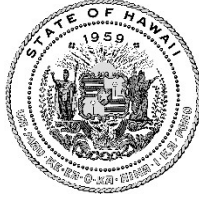


JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA



STATE OF HAWAII | KA MOKU'ĀINA 'O HAWAII'
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA

P.O. BOX 621
HONOLULU, HAWAII 96809

April 29, 2024

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

RYAN K.P. KANAKA'OLE
FIRST DEPUTY

DEAN D. UYENO
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE
MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES
ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

Mary Alice Evans, Director
State of Hawaii
Office of Planning and Sustainable Development
Environmental Review Program
235 South Beretania Street, Room 702
Honolulu, HI 96813

RE: FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT
IMPACT FOR THE KAPĀPALA KOA CANOE MANAGEMENT AREA PLAN

Dear Ms. Evans:

With this letter, the State of Hawaii Department of Land and Natural Resources hereby transmits the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the "Kapāpala Koa Canoe Management Area Plan" for publication in the next available edition of The Environmental Notice.

In addition to this letter, the online Environmental Review Program (ERP) Publication Form has been submitted through the ERP website, including one (1) electronic copy of the FEA-FONSI as an Adobe Acrobat PDF file.

Should you have any questions, please contact Jan Pali of the Division of Forestry and Wildlife at (808) 587-4166.

Sincerely,

A handwritten signature in black ink, appearing to be "DNC", written over a horizontal line.

DNC

Dawn N. S. Chang
Chair, Department of Land and Natural Resources

From: webmaster@hawaii.gov
To: [DBEDT OPSD Environmental Review Program](#)
Subject: New online submission for The Environmental Notice
Date: Monday, May 6, 2024 10:09:10 AM

Action Name

Kapāpala Koa Canoe Management Area Plan

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

Ka‘ū, Hawai‘i

Tax Map Key(s) (TMK(s))

(3) 9-8-001:014

Action type

Agency

Other required permits and approvals

Hawai‘i State Board of Land and Natural Resources Management Plan Approval DLNR-DOFAW Special Use Permit Chapter 6E SHPD Approval of Archaeological Surveys Application to Operate or Transport Oversize and/or Overweight Vehicles and Loads over State Highways

Proposing/determining agency

Hawai‘i State Department of Land and Natural Resources

Agency contact name

Jan Pali

Agency contact email (for info about the action)

jan.n.pali@hawaii.gov

Email address or URL for receiving comments

jan.n.pali@hawaii.gov

Agency contact phone

(808) 587-4166

Agency address

1151 Punchbowl St. #325
Honolulu, HI 96813
United States
[Map It](#)

Is there a consultant for this action?

Yes

Consultant

Geometrician Associates

Consultant contact name

Ron Terry

Consultant contact email

rterry@hawaii.rr.com

Consultant contact phone

(808) 587-4166

Consultant address

10 Hina Street
Hilo, Hawaii 96720
United States
[Map It](#)

Action summary

The Plan guides sustainable harvest and extraction of canoe-quality koa trees on a 100-year timeframe from 1,257 acres of forested land above 3,000 feet in elevation on Mauna Loa. Other objectives include protection of native forest, watershed, and bird habitat; restoration of koa forest; collaboration with educational and community groups; recreational access; and integration of traditional Hawaiian stewardship with western conservation. Groups will apply for a permit to harvest a canoe log, which will be reviewed by a panel of cultural practitioners, voyaging and racing canoe club members, canoe builders, foresters, conservationists and community members, who will advise DOFAW on permit allocation. Selected groups would harvest and extract canoe logs with the DOFAW's guidance. DOFAW will implement stand improvement actions to large, straight koa trees suitable for canoes. Some non-canoe quality timber resources may be sold to help fund management.

Reasons supporting determination

1. Irrevocably commit a natural, cultural, or historic resource. Implementation of the Plan would substantially protect natural resources and benefit cultural practices and involve a balanced use of cultural and natural resources. Historic resources would be protected through incremental archaeological surveys that successively cover the small areas of harvest and infrastructure prior to any disturbance.
2. Curtail the range of beneficial uses of the environment. No restriction of beneficial uses would occur and implementation would sustain beneficial cultural uses and habitat protection uses into the future.
3. Conflict with the State's environmental policies or long-term environmental goals established by law. The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project is environmentally beneficial and minor, and it is thus consistent with all elements of the State's long-term environmental policies.
4. Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State. The project would not have any substantial adverse effect on the economic or social welfare of the Big Island community or the State of Hawai'i. No valuable natural resources or cultural or recreational practices such as forest access, gathering, hunting, or access to ceremonial sites would be substantially affected. The social and economic welfare of the area would be enhanced through culturally appropriate and environmentally sustainable harvest of koa canoe logs.
5. Have a substantial adverse effect on public health. The project would not affect public health and safety in any adverse way.
6. Involve adverse secondary impacts, such as population changes or effects on public facilities. The project would not produce any major secondary impacts, such as population changes or effects on public facilities.
7. Involve a substantial degradation of environmental quality. The project is minor and environmentally benign, and thus it would not contribute to environmental degradation.
8. Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a

commitment for larger actions. Nearby areas where ongoing activities or new projects could generate adverse impacts that could accumulate with those of the proposed project include Hawaii Volcanoes National Park, the Kapāpala Forest Reserve, the Ka'ū Forest Reserve and Kapāpala Ranch. The first three are undergoing uses aimed primarily at conservation, although recreation, subsistence uses and gathering also occur there. The latter supports cattle ranching. No major projects are known to be in planning for any of these nearby areas. The localized disturbances at KKCMA caused by tree harvest, stand improvement and invasive species response may include effects to biota, noise, erosion, emissions, and scenic values, which are expected to be extremely minor, temporary and insignificant. These would not tend to accumulate with the ongoing conservation and ranching activities on the other nearby properties, where similar actions are highly dispersed over a very large area and have generally minor effects that are fully mitigated through their own management plans and/or standard management practices. However, the harvest process can produce two categories of effects that while minor do have at least some potential to interact with those of other activities in Ka'ū: helicopter extraction (which may occasionally occur) and transport of logs on oversize load large trucks on Highway 11 (which will occur for each harvested tree). The infrequent occurrence of truck transport related to KKCMA and the relative infrequency of other oversize loads on Highway 11 will minimize the potential for significant cumulative effects. If implemented in the future, helicopter operations could produce brief but intense noise that is localized in the harvest area, and also brief, moderate noise while transiting from Hilo or other locations to the harvest site. These operations would occur very infrequently, if at all (<5-10/ times year), and would not significantly alter the regions' soundscape or affect other users in a significant way, even when combined with tourist and resource management helicopter operations that are known to occasionally occur in Hawaii Volcanoes National Park, the Kapāpala Forest Reserve and the Ka'ū Forest Reserve. In sum, cumulative effects are negligible for most categories of effect and extremely minor for noise and oversize traffic.

9. Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat. Overview biological surveys have determined that various species of rare and T&E fauna are present and will require mitigation in order to avoid impacts. This mitigation is an integral component of the Plan. Rare and T&E plants have not been observed, but all actions will be preceded by a full botanical survey and mitigation measures will be implemented to prevent impacts.

10. Have a substantial adverse effect on air or water quality or ambient noise levels. No substantial effects to air, water, or ambient noise would occur. Localized and temporary effects would occur during harvest, stand improvement and road maintenance. If any logs are extracted by helicopters in the future, more wide-ranging but minor, brief and infrequent noise impacts could occur. Erosion and sedimentation impacts will be avoided by implementation of Best Management Practices during Plan operations.

11. Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters. Although the project would be located in an area with minor volcanic and moderate seismic risk, the entire Island of Hawai'i shares this risk, and the Plan is not imprudent to implement. The project site is not located in a flood zone nor sensitive waters and would not affect any such areas. The project site is more than 3,000 feet above sea level and will not be affected directly by sea level rise. The project has adapted to climate change by accounting for the potential for larger storms in its extensive erosion BMPs.

12. Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies. The proposed action is not anticipated to adversely affect any vistas or viewplanes identified in county or State plans or studies and will benefit visual quality through maintenance of native forests. No lighting is involved.

13. Require substantial energy consumption or emit substantial greenhouse gases. While non-negligible amounts of energy input and greenhouse gas emission would be required for implementation, the Plan involves a sustainable forestry operation that will assist in carbon capture and storage.

Attached documents (signed agency letter & EA/EIS)

- [Final-EA-Kapapala-Koa-Canoe-Management-Area-Plan.pdf](#)
- [FONSI-letter_Kapapala.pdf](#)

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- [KapapalaKoaCanoeManagementArea.zip](#)

Authorized individual

Jan Pali

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

FINAL ENVIRONMENTAL ASSESSMENT

Kapāpala Koa Canoe Management Area Plan

**Ka‘ū District, Island of Hawai‘i
TMK (3rd) 9-8-001:014**

October 2023

Prepared for:

**State of Hawai‘i
Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawai‘i 96813**

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FINAL ENVIRONMENTAL ASSESSMENT

Kapāpala Koa Canoe Management Area Plan

**Ka‘ū District, Island of Hawai‘i
TMK (3rd.) 9-8-001:014**

PROPOSING/APPROVING AGENCY:

State of Hawai‘i
Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawai‘i 96813

CONSULTANT:

Geometrician Associates LLC
10 Hina Street
Hilo, Hawai‘i 96720

CLASS OF ACTION:

Use of State Lands and State Funds

This document is prepared pursuant to:
The Hawai‘i Environmental Policy Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200.1, Hawai‘i Department of Health Administrative Rules (HAR)

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APPENDIX 1 Kapāpala Koa Canoe Management Area Plan (V. April 2023)

APPENDIX 2 Public Involvement

SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The Division of Forestry and Wildlife (DOFAW) of the Department of Land and Natural Resources (DLNR) is developing a Management Plan for the Kapāpala Koa Canoe Management Area (KKCMA). The Plan is part of an effort to provide a sustainable, long-term supply of koa for the traditional and cultural use of building koa canoes, while minimizing impacts on the natural and cultural resources in the area.

KKCMA consists of roughly 1,257 acres of agriculturally-zoned land at about 3,000-5,000 feet in elevation on the southeastern slope of Mauna Loa, in the district of Ka‘ū and the ahupua‘a of Kapāpala. The area is covered almost entirely by a native koa and ‘ōhi‘a forest. This parcel is the only state land in Hawai‘i specifically designated for the purpose of producing koa canoe resources. Other management objectives include protection of native forest, watershed resources, and bird habitat; increased regeneration and restoration of koa trees; collaboration with educational groups and community groups; access for recreational activities; and integration of traditional Hawaiian stewardship models with western conservation practices. A harvest plan will guide harvest and extraction of canoe-quality trees while regenerating koa resources on a 100-year timeframe. Organizations in the State of Hawai‘i may apply for a permit to harvest a canoe log, which will be reviewed by a group of experts consisting of cultural practitioners; voyaging and racing canoe club members; kālaiwa‘a (canoe builders); forestry experts; conservationists; and community members, who will advise DOFAW on the final allocation of canoe log permits. Current plans call for organizations who have been selected to independently harvest and extract canoe logs with the guidance of DOFAW. It will be the ongoing job of DOFAW to implement stand improvement actions, such as pre-commercial and commercial thinning, that will enhance the ability of the forest to produce large, straight koa trees capable of being made into canoes. Some non-canoe quality timber resources may be sold to help fund the management of KKCMA.

Multiple protection measures will be implemented to ensure that area resources are not degraded due to project activities or ongoing threats such as non-native animals and invasive weeds. Best Management Practices will help avoid erosion. In order to minimize impacts on threatened and endangered species as well as archeological and historical sites, botanists, ornithologists and archaeologists will undertake surveys in all areas prior to any silviculture actions taking place in that unit. Areas of higher value native forest and bird habitat have been designated as lower priority harvest areas. Various cultural mitigation measures are an integral part of the Plan. Implementation of the Plan requires approval by the Board of Land and Natural Resources.

PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND ENVIRONMENTAL ASSESSMENT PROCESS

1.1 Project Location and Overall Objectives

The Division of Forestry and Wildlife (DOFAW) of the Department of Land and Natural Resources (DLNR) is developing a Management Plan for the Kapāpala Koa Canoe Management Area (KKCMA). In overview, the Plan has the primary objective to provide a sustainable, long-term supply of koa (*Acacia koa*) for the traditional and cultural use of building koa canoes, while minimizing impacts on the natural and cultural resources. Other management objectives include protection of native forest, watershed resources, and bird habitat; increased regeneration and restoration of koa trees; collaboration with educational groups and community groups; access for recreational activities; and integration of traditional Hawaiian stewardship models with western conservation practices.

KKCMA consists of roughly 1,257 acres of agriculturally-zoned land within TMK 3-9-8-001:014, situated at about 3,000-5,000 feet in elevation on the southeastern slope of Mauna Loa, in the district of Ka‘ū and the ahupua‘a of Kapāpala. The area is depicted in the map in Figure 1-1, the satellite image in Figure 1-2 and the photos in Figure 1-3. Nearby major landowners or lessees include the State of Hawai‘i, the U.S. National Park Service (NPS), and Kapāpala Ranch. These lands are managed for natural and cultural resource protection and ranching. KKCMA area is covered almost entirely by a native koa and ‘ōhi‘a (*Metrosideros polymorpha*) forest and is the only State land in Hawai‘i specifically designated for koa canoe resources.

The current draft of the Plan is contained in full in Appendix 1. The Plan will be amended after consideration of public comments, and the next version of the Plan will be appended to the Final EA. Implementation of the Plan requires approval by the Board of Land and Natural Resources. The basic goals and objectives of the Plan will then be set, but management actions are meant to be updated through the dynamic process of incorporating community input and research results into resource protection and enhancement, which is called adaptive management. Ongoing refinement of the Plan will involve findings from ecosystem management and traditional ecological knowledge to improve the outcomes of management.

The Plan contains in-depth information that is summarized below to the extent required to provide a basis to evaluate impacts and develop proposed mitigation for adverse impacts. Readers interested in additional details may consult Appendix 1.

Figure 1-1 Location Map

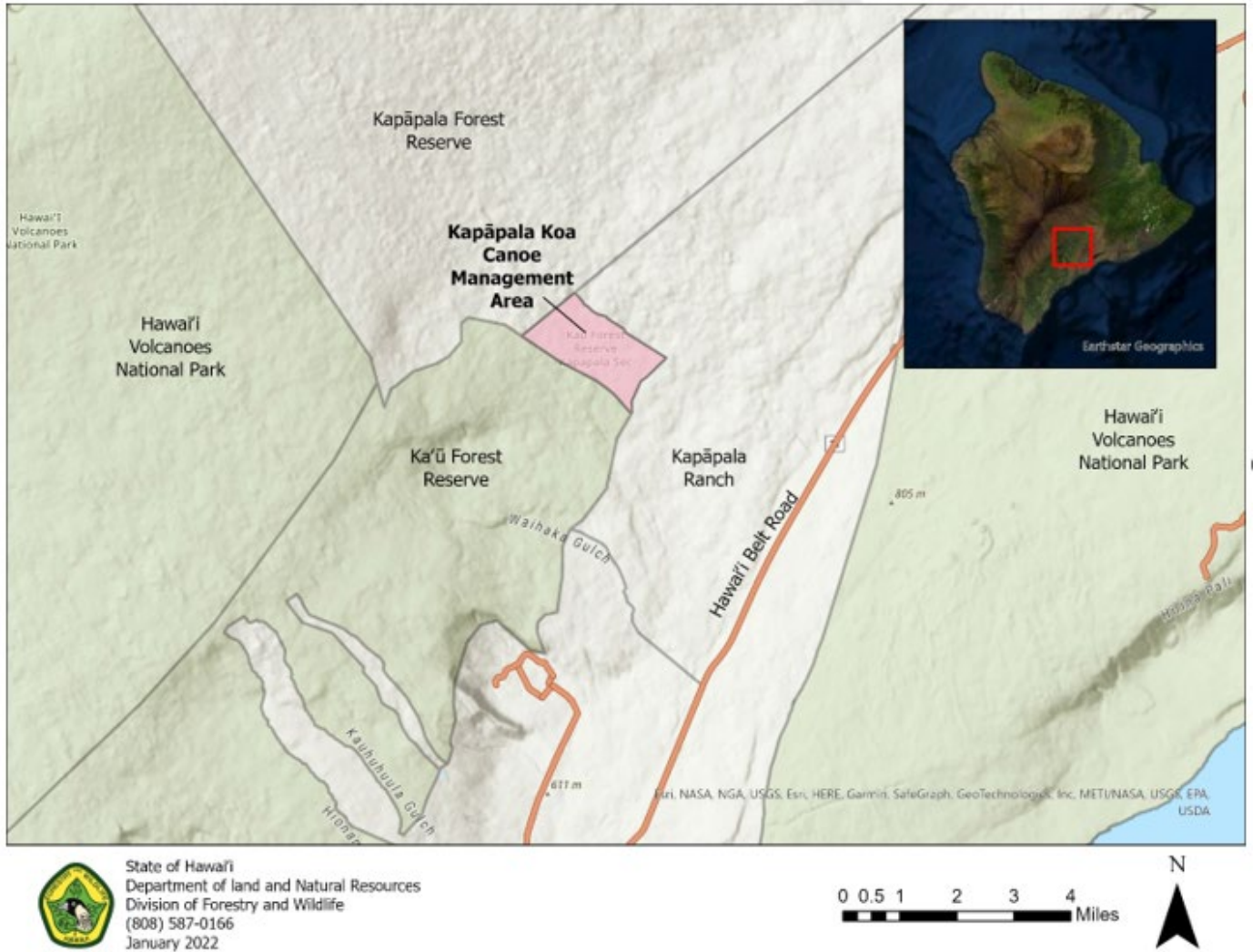


Figure 1-2 Satellite Image

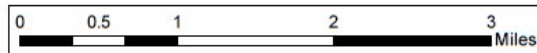
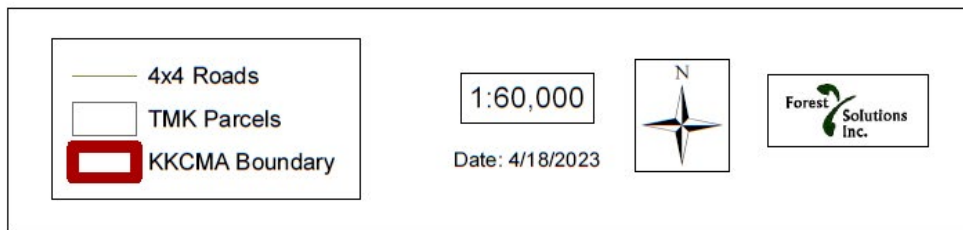


Figure 1-3 Project Area Photos



Oblique aerial of koa forest ▲
▼ Large koa tree



1.2 Project Background and Purpose and Need

Prior to European contact, the mauka regions of the ahupua‘a of Kapāpala, where KKCMA is located, were probably not heavily populated. Handy et. al (1991 p. 613) described Hawaiian communities in the moku of Ka‘ū and the history of cultivation and inhabitation. They stated that “there was never any cultivation, as far as we could learn . . . in the forests above the pali from Kapāpala to Ohaikea the bird snarers or feather hunters had their huts, but no taro was grown.” They further mention that the closest community was Hilea, a small grouping of homesteads southwest of Kapāpala.

KKCMA is located within the upper elevations of the ahupua‘a traditionally known as the wao akua and wao nahele/la‘au. These areas experienced less human activity as compared to the lower elevation wao kanaka or wao ilima, where more intensive gathering and cultivation occurred. The wao akua is typically the highest elevation forested area containing large trees and important watersheds. Entrance here was highly regulated, as people were required to be conscious of their place as kānaka, or humans, in the traditional realm of the gods. Specific protocols or offerings were often required before one could enter.

Early Western accounts of the area are few, but in 1846 Chester H. Lyman described encountering dwellings and canoe making activities in the Kapāpala area. As part of the Mahele in 1848, the entire ahupua‘a of Kapāpala was designated as crown lands under the control of King Kamehameha III. Around 1860, Frederick Lyman established a small ranch at ‘Ainapō, and in 1860 Charles Richardson and William H. Reed acquired Lyman’s ranch and greatly increased its size by leasing the entire ahupua‘a of Kapāpala from King Kamehameha IV. This expansion started their joint venture of Kapāpala Ranch.

Kapāpala Ranch became the largest working cattle ranch in Ka‘ū, producing meat, dairy, hides, and other commodities. Hunting and traditional maile gathering also took place here. Throughout its history the ranch has hosted many famous guests, such as travel writer Isabella Bird, and was a favorite spot of Queen Lili‘uokalani. Over time the ranch changed owners and its boundaries were altered, but it remained on public land either under a lease or permit. The land managed by the ranch has decreased from the original 1860 lease of the entire ahupua‘a, but the area that would become KKCMA was continuously under ranch management from 1860 until 1989. It was used for grazing and likely some timber harvest.

Starting in the late 1980s, DLNR began searching for native forests on State land appropriate for growing and harvesting koa as part of efforts to expand silviculture operations. The ample koa resources on KKCMA made it an ideal location, and on October 27, 1989, the Board of Land and Natural Resources approved the set-aside of approximately 1,257 acres “for commercial koa timber production, with consideration for recreation, forest bird habitat, and watershed values.” In the 1990s, following struggles by organizations to find koa trees suitable for the construction of voyaging canoes, the purpose of the area was further refined from broad koa management to focus on koa canoe logs.

In 2004, the 1,257-acre koa management area was officially subdivided by the County of Hawai‘i, removing it from the rest of the parcel that was still under lease by Kapāpala Ranch.

Subsequently, the Board of Land and Natural Resources approved redesignating the area as the Kapāpala Koa Canoe Management Area, and on June 27, 2005, Executive Order (EO) 4109 was issued, officially setting the area aside for the growth and production of koa trees for making traditional Hawaiian canoes. In order to ensure adequate statutes and rules to provide effective management, the BLNR on February 27, 2013 modified the management regime by incorporating the area as the Kapāpala section of the Ka‘ū State Forest Reserve (FR) in EO 4428.

In developing a harvest program for koa canoe logs, it was important to not only provide an adequate resource area, but also to ensure that harvesting koa logs for traditional canoes was conducted in a culturally appropriate manner. This is because of the deep significance of the wa‘a, or canoe, in Polynesian and Hawaiian culture. Wa‘a were the main transporter of people from one island to the next across Polynesia, and were utilized in many other aspects of life such as fishing, warfare and sport (Chun and Burningham 1995; Fornander 1878). When early Polynesian voyagers first landed on Hawai‘i, they continued to construct and utilize canoes and adapted their craft to the new environment of Hawai‘i. Koa, the second most common tree in the islands and a fast growing hardwood species, became the preferred tree used in canoe construction (Holmes 1981).

Canoe construction in Hawai‘i has traditionally been guided by the kahuna kālaiwa‘a, or master canoe carver. Kahuna kālaiwa‘a was considered the foremost of all traditional occupational trades, as they had to possess a wide range of technical skills from building to forestry to guiding ceremonies and protocols (Holmes 1981). The kālaiwa‘a was responsible for the entire process of building the wa‘a, from deciding when and how to undertake the process until the completed wa‘a was launched into the ocean. Historical accounts recounted in detail in the Cultural Impact Assessment (CIA, Appendix A of Appendix 1) detailed the process of canoe construction common in the South Kona and Ka‘ū areas:

- 1) Beginning rituals of the kahuna kālaiwa‘a
- 2) Ascent to the forest
- 3) Selecting the tree
- 4) Cutting and felling rituals
- 5) Rough hewing the canoe on site
- 6) Hauling the rough canoe to the coast
- 7) Final hewing and initial voyage rituals

The Plan presents details on the wide array of traditional and modern ways for selecting, felling and building a koa canoe. DOFAW supports organizations implementing their own traditional and cultural practices related to canoe tree selection, harvesting and construction at KKCMA, as long as the methods are safe and follow basic DOFAW guidelines for timber harvest.

In preparing the Plan for KKCMA, DOFAW has adopted the management objectives that were expressed in the Executive Orders that created the unit as the purposes of the Plan:

- Utilize the area for the growth and production of koa trees for making traditional Hawaiian canoes.

- Preserve Hawai‘i’s unique natural and cultural inheritance for future generations, by fostering knowledge and respect for Hawai‘i’s native forests in a way that inspires better care of its natural environment.
- Protect threatened tropical forest habitat and promote environmental policies and practices that address biological sustainability and human well-being, by identifying and integrating relevant traditional Hawaiian natural resource stewardship models with current Western management strategies.
- Develop natural resource stewardship models that involve a wide range of constituent groups.
- Involve youth through cooperative programs with the Department of Education, University of Hawai‘i, and other school and education institutions.
- Provide wood workers with portions of harvested trees that are not processed as canoe logs.
- Involve other constituency groups, e.g., canoe clubs, forest management entities, and cultural organizations.
- Provide compatible opportunities for public uses such as hunting and recreation.

1.3 Project Description

The current project builds on a history of research and management in KKCMA. DOFAW began managing KKCMA in 1989 and soon constructed a cattle-proof fenceline around the parcel. Even with a perimeter fence, maintaining fencing and gate closures to minimize the ingress of cattle from adjacent ranching remains a challenge. A variety of timber, flora and fauna surveys have been completed in KKCMA, including a 2000 inventory of koa and ‘ōhi‘a, partial timber surveys in 2006 and 2007, a full timber inventory in 2020 focused on koa canoe timber, and a roadside plant survey. Three Mountain Alliance (TMA) and DOFAW have collaborated annually on bird surveys in KKCMA since 2018. TMA also built a gathering platform in the northeast corner of KKCMA as part of its Youth Education Plan. In the southwest corner of the parcel, the Hawai‘i Agricultural Research Center (HARC) in collaboration with DOFAW created a seed orchard to provide koa seeds from trees screened to be resistant to koa wilt, a disease that often kills or heavily impacts koa trees. This orchard is still active.

In an effort to advance the sustainable management of KKCMA, TMA and DOFAW partnered in late 2014 to bring together key stakeholders including cultural practitioners; voyaging and racing associations, clubs, and members; canoe builders; forestry experts; conservationists; land managers; and residents of Ka‘ū. The KKCMA Working Group provides insight and guidance on the long-term stewardship of the forest and appropriate use and perpetuation of wa‘a and other forest resources in KKCMA. The first several meetings of the working group began by sharing knowledge that ultimately led to the development of a 2016 Preliminary Forest Management Plan. In 2017 and 2018, the working group supported DOFAW in drafting an application and allocation protocol for canoe logs from KKCMA. Based on feedback from the working group and the preliminary plan and allocation protocol, it was determined a forest inventory was needed, which was implemented in 2019-2020. The forest inventory provided DOFAW with the information needed to revise and finalize the forest management plan for KKCMA in consultation with the working group. The working group has met approximately one

to three times per year since its inception, for a total of ten meetings. Over the last seven years, the working group has been a source of diverse expertise and varied perspectives that are critical to the development of this Management Plan and the overall advancement of KKCMA.

DOFAW developed a set of management guidelines and maps to assist in evaluating and balancing human activities and resource management goals and objectives. The purpose of the guidelines is to provide administrative policy direction and prioritize resource management activities based on the integrity of existing natural resources and social needs in five principal classifications: Conservation Resources, Forest Products Management, Recreation Management, Vegetation Management, and Hunting Management. The reader is referred to Section 5.2 of the Plan for detailed discussion, but the summary conclusions were:

Forest Products Management: KKCMA is considered F-2, small, non-commercial scale use. Some small-scale commercial harvests will occur due to thinning operations in the area.

Conservation Resource Guidelines: KKCMA is listed as C-2, an important conservation area, as it consists of increasingly rare predominantly intact native forest. However, there are relatively few rare or endangered species and unique resources in the area that could be at risk from project activities.

Vegetation Management: KKCMA is listed as V-2, Predominantly Native Areas, which although not high quality native vegetation owing to some non-native grasses in lower areas and some invasive species along roadways, is superior to more degraded areas.

Hunting Management: KKCMA is listed as H-2, moderate hunting management, in recognition that public hunting is an encouraged and common activity in KKCMA. However, the main objective of providing a long term sustainable supply of koa timber is a higher management objective than providing continuous hunting opportunities, which is a secondary management objective.

Recreation Management: KKCMA is listed as R-3. Despite public access that allows for hiking, bird watching, hunting and forest product gathering, KKCMA is listed as low recreation management, due to its remote location and difficult accessibility.

A series of management objectives and actions that respond to the purpose and need and match the guidelines described above comprise the “action” elements of the Plan. Most of these actions could have beneficial and/or adverse effects and thus require examination in this EA. The actions listed below are brief summaries adapted from Chapter 5 of the Plan, which may be consulted for background and further details.

1.3.1 Timber Harvest

The primary goal for this area is to sustainably produce koa logs suitable for building canoes now and into the future, with suitable protection of watersheds, native ecosystems, threatened and endangered species and recreational opportunities. This will be done by using sustainable

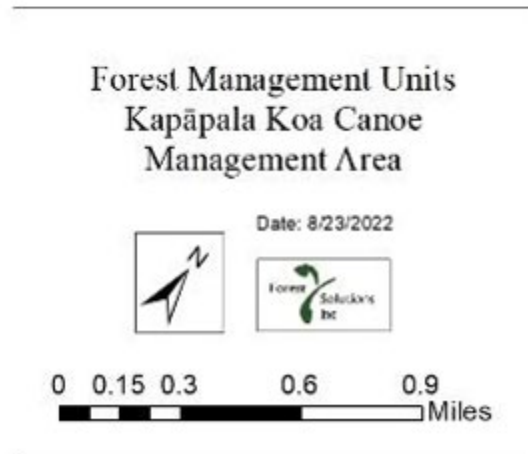
silviculture and forestry practices developed for a 100-year horizon. The Plan will be revisited at least every 10 years to integrate adaptive management strategies as needed.

The harvesting and forestry management proposed at KKCMA will follow the practice of disturbance-based or structural retention silviculture. This involves retaining various structures at the time of harvest, longer harvest rotations, and active creation of heterogeneity in the managed stand, matching conditions created by natural disturbances such as storms (Gustafsson et al. 2012).

Although the main resource targeted during harvest operations will be large koa trees capable of being made into canoes, harvest operations will avoid “high-grading”, which is the unsustainable practice of removing only large trees. Management will also include thinning or other stand improvements actions, including selective harvests of non-canoes trees. Canoe log harvests will be geographically paired with thinning and stand improvement operations to create openings for seedling recruitment. All timber management prescriptions will be guided by Hawai‘i’s Best Management Practices (BMP) policies to mitigate any potential negative impacts from forestry activities (see Appendix F of Appendix 1). These BMPs have a central focus on protection of water quality, and as such they commonly address maintenance of forest roads, timber harvesting, skid trails, reforestation, site preparation, and the protection and management of watersheds (Cristan et al. 2016).

As illustrated in Figure 1-4 and various maps in the Plan, the forest has been divided into ten tracked forest management units (FMUs). These FMUs are large enough to allow for efficient forest management operations yet small enough to be managed in a designated time frame. FMUs will be managed for a combination of 1) Restoration, 2) Forest Product Management, or 3) Resource Protection, based on their past history, current composition, koa canoe resource potential and threats. The lower elevation forests in the restoration management class contain an open ‘ōhi‘a forest with koa mostly in the sub-canopy. This area has a history of more cattle and timber harvests and is the most in need of restoration of forest structure. Suitable management activities may include pre-commercial thinning, commercial thinning, weed control, and enrichment planting of koa and/or other seedlings as needed. The mid-elevation in the forest product management class contains both open ‘ōhi‘a-koa forest and closed koa-‘ōhi‘a forest and has koa trees of all diameter classes. This appears to be the best area for promoting the growth of canoe logs, as there is a higher concentration of canoe trees in this area. Management activities may include pre-commercial thinning, commercial thinning, and forest stand improvements. The upper elevation forest contains remnant native, intact forest with mature koa trees. This area is critical to native bird populations, potential threatened and endangered (T&E) species habitat, and overall watershed functions. Many of the koa trees are large, mature, sprawling trees that would not be suitable for canoes, though they contain a large volume of wood. This area has high conservation value and management will mostly include forest protection and forest stand improvements, with limited harvesting to target specific resources. However, canoe tree harvest of desired resources will occur as needed in the area.

Figure 1-4 Forest Management Units Categorized by Management Class



The forest has also been classified into Priority Zones according to proximity to roadways in order to concentrate the harvest impact to specific areas at different times. Priority Zone 1 is located within 200 feet from roads, and canoe tree resources have already been identified to help

facilitate initial harvest activities. Priority Zone 2 is within 400 yards from roads, and Priority Zone 3 is the interior units that are more than 400 yards from the road. Both canoe tree harvests and stand improvement activities are planned to begin in the Priority Zone 1 in the first 10 years of the plan, then move into Priority Zone 2 management units, followed by Priority Zone 3 management units. However, Priority Zones are not restrictive and harvest activities can occur outside of the given Priority Zone as needed to allow for adaptive management. Priority 1 Zones have already been subject to an inventory of all living koa trees over 20 inches in diameter (see Plan for details). Within this zone alone there is a promising resource of 64 canoe trees and 123 potential/partial canoe trees. Additionally, 193 young canoe trees and 230 young potential/partial canoe trees will likely reach canoe size in 10-20 years. Only living trees were catalogued, although canoe builders have indicated that dead and downed trees can also be utilized.

Harvesting canoe trees will require site infrastructure including skid trails, which are narrow, temporary roads installed for infrequent access to conduct management activities such as the harvest of forest products. At KKCMA, skid trails will be used to extract logs from the forest and bring them to the main access roads. The objective of these trails is to allow suitable access while minimizing damage to the forest ecosystem, which can be accomplished by implementing the Best Management Practices specified in the Plan. Skid trail construction will include water bars for drainage and post-harvest cleanup and restoration activities.

1.3.2 Pre-Harvest Actions

DOFAW will take care to ensure that silviculture activities, such as skid road construction, timber harvest, and stand improvement operation, occur in such a way that the least amount of ecological damage occurs. Mitigation and avoidance of impacts to resources may include spatially and temporally avoiding sensitive and/or listed species, pre-harvest surveys of the areas, and ensuring staff are knowledgeable of sensitive natural and cultural resources and follow protocols to avoid unnecessary impacts. Specific potential impacts and mitigation measures are discussed in Chapter 3.

1.3.3 Harvest Volume Restrictions & Harvest Rotations

In order to ensure sustainable harvest levels and maintain other goals such as watershed protection and native ecosystem protections, harvest amount restrictions within KKCMA will be put in place. No more than 500,000 board feet, or approximately 10% of the 5.5 million board feet of koa estimated within KKCMA, will be removed from the forest within a 10-year period. The volume restriction includes all harvest and thinning operations, including harvesting of canoe trees and additional silvicultural activities.

Koa growth studies have found an average annual growth rate of 0.41 inches of growth per year, indicating that the average diameter in a 100-year-old stand of koa trees would be 41 inches (Baker et al. 2009). Therefore, DOFAW estimates that a typical racing canoe size log is attainable at or before a koa tree becomes 100 years of age by employing a healthy thinning regime. The harvest rotation is the planned number of years between the time a stand regenerates and its final cutting at a specific stage of maturity. The harvest rotation for a canoe tree is 100 years, meaning after a canoe tree is removed and an opening is created for a seedling to grow,

that seedling will be a canoe quality tree in 100 years. If 1% of the forest area is harvested each year, then the first 1% will be ready to harvest again after 100 years. This concept is scaled up to 10% of the forest area every 10 years, to account for variability in management intensity from year to year.

The expected harvest level would be approximately 5 to 15 canoe logs per year. It is likely that koa canoe trees will be in high demand initially, and then decrease significantly with each subsequent year. On average, a canoe tree is estimated to be between 3,000 and 5,000 bf, and therefore the harvest limit is more than enough to meet the needs of all the eligible organizations and sustain harvest activities to support the management of the forest. According to recent inventories and surveys, stand development theory, and anticipated stand improvement actions, a maximum volume of 500,000 board feet every 10 years is predicted to be a sustainable number that will not negatively impact the koa canoe resource and associated forest ecosystems. After each 10-year period, the plan shall be reviewed to ensure the harvest limit restrictions remain sustainable.

1.3.4 Canoe Tree Application Process

Organizations within the State of Hawai‘i may submit an application for the opportunity to harvest a koa tree or trees from KKCMA for the purpose of creating a koa canoe for cultural and traditional uses, such as racing canoes, voyaging canoes, and fishing canoes, among others. Details on the application, scoring and ranking system for applicants and the allocation process will be outlined in a separate submittal that will be brought before the Board of Land and Natural Resources (BLNR) for approval. However, the general application process and award of a canoe log from KKCMA will be as follows:

- 1) Organizations will submit an application for a canoe log from KKCMA.
 - a) Organizations must be able to demonstrate their financial capacity and means of processing the log into a canoe, demonstrate they have an experienced builder available with the capacity to utilize the log, and have a harvest plan approved by DOFAW.
 - b) Organizations must have a stewardship plan outlining forest conservation or land stewardship activities.
 - c) This is a separate application than any other requests for timber from DOFAW, such as the salvage timber waiting list.
- 2) Applications will be reviewed by a selected group of experts that will provide recommendations to DLNR/DOFAW to make final decisions and issue a special use collection permit to allow for harvest.
 - a) Applicant reviewers will consist of cultural practitioners; voyaging and racing associations, clubs, and members; wa‘a (canoe) builders; forestry experts; conservationists; land managers; and community members of Ka‘ū and Hawai‘i Island.
- 3) DOFAW will identify specific trees that are available for harvest according to the Plan. The number of trees and volume of koa harvested annually will depend on the number of qualified applicants, in accordance with the 10-year harvest volume restriction of 10% of the total volume of the area.

- 4) The organizations that are selected will be able to select the appropriate tree for harvest, and they will be provided a timeline of when they are allowed to perform the harvest. In order to reduce costs, the organizations are encouraged to collaborate with one another and/or work in conjunction with DOFAW's other management activities to determine a date for the harvest.
- 5) All harvest operations will be conducted according to the State's Best Management Practices (Appendix F of the Plan).

1.3.5 Canoe Tree Extraction Operations

The operations and costs associated with harvesting and extracting canoe logs will be the responsibility of the organization awarded a DOFAW Special Use Permit for canoe tree harvest. This allows organizations the flexibility to select the protocols and methods appropriate for their traditional and cultural use of harvesting canoe logs, and to allow for different organizations to have different processes for harvest.

Harvesting whole logs destined to become canoes requires different operational activities than harvesting short saw logs for parts or sale. The standard method is to use chainsaws or bulldozers to fell trees and heavy machinery to extract them. Pushing over a tree with a bulldozer can help slow its descent to the earth and thus protect the wood. Once a tree is felled, it is extracted via skid trails to a main access road where it can be loaded onto a highway truck. The extraction can potentially be damaging to the tree and should be supervised by an experienced forest manager to help preserve the condition of the log. Specialized heavy machinery may be needed to safely move these large logs without damaging them. Skid trails will be surveyed and marked ahead of time to avoid sensitive habitat such as mature 'ōhi'a trees. Typically, scarification of the soil by machinery on skid trails can be beneficial in that it activates koa seeds and stimulate regeneration of koa seedlings. It may also be feasible in some cases to extract timber using a helicopter.

The labor costs associated with harvesting include hiring an experienced cutter, ground man, and machine operator, will be the responsibility of the applicant for the canoe log. DOFAW will not be responsible for harvesting and delivering the logs to the applicant. Machine rentals may include an excavator, a forwarder, and/or a bulldozer. These machines need to be transported to and from the forest, which adds additional costs to the operation. Finally, the log is transported on the highway in an oversized load transportation vehicle, which requires a permit from the Department of Transportation that includes various requirements. The log may ultimately be shipped off the island to another location. The budget is estimated between \$6,000 and \$20,000, though it is highly variable and subject to change according to harvest operations and the destination of the log. As many organizations are not experienced foresters and timber harvesters, an existing advisory group, consisting partly of experienced foresters, as well as DOFAW staff, may be able to provide guidance and connections to capable extraction operators and best practices.

If and when possible, it will be cost-efficient and will reduce impacts on infrastructure and on the forest if operations between organizations or with DOFAW can be combined or done in quick succession with each other. All harvest and thinning operations must follow Hawaii Timber Best

Management Practices (Appendix F of Appendix 1) and any other guidelines included in the Special Use Permit for canoe log extraction, and will be done to minimize impacts on the forest.

1.3.6 Thinning & Stand Improvement Operations

Thinning is a stand improvement action designed to preserve a balance of tree sizes and genetic diversity in the forest by removing smaller and less well-formed trees. By removing sub-standard trees, thinning promotes a superior stock for future growth. The result is a balanced stand containing both large and small trees, which prevents the negative impacts of high grading (only harvesting the biggest and best trees). Thinning in KKCMA will target koa trees, as they are the most common and fastest growing native tree in the area. 'Ōhi'a and other natives will usually not be targets for thinning operations unless considered hazard trees. Thinning will favor a selection of dominant koa trees to grow into canoe quality trees quicker and at a higher frequency.

Details and diagrammatic illustrations of thinning and stand improvement are contained in Section 5.3.6 of the Plan. In summary, pre-commercial thinning is performed prior to trees reaching merchantable size, when small trees are cut and typically left in the forest, allowing the remaining trees to grow quicker due to less competition. The goal of all thinning operations is stand improvement, not resource extraction, but in order to avoid waste, wood from pre-commercial thinning may be collected and made available to woodworkers and community members through collection permits. Commercial thinning involves removing damaged or poor form trees that are of merchantable size and will provide growing space for future koa canoe trees. Commercially thinned trees may be sold for revenue to be used in the continued management of the forest. Additionally, both types of thinning could potentially provide material for canoe parts or other woodworking opportunities. Managers at KKCMA will continue to draw on the latest koa forestry research, combined with on-the-ground stand assessments, to develop and adapt a suitable thinning regime.

1.3.7 Non-Harvest Management Objectives

Several management objectives are not directly related to the harvest of koa canoe logs. These are described in detail in Section 5.4 of the Plan and are briefly summarized here:

- *Ungulate Control.* The control of ungulate populations, especially grazing cattle, is a high priority for KKCMA in order to minimize the primary threat to forest recovery. The entirety of KKCMA is fenced, but small, feral herds can occasionally emerge after fence damage or opened gates. Scheduled fence checks and game camera monitoring are currently ongoing and will continue in order to ensure cattle do not become established. If any cattle are found they will quickly be removed. Other planned measures include installation of cattle guards. Although sheep, mouflon, and goats are not currently found in KKCMA, monitoring will be done to ensure they do not enter the area and detrimentally browse native vegetation. Pig populations have the potential to grow and severely damage area cultural resources. Currently, KKCMA is open to public hunting, which provides some control on pig populations. In addition, staff will provide additional pig control either through trapping, staff hunting, or adding skirting to fence lines to

protect forest resources. DOFAW may adopt the goal of making the area 100% ungulate free, depending on periodic assessments of the forest health and the effects of ungulates on the koa resources for canoe construction.

- *Increased Koa Regeneration Activities.* The 2020 timber inventory showed very low natural recruitment of koa seedlings, partially from cattle browsing. Along with more intensive cattle control, other management actions that will be implemented to increase koa recruitment include scarification of seed coats during silviculture ground activities, enrichment planting from improved seed sources and seedling propagation, and site preparation and competition control in special circumstances such as grass patches or post-wildfire.
- *Invasive Plant Control.* Invasive weed populations are minimal throughout the forest. Ongoing weed management actions include eradication of palm grass (*Setaria palmifolia*) and monitoring for Early Detection and Rapid Response (EDRR) target species. Management activities and increased public access have the potential to increase weed populations. Integral to the project are practices to mitigate this on an ongoing basis. Informational signage and boot brushes at the forest entrance will encourage cleaning of gear. The ROD prevention protocol described in detail in the Plan will protect against ROD and also help prevent weed seedlings and propagules from entering the area. Built-in post-harvest monitoring after stand improvement actions will help detect and quickly control new weed populations. When needed, additional invasive weed management will be conducted via manual, limited chemical and biocontrol means to achieve the desired control of the target weed species.
- *Wildfire Management.* Management for wildfire prevention will involve maintaining the perimeter road and the interior crossroad as fuelbreaks by clearing the roads of vegetation or fallen trees. Drought and fire activity in surrounding areas will be monitored to determine the level of wildfire risk at KKCMA. Depending on fire risk, access to the area may be temporarily restricted. The existing helicopter landing zone (LZ) will be improved and maintained to prepare for wildfire response. Finally, water access will be secured to prepare for the control of a wildfire.
- *Access and Public Use.* Ongoing road maintenance and road improvements such as contouring and pothole filling will facilitate safe public access to the forest. Roadways can be utilized for hiking and bird watching opportunities, as well as access for hunting and forest collection. Hunting will be monitored and managed according to the Hawaii Administrative Rules Chapters 122-123. DOFAW requests all hunter takes be reported to contribute to monitoring efforts. Various non-timber products can be collected in the forest with the proper collection permit. When possible, non-commercial timber resources from silvicultural activities in the area will be made available to the public for woodworking, focused on traditional and cultural uses. Furthermore, DOFAW will be collaborating with cultural and educational groups to integrate traditional and cultural practices and work jointly on KKCMA management.
- *Forest Monitoring and Research.* Forest monitoring is critical to determine the success of management activities and to facilitate adaptive management at KKCMA. DOFAW staff will conduct regular fence checks and monitoring for ungulates and invasive species. Periodic inventories, regeneration plots, photo points near harvest areas, and permanent

sample plots will track the long-term growth and recovery of trees in the area. All monitoring activities will include forest health assessments of priority insects and diseases. The plots and photo points will provide both quantitative and qualitative data tracking forest development over time. This forest provides an excellent opportunity for the research community to collect continuous data to create various predictive biometric equations for use in koa forest management. Additionally, DOFAW will continue to collaborate with the Hawai'i Agriculture Research Center (HARC) on koa research by maintaining the existing seed orchard and research plot within KKCMA. For the protection of T&E bird species, DOFAW will continue to collaborate with Three Mountain Alliance in annual forest bird monitoring.

1.3.8 Cost and Schedule

Many elements of the Plan can be accomplished using existing DOFAW staff and equipment, as detailed in Table 12 of Appendix 1, reducing the overall costs of implementation. One-time costs for infrastructure (primarily fence and road construction and repair) are estimated at between \$1.5 and 2.5 million. Yearly costs for stand improvement, forest inventory, resource protection and infrastructure maintenance are currently estimated at between \$100,000 and \$130,000. This excludes the current salary and fringe costs of state employees that work to manage KKCMA. These cost estimates will be refined as the project is further developed. Some non-canoe quality timber resources may be sold to help fund the management of KKCMA. Completion of planning and permitting process is expected in late 2023 or early 2024; pre-harvest surveys should be accomplished within one year of that date; infrastructure improvement, stand improvement activities, and the first harvests should be ready to take place in 2025 or soon after.

1.4 Environmental Assessment Process

Basis for Environmental Assessment

This Environmental Assessment (EA) was prepared in accordance with Chapter 343 of the Hawai'i Revised Statutes (HRS) by the Division of Forestry and Wildlife of the Hawai'i Department of Land and Natural Resources, the proposing and approving agency. Chapter 343, HRS, along with its implementing regulations, Title 11, Chapter 200.1, of the Hawai'i Administrative Rules (HAR), is the basis for the environmental impact assessment process in the State of Hawai'i. An EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 4 of this document states the finding (anticipated in the Draft EA) that no significant impacts are expected to occur, and Part 5 lists each criterion and presents the findings by the approving agency. If the approving agency finds after considering comments to the Draft EA that no significant impacts would be expected to occur, then it issues a Finding of No Significant Impact (FONSI), and the action will be permitted to occur. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then it determines that an Environmental Impact Statement (EIS) must be prepared for the action to proceed.

Implementation of the Plan will require approval by the Board of Land and Natural Resources as well as periodic Chapter 6e, HRS approvals related to protection of historic sites.

1.5 Public Involvement and Agency Coordination

As discussed in Section 1.3, TMA and DOFAW partnered in late 2014 to bring together key stakeholders including cultural practitioners; voyaging and racing associations, clubs, and members; canoe builders; forestry experts; conservationists; land managers; and residents of Ka'ū. The KKCMA Working Group provides insight and guidance on the long-term stewardship of the forest and appropriate use and perpetuation of koa canoe logs and other forest resources. The first several meetings of the working group began by sharing knowledge that ultimately led to the development of a 2016 Preliminary Forest Management Plan. The working group has met approximately one to three times per year since its inception, for a total of ten meetings.

In addition, the project team held outreach with general community members through an informational event held at the Ka'ū Gym on the morning of April 1, 2023. The event was advertised via newsletter and social media promotion as well as in person at the Naalehu market two weeks before. Over 25 people attended in person and one joined via Zoom. Participants included members of various canoe clubs, Ka'ū community members, and other organizations such as the Hawai'i Science and Tech Museum. There were three tables and large posters featuring information on forest conditions, koa and wa'a and process and timeline. The response was positive and appreciative, with interest in applying for koa canoe log permits. Some members shared concern about down trees going to waste while local woodworkers would like access to that material. A few groups expressed interest in developing an educational program around canoe carving and the forestry associated with log selection, as well as field trips.

Public outreach was also conducted through formal early consultation letters to the following:

County Agencies and Officials:

- Department of Parks and Recreation
- Department of Public Works
- Planning Department
- Police Department
- Fire Department
- Game Management Advisory Commission

State Agencies and Officials:

- University of Hawai'i, College of Tropical Agriculture and Human Resources
- Office of Hawaiian Affairs
- Department of Health
- State Senator Dru Kanuha
- County Council Member Michelle Galimba
- Department of Transportation
- Mayor Mitchell Roth
- State Representative Jeanne Kapela

Federal Agencies and Officials:

- Hawai'i Volcanoes (HAVO) National Park

- U.S. Fish and Wildlife Service
- U.S. Natural Resources Conservation Service

Individuals and Organizations:

- | | |
|---------------------------------------|---------------------------------------|
| • Kapapala Ranch | Big Island Invasive Species Committee |
| • Three Mountain Alliance | The Nature Conservancy |
| • Edmund C. Olson Trust | Polynesian Voyaging Society |
| • Friends of Hōkūle‘a and Hawai‘i Loa | Sierra Club |
| • Na Kalai Wa‘a | Kamehameha Schools |

Copies of written communications received in response to early consultation efforts are included in Appendix 2a. Notice of the Draft EA was published in the May 8, 2023 edition of *The Environmental Notice*. Appendix 2 contain a section with the one written comments on the Draft EA and DLNR response to it. Additional/modified text related to EA review is denoted by double underlines.

PART 2: ALTERNATIVES

2.1 No Action Alternative

Under the No Action Alternative, the suite of actions described in the KKCMA Plan would not be undertaken. General management would continue under the status quo, and a variety of new, minor actions might also be undertaken on a piecemeal basis. This EA considers the No Action Alternative as the baseline by which to compare environmental effects from the project.

