



County of Hawai'i
Department of Finance
Property Management Division
25 Aupuni Street, Suite 1101
Hilo, HI 96720
Telephone: (808) 961-8069

OFFICIAL USE ONLY:

PO No. _____

Vendor # _____

Rcv'd: _____

Approved for payment: _____

Dated: _____

STEWARDSHIP GRANT PROGRESS REPORT

PLEASE CHECK TYPE OF PROGRESSREPORT: SEMI-ANNUAL ANNUAL

ENTER INFORMATION IN THE FIELDS PROVIDED.

1. NAME AND ADDRESS OF ORGANIZATION:
2. PERSON TO CONTACT:
3. CONTRACT NO.:
4. CONTRACT AWARD AMOUNT:
5. PROJECT NAME (*same name used on contract*):
6. PROJECT PERIOD:
7. PROGRESS REPORT PERIOD:
8. PROJECT LOCATION (*list all TMKs from the contract*):

9. CERTIFICATION:

The Applicant certifies that the information contained in this report is true and correct to the best of his/her knowledge.

NAME OF AUTHORIZED OFFICIAL:

TITLE OF AUTHORIZED OFFICIAL:

SIGNED: _____ **DATE:** _____

A. PROJECT OVERVIEW:

B. PROJECT ACCOMPLISHMENTS

C. PROJECT CHALLENGES

D. FUTURE PLANS RELATING TO THE PROJECT

E. PHOTOGRAPHS, MAPS, AND OTHER EXHIBITS *(These must be attached at the end of the report as a Word document. If you attach photos, be sure to caption each photo with a date and subject. If it is a group picture, please identify the group and date photo was taken. No need to name the individuals in the photo. There is no need for the same location maps that were attached in the original application. Maps can be sketches and/or drone photos illustrating before and after activities.)*

F. PROJECT ACTIVITIES FOR CONTRACT NO.

(Use the table format below for details on your project's activities. Use more than 1 page, if needed. See examples in Instructions.)

Type of Activity	Completion Date and/or % Complete	Contractors/Collaborators

F. PROJECT ACTIVITIES FOR CONTRACT NO. *(Continued)*

Type of Activity	Completion Date and/or % Complete	Contractors/Collaborators

G. PROJECT RECEIPTS (GRANT FUNDS ONLY) FOR CONTRACT NO.

(Please be prepared to provide documentation upon request to the Dept. of Finance.)

HI County Charter 10- 16(g)	Date(s) of Payment	Type of Expense	Vendor	Number of Receipts	Total Amount
TOTAL AMOUNT FOR THIS PAGE					

G. PROJECT RECEIPTS (GRANT FUNDS ONLY) FOR CONTRACT NO.
(Continued)

HI County Charter 10- 16(g)	Date(s) of Payment	Type of Expense	Vendor	Number of Receipts	Total Amount
TOTAL AMOUNT FOR THIS PAGE					

G. PROJECT RECEIPTS (GRANT FUNDS ONLY) FOR CONTRACT NO.
(Continued)

HI County Charter 10- 16(g)	Date(s) of Payment	Type of Expense	Vendor	Number of Receipts	Total Amount
TOTAL AMOUNT FOR THIS PAGE					
TOTAL AMOUNT OF GRANT FUNDS ENCUMBERED/SPENT FOR REPORTING PERIOD					
GRAND TOTAL OF GRANT FUNDS ENCUMBERED/SPENT <i>(For Annual Report Only)</i>					

H. IN-KIND SERVICES AND OTHER RESOURCES FOR CONTRACT NO.

(Use additional pages, if needed. See Instructions.)

Date	Activity	Person/Organization	# of Participants	Calculation of In-Kind Value	Other Resources
TOTAL OF IN-KIND VALUES AND OTHER RESOURCES FOR REPORTING PERIOD					

H. IN-KIND SERVICES AND OTHER RESOURCES FOR CONTRACT NO. *(Continued)*

Date	Activity	Person/Organization	# of Participants	Calculation of In-Kind Value	Other Resources
TOTAL OF IN-KIND VALUES AND OTHER RESOURCES FOR REPORTING PERIOD					
GRAND TOTAL OF IN-KIND VALUES AND OTHER RESOURCES <i>(For Annual Report Only)</i>					

I. EQUIPMENT INVENTORY $\geq$ \$1,000.00 (GRANT FUNDS ONLY) FOR CONTRACT NO.

(Attach copy of any warranty documents.)

Item Description	Cost	Purchase Date	Model/Serial No.	Location
TOTAL COST				

WAI‘ELE Steering Committee

GUIDELINES & REGULATORY MEASURES



"Mālama i ka 'āina, mālama ke ea."

"Care for the land, and the life will be sustained."

Kaona: This proverb emphasizes the importance of caring for the land ('āina) and all that it sustains, including natural resources and cultural heritage. By protecting and nurturing the land, we ensure the survival and well-being of both the environment and the cultural identity of the people. It highlights the reciprocal relationship between people and their natural surroundings, where the care we give to the land directly influences the life and vitality of our communities.

Prepared By

Iopa Maunakea, Keone Kalawe & Leila Kealoha

Kanaka Maoli Cultural Practitioners

Puna, Hawaii

October 30, 2024

Wai‘ele Steering Committee

Guidelines & Regulatory Measures

Preface

The Wai‘ele region of Puna, Hawai‘i, is a place of immense cultural, environmental, and community significance. It is a region where the land tells stories of generations past, where the natural environment is both a resource and a treasure, where the community is deeply connected to its surroundings. As such, the stewardship of Wai‘ele’s lands is a responsibility that demands careful consideration, guided by a deep respect for the region's heritage and a commitment to its future.

The creation of the Wai‘ele steering committee represents a pivotal moment in the ongoing effort to preserve and protect this unique region. This document, which sets forth the guidelines and regulatory measures for the Council, serves as the foundation for its work. It is designed to ensure that all decisions regarding land stewardship are made with the utmost integrity, transparency, and alignment with the values of the Wai‘ele community.

In the pages that follow, you will find a detailed framework that outlines the purpose, scope, and authority of the Wai‘ele steering committee. These guidelines are not merely administrative; they are a reflection of the community’s collective commitment to safeguarding Wai‘ele’s natural and cultural resources. By clearly defining the roles and responsibilities of the Council, this document ensures that its work is guided by principles of sustainability, cultural preservation, and community engagement.

The development of this framework is a testament to the importance of collaborative governance in land stewardship. It recognizes that the preservation of Wai‘ele requires the active involvement of all stakeholders, from local residents to governmental agencies. The guidelines within this document provide the tools necessary for the Wai‘ele steering committee to fulfill its mission, ensuring that the region’s lands are managed in a way that honors the past, serves the present, and protects the future.

Establishment and Authority of Malama O Puna

1. Establishment

Malama O Puna is a Hawai‘i non-profit corporation and 501(c)(3) established in 2000. It is an organization dedicated to the protection and preservation of the natural environment

in the Puna District of Hawai'i Island. Their mission is to foster environmental stewardship, community resilience, and sustainable practices by engaging the local community in efforts to care for and protect the unique ecosystems of the Puna region.

The organization's initiatives often include education and outreach, conservation projects, promotion of sustainable land use, and restoration of native habitats. By working closely with the community, Mālama O Puna aims to balance the needs of the environment with the well-being and sustainability of the local population while expanding community capacity.

2. PONC (land ownership)

a. Who are they and what they do

PONC refers to the **Public Access, Open Space, and Natural Resources Preservation Commission**. This commission is part of the County of Hawai'i and is responsible for advising on the acquisition and management of lands to preserve and protect natural, cultural, and recreational resources. (source of the PONC)

The PONC program focuses on identifying lands that are important for public access, conservation, and cultural preservation. These lands can include coastal areas, forests, historic sites, and other natural spaces. The commission makes recommendations to the county government on which properties should be acquired and preserved using funds collected through property taxes.

PONC plays a crucial role in ensuring that valuable open spaces and natural resources in Hawai'i are protected for future generations, while also providing public access to these areas for recreation and cultural activities.

- b. Wai'ele was nominated for the PONC acquisition in 2007-2008 by Malama O Puna. This parcel of 'aina was purchased by PONC in December 2021.
- c. Stewardship agreement with Malama O Puna
 - i. See the attached link
[2023 Grant Agreement - Fully Executed.pdf](#)
- d. Wai'ele Description

The project site is on the east side of Hawaii Island, in the ahupua'a (region) of Halepua'a in the moku (district) of Puna. The boundary of the site corresponds to the property line of Hawaii State TMK 3-1-4-3-003 and 3-1-4-3-037. The encompassed area totals 66.9 hectares (165.3 acres) and extends from the existing roadway (mauka-mountain side of the parcel) along the areas of Koa'e and Keonepoko and extends to the ocean (makai). Locally, the area is known as Wai'ele.

The surrounding area is a landscape matrix composed of private homes, ironwood (*Casuarina equisetifolia*) forests, papaya plantations, and bare lava flows. Just inland of Wai'ele is the Halepua'a section of the Nanawale Forest Reserve, which contains sections of hala (*Pandanus tectorius*) and 'ohi'a (*Metrosideros polymorpha*) native forest studied by Clarke et al. (1979).

3. *Management/Stewardship plan development*

- a. Malama O Puna is working on the creation of the Management/Stewardship plan

4. *Viability*

- a. The PONC Commission awarded Malama O Puna a Stewardship grant to develop an advisory committee to engage lineal and cultural descendants in the stewardship of Wai'ele.
- b. The focus is about the protection and preservation of the natural and cultural resources, promoting sustainable land management practices, engaging the local community and enhancing ecological and cultural resilience
- c. Hawaii Environmental Restoration (HER) has been collaborating to assist in the invasive species control, marine coastal clean-ups and application of funds to sustain these projects

Establishment and Authority of Wai'ele steering committee

1. *Establishment and Authority of the steering committee*

- a. The Wai'ele steering committee was established to address the needs and challenges related to:
 - a. Cultural preservation: to raise awareness of the cultural significance of Wai'ele and the surrounding region and promote activities that preserve and celebrate our cultural heritage
 - b. Environmental stewardship: to advocate for and implement sustainable land and resource management practices that protect the environment and support our local economy
 - c. Community engagement: fostering collaborations to build partnerships among various stakeholders including local residents, government agencies and nonprofit organizations to achieve our common goals
- b. The council was formed to provide to strategic guidance, facilitate collaboration and ensure that initiatives in the region align with the values and goals of lineal and cultural descendants and our local community

- c. Malama O Puna wants to ensure that individuals with ancestral ties to Wai'ele direct the planning of long term maintenance and stewardship activities. To that end we have been working with three individuals who will help create a steering committee that is fully inclusive of the current community as well as honoring those families and ohana with ancestral connections to the Wai'ele. Keone Kalawe, anticipated to be recognized by SHPD as the lineal descendent of the Wai'ele, is already recognized as the foremost ancestral representative of the area. He is involved with the maintenance and preservation of the KSBE's Kahuwai adjacent to the Wai'ele. In addition, he is recognized as a direct lineal descendant of the area of Cape Kumukahi. Iopa MaunaKea also has ancestral ties to Wai'ele. He has also taken as his kuleana the management and preservation of many areas along this section of the Puna coast including the adjacent areas to the Wai'ele. With the help of the former President of Malama O Puna, Iopa founded the Men of Pa'a, an organization known for its extensive community service. Leila Kealoha also maintains close ancestral ties to the lands along this section of the Puna coastline. Leila is the President/Chair of Pohaku Pelemaka, a nonprofit that works with 'ohana representing the lands from Kalapana to Kumukahi. With the involvement of these native Hawaiians with ancestral ties to this section of Puna's coastline, we will be guided in the development of a steering committee that will direct the long-term maintenance planning and annual stewardship activities. During the twelve-month grant period and in addition to assisting in stewardship activities as noted above, these three individuals will:
- 1) Research the ancestral families who still maintain a presence in the community surrounding Wai'ele and who may wish to participate in the Steering Committee,
 - 2) Identify community members other than the three consultants and Malama O Puna board members who have an interest in serving on this committee,
 - 3) Set up a process that ensures all persons appointed to the Steering committee agree to respectful behavior as members of the Steering Committee,
 - 4) Set up a protocol for deciding who will be members of the Steering Committee,
 - 5) Identify how the Steering Committee will function with regard to holding regular meetings, time and place for such meetings, and establish rules of behavior for the meetings.
 - 6) Identify the scope of services to be provided by the Steering Committee (e.g. review and approve annual stewardship applications, assist in specific tasks related to stewardship, establish a vision and mission for a comprehensive management plan.)
- The term "Steering committee" will be referred to as the steering committee.

