Lysimachia filifolia</i>  | Current   | Endangered                  |
| 18                       | <i>Lysimachia venosa</i>   | Current   | Endangered                  |
| 19                       | <i>Melicope cruciata</i> (alani)   | Current   | Species of<br>Concern       |
| 20                       | <i>Melicope paniculata</i> (alani)   | a. Current<br>b. Historical                     | Candidate                   |
| 21                       | <i>Myrsine petiolata</i> (kolea)   | Historical                                      | n/a                         |
| 22                       | <i>Neraudia melastomifolia</i> (ma‘aloa, ma‘oloa,<br>‘oloa)                    | Unknown   | n/a                         |
| 23                       | <i>Pisonia wagneriana</i> (papala kepau)                                       | Historical                                      | Species of<br>Concern       |
| 24                       | <i>Plantago princeps</i> var. <i>longibracteata</i> (ale)                      | Current   | Endangered                  |
| 25                       | <i>Pteralyxia kauaiensis</i> (kaulu)   | Current   | Endangered                  |



| Map Number<br>(Figure 9) | Species  | Current/Historical<br>(not seen for<br>>30 yr.) | US-ESA<br>Listing<br>Status |
|--------------------------|--|---|-----------------------------|
| 26                       | <i>Pterodroma sandwichensis</i> ('ua'u, Hawaiian dark-rumped petrel) | Current   | Endangered                  |
| 27                       | <i>Puffinus auricularis newelli</i> ('a'o, Newell's shearwater)      | Current   | Threatened                  |

**Critical Habitat:** US-ESA defines Critical Habitat as areas that may or may not be occupied by a threatened or endangered species, but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S. C. § 1532 (5)). Prior to 2010, Līhu'e-Kōloa Forest Reserve contained US-ESA critical habitat for 16 species of plants and Newcomb's snail (Appendix 1, Figure 9). Recently, another 45 plant species (plus two birds and one insect) have been designated for listing by the US-ESA on Kaua'i (U.S. Fish and Wildlife Service 2010) and Critical Habitat for some of these species occurs within the Reserve. This new Critical Habitat follows an ecosystem-based approach and represents an addition to, rather than a replacement of, the previous Critical Habitat designation. Lowland wet and wet cliff ecosystem types are included in Līhu'e-Kōloa Forest Reserve.

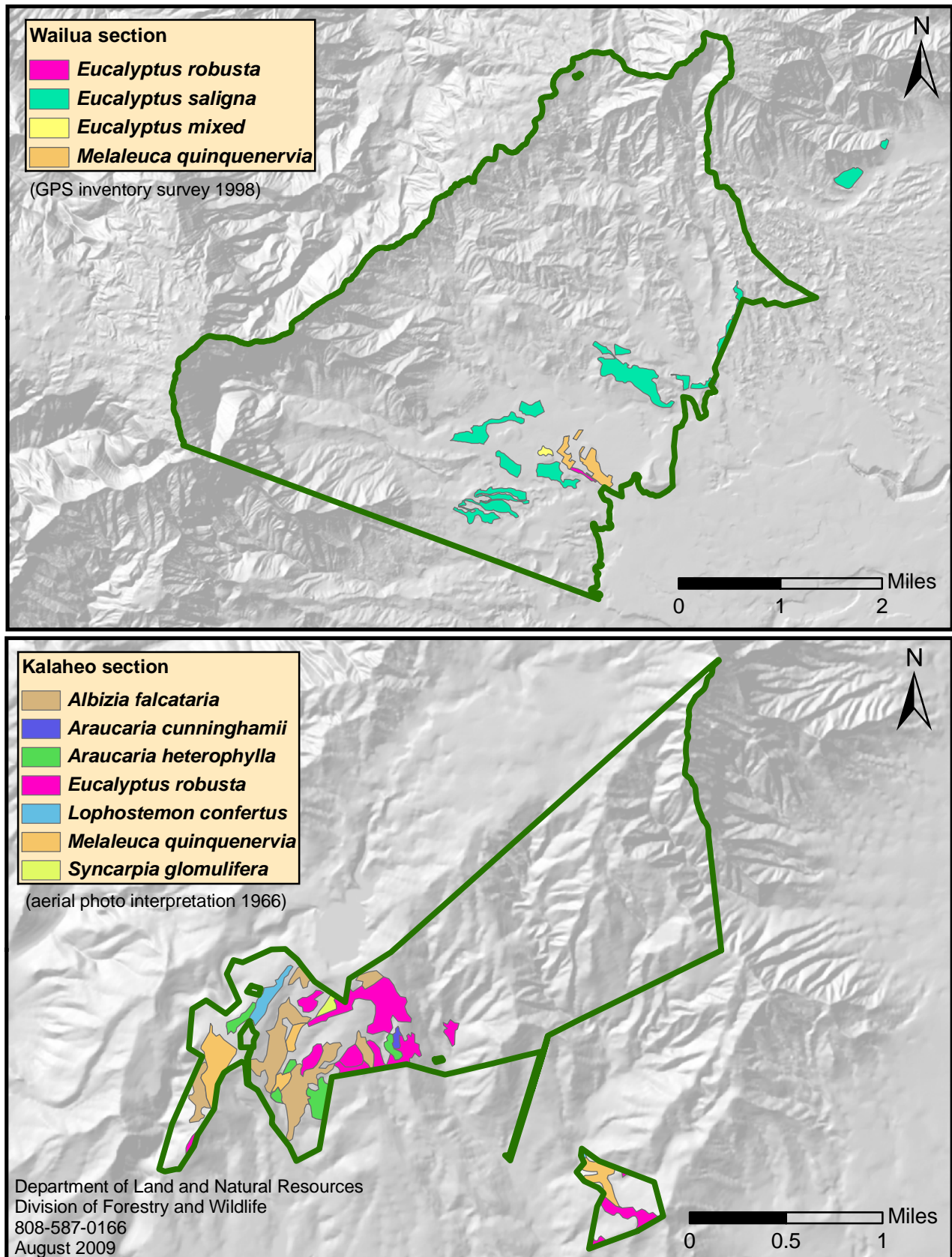
**Timber Species:** Large scale harvesting of the Hawaiian forests began in 1791 with the sandalwood trade; this ultimately led to Hawaii's first conservation law in 1839, restricting the cutting of sandalwood (Nelson 1967). Forest loss continued due to cattle grazing and the need for fuel wood on whaling ships and in sugar mills. Eventually, sugar plantations began replanting efforts. 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.