2.3 Alternatives Evaluated and Dismissed from Further Consideration

As part of conceptualizing the action alternative described and evaluated in detail in this EA, DOFAW also evaluated potential alternative actions that could satisfy the purpose and need of the project. As the purpose is to provide koa canoe logs, all such alternatives would involve land that either currently supports koa forests or on which koa could be grown. In order to avoid high land costs that would make the project too expensive to implement, the land needed to belong to the State or be donated by a private or other government agency. Furthermore, to conform most closely with the purpose of the State Land Use Law and Conservation District rules, DOFAW sought land within the Agricultural District. Only a few parcels around the State meet all these requirements, and nearly the only one with mature koa trees capable of harvest within the next 10 years was the current site. This is the precise reason the parcel was initially designated for koa forestry and later dedicated as the Kapapala Koa Canoe Management Area. Another State property on Mauna Kea at Keanakolu was also initially considered but determined to be too environmentally sensitive and also less suitable for the level of production required to satisfy the demand for traditional canoes. In DOFAW’s view, there are no other State-owned properties in Hawai‘i that are nearly as suitable for the proposed use and would not involve substantially greater environmental concerns. For this reason, no other alternative sites or strategies have been advanced for detailed consideration in this EA.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

Unless otherwise noted, the impact discussion for a resource only relates to the proposed project alternative, because the No Action Alternative has no effects on that resource.

3.1 Biological Resources

The discussion of biological resources below is divided for convenience into sections on Vegetation and Flora, although it is recognized that these resources are part of an integrated ecosystem whole. A related section on the special topic of Wildfire, Pests and Disease follows.

Included in these sections are discussions of threatened and endangered species. Federal and State of Hawai'i endangered species laws require government agencies to ensure that their actions are not likely to jeopardize the continued existence of federal or State listed threatened endangered species (16 U.S.C. §1536(a)(2) and (4); Chapter 195D, HRS). The U.S. Endangered Species Act 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)). Federal and State agencies also have an interest in protecting rare species that do not yet have legal protection under the Endangered Species Act.

Biological resources are treated in greater detail in the Plan; readers interested in additional information are referred to Appendix 1.

3.1.1 Vegetation and Flora

Existing Environment

The vegetation at KKCMA is classified as Montane Wet Forest (Wagner et al 1990). Based on field observations and data collected during forest inventories, the parcel can be further classified into four strata (Figures 3-1 and 3-2), largely based on vegetation cover:

- K01: Open 'Ōhi'a Forest (324 acres)
- K02: Open Koa-'Ōhi'a Forest (386 acres)
- K03: Closed Koa-'Ōhi'a Forest (323 acres)
- K04: Mature Koa Forest (207 acres)

The forest canopy in K01 is characterized as an even-aged stand of 'ōhi'a. Koa are present but generally as a subcanopy species. The forest canopy of K02, K03 & K04 is mixed with both koa and 'ōhi'a. Trees are generally larger and the canopy becomes more closed with increasing elevation. K04 has the largest, most mature koa trees and is overall the most intact native forest in KKCMA. Common subcanopy species in all strata include pilo (*Coprosma rhynchocarpa*), kōlea (*Myrsine lessertiana*), kawa'u (*Ilex anomala*), kōpiko (*Psychotria hawaiiensis*), naio (*Myoporum sandwicense*), and ōlapa (*Cheirodendron trigynum*).

Figure 3-1 Forest Strata



State of Hawai'i
Department of Land and Natural Resources
Division of Forestry and Wildlife
(808) 587-0166
January 2022



The ground cover in the lower elevation strata, including all of K01 and the lower parts of K02, is less intact. It is dominated by non-native grass species such as kikuyu (*Cenchrus clandestinus*), meadow-rice grass (*Ehrharta stipoides*), and various fern species. This extends into K02, a few hundred yards mauka of the crossroad. Above this, in upper K02, K03, and K04 the percent cover of non-native grass in the understory decreases, and species like Hawai'i sedge (*Carex alligata*), i'ō nui (*Dryopteris wallichiana*), ma'ohi'ohi (*Stenogyne microphylla*), hairgrass (*Deschampsia nubigena*) and 'ala'ala wai nui (*Peperomia* sp.) can be found. Common shrubs and ground cover in all strata include 'ōhelo (*Vaccinium* sp.), uluhe (*Dicranopteris linearis*), and abundant maile (*Alyxia stellata*). Native shrub and fern species that are found primarily in K03 and K04 include kanawao (*Hydrangea arguta*), pāpala (*Charpentiera obovata*), 'ākala (*Rubus hawaiiensis*), and hapu'u (*Cibotium* sp.). A working plant list of KKCMA is found in Appendix C of Appendix 1.

Figure 3-2 Forest Understory Types



3-2a) Higher elevation areas have more intact native understory ▲

▼ 3-2b). Lower elevation areas are more likely to have non-native grass in understory



The thick sward of alien grasses, lack of native understory and remains of old cattle fence lines in K01 and lower K02 all suggest that the lower forests have been heavily impacted in the past, either by grazing, logging, fire, or a combination of the three. Further, in the 2020 inventory K02, K03, and K04 were found to have about double the species richness of K01. Overall, the parcel is considered to contain relatively intact native ecosystems with minimal pressure from invasive plant species, with the exception of non-native grasses present at lower elevations.

Currently no rare or T&E plant species are known to occur within KKCMA. A comprehensive vegetation roadside survey of the parcel was completed in 2020 and found no T&E plant species. One individual of *Rubus macraei*, which although not listed is considered rare, was found growing in an old rare plant enclosure just outside of KKCMA in Ka'ū FR. *R. macraei* is known from approximately 3,000-5,000 individuals and is relatively common in the supalpine slopes of Mauna Loa. A wild population of *Phyllostegia velutina*, an endangered native Hawaiian mint with roughly 30 individuals left in the wild, is known to exist about two miles from KKCMA.

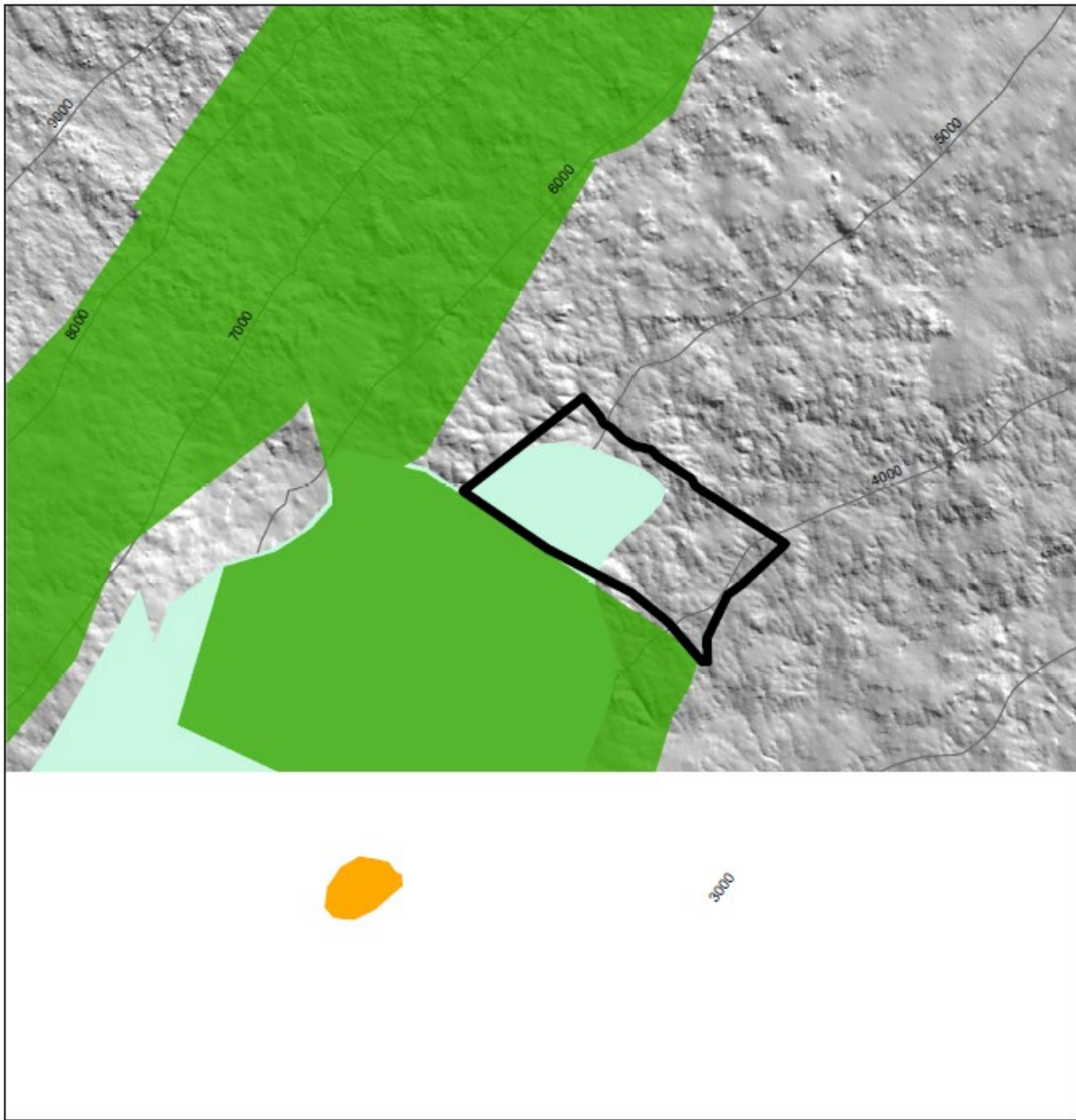
No designated or proposed plant Critical Habitat as defined by the U.S. Endangered Species Act – areas that may or may not be occupied by a threatened or endangered species, but are essential to the conservation of the species – is present within KKCMA (Figure 3-3). However, various units within adjacent areas in the Ka'ū and Kapapala Forest Reserves as well as Hawaii Volcanoes National Park contain Critical Habitat for various plants. These include Mauna Loa silversword (*Argyroxiphium kauense*), alani (*Melicope zahlbruckneri*), *Asplenium peruvianum* var. *insulare*, and kuahiwi laukahi (*Plantago hawaiiensis*). The proposed management actions within KKCMA will not adversely affect these units.






Impacts and Mitigation Measures: Action Alternatives



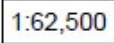
Many elements of the Plan have at least some potential for some adverse effects to native vegetation and flora, even if the Plan is overall beneficial. These elements include timber harvest, thinning and stand improvement, ungulate control, invasive plant control, road and fuelbreak maintenance, access and public use, and forest monitoring and research. As noted by the Big Island Invasive Species Committee in their April 23, 2023 comment in response to early consultation (see Appendix 2), biosecurity measures are vital to reduce the risk of introducing weed spread and ROD. Integral to the Plan are precautions to ensure that silviculture activities, such as skid road construction, timber harvest, and stand improvement operation, occur in such a way that the least amount of ecological damage occurs. Harvest restrictions will limit the amount of disturbance to the ground surface and forest structure. DOFAW's experience working with native vegetation and rare plants around the State indicates that any adverse effects from most of the above will be limited and non-significant with the implementation of mitigation. These measures will be built into all management activities and include the following:

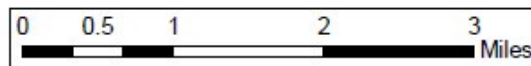
- Prior to activities with the potential to impact rare or T&E plants, botanists will conduct surveys to check all affected areas and identify and map any such species.
- Should any sensitive plants be found, buffers of at least 50 feet in radius will be instituted, and greater if warranted to keep the population safe, and the area will be

Figure 3-3. Critical Habitat Map



	KKCMA Boundary
	Picture-wing fly Critical Habitat
	Plant Critical Habitat
	l'iwi Proposed Critical Habitat
	1,000 ft. Contour Lines

KKCMA Critical Habitat		
		Date: 4/17/2023
		



flagged. Within the buffer, no harvest, tree fall or skid roads will be allowed. Agencies will be advised of and consulted for further mitigation steps. Facilities will be built and roads and trails will be routed in non-sensitive areas or in ways that protect rare plants.

- Weed control will be conducted in a manner to avoid impacts to non-target species.
- DOFAW staff, volunteers and contractors will be required to follow protocols for cleaning of boots, equipment and vehicles in order to avoid introducing or spreading invasive plant species that may compete with native plants and degrade wildlife habitat. In addition, kiosks for education and action will be provided for members of the public accessing the area.
- Follow-up monitoring of harvest areas will be conducted to track the presence and potential establishment of invasive weed populations.

3.1.2 Native Wildlife

Existing Environment

KKCMA contains a variety of wildlife including endemic species of birds and invertebrates and the ‘ōpe‘ape‘a, or the Hawaiian hoary bat (*Lasiurus cinereus semotus*). Non-native species include birds, mammals and invertebrates. The following is a discussion of the faunal resources by group:

Birds

The native tree canopy and fruit bearing understory plants in KKCMA provide excellent habitat for native birds. Bird surveys have been conducted annually since 2018 by the Three Mountain Alliance (TMA) and DOFAW. Fifteen bird species have been detected, eight of which are native (see Table 8 of the Plan for details). ‘Apapane, followed by Hawai‘i amakihi and ‘ōma‘o, are the most abundant native birds in KKCMA. Native birds are present throughout the entire area, with decreasing abundance at lower elevations.

Populations of native Hawaiian forest birds have declined across the State due to habitat loss and the ecological impacts of introduced species. Of the 46 historically known forest bird species in Hawai‘i, only 24 species still survive, and of these, 13 species are listed as endangered. The native birds detected in KKCMA include one listed threatened species, i‘iwi (*Drepanis coccinea*), and three endangered species, ‘akiapola‘au (*Hemiganthus wilsoni*), Hawai‘i creeper/‘alawī (*Loxops mana*), and the ‘io/Hawaiian hawk (*Buteo solitarius*). The ‘io is no longer a federally listed species but is still listed as endangered by the State of Hawai‘i. Ten species of endemic Hawaiian birds have likely gone extinct over the past 25 years – an average of one extinction every two years (Pratt et al 2009). Consideration of the conservation of native birds and bird habitat is thus critical for any activity occurring in native forests.

The Plan contains detailed information on the distribution of T&E species from the surveys conducted from 2018-2021 (see Figures 16-18 and Table 8 of Appendix 1). In summary, i‘iwi were consistently detected and heavily associated with higher elevation areas. This is not surprising given that they are highly sensitive to avian malaria, a disease spread by mosquitoes at lower elevations. The three endangered bird species were all detected in very low numbers. The

‘akiapola‘au was detected only once, in the highest elevational transect of the parcel. The ‘alawī was detected four total times, all in the northwest section of strata K03 & K04.

No designated bird Critical Habitat as defined by the U.S. Endangered Species Act is present within or directly adjacent to KKCMA (Figure 3-3). However, there is a proposed unit for i‘iwi that comprises approximately 275,647 acres of federal, State, and private lands, including large areas of the Ka‘ū and Kapapala Forest Reserves as well as Hawaii Volcanoes National Park, and also includes the mauka portion of KKCMA (USFWS 2022). If Critical Habitat is designated for i‘iwi in the area, it would not at this point appear to directly affect management for koa canoe logs. As the proposed listing states:

Critical habitat designation generally will not affect activities that do not have any Federal involvement; under the Act, designation of critical habitat only affects activities conducted, funded, permitted, or authorized by Federal agencies (USFWS 2022: 79954).

If finalized, the critical habitat designation may affect the ability of management actions to receive federal funding, as federal agencies would be required to consult with the USFWS under Section 7 of the Endangered Species Act on activities they fund, permit, or implement that may affect the species. Consultations include an evaluation of measures to avoid the destruction or adverse modification of critical habitat, which may for practical purposes preclude or greatly increase the cost of harvest and stand improvement actions.

‘Io occurs throughout the island of Hawai‘i from sea level to 8,530 feet in elevation. ‘Io are known to use a variety of habitats, and the mix of forested areas and small gaps in KKCMA is ideal for feeding and roosting. ‘Io were observed most frequently in K02, potentially because of the opening in the canopy created by the road. These hawks nest in tall trees within their large territories from early March through the end of September. There is a high probability that hawks could nest on or near KKCMA. Grading, tree harvest and some forest maintenance activities could disturb nesting. Mitigation measures are necessary to avoid impacts or minimize them to negligible levels.

In addition to birds that have been observed in KKCMA in systematic surveys, other species that have not been detected, including the threatened nēnē or Hawaiian goose (*Branta sandvicensis*), the endangered ‘ua‘u or Hawaiian petrel (*Pterodroma sandwichensis*) and ‘akē‘akē or band-rumped storm-petrel (*Oceanodroma castro*), the endemic pueo or short-eared owl (*Asio flammeus sandwichensis*), and the indigenous kōlea or pacific golden-plover (*Pluvialis fulva*), may use small portions of the area; the importance of KKCMA to these species is low or unknown.

Hawaiian Hoary Bat

The ‘ōpe‘ape‘a or the Hawaiian hoary bat (*Lasiurus cinereus semotus*) is the only native terrestrial mammal in Hawai‘i. The ‘ōpe‘ape‘a is listed as endangered under the U.S. Endangered Species Act. Hawaiian hoary bats have not been detected in KKCMA but they are probably present. The thick ‘ōhi‘a canopy interspersed with open grassy areas and nearby pasture offers ideal habitat for bats, which can use a variety of land cover types. They have been found to

utilize corridors such as hiking trails and roads for hunting and flying through dense forest (Bonaccorso et al. 2015). Hawaiian hoary bats are solitary and roost in both native and non-native tree species with a broad height range (Gorresen et al. 2013). They are vulnerable to disturbance during the summer pupping season, when female bats carrying pups may be unable to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and pups may be unable to flee a tree that is being felled. There is special concern for tree harvest and forest improvement operations that remove multiple trees, as this increases the likelihood of removing one that potentially has a day-roosting bat. Hawaiian hoary bats thus require special mitigation measures.

Invertebrates

Invertebrates in Ka‘ū, and indeed throughout the Hawaiian Islands, have not been fully surveyed. New species are constantly being discovered and distributional information of known species is continually being updated. Adjacent areas of the KFR that support nearly undisturbed native forest are known to contain various species within the Hawaiian picture-wing fly group in the genus *Drosophila*. It consists of 106 known species, most of which are relatively large and have elaborate markings on their wings. The picture-wings have been referred to as the “birds of paradise” of the insect world because of their relatively large size, colorful wing patterns, elaborate courtship displays and territorial defense behaviors. Each species is found only on a single island, and the larvae of each are dependent upon only a single or a few related species of native host plants. The Ka‘ū FR contains 245 acres of designated critical habitat in two separate areas for one endangered species of picture wing fly (*Drosophila heteroneura*), neither of which are inside KKCMA (USFWS 2008) (see Figure 3-3). Habitat for this species is in wet, montane, ‘ōhi‘a and ‘ōhi‘a-koa forest, and larval stage host plants include ‘ōlapa and *Clermontia* sp. (USFWS 2006b). The composition of the forest and the history of grazing disturbance reduces but does not eliminate the possibility of picture-wings habitat. A recent reconnaissance by Dr. Karl Magnacca indicated that although it is unlikely that T&E invertebrates are present, some rare *Drosophila silvestris* and *D. silvarentis* may occur, given the prevalence of large and healthy ‘ōlapa and naio (their respective host plants). In addition, lava tubes and caves associated with pāhoehoe lava flows in KKCMA most likely contain subterranean invertebrate communities. Though there are no T&E lava tube-associate invertebrates on Hawai‘i Island, these communities contain unique species that have not been well inventoried.

Impacts and Mitigation Measures

Native Birds

Native birds can be subject to adverse effects when their habitat is disrupted by forestry activities, vehicles, etc., particularly during nesting and fledging periods, when their mobility is restricted. Because of the large size of the property and the relatively small zone of disturbance at any one time, birds will generally have ample undisturbed habitat. However, in consideration of the native bird populations, mitigation measures will be taken to minimize impacts to T&E bird species. Recent surveys indicate that most of the T&E species have been detected at higher elevations in KKCMA. Harvest activities will be generally be less intense in these areas, especially in the northwest corner where ‘akiapola‘au and ‘alawī have been detected.

To minimize impacts to native birds:

- Extra caution will be taken between March 1 to September 30 during the nesting and fledging season of several native bird species, including ‘i‘iwi. Prior to harvest, the immediate area will be surveyed by DOFAW staff for native bird nests in or near trees being felled. If hawks are nesting within 330 feet, the harvest will not proceed until the juvenile hawk has fully fledged.
- Bird surveys will continue to be conducted annually to verify the distribution of all species and particularly T&E species in order to optimize mitigation.
- There are currently no plans to implement rodent control in the area, but non-native animal control could include the use of rodenticides and other toxic baits for rats and mice, which could potentially poison non-target animals. The use of toxic baits will be done in accordance with the toxicant registration. If implemented, DOFAW will use approved baits with a low toxicity to non-target wildlife and enclosed bait stations to limit the availability of bait blocks to rodents only. The controls and practices will avoid impacts to endangered animal species as well as plants and water resources.

Hawaiian Hoary Bats

As discussed above, Hawaiian hoary bats are vulnerable to disturbance in the pupping season. To minimize impacts to bats:

- No tree harvest or thinning operations that disturb trees or shrubs taller than 15 feet will occur between June 1 and September 15.
- In addition, DOFAW will avoid installing of new top-strand barbed wire, which can entangle bat wings and injure or kill them.

Invertebrates

To gain greater information concerning native invertebrates, and particularly rare or T&E species, DOFAW is embarking on a systematic survey of these species and their obligate host plants. DOFAW will seek to avoid habitat and host plants that are key to these species as part of adaptive management.

3.1.3 Wildfire, Pests and Invasive Fauna

This section discusses several threats to the integrity of the natural biota of KKCMA, each of which is already present and can also be exacerbated or reduced by project activities.

Existing Environment

The main natural ignition sources for wildlife in Hawai‘i are lightning and lava flows. Hawai‘i’s flora evolved with relatively infrequent naturally occurring fire, so most native species are not fire-adapted and are unable to recover quickly after wildfires. Wildfires can leave the landscape bare and vulnerable to erosion and non-native weed invasions. Continued feral ungulate damage

to native ecosystems can convert native forest to non-native grasslands or shrublands, which provide more fuel for fires. Invertebrate pests and disease can weaken and defoliate vegetation, leaving it more vulnerable to fire. Weeds, particularly grasses, are often more fire-adapted than native species and will quickly exploit suitable habitat after a fire. Wildfire in Ka‘ū is generally associated with the urban areas, pastures, and wild grass and shrub lands, which are drier than moist KKCMA. However, wildfire can pose a genuine threat to KKCMA, particularly during times of drought and in areas adjacent to human activity. Wildfire has occurred at the adjacent Kapāpala Ranch. Mitigation for fire prevention and response is thus necessary.

KKCMA has various invertebrates and fungi that may consume native plants, interfere with plant reproduction, predate or act as parasites on native species, transmit disease, affect food availability for native birds, disrupt ecosystem processes, and reduce production of koa canoe logs:

- *Fusarium oxysporum* f.sp. *koae* causes koa wilt, which induces dieback and/or decline of koa, especially in low elevations/warmer areas.
- *Tetraleurodes acacia*, or acacia whitefly, leads to decreased plant vigor, leaf yellowing/defoliation of varying hosts.
- *Accizia uncatoides*, or acacia psyllid, causes decline or poor growth form of koa.
- *Xylosandrus compactus*, or black twig borer, stunts growth or kills more than 100 tree and shrub species.
- *Ceratocystis luku‘ōhi‘a*, and *C. huli‘ōhi‘a* are fungal species that cause widespread and rapid ‘ōhi‘a death (ROD). Spores of both *Ceratocystis* species are circulating widely on Hawai‘i Island and ROD is now found throughout the island. Tree wounds that occur during trimming or heavy equipment operation raise ROD risk considerably.
- *Klambothrips myopori*, or naio thrips, defoliate and can kill naio.
- *Plasmodium relictum* is a mosquito-transmitted single-celled parasite that causes avian malaria, which is deadly to many species of birds, especially native Hawaiian species.
- *Scotoryhta paludicola*, or koa moth, is an endemic insect that occasionally experiences large population increases and can cause severe defoliation of koa trees.

A number of non-native animals are present at KKCMA. None have conservation value and all are deleterious to native flora and fauna, but they are generally found at densities that can be controlled with effective management to levels consistent with a healthy forest and production of koa canoe timber. Regular surveys have found eight species of non-native birds, with the warbling white-eye (*Zosterops japonicus*), most abundant (see Table 8 of Appendix 1). A variety of non-native mammals such as feral pigs (*Sus scrofa*), occasional feral cattle (*Bos taurus*), rats (*Rattus* spp.), mice (*Mus musculus*), cats (*Felis catus*), and small Indian mongooses (*Herpestes auropunctatus*) are present in KKCMA. Other ungulates including mouflon sheep (*Ovis musimon*), sheep (*Ovis aries*), feral sheep-mouflon hybrids (*Ovis aries-Ovis musimon*) and feral goats (*Capra hircus*) are not known from KKCMA, but may be present in directly adjoining areas. No non-native amphibians or reptiles are currently documented at KKCMA.

Impacts and Mitigation Measures

Wildfire may be generated as a result of project actions, and fires generated elsewhere can also spread to KKCMA, threatening forest integrity and the koa canoe resources that the project seeks to utilize. The principal human-caused wildfire ignition threats are catalytic converters and other hot surfaces of vehicles or heavy equipment, along with any tool use that causes sparks during high fire hazard conditions. DOFAW is the primary responder to fires within the Ka‘ū Forest Reserve, including KKCMA. DOFAW is responsible for fire protection within DOFAW lands and also cooperates with the Hawai‘i Fire Department and federal fire control agencies in developing plans, programs and mutual aid agreements for wildfire prevention assistance on other lands. An integral component of the project is the following mitigation:

- Maintain the perimeter road and interior crossroad as fuelbreaks, including clearing the road of vegetation or fallen trees.
- Closely monitor drought and fire activity in surrounding areas to determine the level of wildfire risk at KKCMA. Depending on the level of fire risk, access to the area may be temporarily restricted.
- Improve and maintain the helicopter landing zone to prepare for wildfire response.
- Secure and identify water access to prepare for wildfire control.

Ongoing infestations as well as new and sudden increases of insects and diseases can pose a serious threat to the native forest and management goals at KKCMA. With globalization and an increased dependence on imports, approximately 20 insect species become established in Hawai‘i every year (State of Hawai‘i 2010). Of particular concern in KKCMA are those listed above that have the potential to cause widespread dieback of predominant forest canopy species such as koa and ‘ōhi‘a. They can be hard to control or have limited control options, and a sudden outbreak may drastically alter the forest composition. If an outbreak of one of these diseases does occur, it may drastically alter the management goals for the area.

The Plan includes built-in management actions that counter alien species and promote native species. These will help maintain the overall health of the forest and make it more resistant to threats from insects and disease. Nonetheless, the infrastructure improvement, harvest and stand-improvement elements of the Plan, if implemented improperly and/or without appropriate mitigation, could increase the adverse effects of pests and disease. For this reason, the Plan includes integral and specific management objectives meant to counteract the adverse effects of pests and disease. They include the following:

- Conduct assessment of koa pest insects and diseases as part of all monitoring activities, including timber inventory.
- Assist and collaborate with partners to secure essential technical information and understanding of new threats.
- Include ROD sanitation and prevention procedures in all project activities conducted by DOFAW and also for all collection permits issued for KKCMA. This includes minimizing wounds to ‘ōhi‘a trees during harvest operations.

- Avoid damaging ‘ōhi‘a trees by hand-clearing a path for the machinery ahead of time. Place the path where valuable trees are less dense and make the path only as wide as needed to fit the machine.
- Monitor for signs of increased ROD distribution within KKCMA.
- Utilize forest bird surveys to monitor distribution of avian malaria in the area.
- Ensure that all pesticide use strictly follows labeling requirements.

As discussed in Section 1.3, above, control of non-native mammal populations, especially grazing cattle, is an integral and high priority part of the Plan meant to minimize the primary threat to forest recovery of forests. The following mitigation measures will be implemented to reduce the threats of ungulates and other invasive mammals:

- Continue ongoing regular fence checks, monitor for cattle in order to prevent ingress and identify and remove any invading cattle.
- Install cattle guards at strategic locations.
- Monitor for sheep, mouflon, and goats, which are not currently found in KKCMA, via staff observations and game cameras to ensure they do not enter the area and detrimentally browse native vegetation.
- Increase pig control in the area. This will include utilizing public hunting, and implementing staff control through the use of trapping, staff hunting, and adding skirting to the fenceline as funds are available.
- Monitor and control rats, cats and mongooses in order to reduce their populations.

3.2 Climate and Geology

Existing Environment

Due to its mid-elevation location between 3,150 and 5,160 feet above mean sea level, KKCMA has an average annual temperature of 60°F (49-72°F) and an average annual rainfall of 80 inches (Giambelluca et al 2013). Rainfall is fairly consistent throughout the year, with wetter months during the winter, similar to most of Hawai‘i (UHH 1998). Dense clouds and fog are common, reducing incident sunlight and providing additional moisture via fog drip. Despite the adequate moisture regime, drought is also possible. Rainfall totals from a few large winter storms can be greater than all other rain events during the year combined, which can pose an erosion hazard on cleared slopes. As with most areas in windward Hawai‘i, there is a distinctive diurnal wind regime (daytime upslope, nighttime downslope) overlaid on the prevailing trade wind flow, which is across the slope at KKCMA.

The geologic substrate of the KKCMA is 750-1500-year old volcanic eruptions from Mauna Loa volcano that emerged from the caldera at Moku‘āweoweo (Wolfe and Morris 1996). Mauna Loa is still active and has erupted 33 times between 1843 and 1984 (Lockwood and Lipman 1987) and once since then, in 2022. Forty percent of Mauna Loa’s surface is covered by lava flows less than 1,000 years old, and flows in 1950 reached the upper elevation of Ka‘ū Forest Reserve, south of Kapāpala. As with all areas on Mauna Loa, KKCMA could potentially be covered by lava from future volcanic eruptions. However, it is within an area that is relatively less risky than

many other locations on the flanks of Mauna Loa (including Hilo) because of its topographic position relative to the most active rift zone areas. KKCMA is classified within Volcanic Hazard Zone 6 on an ascending scale of risk from 8 to 1, where there have been no lava flows during the past 750 years (Heliker 1990).

Kīlauea Volcano is also currently active. Trade winds blow the volcanic emissions from Kīlauea to the southwest, towards KKCMA, particularly when there is activity within Halema‘uma‘u Crater. These emissions contain sulfur dioxide and other pollutants and are commonly called vog. On occasion, they have built up to levels that are hazardous to human health and damaging to agriculture. Vog may also adversely affect the health of some native plant and animal species (USGS 1997; UH 2008), but the forest at KKCMA does not appear to suffer significantly from vog exposure.

Ka‘ū experiences frequent seismic activity related to the movement of magma within Kīlauea and Mauna Loa or settling and shifting of earth along numerous fault lines. This activity occasionally leads to landslides and tsunamis. In 1868, an earthquake caused a destructive landslide that buried a village in Wood Valley and also caused a sudden tsunami that swept away many settlements along the coast (Stearns and MacDonald 1946). DOFAW managers have not detected any areas of landslides or rockfall to date at KKCMA that could be activated by earthquakes.

Soils in Ka‘ū have developed from volcanic rocks, cinders, and ash. Soil age and composition, along with climate, are a major influence on plant community composition and hydrology. Pāhoehoe, ‘a‘ā, cinders, and weathered ash provide varying contributions of minerals and drainage characteristics (Mitchell et al 2005). Accumulations of organic matter in the soil and ground litter are the most important factor in soil development on the relatively young substrates at KKCMA.

Three similar soil series are present within KKCMA, with the deepest soil generally found on the lower half of the property. All of these soils are andisols, meaning they were derived from volcanic ash, and are thus relatively fertile and acidic, with 0-60% organic material at the surface. These soils are highly erodible, which must be considered during forestry operations, especially harvesting. Because of the thin soils and high infiltration rates in the parent material, there is limited water holding capacity in the soil profile. This increases stress on plants during occasional droughts.

Due to the recent geology, no true streams or watercourses are present. The area is not classified by FEMA as within a Special Flood Hazard Area (Hawai‘i DLNR: <http://gis.hawaiiinfip.org/FHAT/>). Normally, rainfall rapidly soaks into the ground. However, KKCMA can also experience heavy runoff from storms that cause minor erosion that can worsen where slopes are cleared. The area provides an important watershed that helps ensure the sustainability of groundwater, which is vital for human use. Forests collect and filter water into the aquifers and streams. A healthy forest without soil disturbance limits aquatic pollutants (e.g. siltation, suspended solids, turbidity, nutrients, organic enrichment, toxins and pathogens) due to erosion and runoff. Forests may also reduce the impacts of flooding and erosion by slowing down water as it flows down the mountain.

Impacts and Mitigation Measure

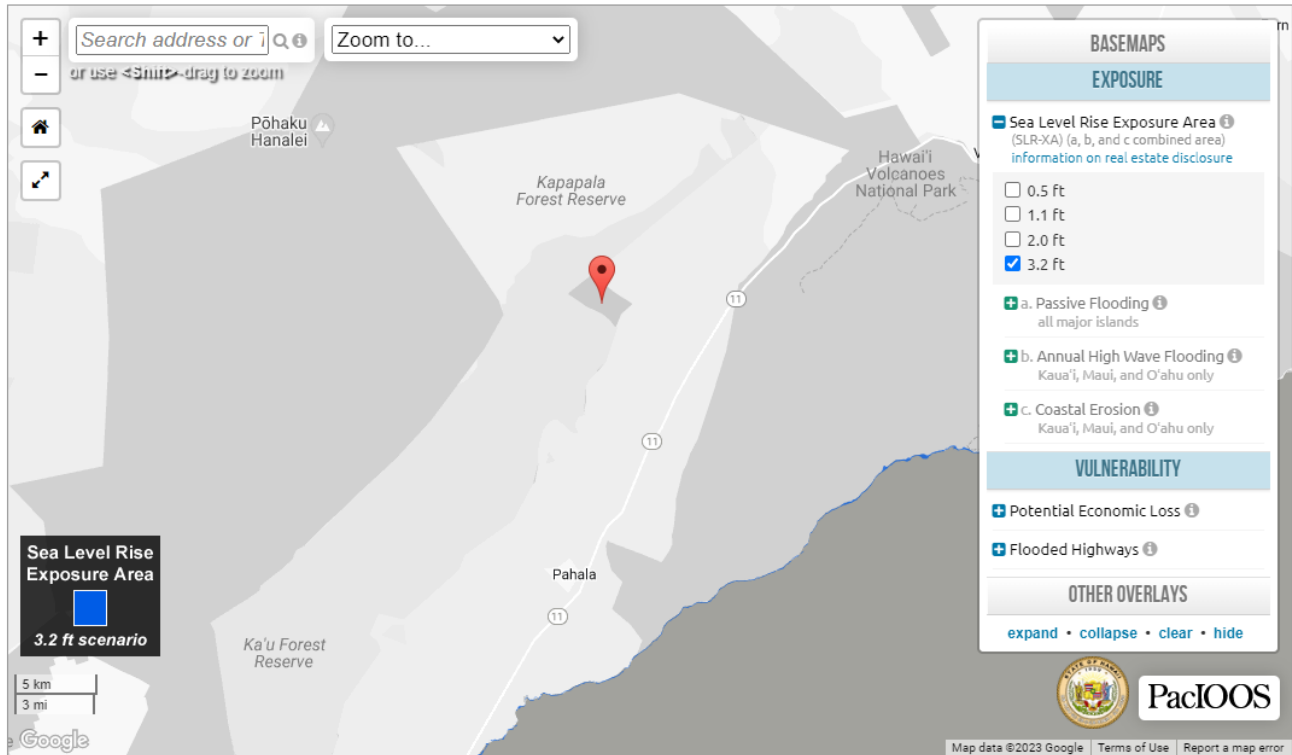
There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the United Nations' Intergovernmental Panel on Climate Change (UH Manoa Sea Grant 2014). Global mean air temperatures are projected to increase by at least 2.7°F by the end of the century. This will be accompanied by the warming of ocean waters, expected to be highest in tropical and subtropical seas of the Northern Hemisphere. For Hawai'i, where warming air temperatures are already quite apparent, not only is the equable climate at risk but also agriculture, ecosystems, the visitor industry and public health. Guidance to federal agencies for addressing climate change issues in environmental reviews was released in August 2016 by the Council on Environmental Quality (US CEQ 2016). The guidance urged that when addressing climate change, agencies should consider: 1) the potential effects of a project on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and 2) the effects of climate change on a project and its environmental impacts. It recommends that agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis in terms of climate change effects and resiliency to the effects of a changing climate. The State of Hawai'i in Hawai'i Revised Statutes §226-109 encourages a similar analysis, and both Act 17 of the 2018 Hawai'i Legislature and Title 11, Chapter 200.1 now require analysis of sea-level rise and greenhouse gases in environmental impact statements.

In terms of precipitation, wet and dry season contrasts will increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation. In general, rainfall in Hawai'i has been variable in the recent past with some years drier and some wetter than average. The El Niño Southern Oscillation (i.e., periodic variation in winds and sea surface temperatures in the Pacific, the warming phase of sea temperature known as El Niño and the cooling phase as La Niña) will likely continue to dominate precipitation patterns from year to year in the tropical Pacific. Climate change-related increases in air temperatures will lead to more evaporation and more moisture in the air. As a result, the variability in El Niño-related precipitation is likely to increase, making rainfall predictions difficult. However, it is very likely that warmer temperatures and larger and more frequent tropical storms and hurricanes will affect the Hawaiian Islands in the future. It is thus important that project activities factor in not only current extreme rainfall events but more volatile future events.

Due to the elevation of the project site at more than 3,150 feet above sea level, there is no risk to the project from sea level rise (Figure 3.4). Carbon emissions as a result of operating the project would be considered negligible and are not expected to contribute significantly to global climate change. The project will lead to a perpetually sustainable growth of koa trees, recycling sequestered carbon and reducing the carbon footprint.

The project involves substantial investment in forest management and infrastructure to support the goal of providing koa canoe logs. There is a small but not discountable risk that must be factored into decisions to proceed that the area will be overrun with lava from Mauna Loa. Lava flows, extremely effusive eruptions, heightened volcanic gas production from Kīlauea, and earthquakes could all pose dangers to workers, koa canoe organizations, and public access users

Figure 3.4 Sea Level Rise Map



Source: <https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/>

engaged in hiking, biking, gathering or hunting. DOFAW will monitor use through the harvest procedures and check-in stations for hunters and recreational users. Warning signs may be installed at trailheads to advise potential users about geologic hazards, along with other hazards such as steep slopes, disorientation, dehydration and hypothermia, and other conditions.

The principal potential impact related to climate and geology is erosion on access roads, skid trails, and other cleared areas. Several factors will act to reduce impact. The perimeter and cross-roads will be re-contoured in order to reduce the constant need for road maintenance and to help facilitate management activities. Road contouring is a grading technique that decreases the slope of the road in areas that are severely impacted by erosion. The road is re-routed along a contour, making a small turn in the road, reducing the slope of the road. Road contouring increases the longevity of the road by mitigating erosion and improves overall water quality in the area. Road contouring will be limited to within the 200-ft road buffer and will not extend into the interior of the forest. In contrast to other forest operations options like clearcutting, the scale of disturbance associated with harvest and stand thinning at KKCMA will be relatively small. Research on harvest access systems found skid trails impact between 1.6% to 10% of the harvest area in temperate and tropical forests (DeArmond et al. 2021). KKCMA is a small-scale, selective harvest system, and the skid trails and the disturbance they involve will not be extensive, and the subsequent impact will be minimal. Skid trails will be designed and located to minimize disruption of natural drainage and prevent excessive soil displacement.

In addition, the project will be managed to ensure all harvest operations follow harvest Best Management Practices (Appendix F of Appendix 1). Among other measures, the following will be implemented as an integral part of the Plan in order to minimize erosion:

- Conduct regular road maintenance, especially re-grading dirt roads and gravel-filling potholes in rocked/gravel roads, as necessary.
- Skid trails will generally have a slope of three to five percent and will not be permitted to exceed a slope of ten percent.
- Skid trails on the steeper slopes will include water bars or drainage features.
- In general, management will maintain and re-use existing skid trails, instead of removing mature trees to clear a new skid trail, especially if needed for ongoing weed control, enrichment planting, thinning, etc. Skid trails will always be GPS-marked to maintain a location record.
- Post-harvest clean-up may include the retirement of skid trails that will no longer be needed. This will involve covering with slash piles (treetops, small branches) from the harvest to mulch erosion-prone areas and to discourage continued use of the trail.
- To reduce erosion and for safety, all operations will be halted during heavy rain and storm events and may be postponed until staff deem roadways safe.

3.3 Socioeconomic Conditions, Access, Hunting and Recreation

Existing Environment

U.S. Census of Population and American Community Survey records indicate that the population of the Ka‘ū District grew steadily over the last four decades, from 3,034 in 1980, to 4,048 in 1990, to 5,554 in 2000, to 8,451 in 2010, and to 8,855 in 2020. This growth rate averaging over 30 percent each decade masks the fact that Ocean View, a community on the western edge of Ka‘ū with inexpensive subdivision lots that attract residents from around the country and world, has accounted for most of that growth. The traditional core of Ka‘ū anchored by Nā‘ālehu and Pāhala was severely affected by the closure of sugar plantations at the end of the last century. Pāhala and Nā‘ālehu both experienced negative population growth during this same time period (-13.3% and -20.1%, respectively). The U.S. Census Bureau estimated the 2021 median household income at \$38,505 in the Ka‘ū District, where 23 percent of households are below the poverty level (U.S. Census Bureau 2021; American Community Survey 5-year estimates. <http://censusreporter.org/profiles/06000US1500191170-kau-ccd-hawaii-county-hi/>>).

Economic generators in the Ka‘ū District are limited. Commercial centers are located in Pāhala, Nā‘ālehu, Wai‘ōhinu and Ocean View. Development in Ka‘ū includes residential, small retail commercial centers, and family-owned or commercial farms. Major government facilities include schools, a police station, a fire station and a hospital. The primary economic drivers in Ka‘ū are currently macadamia nut farms, schools, medical services, retail, cattle ranching, tourism and construction.

Tourism is a growth industry in Ka‘ū largely because it is home to Hawai‘i Volcanoes National Park. Although KKCMA is technically accessible to visitors, the remoteness and lack of

attractions that tourists usually choose to visit means that it is not a common visitor destination. In the KKCMA area, Kapāpala Ranch is the major economic land use. It is important to note that in 2004, the 1,257-acre koa management area was withdrawn with the strong support of the ranch from the ranch's lease area. The ranch is comprised of some 34,000 acres, with about 2,000 head of cattle along with goats which are rotated among various pastures to manage vegetation.

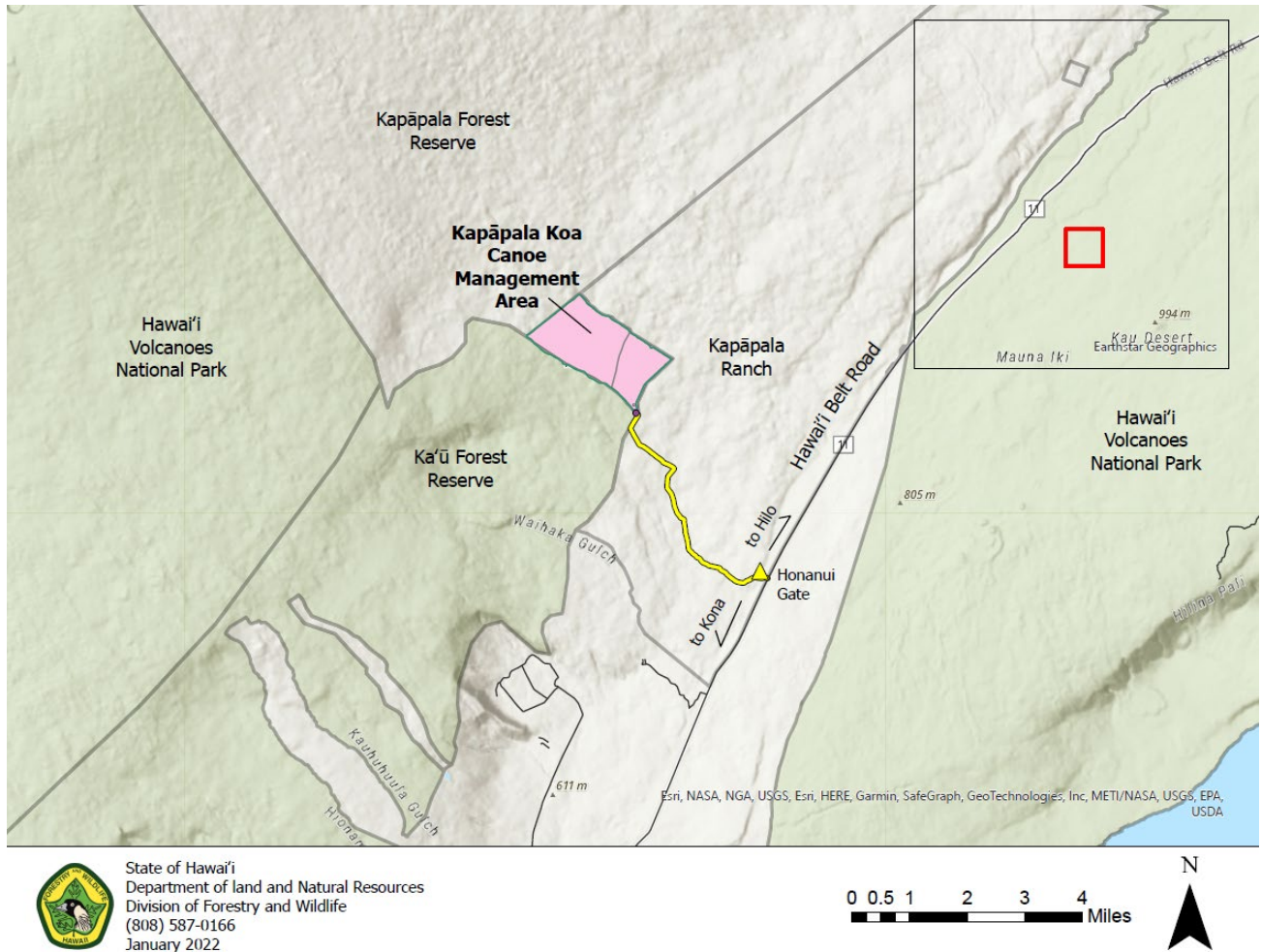
Highway access to KKCMA is via the Honanui gate near the 44-mile marker on State Highway 11, which is 44 miles from Hilo in the north and 11 miles from Pāhala in the south. From here, the access route utilizes a roughly 3.5-mile long 4WD road that crosses the leased lands of Kapāpala Ranch (see Figure 3-5).

Socioeconomic information is useful but not sufficient for describing the relationship of the people of Ka'ū to the upper elevations, including KKCMA and the entire Ka'ū Forest Reserve. In pre-Western Contact times, as described elsewhere in this document, the forest was in the wao, the wilderness. It was generally not inhabited, but was important as the source of life-giving waters and the resources of wood, fiber, medicine and ceremonial products. Its integrity was fundamentally tied to the general wellbeing of Hawaiian society. After Western contact, ecological degradation occurred as the forests became overrun by cattle and were exploited for sandalwood, timber and hāpu'u pulu. Western patterns began to dominate the economy and land use and tenure, particularly plantation sugar. These interests realized that the forest was a vital to protecting their economic water interests, and the concept of "forest reserves" was born. The principal purpose was to protect watersheds from erosion and ensure a steady supply of water for sugar plantations. Fences were erected to keep cattle out and the cattle were removed in many sections.

Although the close association of Forest Reserves in Hawai'i with watersheds slowly diminished along with the demise of sugar and its water infrastructure, the Ka'ū Forest Reserve continues to be used for watershed protection, hunting and gathering practices. More subtly, the forests retain their critical cultural value, for they are still the wao akua and their health is felt to be inextricably linked to the well-being of the ahupua'a and the people. The Ka'ū Listening Project found that the subsistence economy of fishing, gathering and hunting remains important today for many families (James Kent Associates 2007). For many, hunting, along with fishing, is an essential element of being a real kama'āina of Ka'ū. Hunting is a rite of passage, a bonding time among the densely interwoven network of friends and family, a treasure trove of stories for retelling, and a tradition that the community feels needs to be protected for many reasons. Accordingly, the Ka'ū Community Development Plan includes objectives that seek to preserve and enhance what is termed the *nā 'ohana* economy, reflecting the importance of the subsistence and sharing system prevalent in Ka'ū, which depends on gathering, hunting, fishing, and small scale agriculture.

The entirety of KKCMA is within Hunting Unit B. Hunting in state forest reserves is regulated by Hawai'i Administrative Rules (HAR) Chapter 13-121 Hunting General Regulations, Chapter 13-122 Game Bird Hunting, and Chapter 13-123 Game Mammal Hunting (administrative rules for hunting and licenses around found at <https://dlnr.hawaii.gov/recreation/hunting/>). The area is said to experience moderate levels of hunting.

Figure 3-5 Access Route to KKCMA



In addition to hunting, KKCMA is open to hiking and birding as well as gathering forest resources (with a DOFAW permit), such as maile and palapalai ferns. There are no designated hiking trails within KKCMA, but interior roadways can be, and very occasionally are, used to hike and mountain bike around the area. Hikers in the Kapāpala area are more likely to utilize ‘Ainapō Trail to the north of KKCMA, a celebrated historical trail depicted on various paper maps and digital hiking apps.

Illegal, unpermitted harvesting of non-timber forest products has also been documented in the area. DOFAW staff have seen evidence of maile propagation activities, including fertilizer and other cultivation paraphernalia within KKCMA and other parts of the Ka’ū Forest Reserve. Bringing soil, compost, or fertilizer into the forest is environmentally unsound, as it can spread insects and diseases such as little fire ants and rapid ‘ōhi‘a death. Unpermitted collection of forest products diminishes resources for those who collect pono, with permits and in non-commercial quantities. Other human activities of concern are drug use and unsanctioned camping, which can create an unsafe environment for educational groups or the public and lead to wildfire.

Impacts and Mitigation Measures

DOFAW management of recreational uses will emphasize low-impact activities, such as hunting, gathering for personal use, and hiking, with minimal improvements consistent with the remote, wilderness nature of KKCMA. Harvest, stand improvement and infrastructure improvements will tend to be focused in small areas at any one time and will be implemented so as to induce minimal interference with these public activities within KKCMA as a whole. Pig hunting will continue to be permitted in accordance with the regulations governing Hunting Unit B in forest reserves, with the goal of reducing the pig population to levels consistent with the KKCMA management goals. Occasionally, during the transfer of heavy equipment and logs, portions of the access route may be closed for safety reasons. DOFAW will install signs that inform the public during such closures. DOFAW will encourage recreational uses but will work to enforce regulations and laws against illegal plant propagation, camping and drug use on KKCMA.