2. Mission, Vision, and Executive Summary

Mission:

The mission of the Wai'ele steering committee is to honor and perpetuate the cultural heritage of Wai'ele, Halepua'a, Puna Makai through sustainable stewardship practices guided by the 'ike (wisdom) of our ancestors.

Vision:

Our vision is to create a thriving ecosystem in Wai'ele, Halepua'a, Puna Makai where the land, water, and community flourish in Iokahi, guided by the principles of Aloha 'Aina and the expertise of cultural practitioners and educators.

Executive Summary:

The Wai'ele steering committee is a collaboration between Malama O Puna; Ke Aloha 'Aina Foundation, LLC; Kalawe 'Ohana; Kuamo'o Legacy Foundation; and Kauhale Kanaka O Puna that aims to preserve and revitalize the cultural and ecological integrity of Wai'ele, Halepua'a, Puna Makai. Our program is rooted in the principle of Aloha 'Aina which emphasizes holistic approaches to land stewardship, and Kanaka Maoli and community well-being.

The steering committee for stewarding Wai'ele, Halepua'a, Puna Makai plays a crucial role in guiding and overseeing the sustainable management of the land. Overall, the steering committee serves as a collaborative forum for stakeholders to come together, share perspectives, and work towards the shared goal of preserving and perpetuating the cultural and ecological integrity of Wai'ele, Halepua'a, Puna Makai for present and future generations.

Through this initiative, we will engage cultural practitioners and educators to steward best practices for Wai'ele, Halepua'a, Puna Makai. Our activities will include:

- **Cultural Workshops and Education:** Hosting workshops led by cultural practitioners to share traditional knowledge and practices related to land stewardship, agriculture, and resource management.
- **Restoration Projects:** Implementing restoration projects guided by cultural protocols to rehabilitate degraded areas, restore native vegetation, and enhance biodiversity.
- **Community Engagement:** Facilitating community events and kokua opportunities to foster a sense of stewardship and collective responsibility for the Wai'ele, Halepua'a, Puna Makai.
- **Monitoring and Assessment:** Conducting initial and regular assessments of the ecological health of Wai'ele, Halepua'a, Puna Makai, utilizing traditional ecological knowledge and modern scientific methods.

- **Capacity Building**: Providing training and support for community members interested in becoming stewards of the land, empowering them to take an active role in conservation efforts.

By integrating the values and practices of the Wai'ele steering committee with the expertise of Malama O Puna and local cultural practitioners, we aspire to create a resilient and regenerative landscape that serves as a model for sustainable land stewardship across Wai'ele, Halepua'a. Together, we will honor the legacy of our ancestors while ensuring a vibrant future for generations to come.

Core Values

Kanaka Maoli practice the traditional core values of our kupuna and the customary practices within Wai'ele. This includes 'ohana, which emphasizes the importance of family, both immediate and extended.

Aloha/Malama: Embrace and practice the spirit of aloha in all interactions, fostering love, compassion, and respect for oneself, others, and the environment.

Kuleana (Responsibility): Acknowledge and honor our responsibility to care for the land, community, and future generations, recognizing that we are stewards of our cultural and natural heritage.

Ho'okipa (Hospitality): Extend warmth, welcome, and hospitality to all, creating inclusive spaces where everyone feels valued, supported, and empowered.

Laulima (Collaboration): Embrace the power of working together harmoniously, recognizing that collective effort and collaboration yield greater impact and success than individual actions.

Pono (Righteousness): Uphold integrity, honesty, and ethical conduct in all endeavors, striving to do what is right and just for the well-being of all.

3. Steering Committee Defined

- a. The Wai'ele steering committee's core function is to provide the land stewardship and management decisions for Wai'ele.
- b. The body of the steering committee will be made up of lineal/cultural descendants to Wai'ele and/or the surrounding area, a community member who does work within Wai'ele and/or surrounding area and a member from the academic/scientific community. See "Membership."

4. *What are Guidelines & Regulatory Measures*

- a. Guidelines & Regulatory Measures will act as the governing document of the Wai'ele steering committee. Guidelines & Regulatory Measures describe the objectives and roles of the steering committee including procedural requirements regarding the appointment of council members, requirements for the conduct of council members, meetings, and/or any other requirements. All steering committee activities shall be conducted pursuant to Guidelines & Regulatory Measures.

Scope and Powers of the Steering committee

1. *Purpose*

The purpose of the Wai'ele steering committee is to serve as the guiding voice for making management decisions within Wai'ele. To provide strategic guidance and

oversight for the conservation and sustainable management of the Wai'ele ahupua'a and its' natural and cultural resources. The council aims to ensure that initiatives within the region align with community values and priorities while promoting cultural preservation, environmental stewardship and community engagement.

1. Cultural Preservation:

- a. **Definition:** This initiative focuses on safeguarding and promoting the region's cultural heritage, traditions, languages, and practices. It involves efforts to protect historical sites, support cultural education, and ensure that traditional knowledge and customs are passed down to future generations.
- b. **Goals:** To maintain the identity and heritage of the community, encourage the continuation of cultural practices, and prevent the erosion of cultural values in the face of modernization.

2. Environmental Stewardship:

- a. **Definition:** This initiative aims to protect, manage, and restore the natural environment in the region. It includes activities such as conservation of natural resources, sustainable land use, pollution prevention, and efforts to address climate change.
- b. **Goals:** To ensure the long-term health and sustainability of the region's ecosystems, preserve biodiversity, and promote practices that minimize the environmental impact of human activities.

3. Community Engagement:

- a. **Definition:** This initiative is centered around actively involving community members in decision-making processes, project planning, and implementation. It emphasizes inclusivity, collaboration, and transparency, ensuring that the voices of all community members are heard and considered.
- b. **Goals:** To foster a sense of ownership and responsibility within the community, strengthen social ties, and ensure that initiatives are aligned with the needs and desires of the people living in the region.

Together, these initiatives guide the Wai'ele steering committee in shaping policies and projects that reflect the values and priorities of the community while protecting its cultural and natural heritage.

2. Scope of Mana'o (thoughts)

The Wai'ele steering committee will share its 'ike (knowledge) on various subjects and areas including: cultural, physical, biological, economic, educational, and community issues impacting Wai'ele and the surrounding region. The Wai'ele steering committee shall share its mana'o within the limitations of its powers found in Section 3 below.

3. Limitation of Powers

Malama O Puna recognizes the collective 'ike of the Wai'ele steering committee and the thoughts and opinions of the lineal and/or cultural descendants will be used as the final decision making process. As such, the Wai'ele steering committee is authorized and empowered to perform operational and management functions. In addition, the Wai'ele steering committee is authorized and empowered to govern, enforce, dictate, or mandate the policies, plans, decisions, or acts, as it relates to MOP and PONC. **Lineal descendants and/or cultural will ultimately have the final decision when it comes to “culturally sensitive issues”, i.e., lwi kupuna, etc**

Membership

1. Number of Members

The Wai'ele steering committee shall consist of a minimum of three (3) members and a maximum of five (5) voting members. There needs to be an odd number of members at any given time for voting purposes and there is no tie-vote. There are no non-voting members. Malama O Puna may have a representative present at meetings to share mana'o.

2. Selection process

The selection process will consist of each applicant filing out an application form. The existing steering committee and the land management agency or organization representative will review each applicant. It is important to have a balanced membership on the council. The steering committee shall consist of no less than three (3) lineal and/or cultural descendants to begin this process, then it will include two members of the community. The community members shall have one representative from the scientific community and one community member who has been vested in the area of Wai‘ele and who has been serving as a kokua.

- a. Lineal and/or descendants: shall include at least three (3) of the following:
 - i. Kupuna
 - ii. Makua
 - iii. ‘Opio
- b. Two community members: academic/scientific community and members vested within the community doing kokua work. The latter of the two will be referred to as a “General member.”
- c. Each member shall submit an application to become a member of the steering committee. See the attached link-
[■ Waiele Steering Committee Application.pdf](#)
- d. Members may be nominated for these seats on the steering committee

3. Voting

- a. Each member will have a vote
- b. Lineal and/or cultural descendants will comprise of at least 3-votes
- c. Community members will comprise of 2-votes
- d. See attached example of voting [■ Voting Rights, W.S.C..pdf](#)

4. Alaka’i

- a. One member shall serve as the person who will lead the council meetings as decided by consensus on an annual basis
- b. The council will designate a secondary person to lead the meetings in the event the alaka’i/kumu is not available

5. Member terms

- a. Lineal descendants
 - i. Kupuna- 4 years
 - ii. Makua- 3 years
 - iii. ‘Opio- 2 years

- b. Community members
 - i. Scientific-3 years
 - ii. General member- 2 years
- c. Designated beneficiaries
 - i. Each member of the council shall designate a secondary beneficiary to attend or participate in meetings and decision making in the event they are not able to attend meetings
- d. In the event there is a vacant seat, the council is responsible for filling that seat as soon as possible. In this circumstance, there shall be no meetings or decision making until the vacant seat is filled

6. *Additional terms*

- a. At the conclusion of a members term, such member may apply for an additional term
- b. Lineal descendants may serve two consecutive terms. Lineal descendants may serve two terms, then have a break in a term, then apply for another term after the break
- c. If there are no new candidates available for the lineal descendant members seat, then the existing member may serve an additional term on a year-to-year basis
- d. Community members may serve up to two consecutive terms

7. *Termination*

Steering committee members may be terminated if they exude the listed conditions below and may be grounds for dismissal at the discretion of other advisory board members:

- a. Does not abide by the core values guiding the Wai'ele steering committee
- b. Conviction or judgment for violation of federal, state, or county, laws, regulations, or administrative rules, relating to the protection of land, environment and/or cultural resources
- c. Is determined to have abused his/her position as a member of the steering committee (including, but not limited to, use of the steering committee information for person gain; use of the steering committee position to advance personal agenda or to harm another member of the steering committee or community; misrepresentation of, or spreading misinformation about the steering committee or MOP, PONC; and refusal to recuse himself/herself if so requested by other steering committee members in a matter in which the member is perceived to have a conflict of interest

- d. Has a change to the professional affiliation(s) and/or circumstances that comprise a significant portion of that members qualifications for being a member of the steering committee
- e. Misses three consecutive meetings without reasonable justification
- f. Disrupts meetings on one or more occasion, in a manner that significantly interferes with the steering committee conducting its business

8. Resignation

Members who wish to resign from their position shall give the steering committee and the MOP coordinator with 30-days written notice so that arrangements can be made to fill the vacancy as soon as possible. If this position is not filled the council will make all attempts to fill the position

9. Balanced membership

A steering committee that is balanced in terms of interest, geographic representation, skills, knowledge, and expertise will provide the greatest benefit towards the stewardship of Wai'eale. Accordingly, MOP and the initial steering committee members will select applicants, to the extent feasible, that demonstrate skills, knowledge and expertise in the following key areas, which have been identified as critical to the viability of the stewardship of Wai'eale:

- a. Cultural resources
- b. Natural resources
- c. Biological resources
- d. Archaeological resources
- e. Education resources
- f. Community resources

10. Member Application

Each member shall submit an application to become a member of the steering committee. See the attached link- [■ Waiele Advisory Council Application.pdf](#)

11. Member Designees

Members may designate a primary representative to attend meetings and vote for them in the even they are unavailable to attend the meetings

Administration

1. Kokua (Volunteer)

Members of the steering committee shall serve without compensation.

2. Designee

The Executive Director or designee from any nonprofit organization receiving funding for stewardship purposes shall serve as the liaison to the Wai'ele steering committee

Operation and Guidelines for steering committee members

Conduct of members

Steering committee members may not use or allow the use, for other than purposes of the steering committee, any information obtained through or in connection with his/her steering committee affiliation that has not been made available to the general public.

When speaking to the public or writing about any matter regarding Wai'ele in a document for distribution beyond the Wai'ele steering committee member membership, such member shall clearly distinguish those recommendations, opinions, or positions officially adopted by the Wai'ele steering committee member as a body from those he or she may have as an individual. In no case shall a member represent his/her individual opinions as those of the Wai'ele steering committee member or Wai'ele steering committee member.

Any Wai'ele steering committee member who has a conflict of interest (financial, personal, professional, etc.) in any matter before the Wai'ele steering committee member or its Subcommittees or Working Groups, shall declare the conflict and excuse himself or herself from any action on that matter, including discussion and voting actions. The steering committee Alaka'i/Kumu will bring it to the council to determine if a conflict of interests exists or not. If the Alaka'i/Kumu is not present at the meeting, then the vice-Alaka'i/Kumu will consult with the council.

Conduct of steering committee Body

- a. The Wai'ele steering committee shall not provide advice or make recommendations regarding Wai'ele to anyone other than MOP. The Wai'ele steering committee shall not perform operational or management functions, and has no authority to make decisions or express policy on behalf of MOP. Any advice, correspondence or information that the Wai'ele

steering committee wishes to share or express to others beyond MOP must be submitted to and be approved by the MOP Coordinator prior to any Wai'ele steering committee statement/action.

- b. Any communications (oral or written), i.e., correspondence, press releases, informational releases, news articles, or other written documents, that are intended to represent the Wai'ele steering committee as a body must be submitted to and be approved by the MOP Coordinator, in collaboration with MOP's Executive Director or assignee. The following disclaimer shall be placed in documents originating from the Wai'ele steering committee. The opinions and findings of this body do not necessarily reflect the position of the Malama O Puna and the County of Hawaii, PONC."

Committees

1. Subcommittees and Groups

- a. The Wai'ele steering committee may have subcommittees and groups to execute initiatives

Land Management Coordinator/Liaison

1. Malama O Puna Coordinator/Liaison-

- a. The Executive Director or designee shall serve as the liaison to the Wai'ele steering committee
- b. The Wai'ele steering committee shall work with the Malama O Puna in the stewardship of Wai'ele

Malama O Puna, as the grant and PONC awardees, will play a crucial role in the stewardship and management of the awarded property and the implementation of various conservation and community engagement initiatives. Here are the specific roles and responsibilities they can assume

Roles and Responsibilities of Malama O Puna

1. Stewardship and Conservation

- **Land Management:** Overseeing the maintenance and restoration of the awarded property, ensuring that it is managed sustainably and in alignment with conservation goals.

- **Native Species Restoration:** Implementing projects to restore native plant and animal species, removing invasive species, and enhancing the biodiversity of the area.
- **Environmental Monitoring:** Conducting regular monitoring of the ecosystem to track the health and progress of conservation efforts.

2. Community Engagement and Education

- **Educational Programs:** Developing and delivering educational programs and workshops to raise awareness about environmental conservation, cultural preservation, and sustainable practices among local residents and visitors.
- **Kokua Coordination:** Establishing kokua programs to involve the community in hands-on conservation activities, such as tree planting, habitat restoration, and clean-up efforts.
- **Community Events:** Organizing community events, cultural celebrations, and educational tours to foster a sense of stewardship and connection to the land.

3. Cultural Preservation

- **Integration of Traditional Knowledge:** Collaborating with cultural practitioners to integrate traditional ecological knowledge and practices into stewardship activities.
- **Cultural Heritage Projects:** Supporting projects that document, preserve, and celebrate the cultural history and significance of the area.

4. Resource Management

- **Grant Management:** Effectively managing the funds received through the grant, ensuring that they are used efficiently and transparently to achieve project goals.
- **Partnership Development:** Building partnerships with other organizations, government agencies, and stakeholders to leverage additional resources and expertise.

5. Advocacy and Policy

- **Policy Advocacy:** Advocating for policies and practices at the local and state level that support environmental conservation and cultural preservation.
- **Community Representation:** Serving as a representative for the community's interests in discussions and decisions related to land use and environmental protection.

6. Reporting and Accountability

- **Progress Reporting:** Providing regular reports to the funding bodies, stakeholders, and the community on the progress and outcomes of funded projects.
- **Transparency and Accountability:** Ensuring transparency in the use of funds and accountability in the implementation of projects.

Example Initiatives

- **Revegetation Projects:** Planting native species to restore degraded areas and enhance habitat quality.
- **Cultural Workshops:** Hosting workshops on traditional land management practices, Hawaiian language, and cultural history.
- **Public Access Improvements:** Enhancing public access to natural and cultural sites in a way that is respectful and sustainable.

By taking on these roles, Malama O Puna can ensure that the awarded grant and PONC funds are used effectively to create lasting positive impacts on the environment and community in the Wai'ele region. Their efforts will help preserve the natural beauty and cultural heritage of the area while fostering a strong sense of community stewardship.

Meetings

1. Frequency

The Wai'ele steering committee shall meet on a quarterly basis unless more frequency is identified. Special meetings may be called to order, if necessary.

2. Minutes

Minutes will be recorded by a designated member of the council. The minutes will be stored in Google Drive. They can be made available upon written request.

3. Kanaka maoli rules

All steering committee members will abide by and adhere to core values of the council.

Amendments

1. Amendment process

Amendments will be brought to the council by a member and shall be discussed and voted on by the council members

Ratification

1. Ratification of the steering committee

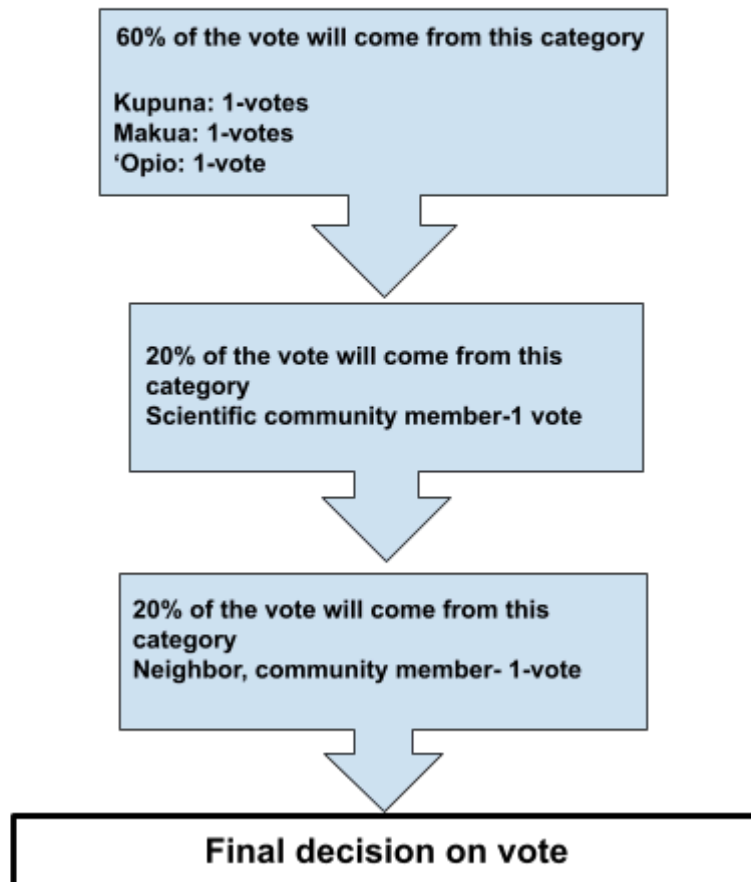
The membership of the steering committee member will be consented and agreed upon with execution of the signature below.

_____ Date

Eileen O'Hara,
Executive Director
Malama O Puna

Appendix

Voting Rights





WAI'ELE STEERING COMMITTEE APPLICATION

First Name: _____ **Middle:** _____

Last: _____ Please include full first, middle and last names.

Area of Expertise (Please check all that apply):

- _____ Cultural Resources
- _____ Natural Resources
- _____ Biological Resources
- _____ Archaeological Resources
- _____ Economic Resources
- _____ Educational Resources
- _____ Community Resources

Home Address: _____

Home Phone: _____ **Cell Phone:** _____

Home Email: _____

Work Address (Including name of company): _____

Work Phone: _____ **Work Fax:** _____

Work Email: _____

Please answer each of the following questions on a separate piece of paper and attach to this application.

1. Why are you interested in being a member of the Wai'ele Steering Committee member?
2. What are your community, professional, and employment, affiliations?
3. What is your previous experience/attendance on councils and/or working groups?

4. What particular expertise, skills, and knowledge would you bring to the 'Wai'ele Steering Committee?
5. What do you think the role of the 'Wai'ele Steering Committee member should be?
6. As a member of the Wai'ele Steering Committee member you will be expected to: attend all committee meetings, participate in subcommittees and or working groups, review documents, and attend other events as planned. Given the above, do you feel you have the time to be a member of the Wai'ele Steering Committee? Please explain.
7. Do you have any other qualifications or experience that you would like to share with us?