DOFAW's Draft Management Guidelines designate Līhu'e-Kōloa Forest Reserve as containing all four levels of forest products classification (Figure 8): Primary (F-1, forest products are a primary objective), Secondary (F-2, limited small scale harvesting or salvage is allowed), Personal (F-3, small scale non-commercial harvesting or salvage is allowed), and Restricted (F-4, forest products are not normally an objective). All classification levels have restrictions regulated by DOFAW and require appropriate permits and/or licenses.

Approximately 360 acres of timber plantations exist in the Wailua section of Līhu'e-Kōloa Forest Reserve (Figure 10); these were planted mostly in the 1930s and the 1960s. Smaller areas of experimental plantings (200+ acres) were also exist in the Kalāheo section, planted mostly by the Civilian Conservation Corps in the 1930s.

**Invasive plant species:** Invasive plants of particular management concern at Līhu'e-Kōloa Forest Reserve include clidemia (*Clidemia hirta*), albizia (*Falcataria moluccana*), Australian tree fern (*Sphaeropteris cooperi*), miconia (*Miconia calvescens*), melastoma (*Melastoma candidum*), tufted beardgrass (*Schizachyrium condensatum*), strawberry guava (*Psidium cattleianum*) common guava (*Psidium guajava*), African tuliptree (*Spathodea campanulata*),

Figure 10: Exotic timber plantations in Lihu'e-Koloa Forest Reserve  
(note difference in scale and data source between maps)



Isenberg bush (*Rhodomirtus tomentosa*), guineagrass (*Panicum maximum*), and catsclaw (*Caesalpinia decapatala*). The area of greatest weed management concern is within the V-1 area of the Wailua section (Figure 8), also referred to as “Blue Hole”.

DOFAW partners with the Kaua‘i Invasive Species Committee (KISC) in efforts to survey for and control miconia (*Miconia calvescens*) on Kaua‘i. Miconia has been found close to the Forest Reserve in the Wailua GMA. The Kaua‘i Watershed Alliance has been mapping Australian tree fern and developing aerial control techniques for remote locations; it is hoped that this work may eventually be expanded to Līhu‘e-Kōloa Forest Reserve.

**F. Wildlife:** Līhu‘e-Kōloa Forest Reserve contains a variety of wildlife resources that provide for both consumptive use such as public hunting, and non-consumptive uses such as wildlife viewing and native species preservation and restoration.

**Native Wildlife:** Habitat for native wildlife, including forest and seabirds, invertebrates, the Hawaiian hoary bat, and stream fauna can be found in Līhu‘e-Kōloa Forest Reserve.

Both sections of the Līhu‘e-Kōloa forest reserve are habitat for native forest birds (P. Roberts, personal communication, unreferenced). There are eight native forest bird species remaining on Kaua‘i, and the great majority of their populations occur in the highest elevations of the island, specifically on the Alaka‘i Plateau, which is immediately adjacent to the Wailua section of the Forest Reserve. The majority of the forest birds are expected to occur in areas over 3,500 feet elevation. These would include:

- puaiohi (*Myadestes palmeri*) Status Endangered
- ‘akeke‘e (*Loxops caeruleirostris*) Status Endangered (2010)
- ‘akikiki (*Oreomystis bairdi*) Status Endangered (2010)
- elepaio (*Chasiempis sandwichensis sclateri*)
- ‘apapane (*Himatione sanguinea*)
- ‘i‘iwi (*Vestiaria coccinea*)
- Kaua‘i ‘amakihi (*Hemignathus kauaiensis*)
- ‘anianiau (*Magumma parva*)

Diseases (especially avian malaria and avian pox) transmitted by mosquitoes (*Culex quinquefasciatus*) prevent native forest birds from occurring at high densities at elevations less than 3500 feet, although low densities of these birds occur at lower elevations, especially ‘apapane and ‘elepaio. These two species are known from areas 2,000 feet elevation and higher on Kaua‘i, and ‘apapane is specifically known from the Kalāheo section near the Kanaele bog and Kahili ridge.