Environmental justice is a term that refers to social inequity in bearing the burdens of adverse environmental impacts. Certain socioeconomic groups in the U.S., including ethnic minorities and low-income residents, have historically experienced a disproportionate share of undesirable side-effects from locally undesirable land uses such as toxic waste dumps, landfills, and freeway projects (Cutter 1995). Executive Order (EO) 12898 requires federal agencies to take appropriate and necessary steps to identify and avoid disproportionately high and adverse effects of federal projects on the health and environment of minority and low-income populations. Although the Plan for KKCMA is not a federal action subject to NEPA, in Act 294 of 2006, the Hawai‘i Legislature called for agencies to implement similar policies, directing consideration of environmental justice concerns where there are disproportionate impacts on the environment, human health, and socioeconomic conditions of Native Hawaiian, minority, and/or low-income populations. As with nearly all parts of the State of Hawai‘i, minority populations in Ka‘ū are actually the majority, with over 60 percent of the population identified as other than white. The proportion of the population in Ka‘ū below the poverty line is estimated at over 23 percent, one of the lowest-income districts in the State of Hawai‘i. It is clear that low-income and minority populations are present. The Plan is focused on providing resources that are critical for cultural practices involving wa‘a for racing, fishing, voyaging and other purposes. It also involves protection of many of the resources in KKCMA, including culturally important plants for gathering and watershed values. These are benefits that are shared across all socioeconomic strata. No disproportionate impacts on low-income and minority populations would occur as a result of the action.

In a letter in response to early consultation of March 2, 2023 (see Appendix 2), the Hawai‘i Department of Transportation (HDOT) provided the following comment:

Please identify the location of the access and route on the State highway to be utilized for the harvesting and transport of trees. The proposed access and route should be designed and constructed for the appropriate vehicle characteristics and utilization. If any work is proposed within the State Highway Right-of-Way, an approved Permit to Perform Work Upon State Highways shall be obtained prior to construction. If the vehicle and/or load exceed the limitations of HRS 291-34 and -35 an approved Application to Operate or

Transport Oversize and/or Overweight Vehicles and Loads over State Highways will be required.

Access routes are depicted in Figure 3.5. There are no current plans to conduct improvements within the HDOT right-of-way. DOFAW will ensure through the Special Use Permit process that heavy equipment and logs are transported in accordance with all applicable regulations and that DOFAW and/or canoe organizations obtain the appropriate approvals. DOFAW will ensure that truck weight loads are professionally estimated prior to transport on highways and to ports for off-island shipment.

3.4 Cultural Resources

Lokelani Brandt, M.A. and S. Kau'i Lopes, B.A., of ASM Affiliates prepared a comprehensive Cultural Impact Assessment (CIA) for the project, which is attached as Appendix A of Appendix 1 and briefly summarized below. Interested readers are referred to the full CIA for detailed discussion. The purpose of the CIA is to assist in compliance with the Chapter 343, HRS requirements for consideration of cultural impacts, in furtherance of Act 50, which specifically acknowledged the State's responsibility to protect native Hawaiian cultural practices. Act 50 states that environmental studies "... should identify and address effects on Hawaii's culture, and traditional and customary rights" and that:

...native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawai'i. Articles IX and XII of the state constitution, other State laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.

Guidelines to assist in conducting the required cultural analysis are contained in the *Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts* (OEQC 1997). These guidelines are particularly helpful for projects that involve sensitive, undeveloped land or clearly have potential cultural impacts. A key element of a CIA is consultation of individuals with knowledge of cultural resources and practices. The current CIA consulted the KKCMA Working Group and also published a public notice in the November 2022 edition of *Ka Wai Ola*, the monthly newspaper of the Office of Hawaiian Affairs (OHA), to solicit broader involvement from any interested parties.

The geographical extent of the inquiry for CIAs should be large enough to ensure consideration of cultural practices that, while not necessarily occurring within boundaries of the project area, may nonetheless be affected. The CIA considered not only KKCMA but also the ahupua'a of Kapāpala and the entire moku of Ka'ū to some extent.

To generate a set of expectations regarding the nature of cultural resources and customary practices that might be encountered within the area, and to establish a context within which to assess the significance of such resources, the CIA began with a general cultural-historical review. The culture-historical context includes a discussion about the theories and beliefs associated with the settlement of the islands, an overview of traditional land management

strategies, and a discussion on the intensification and development of Hawaiian land stewardship practices.

While the question of when Hawai‘i was first settled by Polynesians remains contested, scholars working in the fields of archaeology, folklore, Hawaiian studies, and linguistics have offered several theories. With advances in palynology and radiocarbon dating techniques, Kirch (2011) is among those who argue that Polynesians arrived in the Hawaiian Islands sometime between A.D. 1000 and 1200. This initial migration sailing on intricately crafted wa‘a kaulua (double-hulled canoes) to Hawai‘i from Kahiki, the ancestral homelands of Hawaiian deities and peoples from southern Pacific islands, lasted until at least the 13th century. According to Fornander (1969), Hawaiians brought from their homeland certain Polynesian customs and beliefs: the major gods Kāne, Kū, Lono, and Kanaloa (who have cognates in other Pacific cultures); the kapu system of political and religious governance; and the concepts of pu‘uhonua (places of refuge), ‘aumakua (ancestral deity), and mana (divine power).

A critical concept from the CIA for comprehending the cultural context of the project and its impacts relates to traditional land stewardship systems, especially the concept of ahupua‘a. The ahupua‘a was the principal land division that functioned for tribute or taxation purposes and furnished its residents with nearly all subsistence and household necessities. Ahupua‘a are land divisions that typically include multiple ecozones from mauka (upland mountainous regions) to makai (shore and near-shore regions), assuring a diverse subsistence resource base (Hommon 1986). Although the ahupua‘a land divisions typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974). Noted Hawaiian historian and scholar Samuel Kamakau summarized the ecozones that could be found in a given ahupua‘a:

Here are some names for [the zones of] the mountains—the mauna or kuahiwi. A mountain is called a kuahiwi, but mauna is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (‘ano). The part directly in back and in front of the summit proper is called the kuamauna, mountaintop; below the kuamauna is the kuahea, and makai of the kuahea is the kuahiwi proper. This is where small trees begin to grow; it is the wao nahele. Makai of this region the trees are tall, and this is the wao lipo. Makai of the wao lipo is the wao ‘eiwa, and makai of that the wao ma‘ukele. Makai of the wao ma‘ukele is the wao akua, and makai of there is the wao kanaka, the area that people cultivate. Makai of the wao kanaka is the ‘ama‘u, fern belt, and makai of the ‘ama‘u the ‘apa‘a, grasslands.

A solitary group of trees is a moku la‘au (a “stand” of trees) or an ulu la‘au, grove. Thickets that extend to the kuahiwi are ulunahele, wild growth. An area where koa trees suitable for canoes (koa wa‘a) grow is a wao koa and mauka of there is a wao la‘au, timber land. These are dry forest growths from the ‘apa‘a up to the kuahiwi. The places that are “spongy” (naele) are found in the wao ma‘ukele, the wet forest.

Makai of the ‘apa‘a are the pahe‘e [pili grass] and ‘ilima growths and makai of them the kula, open country, and the ‘apoho hollows near to the habitations of men. Then comes the kahakai, coast, the kahaone, sandy beach, and the kalawa, the curve of the seashore—right down to the ‘ae kai, the water’s edge.

That is the way ka po‘e kahiko [the ancient people] named the land from mountain peak to sea (Kamakau 1976:8-9).

Kapāpala is a massive ahupua‘a that once contained well over 223,000 acres, when the lands of Keauhou were still included as an ‘ili kūpono, and even today has over 150,000 acres. It comprised vast tracts of forest occupying the central region and flanked on either side by numerous lava flows originating from Mauna Loa and Kīlauea (Maly and Maly 2004). The coastline was dry and remote with only limited habitation. In their appraisal of native horticultural practices in the 1930s, Handy et al. provided the following geographical description of Kapāpala Ahupua‘a:

Between the northeasterly ahupua‘a of Kapapala and Kilauea, the upland area of active volcanic craters, there was never any cultivation, so far as we could learn. Below Kao-iki Pali the country is covered with lava, and in the forest above the pali from Kapapala to Ohiakea the bird snarers or feather hunters had their huts, but no taro was grown. On the land flanking the present Kapapala Ranch, which is now in sugar cane, dry taro used to be grown on the sloping kula, on the steep hillsides of gulches, and in the forest lying behind. Forest taro was here referred to as ulu la‘au (forest growth), and that on steep slopes as pi‘ina (climbing) (Handy et al. 1991:613).

The name Kapāpala may refer to the endemic pāpala plant (*Charpentiera* sp.), which is found on all of the main Hawaiian Islands in both mesic and dry forests (Pukui et al. 1974; Rock 1913). Often used in the practice of ‘ōahi (firebrand tossing), the buoyant, soft fibrous wood of the pāpala was carried to coastal precipices on dark moonless nights, lit on fire, then tossed over the cliff where it was carried on the wind to create a fiery aerial display enjoyed by the people (Krauss 1993).

The treatment of the cultural history of Kapāpala Ahupua‘a in the CIA includes information on the relationship of the environmental setting and resilient kinship networks and ‘aumākua worship. There are a number of legendary and historical accounts in which Kapāpala figures prominently, many involving the goddess Pele. Kapāpala’s place in the succession of ruling lines is also discussed, from ‘Umi a Līloa through Lonoikamakahiki down to Kīwala‘ō and Kamehameha. Again, readers are referred to Appendix A of Appendix 1 for details.

Since the scope of the project is the sustainable harvest of koa for making various types of traditional canoes, the principal focus of the CIA are the practices and customs of traditional Hawaiian canoe making. The research included accounts by David Malo, Abraham Fornander, Tommy Holmes, Edgar Henriques, and Kalokuokamaile. The process of selecting, felling and extracting a canoe log was an intricate undertaking, arduous in both the physical and spiritual senses. It began with the initial rituals of the kahuna kālaiwa‘a, the ascent to the koa forest and consulting the ‘elepaio, cutting and felling rituals, and the final hewing process. The continuous use of wa‘a koa today and into the future stands as a testament to the significance of this practice and the necessity of obtaining appropriate koa trees to ensure the continuation of this long-standing customary tradition.

Finally, the CIA provides a summary of relevant accounts of visitors to Kapāpala during this period along with pertinent prior archaeological and cultural studies conducted near the project area. Of special interest was a CIA prepared in 2012 by the firm Ke Ala Pono (Uyeoka et al 2012) on behalf of the Department of Land and Natural Resources for a Management Plan for the Ka‘ū Forest Reserve (Hawai‘i DLNR 2012). Based on ethnographic interviews and historical sources cited throughout their study, Uyeoka et al. (2012:151) stated:

...the forested mauka regions of the Ka‘ū Forest Reserve were commonly used for specialized resource procurement activities....[that]...were likely centralized in specific area that contained important resources for catching/collecting birds, harvesting hardwoods for crafts and other uses, collecting medicinal plants, and spiritual practices.

They added that cultural practices continue within the Ka‘ū Forest Reserve, including the gathering of plant resources, gathering of wai from springs for ceremonial purposes, and hunting for subsistence purposes. The analysis ultimately concluded that DOFAW’s proposed activities “...should have little impact on the known cultural, resources, and beliefs...” and that several of the activities “have the potential to benefit the cultural resources of the Reserve.” To mitigate the potential impacts and community concerns about lifestyles changes and restricted access, the CIA conveyed the importance of maintaining the Ka‘ū way of life, ensuring continued and increased access into the forest reserve to allow for continued subsistence and gathering activities, and protection of the watershed through ungulate removal, invasive species control, and propagating native plants.

Identified Cultural Resources and Practices

The review of culture-historical background information in conjunction with the results of the consultation process revealed the following traditional and customary practices and valued cultural resources.

Forest Resources and Harvesting of Avian and Plant Resources

Kapāpala’s forest and all of its tangible and intangible elements have long been and continue to be recognized as a valued cultural resource. Generations of local residents have traveled to the forests of Kapāpala for a variety of bird and plant resources. Capturing birds for subsistence and artisanal purposes, most notably feathers for fashioning spectacular royal insignia including ahu‘ula (feathered cape), mahi‘ole (feathered helmet), lei (garland), kāhili (feathered standard), and other adornments, was an important practice (Gomes 2016). Although the capture of native birds, including nēnē, ‘ua‘u, ‘ō‘ō, and mamo, is no longer practiced, nēnē was identified by one of the consulted parties as still present on Kapāpala Ranch and likely in the project area. Traditional plant gathering practices that were identified through the historical record included koa harvesting for canoes, ‘iliahi, māmaki, maile and pulu.

Kālaiwa‘a and Māmaki Cultivation Settlement

Historical records indicate that settlements (kauhale) specifically for kālaiwa‘a and māmaki cultivation were established in the forest areas of Kapāpala, likely centered near Pu‘uhoakalei near Keauhou. Historians who wrote about canoe building noted that carving sites were often temporary in nature and were usually located near a water source. While culturally-related organic matter does not preserve well in the forest environment, if stone features were constructed as part of these forest settlements, it may still be possible to identify their archaeological remnants.

Trails

Historical maps identify a trail dating from at least as far back as the 1920s that extends along the southern boundary of the project area and the northeastern boundary of the Ka‘ū Forest Reserve (see Figures 29 and 30 of Appendix A of Appendix 1). This trail connects to the historic Mauna Loa and ‘Āinapō trails, both of which lie outside of the current project area and were utilized during the Precontact and Historic periods. Given the unusual curvature of the Ka‘ū Forest Reserve boundary, it is hypothesized that this trail may have been built when the boundaries of the forest reserve were formalized. It is also possible that the forest reserve boundary followed a pre-existing trail.

Caves

The mo‘olelo (story) of Nānāele recounted in the CIA includes a cave system that reportedly extended from Ka‘ālaiki to Kapāpala, specifically to “a spot back of the Kapāpala stock ranch.” Furthermore, in the battle of Kaua‘awa, upland caves were used as temporary refuges. Although the cave noted in the story of Nānāele is likely not within the project area, other refuge or temporary shelter caves may be present.

Water Resources

Traditional stories and historical maps take note of some of the most valued natural resources in Kapāpala: water holes. A mo‘olelo involving Pele, Waka, and Puna‘aikoa‘e (half man and half bird) tells of Waka’s passage through Kapāpala and the water holes he visited – important to a creature who manifested as a mo‘o. Maps show a number of water holes near but outside KKCMA, including Koiki and various unnamed features. Similar undocumented resources may be present within the project area and could be found during project activities.

Ranching

Ranching has been a part of the history and traditions of Kapāpala since the 1860s. Although not generally considered a traditional cultural practice per se, ranching is recognized as an important Historic-era activity that was and still is a major part of Hawai‘i’s history. Since the establishment of the KKCMA in 1989, ranching activities have ceased on the parcel itself, but the ranching lifestyle continues to thrive at adjacent Kapāpala Ranch. One of the KKCMA

Working Group participants works at and manages Kapāpala Ranch. Many other members have memories of the ranch or horseback riding in the area.

Hunting

Subsistence hunting was identified by several of the consulted parties as an ongoing practice at KKCMA as well as within the adjacent forest reserves. While hunting feral pigs and other game for subsistence or sport is not considered an ancient traditional cultural practice (see Burrows et al 2007), it has developed to be integral to the subsistence and sharing cultural system prevalent in Ka‘ū, which depends on gathering, hunting, fishing, and small scale agriculture.

Impacts and Mitigation Measures

The Plan has been designed in close coordination with cultural experts to ensure that each of the identified cultural resources and practices will be protected as part of management of KKCMA.

The upland forest of Kapāpala has been utilized since the Precontact and Historic periods for a variety of practices, including harvest of koa for the construction of koa canoes. All consultees for the CIA felt that the sustainable harvest of koa from the KKCMA for the construction of koa canoes used customarily for fishing, outrigger canoe racing, and voyaging would likely yield net positive cultural impacts. Furthermore, nearly all of the consulted parties spoke about the importance of responsible human interaction and management with forest resources as a way to mitigate further loss and improve connection and respect for such spaces.

Harvesting of koa for canoe construction has quietly persisted for many generations. Canoe builders with the knowledge and capacity to transform a log into a usable canoe expressed concern about canoe construction as a dying art, as only a handful continue to practice. They spoke about the challenges of obtaining a suitable log and having to work with various landowners, all of whom can impose different restrictions on canoe builders. Because of the difficulties in obtaining a suitable koa log, canoe building is often left to the experts, with little room to include upcoming builders who need experience working with koa. In the view of the consultees, Hawai‘i’s koa forest has for hundreds of years sustainably furnished native builders with the materials needed to make canoes. It was the canoe that allowed early Polynesian voyagers to cross vast oceans and establish Hawai‘i as their permanent home. The canoe allowed them to travel from place to place around these islands, engage in inter-island warfare, and procure food from the shallow and deep seas. Its importance in Hawaiian culture cannot be overstated. Now would appear to be a critical time if the practice of traditional koa canoe-making is to endure.

Nonetheless, consultees stressed that the project needed to be implemented thoughtfully in order to avoid adverse impact to other cultural-natural resources. Given that this is the first project of this nature in Hawai‘i, the consensus is that the State must explore traditional and non-traditional methods of forest management. New partnerships must be forged, existing partnerships improved, and strategies for sustainable funding to manage the KKCMA must be sought. For a project of this nature, DLNR-DOFAW must draw equally upon both traditional and scientific knowledge to strike a balance that will sustain the resources, including kānaka on this ‘āina. The

following actions that were recommended during consultation and evaluated in the CIA are being adopted in the Plan to mitigate for potential impacts on the above-identified valued resources and cultural practices.

- Pending funding approval, DOFAW will seek to hire at least one full-time staff member dedicated to managing KKCMA in order to facilitate access, reduce potential impacts to the area's resources and associated practices, and coordinate communication with the community.
- To identify and protect historic resources that may be located in the KKCMA project area, DOFAW will ensure that archaeological surveys of affected areas are conducted. DOFAW will consult with the DLNR-State Historic Preservation Division to determine the proper scope of the survey area(s). At a minimum, an archaeological survey will be undertaken once a potential harvest area is defined and before any harvesting activities are carried out. This action will ensure that any historic resources (i.e. potential settlements, caves, trails, or ranching era resources) potentially located within the harvest area are properly identified and documented, and that protective measures are implemented. Areas where historic resources are identified will be demarcated on a map and made identifiable in the field. Efforts will be made to preserve in place all historic resources that may exist in the KKCMA project area.
- DOFAW will seek to utilize traditional place names and Hawaiian environmental zones (wao) in its management. Proper utilization of place names, as well as the names of associated individuals such as former konohiki, is one way to ensure the place-based knowledge of Kapāpala is carried forth into the future.
- In keeping with a prevalent theme that emerged from the cultural consultation process, DOFAW will seek to collaborate in the development of educational and stewardship opportunities specific to Kapāpala and Ka'ū. DOFAW will strongly encourage hālau (organizations) who receive logs from the KKCMA to participate in such educational and stewardship activities. DOFAW will promote community involvement in educational and stewardship opportunities and may partner with Ka'ū-based organization organization(s) with capacity to carry out such activities.
- DOFAW will require all hālau to include and implement a plan for culturally appropriate forms of reciprocity when applying for the harvest of a koa log. This could include assisting with stewardship activities, participating in educational opportunities, and/or making culturally appropriate offerings.
- The existing working group will continue to be utilized and will be formalized through the BLNR approval of the management plan and the canoe log allocation process, both of which highlight the integration of the working group. This group can help ensure appropriate cultural protocols are being followed and advise on planned activities. DOFAW will reach out to builders, kūpuna and kama'āina of Kapāpala and Ka'ū, canoe clubs, and other stakeholders.
- Harvest of koa logs inevitably involves some damage to nearby native plants. To make up for this, DOFAW will encourage utilization of the existing collection permit process to allow for gathering of usable forest products, including those damaged during harvest operations.

- DOFAW will post ample notice at the entrance into the KKCMA and any other appropriate outlets notifying the public when harvest activities are scheduled. DOFAW will schedule and coordinate harvest activities to avoid unnecessary disruption to other planned (i.e. education or stewardship activities) or unplanned (subsistence or commercial gathering) activities, and to allow the forest to rest and regenerate until the next harvest.

The Draft EA was made available to agencies and groups who might potentially have additional cultural information or concerns. No party reviewing the Draft EA supplied any additional cultural information.

3.5 Air Quality, Noise and Scenic Resources

Existing Environment

Manmade air pollution in the Kapāpala area is minimal. The principal influence on air quality there is volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog) that chronically blankets the district when Kīlauea Volcano is erupting, as discussed in Section 3.2.

Sound levels at KKCMA are currently minimal and are derived from natural sources such as wind and birdsong. Helicopters engaged in sightseeing tours or conservation actions infrequently pass over the site and briefly produce moderate levels of noise. No sensitive human noise receptors such as residences, schools, hospitals, etc., are present nearby, but a wilderness, upper elevation section of Hawaii Volcanoes National Park is located about three miles to the west.

As detailed in the Hawai'i County General Plan, Ka'ū is notable for containing most of Hawai'i Volcanoes National Park, a vast natural area with great contrasts between open lava land with little or no vegetation, dense native 'ōhi'a-lehua forests, extensive shrublands and grasslands, and spectacular coastlines. In the southern part of Ka'ū the natural beauty of the landscape is characterized by vistas from the mountain slopes to the ocean. The coast is highlighted by Manukā Bay, Green Sands Beach, and Punalu'u Black Sand Beach. Crowning views from most *makai* vantages are the misty uplands of the Ka'ū Forest Reserve, containing scenic eroded mountain forms that contrast with the immense shield of the remainder of Mauna Loa, truly the largest mountain on earth. KKCMA itself, although supporting a healthy, scenic forest, is not readily visible from public viewpoints due to the distance from the highway and gradual slope of Mauna Loa. Where visible, it blends into the background of Kapāpala and the Ka'ū Forest Reserve.

Impacts and Mitigation Measures

Harvest, stand improvement and road maintenance would each produce minor impacts to air quality, primarily through engine emissions. All equipment will be maintained to meet emissions specifications. Negligible quantities of dust may be produced during grading and maintenance operations. The remote nature of the area far from water sources will preclude utilizing water

trucks for dust suppression, but this would be unnecessary because of the very small scale of work at any given time.

Several aspects of the project will produce periodic noise, including harvest, stand improvement and road maintenance that are not expected to substantially impact any human activity. The timing and location of harvest operations, which will generally involve felling trees with chainsaws and or bulldozers, will be planned to avoid noise that affects sensitive native fauna, as discussed in Section 3.1. The optional extraction method of helicopter operations would similarly produce brief but intense noise in the harvest area, and also some level of noise while transiting between Hilo or other locations to the harvest site. Due to the limited local availability of machinery capable of helicopter extractions, and the lack of local experience in operations, helicopter extraction is not a likely near-term option. If these circumstances change, helicopter extraction would still be quite infrequent (<5-10/year max) and would not significantly alter the regions' soundscape or affect other users in a significant way.

Implementation of the Plan would preserve the native vegetation of KKCMA, the principal element that contributes to its scenic value. Although stand improvement and harvests will alter the forest's appearance in limited areas, no general scenic impact is expected, and no mitigation measures are necessary.

3.6 Consistency with Land Use Designations, Permits, Plans and Policies

The KKCMA property is within the State Land Use Agricultural District and is zoned A-20a (Agriculture, minimum lot size 20 acres) by the County of Hawai'i. All proposed activities are permitted uses within these designations.

The Plan requires approval by the Hawai'i State Board of Land and Natural Resources before any harvest or silvicultural operations are implemented. Prior to each harvest operation, a Special Use Permit will be required of applicant organizations from DOFAW that will detail measures to minimize impacts to natural and cultural resources. As a part of the Special Use Permit, organizations must have an approved harvest plan that meets DLNR/DOFAW requirements as outlined in section 5 of Appendix 1. In addition to permits and approvals, the following sections detail general consistency with State and County plans.

3.6.1 Hawai'i State Plan

Adopted in 1978 and last revised in 1991 (Hawai'i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State's long-run growth and development activities. The three themes that express the basic purpose of the *Hawai'i State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being.

The "overall direction" of the Hawai'i State Plan is to improve the quality of life through proper management of the State's land resources, as presented in Section 226-102:

The State shall strive to improve the quality of life for Hawaii's present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.

Among the sections of the Hawai'i State Plan most relevant to the Plan are the following. Section 226-11 deals with land-based, shoreline and marine resources in the physical environment:

Objectives: Planning for the State's physical environment with regard to land-based, shoreline and marine resources shall be directed towards achievement of the following objectives: (1) prudent use of Hawai'i's land-based, shoreline and marine resources and (2) effective protection of Hawai'i's unique and fragile environmental resources. To achieve those objectives, the Plan notes it shall be the policy of the state to:

- (a) Exercise an overall conservation ethic in the use of Hawai'i's natural resources.
- (b) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.
- (c) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.
- (d) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.
- (f) Pursue compatible relationships among activities, facilities, and natural resources.
- (g) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.

Section 226-12 states objectives for the scenic, natural beauty, and historic resources of the physical environment:

Objective: Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawai'i's scenic assets, natural beauty, and multi-cultural/historical resources. To achieve that objective, it shall be the policy of this State to:

- (a) Promote the preservation and restoration of significant natural and historic resources.
- (b) Provide incentives to maintain and enhance historic, cultural, and scenic amenities.
- (c) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
- (d) Protect those special areas, structures, and elements that are an integral and functional part of Hawai'i's ethnic and cultural heritage.

Also relevant is Section 226-13, which concerns land, air and water quality of the physical environment:

Objectives: Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following: (1) Maintenance and pursuit of improved quality in Hawai'i's land, air, and water resources, and (2) Greater public awareness and appreciation of Hawaii's environmental resources. To achieve those objectives it shall be the policy of the State to:

- (a) Foster educational activities that promote a better understanding of Hawai'i's limited environmental resources.
- (b) Promote the proper management of Hawaii's land and water resources.
- (c) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.
- (d) Foster recognition of the importance and value of the land, air and water resources to Hawai'i's people, their cultures and visitors.

The following objective and policies are taken from Section 226-25, relating to culture:

Objective: Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawaii's people. To achieve the objective, it shall be the policy of this State to:

- (a) Foster increased knowledge and understanding of Hawai'i's ethnic and cultural heritages and the history of Hawai'i.
- (b) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people and which are sensitive and responsive to family and community needs.
- (c) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawai'i.

Also relevant to the Plan project is the objective and policy from Section 226-27 pertaining to government and socio-cultural advancement:

Objective: Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of efficient, effective, and responsive government services at all levels in the State. To achieve that objective, it shall be the policy of this State to:

- (a) Provide for necessary public goods and services not assumed by the private sector.

Evaluation of Consistency: In general, implementation of the KKCMA Plan would be highly consistent with State goals and objectives that call for preservation and restoration of natural, cultural and recreational resources. It would help fulfill the overall direction of the Hawai'i State Plan by contributing to management of land resources that balances natural resource protection with responsible human uses that support important cultural purposes, particularly the call to support the cultural identities, traditions, values, customs, and arts of Hawai'i's people.

3.6.2 Hawai'i Forest Reserve Laws, Regulations and Policies

Chapter 183, Part II, Hawaii Revised Statutes, Forest Reserves

This law provides for the establishment and maintenance of Forest Reserves. Most relevant to the discussion of consistency are the duties of DLNR and the ability to remove feral cattle and horses.

§183-1.5 Duties in general.

- (3) Have the power to manage and regulate all lands which may be set apart as forest reserves;
- (4) Devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make that water supply available for use;
- (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 in whole or in part;

§183-19 Exclusion of livestock from forest reserves, game management areas, public hunting areas, and natural area reserves; notice. When branded wild cattle or horses are found on any forest land, game management area, public hunting area, or natural area reserve in the State, which land is duly set apart and established as a forest reserve, game management area, public hunting area, or natural area reserve, or if the land is privately owned and surrendered as defined in section 183-15, the department, in all cases where the land is so set apart and established as a forest reserve, game management area, public hunting area, or natural area reserve, whether from privately owned lands or public lands, may remove, shoot, or destroy the cattle or horses without compensation to the owner, after thirty days' public notice of the intended action in the county where the cattle or horses are found.

Evaluation of Consistency: The Plan has been specifically designed by the agency entrusted with managing the State's Forest Reserves to fulfill and be consistent with all aspects of Chapter 183, Part II, including the sections cited above.

3.6.3 Hawai'i County General Plan

The *General Plan* for the County of Hawai'i is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawai'i. The plan was adopted by ordinance in 1989 and revised in 2005 (Hawai'i County Planning Department). The *General Plan* itself is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai'i. Most relevant to the proposed project are the following Goals, Policies and Standards of particular chapters of the General Plan:

Economic – Goals

- Promote and develop the island of Hawaii into a unique scientific and cultural model, where economic gains are in balance with social and physical amenities. Development should be reviewed on the basis of total impact on the residents of the County, not only in terms of immediate short run economic benefits.

Economic – Goals

- Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural and social environment.

Environmental Quality – Goals

- Define the most desirable use of land within the County that achieves an ecological balance providing residents and visitors the quality of life and an environment in which the natural resources of the island are viable and sustainable.
- Maintain and, if feasible, improve the existing environmental quality of the island.
- Control pollution.

Environmental Quality – Policies

- Take positive action to further maintain the quality of the environment.
- Advise the public of environmental conditions and research undertaken on the island's environment.

Environmental Quality – Standards

- Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.
- Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.
- Federal and State environmental regulations shall be adhered to.

Natural Beauty – Goals

- Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.
- Protect scenic vistas and view planes from becoming obstructed.
- Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

Natural Resources and Shoreline – Goals

- Protect and conserve the natural resources from undue exploitation, encroachment and damage.
- Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.
- Protect rare or endangered species and habitats native to Hawaii.
- Protect and effectively manage Hawaii's open space, watersheds, shoreline, and natural

areas.

Natural Resources and Shoreline – Policies

- Encourage a program of collection and dissemination of basic data concerning natural resources.
- Coordinate programs to protect natural resources with other government agencies.
- Encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.
- Encourage an overall conservation ethic in the use of Hawaii's resources by protecting, preserving, and conserving the critical and significant natural resources of the County of Hawaii.
- Encourage the protection of watersheds, forest, brush and grassland from destructive agents and uses.
- Work with the appropriate State, Federal agencies, and private landowners to establish a program to manage and protect identified watersheds.
- Create incentives for landowners to retain and re-establish forest cover in upland watershed areas with emphasis on native forest species.

Natural Resources and Shoreline – Standards

- The following shall be considered for the protection and conservation of natural resources:
 - Areas necessary for the protection and propagation of specified endangered native wildlife, and conservation for natural ecosystems of endemic plants, fish and wildlife.
 - Lands necessary for the preservation of forests, park lands, wilderness and beach areas.

Land Use – Public Lands - Goal

- Utilize publicly owned lands in the best public interest and to the maximum benefit for the greatest number of people.

Land Use – Public Lands – Policy

- Encourage uses of public lands that will satisfy specific public needs, such as housing, recreation, open space and education.

Land Use – Public Lands - Standard

- Public lands with unique recreational and natural resources shall be maintained for public use.

Evaluation of Consistency: The Plan will fulfill the specifications of the Hawai'i County General Plan in many ways. The harvest of koa canoe logs is an exemplary economic opportunity that is compatible with the County's goals of promoting local culture while also maintaining and improving the environmental quality of the island through protecting native forest habitat and watershed values. Implementation of the Plan would not affect important vantages and vistas. It is in keeping with goals, objectives and policies related to native forests

and watersheds, specifically fulfilling the Natural Resources and Shoreline elements of the Hawai‘i County General Plan. It preserves recreational opportunities directly, through ensuring the supply of the most important raw material for traditional Hawaiian canoes, and indirectly, through preserving hiking and hunting.

3.6.4 Ka‘ū Community Development Plan (CDP)

This CDP encompasses the judicial district of Ka‘ū, and was developed under the framework of the February 2005 County of Hawai‘i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. CDPs are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area. The intention and scope of the Ka‘ū CDP is best summarized in its Community Objectives, which are explicitly intended for, among others, agencies seeking to implement forestry (Hawai‘i County Planning Department 2017:15):

ENCOURAGE SUSTAINABLE SETTLEMENT PATTERNS

- Objective 1: Encourage future settlement patterns that are safe, sustainable, and connected. They should protect people and community facilities from natural hazards, and they should honor the best of Ka‘ū’s historic precedents: concentrating new commercial and residential development in compact, walkable, mixed-use town/village centers, allowing rural development in the rural lands, and limiting development on the shorelines.
- Objective 2: Preserve prime and other viable agricultural lands and preserve and enhance viewsapes that exemplify Ka‘ū’s rural character.

CONSERVE AND MANAGE NATURAL AND CULTURAL RESOURCES

- Objective 3: Protect, restore, and enhance ecosystems, including mauka forests and the shorelines, while assuring responsible access for residents and for visitors.
- Objective 4: Protect, restore, and enhance Ka‘ū’s unique cultural assets, including archeological and historic sites and historic buildings.
- Objective 5: Establish and enforce standards for development and construction that reflect community values of architectural beauty and distinctiveness.
- Objective 6: Encourage community-based management plans to assure that human activity doesn’t degrade the quality of Ka‘ū’s unique natural and cultural landscape.

ENHANCE COMMUNITY INFRASTRUCTURE

- Objective 7: Identify viable sites for critical community infrastructure, including water, emergency services and educational facilities to serve both youth and adults.
- Objective 8: Establish a rural transportation network, including roadway alternatives to Highway 11, a regional trail system, and an interconnected transit system.

BUILD A RESILIENT LOCAL ECONOMY

- Objective 9: Preserve and greatly enhance nā ‘ohana economy.

- Objective 10: Encourage and enhance agriculture, ranching, and related economic infrastructure.
- Objective 11: Increase the number and diversity of income sources for residents, including jobs and entrepreneurial opportunities that complement Ka‘ū’s ecology, culture, and evolving demographics.
- Objective 12: Establish or expand retail, service, dining, and entertainment centers in rural villages and towns capable of supporting Ka‘ū-appropriate growth.

All objectives require consideration of the concept of the ‘ohana institution. In the words of the CPD (Ibid: 7):

Embedded in this understanding is an innate awareness that the three pillars of rural life – land, community, and livelihood – are inseparable. In *The Polynesian Family System in Ka‘ū*, Mary Kawena Puku‘i referred to this as the “management of the household,” known in Hawaiian as the institution of ‘ohana. According to Tūtū Puku‘i, features of ‘ohana include a cohesive force tied by ancestry to the ‘āina, genuine community spirit of mutual benefit, economic exchange regulated by relationships, and voluntary giving of food, possessions, services, and communal labor.

The ‘ohana system sustained generations of families in Hawai‘i and remains a vital force that gives the people of Ka‘ū their resilience. People live off the land, and the medium of exchange is reciprocity. The people of Ka‘ū grow food in gardens, gather it from the shoreline and forest, fish for it in the ocean, and hunt for it mauka. More importantly, the people of Ka‘ū share what they have. Bounty from the garden or hunt is shared with ‘ohana, which includes far more people than those connected by blood. As one resident put it, “Only in Ka‘ū. We share, that’s the Ka‘ū style – with our family, our neighbors, everyone.”

These practices feed families, bring communities together, and create a means for sharing cultural wisdom from one generation to the next. By sustaining and nurturing this relationship with ‘āina that families have used to survive and thrive in Ka‘ū for generations, the local economy is built on the foundation of the region’s unique natural, cultural, and social assets.

Evaluation of Consistency: The KKCMA Plan is highly consistent with the Ka‘ū Community Development Plan, in that, among other actions, it 1) involves a community-based management plan vital for a culturally-based land use that also ensures that human activity doesn’t degrade the quality of Ka‘ū’s unique natural and cultural landscape; 2) protects of mauka forests while ensuring responsible access for and use by residents; and 3) preserves and enhances the nā ‘ohana economy and incorporates the concept of reciprocity as part of koa canoe timber harvest. No aspect of the KKCMA Plan is inconsistent with the CDP.

3.7 Cumulative and Secondary Impacts

Cumulative effects may occur when the adverse effects of a proposed action are added to other past, present, and reasonably foreseeable future actions of any government or private entity. In some cases, the direct effects of a project may be minor but the cumulative effects significant.

In analyzing cumulative effects, it is important to first identify actions in nearby areas with the potential to have impacts that interact with those of the proposed project. As shown in Figure 1, KKCMA is near three areas – Hawaii Volcanoes National Park, the Kapāpala Forest Reserve and the Ka‘ū Forest Reserve – that are undergoing uses aimed primarily at conservation, although recreational, subsistence and gathering uses also occur there, particularly in the State of Hawai‘i units. KKCMA is also adjacent to Kapāpala Ranch, where the primary activity with potential to have interactive effects is cattle ranching. No major projects are known to be in planning for nearby areas. The localized, short-term disturbances at KKCMA caused by tree harvest, stand improvement, infrastructure and invasive species response may include effects to biota, noise, erosion, emissions, and scenic values, which are expected to be extremely minor, temporary and insignificant. These would not tend to accumulate with the ongoing conservation and ranching activities on the other nearby properties, where similar actions are highly dispersed over a very large area and have generally minor effects that are fully mitigated through their own management plans and/or standard management practices.

However, the harvest process can produce two categories of effects that while minor do have at least some potential to interact with those of other activities in Ka‘ū: helicopter extraction (which may occasionally occur) and transport of logs on oversize load large trucks on Highway 11 (which will occur for each harvested tree). The potential for significant cumulative effects from truck transport of logs is small. The expected harvest level would be 5 to 15 canoe logs per year, and it will frequently be the case that for logistical purposes, multiple trees will be harvested in the same operation. The number of days with oversize loads will thus likely be considerably fewer than 15, or approximately once per month. Furthermore, unlike other parts of the island where oversize loads are more common because of military, astronomy or wind turbine related transport, few oversize loads travel Highway 11 between Kapāpala and Hilo. Nonetheless, as discussed in Section 3.3, DOFAW will utilize the Special Use Permit process to coordinate during harvest operations with the Department of Transportation and the oversize load permit application to determine if any alternate scheduling is needed to reduce interaction with other planned oversize loads. As discussed in Section 3.5, helicopter operations are currently not a near-term operation expected to be implemented at KKCMA. If they were, they could produce brief but intense noise that is localized in the harvest area, and also brief, moderate noise while transiting from Hilo or other locations to the harvest site. However, even if implemented, the occasional helicopter extraction would not significantly alter the region’s soundscape or affect other users in a significant way, even when combined with tourist and resource management helicopter operations that are known to occasionally occur in Hawaii Volcanoes National Park, the Kapāpala Forest Reserve and the Ka‘ū Forest Reserve.

In sum, cumulative effects are negligible for most categories of effect and extremely minor for noise and oversize traffic.

Secondary impacts occur when projects induce physical and social impacts that are only indirectly related to the project – e.g., effects on housing scarcity when a major resort is constructed in a rural area. The project will not create a large number of new jobs that could lead to in-migration and will not cause stresses on government infrastructure or induce any other type of adverse secondary effects.

3.8 Summary of Mitigation Measures

DOFAW will implement or supervise the implementation of the following mitigation measures as part of KKCMA management. These mitigation measures may be modified as a result of feedback during adaptive management. Table 3 provides a summary of measures.

Table 3-1. Summary of Mitigation Measures

Subject (Reference)	Mitigation
Vegetation and Flora (3.1.1)	<ul style="list-style-type: none"> • Prior to activities with the potential to impact rare or T&E plants, botanists will conduct botanical surveys and identify and map any such species. • Inform regulatory agencies if T&E species found and implement further mitigation if needed. • Establish buffers of at least 50 feet in radius around any sensitive plants and flag area. No harvest, tree fall or skid roads allowed inside buffer. • Build facilities and route roads and trails in non-sensitive areas or in ways that protect rare plants. • Conduct weed control to avoid impacts to non-target species. • Staff, volunteers and contractors will follow protocols for cleaning of boots, equipment and vehicles to avoid introducing or spreading invasive plant species. <ul style="list-style-type: none"> • Provide kiosks for invasive species education and action for members of the public accessing the area. • Follow up monitoring of harvest areas will be used to track the presence and potential establishment of invasive weed populations.
Native Wildlife (3.1.2)	<ul style="list-style-type: none"> • Utilize extra caution between March 1 to September 30 during nesting and fledging season of several native bird species. Survey immediate area prior to harvest for native bird nests in or near trees being felled. • If hawks are nesting within 330 feet, the harvest will not proceed until the juvenile hawk has fully fledged. • Conduct annual bird surveys to verify the distribution of all species and particularly T&E species in order to optimize mitigation. • To protect Hawaiian hoary bats, no tree harvest or thinning operations that disturb trees or shrubs taller than 15 feet will occur between June 1 and Sept. 15. • Avoid installing any new top-strand barbed wire, which can entangle bat wings and injure or kill them. <ul style="list-style-type: none"> • Survey for rare or T&E native invertebrates and seek to avoid habitat and obligate host plants as part of adaptive management.
Wildfire, Pests and Invasive Fauna (3.1.3)	<ul style="list-style-type: none"> • Maintain perimeter road and interior crossroad as fuelbreaks. • Monitor drought and fire activity in surrounding areas to determine level of wildfire risk at KKCMA. Depending on fire risk, access to the area may be temporarily restricted. • Improve and maintain the helicopter landing zone to prepare for wildfire response.

	<ul style="list-style-type: none"> • Secure and identify water access to prepare for wildfire control. • Conduct assessment of koa pest insects and diseases as part of all monitoring activities, including timber inventory. • Assist and collaborate with partners to secure essential technical information and understanding of new threats. • Include ROD sanitation and prevention procedures in all project activities conducted by DOFAW and also for all collection permits issued for KKCMA, including minimizing wounds to ‘ōhi‘a trees during harvest operations. • Avoid damaging ‘ōhi‘a trees by hand-clearing a path for the machinery ahead of time. Place the path where valuable trees are less dense and make the path only as wide as needed to fit the machine. • Monitor for signs of increased ROD distribution within KKCMA. • Utilize forest bird surveys to monitor distribution of avian malaria. • Ensure that all pesticide use strictly follows labeling requirements. • Continue ongoing regular fence checks, monitor for cattle in order to prevent ingress and identify and remove any invading cattle. • Install cattle guards at strategic locations. • Monitor for sheep, mouflon, and goats via staff observations and game cameras to ensure they do not enter area and browse native vegetation. • Increase pig control in the area, including utilizing public hunting; implementing staff control through the use of trapping and staff hunting; and adding skirting to the fenceline as funds are available. • Monitor rats, cats and mongooses in order to reduce their populations. If control of rodents is implemented to protect native wildlife, it will use toxic baits with a low toxicity to non-target wildlife in enclosed bait stations carefully and in strict compliance with toxicant registration.
Climate and Geology (3.2)	<ul style="list-style-type: none"> • Conduct regular road maintenance, especially re-grading dirt roads and gravel-filling potholes in rocked/gravel roads, as necessary. • Keep skid trails generally at 3-5% slope and not over 10%. • Include water bars or drainage features on steeper skid trails. • In general, maintain and re-use existing skid trails, instead of clearing a new skid trail, especially if needed for ongoing weed control, enrichment planting, thinning, etc. GPS-marked all skid trails to maintain a location record. • If skid trails are retired, cover with harvest slash piles (treetops, small branches) as mulch to prevent erosion and use of discontinued trail. • To reduce erosion and for safety, halt operations during heavy rain and storm events and postpone until staff deem roadways safe.
Socioeconomic Conditions, Access, Hunting and Recreation (3.3)	<ul style="list-style-type: none"> • Harvest, stand improvement, and infrastructure improvements will focus on small areas at any one time and implemented so as to induce minimal interference with hunting, hiking, birding and forest resource gathering in KKCMA as a whole. • Pig hunting will continue to be permitted per regulations governing Hunting Unit B in forest reserves, with the goal of reducing the pig population to levels consistent with maintaining KKCMA management goals. • Ensure through the Special Use Permit for harvest that heavy equipment and logs are transported in accordance with all applicable regulations and that DOFAW and/or canoe organizations obtain the appropriate approvals per an Application to Operate or Transport Oversize and/or Overweight Vehicles and Loads over State Highways. • Ensure that truck weight loads are professionally estimated prior to transport on highways and to ports for off-island shipment.
Cultural Resources (3.4)	<ul style="list-style-type: none"> • If funding is approved, seek to hire at least one full-time staff member dedicated to managing KKCMA in order to facilitate access, reduce potential impacts to the

	<p>area's resources and associated practices, and coordinate communication with the community.</p> <ul style="list-style-type: none"> • Ensure that archaeological surveys of affected areas are conducted. DOFAW will consult with the DLNR-State Historic Preservation Division to determine the proper scope of the survey area(s). At a minimum, an archaeological survey will be undertaken once a potential harvest area is defined and before any harvesting activities are carried out. Areas where historic resources are identified will be demarcated on a map and made identifiable in the field. Efforts will be made to preserve in place all historic resources that may exist in the KKCMA project area. • Seek as part of management to utilize names of traditional places, Hawaiian environmental zones (wao) and associated individuals such as former konohiki in order to perpetuate the place-based knowledge of Kapāpala. • Collaborate in the development of educational and stewardship opportunities specific to Kapāpala and Ka'ū. Strongly encourage hālau who receive logs from the KKCMA to participate in such educational and stewardship activities. Promote community involvement in educational and stewardship opportunities and may partner with Ka'ū-based organization organization(s) with capacity to carry out such activities. • Require all hālau (organizations) to include and implement a plan for culturally appropriate forms of reciprocity when applying for the harvest of a koa log. This could include assisting with stewardship activities, participating in educational opportunities, and/or making culturally appropriate offerings. • The existing working group will continue to be utilized and will be formalized through the BLNR approval of the management plan and the canoe log allocation process, both of which highlight the integration of the working group. This group can help ensure appropriate cultural protocols are being followed and advise on planned activities. DOFAW will reach out to builders, kūpuna and kama'āina of Kapāpala and Ka'ū, canoe clubs, and other stakeholders. • Encourage utilization of the existing collection permit process to allow for gathering of usable forest products, including those damaged during harvest operations. • Post ample notice at the entrance into the KKCMA and any other appropriate outlets notifying the public when harvest activities are scheduled. Schedule and coordinate harvest activities to avoid unnecessary disruption to other planned (i.e. education or stewardship activities) or unplanned (subsistence or commercial gathering) activities, and to allow the forest to rest and regenerate until the next harvest.
Air Quality, Noise and Scenic Resources (3.5)	<ul style="list-style-type: none"> • Maintain all equipment to meet emissions specifications.
Consistency with Plans and Policies (3.6)	None warranted (Plan is consistent).
Secondary and Cumulative (3.7)	<ul style="list-style-type: none"> • Utilize the Special Use Permit process to coordinate during harvest operations with the Department of Transportation and the oversize load permit application to determine if any alternate scheduling is needed to reduce interaction with other planned oversize loads.

PART 4: DETERMINATION

Based on the findings below, and upon consideration of comments to the Draft EA, the Hawai‘i State Department of Land and Natural Resources (DLNR) has determined that the proposed action will not have any significant effect in the context of Chapter 343, Hawai‘i Revised Statutes and Chapter 11-200.1-13 of the State Administrative Rules, as impacts will be minimal, and will accordingly issue a Finding of No Significant Impact (FONSI).

PART 5: FINDINGS AND REASONS

Chapter 11-200.1-13, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

(a) In considering the significance of potential environmental effects, agencies shall consider and evaluate the sum of effects of the project on the quality of the environment.

(b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a project, the expected impacts, and the proposed mitigation measures. In most instances, an action shall be determined to have a significant effect on the environment if it may:

1. *Irrevocably commit a natural, cultural, or historic resource.* Implementation of the Plan would substantially protect natural resources and benefit cultural practices and involve a balanced use of cultural and natural resources. Historic resources would be protected through incremental archaeological surveys that successively cover the small areas of harvest and infrastructure prior to any disturbance.
2. *Curtail the range of beneficial uses of the environment.* No restriction of beneficial uses would occur and implementation would sustain beneficial cultural uses and habitat protection uses into the future.
3. *Conflict with the State’s environmental policies or long-term environmental goals established by law.* The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project is environmentally beneficial and minor, and it is thus consistent with all elements of the State’s long-term environmental policies.
4. *Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State.* The project would not have any substantial adverse effect on the economic or social welfare of the Big Island community or the State of Hawai‘i. No valuable natural resources or cultural or recreational practices such as forest access, gathering, hunting, or access to ceremonial sites would be substantially affected. The social and economic welfare of the area would be enhanced through culturally appropriate and environmentally sustainable harvest of koa canoe logs.
5. *Have a substantial adverse effect on public health.* The project would not affect public

health and safety in any adverse way.

6. *Involve adverse secondary impacts, such as population changes or effects on public facilities.* The project would not produce any major secondary impacts, such as population changes or effects on public facilities.
7. *Involve a substantial degradation of environmental quality.* The project is minor and environmentally benign, and thus it would not contribute to environmental degradation.
8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions.* Nearby areas where ongoing activities or new projects could generate adverse impacts that could accumulate with those of the proposed project include Hawaii Volcanoes National Park, the Kapāpala Forest Reserve, the Ka‘ū Forest Reserve and Kapāpala Ranch. The first three are undergoing uses aimed primarily at conservation, although recreation, subsistence uses and gathering also occur there. The latter supports cattle ranching. No major projects are known to be in planning for any of these nearby areas. The localized disturbances at KKCMA caused by tree harvest, stand improvement and invasive species response may include effects to biota, noise, erosion, emissions, and scenic values, which are expected to be extremely minor, temporary and insignificant. These would not tend to accumulate with the ongoing conservation and ranching activities on the other nearby properties, where similar actions are highly dispersed over a very large area and have generally minor effects that are fully mitigated through their own management plans and/or standard management practices. However, the harvest process can produce two categories of effects that while minor do have at least some potential to interact with those of other activities in Ka‘ū: helicopter extraction (which may occasionally occur) and transport of logs on oversize load large trucks on Highway 11 (which will occur for each harvested tree). The infrequent occurrence of truck transport related to KKCMA and the relative infrequency of other oversize loads on Highway 11 will minimize the potential for significant cumulative effects. If implemented in the future, helicopter operations could produce brief but intense noise that is localized in the harvest area, and also brief, moderate noise while transiting from Hilo or other locations to the harvest site. These operations would occur very infrequently, if at all (<5-10/ times year), and would not significantly alter the regions’ soundscape or affect other users in a significant way, even when combined with tourist and resource management helicopter operations that are known to occasionally occur in Hawaii Volcanoes National Park, the Kapāpala Forest Reserve and the Ka‘ū Forest Reserve. In sum, cumulative effects are negligible for most categories of effect and extremely minor for noise and oversize traffic.
9. *Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.* Overview biological surveys have determined that various species of rare and T&E fauna are present and will require mitigation in order to avoid impacts. This mitigation is an integral component of the Plan. Rare and T&E plants have not been observed, but all actions will be preceded by a full botanical survey and mitigation measures will be implemented to prevent impacts.
10. *Have a substantial adverse effect on air or water quality or ambient noise levels.* No substantial effects to air, water, or ambient noise would occur. Localized and temporary effects

would occur during harvest, stand improvement and road maintenance. If any logs are extracted by helicopters in the future, more wide-ranging but minor, brief and infrequent noise impacts could occur. Erosion and sedimentation impacts will be avoided by implementation of Best Management Practices during Plan operations.

11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.* Although the project would be located in an area with minor volcanic and moderate seismic risk, the entire Island of Hawai‘i shares this risk, and the Plan is not imprudent to implement. The project site is not located in a flood zone nor sensitive waters and would not affect any such areas. The project site is more than 3,000 feet above sea level and will not be affected directly by sea level rise. The project has adapted to climate change by accounting for the potential for larger storms in its extensive erosion BMPs.

12. *Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies.* The proposed action is not anticipated to adversely affect any vistas or viewplanes identified in county or State plans or studies and will benefit visual quality through maintenance of native forests. No lighting is involved.