Mahalo for your interest and taking the time to complete this application. The information obtained through this application will help us determine your potential participation as a Wai'ele Steering Committee member. You will be notified in writing as to the status of your application.

Please return your application to:

Eileen O'Hara

15-2833 Pahoia Village Road

Pahoia, HI 96778

In you have any questions regarding this application, you may contact Eileen at 808-896-1902, or email at eohara58@gmail.com

Botanical Survey and Vegetation Analysis

Wai‘ele, Hawai‘i

Jon Rathbun & William Stein

Technical Report June 2024



Presented are the results of a botanical survey conducted on the east side of Hawaii Island, with a comprehensive overview of the site's floral diversity. Our study identified a total of 103 vascular plant taxa. The flora comprises 73 naturalized taxa, 19 native taxa and 11 Polynesian-introduced taxa. Among the findings was the endemic endangered species *Ischaemum byrone* and the Polynesian introduced *Piper methysticum*. The site's vegetation abundance was measured using relevé plots, and analyzed for clustering. We categorized the vegetation into three major types: *Scaevola-Heliotropium Shrubland*, *Hibiscus-Paederia Shrubland*, and *Mangifera-Thelypteris-Oplismenus Forest*.

The island of Hawai‘i, known for its rich and diverse ecosystems and also its rates of extinction, presents a unique opportunity for botanical research. The east side of Hawai‘i Island, in particular, boasts a range of ecological zones that are home to a variety of plant taxa, some of which are found nowhere else on Earth.

Beyond Hawai'i's wealth of endemic plant diversity, Indigenous communities possess a profound connection with their ancestral lands, often encompassing centuries of accumulated knowledge and sustainable land management practices. Just before contact, the Kanaka Maoli (Indigenous Hawaiians) had developed an immense number of varieties of crops (Table 1), most of which have been lost, and many more are rare, or threatened (Kagawa-Viviani *et al.* 2018).

This technical report documents the findings of a botanical survey aimed at cataloging the vegetation and assessing the presence of rare and endangered taxa on two parcels recently acquired through the Public Access,

Open Space, and Natural Resources Conservation Commission (PONC) for perpetual preservation by the County of Hawai'i within this region. The survey's objectives were not only to enrich the scientific understanding of the area's flora but also to inform future conservation and management efforts.

The significance of this survey extends beyond academic interest; it is a critical step towards preserving Hawai'i's natural heritage. The objectives are as follows:

1. to identify and map the major vegetation types
2. to determine the occurrence of threatened and/or endangered taxa
3. to determine the occurrence of Hawaiian cultivars
4. to provide data sufficient to facilitate future management

These goals were pursued with awareness of the delicate balance that exists within island ecosystems and the threats posed by both invasive species and the interruption of Indigenous land management practices.

Our methodological approach was designed to be as thorough and minimally invasive as possible. It included a review of existing literature, consultations with persons familiar with the area, and extensive fieldwork conducted over several months.

Crop	No. Hawaiian Varieties	No. Remaining	Remaining (%)
Kalo <i>Colocasia esculenta</i>	300-400	~60	15-20%
'Uala <i>Ipomoea batatas</i>	~250	unknown	-
Mai'a <i>Musa</i> spp.	40	-	-
'Awa <i>Piper methysticum</i>	35	13	37%
Kō <i>Saccharum officinarum</i>	50	-	-
'Uhi <i>Dioscorea</i> spp.	9	-	-
'Ulu <i>Artocarpus altilis</i>	1	-	-
Niu <i>Cocos nucifera</i>	2	-	-

Table 1: Hawaiian crops with number of varieties documented and currently known. Numbers from KagawaViviani et al. 2018.

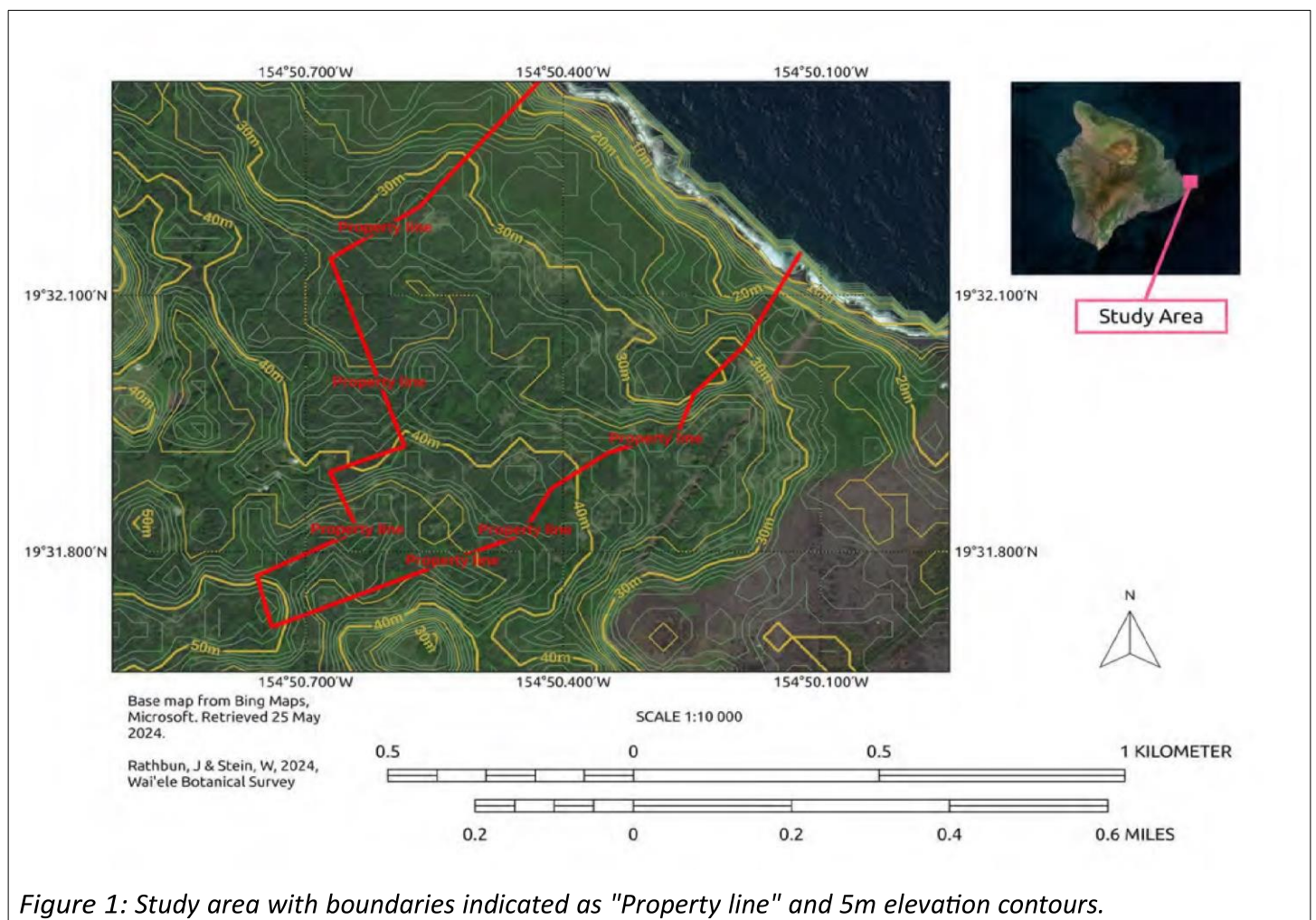
The survey was conducted within the context of a changing global climate and increasing ecological pressures. The findings presented in this report are intended to serve as a baseline for future studies and as a guide for conservation strategies. By providing a snapshot of the current state of the site's flora, we hope to contribute to the ongoing efforts to protect and preserve the unique plant life and indigenous practices that contribute to the identity and ecological integrity of the island.

MATERIALS & METHODS

STUDY AREA

This study was based on the east side of Hawai'i Island, in the ahupua'a (region) of Halepua'a in the moku (district) of Puna. The boundary of the study corresponds to the property line of Hawai'i State TMK 3-1-4-3003 and 3-1-4-3-037. The encompassed area totals 66.9 hectares (165.3 acres) and extends from 53 m.a.s.l. to the ocean. Locally, the area is known as Wai'ele.

The surrounding area is a landscape matrix composed of private homes, *Casuarina* forests, papaya plantations, and bare lava flows. Just inland of Wai'ele is the Halepua'a section of the Nānāwale Forest Reserve, which contains sections of hala (*Pandanus tectorius*) and 'ōhi'a (*Metrosideros polymorpha*) native forest studied by Clarke *et al.* (1979).



The climate is moist mesic (Price *et al.* 2012) with a mean annual precipitation of 2500 mm (98 inches) (Giambelluca *et al.* 2013). Summers tend to be dryer, though dry periods may occur at any time of year. Eastnortheast trade winds predominate, and they blow onshore for much of the year. Occasionally, generally

during the winter, the area is subject to southerly to south-westerly Kona winds that are sometimes strong and quite dry.

The lava substrate that underlies Wai‘ele is a relatively smooth and flat pāhoehoe that has been dated AD 1200-1550 (Sherrod *et al.* 2021). We did not encounter any lava tube systems within the survey area. A layer of black muck soil averaging more than 20 cm thick has accumulated on top of the pāhoehoe. This organic soil has been supplemented by a considerable quantity of fine cinder sand probably deposited from the 1960 Kapoho eruption and/or earlier eruptions from the nearby east rift of the Kīlauea Volcano. The soil thins out toward the rocky shore. Low cliffs line most of the shore, which are, in places, fronted by boulder beaches. Rock walls and other stone structures are ubiquitous throughout Wai‘ele, evidence that the area has been used by humans in the past.

FLORA SAMPLING

We reviewed the available literature on the site and its adjoining areas. This was complemented by discussions with local experts, community members and other individuals familiar with the terrain. Fieldwork was conducted from November 2023 to June 2024.