Native forest bird species that would have occurred in the Forest Reserve in the past include:

- kama‘o (*Myadestes myadestinus*) Status Endangered
- Kaua‘i ‘o‘o (*Moho braccatus*) Status Endangered
- ‘o‘u (*Psittirostra psittacea*) Status Endangered
- nukupu‘u (*Hemignathus lucidus*) Status Endangered
- Kaua‘i akialoa (*Hemignathus procerus*) Status Endangered

These are all considered endangered and not extinct, though none have been seen since at least 1989.

Habitat for the endangered nene (*Branta sandvicensis*) is known to exist along the makai boundary of the Wailua section of the Forest Reserve and into adjacent agricultural lands. Koloa (*Anas wyvilliana*) and kōlea (*Pluvialis fulva*) occur in stream tributaries in this area, and ‘alae‘ula (*Gallinula chloropus sandvicensis*) may also be seen on occasion. Pueo (*Asio flammeus sandwichensis*) also may occur throughout the Forest Reserve.

Rare, upland nesting seabirds, including the ‘ua‘u (Hawaiian dark-rumped petrel) and the ‘a‘o (Newell’s shearwater) are known to occur in Līhu‘e-Kōloa Forest Reserve (Table 4, Figure 9) (Hawai‘i Biodiversity and Mapping Program 2008). According to auditory surveys conducted by the Kaua‘i Endangered Seabird Recovery Project (KESRP), the ‘akē‘akē (Band-rumped storm-petrel, *Oceanodroma castro*), which is a candidate species for US-ESA listing, occurs here as well. KESRP has conducted surveys that cover both sections of the Forest Reserve, showing the occurrence of these birds to be concentrated near the headwaters of the North Fork of the Wailua River and along Kuilau Ridge in the Wailua section and in the mauka part of the Kalāheo section.

The Hawaiian hoary bat (*Lasiurus cinereus semotus* or ‘ōpe‘ape‘a), Hawai‘i’s only endemic land mammal, is federally listed as endangered; Kaua‘i and the Big Island host the largest populations (U.S. Fish and Wildlife Service 1998). The ‘ōpe‘ape‘a is one of three known subspecies of hoary bat; there are also North American and South American subspecies. The Hawaiian hoary bat roosts solitarily in the foliage of trees and is most active at dusk when foraging on flying insects. No information on the density and distribution of these animals is yet available, but they are apparently quite versatile and exist from sea level to over 4000 feet elevation, feeding heavily on both native and introduced insects.

Invertebrates are generally poorly studied and hence, few studies have been conducted on most native Hawaiian insects and other invertebrates. It is likely that there are many more endemic invertebrates that have yet to be discovered in pockets of native forest. Kaua‘i is home to the extremely rare Fabulous green sphinx moth (*Tinostoma smaragditis*), and was likely once included in the distribution of the endangered Blackburn’s sphinx moth (*Manduca blackburni*). *Drosophila sharpi*, one of over 100 species of Hawaiian picture-wing flies, was designated as an endangered species in 2010; *Drosophila attigua* is among the species proposed for listing by the US-ESA. Līhu‘e-Kōloa Forest Reserve currently contains critical habitat for Newcomb’s snail (U.S. Fish and Wildlife Service 2006). No known populations exist within the Reserve, but there are two populations just outside the eastern boundaries of the Wailua section on the Makaleha Stream and the Wailua River. The Large Kaua‘i land snail (*Carelia evelynae*) may have once existed within the Forest Reserve.

The majority of the streams within the Forest Reserve are considered to be of moderate condition. The amphidromous native fish, ‘o‘opu nakea (*Awaous stamineus*) and the crustacean, ‘o‘pae kala‘ole (*Atyoida bisulcata*), are found within the streams of the Wailua section of the Forest Reserve. In the Kalāheo section, there are only two streams present; āholehole (*Kuhlia sandvicensis*) and ‘o‘opu nakea may be found in the upper segments of Lāwa‘i Stream, while



introduced swordtails (*Xiphophorous* spp.) may be found in all segments of Hulē‘ia Stream, which is otherwise classified as an outstanding quality stream. (Kaua‘i Aquatic Species Distribution GIS layer).

**Non-Native Wildlife:** A large variety of introduced song birds inhabit Kaua‘i forests; these birds make up the typical fauna enjoyed by people while using forest areas for recreational activities. Effects of these birds range from benign to harmful; they can act as disease reservoirs, compete with native birds for food sources, and spread seeds of weedy plants. In addition, the introduced barn owl (*Tyto alba*) sometimes preys on native birds.

Non-native mammals that may be found in the Forest Reserve include feral cats (*Felis domesticus*), feral dogs (*Canis domesticus*), feral cattle (*Bos taurus*), rats (*Rattus* spp.) and mice (*Mus* spp.). Fortunately, Kaua‘i has managed to remain free from a resident mongoose (*Herpestes javanicus*) population and has thus been spared this threat to native wildlife.

Introduced game animals, most of which have negative impacts on native ecosystems, are described below in section I: Additional Public Use.