13. *Require substantial energy consumption or emit substantial greenhouse gases.* While non-negligible amounts of energy input and greenhouse gas emission would be required for implementation, the Plan involves a sustainable forestry operation that will assist in carbon capture and storage.

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ENVIRONMENTAL ASSESSMENT

Kapāpala Koa Canoe Management Area Plan

APPENDIX 1

Kapāpala Koa Canoe Management Area Plan

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KAPĀPALA

KOA CANOE MANAGEMENT AREA

Management
Plan 2023



EXECUTIVE SUMMARY

This management plan for the Kapāpala Koa Canoe Management Area (KKCMA) is one in a series of site-specific natural resource management plans to be prepared by the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW). These plans present a brief history of the specific forest reserve or section, a complete record of land transactions and boundary changes over time, a description of natural and cultural resources, as well as an account of infrastructure and intended use(s) of the area. These plans serve to: (1) assist in the 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; (4) solicit requests for proposals or bids to implement plan objectives; and (5) inform the public of short and long-term goals.

KKCMA consists of roughly 1,257 acres on the southeastern slope of Mauna Loa in the district of Ka‘ū and the ahupua‘a of Kapāpala. The area is covered almost entirely by a native montane koa (*Acacia koa*) and ‘ōhi‘a (*Metrosideros polymorpha*) forest at about 3,000-5,000ft in elevation. The primary management objective for the area is to provide a sustainable, long-term supply of koa for the traditional and cultural use of constructing koa canoes, while minimizing impacts on the natural and cultural resources in the area. This parcel is the only state land in Hawai‘i specifically zoned for the purpose of producing koa canoe resources. Other management objectives include native forest protection, protection of watershed resources, protection of forest bird habitat, increased regeneration and restoration of koa trees and forest habitat, collaboration with educational groups and community groups, access for recreational activities, and integration of traditional Hawaiian stewardship models with western conservation practices.

A harvest plan has been developed to allow for the harvest and extraction of canoe-quality trees while regenerating koa resources on a 100-year timeframe. Current plans call for organizations who have been selected to independently implement the harvest of canoe logs with the guidance of DOFAW. DOFAW will also implement stand improvement actions, such as pre-commercial and commercial thinning, that will enhance the ability of the forest to produce large, straight koa trees capable of being made into canoes. Some of these timber resources may be sold to help fund the management of KKCMA. KKCMA has been split into management units and areas have been prioritized for restoration, habitat protection, and forest product gathering, while allowing for adaptive management as necessary. A recent timber survey of the area indicates available koa resources will likely be able to meet expected demand and maintain sustainable harvest levels. Organizations in the state of Hawai‘i may apply for a permit to harvest a canoe log, which will be reviewed by a group of experts consisting of cultural practitioners; voyaging and racing members; kālaiwa‘a (canoe builders); forestry experts; conservationists; and community members, who will advise DOFAW/DLNR on the final allocation of canoe log permits.

Multiple protection measures will be implemented to ensure that the resources in the area are not degraded due to threats such as non-native animals, invasive weeds, human impacts, climate change, and/ or erosion. There are currently no known populations of cattle or mouflon sheep in the area, and there will continue to be zero tolerance for these animals as they severely impact koa trees and native forest ecosystems. Pigs are known in the area, a mixture of public hunting

and staff control will be used to decrease pig populations and the damage the cause to koa and other resources in the area.. Invasive weeds are not widespread and are mostly contained to roadways in KKCMA. Weed presence has the possibility to increase with increased traffic, and monitoring and control measures will be implemented to ensure new species and populations do not become established. Erosion is another concern, and roadways within the area will be maintained with recontouring of steep, commonly degraded roadways as a high priority objective.

In order to minimize impacts on threatened and endangered (T&E) species and archeological and historical sites, mitigation measures will be implemented. Botanical surveys and archeological surveys will be implemented in all areas prior to any silviculture actions taking place in that unit. No T&E plant species are currently known within the area. Surveys for forest birds will also be implemented, and areas of higher value native forest and bird habitat will be lower priority harvest areas.

Staff have created the following categories for management priorities within KKCMA and ranked them for the area as follows:

1. Watershed Values – protect watershed values of the area.
2. Cultural Practices & Uses – implement small-scale koa timber harvest for canoe construction.
3. Resource Protection – reduce damages from threats such as invasive plants and animals, wildfire, or insects and diseases on resources.
4. Native Ecosystems – protect and enhance native ecosystems in the area.
5. Threatened and Endangered (T&E) Species Management – protect and enhance T&E species in the area.
6. Access, Trails, Hunting & Other Public Uses– provide public use opportunities such as hiking, hunting, and bird watching.
7. Commercial Activity – implement small-scale sales of non-canoe quality trees.

A history of the area and Hawaiian canoe construction is found in Section 2. A full description of the site and the resources within it can be found in Section 3. Threats to the area are detailed in Section 4. Details of the above-mentioned management actions can be found in Section 5. A full list of management priority actions can be found in Table 14.

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KAPĀPALA KOA CANOE MANAGEMENT AREA MANAGEMENT PLAN SIGNATURE PAGE

Hawai‘i District certification: This plan was prepared by a team of Division of Forestry and Wildlife (DOFAW) staff to provide a management framework for Kapāpala Koa Canoe Management Area.



Steven T. Bergfeld – DOFAW Hawai‘i District Manager

May 1, 2024

Date

Division of Forestry and Wildlife 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 Kapāpala Koa Canoe Management Area.



David G. Smith – DOFAW Administrator

May 1, 2024

Date

Department of Land and Natural Resources Board approval: This plan is in accordance with the mandates of the State Forest Reserve System which includes Chapter 183, Hawai‘i Revised Statutes, and Chapter 13-104, Hawai‘i Administrative Rules.



Dawn N.S. Chang – BLNR Chairperson

Approved by the Board
of Land and Natural
Resources at its meeting
held on April 26, 2024.

DEVELOPMENT PROCESS TIMELINE

Kapāpala Koa Canoe Management Area, Hawai‘i

Stage of Development	Date Achieved	Comments
District review	11/30/2022	Comments incorporated
DOFAW review	01/31/2023	Comments incorporated
Partner agency consultation	04/21/2023	1 comment, incorporated
Public consultation	05/31/2023	3 comments incorporated
DOFAW approval	07/31/2023	
BLNR approval	04/26/2024	

1. INTRODUCTION & METHODS

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. The format and content of the respective reserve plans are generally consistent across the State and serve to guide field operations, assist in budgeting and funding concerns, and make the management 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.

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 Kapāpala Koa Canoe Management Area (KKCMA), a section of the Ka'ū Forest Reserve, and addresses concerns and strategies only related to this section of the forest reserve.

This management plan for KKCMA was developed using a variety of methods. Initial development consisted of reviewing the 2016 draft Forest Management Plan for the area, and reviewing and analyzing DOFAW historic and current files (found at the Administrative and Hawai'i District office). Documents were also obtained from other state agencies including the Department of Land and Natural Resources Land Division and Bureau of Conveyances, and the Department of Accounting and General Services (DAGS) Survey Division. Hawai'i Statewide Geographic Information System (GIS) data relating to biological, historical, and environmental resources were referenced extensively to develop this plan.

Additional resources utilized for the development of this plan (including other plans that identified the forest reserve or the general area), were the Hawaiian Forester and Agriculturalist, Hawai'i Biodiversity and Mapping Program (HBMP), Hawai'i Statewide Assessment of Forest Conditions and Trends, Hawai'i Comprehensive Wildlife Conservation Strategy, biological surveys and others. The plan then evolved into its final iteration through discussions with DOFAW staff from all program areas, both at the district and administrative offices, other Divisions and State agencies, DOFAW partners, and the public.

Once finalized by DOFAW, the KKCMA management plan will be submitted for review and approval by the Board of Land and Natural Resources (Board). 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 (Chapter 104-22, HAR), as necessary.

2. HISTORY

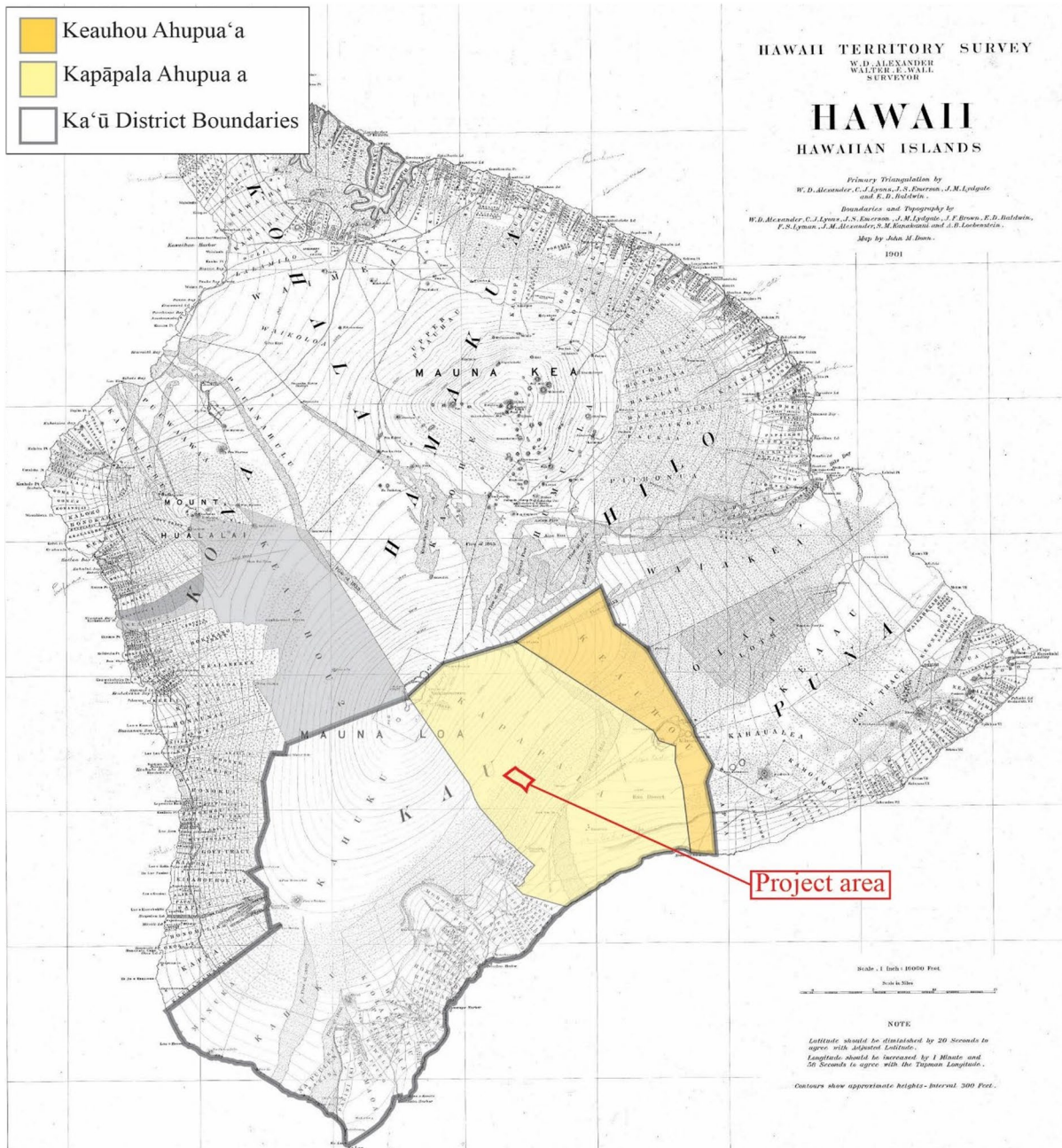


Figure 1 Hawai'i Registered Map 2060 from J.M. Donn (1901) showing KKCMA project area in Kapāpala, Ka'ū. Taken from KKCMA Cultural Impact Assessment (Appendix A)

2.1 Site History

The Kapāpala Koa Canoe Management Area (KKCMA) lies within the ahupua'a of Kapāpala in the moku of Ka'ū (Figure 1). Prior to European contact, the mauka regions of the ahupua'a of Kapāpala, where KKCMA is located, were likely not very heavily populated. Handy et. al (1991 p. 613) describe Hawaiian communities in the moku of Ka'ū, and known evidence of cultivation and inhabitation. They state that “there was never any cultivation, as far as we could learn . . . in

the forests above the pali from Kapāpala to Ohaikea the bird snarers or feather hunters had their huts, but no taro was grown.” They further mention that the closest community was Hilea, a small grouping of homesteads southwest of Kapāpala.

Early European arrivals, including Captain James Cook, observed the moku of Ka‘ū from the sea and accessed some of the coastal areas, but few ventured far into the inland areas where KKCMA is located. A handful of accounts from foreign travelers of the upland areas in Ka‘ū include William Ellis in 1823, and Chester H. Lyman in 1846. Lyman, when describing the ahupua‘a of Kapāpala, notes that he encountered some dwellings and canoe making sheds, and was impressed by the green hills and moist soil (Lyman 1846, p.9-10). Lyman’s documentation of “canoe making sheds” is one account of Hawaiians utilizing trees from the Kapāpala area for the construction of wa‘a, or canoes.

Following the Great Mahele in 1848, the entire ahupua‘a of Kapāpala was designated as crown lands under the control of King Kamehameha III. Around 1860, Frederick Lyman established a small ranch at ‘Ainapō, and in 1860 Charles Richardson and William H. Reed acquired Lyman’s ranch and greatly increased its size by leasing the entire ahupua‘a of Kapāpala from King Kamehameha IV. This expansion started their joint venture of Kapāpala Ranch.

Kapāpala Ranch became the largest working cattle ranch in Ka‘ū, producing meat, dairy, hides, and other commodities. Other uses such as hunting and traditional maile gathering also occurred in the area. Throughout its history the ranch has hosted many famous guests, such as travel writer Isabella Bird, naturalist Archibald Menzies, and it was also a favorite spot of Queen Lili‘uokalani.

Over time the ranch switched owners and its boundaries changed, but it remained on public land either under a lease or permit. The lands managed by the ranch has decreased from the original 1860 lease of the entire ahupua‘a, but the area that would become KKCMA was continuously under ranch management from 1860 until 1989. Evidence that KKCMA was used for grazing still remains on the property including the old barbed wire cattle fence just mauka of the crossroad. There were also likely timber harvests that occurred in KKCMA prior to 1989, but documentation of such events has not been found. The current forest structure of the lower elevations of KKCMA are indicative of its past exposure to cattle grazing and/or timber harvesting (see section 3.4).

Starting in the late 1980s, DLNR began searching for native forests on state land for the purpose of designating areas for koa management, in efforts to expand silviculture operations in the state. The ample koa resources on KKCMA made it an ideal location, and on October 27, 1989, the Board of Land and Natural Resources approved the set-aside of approximately 1,257 acres “for commercial koa timber production, with consideration for recreation, forest bird habitat, and watershed values.” In the 1990s, following struggles by organizations to find koa trees suitable for the construction of voyaging canoes, the purpose of the area was further refined from broad koa management to focus on the management and cultivation of koa canoe logs.

In 2004, the 1,257 acre koa management area was officially sub-divided by the County of Hawai‘i, removing it from the rest of the parcel that is still under lease by Kapāpala Ranch.

Subsequently, in 2004 the Board of Land and Natural Resources approved redesignating the area as the Kapapāla Koa Canoe Management Area, and on June 27, 2005 Executive Order 4109 was issued, officially setting the area aside for the growth and production of koa trees for use in the making of traditional Hawaiian canoes. Seven additional management goals that were defined for the area include:

- 1) Preserve Hawai‘i’s unique natural and cultural inheritance for future generations, by fostering knowledge and respect for Hawai‘i’s native forests, in a way that inspires better care of its natural environment.
- 2) Protect threatened tropical forest habitat and promote environmental policies and practices, that address biological sustainability and human well-being, by identifying and integrating relevant traditional Hawaiian natural resource stewardship models with current Western management strategies.
- 3) Develop natural resource stewardship models that involve a wide range of constituent groups.
- 4) Involve youth through cooperative programs with the Department of Education, University of Hawaii, and other school and education institutions.
- 5) Provide wood workers with portions of harvested trees that are not processed as canoe logs.
- 6) Involve other constituency groups (e.g. canoe clubs, forest management entities, and cultural organizations).
- 7) Provide compatible opportunities for public uses such as hunting and recreation.

The set-aside as a “Koa Canoe Management Area” designation had the potential to jeopardize effective management due to the lack of applicable statutes and rules to enact and enforce for the area. Therefore in 2004, the BLNR approved the cancellation of EO4109, and the issuance of a new EO incorporating the area as the Kapāpala section of the Ka‘ū State Forest Reserve, therefore rules governing forest reserves could be applied to KKCMA. These actions were formalized by the issuance of EO4427 which cancelled EO4109, and EO4428 which formalized KKCMA’s inclusion into Ka‘ū FR on February 27, 2013.

Table 1. Summary of Executive Orders Relating to KKCMA

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Executive Order 4109	May 23, 2005	A	Land Set Aside for the Establishment of Kapāpala Koa Mgmt Area	1257.73	23859	(3) 9-8-001:014
Executive Order 4427	February 27, 2013	-	Cancellation of EO 4109, preparation for addition to FRS	1257.73	23859	(3) 9-8-001:014
Executive Order 4428	February 28, 2013	-	Addition of parcel to FRS as Kapāpala section, K‘aū FR	1257.73	25,042	(3) 9-8-001:014

Table 2. Historical Land Use Agreements in Kapāpala Koa Canoe Management Area.

Type of Action	Action Number	Duration	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key parcels included (current TMKs)
Lease		March 1, 1860-1887	Lease to W.H. Reed & C. Richardson	Ahupua'a of Kapāpala excepting Kuleanas		
Lease	106	07/01/1887-06/30/1907	Pasture Lease to Hawaiian Agricultural Co.	172,780		
Lease	603	07/01/1908 - 06/30/1929	Pasture Lease to Hawaiian Agricultural Co.	72,850	1853	
Lease	1920	04/16/1928-07/01/1950	Pasture Lease to Hawaiian Agricultural Co.	50,535	4980	(3) 9-8-001:003
Lease	3376	02/14/1951-12/31/1973	Pasture Lease to Hawaiian Agricultural Co.	37,466	11033	(3) 9-8-001:003, 010, 013, 014
Revocable Permit	5254	November 21, 1975 (BLNR approval) – 10/31/1977	Permit to Ka'ū Sugar Co and Richard Smart dba. Parker Ranch for sugar cane cultivation and pasture purposes	37,266		(3) 9-5-19:1, 2, 12, 16, 17, por 27, 28 ; 9-6-2:5, 10, 11, 13 ; 9-6-12:4; 9-6-13:2; 9-8-1:3, por 2
Revocable Permit	S – 5491	October 28, 1977 (blnr approval) – September 9, 1988 (blnr approved cancellation)	Permit to Ka'ū Sugar, Richard Smart dba: Parker Ranch and Gordon Cran dba: Kapāpala Ranch	38,689		(3) 9-5-19:1, 2, 12, 16, 17, por 27, 28 ; 9-6-2:5, 10, 11, 13 ; 9-6-12:4; 9-6-13:2; 9-8-1:3, por 2
Revocable Permit	S – 6582	September 9, 1988 (blnr approval) – 10/31/1989	Permit to Gordon Cran for pasture and residential purposes.	24,573		(3) 9-8-001: por 003
Revocable Permit	S – 6695	10/27/1989 (blnr approval) -	Permit to Kapāpala Ranch	23,473		(3) 9-8-001: por 003
Lease	S - 5374	12/1/1994-present	Lease for pasture w. Amendment for ecotourism. Lease S-5374 is still active, however <i>KKCMA was officially withdrawn from the lease in 2005.</i>	23,408	22110, HSS Plat 127-A	(3) 9-8-001:014
Right of Entry		10/27/1989	Right of Entry to DOFAW to begin management actions	1257.33	NA	(3) 9-8-001:014

2.2 History of Kālaiwa‘a, Hawaiian Canoe Construction

The significance of the wa‘a, or canoe, in Polynesian and Hawaiian culture is deeply rooted and cannot be overstated. Wa‘a were the main transporter of people from one island to the next across Polynesia, and were utilized in many other aspects of life such as fishing, warfare, and sport (Chun and Burningham 1995; Fornander 1878). When early Polynesian voyagers first landed on Hawai‘i, they continued to construct and utilize canoes and adapted their craft to the new environment of Hawai‘i. Koa (*Acacia koa*), the second most common tree in the islands and a fast growing hardwood species, became the preferred tree used in canoe construction (Holmes 1981).

Canoe construction in Hawai‘i has traditionally been guided by the kahuna kālaiwa‘a, or master canoe carver. The role of kahuna kālaiwa‘a was considered the foremost of all traditional occupational trades, as they had to possess a wide range of technical skills from building to forestry to guiding ceremonies and protocols (Holmes 1981). The kālaiwa‘a was responsible for the entire process of building the wa‘a, from deciding when and how to undertake the process until the completed wa‘a was launched into the ocean.

According to the account of David Malo, an early native Hawaiian historian, “the building of the canoe was an affair of religion” (Malo 1903). Due to the danger, high degree of difficulty, and cultural importance of canoe construction, many rituals and traditions guided the process. The exact process likely varied by location and across the islands, however the CIA drafted for this project (Appendix A) identified the accounts recorded by multiple individuals, including David Malo, Abraham Fornander, Tommy Holmes, Edgar Henriques, and Kalakuokamaile, that outlined the process likely common in the south Kona and Ka‘ū areas, and the steps during canoe construction are listed below. Detailed information can be found in the CIA which has been include as Appendix A of this plan.

- 1) Beginning rituals of the kahuna kālaiwa‘a
- 2) The ascent to the forest
- 3) Selecting the tree
- 4) Cutting and felling rituals
- 5) Rough hewing the canoe on site
- 6) Hauling the rough canoe to the coast
- 7) Final hewing and initial voyage rituals

Canoe Log Selection and Terminology The process of finding the right tree to create a canoe varies among historians. Many different terminologies and methods have been used to describe and qualify the growth form and suitability of koa trees for use in canoe construction. Table 3 lists a variety of Hawaiian terms gathered by Holmes (1981) describing koa trees, many of which relate to the suitability for canoe construction:

Table 3 Hawaiian Koa Terminology (Holmes 1981)

Hawaiian Term	Definition
koa 'awapuhi	Low density, similar to koa lā'au mai'a, but considered female.
koa hi'u wa'a	growing straight up before branching; also koa hi'u awa.
koa huhui	growing straight up, with a cluster of branches at the top.
koa huli pū	having wood of such good quality throughout that it was thought best to avoid cracking the log by exposing and drying out the roots, letting the tree fall over, rather than cutting it down.
koa iho 'ole	crooked but nicely bent in an arc; could be easily shaped to give the hull a "banana" curve; considered the most desirable type.
koa 'i'o 'ōhi'a	'ōhi'a grain koa, high density (60-80 lbs/ft ³)
koa kamahele	having one branch larger and more serviceable than the trunk itself; also koa lālā kamahele.
koa kolo	leaning or sprawling, but still fit for use.
koa kolopū	growing straight up with no significant branching; of uniform diameter nearly the whole length of the trunk; waves will wash into a canoe made from this type.
koa kū ke'ele wa'a	straight but somewhat flattened on both sides.
koa kūpalaha	having a broad, straight trunk, but rather flat on one side.
koa kūpalina	generally usable but imperfect; bent, flattened, short, not well-proportioned.
koa kupulā'iki	same as koa kūpalaha.
koa lālā kamahele	same as koa kamahele.
koa lā'au mai'a	banana colored koa, low density (30-40 lbs/ft ³)
koa lau kane	(no data)
koa lau kani	strong; considered male; possibly same as koa lau kane.
koa lau nui	a large-leafed variety.
koa no'u	straight, thick, unblemished, not very tall; suitable for a wide, short canoe such as an 'ōpelu (heavy duty fishing canoe).
koa poepoe	of good size but short and thick.

Outside of growth form, the color, density, and grain of the wood is also of importance to the kahuna kālaiwa'a. Holmes (1981) presented different densities of wood. Low-density koa (roughly 30-40 lbs/ft³), which was most suitable for paddles but sometimes used for canoes, was known as koa lā'au mai'a (banana-colored koa) and was characterized by its soft, lightweight, and yellow color. This type of koa was also known as koa 'awapuhi (ginger koa) but was considered female. The favored wood grain for canoes was the mid-range density koa (40-60 lbs/ft³), which was valued for both its durability and strength. High-density koa (60-80 lbs/ft³) known as koa 'i'o 'ōhi'a ('ōhi'a grain koa) was less ideal for canoe building as the wood was exceptionally dense which made carving very difficult.

Another important factor often documented is the consultation of the 'elepaio (*Chasiempis* sp.). 'Elepaio are native birds that eat small insects, and are considered bold and curious and often follow humans in the forest. Kahuna kālaiwa'a formed a close connection with 'elepaio, and

would notice the behavior of these birds and use it to determine if trees were suitable for canoe construction. Holmes (1981) mentions that on islands where ‘elepaio were not present, kahuna kālaiwa‘a may have consulted other birds. Below is one description from Fornander of the process (Fornander 1919-1920):

“If the bird darted down and perched on the trunk of the tree and then ran along the trunk to the other end, the canoe-hewing priest would remark: "The canoe is perfect." The conduct of the bird in running direct from the base to the end was the sign which enabled the priest to pronounce it perfect. Where the bird traversed was the top opening of the canoe. Supposing that the opening of the canoe which the bird apparently intended was underneath, the bird would fly to a certain height, then circle over the tree, the priest would understand that it was urging the turning of the tree. But if the opening that the elepaio intended to be was on the side, it would fly in that direction. On the other hand, if the bird came and stood on the trunk of the tree intended for a canoe, if it continued to remain there for some time, the canoe-hewing priest knew that a defect was at that point. If the bird again ran from the trunk and stood in another place, then another defect was at that locality, and thus the bird would indicate all the defects in the canoe, whether it be rottenness, hollow-cored, or knotted. In this way the canoe-hewing priest was made aware of the defects of the [tree for a] canoe.” (Fornander 1919-1920)

Canoe Size Requirements: Different size trees are typically needed for the construction of different canoes. The dimensions for three major canoe types are shown in Table 4. These dimensions are not restrictive, as different carvers may make larger or smaller versions intended for different uses.

When making a canoe, builders often prefer to utilize a single ideal tree, however some will piece together 2-3 shorter lengths that can come from multiple trees. For the latter style, the most important requirement is tree diameter. Trees can be used even if upper sections of those trees split or do not have the most ideal growth form. Further, some builders may build canoes by combining planks instead of hollowing out entire logs, which allows for more flexibility in tree size and growth requirements. Koa trees that are too small and/or have less optimal growth form (lots of forking, a twisting main stem etc.), are not ideal for being carved into koa canoes.

Table 4 Different Types of Koa Canoes

Canoe Type*	Minimum Width**	General Length**
Fishing (‘ōpelu)- Present-day term for a short, thick hulled, wide bodied and heavy fishing canoe.	24”	10-20’
Racing - The Hawaiian Canoe Racing Association (HCRA) has strict regulations regarding racing canoes. There are separate races for koa canoes, non-koa canoes, and others.	36”	30-45’
Voyaging - The largest type of koa canoes, first designed by the Polynesian people that arrived at the islands of Hawai’i.	40”	40-60’

*Descriptions from Holmes 1981.

**Size requirements are based on discussions with a variety of traditional koa canoe builders. There are no established sizing standards, and these numbers are subject to change depending on the builder.

At this point DOFAW has done timber surveys indicating the size and general growth from of many trees in the area, details of which can be seen in section 3.5 and Appendix B. Surveys have not determined the density or grain types of trees found in KKCMA, but opportunities in monitoring and collaboration with organizations during harvest may shed light on these details in the future.

Ongoing Cultural Practices.

The practice of kālaiwa‘a has historical roots but is an evolving art still practiced by many today. The techniques and methods for canoe building are constantly growing, as methods for felling, extraction, and carving are changing as new technologies emerge. One early example can be seen in Figure 2. During the precontact and early historic periods, hauling the koa out from the forest was done entirely by hand. However, as new technologies emerged including carts and wagons, kālaiwa‘a adapted their traditions to utilize these new tools to ease the workload.



Figure 2 Men preparing to haul an unfinished canoe to Hōnaunau, South Kona. Photo courtesy of K. P. Emory, Bishop Museum Archives.

Today, modern tools include heavy machinery such as bulldozers and logging trucks for felling and transporting logs, as well as hand tools such as chainsaws to assist in felling and carving are often used in canoe construction. While canoes were traditionally hewn from hollowing out a single log entirely with adzes and hand tools, some builders today utilize chainsaws to rough hew the shape before finishing with adzes. Other builders utilize planks instead of hollowing out a single tree, connecting planks together to create the hull of the canoe. This has the advantage of utilizing more wood from a tree and being able to use smaller sections of a tree in canoe construction.

Given the wide array of traditional and modern ways for selecting, felling and building a koa canoe, DOFAW understands that different organizations will want to implement different techniques. DOFAW supports organizations implementing their own traditional and cultural practices related to canoe tree selection, harvesting and construction at KKCMA, as long as the methods are safe and follow DOFAW's guidelines for timber harvest, as outlined in Section 5.3.

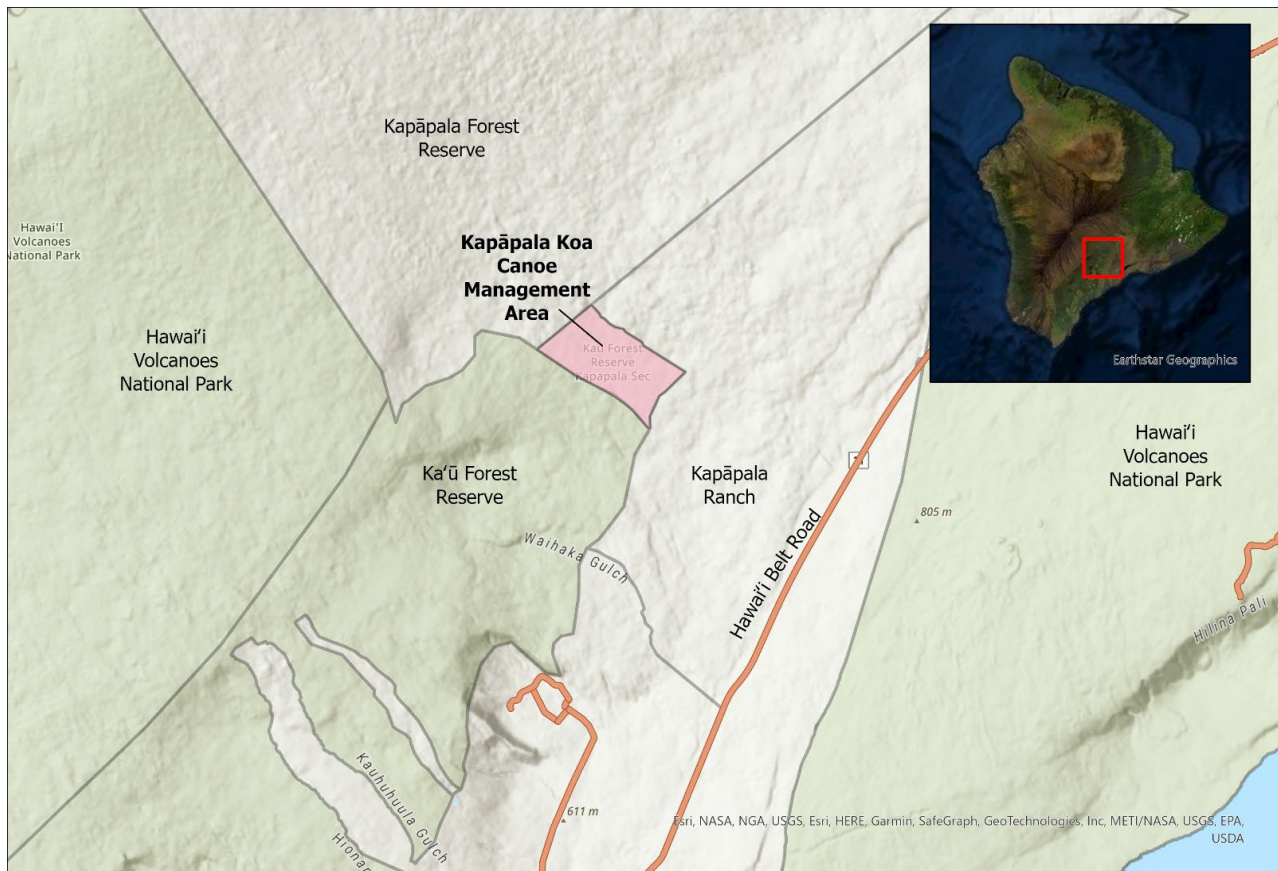
3. SITE DESCRIPTION

3.1 Location

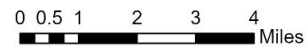
The Kapāpala Koa Canoe Management Area (KKCMA) is comprised of 1,257 acres of public land in the moku of Ka‘ū on the island of Hawai‘i. It is in the ahupua‘a of Kapāpala on the southeastern slopes of Mauna Loa between 3,640ft-5,100ft in elevation, with an average slope between 6-20%. The land cover is completely forested, dominated by mesic montane native koa-‘ōhi‘a forest.

KKCMA is part of the Ka‘ū Forest Reserve and is surrounded by other state lands, including other sections of the Ka‘ū Forest Reserve to the southwest, the Kapāpala Forest Reserve to the northwest, and public lands under general lease and revocable permits to Kapāpala Ranch to the northeast and southeast (Figure 3). Portions of Kapāpala Ranch are also a cooperative game management area (GMA). The small town of Pahala is about 10 miles south of KKCMA, and the town of Volcano is approximately 15 miles to the northeast. Kīlauea caldera is about 12 miles to the northeast as well. KKCMA is composed of Tax Map Key (TMK) (3) 9-8-001:014 and is zoned by the county of Hawai‘i as A-20 agricultural land.

Figure 3 KKCMA Location



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3.2 Soils

The underlying geology in the area is comprised of basic igneous rocks (basalt) beneath weathered volcanic ash and cinders. There are three soil series within KKCMA: Kaholimo, Kuanene, and Alapai (Figure 4). Kaholimo soil developed over basalt bedrock and is prevalent at higher elevations, comprising approximately 45% of KKCMA. The Kaholimo soils in the reserve generally has a rooting depth ranging from 13-17” which is shallow for a forest soil. Kuanene soil developed over pāhoehoe lava flows and comprises approximately 50% of the area, dominating lower elevations. These are the deepest soils within the parcel. Alapai soils cover a small section of the southeast corner of the reserve, and are the most shallow in the parcel.

All of these soils are andisols, meaning they were derived from volcanic ash, and are thus relatively fertile and acidic, with 0-60% organic material at the surface. These soils are highly

erodible, which must be considered during forestry operations, especially harvesting. Because of the thin soils and high infiltration rates in the parent material, there is limited water holding capacity in the soil profile. This means the area is susceptible to drought, which is a common occurrence in Ka’ū.

3.3 Climate

KKCMA has an average annual temperature of 60°F (49-72 °F) and an average annual rainfall of 80 inches. Rainfall is consistent throughout the year with wetter months during the winter, similar to the rest of Hawai’i (Figure 5). Winter is also when temperatures are slightly cooler as daylight

Figure 4 Soils in KKCMA



hours are shorter and sun angles lower. The area commonly has dense cloud and fog, further impairing the incident sunlight and providing additional moisture via fog drip. Fog is also quite common given its proximity to Kilauea caldera, however native forests in Ka‘ū do not appear to suffer from fog exposure.

A climatological study of KKCMA was conducted by James Juvik and Paul Fishbein from 1993-1994. They summarized that there was a “distinctive diurnal wind regime (daytime upslope, nighttime downslope)” complementing the prevailing trade wind (cross slope) flow. Also discussed was the heavy rainfall recorded during a few winter storms. Rain totals were larger during these winter storms than all other rain events during the year combined. Winter storms can cause mass erosion and should be considered when planning timber activities.

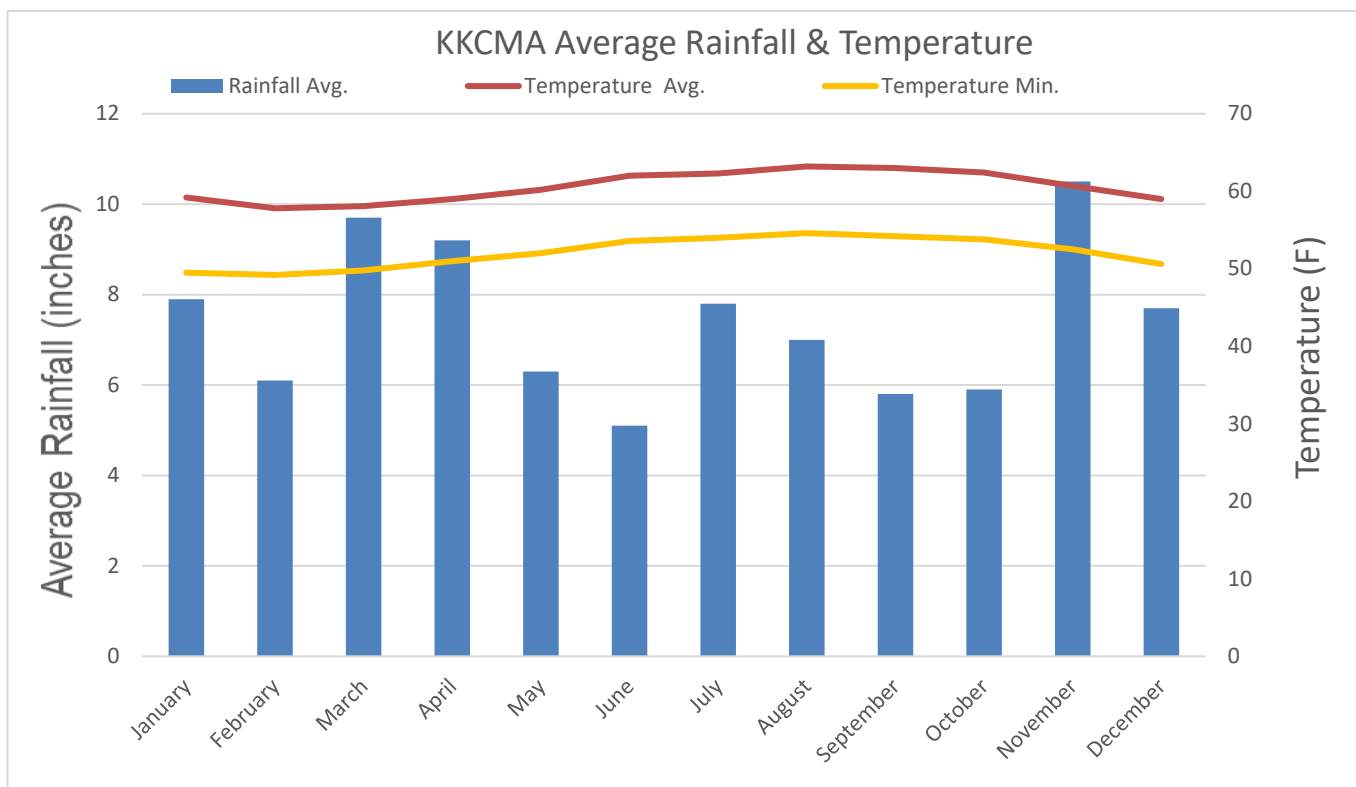


Figure 5 Average monthly rainfall and temperature in KKCMA (Giambelluca et al 2013).

Note: this graph obscures powerful winter rainstorms

3.4 Vegetation

The vegetation at KKCMA is classified as Montane Wet Forest (Wagner 1999). Based on field observations and data collected during forest inventories, the parcel was further split into four strata, largely based on vegetation cover:

- KO1: Open ‘Ōhi‘a Forest (324 acres)
- KO2: Open Koa-‘Ōhi‘a Forest (386 acres)
- KO3: Closed Koa-‘Ōhi‘a Forest (323 acres)
- KO4: Mature Koa Forest (207 acres)

The forest canopy in K01 is characterized as an even-aged stand of ‘ōhi‘a (*Metrosideros polymorpha*). Koa are present but generally as a subcanopy species. The forest canopy of KO2, KO3 & KO4 is mixed with both koa and ‘ōhi‘a. Trees are generally larger and the canopy is more closed the higher you go in elevation. KO4 has the largest, most mature koa trees and is overall the most intact native forest in KKCMA. Common subcanopy species in all strata include pilo (*Coprosma rhynchocarpa*), kōlea (*Myrsine lessertiana*), kawa‘u (*Ilex anomala*), kōpiko (*Psychotria hawaiiensis*), naio (*Myoporum sandwicense*), and ōlapa (*Cheirodendron trigynum*).

The ground cover in the lower elevation strata, including all of KO1 and the lower parts of KO2, is less intact. It is dominated by non-native grass species such as kikuyu (*Cenchrus clandestinus*), meadow-rice grass (*Ehrharta stipoides*), and various fern species. This extends into KO2, a few hundred yards mauka of the crossroad. Above this, in upper KO2, KO3, and KO4 the percent cover of non-native grass in the understory decreases, and species like Hawai‘i sedge (*Carex alligata*), i‘o nui (*Dryopteris wallichiana*), ma‘ohi‘ohi (*Stenogyne microphylla*), hairgrass (*Deschampsia nubigena*) and ‘ala‘ala wai nui (*Peperomia* sp.) can be found. Common shrubs and ground cover in all strata include ‘ōhelo (*Vaccinium* sp.), uluhe (*Dicranopteris linearis*), and abundant maile (*Alyxia stellata*). Native shrub and fern species that are found primarily in KO3 and KO4, include kanawao (*Hydrangea arguta*), pāpala (*Charpentiera obovata*), ‘ākala (*Rubus hawaiiensis*), and hapu‘u (*Cibotium* sp.). For a current, working plant list of KKCMA, see Appendix C.

The thick sward of alien grasses, lack of native understory and remains of old cattle fencelines in KO1 and lower KO2 all suggest that the lower forests have been heavily impacted in the past, either by grazing, logging, fire, or a combination of the three. Further, in the 2020 inventory surveys KO2, KO3, and KO4 had around double the species richness of KO1. Overall, the parcel is considered to contain relatively intact native ecosystems with minimal pressure from invasive plant species, with the exception of non-native grasses present at lower elevations.



Figure 7 Higher elevations areas have more intact native understories, especially native fern species



Figure 6 Lower elevations areas, especially below the cross-road, are more likely to have non-native grass in the understory

Figure 8 Forest Strata in Kapāpala Koa Canoe Management Area (KKCMA)



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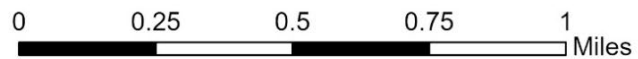


Table 5 Basal Area (ft²/acre) of Native Tree Species by Strata

Strata	koa (<i>Acacia koa</i>)	‘ōhi‘a (<i>Metrosideros polymorpha</i>)	ōlapa (<i>Cheirodendron trigynum</i>)	kōlea (<i>Myrsine lessertiana</i>)	kawa‘u (<i>Ilex anomala</i>)	pilo (<i>Coprosma rhynchoarpa</i>)	naio (<i>Myoporum sandwicensis</i>)	kōpiko (<i>Psychotria hawaiiensis</i>)	Total
K01	22.9	127.4	0.0	0.0	11.4	1.6	0.0	0.0	162
K02	20.8	121.1	1.2	0.00	12.7	2.3	0.0	0.0	156
K03	46.8	74.6	2.5	1.3	6.3	15.2	2.5	1.3	132
K04	25.4	115.3	6.9	4.6	0.00	2.3	4.6	0.0	152
Overall	28.9	109.6	2.7	1.5	7.6	5.4	1.8	0.3	150.3

Table 6 Native Tree Seedlings and Shrubs in KKCMA (Stems Per Acre by Strata)

Tree Seedlings							
Strata	koa (<i>Acacia koa</i>)	‘ōhi‘a (<i>Metrosideros polymorpha</i>)	ōlapa (<i>Cheirodendron trigynum</i>)	kōlea (<i>Myrsine lessertiana</i>)	kawa‘u (<i>Ilex anomala</i>)	pilo (<i>Coprosma rhynchoarpa</i>)	kōpiko (<i>Psychotria hawaiiensis</i>)
K01	0	13	134	0	13	13	0
K02	0	123	38	0	19	85	57
K03	0	197	94	10	31	62	0
K04	265	379	701	19	0	303	0
Shrubs							
Strata	‘ākala (<i>Rubus hawaiiensis</i>)	hapu‘u (<i>Cibotium sp.</i>)	kanawao (<i>Brussaisia arguta</i>)	‘ōhelo (<i>Vaccinium sp.</i>)	pāpala (<i>Charpenteria obovata</i>)		
K01	0	161	0	0	13		
K02	0	208	0	0	0		
K03	10	239	31	83	0		
K04	19	133	0	114	0		

3.4.1 Rare, Threatened and Endangered Plants: Threatened and endangered (T&E) plant species in Hawai‘i are listed under and protected by the Federal Endangered Species Act (ESA) and the State Endangered Species Law, Chapter 195D, HRS. Other species not listed as T&E by either the state or federal listings can still be considered rare or species of concern by land managers.

Currently no rare or T&E plant species are known to occur within KKCMA. A comprehensive vegetation roadside survey of the parcel was completed in 2020 and found no T&E plant species. One individual of *Rubus macraei*, which is not a protected species but is considered rare, was found growing in an old rare plant enclosure just outside of KKCMA in Ka‘ū FR. *R. macraei* is known from approximately 3000-5000 individuals and is relatively common in the supalpine slopes of Mauna Loa. A wild population of *Phyllostegia velutina*, an endangered native hawaiian mint with roughly 30 individuals left in the wild, is known to exist about 3.5 km away from KKCMA. Surveys for rare and T&E plant species should be done in any areas where timber harvest or other management activities are planned that may cause a disturbance to avoid any potential impacts.

3.5 Koa Timber Resources

In line with the specific designation of this area, the primary timber resources of concern are koa trees capable of being carved into canoes. There is a rich history and language around the various types of koa canoes traditionally built by native Hawaiians, and on the type and size of koa trees required (see Section 2.2.).

2020 Timber inventory: In 2020 a timber inventory was done of KKCMA. The inventory consisted of two parts: 1) plot data collected throughout the entire parcel to get an overall estimate of the quantity, volume, and spatial distribution of timber 2) a more in-depth 100% tree count of roadside areas to use for planning and implementing harvest operations in the near future (see Appendix B for the entire timber inventory).

Results of the plot data show that there is approximately 5.5 million board feet (bf) of koa in KKCMA. Of this, an estimated 1 million bf, or around 18% of the koa volume, is in “canoe log trees”, or trees ideal for use canoe log construction. Another 1.5 million bf, or 27% of the koa volume, is in younger trees that will likely be capable of canoe log construction in 10-20 years. The remaining ~3.5 million bf of koa is either too small, or in trees that have the wrong growth form. Spatially, it appears



Figure 9 Big, unbranched trees are ideal for canoe construction

that strata K02 and K03 have higher numbers of canoe log trees. The trees in K01 are smaller and a more often a subcanopy species to ‘ōhi‘a (see section 3.4), and many of the trees in strata K04 are large, but over mature and far from the desired tree form. However, canoes trees can be found in both K01 and K04, just in smaller quantities. Another important finding from the plot data is that koa regeneration is alarmingly low throughout most of KKCMA. Although seedling recruitment for ‘ōhi‘a, kawa‘u, and ōlapa seems to be occurring in all strata, koa seedlings were only present in K04 plots (see Table 6). This could be due to a lack of disturbance, or due to grazing pressures from ungulates. The low levels of koa regeneration is concerning in regards to maintaining a sustainable supply of koa trees for canoe logs.

The 100% tree count measured and evaluated all koa trees within 200 feet of all roads. Based on their form, trees were put into 4 classes as seen in Figure 10, with class 1 being the most ideal growth form for a canoe log and class 4 being the least ideal. For the purposes of this plan trees in class 1 and class 2 were considered useable for canoe logs; class 3 and class 4 were considered unsuitable or less suitable for constructing canoes. Taking both tree form (Figure 10) and diameter requirements (Table 4) into consideration, criteria for what trees could be used in canoe construction were developed and they are shown in Table 7. Results of the 100% roadside tree count show that most of the desirable trees are along the middle cross road (K02) and along the upper northern boundary (K03, K04) (Figure 11).

Table 7 Canoe Log Classification of Koa Trees in KKCMA

Canoe Class	Koa Tree Diameter	Form Classification*	Description**
Ideal canoe log	≥30"	1	Koa tree likely capable of making an entire canoe
Potential/partial canoe log	≥30"	2	Koa tree with potential to make an entire canoe, or parts can be used in canoe construction
Young ideal canoe log	20-30"	1	In about 10-20+ years could become a koa tree capable of making an entire canoe
Young potential/partial canoe log	20-30"	2	In about 10-20 years could become a koa tree capable of making an entire canoe, or parts of a canoe
N/A	<20"	Any	Not capable of being used in canoe construction in near future (10-20 years)
N/A	>20"	3, 4	Not ideal for use in canoe construction

*See Figure 10 for form classification description

**These rough broad categories help provide an idea of ideal canoe trees. Canoe builders may have other methods for quantifying tree shape, such as those in Table 3

Figure 10. Koa Tree Form Classifications Used During 2020 KKCMA Forest Inventory.