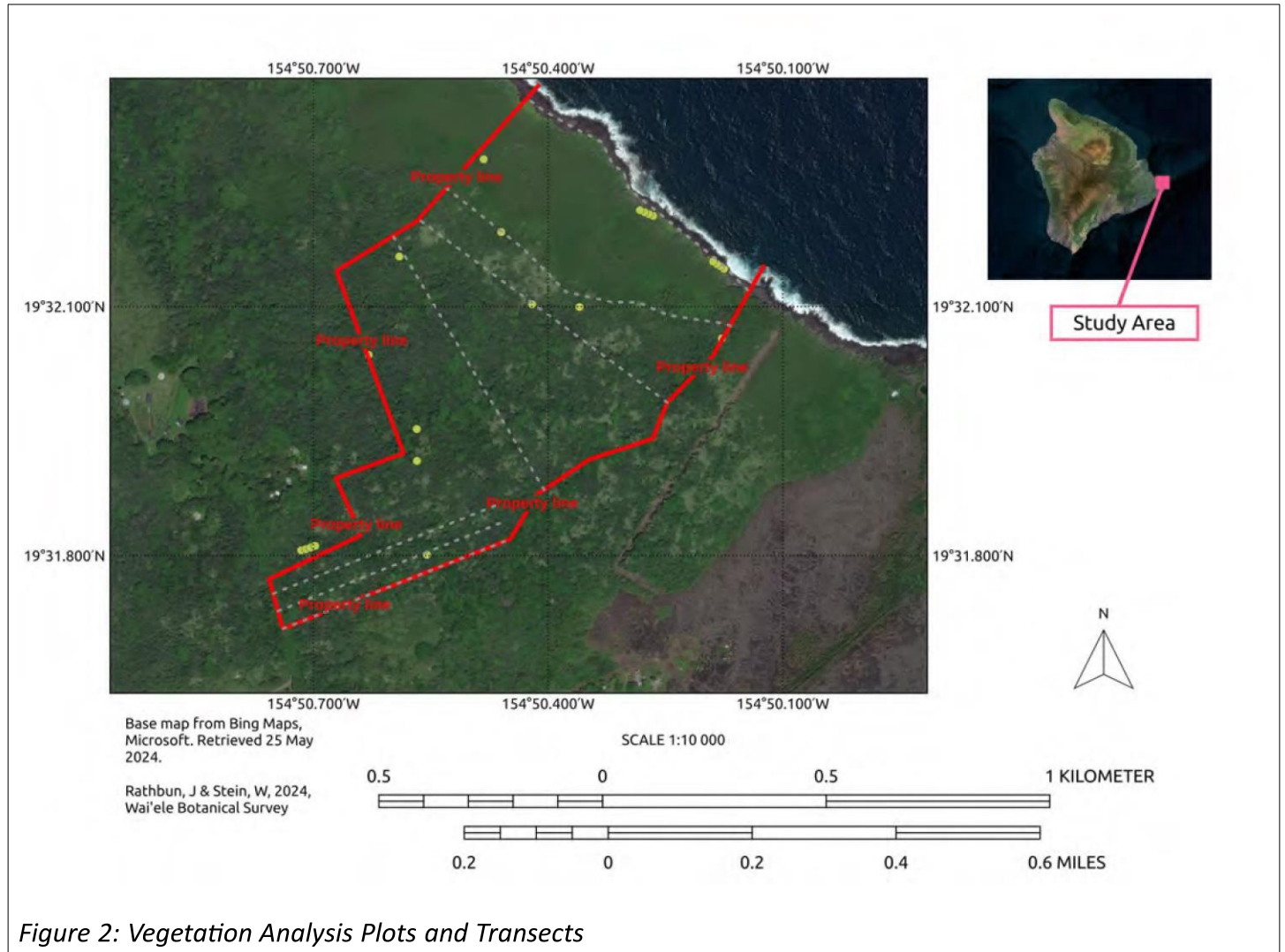
Transects and plots were located in the *QGIS* desktop application (QGIS Development Team 2024), following a period of ground familiarization. The field team utilized this GIS data in the *QField* phone app and GPS, for real-time data collection and editing. Our survey efforts were intensified in regions reported to harbor rare plants by the area’s community, selected via aerial photos, and/or identified in our preliminary site walk. Aerial photography was also studied to delineate tentative vegetation types. Presence/absence data were developed via transect sampling. Abundance data were collected via twenty-two 10 m x 10 m quadrats. Twelve initial quadrats in groups of four were laid out along 40 m transects to evaluate species accumulation curves, vegetation diversity indices and other preliminary data (Mueller-Dombois & Ellenberg 1974). The first four plots were the inland plots laid just north of the property line, and may be used as a control in analyzing the effectiveness of management decisions. The subsequent plots were laid out at random using the “random points in polygons” tool in *QGIS* and located *in situ* with a GPS smartphone app. Within each plot, each species was assigned an ordinal cover value and height class according to a modified Braun-Blanquet coverscale (MuellerDombois & Ellenberg 1974).

Taxa were identified to species, or subspecies, *in situ*, with unidentified specimens collected for subsequent determination. When significant characters such as flowers or fruits were not available, plants were identified to the lowest level possible, or given a cf. taxa designation. Names were validated against *Plants of the World Online* (POWO 2024) and flora lists published for Hawai‘i (Imada 2012, Imada 2019, Herbst & Staples 2005).

Notable taxa were mapped using GIS tools. As *Ischaemum byrone* is well documented from surrounding areas, we refrained from collecting vouchers to minimize impact on the study area and its small population.

DATA ANALYSIS

In identifying and mapping the various vegetation communities, we aimed to quantify the difference between plots. To accomplish this, we utilized a suite of analytical tools. Various dissimilarity indices for samples were calculated and the results compared using the package *vegan* (Okansen *et al.* 2024) in R 4.1.2 (R Core Team



2021). Clustering between samples was analyzed according to various clustering criterion. Optimal group number was verified according to the Calinski-Harabasz (1974) criterion. Non-metric multidimensional scaling ordination with Bray-Curtis distance was used to further evaluate clustering in the vegetation. The ShannonWeiner diversity index (Hill 1973) was calculated for each plot for insights into how vegetation diversity differed across the site.

RESULTS

VASCULAR PLANTS

The study identified a total of 103 vascular plant taxa across 48 families. The naturalized flora comprises 73 taxa or 70.8% of the total species richness, with 52 dicots, 11 monocots and 10 ferns. Native flora are represented by 19 taxa or 18.4%, including 3 endemic taxa and one endemic hybrid taxon, *Nephrolepis* × *medlerae*, resulting from naturalized *N. brownii* crossed with indigenous *N. exaltata*. Polynesian introductions are represented by 11 taxa or 10.6%, which constitute roughly half of the original canoe plants brought to Hawai'i. Of the 48 families represented, more than half (58%) of the vascular plant diversity is represented by only 13 (27%) families. The three most diverse families are Fabaceae and Polypodiaceae with 7 taxa, and Aspleniaceae with 6 taxa.

Of the 18 native taxa recorded, only 4 are endemic, meaning they occur only in the Hawaiian Archipelago: *Pipturus albidus*, *Thelypteris hudsoniana*, *Ischaemum byrone*, and the hybrid *Nephrolepis* × *medlerae*. The remaining taxa are indigenous, i.e. occurring naturally in the Hawaiian Archipelago, but also elsewhere in the world.

One-third of the native taxa are represented by epiphytic ferns. Almost another third (5 taxa) are lianas or vines. That corresponds to 61% of the native vegetation richness that lives exclusively or mostly above the forest floor.

Laukahi (*Thelypteris hudsoniana*), was the sole native terrestrial fern encountered, though at times it formed a dominant aspect of the ground cover. Only two individuals of māmaki (*Pipturus albidus*), a shrub, were encountered, surviving at the southeast *Hibiscus-Paederia Shrubland* to *Mangifera-Thelypteris-Oplismenus Forest* boundary.

Hala (*Pandanus tectorius*) is a native tree, and constitutes a significant proportion of the biomass produced at Wai'ele. Several moderately dense hala groves are scattered around the forest, these usually overtopped by taller mango (*Mangifera indica*) and cecropia (*Cecropia obtusifolia*) trees.

The origin status of hau (*Hibiscus tiliaceus*) is uncertain. Whether it arrived to the Hawaiian Islands via sea or with Polynesian voyagers has not yet been conclusively proven (Wagner *et al.* 1999, Herbst & Staples 2005). Nevertheless, it is currently considered indigenous to Hawai'i by *The Manual of Flowering Plants to Hawaii* (Wagner *et al.* 1999), the Imada Checklists (2012, 2019), the *Flora of the Hawaiian Islands* (Wagner *et al.* 2023), and *Plants of the World Online* (POWO 2024), and we follow that consensus in this report.

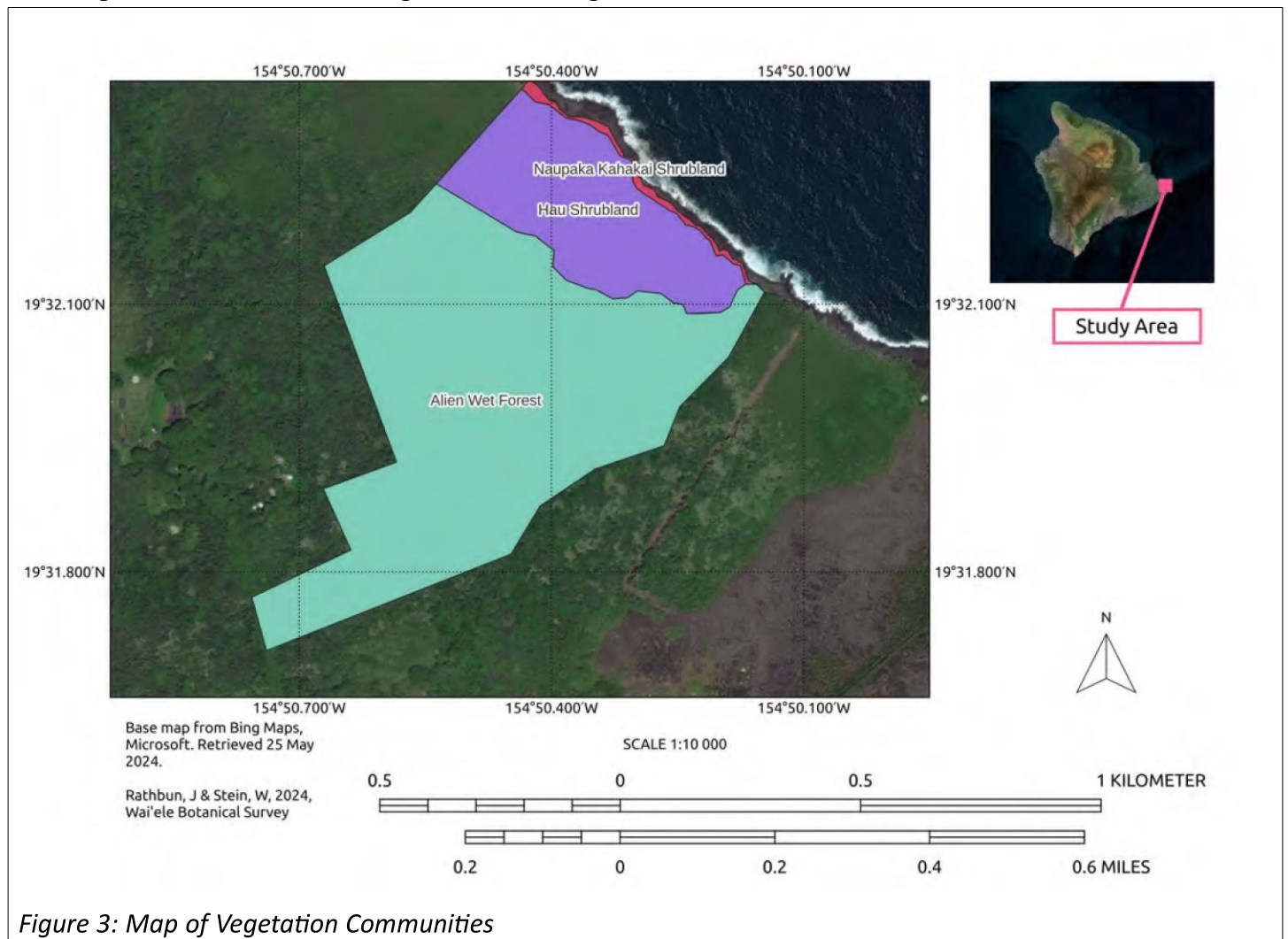
Among the taxa cataloged, *Ischaemum byrone* stands out as it is listed as Endangered under the Endangered Species Act (ESA) (Fish and Wildlife Service 2019). It is the only rare native taxon cataloged. A few individuals of this endangered species grow along the immediate shoreline within the *Scaevola-Heliotropium Shrubland*.