### **G: Access:**

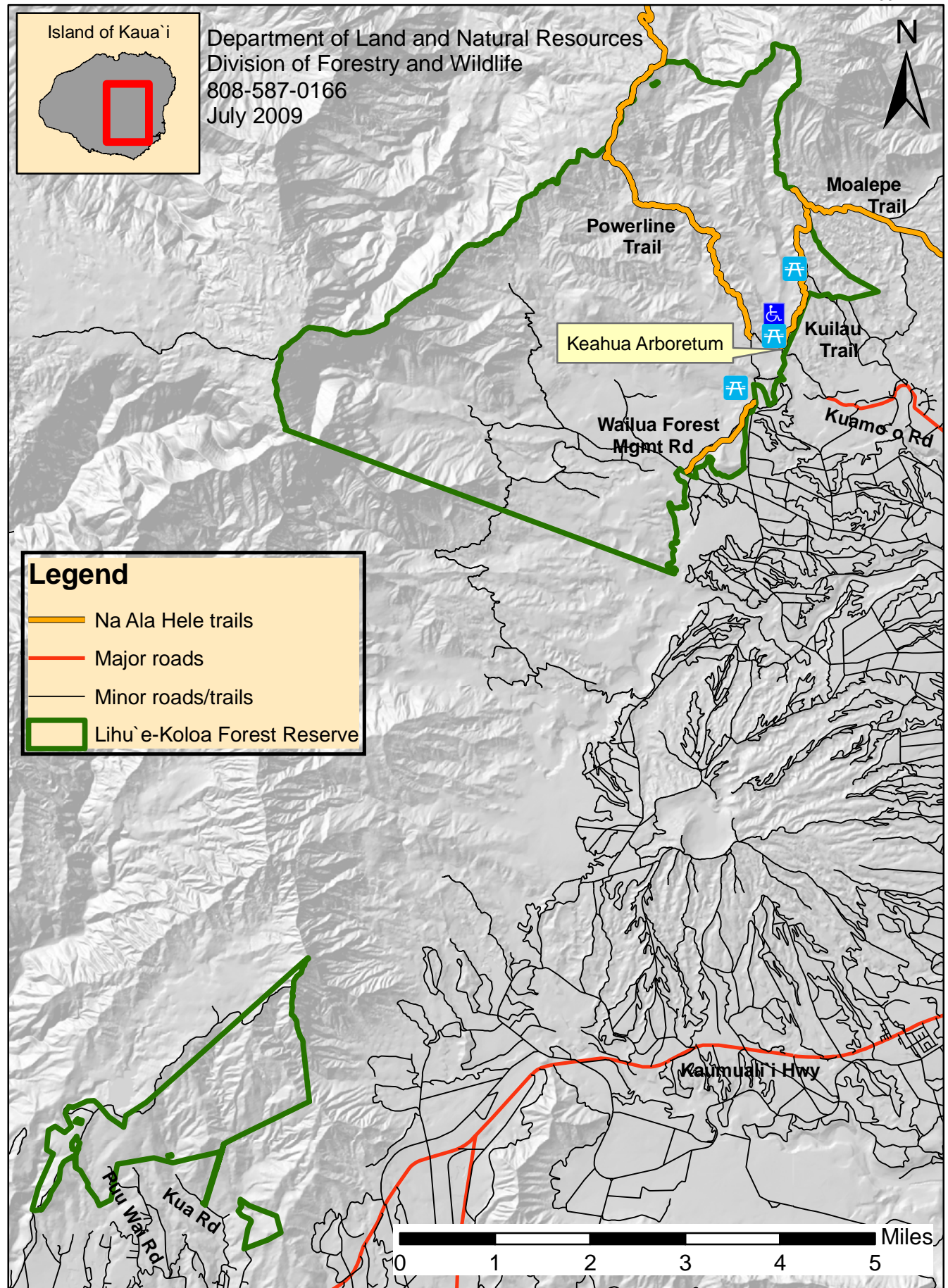
**Vehicular Access:** To access the Wailua section of the Līhu‘e-Kōloa Forest Reserve by car, follow Highway 580 (Kuamo‘o Road) mauka from Wailua town to the Keāhua Arboretum, where parking is available (Figure 11). From here, 4WD vehicles may proceed southbound into the Reserve along the Wailua Forest Management Road. The Kalāheo section of the Forest Reserve may be reached via two unmaintained rights-of-way: one near the end of Kua Road, where a small parking area is available, and another off Pu‘u Wai Road.

**Trails:** Na Ala Hele, the State of Hawaii Trail and Access Program, manages three trails at Līhu‘e-Kōloa Forest Reserve (Figure 11). Hiking on undesignated trails is not recommended due to the potential for natural hazards.

- **Powerline Trail** follows a 13 mile electric transmission line maintenance route along the eastern edge of Halele‘a Forest Reserve, starting at the Hanalei National Wildlife Refuge and ending near the Keāhua Forestry Arboretum in Līhu‘e-Kōloa Forest Reserve. This trail is designated for hiking, equestrian, bicycle, or motorcycle use. It is not maintained and there are no amenities.
- **Kuilau Trail** starts on Highway 580 about 100 yards before the Keāhua Arboretum. It travels approximately 1.75 miles to meet up with the Moalepe Trail, which continues on into the Keālia Forest Reserve. These two trails are popular equestrian routes, although hiking and bicycle uses are also allowed. Kuilau Trail features bridges, parking, shelters, and tables.
- **Wailua Forest Management Road** starts at the Keāhua Arboretum and ends at the gate leading to Blue Hole. The road crosses the North Fork of the Wailua River and continues past Hanahanapuni. The road is primarily used for 4WD access to hunting unit C and for 4WD ecotours. Bicycles and licensed dirtbikes are allowed. Non-hunters are advised to wear bright colors. There are no amenities.