Tree Form Class 1: Straight and tall trunk, does not split until canopy (~40 ft), canoe log



Tree Form Class 2: Straight and tall, but splits or forks lower on trunk, potential canoe log

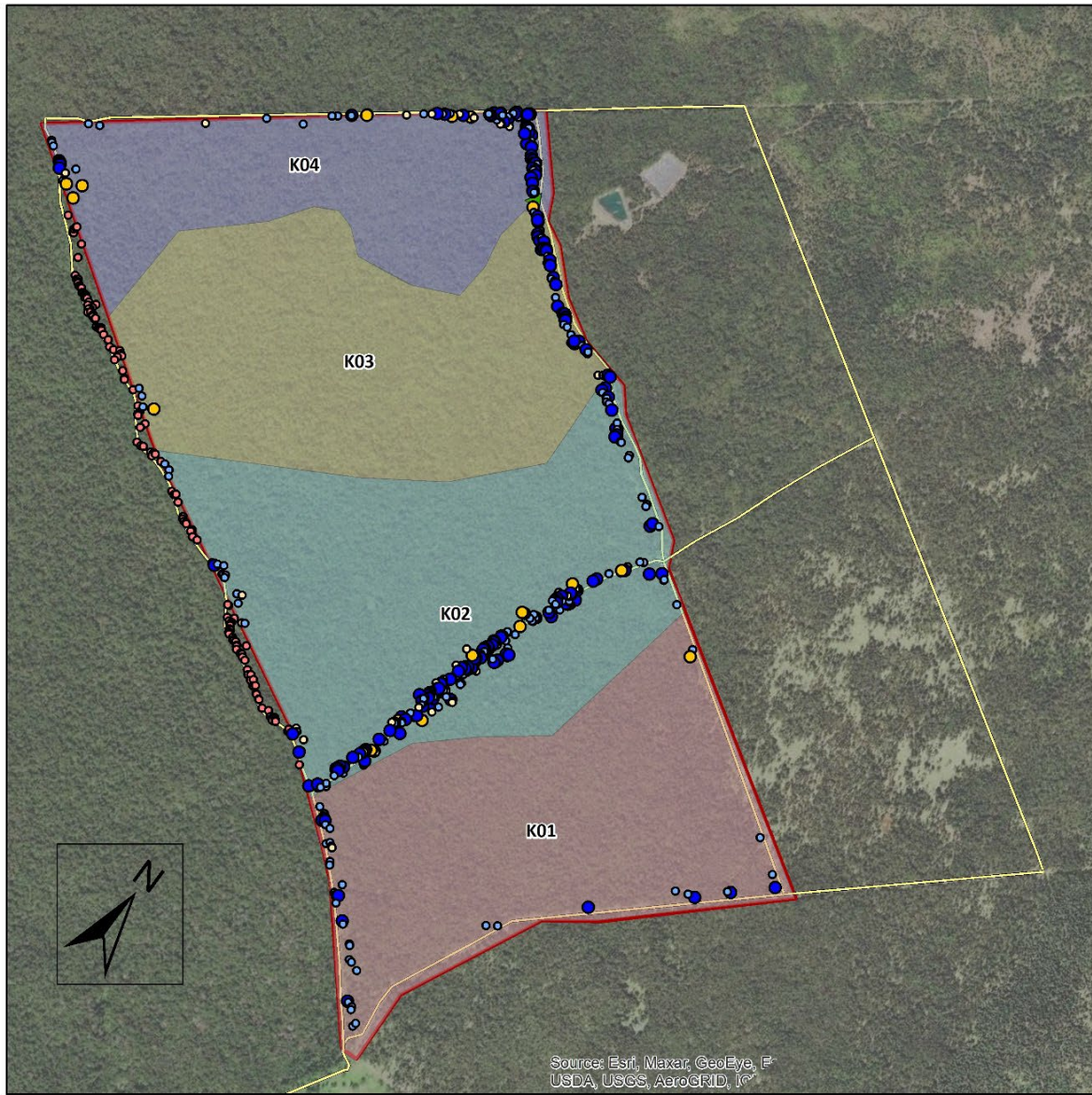


Tree Form Class 3: Big branches fork off from a lower part of the tree, sprawling form



Tree Form Class 4: Many forks, curved trunk, no canoe logs possible

Figure 11 Results of KKCMA Roadside 100% Tree Survey



Roadside Strip Cruise	KKCMA Strata
100% Tally Results	K01: Open Ohia Forest, 324 ac
● Canoe	K02: Open Koa- Ohia Forest, 386 ac
○ Potential Canoe	K03: Closed Koa- Ohia Forest, 323 ac
● Young Canoe	K04: Mature Koa Forest, 207 ac
● Potential Young Canoe	— 4 x4 Roads
● Trees Outside KKCMA Boundary	— KKCMA Boundary
▲ Camp Platform	



Date: 1/6/2021
 Author: Aviva Gottesman



3.5.1 Koa research plot: Within KKCMA there is a small, fenced area managed by the Hawai‘i Agricultural Research Center (HARC) in collaboration with DOFAW and other partners. This originally was a koa seed orchard and part of a project to develop a tree improvement program that will provide koa seeds that have been screened to be resistant to koa wilt disease. Koa wilt is a vascular wilt disease caused by the fungal pathogen *Fusarium oxysporum* f. sp. *koa* that causes high rates of mortality in many koa trees across the state, especially at lower elevations and in field plantings (Dudley et. al 2017). See section 4.3 for more information on koa wilt. Koa wilt disease is not widespread in KKCMA.



Figure 12 Koa trees within the research plot in KKCMA testing resistance to koa wilt

3.6 Wildlife

Native Birds: The native tree canopy and fruit bearing understory plant species in KKCMA provides excellent habitat for native birds. Bird surveys have been done annually since 2018 by the Three Mountain Alliance (TMA) and DOFAW. Fifteen bird species have been detected, the majority of which are native (Table 8). Apapane, followed by Hawai‘i amakihi and ‘ōma‘o, were the most abundant native birds in KKCMA. Native birds are present throughout the entire area, with decreasing abundance at lower elevations. The Japanese white eye was the most abundant non-native bird. (Table 8).

In total, eight species of native birds have been detected, including one threatened species, i‘iwi (*Drepanis coccinea*), and three endangered species, ‘akiapola‘au (*Hemiganthus wilsoni*), Hawai‘i creeper/‘alawī (*Loxops mana*), and the ‘io/hawaiian hawk (*Drepanis coccinea*) (Table 8). Threatened and endangered species in Hawai‘i are listed under and protected by the Federal Endangered Species Act (ESA) and the State Endangered Species Law, Chapter 195D, HRS. Note that the ‘io is no longer a federally listed species but is still considered an endangered species by the State of Hawai‘i.

I'iwi were consistently detected and heavily correlated with higher elevation areas (Figure 16). This is not surprising given that they are highly sensitive to avian malaria, a disease spread by mosquitoes at lower elevations.

The three endangered bird species were all detected in very low numbers (Figure 17). The 'akiapola'au was only detected once, in the highest elevational transect of the parcel. The 'alawī was detected four total times, all in northwest section in strata K03 & K04. 'Io were observed most frequently in K02, potentially because of the opening in the canopy created by the road. 'Io are known to use a variety of habitats and the mix of forested areas and small gaps in KKCMA are ideal for feeding and roosting.

Hawaiian Hoary Bat: The endangered 'ope'ape'a (*Lasiurus cinereus cermotus*, Hawaiian hoary bat) has not been detected in KKCMA but it is highly probable that they are present in or around the area. With thick 'ōhi'a canopy interspersed with open grassy areas and nearby pasture, the forest structure of Kapāpala is ideal habitat for this species.

More research is needed on bat populations across the Hawaiian Islands. Monitoring prey items and availability through invertebrate studies can provide indicators for the health and success of bat populations. Additionally, vegetation cover should be regularly monitored to supplement the other Hawaiian hoary bat monitoring efforts.

The Hawaiian hoary bat can use a variety of land cover types; therefore, promoting a mosaic of diverse habitat types across the landscape may contribute positively to bat populations. Management activities should not seek to create a uniform, homogenous cover of native forest. Hoary bats have been found to utilize corridors and edges of corridors, such as along hiking trails and roads, for hunting and flying through dense forest (Bonaccorso et al. 2015). Since the Hawaiian hoary bat is a solitary, foliage roosting bat that roosts in both native and non-native tree species with a broad height range, care should be taken if any trees are removed from KKCMA (Gorresen et al. 2013). This is especially true if multiple trees are harvested at once, as this increases the likelihood of removing one that potentially has a day roosting bat.

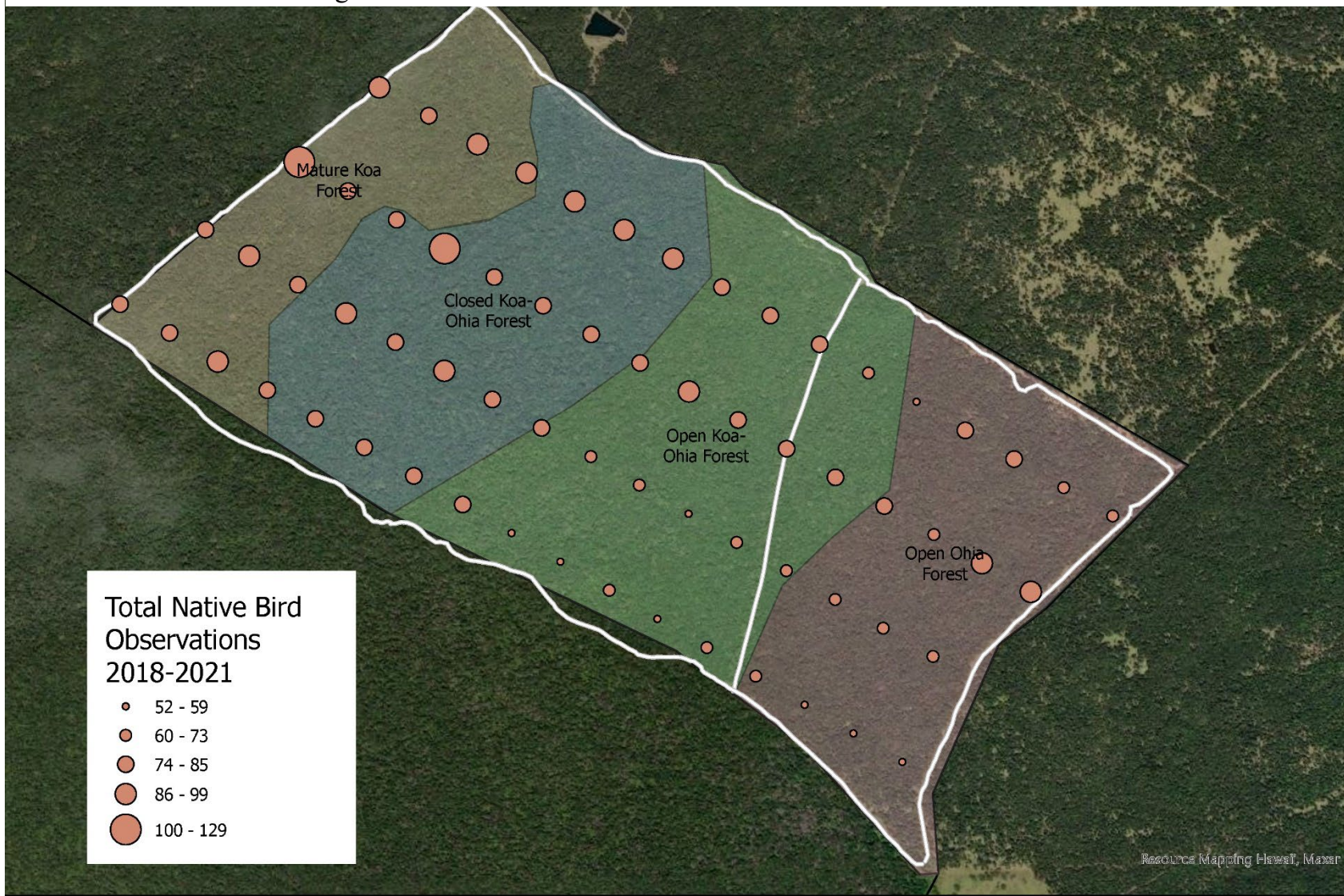


Figure 13. 'Akiapola'au (*Drepanis coccinea*), an endangered forest bird detected in very small quantities in the highest elevations of KKCMA



Figure 14. Hawai'i creeper (*Loxops mana*), another endangered forest bird found in very small quantities in the highest elevations of KKCMA

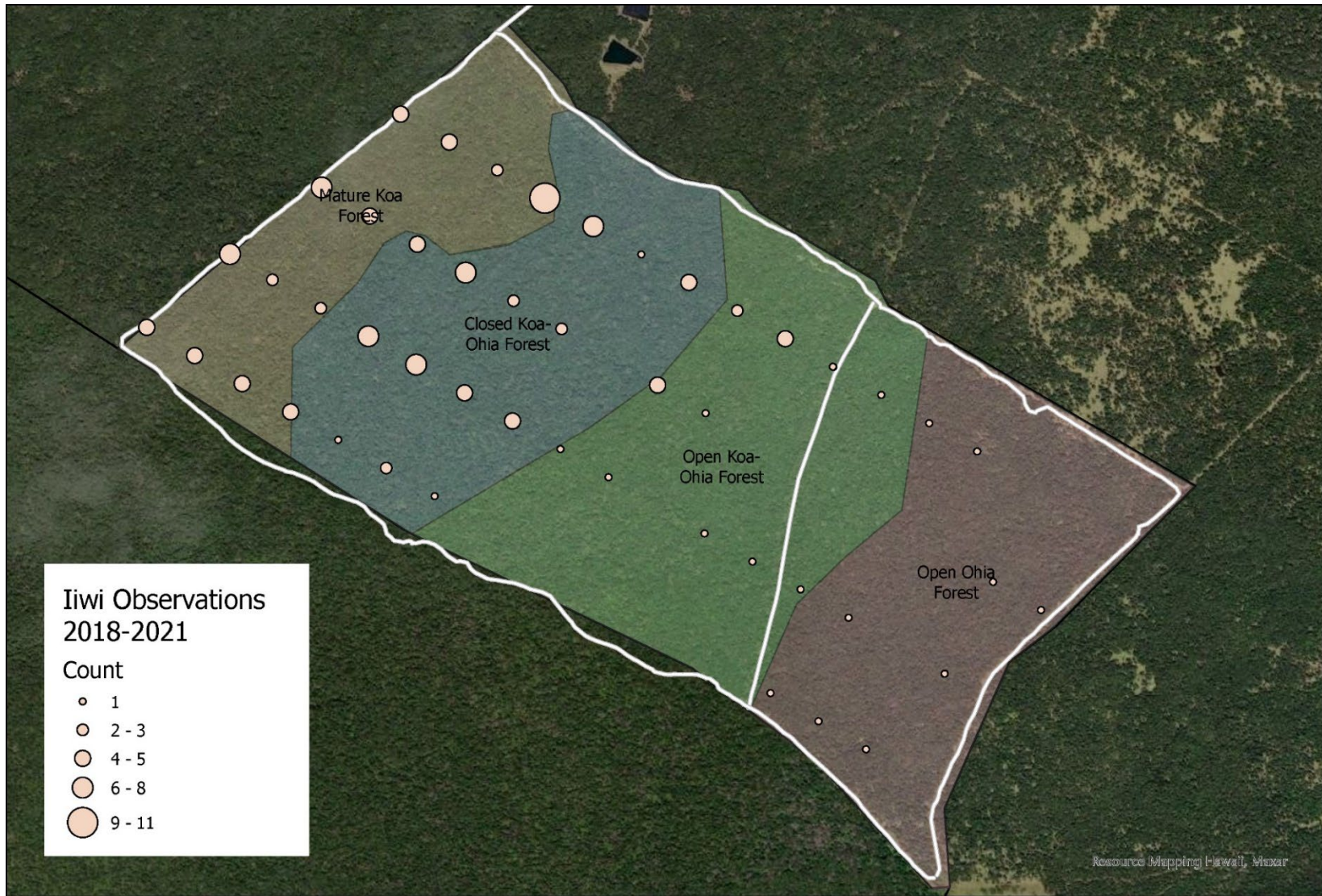
Figure 15 Total Native Bird Observations in KKCMA 2018-2021



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Figure 16 'I'iwi (Threatened) Observations in KKCMA 2018-2021



**Iiwi Observations
2018-2021**

Count

- 1
- 2 - 3
- 4 - 5
- 6 - 8
- 9 - 11

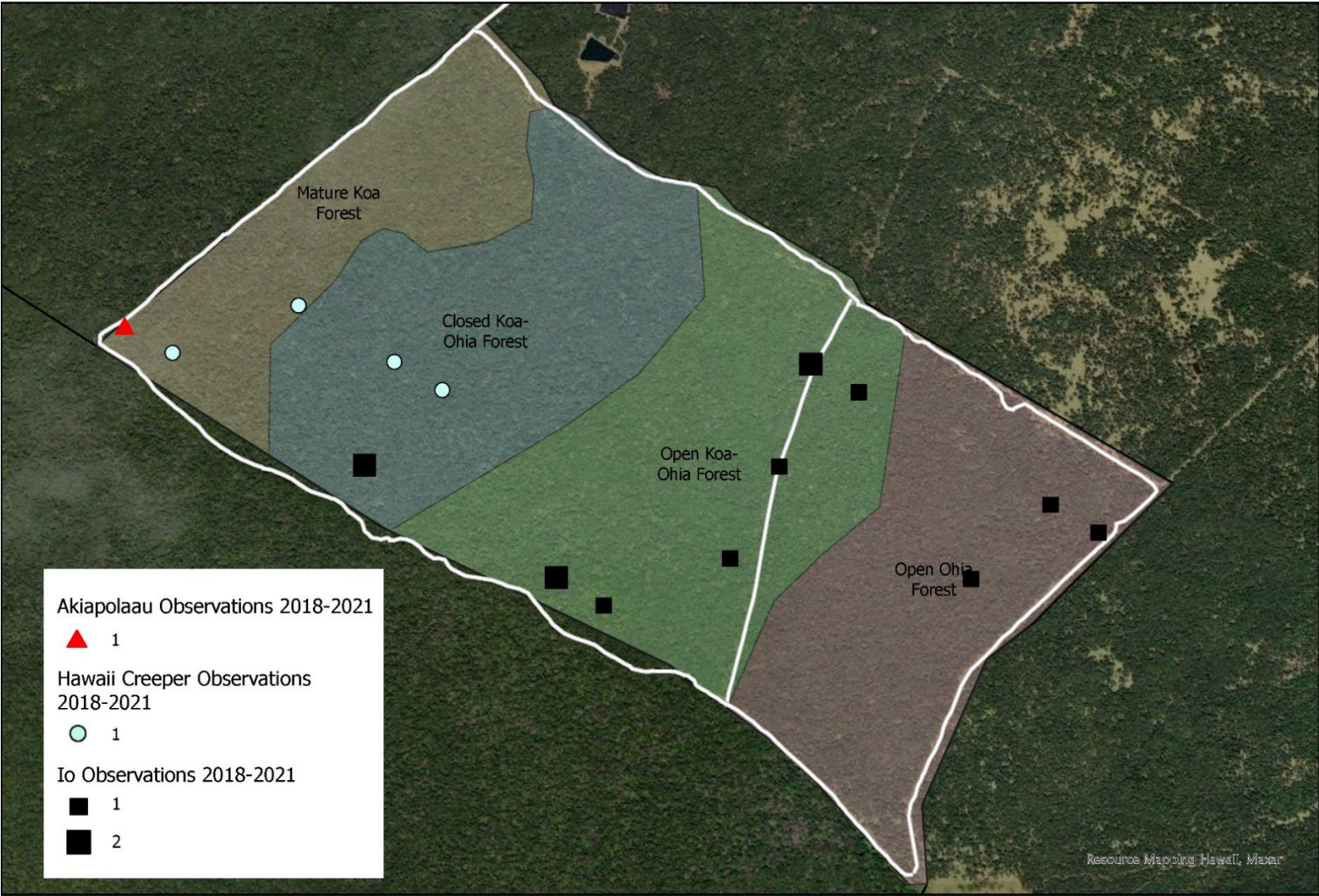


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0 0.25 0.5 0.75 1 Miles



Figure 17 Endangered Bird Species Observations in KKCMA 2018-2021



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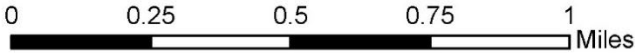


Table 8 Species Detections during 2021 KKCMA Bird Surveys (with comparison of birds per station for 2018-2020)

Alpha Code	Common Name	Scientific Name	Origin [†]	Status* Fed/State	2021 # Stations Occupied	2021 # Detected	2021 Percent Occurrence	2021 Birds per Station	2020 Birds per Station	2019 Birds per Station	2018 Birds per Station
AKIP	‘Akiapola‘au	<i>Hemiganthus wilsoni</i>	End	E/E	0	0	-	-	-	0.02	-
APAP	‘Apapane	<i>Himatione sanguinea</i>	End		65	827	100%	12.72	13.49	10.05	11.66
HAAM	Hawai‘i ‘Amakihi	<i>Chlorodepanis virens</i>	End		64	295	95.4%	4.54	4.60	4.20	3.91
HAEL	Hawai‘i ‘Elepaio	<i>Chasiempis sandwichensis</i>	End		17	23	26.15%	0.35	0.38	0.85	0.48
HCRE	Hawai‘i Creeper/‘Alawī	<i>Loxops mana</i>	End	E/E	0	0	-	-	-	0.02	0.05
HOFI	House Finch	<i>Carpodacus mexicanus</i>	Int		1	1	1.54%	0.02	-	-	-
HWAH	‘Io, Hawaiian Hawk	<i>Buteo solitarius</i>	End	-/E	1	1	1.54%	0.02	0.08	0.08	0.03
IIWI	‘I‘iwi	<i>Drepanis coccinea</i>	End	T/^	16	19	24.62%	0.29	0.65	0.93	0.58
JABW	Japanese Bush- Warbler	<i>Cettia diphone</i>	Int		9	10	13.85%	0.15	0.23	0.41	0.35
JAWE	Japanese White-eye	<i>Zosterops japonicus</i>	Int		60	131	92.31%	2.02	1.78	2.34	2.18
KAPH	Kalij Pheasant	<i>Lophura leucomelanos</i>	Int		2	2	3.08%	0.03	0.02	-	0.03
NOCA	Northern Cardinal	<i>Cardinalis cardinalis</i>	Int		5	8	7.69%	0.12	0.08	0.10	0.09
OMAO	‘Ōma‘o	<i>Myadestes obscurus</i>	End		61	180	93.85%	2.77	1.34	2.08	2.65
RBLE	Red-billed Leiothrix	<i>Leiothrix lutea</i>	Int		25	40	38.46%	0.62	0.09	0.41	0.40
YFCA	Yellow-fronted Canary	<i>Serinus mozambicus</i>	Int		5	6	7.69%	0.09	0.06	0.07	0.06

[†]End = endemic, Int = introduced, Ind = Indigenous; * E = endangered; T = threatened; ^State status here refers to Hawai‘i Island only

Native Insects: DOFAW entomologists implemented insect surveys in KKCMA in April 2023. Preliminary information shows that there aren't likely to be any T&E species present. There is some possibility that the rare picture wing species, *Drosophila silvestris* and *D. silvarentis* may be present, given their host plant species 'olapa (*Cheirodendron trigynum*) and naio (*Myoporum sandwicense*),)) are present but none were found in surveys. Full details on the findings of the 2023 entomological surveys will be completed later in 2023.

3.7 Archaeological & Historical Sites

Based on research done by DOFAW staff and through the Cultural Impact Assessment (Appendix A), the area within KKCMA was likely not heavily inhabited during pre-European contact. Trails, small forest shrines, burial caves and lava tube shelters are the types of historical features that may be present, as the greater area was used historically by Hawaiians for activities such as bird hunting, harvesting timber for canoe-making, and gathering forest plants for medicinal uses. Post-European contact the lower sections of the project area were likely used for grazing, ranching, and/or timber harvest. The remnants of an old ranching era structure, now collapsed, may still be present near the east end of the cross road. DOFAW plan to implement archeological surveys in all areas that may be impacted by silviculture actions prior to any potentially disturbing actions occur, such as timber harvest, skid road construction, or stand improvement actions. Archeological features are protected by state law in Hawai'i. If any evidence of archeological features are found all management activities will stop until appropriate efforts to preserve or mitigate damages to the area can be put in place.

3.8 Infrastructure

Roads: Within KKCMA there are roads that roughly follow the entire perimeter of the parcel, the perimeter roads occasionally dip into the adjacent sections of the Ka'ū FR. There is also one crossroad that cuts across the parcel (Figure 18). Some of these roadways may be impassable or hard to access and may be more suitable to ATV access during or following storms, especially in winter months.

Designated Helicopter Landing Zones: There is one designated landing zone within KKCMA, however it is not actively used and needs maintenance.

Fencelines: The entire boundary of KKCMA is fenced to prevent cattle from entering the parcel. All current fencing was constructed to restrict cattle, and does not control the movement of other ungulates such as pigs or sheep. The northwest and southwest sides of the parcel have been fenced with thicker, bull-wire fencing, constructed between 2019-2021. The northeast and southeast sections of the fence are made of a lighter gauge hog wire, and was constructed within the last 10 years.

Gates & Pedestration Crossovers: There is one the main access gate, known as "domingo corner gate" located on the southwest corner. All other gates are for management use only. There are pedestration crossovers located on the fenceline between Ka'ū FR and Kapāpala FR.

Gathering platform: A platform/gathering place was constructed in the northeast corner of KKCMA. The platform is used by staff, partner organizations, and educational groups for operations.

Koa seed orchard: A koa seed orchard, maintained by the Hawaii Agricultural Research Center (HARC), can be found in the lower section of the reserve. See section 3.5.1 for more information.

Figure 18 Infrastructure at KKCMA



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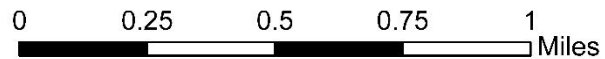




Figure 19. The public can access KKCMA via a rough 4x4 access road, but prior approval must be secured with the adjacent Kapāpala Ranch

3.9 Public Use Opportunities

Vehicle Access & Roadways: While there are multiple access roads to adjacent forest reserve lands in Ka‘ū, there is one road for public access to KKCMA. The entrance is at the Honanui gate, near the 44 mile marker on Mamalahoa Hwy. This access road passes through Kapāpala Ranch, which is under lease, and requires registration and prior approval from ranch staff before the public can pass through this gate. You will not be able to get through the locked gate at the entrance without going through this process. More information about registration and access through Kapāpala Ranch can be found at: <http://kapāpalaranch.weebly.com/public-access.html>

This road is a very rough, 4x4 vehicle only road. During heavy storms, which can be common in the area during winter months, roadways are often not passable. The road first enters Ka‘ū Forest Reserve through Kapāpala Ranch, then provides access to KKCMA at the “domingo gate” in the southwest corner of the parcel (see Figure 18).

Hiking: There are no designated hiking trails within KKCMA, but interior roadways (Figure 18) can be used to hike around the area.

Mountain Biking: mountain biking is allowed unless otherwise posted, but only on established roadways. Due to the remote access and condition of roadways, mountain biking is not a common activity in KKCMA.

Horseback Riding: Horseback riding is not recommended within KKCMA due to the difficult access, lack of trail infrastructure, and generally steep slopes and unstable footing for horses in the area.

Dirt Bikes and All Terrain Vehicles: OHVs are allowed unless otherwise posted, but only on established roadways.

Camping: There are no designated camping areas within KKCMA.

Fishing: No fishing opportunities are available in KKCMA.

Hunting: Hunting in state forest reserves is regulated by the Hawai‘i Administrative Rules (HAR) Chapter 13-121 Hunting General Regulations, Chapter 13-122 Game Bird Hunting, and Chapter 13-123 Game Mammal Hunting. The entirety of KKCMA is within Hunting Unit B. For copies of the administrative rules, additional information on hunter education, hunting licenses and more, visit <https://dlnr.hawaii.gov/recreation/hunting/>.

Forest Product Collection: Koa timber resources from KKCMA will be managed via a separate permit system, see section 5.3.4. Gathering of other non-timber 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 Chapter 13-104, Hawaii Administrative Rules (HAR). Gathering of non-listed species or common materials requested in quantities that 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 Product Price List on the DOFAW website for information on personal versus commercial use quantities, as well as current commercial use pricing:

https://dlnr.hawaii.gov/forestry/files/2013/09/2018-12-11_DLNR_Forest-Products-Price-List.pdf

Collection of listed threatened, endangered, or other rare species; common invertebrate species; or any migratory bird species is prohibited under state laws Chapter 183D and 195D, HRS and subject to regulation under applicable HAR. Applications for permits for such activities may be submitted to the “Administrator,” at the DOFAW Honolulu office. In these cases, a separate Access Permit may be required which is obtained through the district manager at the DOFAW Hawai‘i Island office. Both addresses follow:

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

Hawai‘i Forestry Manager
Division of Forestry and Wildlife
19 E. Kawili Street
Hilo, HI 96720
Phone (808) 974-4221

The collection of any federally listed or migratory bird species is also subject to federal permits. Contact the USFWS for additional information.

For more information for how to apply for permits for the state Forest Reserve System visit our permitting page:

<https://dlnr.hawaii.gov/dofaw/permits>

Traditional and Customary Rights: Traditional and customary rights of the native Hawaiian people are protected under Hawai‘i law. The Constitution of the State of Hawai‘i, Article XII, Section 7 states: “The State reaffirms and shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua‘a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights.”

A Cultural Impact Assessment (CIA) was completed for the KKCMA plan, which can be seen in full in Appendix A. The CIA identified traditional and customary practices and valued cultural resources found within and in the surrounding areas of KKCMA, Kapāpala, and Ka‘ū. Some known cultural practices and resources include, but are not limited to: plant gathering, including koa for canoe building or kālaiwa‘a, and gathering of other plant species such as maile, māmaki, pulu, and ‘iliahi. Further details of known historical and current traditional and cultural practices can be seen starting on p. 85 of Appendix A. For additional inquiries regarding traditional and customary rights, please contact the “Hawai‘i Forestry Manager” at the Hawai‘i Island DOFAW office at the address listed above.

4. THREATS

4.1 Invasive Plants

Invasive plants are non-native species with the ability to invade natural areas, grow and reproduce rapidly, and reduce biodiversity. They are harmful to the environment, economy, and/or human health and can alter ecosystem functions such as freshwater collection, soil erosion, and flood control.

Currently there are limited numbers of invasive plants in KKCMA, but there are large populations of invasive plants below the property. Within KKCMA invasive plants are more common in the lower strata and along roadways. Increased activity or timber harvest can be a vector to introduce new invasive plant species and it creates disturbance where invasive species can flourish. Table 8 lists the invasive plants known to occur in KKCMA or the surrounding Ka‘u area. The Hawai‘i Invasive Species Council has invasive species profiles for many of these species, which can be found online at: <https://dlnr.hawaii.gov/hisc/info/invasive-species-profiles/>. Based on potential impacts, distribution, and available control methods DOFAW has set a management objective for each species:

Invasive plant management objectives:

- Control – Reduce populations and/or the vigor of individuals
- Contain – Stop or minimize population growth and geographic spread
- Remove – Elimination of populations within KKCMA

- EDRR (Early detection rapid response) – Species that are not established within KKCMA but are a serious threat to watershed function and/or native ecosystems. Early detection, rapid assessment and response are a critical defense against the establishment of new invasive species.
- Monitor – Monitor spread over time

Table 9 Invasive plant species threatening KKCMA

Species	Common Name	DOFAW Objective (in KKCMA)	Noxious Weed List Status
<i>Abutilon pictum</i>	painted abutilon	EDRR*	None
<i>Andropogon virginicus</i>	broomsedge	Contain	Hawai‘i Noxious Weed List
<i>Bocconia frutescens</i>	plume poppy	EDRR	Hawai‘i Noxious Weed List
<i>Caesalpinia decapetala</i>	cat’s claw	EDRR	None
<i>Cestrum nocturnum</i>	night-blooming jasmine	EDRR	None
<i>Clidemia hirta</i>	koster’s curse	EDRR	Hawai‘i Noxious Weed List
<i>Crotalaria pallida</i>	rattlepod	Contain	None
<i>Desmodium intortum</i>	greenleaf desmodium	Contain	None
<i>Derris elliptica</i>	tuba root	EDRR	None
<i>Ehrharta stipoides</i>	meadow rice grass	Contain	None
<i>Grevillea robusta</i>	silk oak	Contain	None
<i>Fuchsia x hybridus</i>	fuchsia	EDRR	None
<i>Morella faya</i>	firetree	Remove	Hawai‘i Noxious Weed List
<i>Hedychium gardnerianum</i>	Himalayan ginger	EDRR	None
<i>Heterocentron subtriplinervium</i>	pearlflower	EDRR	None
<i>Passiflora laurifolia</i>	orange lilikoi	EDRR	None
<i>Passiflora tarminiana</i>	banana poka	EDRR	Hawai‘i Noxious Weed List
<i>Psidium cattleianum</i>	strawberry guava	Contain	None
<i>Psidium guajava</i>	common guava	Contain	None
<i>Rubus argutus</i>	blackberry	Contain	Hawai‘i Noxious Weed List
<i>Rubus ellipticus</i>	Himalayan raspberry	Contain	Hawai‘i Noxious Weed List
<i>Rubus niveus</i>	mysore raspberry	Contain	Hawai‘i Noxious Weed List
<i>Setaria palmifolia</i>	palm grass	Remove	None
<i>Schinus terebinthifolia</i>	Christmas berry	EDRR	None
<i>Senecio madagascariensis</i>	fireweed	Contain	Hawai‘i Noxious Weed List
<i>Tibouchina</i> spp.	glorybush, cane tibouchina	Contain	Hawai‘i Noxious Weed List

* EDRR – Early Detection, Rapid Response; target species not currently known to occur in KKCMA, but are known in the surrounding areas.

Many invasive plants are also designated as noxious weeds by the Hawai‘i Department of Agriculture. A noxious weed is defined as a plant species which is, or may be likely to become, injurious, harmful, or deleterious to the agricultural industry or natural resources of the state. Selling or transporting noxious weeds, their seeds or vegetative reproductive parts is prohibited under state law Chapter 152, HRS and subject to regulation under Chapter 4-68, HAR.

4.2 Invasive Animals

Invasive animal species, especially ungulates, are a significant stressor on all native terrestrial ecosystems in Hawai‘i. They have been shown to alter ecosystem processes, contribute to native species mortality, and undermine the integrity and persistence of native ecosystems (Gregg, 2018).

Cattle appear to be the primary animal threat to the native ecosystems in KKCMA. They cause damage by trampling and browsing native vegetation. In KKCMA damage to koa seedlings and inhibition of koa recruitment is especially concerning. Although cattle fencing surrounds the parcel there is still cattle ingress to the area, either from damage to fencing, and gates being left open either intentionally or accidentally. Cattle have been observed in KKCMA and there are signs of activity including excrement and browse damage on vegetation throughout the parcel, especially in the lower strata.

Other ungulates reported from the Kapāpala area include mouflon and pigs. Mouflon cause similar browsing damage as cattle. Pigs root and disturb soil, which disturbs native ecosystems and creates habitat that invasive plant species can then colonize. Other non-native animal species include rats, cats, and mongoose, all of which are widespread in the hawaiian islands and negatively effect native plants and animals.

Invasive animals known to occur in KKCMA and their potential impacts are listed in Table 10. Based on potential impacts, distribution, and available control methods, DOFAW has set a management objective for each non-native animal species.



Figure 20. damage to koa seedlings, likely from grazing from cattle

Invasive animal management objectives:

- **Control** – Reduce populations and/or the vigor of individuals.
- **Contain** – Stop or minimize population growth and geographic spread.
- **Remove** – Full removal of populations within KKCMA.
- **EDRR** (Early detection rapid response) – Species that are not established within KKCMA but are a serious threat to watershed function and/or native ecosystems. Early detection, rapid assessment and response are a critical defense against the establishment of new invasive species.
- **Public hunting** – provide hunting opportunities.

Table 10 Invasive Animals with the Potential to Disrupt Ecosystems in KKCMA

Species	Common Name	Status/Threat	DOFAW Objective
<i>Bos taurus</i>	cattle	Trample plants, strip bark from trees, causing vegetation damage/erosion (currently believed to not be present)	EDRR*
<i>Canis lupus familiaris</i>	dog	Predate on native birds, game mammals and game birds; threat to public safety	Control
<i>Ovis gmelini musimon</i>	mouflon	Eat and trample vegetation; cause erosion (currently believed to not be present).	EDRR
<i>Culex</i> spp.	mosquito	Vectors for diseases that are a threat to public safety and native wildlife (especially <i>Culex quinquefasciatus</i>).	Control
<i>Felis catus</i>	cat	Predate on native and game birds; vectors of toxoplasmosis, a zoonotic disease	Control
<i>Herpestes auropunctatus</i>	mongoose	Predate on native and game birds	Control
<i>Rattus</i> spp.	rat	Predate on native plant fruits/seeds and native and game birds	Control
<i>Sus scrofa</i>	feral pig	Vegetation damage; trail damage & erosion; decrease infiltration/water quality and increase runoff; spread of invasive species and pathogens such as ROD; creating breeding ground for mosquitos carrying avian malaria	Public Hunting, Control

*EDRR – Early Detection, Rapid Response; target species not currently believe to be in KKCMA, but known from surrounding areas

4.3 Insects & Disease

New and sudden increases of insects and diseases can be a serious threat to KKCMA. With globalization and an increased dependence on imports, approximately 20 insect species become established in Hawai‘i every year (State of Hawai‘i 2010). Of particular concern in KKCMA are those that have the potential to cause widespread dieback of predominant forest canopy species such as koa and ‘ōhi‘a. Below are some of the known insects and diseases that threaten KKCMA. Many of these insects or diseases are very hard to control or have limited control options, and a sudden outbreak may drastically alter the forest composition. If an outbreak of one of these diseases does occur, it may drastically alter the management goals for the area.

Based on potential impacts, distribution, and available control methods, DOFAW has set a management objective for each insect or disease.

- Control – Reduce populations and/or the vigor of individuals
- Contain – Stop or minimize population growth and geographic spread

- Early Detection Rapid Response (EDRR) –These species are not established in the area but pose a threat. Actions will be taken to try and control the population early if detected.
- Remove – Elimination of populations within KKCMA
- Monitor – Species is widespread and containment is not feasible. Monitor changes in population over time and evaluate if new control options become available.

Table 11 Insects and Diseases with Potential to Cause Damages in KKCMA

Species	Common Name	Threat	DOFAW Objective (in KKCMA)
<i>Fusarium oxysporum</i> f.sp <i>koae</i>	koa wilt	Dieback and/or decline of koa, especially in low elevations/warmer areas	EDRR
<i>Scotoryhta paludicola</i>	koa moth	Endemic insect that occasionally experiences large population increases that can cause severe defoliation of koa trees.	Monitor
<i>Tetraleurodes acaciae</i>	acacia whitefly	Decreased plant vigor, leaf yellowing/defoliation of varying hosts	EDRR
<i>Accizia uncatoides</i>	acacia psyllid	Decline or poor growth form of koa.	Monitor
<i>Xylosandrus compactus</i>	black twig borer	Stunted growth and death of over 100 tree and shrub species	Monitor
<i>Ceratocystis luku‘ōhi‘a</i> , <i>C. huli‘ōhi‘a</i>	rapid ‘ōhi‘a death	Widespread and rapid death and/or stress of ‘ōhi‘a lehua	Monitor
<i>Klambothrips myopori</i>	naio thrips	Defoliation and potential death of naio	Monitor
<i>Plasmodium relictum</i>	avian malaria	Deadly to many species of birds, especially native hawaiian species	Monitor

Koa wilt: Koa wilt is a vascular disease that affects the xylem tissue and water transport capabilities of koa trees and can eventually lead to tree mortality. The disease is caused by the soil borne fungal pathogen *Fusarium oxysporum* f. sp. *koae* that invades susceptible plants through the root system (Dudley et. al 2017). The first sign of infection in trees is usually a yellowing or wilting of leaves on a single branch or part of the tree's canopy. If the branch is cut, there are usually dark stains in the sapwood. This disease severely restricts koa reforestation in most low to mid-elevation locations (sea level to approximately 1,000m elevation) with mortality rates commonly exceeding 75% (Dudley et. al 2017).

The virulence of *Fusarium oxysporum* in relationship to soil temperature is well studied in many host species and it has been determined that there is increased virulence at higher temperatures (Scott et al. 2001, Landa et al. 2006). The effects of koa wilt appear minimal at KKCMA and it is hypothesized that the high elevation and cool ambient soil temperatures of the area are not optimal for the survival of *F. oxysporum* f. sp. *koae*. Nonetheless, with climate change and the

potential for increasing soil temperatures, koa in KKCMA should be monitored for signs of koa wilt.

DOFAW has worked in collaboration with the Hawaii Agricultural Research Center (HARC) to create seed orchards of koa trees that have been screened and found resistant to koa wilt and installed across the state. This statewide network of koa orchards are located on state and private lands across the state, providing wilt resistant, localized koa seeds for outplanting and reforestation projects. One of these seed orchards was planted in KKCMA in roughly 2014 and is still functioning today.

Acacia whitefly: The acacia whitefly (*Tetraleurodes acaciae*) is a new pest that was first identified in Hawai‘i in 2021 from populations in Waikiki on O‘ahu. Infestations can lead to decreased plant vigor, including leaf yellowing, wilting, and defoliation. Their preferred hosts are within the Fabaceae plant family but other species can be affected as well. Known hosts include common landscape trees such as shower trees (*Cassia* spp.), orchid trees (*Bauhinia* spp.), and endemic plants such as wiliwili (*Erythrina sandwicensis*) and koa (*Acacia koa*). At this point the acacia whitefly has only been detected on O‘ahu, but more monitoring is likely needed on other islands. For more information see:

<https://hdoa.hawaii.gov/pi/files/2021/12/NPA-21-02-Tetraleurodes-acaciae2.pdf>

Black twig borer: The black twig borer (*Xylosandrus compactus*) is a small ambrosia beetle that is a major forestry, ornamental, and agricultural pest. They damage and stunt the growth of over 100 different shrub and tree species in Hawai‘i (Hara & Beardsley 1979). Female black twig borers tunnel into woody twigs, leaving pin-sized entry holes. Once inside they excavate galleries and lay eggs. This excavation, along with the introduction of pathogens, is the cause of damage to the host. Black twig borers damage koa and field plantings of other host species, hindering restoration and reforestation efforts. It is not known if black twig borer is a problem within KKCMA. Further surveys are needed to determine the extent and damages to trees in the area.

Acacia psyllid: The acacia psyllid (*Accizia uncatoides*) was first detected in Hawai‘i in 1966. This insect feeds on new growth of koa, which usually does not kill trees but can potentially lead to forking or multiple stems. This is a concern for KKCMA since growth form is important for koa canoe logs. Both biocontrol and chemical agents have been used to control acacia psyllids, the latter with success in forest plantings (Baribault 2014). Insect surveys in April 2023 did not find any acacia psyllids present, which is uncommon for forests in Hawai‘i (K. Insect surveys in



Figure 21 A koa trunk infected with koa wilt. Note the staining in the sapwood. Photo by J.B. Friday

April 2023 did not find any acacia psyllids present, which is uncommon for forests in Hawai‘i (K. Magnacca, pers. comm). The presence or extent of acacia psyllids present, which is uncommon for forests in Hawai‘i (K. Magnacca, pers. comm). Forest health monitoring surveys should continue to look for this pest species and potential impacts to koa regeneration should be examined.

Koa moth: The koa moth (*Scotoryhta paludicola*) is an endemic insect on the islands of Hawai‘i, Maui and O‘ahu. The caterpillars feed on koa leaves and are capable of defoliating large swaths of koa forests. The insect is normally present in low levels in the koa forests. In January 2013 DLNR staff reported severe defoliation of koa forests above Hilo, and surveys concluded the cause was likely due to damages from large populations of the *S. paludicola* caterpillars. The outbreak soon spread all over Hawai‘i island causing wide spread defoliation. The outbreak seemed to subside within a few months in most places and trees began to re-leaf. It is not known what caused the large population spike and eventual decline, but this is another insect that should be monitored for in KKCMA.

Rapid ‘ōhi‘a death (ROD): ROD is a disease that has killed over a million ‘ōhi‘a trees on Hawai‘i Island and has been found on Kaua‘i and O‘ahu. The fungi that cause the disease are wound fungi that enter the tree through wounds to the bark and then spread in the sapwood. There are two pathogens associated with ROD: *Ceratocystis luku‘ōhi‘a* which causes an aggressive wilt disease and is responsible for most of the stand-level die-off; and *Ceratocystis huli‘ōhi‘a* which is a slower-acting, canker pathogen which is thought to have been present in Hawai‘i for a longer period of time.

Through various efforts, managers have recognized a few patterns of disease occurrence and spread. Climate does not seem to limit presence of the disease, but ROD appears most aggressive in wet areas and lower elevations, likely from higher temperatures. Storm and wind events that wound ‘ōhi‘a trees can lead to infection by the fungus. Typically, these storm events occur in an “episode” with a spike of tree mortality, followed by a decreased continuing mortality.

Another pattern that has been more recently observed in surveys is the higher incidence of *C. luku'ōhi'a* detections in areas where hoofed animals are present, compared to adjacent areas where animals have been removed. The mechanisms are not fully understood, but it is thought that by wounding trees, animals might cause tree infection if spores are present. It is also possible that animals are moving spores of the fungus contained in soil, and research on animals directly spreading ROD are underway.

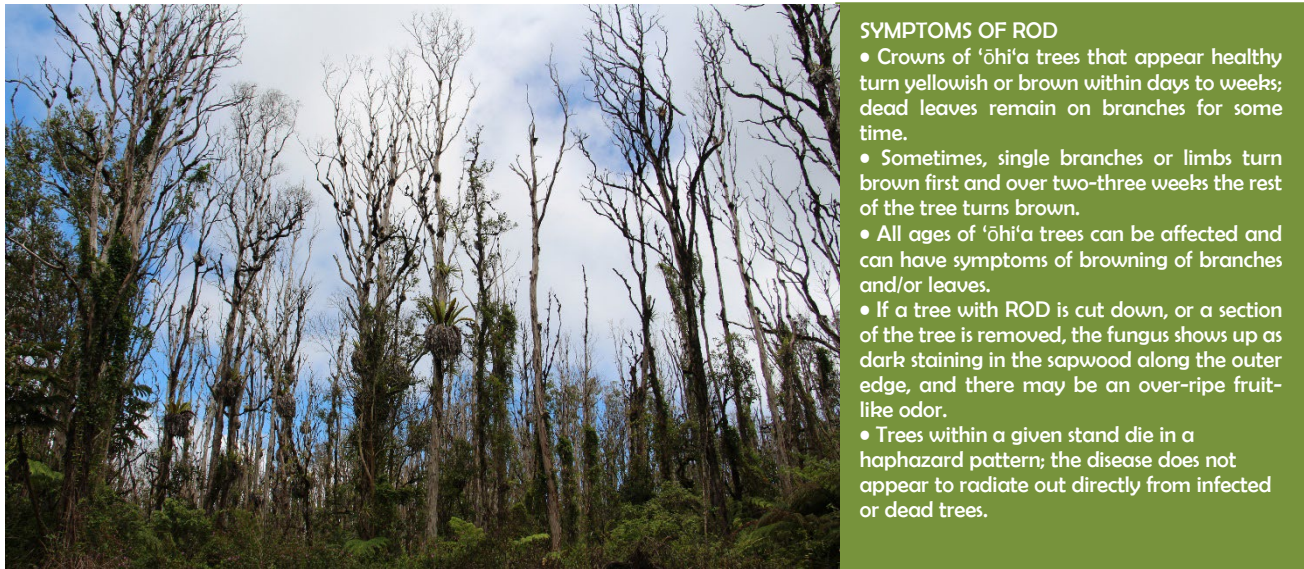


Figure 22. 'Ōhi'a killed by ROD in lower Puna on the island of Hawai'i Photo Credit: J.B. Friday

Ambrosia beetles which bore into 'ōhi'a trees are responsible for releasing frass which contains fungal spores into the environment. Entomologists have conducted controlled studies demonstrating that beetles can actually carry the fungus on their bodies and directly infect living 'ōhi'a seedlings. However, beetles normally attack dead and dying trees, and scientists do not think that beetles serve as the main disease vector. Humans can also spread ROD through moving soil either on their clothing, boots, or vehicles. Anyone entering or exiting KKCMA should brush and sanitize all footwear and vehicles to minimize the risk of spreading ROD pathogens.

ROD is now found throughout Hawai'i Island forests and will need to be managed in the long-term similar to invasive plants or effects of climate change. It is believed that spores of both *Ceratocystis* species are circulating widely on the island, and management actions can only help reduce wounding and entry points for the disease to enter trees. The relationship to feral animals offers potential management tools for preventing wounding and possibly spread of the disease by removing animals from the landscape. It is not currently clear which animals are responsible, but the pattern has been seen in forests with high populations of cattle and pigs, the former which strip bark from 'ōhi'a trees and the latter which damage roots when digging for food.

To protect important 'ōhi'a stands and forests, managers can utilize ungulate management (exclusion fences, hunting, or animal removal) to reduce incidence of ROD. This may be the most effective tool we have for managing ROD, but this only removes one potential vector and cannot prevent ROD outbreaks caused by storm damage. Areas in which ungulates have already

been excluded are still likely to have ROD show up, but the rate of infection over time is likely to be reduced.

ROD has been detected in KKCMA and the surrounding areas. A few 'ōhi'a trees that were sampled confirm the presence within KKCMA, and a large number of positive samples have been documented in the adjacent Ka'ū Forest Reserve to the west. Almost all samples taken in and around KKCMA show the presence of *C. luku'ōhi'a*, the more damaging of the two pathogens.

Myoporum thrips: Myoporum, or naio thrips (*Klambothrips myopori*) feed on and infest native naio trees (*Myoporum sandwicense*). Myoporum thrips are likely native to Australia or New Zealand and were detected in Southern California in 2005. In 2008, it was found on the island of Hawai'i and then found in several locations on O'ahu in 2018. They cause leaf distortion, gall-like symptoms and in severe cases, death. It appears that naio trees located in drier habitats are more vulnerable, and widescale dieback, potentially combined with drought stress, has been seen at Pu'u Wa'awa'a on Hawai'i island. Mortality rates could increase with climate change if rainfall decreases. Thrips and thrips damage have been observed throughout KKCMA, but widespread dieback has not been documented. Insect surveys in April 2023 did not detect any *K. myopori* present, although some plants showed slight damage associated with the insect. It may be that they move into the area seasonally and with warmer, drier weather, but the exact reasoning for their absence in surveys is undetermined.



Figure 23. Close up of curled leaf damage due to naio thrips, *Klambothrips myopori*

Avian malaria: This disease is carried by mosquitos and is deadly to many native birds species. It is considered one of the key factors limiting the distribution and abundance of native forest birds in Hawai'i. Even when avian malaria isn't fatal, it can decrease lifespans, and female birds infected with malaria can pass down a genetic predisposition for shorter life spans (Asghar et al. 2015). The range of suitable habitat for mosquitos is expanding as temperatures rise due to climate change, placing Hawaii's forest birds at higher risk of avian malaria and further decreasing their available habitat. Bird surveys of KKCMA show that threatened and endangered bird species are mostly found at higher elevations which may be partly due to the presence of avian malaria (see section 3.6).

4.4 Fire

Native ecosystems in Hawai‘i are not well adapted to wildfire and the majority of native plant species are not able to regenerate after a fire. Wildfires tend to lead to increased cover of non-native species and can convert forested areas to shrublands or grasslands (Trauernicht 2014). There have been no documented fires within KKCMA and wildfire risk in the parcel is considered low. However, wildfires are still possible, especially with human activity in the area. The principal human caused ignition threats are from vehicles or heavy equipment interactions with vegetation on roadways, arson, or illegal campfires. Fires have been documented in the adjacent Ka‘ū Forest Reserve and at lower elevations nearby. In 2005, a roughly 100 acre burn occurred on state land in the Kapapāla Ranch area about 3 miles directly south of KKCMA. In 2002/2003, the Pahuamimi fire burned 1000+ acres in Kapāpala FR, about 5 miles east of KKCMA.

4.5 Flooding & Erosion

Flood risk is considered low in KKCMA due to the lack of nearby streams. Erosion is a concern, as topsoil in portions of the reserve is shallow and highly erodible (see section 3.2). Erosion is most likely to occur along roadways, especially during heavy winter storms which can be common in the Ka‘ū area. The use of heavy machinery during timber harvest or other management activities could also increase soil erosion and appropriate mitigation strategies should be implemented.

4.6 Climate Change

Forest ecosystems in Hawai‘i will face new environmental conditions and a variety of increased threats associated with climate change. According to the 2012 Pacific Islands Regional Climate Assessment (PIRCA), documented indicators of climate change in the region include increasing air temperature (more significant at higher elevation), decrease in rainfall across much of the region, decrease in ground water discharge to streams, changes to frequency and intensity of climatic extremes, mean sea level rise (Western Pacific), and changes in species distributions. Potential impacts to our communities and natural environments include shifts in rainfall patterns, a decrease in freshwater supplies, increase in extreme weather events, flooding and erosion, increase in non-native biological invasions, increase in frequency and size of wildfires, and an increased risk of species extinction (Keener et al. 2012).