In addition to the native taxa, the survey identified 11 taxa that are Polynesian introductions, reflecting Kanaka Maoli land-use and cultivation. Plants brought to and/or developed in the Hawaiian Islands in ancient times form a conspicuous part of the flora of Wai'ele today, including extensive stands of kukui

(*Aleurites moluccana*), ‘ulu (breadfruit; *Artocarpus altilis*), ‘ōhi’a ‘ai (*Syzygium malaccense*), noni (*Morinda citrifolia*), kī (tī; *Cordyline fruticosa*), and niu (coconut; coconut palm; *Cocos nucifera*). ‘Ulu sap “was commonly used throughout Polynesia and Fiji for caulking canoes and as an adhesive,” and several trees in Wai‘ele bore successive horizontal scarring indicative of sap harvesting (Whistler 2009). Several coconut palms were tall and appeared quite old. Their provenance deserves further investigation. As well as these, a single, small patch of ‘awa (*Piper methysticum*) was recorded.

Lebot *et al.* (1999) formalized 13 ‘awa varieties. According to Table 1 from Lebot *et al.*, “Morphological description of the germplasm collection,” the ‘awa found corresponds closest to cultivar (cv.) *Wa’a Wa’a* or cv. *Moloka’i*. An ‘awa expert (anon., pers. comm.) identified the ‘awa as cv. *Nene*, which Lebot *et al.* synonymize with cv. *Ava Lea*, a Samoan genotype, and to which the plant’s morphology also closely agrees.

The extent of the Kanaka Maoli crops was not limited to the property boundaries. The forest extended along the road north and to the west of the acquired parcels, and a large population lies to the south and east, including more kukui-dominant vegetation, and large stands of ‘ulu and ‘ōhi’a ‘ai.



VEGETATION COMMUNITIES

Cluster Analysis & Ordination

Our cluster analysis and ordination support the existence of three vegetative communities. For inland Wai‘ele, the canopy can be diverse, with some areas being largely mango, and others, largely cecropia, or kukui. Our data do not support these canopy types as distinct communities when compared to the differences between the three major communities. The three communities proposed by our analysis have obvious structural differences on the ground, as well as their compositional differences examined by our analysis. We will discuss them at length in their corresponding sections, below.

The Calinski-Harabasz criterion (CHC) was highest for 2 clusters within our plots, indicating 2 clusters as the “optimal” grouping just slightly above 3, with decreasing values for 4, and 5 groups. However, a variety of dissimilarity indices (Chao, Bray-Curtis & Horn–Morisita) all converged on the same 3 clusters. Further, visualizing the Bray-Curtis distance with non-metric multidimensional scaling (NMDS) ordination, showed the three clusters were well-defined.

The first division splits coastal naupaka-dominant (*Scaevola taccada*) plots (5-12) with more inland plots (13-22), and the second division splits the hau-dominant (*Hibiscus tiliaceus*) plots (18-19) from the rest of the inland plots. The prevalence of these divisions were preserved across various dissimilarity indices. The vegetation dissimilarity between naupaka (5-8) and hala (9-12) plots was lower than most other divisions.

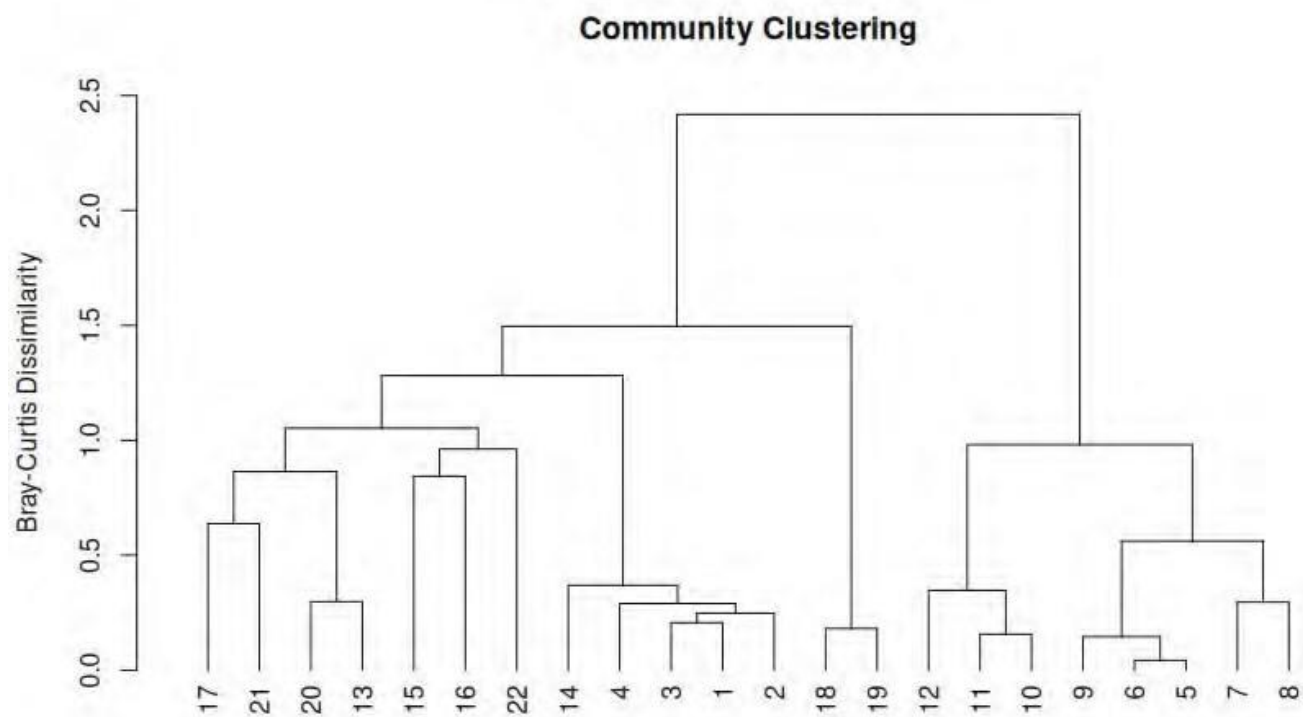


Figure 5: Dendrogram of Vegetation Clusters. No.s 1-22 refer to plot numbers.

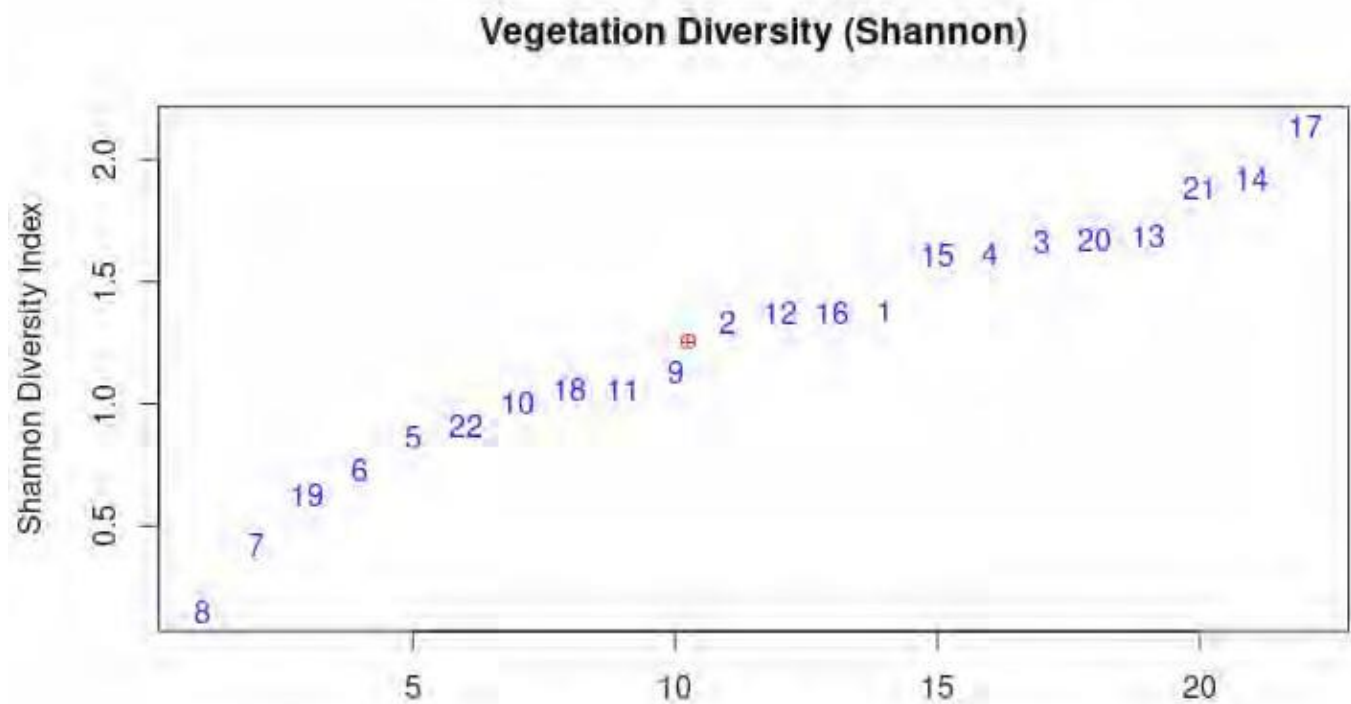


Figure 4: Shannon Diversity Index of plots. Blue numbers are plots, the red circle is the mean diversity.

Our NMDS ordination clarified the differences in clustering between the different dissimilarity indices. Both the hoi-dominant plot (16) and the coconut palm plot (22) were fairly distant from the main group of inland plots, but much closer to the group 1 centroid than the group 2 or group 3.

According to Gagné and Cuddihy's (1999) vegetation classification for the Hawaiian Islands, our groups most closely follow: *Naupaka Kahakai Shrubland/Hala Forest*, *Hau (Hibiscus) Shrubland*. The forest zone lacks a clear designation under their system, following closely *Alien Wet Forest*, but at times resembling their mesic *Kukui (Aleurites) Forest*. Although Wai'ele falls within the 1200 to 3800 mm mesic range, *Alien Wet Forest* follows closely the diversity of naturalized species present at our site. The being said, "*Alien Wet Forest*" is ill-fitting for an area that has a large portion of Hawaiian crops, but accommodates the zone's quantity of naturalized species.