Figure 11: Access and facilities at Lihue-Koloa Forest Reserve

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**Designated Helicopter Landing Zones:** There are no designated helicopter landing zones in Līhu‘e-Kōloa Forest Reserve.

**Restricted Watershed:** No restricted watershed areas exist on the island of Kaua‘i.

**H: Infrastructure:** In addition to the Na Ala Hele Trails listed above, infrastructure includes facilities at the Keāhūa Arboretum, consisting of four picnic shelters with tables and one ADA (Americans with Disabilities Act) compliant composting toilet. Two other picnic shelters with tables also exist: one along the Kuilau Trail and one near the North Fork of the Wailua River crossing.

**I: Archaeological and Historical Sites:** An ancient Hawaiian adze quarry is located at the Keāhūa Arboretum. Also notable is the Ka‘awakō heiau at the Wai‘ale‘ale summit; although not technically within the Forest Reserve, it is on the boundary and looks over the ahupua‘a of Wailua. According to GIS data from the Office of Hawaiian Affairs, another unidentified site exists near Lokoawa Stream on the southern boundary of the Kalāheo Section. Historical sites, here defined as post Western contact era, consist of irrigation ditches and ruined structures dating from World War II at Kalāheo.

## **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 varied hunting methods. DLNR’s Division of Conservation and Resources Enforcement (DOCARE) carries out enforcement of hunting regulations (Chapter 122 Rules Regulating Game Bird Hunting, and Chapter 123 Rules Regulating Game Mammal Hunting). General hunting regulations can be found in HRS Title 13 Chapter 121. Līhu‘e-Koloa Forest Reserve contains three of four Game Animal management classes (Figure 8) according to DOFAW’s Draft Management Guidelines: A-2: Mixed Game and Other Uses, A-3: Game Control (public), and A-4: Game Control (supervised). 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. 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. A-4 areas are designated for animal removal only by staff or agency designees due to environmental sensitivity, remoteness, or public safety.

Game animal hunting is allowed throughout the majority of both sections of Līhu‘e-Koloa Forest Reserve, which lie within hunting unit “C”. Game mammals found within the hunting unit include feral pigs (*Sus scrofa*) and feral goats (*Capra hircus*). DOFAW regulates game mammal hunting according to HRS Title 13 Chapter 123; hunting units on Kaua‘i are described in §13-123-15 and mapped in Chapter 123 Exhibit 2. Game bird hunting is not permitted in the Forest Reserve, although it is permitted in the adjacent Wailua GMA.

Hunting in all of these forest areas is restricted to weekends, Mondays, and State holidays unless otherwise allowed by special hunts. Illegal hunting activity occurs, but it has been controlled to

some degree by a system of locked gates during weekdays. Contact the Kaua‘i DOFAW office for current hunting rules including seasons and bag limits. A public shooting range is planned at Hanahanapuni in the Wailua section of the Forest Reserve.

**Camping:** Camping is not allowed in Līhu‘e-Kōloa Forest Reserve.

**Fishing:** Opportunities exist to fish for small mouth bass (*Micropterus dolomieu*) in the Wailua section of the Forest Reserve.

**Hiking:** Many opportunities exist for hiking in Līhu‘e-Kōloa Forest Reserve. See Section G: Access above.

**Horseback Riding:** Horseback riding is allowed on the Powerline Trail and the Kuilau Trail. See Section G: Access above for more details. Parking for trailers and a “horse parking” area is available at the Keāhua Arboretum.

**Dirt Bikes, All Terrain Vehicles (ATVs) and Mountain Bikes:** Dirt bikes are allowed on Powerline Trail and the Wailua Forestry Road if registered by the County Division of Motor Vehicles. ATVs are not allowed in Līhu‘e-Kōloa Forest Reserve. Mountain bikes (non-motorized) are allowed on all trails in the Reserve.

**Non-Timber Forest Product Collection:** Non-timber forest products may be collected within the Reserve. Examples include:

- a. Ferns
- b. Flowers
- c. Fruits
- d. *Psidium* spp. (guava) poles
- e. *Alyxia oliviformis* (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. Gathering of plant materials from threatened, endangered, or other equally rare species may be allowed if individuals have obtained a special permit from the DLNR Administrative office in Honolulu. Harvesting permits are required for gathering the items listed above. Permit applications for gathering plant material can be obtained from the DLNR Lihue office at 3060 Eiwa Street, Room 306, Lihue, Hawai‘i 96766; phone (808) 274-3433. These permits are available, upon approval, free (for common personal use items) of charge or at a fee, depending on the purpose. Public Use Permits available in conjunction with the Forest Reserve System are described in HAR §13-104.

**Picnicking:** Six open shelters with picnic tables exist in Līhu‘e-Kōloa Forest Reserve Forest Reserve. They are available for day use only. See Section H: Infrastructure above for more information.

**General Recreation:** Līhu‘e-Kōloa Forest Reserve contains all four possible Recreation Management classes according to DOFAW’s 2001 Draft Management Guidelines (Figure 8): R-1 (Heavy Use Areas), R-2 (Medium Use Areas), R-3 (Light Use Areas), and R-4 (Restricted Areas). R-1 areas are where outdoor recreation is a primary objective. These areas may have highly developed recreational facilities such as checking stations, camp sites with utilities, and parking lots. R-2 designates areas 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. R-4 areas are where 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.