In 2018, the Pacific Island Climate Change Cooperative (PICCC) and EcoAdapt completed the Hawaiian Islands Climate Vulnerability and Adaptation Synthesis. Through literature reviews, expert elicitation, vulnerability mapping, and workshops with resource managers and conservation planners, the synthesis provides information to improve understanding of climate



Figure 24. Roadways in KKCMA can get washed out and hard to pass due to erosion

change impacts, increase capacity to reduce impacts, and facilitate decision-making by land managers (Gregg 2018). The climate synthesis contains summaries of adaptation strategies and actions for habitats types and ecosystem services.

The habitat classification from the 2018 Climate Synthesis that applies to KKCMA is Mesic and Wet Forests, which according to the report are moderately vulnerable to climate change. Some of the recommendations suggested for mitigating damage from climate change in these habitats are to expand fencing and ungulate removal, prioritize the planting of native species that thrive in a wide variety of conditions, and to determine agency roles in biosecurity plans for the area. The full summary of climate change adaptation for mesic & wet forests on Hawai'i island can be found here:

http://www.cakex.org/sites/default/files/documents/EcoAdapt_Hawaii_Mesic%20%26%20Wet%20Forest_Adaptation%20Summary_January2018.pdf

4.7 Volcanism

Although KKCMA is only about 12 miles southwest of Kīlauea crater, the parcel is at low risk of having direct lava flow or an eruption event. Figure 26 shows the lava hazard zones for the island of Hawai'i; Zone 1 is the area of greatest hazard and Zone 9 is the least hazardous. KKCMA falls within lava hazard Zone 6 on the southeast slope of Mauna Loa (Juvik & Juvik 1998).

A secondary effect of volcanic activity, volcanic smog or “vog,” is of concern at KKCMA. Vog refers to the hazy air pollution caused by volcanic emissions. The main particles of concern are sulfur gases, especially sulfur dioxide (SO₂), and small particulate matter (PM). In high quantities vog can cause serious deterioration of metal fencing and other infrastructure. Vog can also damage vegetation, especially non-native crops and agricultural species. Some native plants, such as ‘ōhi‘a lehua, appear to have adapted to periodic exposure to vog (Elias & Sutton 2017). Humans vary in their sensitivity to vog, but symptoms can include respiratory irritation or a general lack of energy.

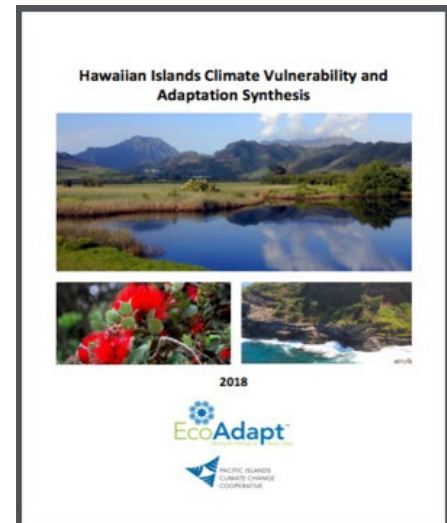


Figure 25 The Hawaiian Islands and Climate Vulnerability and Adaptation Synthesis

4.8 Vandalism & Human Activities

It is believed human activities are one of the main reasons for cattle ingress into KKCMA. Gates to the area have been left open, either purposefully or accidentally, allowing cattle to enter the area. Vandalism of infrastructure in the area, particularly to the fencing surrounding KKCMA is another potential source of cattle ingress. Cattle damage native forest ecosystems and are likely severely limiting koa regeneration. This threatens the continued supply of koa resources for cultural uses for generations to come.

Illegal, unpermitted harvesting of non-timber forest products has also been documented in the area. DOFAW staff have also seen evidence of maile propagation activities, including fertilizer and other cultivation paraphernalia within KKCMA and other parts of Ka'ū FR. Bringing soil, compost, or fertilizer into the forest is unsafe as it can lead to the spread of insects and diseases, such as rapid 'ōhi'a death and little fire ants. The unpermitted collection of forest products leads to the decline of resources for the rest of the public and for those collecting pono, with permits and in non-commercial quantities.

Other human activities of concern that have been noted is evidence of drug use in the area, and unsanctioned camping. Unsanctioned camping and campfires can be a fire threat, and drug use can create an unsafe environment for educational groups or the public.

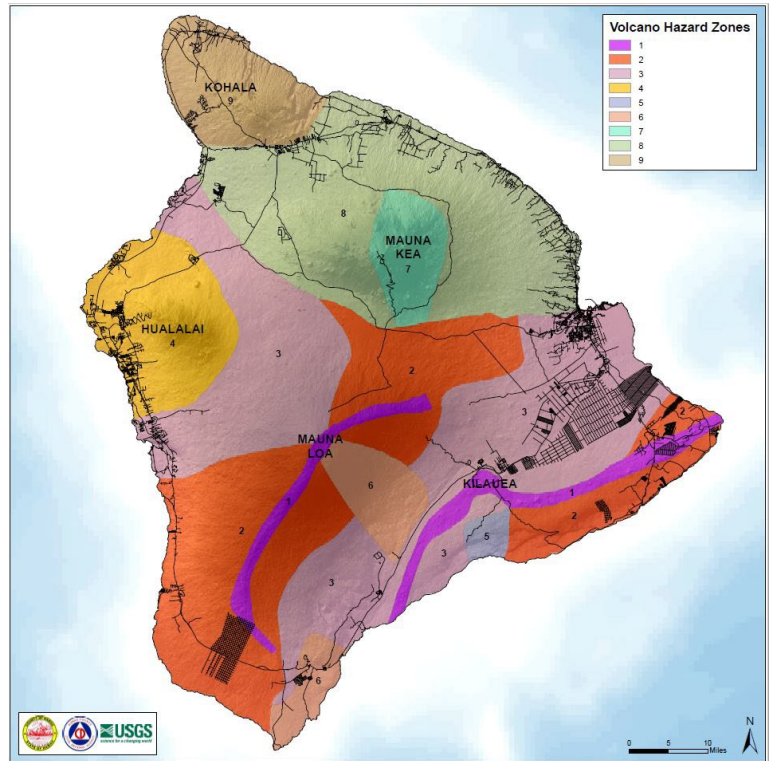


Figure 26 Volcano Hazard Zones on Hawai'i Island. KKCMA lies within Hazard Zone 6.

5. MANAGEMENT

5.1 Summary of Past Management Activities

DOFAW began managing KKCMA in 1989. For information on the area before 1989, see Section 2.1. Between 1990-1994, state funding was secured and a cattle proof fenceline was constructed around the parcel in two phases. During the construction of this fence, some trees were cut and harvested that were either obstructing the fence or threatening the integrity of the fenceline. Cattle from nearby ranchlands still ingressed into the area during and after fence construction, which was mainly managed by notifying the nearby ranches to retrieve and remove cattle. Cattle have been periodically removed over time, but they often encroach back into the area. Fence maintenance has improved, but cattle ingress either through fence failures or gates being left open is an ongoing issue.

A variety of timber, flora and fauna surveys have been completed in KKCMA. Multiple timber surveys have occurred, including a 2000 inventory of koa and 'ōhi'a, partial timber surveys in 2006 and 2007, and a full timber inventory in 2020, the 2020 Kapāpala Koa Canoe Forest Inventory (Appendix B). The 2020 inventory focused on koa timber resources, but also describes other vegetation in the area, and has heavily influenced the understanding of forest composition and koa timber resources for this plan. A roadside plant species list of KKCMA was completed in 2021, noting the presence of every plant species found in view from the roadside areas. This has been adapted to the Kapāpala Working Plant List (Appendix C). The Three Mountain Alliance (TMA) and DOFAW have collaborated on annual bird surveys in KKCMA from 2018-2022, of which the 2018-2021 data can be seen summarized (Section 3.6) and in its entirety (Appendix D).

The Three Mountain Alliance spearheaded a Youth Education Plan in the early 2010's, which included the construction of a gathering platform in the northeast corner of KKCMA (see Figure 18). TMA led educational trips to the area, but a few problems led the organization to determine it was not an ideal site. The parcel is open to the public, and some evidence of drug use and illegal camping had been noted. Also, the remoteness of the location, in combination with the very rough 4x4 access road that was often impassable during winter storms, made it hard to reliably access the area for educational groups.

In the southwest corner of the parcel, the Hawai'i Agricultural Research Center (HARC) in collaboration with DOFAW, created a koa seed orchard to provide koa seeds from trees screened to be resistant to koa wilt, a disease that often kills or heavily impacts koa trees, mainly at lower elevations (see section 3.5.1 and 4.3). This orchard is still present and active.

KKCMA Working Group: In an effort to advance the sustainable management of KKCMA, TMA and DOFAW partnered in late 2014 to bring together roughly 20 key stakeholders including cultural practitioners; voyaging and racing associations, clubs, and members; wa'a (canoe) builders; forestry experts; conservationists; land managers; and residents of Ka'ū. This working group was asked to provide insight and guidance on the long-term stewardship of the forest and appropriate use and perpetuation of wa'a and other forest resources in KKCMA. The first several meetings of the working group began by sharing knowledge that ultimately led to the development of a 2016 Preliminary Forest Management Plan. In 2017 and 2018, the working

group supported DOFAW in drafting an application and allocation protocol for canoe logs from KKCMA. Based on feedback from the working group and the preliminary plan and allocation protocol, it was determined a forest inventory was needed, which was implemented in 2019 and early 2020 (Appendix B). The forest inventory provided DOFAW with the needed information to revise and finalize the forest management plan for KKCMA, which the working group was once again asked to provide guidance on. The KKCMA working group has met approximately one to three times per year since its inception, for a total of ten meetings. Over the last seven years, the working group has been a source of diverse expertise and varied perspectives that are critical to the development of this Management Plan and the overall advancement of KKCMA.

5.1.1 Past & Related Plans

Plans that contain relevant information on the resources and management strategies pertinent to the management of KKCMA are listed below.

- Hawai‘i’s State Wildlife Action Plan
- DOFAW Forest Action Plan
- DOFAW Draft Management Guidelines (Appendix E)
- USFWS Endangered Species Recovery Plans
- KCF Preliminary Draft Management Plan (2016)
- Kapāpala Koa Canoe Forest Youth Education Plan
- Ka‘ū Forest Reserve Management Plan (2012)
- Forest Management Plan for the Waiākea Timber Management Area

5.2 Management Guidelines

DOFAW has developed a set of draft management guidelines and associated maps to assist in evaluating and balancing human activities and resource management goals and objectives. The purpose of the guidelines is to provide administrative policy direction and prioritize resource management activities based on the integrity of existing natural resources and social needs in five principal classifications: Conservation Resources, Forest Products Management, Recreation Management, Vegetation Management, and Hunting Management (Figure 27). Detailed definitions of these classifications and their associated management strategies can be found in Appendix E.

Forest Products Management Guidelines: There are four categories for Forest Products Management: Large Scale Commercial (F-1), Small Scale Commercial (F-2), Personal Use (F-3), and Restricted (F-4). **KKCMA is listed as F-2.** While the main purpose of KKCMA is koa timber harvest for koa construction, this is considered at a small, non-commercial scale and not large scale commercial. Some small scale commercial harvests will occur due to thinning operations in the area.

Conservation Resource Guidelines: There are four categories for Conservation Resources: C-1 (High Conservation Resources), C-2 (Medium Conservation Resources), C-3 (Low Conservation Resources), and C-4 (Little to No Conservations Resources). **KKCMA is listed as C-2.** KKCMA consists of predominantly intact native forest, something that is increasingly rare in

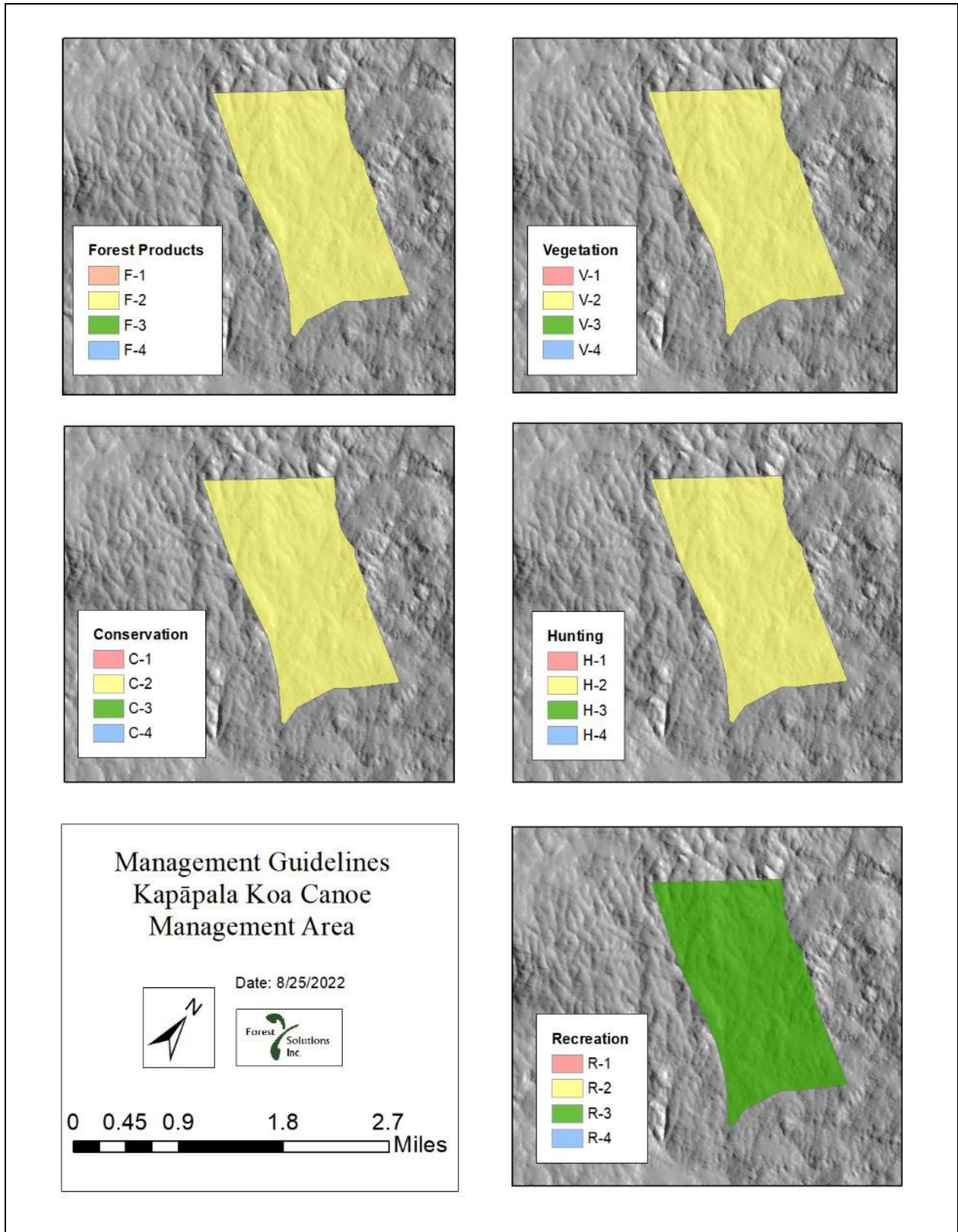
Hawai'i. However, there are minimal rare or endangered species, and unique resources in the area, which is why it is not considered C-1. However, it is still a very important area of conservation value.

Vegetation Management Guidelines: There are four categories for Vegetation Management: V-1 (Highest Quality Native Vegetation), V-2 (Predominantly Native Areas), V-3 (Considerable Degraded Vegetation Areas) and V-4 (Heavily Degraded Areas). **KKCMA is listed as V-2.** Similar to the conservation guideline, the vegetation in KKCMA is predominantly native, although there are some non-native grasses in lower areas and some invasive species along roadways (see section 4.1).

Hunting Management Guidelines: There are four categories for Hunting Management: Active Hunting Management (H-1), Moderate Hunting Management (H-2), Low Intensity Hunting Management (H-3), and No Hunting Management (H-4). **KKCMA is listed as H-2.** Public hunting is encouraged and common activity in KKCMA. However, the main objective of providing a long term sustainable supply of koa timber is a higher management objective than providing continuous hunting opportunities, which are a secondary management objective.

Recreation Management Guidelines: There are four categories for Recreation Management: R-1 (High Recreation Management), R-2 (Medium Recreation Management), R-3 (Low Recreation Management), and R-4 (Restricted Access). **KKCMA is listed as R-3.** Due to its remote location and difficult accessibility, KKCMA is not a common recreation area for many visitors. However, there is current public access that allows for hiking, bird watching, hunting and forest product gathering, provided you secure access through the nearby ranchlands (see section 3.9).

Figure 27 Management Guidelines for KKCMA



5.3 Timber Harvest

5.3.1 Harvest Plan Overview

The primary goal for this area is to sustainably produce koa logs suitable for building canoes now and for future generations. However, other goals, such as the protection of watershed benefits, native ecosystems, threatened and endangered species, and providing recreational opportunities, are also priorities. Therefore, this timber harvest plan is designed so that KKCMA can fulfill the need for koa canoe logs while also ensuring these other resources will be protected in perpetuity. This will be done by using sustainable silviculture and forestry practices developed for a 100-year horizon, and will be revisited at least every 10-years to integrate adaptive management strategies as needed.

The harvesting and forestry management proposed at KKCMA will follow the practice of disturbance-based or structural retention silviculture. This involves retaining various structures at the time of harvest, longer harvest rotations, and active creation of heterogeneity in the managed stand (Gustafsson et al. 2012). By attempting to emulate natural disturbance processes, management actions can give rise to a complex, structurally diverse forest while still utilizing and cultivating timber resources. In Hawai‘i, the most common disturbances in forests are flooding and landslides caused by extreme rainfall events, wind damage from tropical cyclones, and wildfire (Barton et al. 2021). In general, the spatial extent and intensity of the disturbance are inversely correlated with frequency, meaning small storms occur more frequently than large hurricanes or floods (Barton et al. 2021). At KKCMA, there are often windstorms that cause one or more koa trees to fall, increasing light availability to the forest ground and allowing a new generation of seedlings to grow. Forest management prescriptions can simulate this process through the harvest of single trees and groups of trees across the landscape at varying frequencies.

The main resource targeted during harvest operations will be large koa trees capable of being made into canoes (see Section 3.5). However, harvesting only large trees from the forest will, in the long term, result in a forest composed of smaller trees with poor form. The practice of removing only large trees, with hope that smaller ones will fill in, is referred to as high-grading or diameter-limit harvesting. This is an unsustainable practice with deleterious outcomes well documented in forests world-wide (Power et al. 2019, Oliver & Larson 1996). Through harvesting a variety of sizes and qualities of koa trees, forest



Figure 28 The disturbance-based harvest plan is meant to minimize impacts on the forest and promote regeneration of koa resources

management can positively influence the development of future koa stands, as opposed to selectively harvesting all the large koa trees in an area.

Therefore, harvest activities at KKCMA will be two-fold, and implemented in the same location:

1. Selective harvest of canoe trees
2. Thinning or other stand improvements actions, including selective harvests of non-canoe trees.

Canoe log harvests will be geographically paired with thinning and stand improvement operations to create openings for seedling recruitment and to prevent high grading through the removal of non-canoe quality trees. All timber management prescriptions will be guided by Hawai'i's Best Management Practices (BMP) policies (Appendix F) to mitigate any potential negative impacts from forestry activities. BMPs have a central focus on protection of water quality, and as such they commonly address maintenance of forest roads, timber harvesting, skid trails, reforestation, site preparation, and the protection and management of watersheds (Cristan et al. 2016).

Forest Management Units:

To assist in the organization of management practices, the forest has been divided into ten forest management units (FMU's). These FMU's are large enough to allow for efficient forest management operations yet small enough to be managed in a designated time frame. Each FMU has a unique identification number (UID), so that operations within it can be tracked and planned (Figure 30).

Forest Management Classes:

Each FMU is also assigned a management class as either 1) Restoration 2) Forest Product Management, or 3) Resource Protection (Figure 30). These classes represent the overall management goal for that unit and the potential management activities in that area. However, this does not mean management activity must be applied across the entire area, or that activities will not overlap across classes.

Restoration (271 acres): The lower elevation forests in the restoration management class contain an open 'ōhi'a forest with koa mostly in the sub-canopy (Figure 8). This area has a prior history of grazing and potentially past harvesting (see section 3.4), and is the most in need of restoration of forest structure. Suitable management activities may include pre-commercial thinning, commercial thinning, weed control, and enrichment planting of koa and/or other seedlings as needed.

Forest Product Management (684 acres): The mid-elevation in the forest product management class (Figure 30) contain both open 'ōhi'a-koa forest and closed koa-'ōhi'a forest and has koa trees of all diameter classes. These units include strata K02 and K03 (Figure 8), therefore, containing the transitional zone from the low elevation forest to the thick, diverse, mature koa

forest. This seems to be the best area for promoting the growth of canoe logs, as there is a higher concentration of canoe trees in this area (Figure 32). Management activities may include pre-commercial thinning, commercial thinning, and forest stand improvements.

Resource Protection (285 acres): The upper elevation forest of KKCMA contains remnant native, intact forest with mature koa trees represented by strata K04 (Figure 8). This area is critical to native bird populations, potential T&E species habitat, and overall watershed functions. The majority of koa trees are large, mature, sprawling trees that would not be suitable for canoes, though they contain a large volume of wood. There are three FMU's in this class, totaling 285 acres (Figure 30). This area has high conservation value and management will mostly include forest protection and forest stand improvements, with limited harvesting to target specific resources. However, canoe tree harvest of desired resources will occur as needed in the area.

Harvest Priority Zones:

In addition to FMU's and management classes, the forest has been divided into Priority Zones according to proximity to roadways. The goal of defining Priority Zones is to concentrate the harvest impact to specific areas at different times. Priority 1 is located within 200-feet from the roads and canoe tree resources have already been identified to help facilitate initial harvest activities. Priority 2 is 400-yards from the road and Priority 3 is the interior units that are more than 400-yards from the road (Figure 31). Both canoe tree harvests and stand improvement activities are planned to begin in the Priority 1 Zone in the first 10 years of the plan, then move into Priority 2 management units, followed by Priority 3 management units. However, Priority Zones are not restrictive and harvest activities can occur outside of the given Priority Zone as needed to allow for adaptive management.



Figure 29 Upper areas shown as “resource protection” in Figure 31 have more intact native ecosystems and large koa trees, but many are not ideal for canoe construction. Harvesting may still occur in these areas, but will be a lower priority.

Figure 30 Forest Management Units (FMUs) categorized by Forest Management

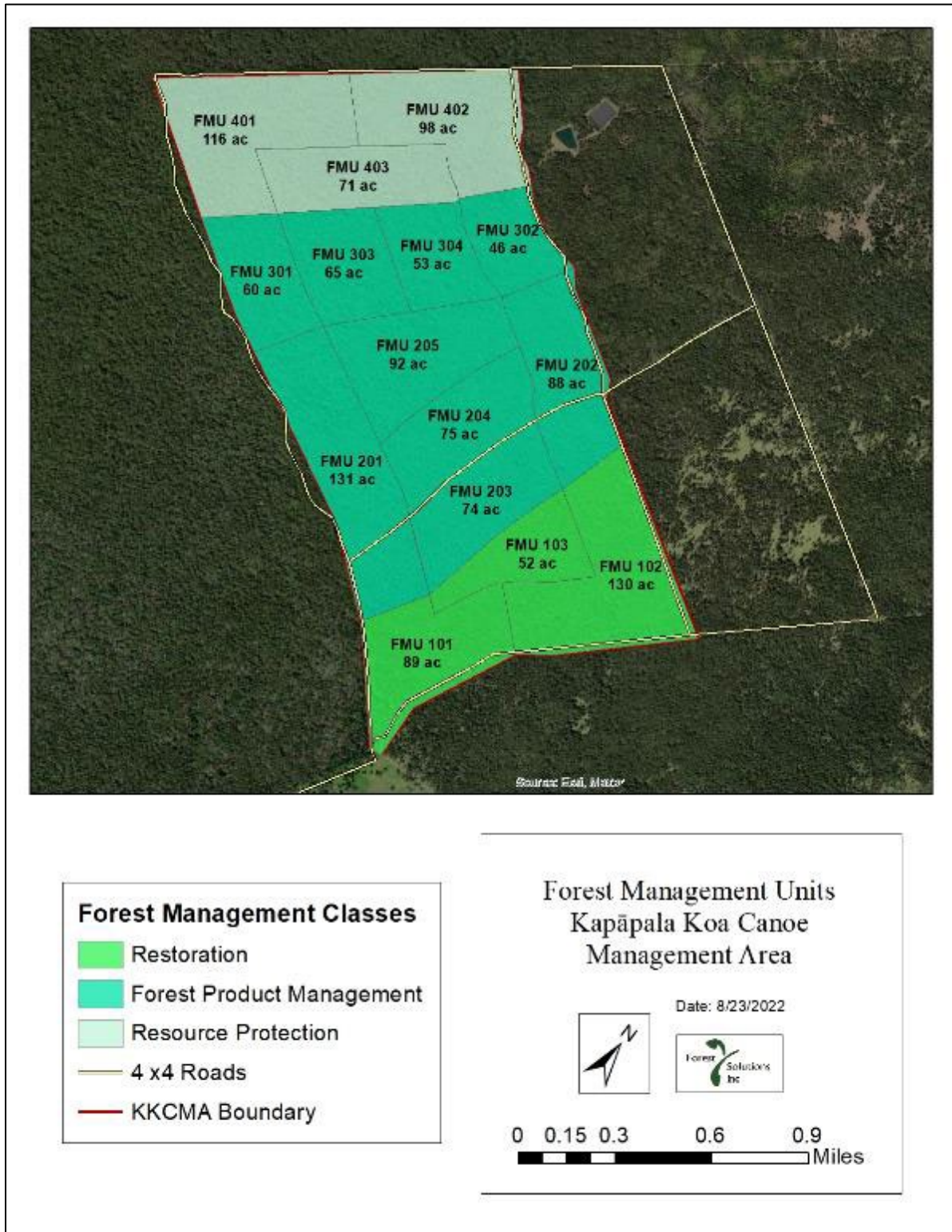


Figure 31 Priority Areas for Silviculture Activities

Note: Priority areas are broad designations showing where timber harvest, thinning operations, and general stand improvement actions are most likely to occur in the next 10-20 years. Actual operations may vary based on adaptive management needs

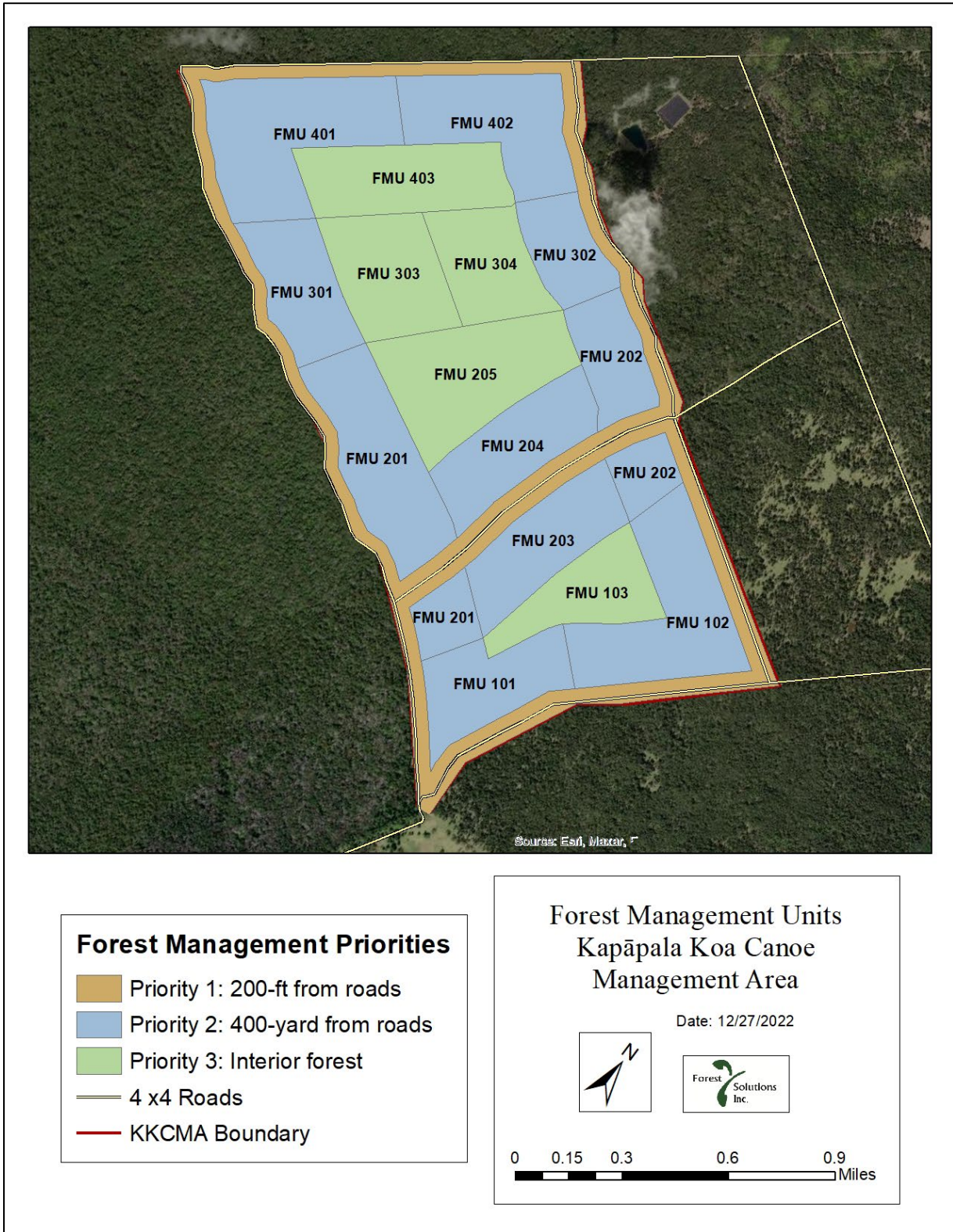


Table 12 Description of Forest Management Units (FMUs)

Management Class	Forest Type*	FMU	Acres	Estimated volume (bf)**	Koa canoe tree frequency***	Location	Potential Silviculture Actions
K01: Restoration	Open 'Ōhi'a Forest	101	89	192,000	Low	400-yard	pre-commercial & commercial thinning, enrichment planting, weed control, harvesting
		102	130	280,800	Low	400-yard	
		103	52	113,000	Low	Interior	
K02: Forest Product Management	Open Koa-'Ōhi'a Forest	201	131	460,500	Medium	400-yard	pre-commercial & commercial thinning, forest stand improvements, weed control, harvesting
		202	88	361,600	Medium	400-yard	
		203	74	248,500	Medium	400-yard	
		204	75	290,300	Medium	400-yard	
		205	92	475,000	Medium	Interior	
K03: Forest Product Management	Closed Koa-'Ōhi'a Forest	301	60	475,300	High	400-yard	
		302	46	393,200	High	400-yard	
		303	65	566,900	High	Interior	
		304	53	463,000	High	Interior	
K04: Resource Protection	Mature Koa Forest	401	116	383,000	Medium	400-yard	forest protection, stand improvements, limited harvesting
		402	98	325,300	Medium	400-yard	
		403	71	476,200	Medium	Interior	

*see section 3.4 for in-depth description of forest composition

**volume is rounded to nearest 100 board feet (bf)

***see section 3.5 for in-depth description of koa resources

Roadside Inventory and Known Canoe Quality Trees:

During the 2020 timber inventory, all living koa trees over 20 inches and within 200-feet of the roadsides were tallied and spatially logged with GPS. The roadsides were targeted as a good starting point for canoe tree selection, as these trees are easier to access, thus they will require fewer initial resources to harvest and leave minimal impact on the forest. A total of 822 koa trees

were tallied (Table 13). There was a total of 64 canoe trees and 123 potential/partial canoe trees. Additionally, 193 young canoe trees and 230 young potential/partial canoe trees will likely reach canoe size in 10- 20 years. There were 212 koa trees over 20 inches that were identified as unsuitable for canoe logs (see section 3.5 for more information on canoe log descriptions). Only living trees were catalogued, although canoe builders have indicated that dead and downed trees can also be utilized.

During the 2020 timber inventory, sample plots were also taken at regular intervals in the interior of KKCMA. While not a full survey, some notes were made of canoe quality trees in the interior of KKCMA. Figure 32 shows the location of known living canoe quality trees in KKCMA. While not complete, this help identify what areas of the forest are most likely to have canoe quality trees. Note Figure 32 only shows living trees.

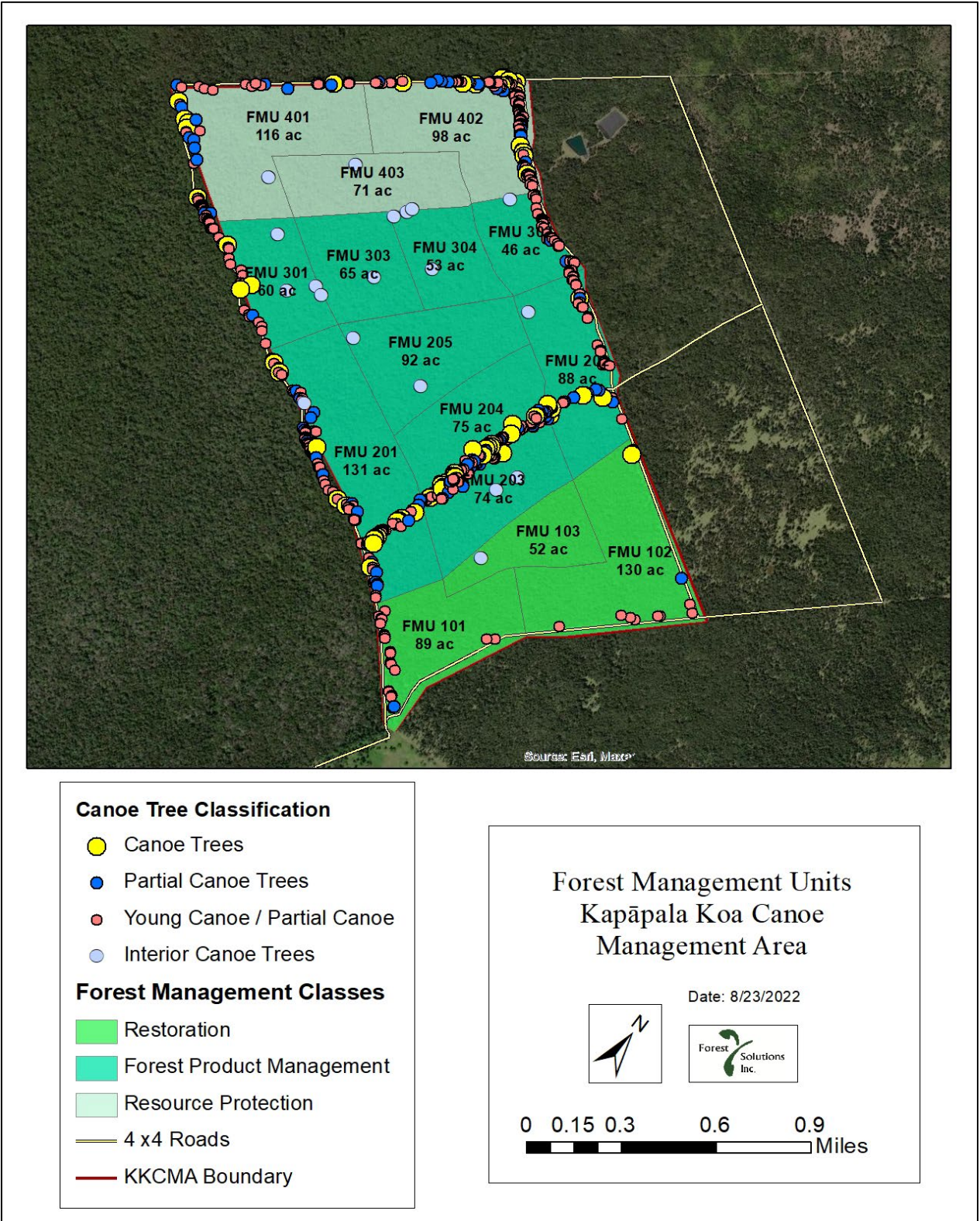
Table 13. Results of Canoe Trees* from 2020 100% Roadside Tally

200-ft boundary by FMU	Canoe	Partial Canoe	Young Canoe	Young Partial Canoe	Additional Koa > 20 in (non-canoe form)
101	0	1	4	17	28
102	1	1	4	5	11
201	14	32	39	45	54
202	6	10	13	17	36
203	6	20	17	30	4
204	13	17	34	16	0
301	3	3	4	18	20
302	0	2	17	15	12
401	6	18	12	25	37
402	15	19	49	42	10
Total**	64	123	193	230	212

* See section 3.5 for more information on canoe tree classification. These totals do no include dead and downed trees, which can be utilized.

Figure 32 Location of Known Koa Canoe Quality Trees in KKCMA

Note: While not complete, this map identifies areas with the highest potential for canoe quality trees (see section 3.5 for details on canoe tree classification). All living trees within 200ft of roadways were assessed in the 2020 timber survey (Appendix E). Interior areas have not been fully surveyed, but some canoe trees were noted during plot sampling. This map only shows living trees, but dead and downed trees may also be utilized in canoe construction.



Skid Trails and Interior Access

Skid trails, also known as skid roads, are roads installed for access to conduct management activities, such as the harvest of forest products. At KKCMA, skid trails will be used to extract logs from the forest and bring them to the main access roads. The objective of these trails is to allow suitable access while minimizing damage to the forest ecosystem, and not creating a large network of permanent public access roads.

Skid trail installation will follow Best Management Practices by planning the design and location with the objective of minimizing the disruption of natural drainage and preventing excessive soil displacement. Skid trails should have a slope of three to five percent and not exceed a slope of ten percent. Skid trails on a steep slope will require occasional water bars or drainage features. The width of the trail should be one meter (3.28 ft) wider than the width of the equipment employed for log extraction (Gumus and Turk 2016). Typically at KKCMA, this results in a trail width between 12 - 16 feet.

It is difficult to predict the scope of land impacted by skid trails without knowing the number of trees and their locations for each harvest entry.

Research on harvest access systems found skid trails impact between 1.6% to 10% of the harvest area in temperate and tropical forests (Sawyers et al. 2012, Medjibe et al. 2013, DeArmond et al. 2021). KKCMA is a small-scale, selective harvest system, therefore the skid trails will not be extensive, and the subsequent impact will be minimal. Additionally, the scarification created by skid trails will likely increase koa germination.

Post-harvest clean-up may include the retirement of skid trails that will no longer be needed. Retired skid trails are covered with slash piles (treetops, small branches) from the harvest to mulch erosion-prone areas and to discourage continued use of the trail. Lightly used skid trails can fully recover within a decade or less (DeArmond et al. 2021). If a skid trail is in an area that will require ongoing management activities (e.g. weed control, enrichment planting, thinning), the trail may be maintained and used again. It is always better to re-use existing skid trails, instead of removing mature trees to clear a new skid trail. Therefore, skid trails will always be GPS marked to maintain a record of their locations.

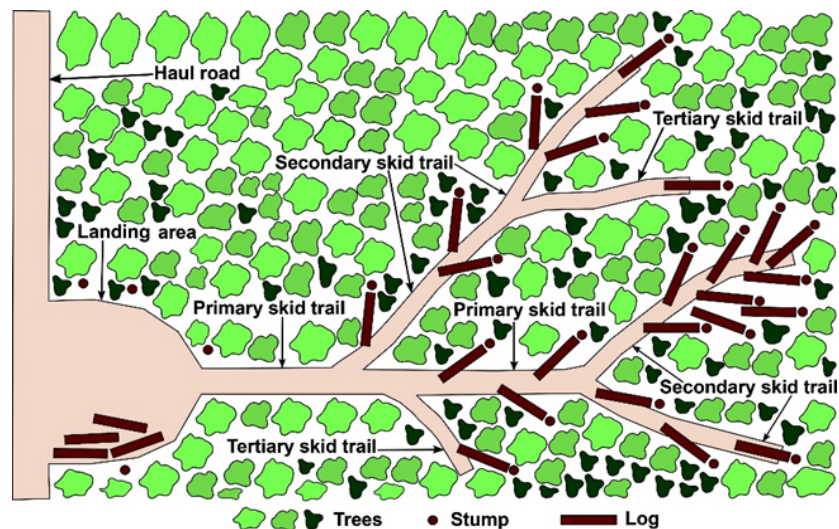


Figure 33 Example of a skid trail and timber hauling road system (DeArmond et al 2021)



Figure 34 Examples of Skid Roads in Hawai'i.

Top Row l to r: 1) newly constructed skid road 2) skid road about 5-10 years after construction 3) skid road 10+ years after construction.

Bottom row l to r: 1) a newly constructed skid road 2) a similar skid road 4 years after construction

5.3.2 Pre-Harvest Actions and Mitigation Measures

All efforts will be taken so that silviculture activities, such as skid road construction, timber harvest, and stand improvement operations, occur in such a way that the least amount of ecological damage occurs. Mitigation and avoidance of impacts to resources may include spatially and temporally avoiding sensitive and/or listed species, pre-harvest surveys of the areas, and ensuring staff are knowledgeable of sensitive natural and cultural resources. Further descriptions are provided below:

Native Birds: In consideration of the native bird populations, mitigation measures will be taken to minimize impacts to T&E bird species. Recent surveys (see section 3.4) indicate that most of the T&E species have been detected at higher elevations in KKCMA. Harvest activities will be generally be lower in these areas, especially in the northwest corner where ‘akiapola‘au and ‘alawī have been detected. Additionally, extra caution will be taken between March 1 to June 1 during the nesting and fledging season of native bird species, including ‘i‘iwi. Prior to harvest, the immediate area will be checked by DOFAW staff to survey for bird nests in or nearby trees being felled. If ‘io are found nesting, harvesting within 330 feet of that area will not proceed until the juvenile hawk has fully fledged.

Hawaiian Hoary Bat: To reduce the chances of injuring ‘ope‘ope‘a, the Hawaiian hoary bat, no tree harvest will occur between June 1 and September 15. Harvest and related forest disturbance activities will therefore be done in the period from September 16 to June 1, when it is least likely to affect native listed fauna reproduction. Prior to harvest, the immediate area will be checked for visual observations of bats that may be nesting or foraging nearby. Additionally, information on bat identification will be included in the worker training event for field personnel prior to starting harvest operations.

Native Invertebrates: Implement staff surveys for rare or T&E native insects and spiders and seek to avoid habitat and obligate host plants as part of adaptive management.

Rare and Endangered Plants: Prior to harvest, botanical surveys will be performed to check harvest areas and proposed skid road pathways to ensure activities will not harm sensitive or T&E resources. Currently, no T&E plant species are known in the area (see section 3.4).

Should any T&E flora species be found, they will be buffered to at least 50 ft. of their location or larger if warranted to keep the population safe and the area will be flagged. The buffer includes not felling trees into this area or creating skid roads in that area. The proper agencies will be advised of and consulted for further mitigation steps.

Historical Sites & Archeology: DOFAW will implement archeological surveys in all areas of KKCMA prior to the implementation of any timber harvest, skid road construction, or thinning operations. This may either be through one large survey of the entire parcel, or through incremental surveys. Regardless, potentially disruptive management actions such as timber harvest,

skid road construction, and stand improvement actions will not occur in an area prior to archeological surveys of that place.

In the event any surface and/or subsurface evidence of historic properties, including cultural deposits or features, human remains, lava tubes, structural remnants or concentrations of artifacts are uncovered during any management activities, DOFAW will immediately cease activity in the area, protect the discovery from further disturbance, and contact the State Historic Preservation Division (SHPD) for further advisement. If significant historical sites are present and require mitigation, a mitigation or preservation plan will need to be developed and submitted to SHPD for review and acceptance prior to initiation of project work.

Rapid ‘Ōhi‘a Death (ROD): ROD is known to occur within and near KKCMA, and mitigation measure are meant to decrease the potential spread or increase of ROD in the area. Damages to ‘ōhi‘a trees can increase pathways for ROD to enter uninfected trees (see section 4.3), and silviculture actions may require the impacting some ‘ōhi‘a trees during skid road construction or timber harvest. However, damages can be mitigated by implementing the following actions (CTAHR, accessed June 2022):

- Inspect and clean all vehicles, machinery, equipment, and material (including fill) prior to entering the forest. Vehicles and machinery must be sanitized using hoses to clean wheel wells, bumpers, grill, fenders, and side panels behind wheel. A pressurized hose is recommended, though a hose with spray nozzle attachment can be used.
- Sanitize boots, backpacks and equipment with 70% isopropyl or ethanol. Vehicles should be washed before and after entry into the area.
- Avoid damaging ‘ōhi‘a trees by hand clearing a path for the machinery ahead of time. Place the path where valuable trees are less dense and make the path only as wide as needed to fit the machine.
- When possible, give small ‘ōhi‘a a 10-ft buffer and large ‘ōhi‘a a 20-ft buffer to minimize damage to roots and trunks.
- If damage occurs, fresh injuries to ‘ōhi‘a can be sprayed with a pruning sealant to prevent ROD-causing fungi from landing on the wounds and causing infection. Be aware that the use of pruning sealant will not guarantee that the tree will be safe from infection.

Improved Road Access & Erosion Management: To improve access for harvest operations, road improvements and road contouring along some roadways within KKCMA (see Figure 18) are high management priorities. Also, some sections of the access road will likely need improvements to facilitate the movement of heavy machinery and forest products.

Due to the steep nature of the mauka-makai roads within KKCMA, road re-contouring will be necessary to reduce the constant need for road maintenance and to help facilitate management activities. Road contouring is a grading technique that decreases the slope of the road in areas that are severely impacted by erosion. The road is re-routed along a contour, making a small turn in the road, reducing the slope of the road. Road contouring increases the longevity of the road by mitigating erosion and improves overall water quality in the area. Road contouring will be limited to within the 200-ft road buffer and will not extend into the interior of the forest.

Temporary skid trails will be created as necessary to access interior forest areas during harvest operations. After harvest operations, skid trails can be closed with slash piles to prevent continued use of roads. This will be done to decrease chances for invasive species entry and spread, decrease chances for erosion, and decrease habitat fragmentation, among other concerns.

To reduce erosion and for safety concerns, all operations will be halted during heavy rain and storm events, and may be postponed until staff deem roadways safe. Storms in KKCMA are most common during the winter and early spring.

5.3.3 Harvest Volume Restrictions & Harvest Rotations

In order to ensure sustainable harvest levels, and to maintain other goals such as watershed protection and native ecosystem protections, restrictions on the amount that will be harvested within KKCMA will be put in place. No more than 500,000 board feet, or approximately 10% of the 5.5 million board feet of koa estimated within KKCMA, will be removed from the forest within a 10-year period. The volume restriction includes all harvest and thinning operations, including harvesting of canoe trees and additional silvicultural activities.

Like many tree species, diameter growth for koa varies throughout tree and stand development. Koa growth studies have found an annual growth rate ranging between 0.24 inches/year in low quality shady sites, to 0.59 inches/year in direct sunlight (Baker et al. 2009). This is an average of 0.41 inches of growth per year, indicating that the average diameter in a 100-year-old stand of koa trees would be 41 inches. Therefore, we estimate that a typical racing canoe size log (see section 3.5), with a healthy thinning regime, is attainable at or before a koa tree becomes 100 years of age.

The harvest rotation is the planned number of years between the time a stand regenerates and its final cutting at a specific stage of maturity (Nyland 2007). The harvest rotation for a canoe tree is 100 years, meaning after a canoe tree is removed and an opening is created for a seedling to grow, that seedling will be a canoe quality tree in 100 years. If 1% of the forest area is harvested each year, then the first 1% will be ready to harvest again after 100 years. This concept is scaled up to 10% of the forest area every 10 years, to account for variability in management intensity from year to year.

Although there is variety in koa volume densities across the property, if 10% of the total volume is removed in an area, then that volume will return over the course of the lengthy 100-year rotational period. In fact, it is likely that more than the original volume will come back due to stand improvement activities and forest health management.

Expected demand and available koa timber: The protocol and guidelines required for an organization to be allocated a canoe are extensive. Further, the number of suitable organizations and canoe carvers is finite. Once all the organizations needing a canoe tree are satisfied, they will not need another one for many years. By implementing a harvest limit of 10% of the total volume over a 10-year period, the annual harvest volumes may vary depending on the needs of the organizations. It is likely that koa canoe trees will be in high demand initially, and then decrease significantly with each subsequent year. On average, a canoe tree is estimated to be

between 3,000 bf and 5,000 bf, therefore the harvest limit is more than enough to meet the needs of all the eligible organizations and sustain harvest activities to support the management of the forest.

According to recent inventories and surveys, stand development theory, and anticipated stand improvement actions, a maximum volume of 500,000 board feet every 10 years is predicted to be a sustainable number that will not negatively impact the koa canoe resource and associated forest ecosystems. After each 10-year period, the plan shall be reviewed to ensure the harvest limit restrictions remain sustainable.

5.3.4 Canoe Tree Application Process

Organizations within the state of Hawai‘i may submit an application for the opportunity to harvest a koa tree or tree(s) from KKCMA for the purpose of creating a koa canoe for cultural and traditional uses. This includes for the purpose of creating racing canoes, voyaging canoes, or fishing canoes, among others. Details on the application, scoring and ranking system for applicants and the allocation process will be outlined in a separate submittal that will be brought before the Board of Land and Natural Resources (BLNR) for approval. However, the general application process and award of a canoe log from KKCMA will be as follows:

- 1) Organizations will submit an application for a canoe log from KKCMA.
 - a) Organizations must be able to demonstrate their financial capacity and means of processing the log into a canoe, demonstrate they have an experienced builder available with the capacity to utilize the log, and have a harvest plan approved by DOFAW.
 - b) Organizations must have a Stewardship Plan outlining forest conservation or land stewardship activities.
 - c) This is a separate application than any other requests for timber from DOFAW, such as the salvage timber waiting list.
- 2) Applications will be reviewed by a selected group of experts that will provide recommendations to DLNR/DOFAW to make final decisions and issue a special use collection permit to allow for harvest.
 - a) Applicant reviewers will consist of cultural practitioners; voyaging and racing associations, clubs, and members; wa'a (canoe) builders; forestry experts; conservationists; land managers; and community members of Ka‘ū and Hawai‘i island.
- 3) DOFAW will identify specific trees that are available for harvest according to the plan. The number of trees and volume of koa harvested annually will depend on the number of qualified applicants, in accordance with the 10-year harvest volume restriction of 10% of the total volume of the area.
- 4) The organizations that are selected will be able to select the appropriate tree for harvest, and be provided a timeline of when they are allowed to perform the harvest. The

organizations are encouraged to collaborate with one another or in conjunction with DOFAW's other management activities to decrease costs, or independently to determine a date for the harvest.