Our indicator species analysis (ISA), showed that group 1 is indicated by *Mangifera indica*, *Oplismenus hirtellus*, *Thelypteris parasitica* ($p < 0.01$), *Nephrolepis blanda* and *Aleurites moluccana* ($p \leq 0.05$), group 2 is indicated by *Scaevola taccada* and *Heliotropium foertherianum* ($p < 0.01$), and group 3 is indicated by *Hibiscus tiliaceus*, *Paederia scandens* and *Morinda citrifolia* ($p \leq 0.05$).

Vegetation diversity, via the Shannon-Weiner diversity index, was lowest for naupaka-dominant (5-8) plots with a hau (19) plot and the coconut palm (22) plot being about comparable. The second hau (18) plot scored above the naupaka plots and below the hala (9-12) plots. Plots 17 & 14 were scored as the most diverse, but the inland plots were characterized by a generally higher diversity than the other groups.

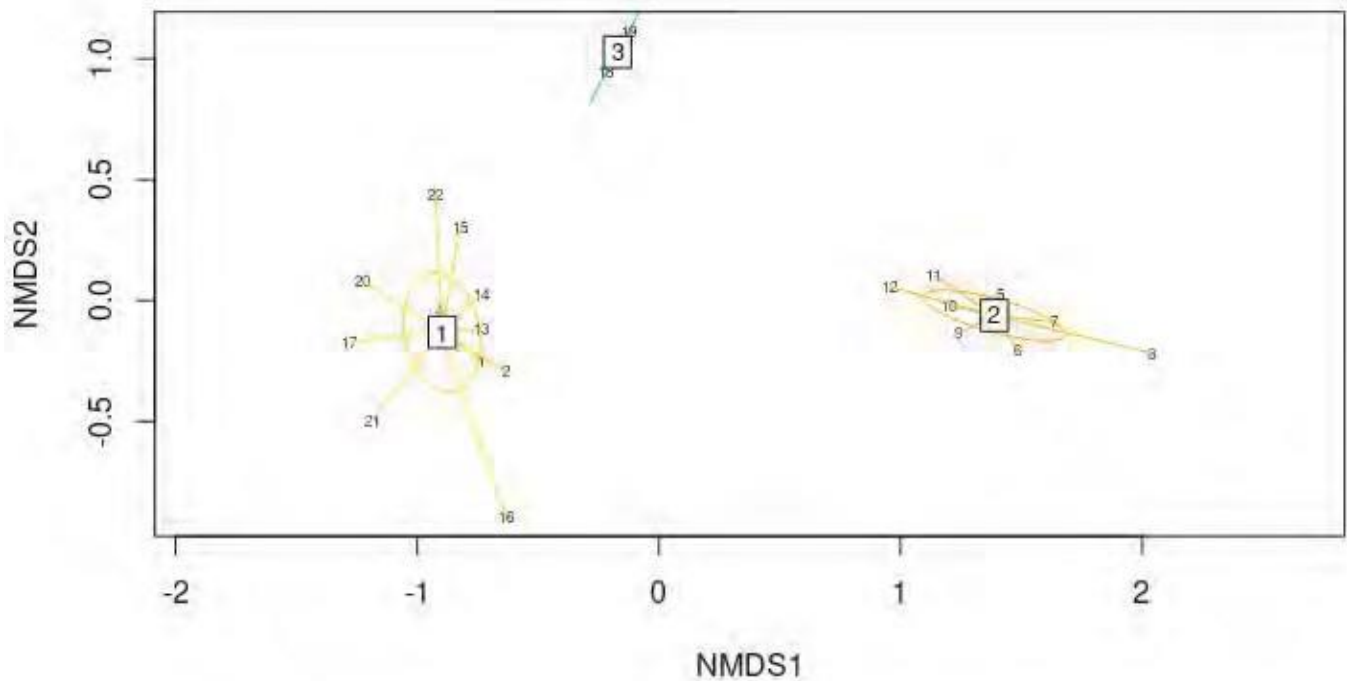


Figure 6: Visualization of clusters, small numbers with lines represent plot numbers, circles represent the group centroid.

SCAEVOLA-HELIOTROPIUM SHRUBLAND

This narrow shoreline community is squeezed between the ocean and the hau thicket described below. The vegetated portion occupies only about 0.6 hectares in area, or 0.8% of our study area, with about 8 hectares of rock and intertidal zone seaward. Plants growing here tolerate salt spray and strong wind. This zone is dominated by naupaka kahakai (*Scaevola taccada*, ~47% cover), which often forms large pure stands. It is typified by this shrub, and in all places is generally low-statured (5 m, 15 ft tall, often less). In places hala (~34%), coconut palm and tree heliotrope (*Heliotropium foertherianum*, ~21%) rise above the naupaka shrubs. The vine *Ipomoea violacea* grows near the southeastern end of the coastal strip. Other plants forming a more minor component of this zone include false kamani (*Terminalia catappa*), laua'e, holly fern (*Cyrtomium falcatum*), crab grass (*Digitaria ciliaris*), the indigenous vine mohihi (*Vigna marina*), and the endangered endemic grass *Ischaemum byrone*. In the extreme southeastern corner behind the cobble beach, the naupaka is less, and the vegetation is dominated by coconut palm and false kamani.

Occasionally, barren areas are vegetated by mau'u 'aki'aki (*Fimbristylis cymosa*) and little else, sometimes with a thin layer of sand. This littoral zone is often scoured by heavy surf, but is dry for periods too long to sustain marine vegetation. The upper tidal zone is dominated by the yellowish limu 'aki'aki (*Ahnfeltiopsis concinna*). Coralline alga (*Hydrolithon onkoides*) at times forms a thin pink crust dominating the intertidal rocks below the limu 'aki'aki.

HIBISCUS-PAEDERIA SHRUBLAND

The trunks of hau trees here interlock to form a dense thicket. At 12.5 hectares, this shrubland represents approximately 18.6% of the study. It extends just behind the narrow naupaka zone along nearly the entire shoreline. This community has an even height, being nearly everywhere about 5m (15 ft) tall. Some of the taxa found within are maile pilau (*Paederia scandens*), moon flower (*Ipomoea alba*), noni (*Morinda citrifolia*) and clock vine (*Thunbergia fragrans*). Moa (*Psilotum nudum*) is fairly frequent, terrestrially, and epiphytically. Occasionally the ferns 'ekaha (*Asplenium nidus*) and laua'e grow among the tangled branches. Trees of kukui, and niu may be feral progeny of remnant cultivation, or themselves planted by people.

In the previous section on Vascular Plants, we commented on the contention surrounding the distributional origin of hau. The presence of limited strawberry guava (*Psidium cattleianum*) thickets within the shrubland, but without any seedlings under the hau, indicated no/limited recruitment in hau thickets. In plot no. 19, there were no strawberry guava seedlings found beneath the two mature and fruiting trees within the plot. The hau may have been planted as a windbreak along the shore in ancient times or in early post-contact times. Such a windbreak would have protected crops and villages alike. Regardless of distributional origin, the presence of strawberry guava thickets within the hau might indicate the community as it is today formed after strawberry guava's introduction in 1825 (Herbst & Staples 2005).

MANGIFERA-THELYPTERIS-OPLISMENUS FOREST

At around 45.4 hectares, this zone represents 67.8% of the area studied. This forest has a nearly continuous canopy mostly 15–25 m (50–75 ft) tall, and is the most diverse vegetation community. The canopy reflects this, with the most abundant large tree being mango (~50%), followed by cecropia (~22%) and kukui (~17%). In a few places *Melochia umbellata* and *Trema orientalis* join the canopy. In others, 'ulu (*Artocarpus alitis*) and coconut palm predominate. The understory is relatively open in most places, making walking easy along the numerous pig trails. In places there is an understory of shrubs or small trees, especially Myrtaceae like guava



Illustration 1: ▲ *Cecropia* canopy "dieback"—the tall snag in the upper left is *cecropia*.

▼ Healthy *cecropia* canopy.

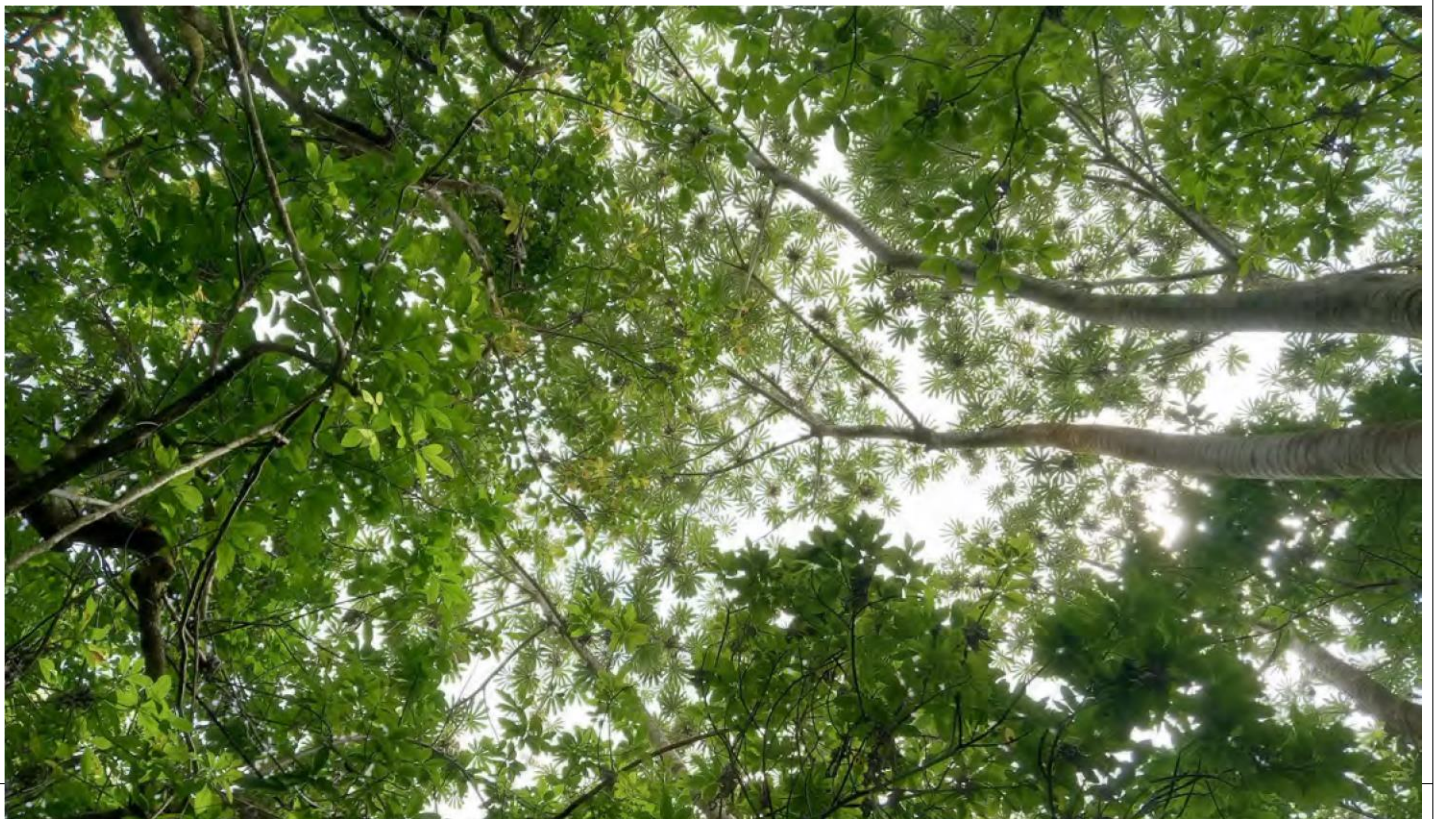




Illustration 2: 'Awa, *Piper methysticum*

(*Psidium* spp.) or *Syzygium* spp. and Rubiaceae like noni (*Morinda citrifolia*) or coffee (*Coffea arabica*). Much of the ground in the forest area is covered with the grass honohono kukui (*Oplismenus hirtellus*) and naturalized ferns, especially wood fern (*Thelypteris parasitica*), these two plants are nearly ubiquitous and highly characterize this group. Herbs are remarkably sparse; in fact, the only grass seen in the forest during our survey was honohono kukui. A considerable proportion of the ground is bare due to the rooting of pigs and/or the dense shade cast by some of the trees.