The Wailua section of the Forest Reserve is classified as R-1 along part of the makai boundary, R-2 across most of the section, and R-4 in the mauka areas towards Mt. Wai‘ale‘ale. The Kalāheo section is classified R-3. Refer to the previous Sections G: Access and H: Infrastructure for more detailed information on recreational facilities in Līhu‘e-Kōloa Forest Reserve.

#### **K. Threats:**

**Plants:** Invasive and weedy plants pose a threat to native ecosystems in the Forest Reserve, especially in more intact areas such as those designated V-1 and V-2 by DOFAW’s Draft Management Guidelines. Weedy plants often out-compete and replace native plants, which in turn reduces habitat and food sources for native animals.

**Animals:** Ungulates including deer, goats, and pigs contribute to soil erosion, destroy native plants, spread invasive seeds, and may serve as disease reservoirs. Pig wallows also serve as breeding habitat for mosquitoes, including *Culex quinquefasciatus*, the primary vector of avian malaria (*Plasmodium relictum*) and avian pox (*Poxvirus avium*). These two diseases have been devastating to native forest bird populations at mid and low elevations. Introduced birds are relatively resistant to these diseases, serving as reservoirs and providing competition for native birds. Feral cats and dogs and introduced barn owls prey on native birds and may carry parasites that affect other animals and/or humans.

**Fire:** Līhu‘e-Kōloa Forest Reserve is generally a low fire risk area. However, this risk is increased wherever there is a human presence, particularly in areas with susceptible vegetation. DOFAW is the primary responder for fires in the Reserve (Figure 12).

**Floods/landslides:** Floods and landslides have occurred in the Forest Reserve in the past. This is especially a risk during/after heavy rainfall events and on the roadways in the Wailua section.

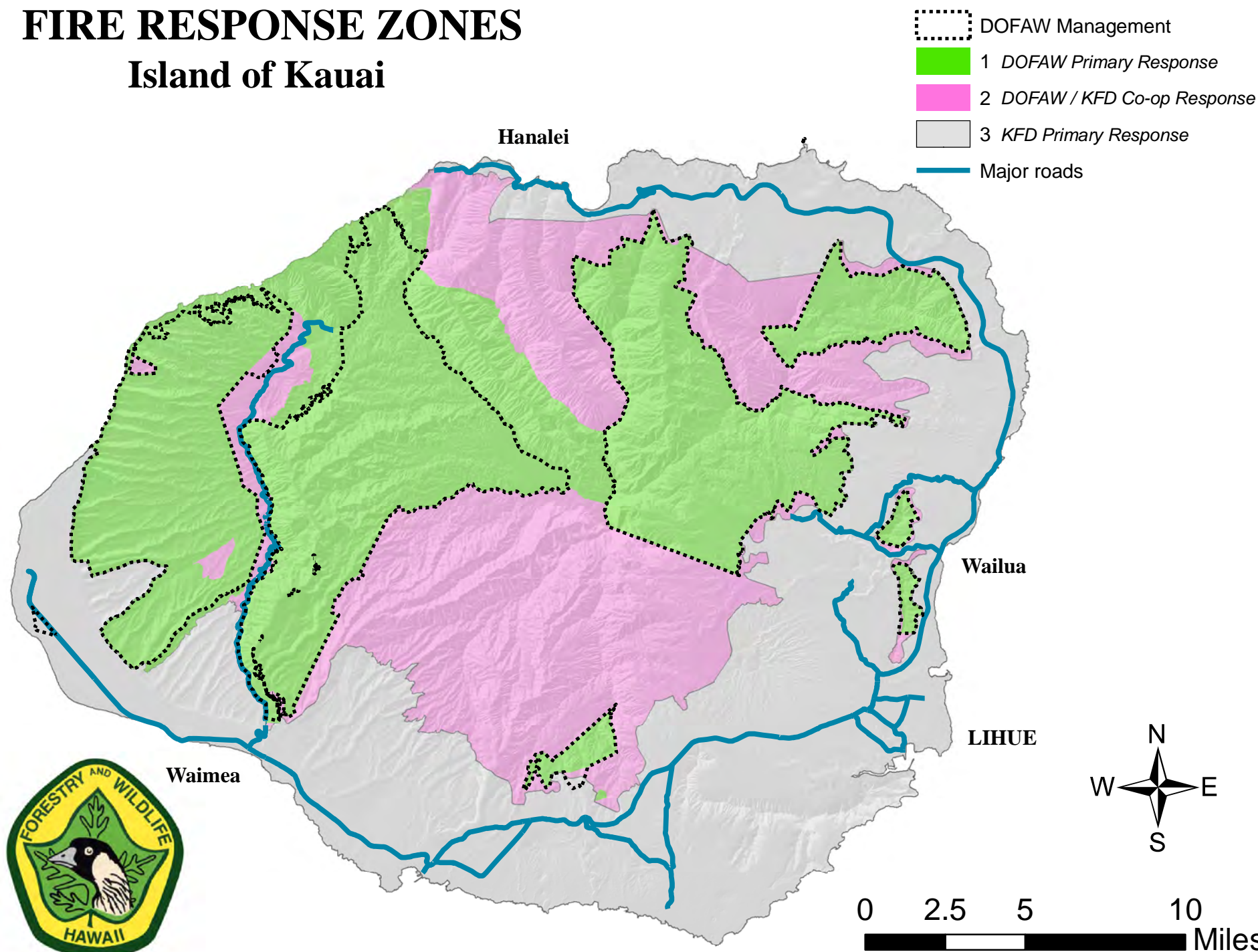
**Vandalism:** Vandalism is a constant problem throughout the Forest Reserve System. Common nuisances include theft of native plants and damage to infrastructure and trees. Vandals often use firearms to damage signs, which poses a threat to people in the area. DLNR’s Division of