- 5) All harvest operations will be conducted according to the State's Best Management Practices (Appendix F).

5.3.5 Canoe Tree Extraction Operations

The harvest operations, and costs associated with extracting canoe trees, will be the responsibility of the organization who is awarded a special use permit for canoe tree harvest. All thinning or stand improvement silviculture actions will be the responsibility of DOFAW. This allows organizations the flexibility of what protocols and methods are appropriate for their traditional and cultural use of harvesting canoe logs, and to allow for different organizations to have different processes for harvest.

Harvesting whole logs destined to become canoes requires different operational activities than harvesting short saw logs for parts or sale. The method recommended for extraction is ground-based, however alternative extraction methods may be feasible (i.e. helicopters). Ground based methods use chainsaws or bulldozers to fell trees and heavy machinery to extract them. Some trees may be felled by a bulldozer pushing over the tree and slowing its descent to the earth to protect the wood. Once a tree is felled, it is extracted to a main access road where it can be loaded onto a highway truck. The extraction can potentially be damaging to the tree and should be supervised by an experienced forest manager to help preserve the condition of the log. Specialized heavy machinery may be needed to safely move these large logs without damaging them. Trees will be extracted from the forest to the road using skid trails, which are temporary routes for the machinery to remove the log. Skid trails will be surveyed and marked ahead of time, to avoid sensitive habitat, such as mature 'ōhi'a trees. Typically, scarification of the soil by machinery on skid trails can activate koa seeds and stimulate regeneration of koa seedlings.

The labor costs associated with harvesting include hiring an experienced cutter, a ground man, and a machine operator, are the responsibility of the applicant for the canoe log. DOFAW is not responsible for harvesting and delivering the logs to the applicant. Machine rentals may include an excavator, a forwarder, and/or a bulldozer. These machines need to be transported to and from the forest, which adds additional costs to the operation. Finally, the log is transported on the highway in an oversized load transportation vehicle and may ultimately be shipped off the island to another location. The budget is estimated between \$6,000 and \$20,000, though it is highly variable and subject to change according to harvest operations and the destination of the log. As many organizations are not experienced foresters and timber harvesters, an existing advisory group, consisting partly of experienced foresters, as well as DOFAW staff, may be able to provide guidance and connections to capable extraction operators and best practices.

If and when possible, it will be cost-efficient and reduce impacts on infrastructure and on the forest if operations between organizations or with DOFAW can be combined or done in quick succession with each other. All harvest and thinning operations must follow Hawaii Timber Best

Management Practices (Appendix F) and any other guidelines included in the special-use permit for canoe log extraction, and will be done to minimize impacts on the forest.

5.3.6 Thinning & Stand Improvement Operations

Thinning is a stand improvement action designed to preserve a balance of tree sizes and genetic diversity in the forest by removing smaller and less well-formed trees. By removing sub-standard quality trees, thinning promotes a superior growing stock for future growth. The result is a balanced stand containing both large and small trees, which prevents the negative impacts of high grading (only harvesting the biggest and best trees). Thinning in KKCMA will target koa trees, as they are the most common and fastest growing native tree in the area. ‘Ōhi‘a and other natives will usually not be targets for thinning operations unless considered hazard trees. Thinning will favor a selection of dominant koa trees to grow into canoe quality trees quicker and at a higher frequency.

As harvesting operations occur at KKCMA, dense stands of young trees are expected to grow in the openings created by tree removal. Young koa growing in this environment experience high rates of mortality and grow very slowly. Research on koa stands ranging from 9 to 25 years found that thinning leads to substantially increased tree growth rates and tree vigor (Baker et al. 2009). Therefore, the two thinning practices that will be implemented at KKCMA are pre-commercial thinning and commercial thinning. Both practices are employed to reduce stand densities, prevent stagnation, improve tree form, and increase the growth of the remaining trees. **The goal of all thinning operations is stand improvement, not resource extraction.**

Pre-commercial thinning. This thinning method is performed prior to trees reaching merchantable size. During pre-commercial thinning, small trees are cut and typically left in the forest, allowing the remaining trees to grow quicker due to less competition (NRCS 2012). This type of thinning can be done in-house by DOFAW with mechanical or chemical methods, depending on the size of the trees being thinned. The smaller the trees, the less costly it is to perform the thinning operation. Wood from precommercial thinning may be collected and made available to woodworkers and community members through collection permits.

Commercial thinning. This involves removing damaged or poor form trees that are of merchantable size. Commercial thinning operations will target koa trees that are damaged or have abundant rot, to provide growing space for future koa canoe trees. Staff will also remove trees that are less dominant or of poor form. Commercially thinned trees may be sold for revenue to be used in the continued management of the forest, i.e.:

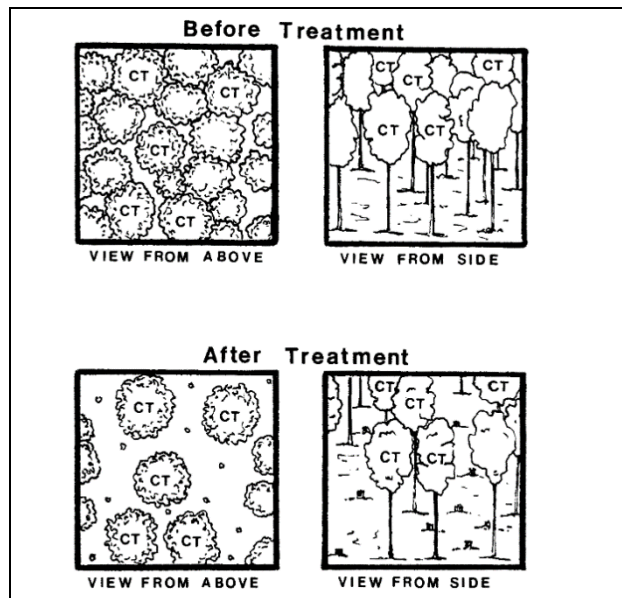


Figure 35 Aerial and side views of stand before and after releasing crop trees by crown tree release/thinning operations. (Lamson et al. 1990)

ecosystem protection, weed management, thinning operations, inventory, and data collection. Additionally, both types of thinning could potentially provide material for canoe parts or other woodworking opportunities.

In forest management, land managers utilize species-specific stocking guides to develop a sound precommercial and commercial thinning regime. Unfortunately, a koa growth model does not exist and conclusive stocking data is not available. However, studies have examined the response of koa to thinning and found that stands thinned to lower densities of trees (80-120 trees per acre) result in much faster growth of the remaining trees, compared to stands thinned more lightly (Baker et al. 2009). Managers at KKCMA will continue to draw on the latest koa forestry research, combined with on the ground stand assessments, to develop and adapt a suitable thinning regime.

5.4 Non-Harvest Management Objectives

5.4.1 Ungulate control

The control of ungulate populations is a high priority for KKCMA. The primary threat to the recovery of forests within KKCMA is from grazing cattle (see section 4.2). The entirety of KKCMA is fenced, and currently staff believe the area is cattle free. Recently there has been evidence of a small feral herd (<5 cattle) present in the reserve, and that ingress from nearby ranching land has occurred either when gates are left open, or potentially through openings in the fence due to vandalism. Scheduled fence checks and monitoring of the area through checking game cameras are currently ongoing to ensure cattle do not return, and if any cattle are found they will quickly be removed. Another goal is to secure funding to be able to install cattle guards at access gates to prevent intrusion. For this project to succeed, the threat of cattle must be removed and actively monitored to ensure they do not come back in.

Sheep, mouflon sheep, and goats are not currently found in KKCMA, but monitoring will be done to ensure they do not enter the area. These ungulates detrimentally browse native vegetation, including koa, therefore there will be zero tolerance for sheep, mouflon, goats and cattle in the area. Damage to koa seedlings and regeneration is too costly economically, biologically, and culturally.

Pig populations are present at KKCMA, and they have the potential to grow and severely damage natural and cultural resources, especially koa trees in the area (see section 4.2). Currently, KKCMA is open to public hunting as part of hunting unit B (see section 3.9). DOFAW plans to include additional staff control of pigs to reduce populations levels within KKCMA. This may include trapping, staff hunting, and adding skirting to fence lines to protect forest resources, with the possibility of making the area 100% ungulate free depending on forest health needs and the needs to protect koa resources for canoe construction.

5.4.2 Increased koa regeneration

The 2020 timber inventory showed that natural recruitment of koa seedlings is low or non-existent throughout much of the area (see section 3.5 and Appendix B). This is likely due to recent browsing by cattle, and more intensive cattle control will likely increase seedling

recruitment. However, other management actions that can be done to increase koa recruitment include:

Scarification: Koa seeds have a hard, protective seed coat that protect it for a few decades or more in the soil. Most of KKCMA contains mature, fruiting koa trees and therefore likely has a healthy seedbank of koa seeds in the soil. Scarification of the seed coat is needed to break dormancy for germination. Ground disturbance due to silviculture operations (see section 5.3) will scarify seeds and stimulate germination. This operation is inexpensive, effective and will be an important component of stand replacement, provided that cattle are excluded.

Enrichment planting: Insufficient koa regeneration can occur due to a limited seed bank, uneven diameter class distribution, disease or invasive species, and inadvertent cattle predation. Should regeneration fail, planting of seedlings from good seed stock will be needed. The seed source should come from within KKCMA and should be propagated using well-developed nursery techniques.

If large areas are found without regeneration, then proper forestry techniques including site preparation and competition control should be considered to ensure survival of planted seedlings. This is an unlikely outcome, such as in the recovery of a severe fire or when reforesting open grass patches.

5.4.3 Invasive plant control

At this time, invasive weed populations are minimal throughout the forest (see section 4.1). Current weed management actions, including the eradication of palm grass (*Setaria palmifolia*) and monitoring for the presence of Early Detection and Rapid Response (EDRR) target species will continue (see section 4.1 for a list of target weed species and goals). However, with increased management activities and traffic in the forest, it is likely that there may be an increase in weed populations. To mitigate the spread and introduction of invasive plants due to increased public access, informational signage and boot brushes will be installed at the forest entrance to encourage public cleaning of gear. Additionally, the ROD prevention protocol (section 5.3.2), including pressure washing vehicles, will also provide protection against weed seedlings and propagules from entering the area.

Monitoring of areas post harvest or after stand improvement actions is necessary to detect and quickly control new weed populations. A diverse monitoring regime (outlined in section 5.4.6) promotes early detection of incipient weeds, as well as long-term information on changes in understory species composition.

When needed, additional invasive weed management will be conducted to achieve the desired control of the target weed species. Manual and chemical control of habitat-modifying weed species will target incipient weeds that may be altering the native forest composition. Biological control will also be used to manage invasive species when they are available.

5.4.4 Wildfire Management

Management for the prevention of wildfire requires that both the perimeter road and the interior crossroad are maintained as fuelbreaks. Maintenance includes clearing the road of vegetation or fallen trees. Fire activity in surrounding areas should be monitored to determine the level of risk at KKCMA. If fire risk is high, the area will be closed to the public. The existing helicopter LZ (Figure 18) will also be improved and maintained to prepare for wildfire response. Finally, water access must be identified and secured to prepare for the control of a wildfire.

5.4.5 Access and Public Use

Ongoing road maintenance and road improvements (see section 5.3.2) will facilitate safe public access of the forest. Road contouring for harvest operations will help improve access and prevent erosion in the area. Road re-grading is another common maintenance that will be implemented to remove ruts and washouts created by erosion.

Roadways can be utilized for hiking and bird watching opportunities, as well as access for hunting and forest collection. Hunting will be monitored and managed according to HAR Chapter 122 & 123. Signs and a boot cleaning station will be installed and maintained at the entrance to increase public awareness on pests and disease (i.e. ROD, invasive plants, invasive animals). DOFAW requests all hunter takes be reported to contribute to monitoring efforts. Various non-timber products can be collected in the forest with the proper collection permit (see section 3.9), and when possible non-commercial timber resources from silvicultural activities in the area will be made available to the public for wood working, focused on traditional and cultural uses. Further, DOFAW will look to collaborate with cultural and educational groups, as well as organizations harvesting canoe logs, to integrate traditional and cultural practices and collaborate on management of KKCMA when possible.

5.4.6 Forest Monitoring and Research

Forest monitoring is critical to determine the success of management activities and to facilitate adaptive management at KKCMA. DOFAW staff will conduct regular fence checks and informal monitoring during site visits to observe ungulate transgress, as well as invasive weed species. In addition to informal forest checks, regeneration plots and/or photo points near or in harvest areas, and permanent sample plots will track the long-term growth and recovery of trees in the area. Further, a full forest inventory, similar to what was conducted in 2020 (Appendix B), will be conducted roughly every 10-20 years. All monitoring activities will include forest health assessments of priority insects and diseases (Table 11).

Regeneration plots and photo points

Prior to each harvest, between one and three regeneration plots should be installed to measure baseline forest conditions. The plots will measure the abundance (count) of koa seedlings and saplings, as well as other regenerating tree species. Observations of ungulate browse within the plot will be recorded. Each plot will have a photo point associated with it, to provide photo documentation of the forest conditions. Plot re-measurements and photo point documentation should occur approximately 6 months post-harvest and then every 2-3 years after that. The regeneration plots and photo points will provide both quantitative and qualitative data tracking forest development over time.

Permanant Sample Plots and other research opportunities

DOFAW, either internally or through collaborations with outside groups, will establish monitoring to track growth and health of timber resources, likely through permanent sample plots. Permanent Sample Plots (PSPs) are fixed plots designed to measure koa growth and yield. All trees in the plots are marked and measured repeatedly to track growth. Data generated from this type of monitoring can help contribute to the general understanding of koa stand dynamics, aiding in management decisions regarding diameter class thinning or other silviculture prescriptions. This forest provides an excellent opportunity for the research community to collect continuous data to create various predictive biometric equations for use in koa forest management.

Additionally, DOFAW will continue to collaborate with Hawai'i Agriculture Research Center (HARC) on koa research by maintaining the existing seed orchard and research plot within KKCMA (see section 3.5).

Inventory of koa resources

A complete inventory of the forest, documenting all trees that meet the criteria for a canoe log currently and trees that will meet the criteria in the near future, is vital to determine how many canoe logs are in the forest. This inventory will focus on koa resources, to understand how management activities have impacted the forest. Data gathered from this management inventory will provide information on stocking, basal area, diameter, heights, form, and health. This inventory is the most infrequent of all monitoring work, estimated to be conducted every 10-20 years, and will be similar to the inventory conducted in 2020 (Appendix B).

Biodiversity and forest health monitoring

Regular monitoring supports the early detection of pests and disease. DOFAW will collaborate with partners to secure essential technical information and understanding of new threats. Forest health monitoring will include checking for evidence of ROD within KKCMA to determine if the distribution is increasing over time. For the protection of T&E bird species, DOFAW will continue to collaborate with the Three Mountain Alliance in annual forest bird monitoring.

Bird Surveys

DOFAW will continue to collaborate with TMA to implement annual bird surveys at KKCMA. This data has been crucial to develop spatial representation of native birds and T&E species in the reserve and track the impacts of climate change on increasing distribution of avian malaria.

Insect Surveys

DOFAW plans to implement invertebrate surveys at KKCMA in the near future. These surveys will be done by DOFAW staff, mainly focusing on insects and spiders and not cover all invertebrates. Surveys will focus on T&E and rare insect species such as the endangered picture wing fly *Drosophila heteroneura* and other rare species like endemic species of pinapiao (*Megalagrion* sp.).

5.5 Management Actions & Costs

Table 14 Management Goals for KKCMA

Priority #1: Watershed Values

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Reduce impacts of ungulates on watershed resources	Cattle control & removal	Maintain fences surrounding KKCMA through regular fence checks and repairs	\$15k/year, staff & mgmt. costs
		Replace fence with bull wire as needed (10+ years)	\$1M
		Continued monitoring of cattle populations & removal as needed	Staff & mgmt. costs only
		Implement Cattle guards at 3 gates entering property (\$20K per cattle guard)	\$60K
		Check game cameras to ensure cattle remain absent from the area	Staff & mgmt. costs only
	Mouflon sheep monitoring	Continue to monitor (game cameras, staff observations) for presence of mouflon within the area (currently none are believed to be present)	Staff & mgmt. costs only
	Monitor & manage pig populations	Promote & track public hunting of pigs within the area	Staff & mgmt. costs only
		Increase staff control of pigs in the area through trapping and/or staff hunts	Staff & mgmt. costs only
		Install fence skirting along existing fencelines	~\$800K

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Minimize Erosion	Monitor and manage access road conditions	Implement road contouring in steep areas of mauka/makai roads prone to erosion	\$20K
		Conduct road maintenance (gravel fill potholes) as needed	\$TBD/year + staff costs
	Minimize erosional impacts from harvest operations	Ensure all harvest operations follow harvest best management practices (Appendix F)	Staff & mgmt. costs only
		Suspend all harvest operations during storms or heavy rain events	Staff & mgmt. costs only
Collaboration	Maintain DOFAW's partner role in the Three Mountain Alliance (TMA) Watershed Partnership	Establish regular communications, schedules, and protocols with WP	Staff & mgmt. costs only
		Participate in WP meetings.	Staff & mgmt. costs only
Climate change adaptation	Monitor latest information on climate change, vulnerability, modelling, and adaptation.	Participate in climate change seminars, meetings, and workshops	Staff & mgmt. costs only
	Track changes to forest composition over time	Utilize monitoring to determine if forest plant composition changes over time. Adapt management actions as needed to account for new environment as needed	Staff & mgmt. costs only

Priority #2: Cultural Practices & Uses

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Increase DOFAW capacity to manage KKCMA	Increase funding and resources for KKCMA	Request funding for a dedicated forester position to guide the management, community collaboration, planning, and implementation of projects at KKCMA	~\$74-90K/year
		Pursue state and federal funding sources to implement short and near term management goals	Staff & mgmt costs
Oversee & guide koa canoe tree harvest	Facilitate canoe tree distribution	DLNR will manage and award koa canoe tree allocation, in collaboration with recommendations from community, cultural, user group, and natural resource experts	Staff & mgmt. costs only
		Provide oversight prior to and during the applicant koa tree harvest	Staff & mgmt. costs only
		Work with canoe log recipients to ensure they implement work plans aimed at conserving and/or giving back to KKCMA or other forest areas within the state	Staff & mgmt costs only
		Encourage and collaborate with applicants on culturally appropriate harvest operations and protocols	Staff & mgmt costs only
		Ensure all permits require compliance with DOT regulations of transporting oversize or overweight vehicles.	Staff & mgmt costs only

General Management Actions	Tactical Goals	Action Items	Estimated Cost
		Ensure transportation crews coordinate with DOT through oversize load permit process to determine scheduling	Staff & mgmt costs only
Manage koa resources for sustainable long term supply of canoe logs	Ensure sustainable harvest levels for long term use	Track harvest levels annually and evaluate harvest goals and operations every 10 years	TBD, Staff & mgmt costs
		Implement forest monitoring as described in Resource Protection below	TBD
	Promote koa regeneration	Conduct mechanical scarification in select areas to increase koa seedling recruitment	Staff & mgmt. costs only
		Implement enrichment planting as needed	TBD, based on acreage
	Conduct silvicultural activities to improve koa canoe log availability	Develop thinning plan with desired stocking densities prior to implementation	Staff & mgmt. costs only
		Conduct thinning in specified management units according to a designated timeline	TBD Staff & mgmt. costs only
	Integrate traditional Hawaiian knowledge in silviculture operations	Implement traditional Hawaiian practices in the monitoring, selection of canoe trees, and management of KKCMA	Staff & mgmt. costs only

Priority #3: Resource Protection

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Manage incipient and established invasive species	Invasive species monitoring and control	Prevent the establishment of new invasive weed species within KKCMA, especially those outlined in Table 8 of this plan	TBD
		Use photo point monitoring (as well as regeneration and timber inventory data) to track invasive species levels over time	Staff & mgmt. costs only
		Implement manual, chemical, mechanical, and/or biological control as needed	Manual - \$625/ac, chemical- \$350/ac, and mechanical- \$180/ac
		Require cleaning of harvest machinery per Best Management Practices (Appendix F)	Staff & mgmt. Costs only
		Encourage public cleaning of gear via informational signage and boot brushes at forest entrance	Staff & mgmt. costs only
Manage ungulate populations	Control all ungulate populations at levels consistent with forest protection needs	Regular checks for animal ingress	Staff & mgmt. costs only
		Install motion sensor game cameras at known locations of cattle ingress	\$2,000
		Staff control of ungulates according to observations by staff, hunting data, and regeneration data	Staff & mgmt. costs only

General Management Actions	Tactical Goals	Action Items	Estimated Cost	
		Install cattle guards at gates	\$60K	
Forest health protection from insects and diseases	Protection of koa trees from insects and diseases	Include monitoring for koa insects and diseases, especially those outlined in Table 10 of this plan, in all monitoring activities, including timber inventory	Staff & mgmt. costs only	
	Early detection of pests and disease	Assist and collaborate with partners to secure essential technical information and understanding of new threats	Staff & mgmt. costs only	
	Rapid 'Ōhi'a Death		Include ROD sanitation and prevention procedures for all collection permits issued for KKCMA	Staff & mgmt. costs only
			Minimize impacts and wounds to 'ōhi'a trees during harvest operations	Staff & mgmt. costs only
			Look for signs of increased ROD distribution within KKCMA	Staff & mgmt. costs only
	Monitor avian malaria	Utilize forest bird surveys to monitor distribution of avian malaria in the area	Staff & mgmt. costs only	
	Increase public information and awareness on pests and disease	Sign installation and replacement as needed	\$2K/year + staff costs	
Wildfire management and prevention	Wildfire prevention	Maintain roadways to act as fuelbreaks	Staff & mgmt. costs only	

General Management Actions	Tactical Goals	Action Items	Estimated Cost
	Wildfire response	Monitor fire activity in surrounding areas to determine activity increases in elevation or in surrounding areas	Staff & mgmt. costs only
		Improve and maintain helicopter lz for access to the area	Staff & mgmt. costs only
		Ensure access to water in case of fire response in the area	Staff & mgmt. costs only
Forest monitoring and research	Forest monitoring	Conduct regular fences checks, and informal staff monitoring of presence of invasive species through regular operations	Staff & mgmt. costs only
		Conduct photo point plots to measure regeneration and identify evidence of ungulates	Staff & mgmt. costs only
		Implement growth monitoring, likely through permanent sample plots (PSPs)	TBD
		Conduct full timber inventory (roughly every 10-20 years)	\$30K
	Collaborate with Hawaii Agriculture Research Center (HARC) on koa research	Utilize seed orchard/research plot for timber or growth experiments	TBD
		Management and maintenance of fenceline around research plot	TBD
		Collect wilt resistant seeds from current orchard trees	TBD
		Collaborate with HARC on establishing alternative koa orchard seedlings on Hawai'i island	Staff & mgmt costs only

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Cultural resource protection	Protect Historic Sites found within KKCMA	At a minimum, an archaeological survey will be undertaken once a potential harvest area is defined and before any harvesting activities are carried out.	TBD
	Include native Hawaiian knowledge within management plans and actions	Seek as a part of management to utilize names of traditional places, Hawaiian environmental zones (wao) and associated individuals such as former konohiki	Staff & mgmt costs only
	Formalize and utilize existing working group	Continue to utilize the existing working group to guide appropriate cultural protocols and advise on planned activities.	Staff & mgmt costs only
		Utilize working group to advise on the canoe log allocation process	Staff & mgmt costs only
		Continue to maintain the working group consisting of kālaiwa‘a, kūpuna and kama‘āina of Kapāpala and Ka‘ū, canoe clubs, forestry experts, and other stakeholders	Staff & mgmt costs only
	Develop culturally integrated educational and stewardship opportunities	Require hālau (organizations) requesting a canoe log to implement stewardship, educational, and/or outreach efforts as a form of reciprocation as part of receiving permits to harvest a canoe log	Staff & mgmt costs only
		Collaborate with Ka‘ū and Hawai‘i island community groups and organizations on educational and stewardship opportunities at KKCMA	Staff & mgmt costs only

Priority #4: Native Ecosystems

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Maintain intact native forest habitats	Protection of upper elevation and interior forests	Interior and upper elevation areas prioritized as resource protection areas where silviculture operations will not occur	Staff & mgmt costs only
	Ensure regeneration of koa and other native trees post harvest operations	Based on monitoring data, utilize scarification or enrichment planting to ensure native seedlings regenerate in harvest areas	TBD
	Utilize monitoring to track native ecosystems over time	Photo point data, regeneration, and timber inventories will use to track status of native ecosystems overtime, and guide protection measures or adjustments to harvest operations	Staff & mgmt costs only
Climate change adaptation	Anticipate and facilitate habitat migration	Monitor abundance of native and invasive species as temperature rises and precipitation changes	Staff & mgmt costs only
	Prepare for increased possibility of insects and diseases	Integrate monitoring for insects and diseases (esp. those in Table 10) in monitoring and surveys	Staff & mgmt costs only
Minimize invasive species impacts on native ecosystems	Ungulate control	see Resource Protection goals for invasive plants, cattle, mouflon, and pigs	Staff & mgmt. costs only
	Invasive weed control		

Priority #5: Threatened & Endangered Species

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Protection and recovery of listed rare plants and animals	Protection of T&E bird species	DOFAW to implement pre-harvest surveys for T&E birds in any areas prior to harvest	Staff & mgmt. costs only
		Prioritize mid-elevation areas for majority of harvest operations	Staff & mgmt. costs only
		Continue annual forest bird monitoring in collaboration with Three Mountain Alliance	TBD
		If hawks are found nesting, no harvest operations will occur within 330 feet until the juvenile hawk has fully fledged	Staff & mgmt costs only
	Protection of the Hawaiian hoary bat	Maintain diversity in forest cover to protect bat habitat and food sources	Staff & mgmt. costs only
		Temporal avoidance of harvest operations to avoid bat pupping season (June 1-Sept 15)	Staff & mgmt. costs only
	Protection of rare plant species (none currently known within parcel)	Implement DOFAW staff monitoring for T&E plant species in all areas planned for timber harvest prior to any timber operations	Staff & mgmt. costs only
	Protection of T&E insect species	Implement DOFAW staff surveys of insects in the area. Utilize surveys to avoid damages to listed T&E species	Staff & mgmt. Costs only

Priority #6: Access, Trails, Hunting, & Other Public Uses

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Promote public hunting through Chapter 122 & 123	Regulate hunting as per HAR Chapter 122 & 123	Monitor and manage hunting activities	Staff & mgmt. costs only
		Ask hunters to report their daily take to contribute to monitoring efforts	Staff & mgmt. costs only
Maintain a variety of public uses	Encourage sustainable collecting of plants by the public	Require the use of collection permits for maile collection	Staff & mgmt. costs only
		Issue collection permits for other non-timber forest products	Staff & mgmt. costs only
		Collaborate with DOCARE to enforce over-harvesting or illegal collections within KKCMA	Staff & mgmt. costs only
	Facilitate public use of the forest for cultural, educational, and stewardship activities	Collaborate with organizations harvesting canoe logs to implement conservation and restoration efforts	Staff & mgmt. costs only
		Collaborate with cultural and educational groups	Staff & mgmt. costs only
	Utilize non-commercial timber resources from stand improving silviculture activities	Supply pre-commercial thinning timber to small wood workers and cultural practitioners through collection or harvest permits	Staff & mgmt. costs only
	Maintain hiking and bird watching opportunities	Utilize roadways as hiking and bird watching opportunities	Staff & mgmt. costs only
Maintain public access	Maintain roadways within parcel	Road maintenance and improvements as needed	Staff & mgmt. costs only

General Management Actions	Tactical Goals	Action Items	Estimated Cost
	Secure access agreement to the reserve	Solidify public access agreement through Honanui road	Staff & mgmt. costs only

Priority #7: Commercial Activity

General Management Actions	Tactical Goals	Action Items	Estimated Cost
Commercial thinning operations	Utilize commercially viable timber from thinning operations	Generate revenue from small scale commercial thinning operations through the sale of harvested koa. Revenue would be used to fund management at KKCMA	TBD

5.6 Measures of Success

Measures of success for individual reserve management plans can be derived from the State of Hawai‘i annual variance reports. Initial measures of success that may be applicable to KKCMA include:

- Number of koa canoe tree permits allocated
- Number of non-timber forest product collection permits allocated
- Percent increase of koa population rates
- Percent reduction of ungulates present in the forest
- Number of invasive animals removed
- Acres of invasive plants controlled
- Miles of fence maintained
- Number of T&E plants/animals protected
- Acres of forests without new invasive species established
- Acres of native ecosystem that remain intact
- Number of stewardship projects implemented
- Number of cultural and educational group visits/ events
- Number of regeneration plots and photo points installed and remeasured
- Number of biological surveys and/or research studies conducted

5.7 Future Recommendations

Additional suggestions for management activities include:

- Conduct further surveys of other biological resources
- Continue to monitor harvest levels to ensure they remain sustainable for long term use
- Utilize regeneration plot results to help inform adaptive silvicultural management
- Collect seeds for establishing seed orchards
- Continued collaboration with Working Group
- Plan for harvests of more interior areas where appropriate.
- Collaborate with educational, cultural, and conservation groups at KKCMA when possible.

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7. APPENDICES

Appendix A: Cultural Impact Assessment for the Kapāpala Koa Canoe Management Area

Appendix B: 2020 Kapāpala Koa Canoe Forest Inventory

Appendix C: Kapāpala Koa Canoe Management Area Working Plant List

Appendix D: Kapāpala Koa Canoe Management Area Forest Bird Surveys 2021

Appendix E: DOFAW Management Guideline Classification Definitions

Appendix F: Best Management Practices for Maintaining Water Quality in Hawaii

Appendix A: Cultural Impact Assessment (CIA) for the Kapāpala Koa Canoe Management Area

Due to the length of the Cultural Impact Assessment, the entire document has been made available online at the address below:

https://dlnr.hawaii.gov/forestry/files/2023/03/CIA_Kapapala-Canoe-Forest-3.14.2023_final.pdf

Appendix B: Kapāpala Koa Canoe Management Area Forest Inventory 2020

Due to the length of this appendix, the entire document has been made available online at the address below:

<https://dlnr.hawaii.gov/forestry/files/2023/01/Kapapala-Koa-Canoe-Management-Area-Inventory-2020.pdf>

Appendix C: Kapāpala Koa Canoe Management Area Working Plant List

Kapapala Koa Canoe Area Roadside Survey

March 10, 2021

Conducted by L. Perry and J. VanDeMark

This was a roadside survey to compile a plant species list. All roads (approximately seven miles) in the Kapapala Koa Canoe Area were traversed and plant species recorded within 200 feet of the roadways. No endangered species were observed along these roadways but there was a rare species (*Rubus macraei*) observed adjacent to the western boundary of the Koa Canoe Area within an old Vicia enclosure. It will be important to look for this species during future surveys when any koa felling is to occur. DOFAW recommends that prior to any tree felling a comprehensive floristic and entomological survey be conducted in the immediate vicinity of each tree that is extracted from this area and along any pathways that are utilized to extract such trees to minimize damage to native species. Another recommendation is to prioritize the lowest areas in terms of elevation for tree extraction first as these areas are more degraded by introduced species and less damage will be done to native species and the habitat by concentrating extraction activities in the lower half of the Koa Canoe Area. The forest steadily improves in terms of quality the higher in elevation one travels.

Native species observed:

Tree and Shrub species:

Acacia koa (koa)

Metrosideros polymorpha (ohi'a)

Cheirodendron trigynum ('olapa)

Ilex anomala (kawa'u)

Melicope volcanica (alani)

Myoporum sandwicense (naio)

Myrsine lessertiana (kolea)

Psychotria hawaiiensis (kopiko)

Broussaissia arguta (kanawao)

Coprosma ernodeiodes (kukaenene)

Coprosma rhynchocarpa (pilo)

Vaccinium reticulatum (ohelo)

Vaccinium calycinum (ohelo)

Dodonaea viscosa (a'ali'i)

Lythrum maritimum (pukamole)

Pipturus albidus (mamaki)

Rubus hawaiiensis ('akala)

Rubus macraei (rare species of *Rubus* that was observed in old Vicia enclosure just outside of Koa Canoe area)

Styphelia tamieamiae (pukiawe)

Vines, Herbaceous and Grass Species:

Astelia menziesiana (pa'iniu)

Alyxia stellata (maile)
Carex alligata
Deschampsia nubigena
Stenogyne calaminthoides
Smilax melastomifolia (hoi kuahiwi)
 Fern Species:
Amauropelta globulifera (palapalai a Kamapua`a)
Asplenium lobulatum (pi`ipi`I lau manamana)
Asplenium contiguum
Athyrium microphyllum (`akolea)
Cibotium glaucum (hapu`u pulu)
Cibotium menziesii (hapu`u `I`i)
Cyclosorus interruptus (neke)
Dicranopteris linearis (uluhe)
Diplazium sandwichianum (ho`i`o)
Dryopteris hawaiiensis
Dryopteris wallichiana (`i`o nui)
Marattia douglasii (pala)
Microlepia strigosa (palapalai)
Nephrolepis cordifolia (sword fern)
Pneumatopteris sandwicensis (ho`i`o kula)
Pseudophegopteris keraudriana (waimakanui)
Pteris cretica (`oali)
Pteris excelsa (`iwa)
Sadleria souleytiana (`ama`u)
Sadleria cyatheoides (`ama`u)
Sphenomeris chinensis (pala`a)

Non-native species observed:

Grass Species:
Andropogon virginicus (broomsedge)
Anthoxanthum odoratum (sweet vernalgrass)
Ehrharta stipoides (meadow rice grass)
Holcus lanatus (Yorkshire fog, velvet grass)
Paspalum vaginatum (seashore paspalum)
Pennisetum clandestinum (kikuyu grass)
Schizachryium condensatum (bushy beard grass)
 Tree, Shrub and Herb Species:
Anemone huphensis (Japanese anemone)
Arundina grandifolia (bamboo orchid)
Crocsmia x crocosmiiflora
Desmodium intortum
Erechtites valerianifolia
Fragaria vesca (European strawberry)
Grevillea robusta (silk oak)
Ipomoea sp.

Juncus effusus (Japanese mat rush)
Morella faya (faya tree)
Musa sp. (banana)
Physalis peruviana (poha)
Plantago major (plantain)
Pluchea symphitifolia (sourbush)
Psidium cattleianum (waiwi)
Pyracantha angustifolia (firethorn)
Rubus argutus (blackberry)
Senna pendula
Tibouchina herbacea (glorybush)

Appendix D: Kapāpala Koa Canoe Management Area Forest Bird Surveys 2021

Three Mountain Alliance Forest Bird Surveys
at the Kapāpala Koa Canoe Forest
Summary of Detections in 2021

March 2021



The TMA forest bird surveys at Kapāpala Koa Canoe Forest took place February 8 & 20, 2021. Survey efforts were led by Colleen Cole, TMA Coordinator; assistance was provided DOFAW staff.

Table 1. Participants, 2021 Kapāpala Koa Canoe Forest Bird Surveys

Name	Affiliation	Counter type
Colleen Cole	TMA	Primary
Ian Cole	DOFAW East Hawai‘i Wildlife	Primary
Bret Mossman	DOFAW NARS	Primary
Alex Wang	DOFAW NARS	Primary
Naomi Himley	KUPU/DOFAW NARS	Secondary

Observers used the variable circular plot method (VCP). At each station species, distance and detection method (audible and/or visual) were recorded for each individual bird detected during an 8-minute interval. For rare birds, detection before or after the count period and detections between stations were also recorded. Data were entered into a MS Access database using the Avian Monitoring Entry Form. Entered and proofed data were passed on to USGS for inclusion in Hawai‘i Forest Bird Database and possible future analysis of population trends. This report provides a short summary of the detections.

A total of 65 stations along four transects were surveyed in the Kapāpala Koa Canoe Forest (Figure 1). The counters detected seven introduced species, and six endemic species including one threatened species (‘I‘iwi). All species detections are presented in Table 2 and illustrated in Figures 2-10.

Table 2. Species detected during the 2021 Kapāpala Koa Canoe Forest bird surveys, with comparison of bps values for three prior years.

Alpha Code	Common Name	Scientific Name	Origin [†]	Status* Fed/State	2021 # Stations Occupied**	2021 # Detected	2021 Percent Occurrence	2021 Birds per Station	2020 Birds per Station	2019 Birds per Station	2018 Birds per Station
AKIP	‘Akiapola‘au	<i>Hemiganthus wilsoni</i>	End	E/E	0	0	-	-	-	0.02	-
APAP	‘Apapane	<i>Himatione sanguinea</i>	End		65	827	100%	12.72	13.49	10.05	11.66
HAA M	Hawai‘i ‘Amakihi	<i>Chlorodepanis virens</i>	End		64	295	95.4%	4.54	4.60	4.20	3.91
HAEL	Hawai‘i ‘Elepaio	<i>Chasiempis sandwichensis</i>	End		17	23	26.15%	0.35	0.38	0.85	0.48
HCRE	Hawai‘i Creeper/‘Alawī	<i>Loxops mana</i>	End	E/E	0	0	-	-	-	0.02	0.05
HOFI	House Finch	<i>Carpodacus mexicanus</i>	Int		1	1	1.54%	0.02	-	-	-
HWA H	‘Io, Hawaiian Hawk	<i>Buteo solitarius</i>	End	-/E	1	1	1.54%	0.02	0.08	0.08	0.03
IIWI	‘I‘iwi	<i>Drepanis coccinea</i>	End	T/-^	16	19	24.62%	0.29	0.65	0.93	0.58
JABW	Japanese Bush-Warbler	<i>Cettia diphone</i>	Int		9	10	13.85%	0.15	0.23	0.41	0.35
JAWE	Japanese White-eye	<i>Zosterops japonicus</i>	Int		60	131	92.31%	2.02	1.78	2.34	2.18
KAPH	Kalij Pheasant	<i>Lophura leucomelanos</i>	Int		2	2	3.08%	0.03	0.02	-	0.03
NOCA	Northern Cardinal	<i>Cardinalis cardinalis</i>	Int		5	8	7.69%	0.12	0.08	0.10	0.09
OMA O	‘Ōma‘o	<i>Myadestes obscurus</i>	End		61	180	93.85%	2.77	1.34	2.08	2.65
RBLE	Red-billed Leiothrix	<i>Leiothrix lutea</i>	Int		25	40	38.46%	0.62	0.09	0.41	0.40
YFCA	Yellow-fronted Canary	<i>Serinus mozambicus</i>	Int		5	6	7.69%	0.09	0.06	0.07	0.06

[†]End = endemic, Int = introduced, Ind = Indigenous; * E = endangered; T = threatened; ^State status here refers to Hawai‘i Island only.

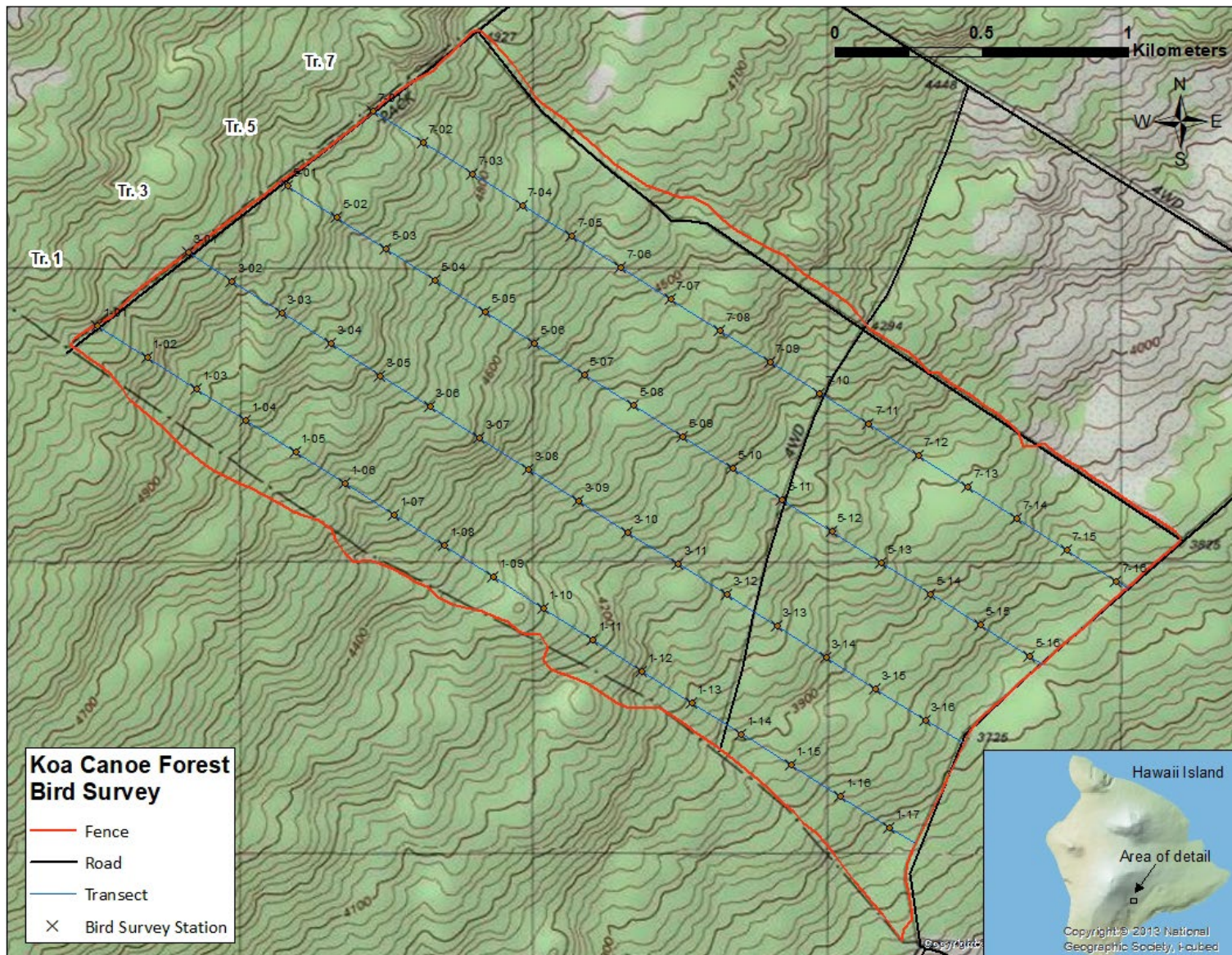


Figure 1. Transects and stations surveyed during the 2021 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

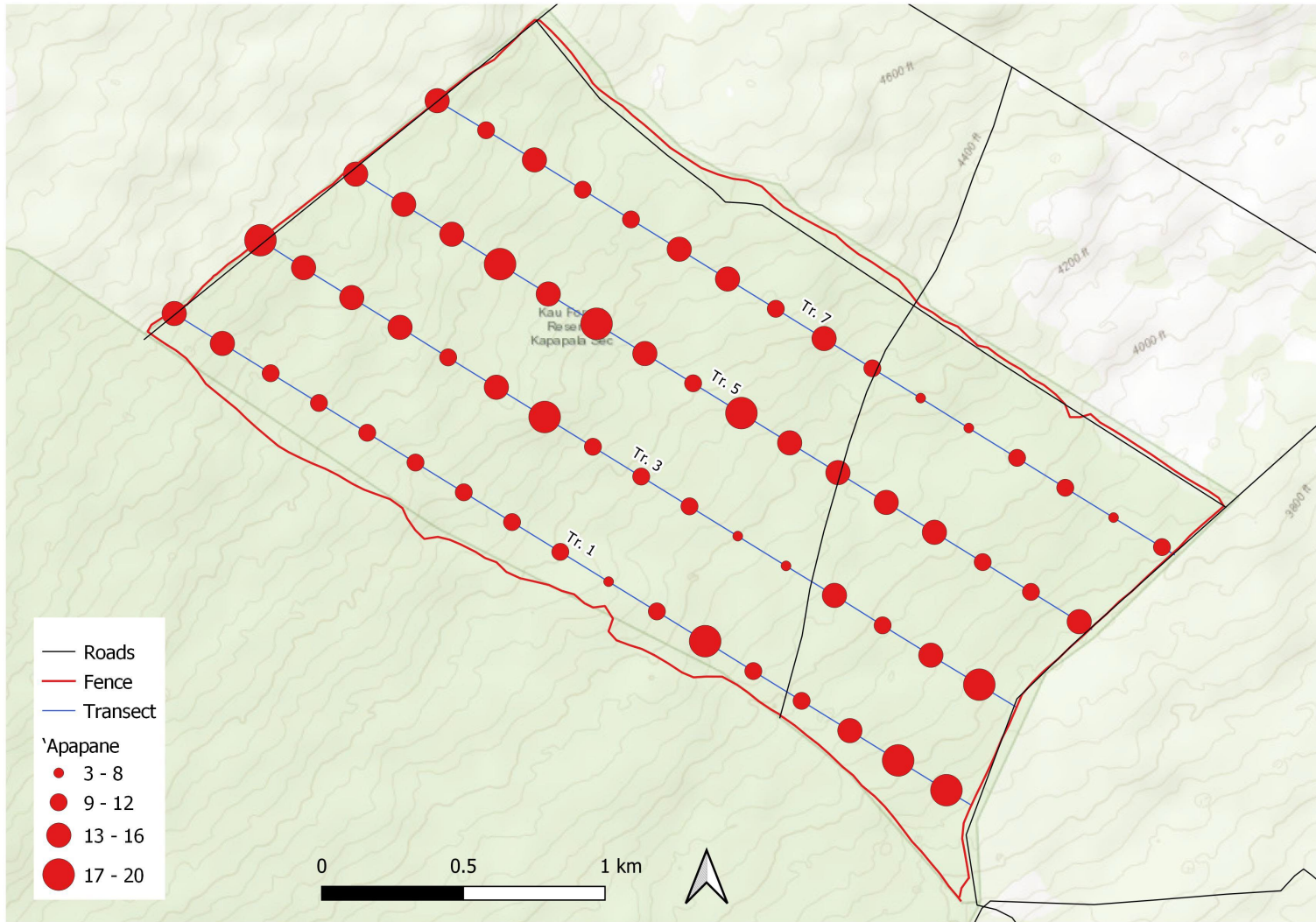


Figure 2. Detections of 'Apapane (*Himatione sanguinea*) during the 2021 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

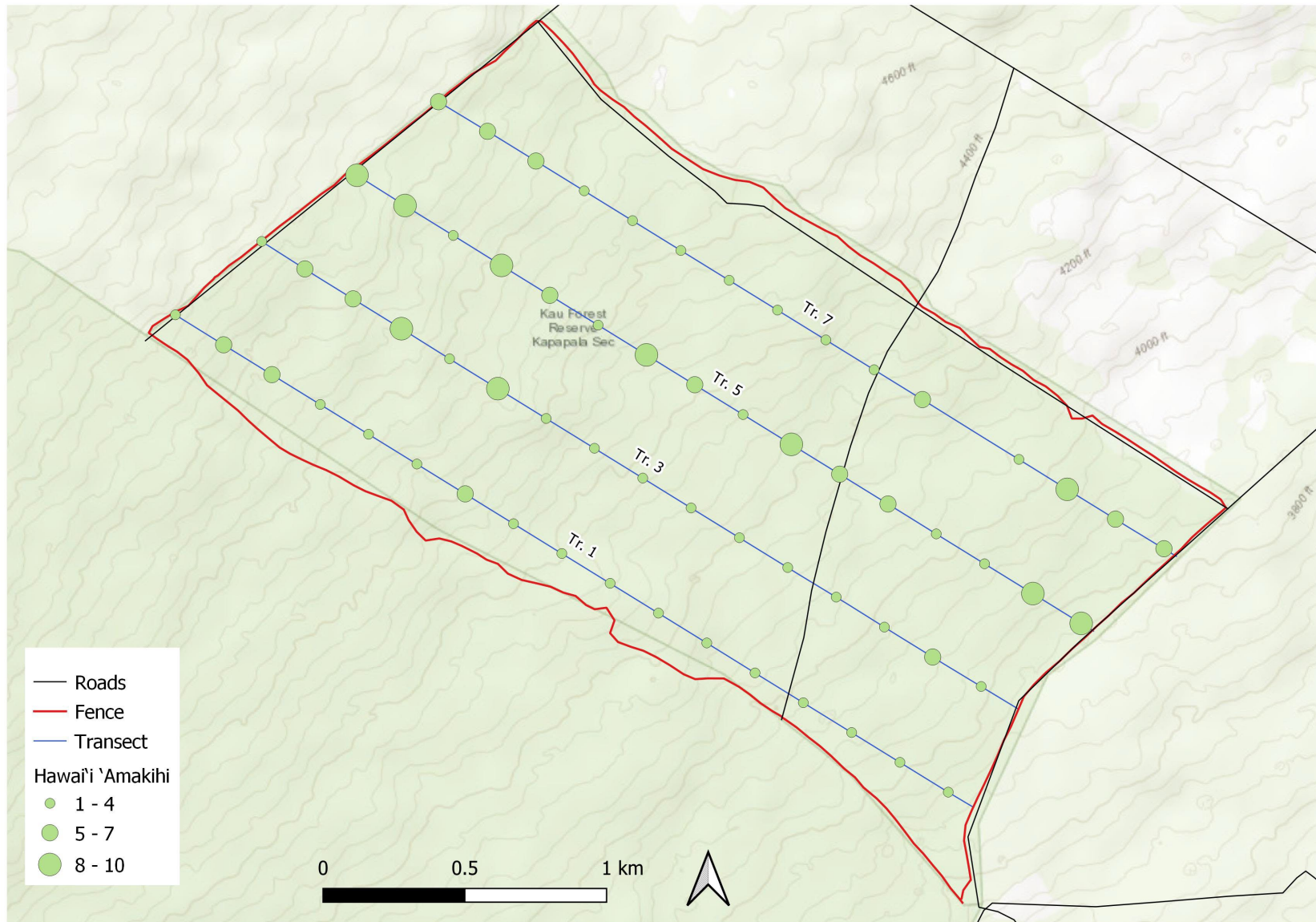


Figure 3. Detections of Hawai'i 'Amakihi (*Chlorodepanis virens*) during the 2021 TMA forest bird surveys