Figure 12: Fire response zones for the island of Kaua'i

# FIRE RESPONSE ZONES

## Island of Kauai



Conservation and Resource Enforcement (DOCARE) is mandated to enforce all State laws and rules involving forest reserves.

**Cultivation of marijuana:** There have been past reports of marijuana cultivation in the Forest Reserve; this illegal activity may pose a risk for DOFAW staff and/or visitors that utilize the area for legitimate purposes.

### **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.

Annual revenue collected for DOFAW from Līhu‘e-Kōloa Forest Reserve includes:

- 4WD ecotours on Wailua Forest Management Road - \$28,820.00
- Equestrian tours on Kuilau/Moalepe Trails - \$3295.60
- Special Use Permit for telecommunications purposes at Mt. Wekiu - \$9000.00
- Hunting licenses @ \$10.00 each (island wide) - \$26,000.00 +/- \$1000.00

Possibilities exist for harvest of timber and/or biomass in the Wailua section. In addition to historic timber plantings, albizia has become widespread in this area since hurricanes Iwa (1982) and Iniki (1992); this tree is of interest to Hawai‘i's prospective biofuel industry.

## **III. MANAGEMENT**

### **A. Past Planning:**

The KWA published the Kaua‘i Watershed Management Plan in 2005. Both sections of Līhu‘e-Kōloa Forest Reserve fall within the boundaries of the KWA and are designated as Core 3 Management Areas, intended to provide buffer zones for central, actively managed areas. Buffer areas are described as third priority, having alien-dominated, lower quality forests with large populations of ungulates. KWA’s goals for these areas are to encourage public hunting access, control miconia, and implement other management actions as determined.

### **B. Summary of Existing Management Activities:**

Current management activities in Līhu‘e-Kōloa Forest Reserve focus on supervision of ecotours, maintenance of trails, roads and the arboretum, public hunting, wildlife surveys, and rare plant collection and surveys.

### **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)
- 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)
- Native Ecosystems (landscape level protection)
- 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.)
- Additional Public Activity (non-income generating uses, such as recreation, cultural activities, personal gathering, educational or research activities, and events among others)

Each category has been ranked on a qualitative scale of 1 to 8 with 1 as higher priority and 8 as lower priority. Table 5 is an excerpt from the Kaua‘i Forest Reserves Draft Umbrella Management Plan and lists qualitative rankings of the management priority categories for Līhu‘e-Kōloa Forest Reserve.

**Table 5:** Līhu‘e-Kōloa Forest Reserve 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 |
|-----------------------------|---------------------|------------------|--------------------------|-------------------|-------------------|-------------------|---------------------|----------------------------|
| Līhu‘e-Koloa                | 7                   | 1                | 4                        | 8                 | 3                 | 5                 | 6                   | 2                          |

Table 6 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.

**Table 6:** Management objectives and associated plans for Līhu‘e-Kōloa Forest Reserve.  
Estimated cost refers to State funds.

| Management Priority               | General Management Action                                    | Tactical Goals   | Action Items  | Estimated Cost                     |
|-----------------------------------|--|--|---|------------------------------------|
| <b>Watershed Values</b>           | Reduce the threat and impact of erosion on reserve resources | Reduce ungulate damage in ecologically sensitive areas | Strategic ungulate fencing at back of Blue Hole (~300 ft.)    | \$40,000                           |
|                                   |  |  | Special fly-in public hunts at back of Blue Hole              | \$25,000 plus staff and mgmt costs |
| <b>Additional Public Activity</b> | Provide high quality recreational opportunities              | Maintain trails and roads                              | Purchase road fill material, grade roads and maintain bridges | \$30,000/yr                        |
|                                   |  |  | Brush removal, mowing, gravel and grade trails                | \$10,000/yr                        |



| Management Priority               | General Management Action   | Tactical Goals   | Action Items  | Estimated Cost                        |
|-----------------------------------|---|--|---|---------------------------------------|
|                                   |   | Maintain signs and structures  | Toilet and shelter repair/maintenance   | Mgmt and staff costs only             |
|                                   |   |  | Sign replacement  | \$1000/yr                             |
| <b>Native Ecosystems</b>          | Protect V-1 and V-2 areas as defined by DOFAW's draft mgmt Guidelines | Reduce ungulate damage in ecologically sensitive areas                             | See items from "Watershed Values" above   | As above                              |
|                                   |   | Review and update mgmt guidelines  | Re-evaluate vegetation classes, especially in Kalāheo section   | Mgmt and staff costs only             |
| <b>Invasive Species Control</b>   | Reduce/prevent invasive species from entering V-1 and V-2 areas       | Aerial spraying of target species  | Australian Tree Fern (Guava and African tulip if technology is developed)   | \$82,500                              |
|                                   |   | Chemical and biological ground control of target species                           | Clidemia<br>Schizachryium<br>Australian Tree Fern<br>Guava<br>Albizia   | \$30,000/yr plus staff and mgmt costs |
| <b>Game Animal Management</b>     | Continue to provide public hunting opportunities                      | Improve/increase hunting access in Kalāheo section                                 | Clear right-of way at Lāwa'i Valley   | \$20,000                              |
|                                   |   |  | Work with private landowners to obtain access to Alexander Dam area of Kalāheo section  | Mgmt and staff costs only             |
|                                   |   | Create a public shooting range at Hanahanpuni                                      | Obtain boundary survey in order to add designated land to the Forest Reserve  | \$15,000                              |
| <b>Commercial Activity</b>        | Promote ecotourism and manage forest/timber resources                 | Review and provide opportunities for approved ecotourism operations and timber use | Monitor ecotourism activities to ensure compliance with current agreements  | Mgmt and staff costs only             |
| <b>Resource Protection</b>        | Reduce the threat of fire, insects, and disease                       | Respond to threats as needed   | Reduce fuel loads along access corridors  | Mgmt and staff costs only             |
|                                   |   |  | Monitor for insects and disease   | Mgmt and staff costs only             |
| <b>T&amp;E Species Management</b> | Protect occurrences of listed and rare plants and animals             | Protect and monitor wild populations of rare plants                                | <ul style="list-style-type: none"> <li>Fence individual plants/populations as needed or where accessible</li> <li>Maintain existing fences</li> <li>Collect, propagate and outplant into protected areas</li> </ul> | \$10,000/yr+                          |

| Management Priority | General Management Action | Tactical Goals                       | Action Items  | Estimated Cost |
|---------------------|---------------------------|--------------------------------------|---|----------------|
|                     |                           | Protect and monitor bird populations | Support Kaua'i Endangered Seabird Recovery Project annual surveys of known colony sites | \$136,000/yr   |

#### **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 Līhu'e-Kōloa Forest Reserve include:

- Miles of trail maintenance
- Miles of unpaved access road maintenance
- Number of volunteer service projects
- Number of game mammals harvested
- Number of commercial trail and road tours
- Number of commercial trail tour patrons
- Number of commercial trail operator permits issued
- Acres of public hunting grounds managed
- Acres of noxious plants controlled
- Acres of erosion controlled
- Acres of fire protection area
- Miles of fence constructed
- Miles of fence maintained
- Acres of enclosure developed
- Acres of enclosure maintained
- Number of rare, threatened, or endangered plant/animal species protected
- Number of special use permits issued
- Number of appurtenant features maintained

## **IV. FUTURE RECOMMENDATIONS**

**A. Desired Outcome for the Forest Reserve:** Līhu'e-Kōloa Forest Reserve is a multiple resource management area and contains many unique features. Important mandates include watershed protection, trail access, native ecosystems, and hunting. Relatively intact native ecosystem areas, such as the Blue Hole, should be protected for their watershed and biological value. High quality recreational opportunities are also important and must be compatible with resource protection. Hunting is a significant component of the area, providing game mammal

hunting opportunities for the residents of Kaua‘i. Prospective commercial timber stands already exist in Līhu‘e-Kōloa Forest Reserve; these stands hold the potential to provide revenue for DOFAW and materials for businesses in Hawai‘i, such as carpenters, woodworkers, and bioenergy companies.

**B. Future Recommendations:** Līhu‘e-Kōloa Forest Reserve contains a variety of resources and is managed as a multiple-use area; its needs are diverse. Increased access for hunting and recreation is desired, especially in the Kalāheo section, which historically has had little public access. Recommendations for the future include an increased enforcement presence to reduce vandalism and other illegal activities, along with protection for the biological resources of the Forest Reserve, including fencing at Blue Hole, surveying of T&E species, and monitoring and control of invasive species.

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**Appendix 1:** Species with US-ESA Critical Habitat designation within Līhu‘e-Kōloa Forest Reserve (State of Hawai‘i Critical Habitat GIS layers).

| <u>Plants</u>                  | <u>Acres</u> |
|--------------------------------|--------------|
| <i>Adenophorus periens</i>     | 28.96        |
| <i>Bonamia menziesii</i>       | 27.45        |
| <i>Cyanea asarifolia</i>       | 398.35       |
| <i>Cyanea undulata</i>         | 129.85       |
| <i>Cyrtandra cyaneoides</i>    | 0.11         |
| <i>Cyrtandra limahuliensis</i> | 934.62       |
| <i>Dubautia pauciflora</i>     | 92.88        |
| <i>Exocarpos luteolus</i>      | 5.24         |
| <i>Labordia lydgatei</i>       | 332.92       |
| <i>Lysimachia filifolia</i>    | 421.52       |
| <i>Myrsine linearifolia</i>    | 0.11         |
| <i>Phlegmariurus nutans</i>    | 107.47       |
| <i>Plantago princeps</i>       | 423.21       |
| <i>Pteralyxia kauaiensis</i>   | 492.68       |
| <i>Viola helenae</i>           | 32.61        |
| <i>Viola kauaiensis</i>        | 133.82       |

| <u>Animals</u>                              | <u>Acres</u> |
|---|--------------|
| <i>Erinna newcombi</i><br>(Newcomb’s snail) | 89.50        |