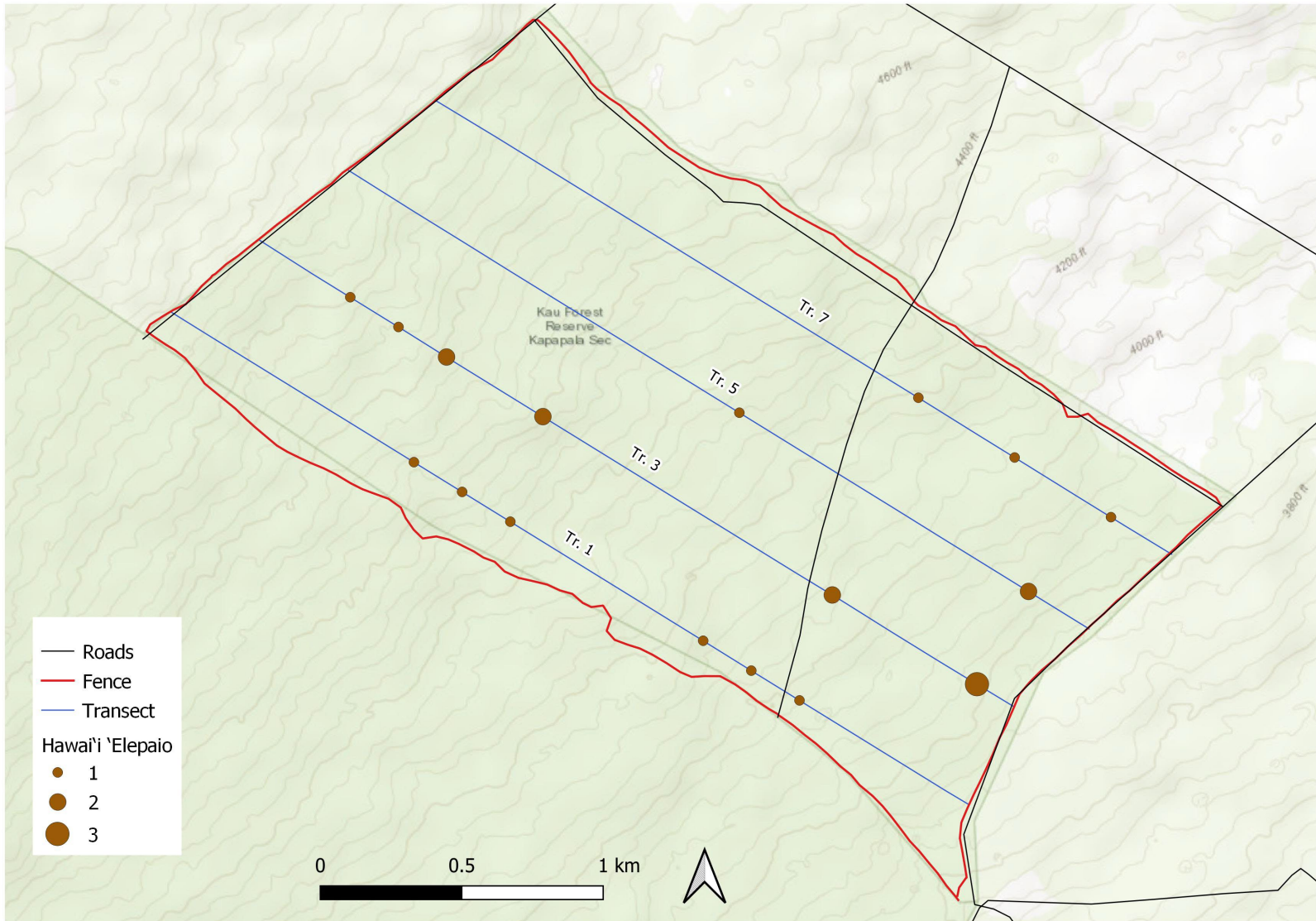


Figure 4. Detections of Hawai'i 'Elepaio (*Chasiempis sandwichensis*) during the 2021 TMA forest bird surveys

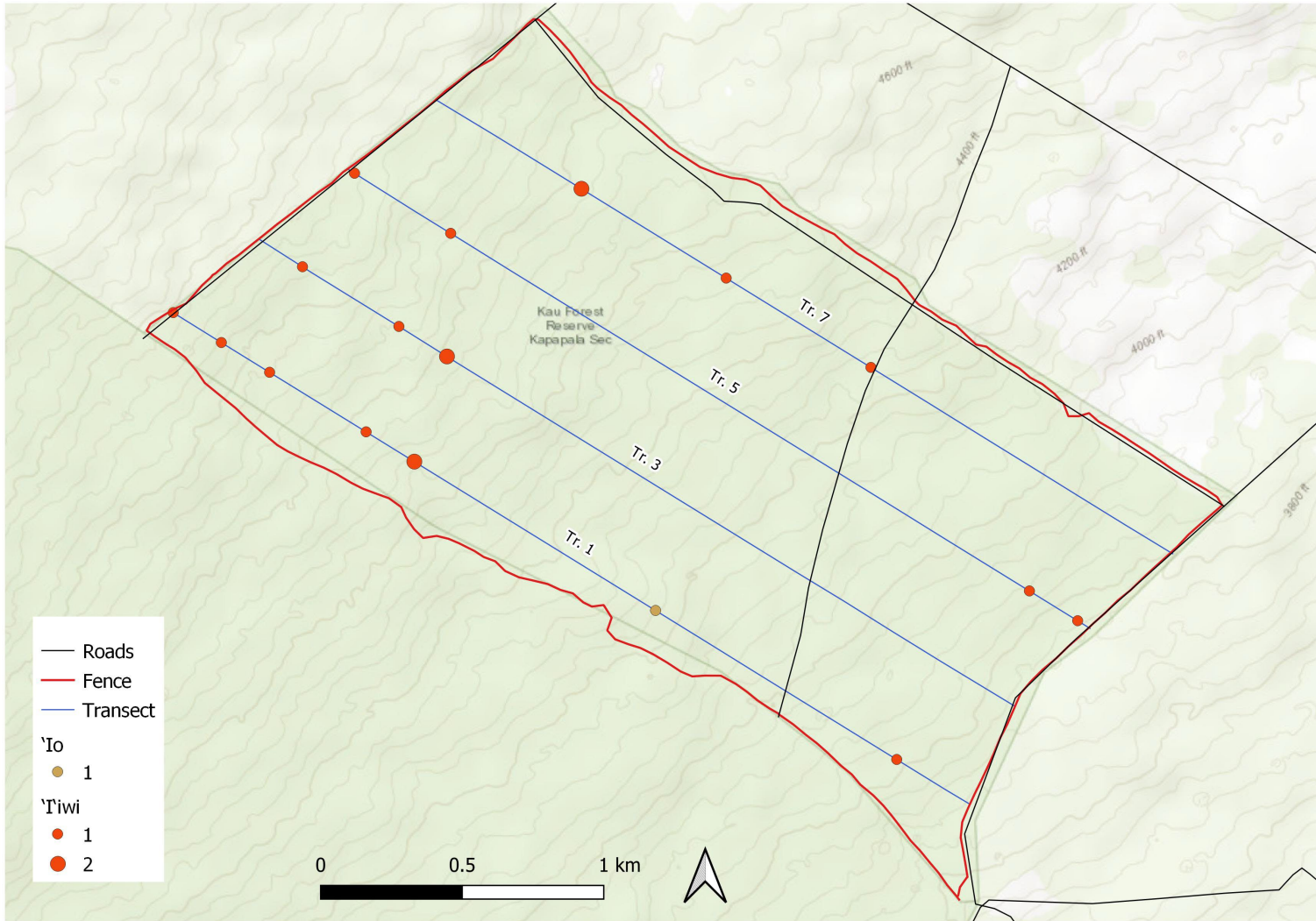


Figure 5. Detections of 'Iwi (*Drepanis coccinea*) and 'Io/Hawaiian Hawk (*Buteo solitarius*) during the 2021 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

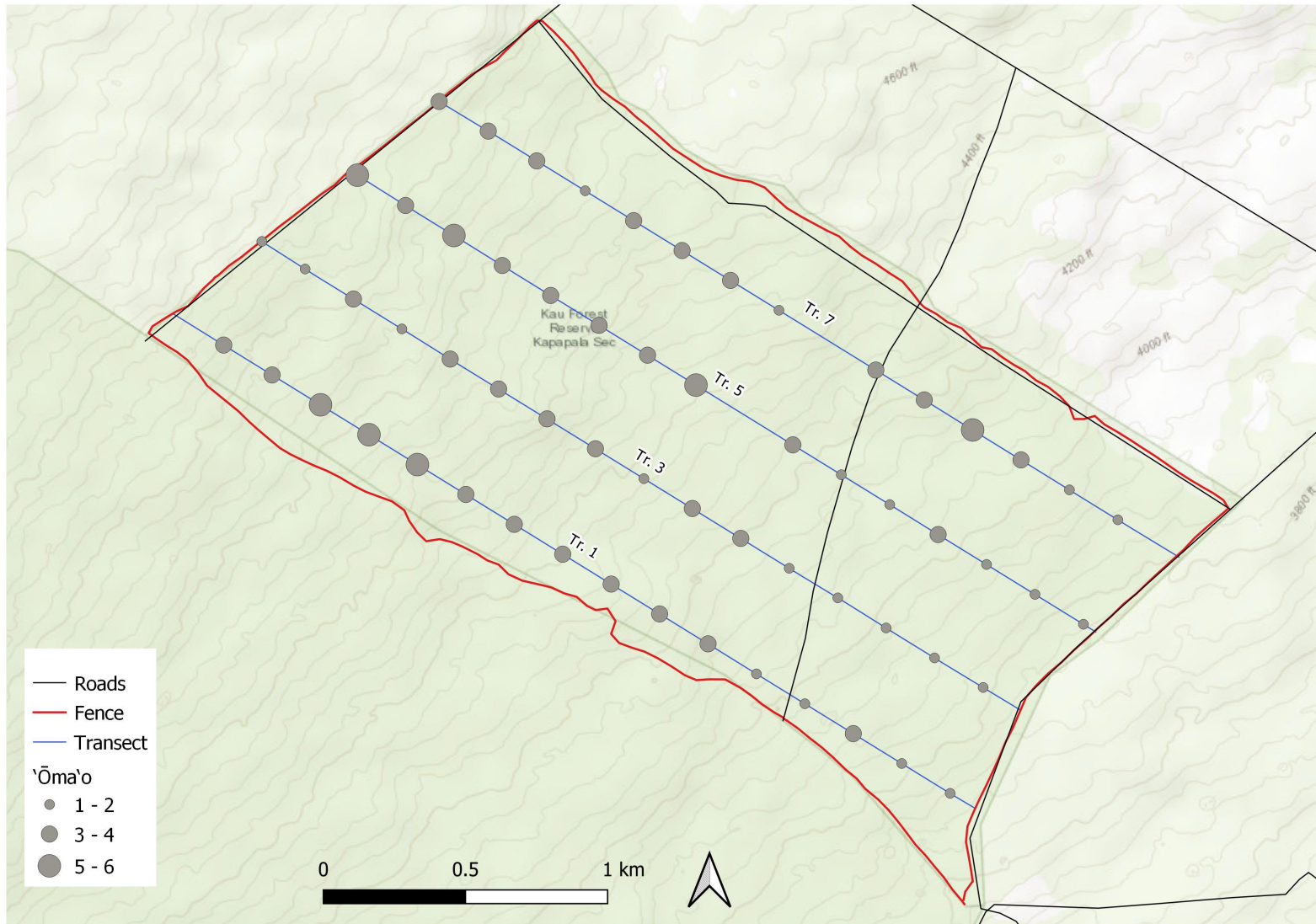


Figure 6. Detections of 'Ōma'ō (*Myadestes obscurus*) during the 2021 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

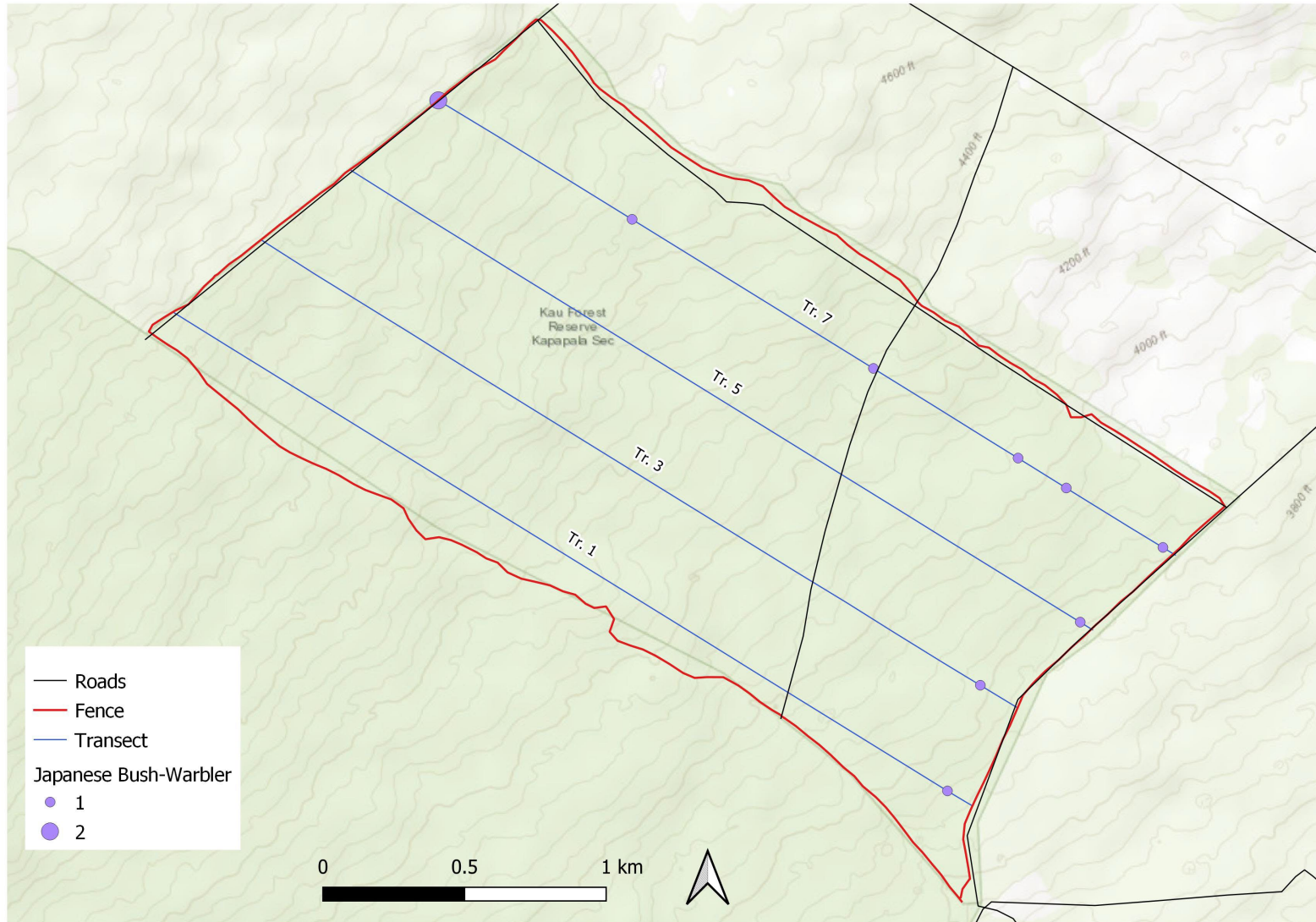


Figure 7. Detections of Japanese Bush-Warbler (*Cettia diphone*) during the 2021 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

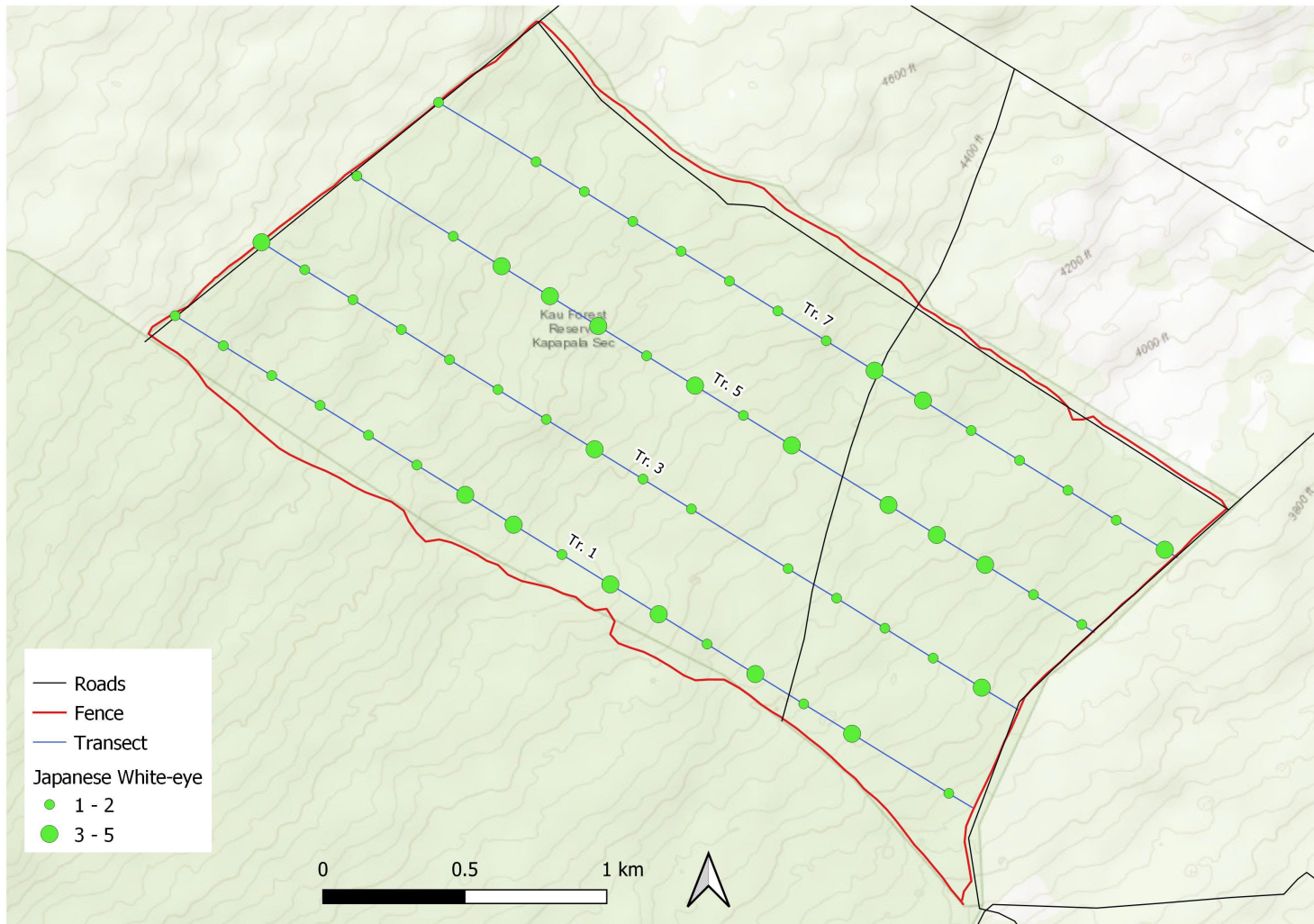


Figure 8. Detections of Japanese White-eye (*Zosterops japonicus*) during the 2021 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

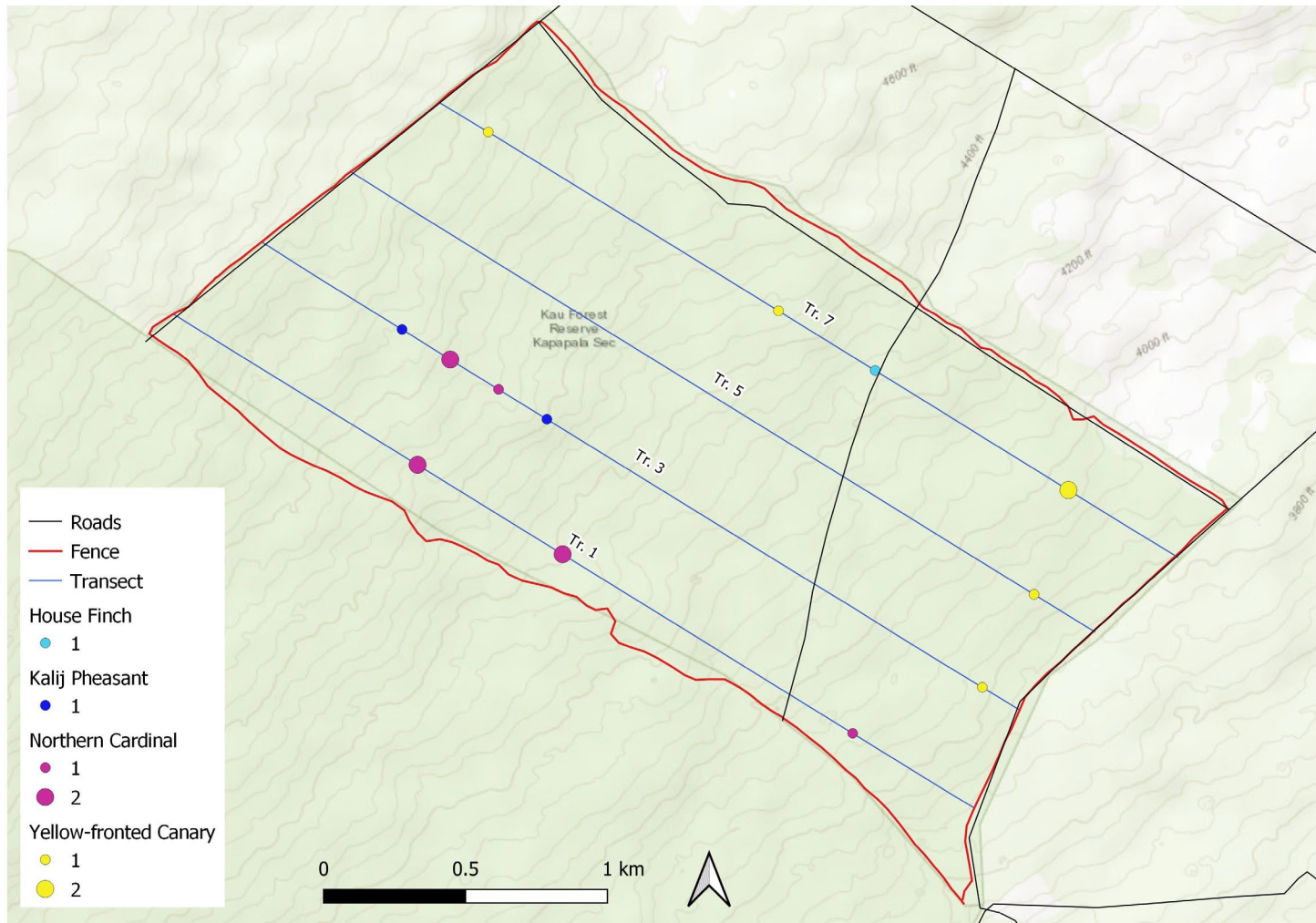


Figure 9. Detections of House Finch (*Carpodacus mexicanus*), Kalij Pheasant (*Lophura leucomelanos*), Northern Cardinal (*Cardinalis cardinalis*), Red-billed Leiothrix (*Leiothrix lutea*) and Yellow-fronted Canary (*Serinus mozambicus*) during the 2020 TMA forest bird surveys at the Kapāpala Koa Canoe Forest.

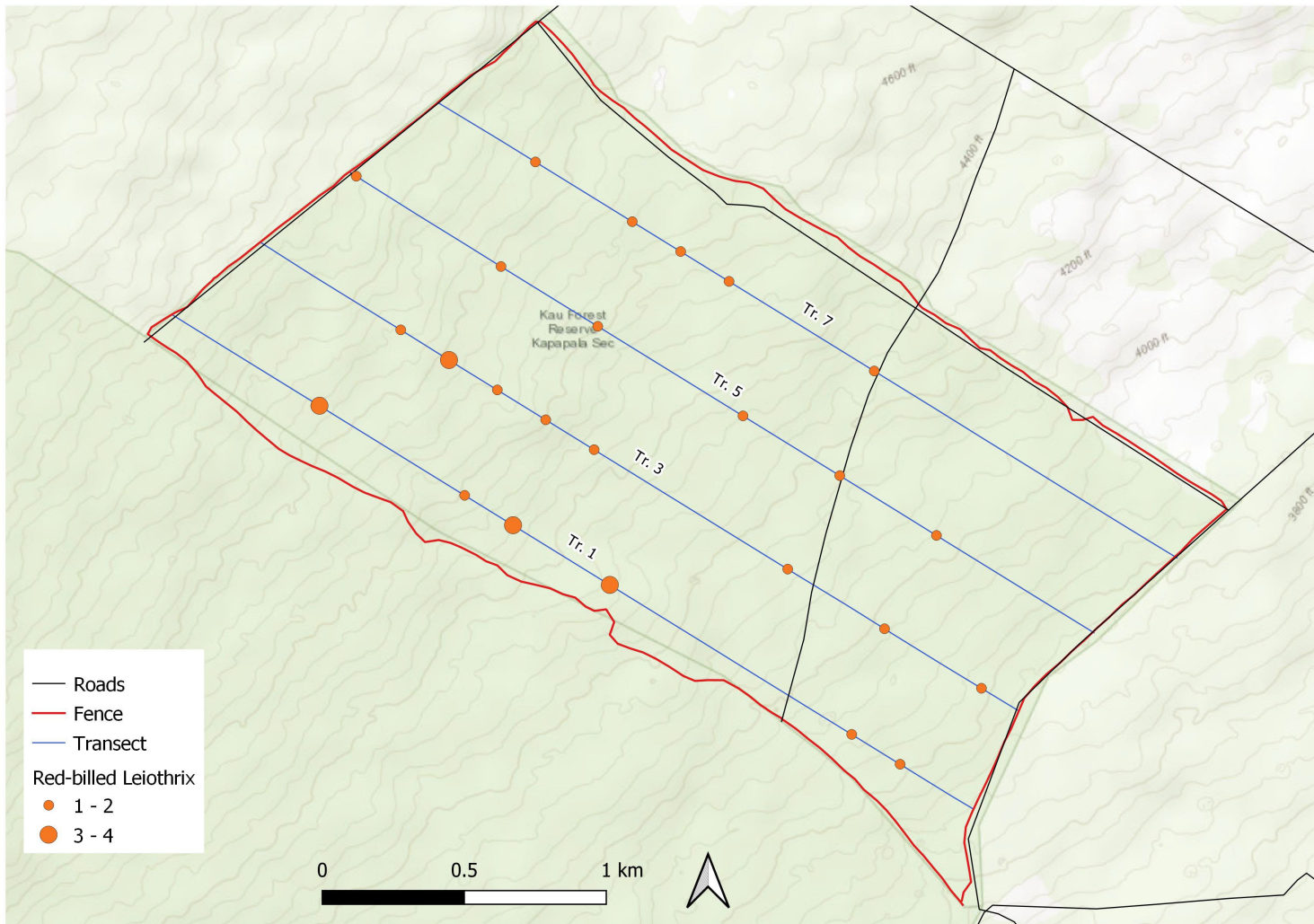


Figure 10. Detections of Red-billed Leiothrix (*Leiothrix lutea*) during the 2020 TMA forest bird surveys at the Kapapala Koa Canoe Forest.

Appendix E: DOFAW Management Guidelines Classification

Forest Products Management – LNR 172		
Management of sustainable forest product opportunities.		
Class Name	Class Definition	Management Strategies
F-1: Large Scale Commercial	<ul style="list-style-type: none"> • Forest products are a primary objective, and large scale sustainable commercial timber harvesting or salvage is allowed; • Permits, licenses and environmental compliance are required; • Harvesting of non-timber forest products is allowed. 	<ul style="list-style-type: none"> • Produce a sustainable timber supply in balance with other resource management objectives; • Activities may include site preparation, tree-planting, thinning operations, forest stand improvement and large-scale timber harvest; • Timber management plans are required to mitigate non-timber resource impacts, and assure sustainable yield and positive impact forestry.
F-2: Small Scale Commercial	<ul style="list-style-type: none"> • Areas where limited commercial timber harvesting or salvage is allowed in balance with other land uses; • Required permits, licenses and environmental compliance depend on scope and scale of operations; • Harvesting of non-timber forest products may be allowed. 	<ul style="list-style-type: none"> • To produce a sustainable supply of forest products while minimizing other resource impacts; • Activities may include site preparation, tree-planting, thinning operations, forest stand improvement and small-scale timber harvest; • Impacts of harvesting distributed over the resource area through controlled seasons and harvest; • Timber management plans are required to mitigate non-timber resource impacts, and assure sustainable yield and positive impact forestry; • Forest management activities performed in coordination with other resource management activities.
F-3: Personal Use	<ul style="list-style-type: none"> • Areas where selective non-commercial timber harvesting and targeted commercial timber salvage is allowed in balance with other land use objectives; • Permits for harvest of non-timber products issued on a case by case basis. 	<ul style="list-style-type: none"> • Limited timber harvest performed as appropriate to bring materials to local market, and produce other positive resource outcomes; • Minimize human impacts to native species and native ecosystems; • Accommodate harvest of forest products for sustainable personal use.
F-4: Restricted	<ul style="list-style-type: none"> • Harvesting of timber only considered if activity improves other priority resource outcomes; 	<ul style="list-style-type: none"> • Resource protection is the top priority;

	<ul style="list-style-type: none"> Permits for harvest of non-timber forest products will be considered on a case by case basis for research and education, improving forest science and health, watershed protection, traditional and customary practices, and conservation efforts. 	<ul style="list-style-type: none"> Prioritize protection of native species and native ecosystems; Permitted activities in these areas are minimally disruptive, and focused on improving forest and watershed health, native ecosystems, and other conservation efforts.
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Conservation Resources - Native Species Habitat, Water Resources – LNR 402/407		
Class Name	Class Definition: May have one, all, or a combination of conservation values	Management Strategy
C-1: High Conservation Resources	<ul style="list-style-type: none"> High level of native biological resources, native ecosystem intactness, and/or recovery potential; Essential to the conservation and/or recovery of native species; Important restoration areas, such as rare ecosystem remnants, native wildlife habitat, wetlands, and offshore islands; High degree of conservation related regulatory encumbrances - critical habitat, restricted watershed, conservation easements and/or zoning; High watershed conservation value per CWRM, USGS, BWS, and/or DOFAW. 	<ul style="list-style-type: none"> Intensive management applied, as necessary, to protect watershed values, and native species and ecosystems, as resources permit; Management may include animal exclusion fencing, predator control, vegetation/weed control; Work may include out-planting of native vegetation and reintroduction of native wildlife, as needed.
C-2: Medium Conservation Resources	<ul style="list-style-type: none"> Moderate level of native biological diversity and/or native ecosystem intactness; Contributes to the conservation and/or recovery of native species (i.e. T&E / native species habitat, water resources); Medium degree of conservation related regulatory encumbrances; Medium watershed conservation value. 	<ul style="list-style-type: none"> Management activities to control priority threats and improve watershed, native species or ecosystem outcomes; Work may include out-planting of native vegetation and reintroduction of native wildlife, as needed. Other uses may include forest products gathering, hiking, and liberal hunting.
C-3: Low Conservation Resources	<ul style="list-style-type: none"> Low level of native biological diversity and/or native ecosystem intactness; Low conservation and/or recovery of native species but may contribute to conservation (i.e. individual or small clusters of rare plants; genetic collection); Low degree of conservation related regulatory encumbrances; May have low watershed conservation value. 	<ul style="list-style-type: none"> Native species management occurs mostly in remnant patches and fenced units; Mixed use area with forest products gathering, hunting and non-hunting recreation, as appropriate.

C-4: Little to No Conservation Resources	<ul style="list-style-type: none"> • Little to no native biological diversity and/or native ecosystems highly degraded or absent; • Little to no contribution to the conservation and/or recovery of native species; • Very little or no conservation related regulatory encumbrances; • May have low watershed conservation value. 	<ul style="list-style-type: none"> • Area managed for a variety of uses not appropriate for more pristine environments, including timber harvest, regulated hunting and more intensive non-hunting recreation (hiking, equestrian and/or off-road vehicles).
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Conservation Management - Native Species Habitat, Water Resources – LNR 402/407

Class Name	Class Definition	Management Strategy
Intensively Managed Areas	<ul style="list-style-type: none"> • High degree of watershed, native species and/or biodiversity conservation management is underway. 	<ul style="list-style-type: none"> • Conservation of watersheds and/or native species and biodiversity is a higher priority than all other uses; • Management focus is on protection, restoration and maintenance of native ecosystems and species; • Employ strategies to reduce the threat of alien species or other factors to the greatest extent possible - fencing, intensive animal and/or weed control; • Maintain & improve native ecosystem processes; • Collect genetic material, reintroduce species, work to recover threatened and endangered species, protect areas from degradation, restore damaged resources as needed;

Vegetation Resources – LNR 402/407

Class Name	Class Definition
V-1: Highest Quality Native Vegetation	These areas consist of the highest quality native ecosystems and communities. They have minimal disturbance, with low levels (less than 10%) of non-native plants in any vegetative layer (91-100% native plant cover).
V-2: Predominantly Native Areas:	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 (51-90% native plant cover).
V-3: Considerably Degraded Native Vegetation Cover:	Areas have a considerable amount of disturbance to native vegetation. Non-native plants may predominate, however there may be pockets of remaining native plant communities (11-50% native plant cover).

V-4: Heavily Degraded Areas:	Areas where the native vegetation is severely degraded or highly altered from its natural state. There may be areas of severe erosion, former pasture or crop lands, forest plantations, areas of non-native grass or brush resulting from fires or intensive grazing. (0-10% native plant cover).
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Hunting Management – LNR 804		
Management for public recreation, subsistence hunting and animal damage control.		
Class Name	Class Definition	Management Strategy
H-1: Active Hunting Management:	<ul style="list-style-type: none"> Public hunting is a high priority land use; Area is suitable for a high degree of active management for public hunting; Management of the area is designed to provide maximum sustained yield of game animals. 	<ul style="list-style-type: none"> Hunting regulations for the area are designed to provide maximum sustained yield while minimizing environmental impacts; High degree of management to maintain or improve hunting program infrastructure; Habitat is managed to maintain or increase game animal carrying capacity, while maintaining healthy vegetative cover for proper range management and erosion control.
H-2: Moderate Hunting Management:	<ul style="list-style-type: none"> Area is suitable for a moderate degree of active management for animal enhancement and habitat management to increase animal productivity for public hunting; Public hunting opportunities may be improved or maximized; Public hunting is balanced with other objectives. 	<ul style="list-style-type: none"> Hunting regulations established to manage animal harvest; Moderate degree of infrastructure for animal management; Habitat modification for game animal production as appropriate for the area; Balance animal impacts with other resources.
H-3: Low Intensity Hunting Management:	<ul style="list-style-type: none"> Area not suitable for game enhancement and habitat management to increase animal densities - hunters play an important role in limiting animal impacts; Minimal public hunting restrictions provide maximum public hunting opportunity; Public hunting management includes maintaining access and monitoring hunter effort and success. 	<ul style="list-style-type: none"> Hunting seasons, bag limits and other hunting regulations liberalized to maximize hunting opportunity; Hunting opportunities may include permitted hunts if needed to improve access; No habitat modification for production and/or enhancement of game animals.
H-4: No Hunting Management:	<ul style="list-style-type: none"> Area is not suitable for open public hunting due to environmental sensitivity, access, or safety; No active management for public hunting; public hunting may be used for animal damage control on a permit basis; Public hunting is not a primary land management objective. 	<ul style="list-style-type: none"> Area not open to regular public hunting seasons for either management, access or safety reasons; Animal control to be conducted by staff, permitted and/or guided hunters, and other cooperators as appropriate.

Recreation Management – LNR 804

Class Name	Class Definition	Management Strategy
R-1: High Recreation Management:	<ul style="list-style-type: none"> • Areas where outdoor recreation is a primary objective; • High level of visitor use is received and accommodated; • May include recreation, transit and/or urban elements; • Approximate average daily use: 100 - 1000+ users. 	<ul style="list-style-type: none"> • Area can sustain heavy recreational use; recreation plays a major role in use of the area; • Trails maintained to sustain heavy use which may include hiking, mountain bike riding, equestrian and/or off-road vehicle use; • Improvements commensurate with use.
R-2: Medium Recreation Management:	<ul style="list-style-type: none"> • Areas where outdoor recreation is of moderate intensity, and may be integrated with other uses; • Includes a wide range of trails and roads requiring a moderate level of management and maintenance to meet user needs and balance other land use objectives; • Approximate average daily use: 0 – 500 (+/-) users. 	<ul style="list-style-type: none"> • Area can sustain moderate recreational use; recreation integrated with other management programs; • Roads and trails maintained to sustain moderate use which may include hiking, mountain bike riding, equestrian, and/or off-road vehicle improvements; • Improvements commensurate with use.
R-3: Low Recreation Management:	<ul style="list-style-type: none"> • Areas where outdoor recreation is of low intensity, and is integrated with other uses; • Trails and roads that receive limited use, or whose character and terrain require little maintenance relative to the usage; • Approximate average daily use: 0 – 100 (+/-). 	<ul style="list-style-type: none"> • Areas may be inaccessible or remote; facilities and improvements are limited, in keeping with the level of use; • Areas may be managed for multiple uses including forest protection, conservation, hunting, and hiking, or protected and managed to preserve natural conditions; activities may include hiking, biking, equestrian and/or off-road vehicles; • To protect both the trail environment and experience, improvements are typically minimal, and designed to fit the setting and need.

<p>R-4: Recreation Management (Restricted access):</p>	<ul style="list-style-type: none"> • Areas where outdoor recreation is restricted or controlled; • Areas sensitive to human disturbance due to natural, cultural or archaeological features; • Access primarily for management purposes, and/or limited or programmatic recreational or educational uses. 	<ul style="list-style-type: none"> • Areas may be classified “restricted” due to hazardous conditions, watershed protection, sensitive wildlife, fragile ecosystems, cultural resources, limited accessibility, or management practices incompatible with recreational activities; • Managed to limit impacts from human activities; • Facilities and improvements are very limited and generally associated resource management; • Trails will not feature extensive recreational amenities and will generally incorporate only facilities necessary to protect and manage the resource; • Access may be controlled via permits, group number limitations, or other restrictions as appropriate for the area.
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Appendix F: Best Management Practices for Maintaining Water Quality in Hawai'i

Due to the length of the Cultural Impact Assessment, the entire document has been made available online at the address below:

<https://dlnr.hawaii.gov/forestry/files/2023/01/DOFAW-Best-Management-Practices-for-Maintaining-Water-Quality-in-Hawaii-1996.pdf>

ENVIRONMENTAL ASSESSMENT

Kapāpala Koa Canoe Management Area Plan

APPENDIX 2a

Public Involvement, Response to Early Consultation

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geometrician

ASSOCIATES, LLC
integrating geographic science and planning

phone: (808) 969-7090 10 Hina Street Hilo Hawai'i 96720 rterry@hawaii.rr.com
geometricianassociates.com

February 17, 2023

Dear Neighbor or Agency/Organization Official:

Subject: Early Consultation for Environmental Assessment for Kapāpala Koa Canoe Management Area Management Plan, Island of Hawai'i

My firm is in the process of preparing a Draft Environmental Assessment (EA) for a proposed State of Hawai'i activity, in compliance with Chapter 343, Hawai'i Revised Statutes, and Title 11, Chapter 200.1, Hawai'i Administrative Rules. The Division of Forestry and Wildlife (DOFAW) of the Department of Land and Natural Resources (DLNR) is developing a Management Plan for the Kapāpala Koa Canoe Management Area (KKCMA). The Plan is part of an effort to provide a sustainable, long-term supply of koa for the traditional and cultural use of constructing koa canoes, while minimizing impacts on the natural and cultural resources in the area.

KKCMA consists of roughly 1,257 acres at about 3,000-5,000 feet in elevation on the southeastern slope of Mauna Loa, in the district of Ka'ū and the ahupua'a of Kapāpala (see map below). The area is covered almost entirely by a native koa and 'ōhi'a forest. This parcel is the only state land in Hawai'i specifically designated for the purpose of producing koa canoe resources. Other management objectives include protection of native forest, watershed resources, and bird habitat; increased regeneration and restoration of koa trees; collaboration with educational groups and community groups; access for recreational activities; and integration of traditional Hawaiian stewardship models with western conservation practices. A harvest plan will guide harvest and extraction of canoe-quality trees while regenerating koa resources on a 100-year timeframe. Organizations in the state of Hawai'i may apply for a permit to harvest a canoe log, which will be reviewed by a group of experts consisting of cultural practitioners; voyaging and racing members; kālaiwa'a (canoe builders); forestry experts; conservationists; and community members, who will advise DLNR and DOFAW on the final allocation of canoe log permits. Current plans call for organizations who have been selected to independently harvest and extract canoe logs with the guidance of DOFAW. It will be the ongoing job of DOFAW to implement stand improvement actions, such as pre-commercial and commercial thinning, that will enhance the ability of the forest to produce large, straight koa trees capable of being made into canoes. Some non-canoe quality timber resources may be sold to help fund the management of KKCMA.

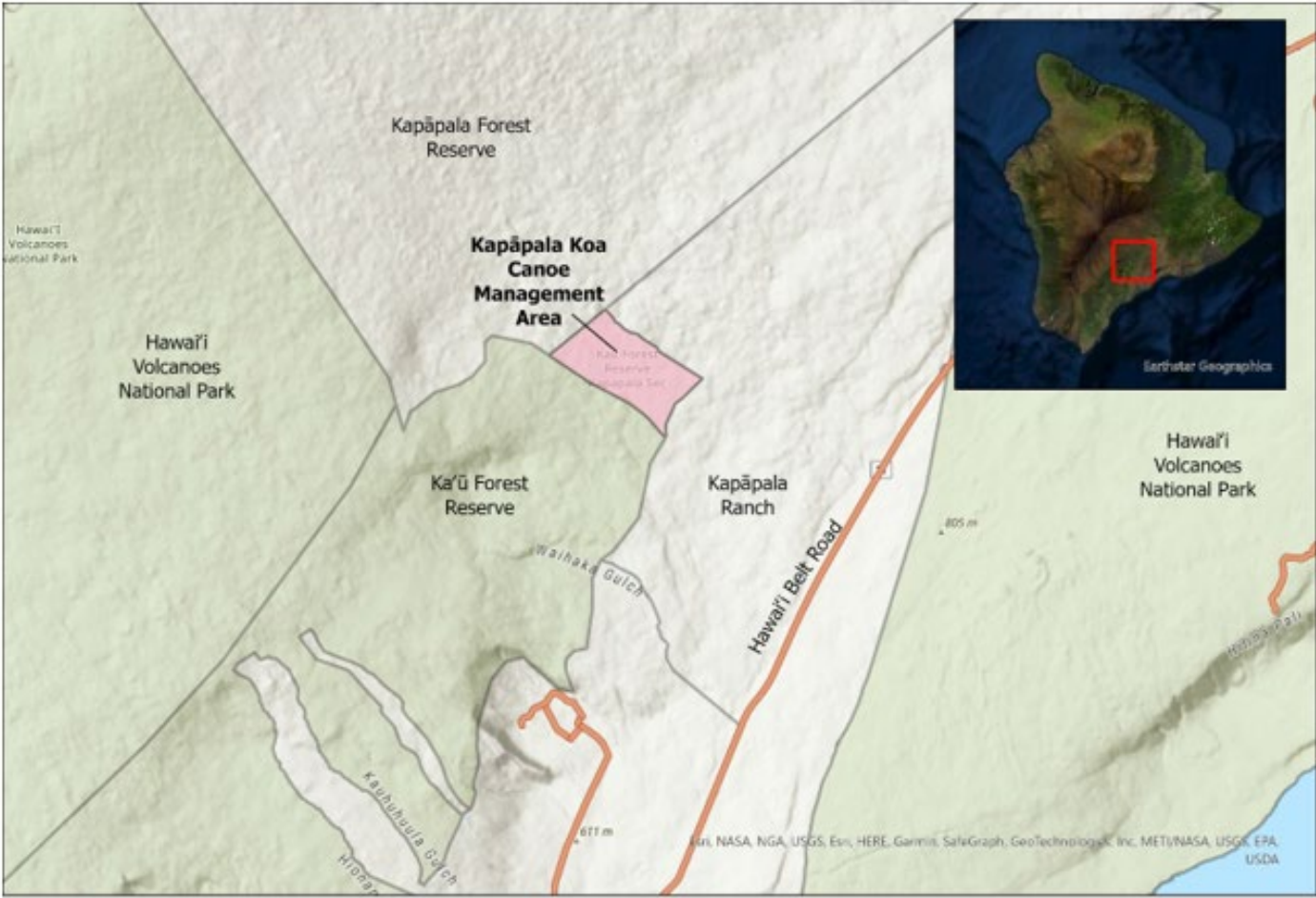
Multiple protection measures will be implemented to ensure that the resources in the area are not degraded due to threats such as non-native animals, invasive weeds, human impacts, climate change, and/or erosion. In order to minimize impacts on threatened and endangered species as well as archeological and historical sites, botanists, ornithologists and archaeologists will undertake surveys in all areas prior to any silviculture actions taking place in that unit. Areas of higher value native forest and bird habitat will be designated as lower priority harvest areas.

The areas of investigation in the Environmental Assessment will include but not be limited to the following: health and safety; water quality assurance; flora, fauna, and ecosystems; access, road and traffic impacts; geology, soils, and hazards; flooding and drainage impacts; social, cultural and community impacts; historic sites; and economic impacts. I would appreciate your comments on any special environmental conditions or impacts related to the development. Please contact me at (808) 969-7090, or rterry@hawaii.rr.com, if you have any questions or require clarification. Kindly indicate whether you wish to receive notification of the EA's availability when it is completed.

Please note also that a first public release draft of the plan will be available online for public review within the next one to three months. Finalization of the management plan and the draft EA will occur after consideration of comments and suggestions from reviewing parties. If you wish to review this initial draft, please reply to this letter indicating so, and we will add you to the mailing list. On behalf of DOFAW, I thank you in advance for your attention and cooperation.



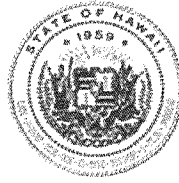
Ron Terry, Ph.D.



State of Hawai'i
Department of Land and Natural Resources
Division of Forestry and Wildlife
(808) 587-0166
January 2022



JOSH GREEN, M.D.
GOVERNOR



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

HAWAII DISTRICT
50 MAKAALA STREET
HILO, HAWAII 96720
TELEPHONE: (808) 933-8866 • FAX: (808) 933-8869

March 2, 2023

EDWIN H. SNIFFEN
DIRECTOR

Deputy Directors
DREANALEE K. KALILI
TAMMY L. LEE
ROBIN K. SHISHIDO
JAMES KUNANE TOKIOKA

IN REPLY REFER TO:

HWY-H 23-2.0037

VIA EMAIL: rterry@hawaii.rr.com

Mr. Ron Terry
Geometrician Associates, LLC
Principal
10 Hina Street
Hilo, Hawaii 96720

Dear Mr. Terry:

Subject: Early Consultation for Environmental Assessment
Kapapala Koa Canoe Management Area Management Plan
Route 11 – Mamalahoa Highway
Kapapala, Kau, Hawaii
Tax Map Key: (3) 9-8-001:014

This is in response to your February 17, 2023, letter requesting comments on the Early Consultation for Environmental Assessment for Kapapala Koa Canoe Management Area Management Plan, Island of Hawaii.

Please identify the location of the access and route on the State highway to be utilized for the harvesting and transport of trees.

The proposed access and route should be designed and constructed for the appropriate vehicle characteristics and utilization. If any work is proposed within the State Highway Right-of-Way an approved Permit to Perform Work Upon State Highways shall be obtained prior to construction.

If the vehicle and/or load exceed the limitations of HRS 291-34 and -35 an approved Application to Operate or Transport Oversize and/or Overweight Vehicles and Loads over State Highways will be required.

Please contact me at (808) 933-8866 or by email at harry.h.takiue@hawaii.gov if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Harry H. Takiue".

HARRY H. TAKIUE
Hawaii District Engineer

April 21, 2023

23 E. Kawili St
Hilo, HI 96771
BIISC@hawaii.edu
www.biisc.org



Aloha Mr. Terry,

Thank you for reaching out in regards to the proposed Koa Canoe Management Plan for Kapāpala. We have no opposition to the proposed land use, but we must caution about the importance of stringent biosecurity measures to prevent the accidental introduction of invasive plants and animals to Kapāpala. This area is a relatively pristine native forest, and extra vigilance should be undertaken to ensure that any equipment, vehicles, and gear are completely free of seeds, vegetative material, and soil before proceeding into the area.

Our team has observed Rapid Ohī'a Death to be spreading in this area, particularly in the unfenced sections, so special consideration should be given to avoiding wounding of ohī'a as much as is possible during any activity. Bark wounding is the known point of entry for the fungi that cause ROD. Recommendations for cleaning equipment and vehicles here: <https://www.youtube.com/watch?v=CU6GH4PH-7I> and on the RapidOhiaDeath.org site.

Mahalo for the opportunity to comment on this project. Please do not hesitate to contact me for further information.

Franny Brewer
Manager
fbrewer@hawaii.edu

ENVIRONMENTAL ASSESSMENT

Kapāpala Koa Canoe Management Area Plan

APPENDIX 2b

Public Involvement, Comments to Draft EA and Responses



Siglo Tonewoods | PO Box 26 | Papa'aloa, HI 96780-0026

07 June 2023

Andy Cullison
Hawai'i Island Forestry Planner
Department of Land and Natural Resources
1151 Punchbowl Street #131
Honolulu, Hawai'i 96813

Re: Draft Environmental Assessment, Kapāpala Koa Canoe Forest (full support)

Aloha Mr. Cullison,

Siglo Tonewoods is a Hawai'i company focused on securing responsibly grown tropical hardwoods to manufacture guitars while improving native forest health. I am a forester with 23 years of Hawai'i forest management experience and have dedicated my professional career to planting and caring for native forests, particularly koa trees. I have also been involved in several projects that combine tree harvesting with native forest regeneration over thousands of acres.

Due to this commitment to native forest management, I have consistently participated in the Kapāpala Koa Canoe Forest (KCF) working group over the years and have eagerly awaited the release of the Draft Environmental Assessment and related Management Plan for KKCF.

This is a well-thought-out management plan for the KKCF. I believe it will achieve its goal of producing koa canoe logs consistently and in perpetuity while also improving the native forest.

Balancing the needs of native forest health with community needs and public access in the context of climate change and endangered species is challenging. However, you successfully balance these needs within the KCF by carefully setting out management regimes by forest type, reasonable restrictions on management practices, no-cut periods, and achievable harvest goals, and allowing sufficient flexibility for safe and efficient harvest operations.

I urge you to accept this draft Environmental Assessment and Finding of No Significant Impact.

Regards,

Nicholas Koch,
General Manager

geometrician

ASSOCIATES, LLC
integrating geographic science and planning

phone: (808) 969-7090 10 Hina Street Hilo Hawai'i 96720 rterry@hawaii.rr.com
geometricianassociates.com

July 11, 2023

Nicholas Koch, General Manager
Siglo Tonewoods
PO Box 26
Papa'aloa, HI 96780-0026

**Subject: Comment to Draft Environmental Assessment for 'Kapāpala Koa
Canoe Management Area Plan, TMK (3) 9-8-001:014, Kapāpala,
Ka'ū, County of Hawai'i, State of Hawai'i**

Dear Mr. Koch:

Thank you for your comment letter on the Draft EA dated June 7, 2023, in which you stated your opinion that that the management plan was well-thought-out and would achieve its goal of producing koa canoe logs consistently and in perpetuity while also improving the native forest. You also urged the BLNR to accept the Draft EA and issue a Finding of No Significant Impact. We very much appreciate your review of the document. If you have any questions, please contact Andy Cullison at (808) 436-8122 and james.a.cullison@hawaii.gov, or me, Ron Terry, the preparer of the EA, at (808) 969-7090, or rterry@hawaii.rr.com.

Sincerely,

A handwritten signature in black ink that reads "Ron Terry". The signature is written in a cursive, slightly slanted style. Below the name, there is a horizontal line that tapers to a point on the right side, serving as a decorative flourish.

Ron Terry, Principal

Cc: Andy Cullison, DLNR