QUEENSLAND LONGHORN BEETLE

A recent introduction to Hawai'i County, the Queensland longhorn beetle (QLB; *Acalolepta aesthetica*), is posed to have a dramatic impact upon vegetation island-wide (BIISC 2024). Adult QLB are known to affect a wide range of hosts, like citrus, cacao, kukui, cecropia, breadfruit, and many others. A single grub, excised from a dead kukui tree, was identified as QLB by Ann Kobsa, and Jade Miyashiro of BIISC (pers.



Illustration 3: QLB (*Acalolepta aesthetica*) larva

comm.). We often encountered dying cecropia at Wai'ele with a number of bore holes and stringy frass around their trunk. Although the only grub was found in a kukui tree, cecropia were dead nor dying more than any other tree species at Wai'ele. QLB should be investigated as the cause of the cecropia dieback currently advancing at the site.

LIMITATIONS

The results of our botanical survey are reflective of the specific season and environmental conditions prevalent during the period of study. It is important to acknowledge that slight variations in these conditions could potentially lead to different outcomes. While we have made every effort to ensure comprehensive coverage, the dynamic nature of ecosystems means that our findings may not capture the full extent of taxa diversity present at other times of the year or under different environmental scenarios.

RECOMMENDATIONS

The volumes of research in Hawaiian and other ecosystems have highlighted the significant impact of feral pigs (*Sus scrofa*) on vegetation dynamics. Almost every plot in the *Mangifera-Thelypteris-Oplismenus* Forest community had some degree of pig disturbance. At times nearly 50% of the forest floor was bare, and pigs were seen often on field days. Implementing control measures typical for Hawai'i, such as fencing, hunting, or trapping, could have profound implications for the ecosystem.

We have selected a few species as notable for removal (*Macaranga* sp., *Passiflora laurifolia*, *Ficus microcarpa*, *Schinus terebinthifolius*, see supplemental maps). There is a notable stratification of dispersal strategy by date of introduction. Pre-contact and early post-contact species represent more anthropochorus (human-dispersed) turned barrochorus (weight-dispersed) taxa (i.e. *Aleurites moluccana*, *Mangifera indica*, *Syzygium malaccense*, *Cocos nucifera*, &c). The later post-contact species within Wai'ele's interior more often tend to be zoochores/ornithochores (animal/bird-dispersed, i.e. *Ficus microcarpa*, *Miconia crenata* sp.) (Shiels



Illustration 4: *Cyrtomium falcatum*, among *Terminalia cattapa* leaves near the shore.



Illustration 5: *Begonia* sp.

2010). *Cardinalis cardinalis* and *Carpodacus mexicanus*, encountered in our survey, are both known seed predators, passing seeds below 2 mm (Carpenter *et al.* 2020).

As management and traffic increases in the area, there is the potential for this balance to shift in the favor of introduced exoanthropochores (on-the-outside-of-people) like *Desmodium* spp., *Bidens pilosa*, &c. that are common about the Puna district of Hawai'i Island today. Early implementation of sanitation procedures could help control the spread of such weeds.

The wide dispersion of seedlings of certain invasive species implies constant monitoring would be required for population control. *Macaranga tanarius* & *M. mappa* both are clearly increasing in abundance within Wai‘ele, even in remote areas.

In addition to a monitoring and control program, a strategic outplanting program could be implemented to enhance native and Polynesian biodiversity as well as preserve the site’s unique genetic resources.



Illustration 6: Heliotropium foertherianum, center.

VASCULAR PLANTS OF WAI‘ELE

FORMAT

Native Plants Scientific name	Common name(s)	Notes
Ferns & Fern Allies <i>Asplenium nidus</i> L.	‘Ekaha, bird's nest fern	The largest, most common, and most conspicuous epiphyte in the forest.
<i>Haplopteris elongata</i> (Sw.) E.H.Crane	‘Ohe‘ohe	Infrequent, usually epiphytic on ‘ekaha, sometimes epiphytic directly on upper tree trunks.
<i>Lepisorus thunbergianus</i> (Kaulf.) Ching	Pākahakaha	Occasional epiphyte.
<i>Nephrolepis</i> × <i>medlerae</i> W.H.Wagner		Frequent. <i>N. exaltata</i> seems to have disappeared from Wai‘ele. This hybrid between naturalized <i>N. brownii</i> and native <i>N.exaltata</i> is sterile, though robust and can persist indefinitely and spread by plantlets that form on runners.

<i>Ophioglossum pendulum</i> L.	Puapuamoa, syn. <i>Ophioderma pendulum</i>	A single large specimen was seen growing epiphytically on 'ekaha.
<i>Psilotum nudum</i> (L.) P.Beauv.	Moa, whisk fern	Occasional. Most plants seen here grow epiphytically.

This list divides the vascular plants of our survey into 3 groups, according to their distributional origin status: Native (including indigenous and endemic taxa), Polynesian, and Naturalized, following their category in either: the *Hawaiian Native and Naturalized Vascular Plants Checklist* (Imada 2012, hereafter referred to as the *2012 Checklist*), the *Hawaiian Naturalized Vascular Plants Checklist* (Imada 2019, the *2019 Checklist*) or assigned to the Naturalized section if the taxon appears in neither.

Scientific names and their author's abbreviation follows either the *2012 Checklist*, the *2019 Checklist*, *A Tropical Garden Flora* (Herbst & Staples 2005), or *Plants of the World* (citation).

ABBREVIATIONS

We use two common abbreviations throughout the following tables:

- ssp. = subspecies
- syn. = synonym. A scientific name that has been superseded by a newer name.

Native Plants Scientific
name

Thelypteris hudsoniana (Brack.) Laukahi, syn. *Pneumatopteris*
C.F.Reed *hudsoniana*

Relatively common on the forest floor,
dominating the understory in a few places,
though much less common than its non-
native
relative *Thelypteris parasitica*
A common but tiny and inconspicuous
fern

Trichomanes minutum syn. *Gonocormus minutus*,
(Blume) K.Iwats. *Crepidomanes minutum*

growing among mosses and liverworts on tree
trunks and logs.

Flowering Plants

Cassytha filiformis L. Kauna’oa pehu

These leafless orange hemiparasitic vines
climb trees here and there.

Fimbristylis cymosa R.Br. ssp.
Mau’u ‘aki’aki
spathacea (Roth) T.Koyama

Common along immediate shoreline. This
small sedge grows closer to the ocean than
any other non-marine plant, seaward of the
naupaka fringe, where storm waves
occasionally splash.

Kākalaioa, syn. *Caesalpinia*
Guilandina bonduc L. *bonduc*

High-climbing lianas. Shrubby young plants
numerous on the forest floor.

Hibiscus tiliaceus L. Hau

A broad thicket fronts nearly the entire
Wai’ele coast. The hau may have been
planted long ago as a wind break.

Ipomoea indica (Burm.) Merr. Koali

Scattered thin vines; prefers a more open
environment than provided at Wai’ele.

Ischaemum byrone (Trin.) Hitchc.

Less than a dozen plants scattered along the
shoreline at the edge of the naupaka. See
photo above.

Mucuna gigantea (Willd.)
Kā’e’e
DC. ssp. *gigantea*

Common. Large lianas climb to tree tops.

<i>Pandanus tectorius</i> Parkinson	Hala	Groves scattered along shore and within the forest. Hala, the only native tree in Wai‘ele, is common, dominating several areas.
ex Z		
<i>Pipturus albidus</i> (Hook. & Arn.) A.Gray	Māmaki	An area behind the hau near the boulder beach supports several scattered shrubs; scarce elsewhere.
<i>Scaevola taccada</i> (Gaertn.) Roxb.	Naupaka	This shrub forms a dense fringe between the hau thicket and the ocean.
<i>Vigna marina</i> (Burm.) Merr.	Mohihi, nanea	A dried-up vine with viable seeds seen among naupaka along the shore.

Polynesian Introductions

Scientific name	Common name(s)	Notes
<i>Aleurites moluccana</i> (L.) Willd.	Kukui	Abundant, forms dominant cover in many areas.
<i>Alocasia macrorrhizos</i> (L.) G.Don	‘Ape	A few plants seen.
<i>Artocarpus altilis</i> (Parkinson ex Z) Fosberg	‘Ulu, breadfruit	Common, old and younger trees scattered throughout the forest zone.
<i>Cocos nucifera</i> L.	Niu, coconut palm	Several groves scattered along the shore and in the forest zone. A circle of very old, very tall trees grows within the hau thicket.
<i>Cordyline fruticosa</i> (L.) A.Chev.	Kī, ti plant	Numerous, thinly scattered. Green-leaf form presumably of old to ancient origin, red-leaf cultivars recently planted.
<i>Dioscorea bulbifera</i> L.	Hoi, bitter yam	Three large patches, vines densely cover ground and climb trees.
<i>Dioscorea pentaphylla</i> L.	Pi‘a	Seen but not conspicuous during survey in the winter season.

<i>Morinda citrifolia</i> L.	Noni	Occasional, scattered.
<i>Piper methysticum</i> G.Forst.	‘Awa	Scarce. A patch of three small plants, a variety with black lenticels.
<i>Syzygium malaccense</i> (L.) Merr. & L.M.Perry	‘Ōhi‘a ‘ai, mountain apple.	Dense groves form an understory in several places.
<i>Zingiber zerumbet</i> (L.) Sm.	‘Awapuhi	Scattered rhizomes visible above ground. Dormant in winter season, but becomes conspicuous and common as spring progresses.

Naturalized Plants

Scientific name	Common name(s)	Notes
Ferns & Fern Allies		
<i>Adiantum hispidulum</i> Sw.	Rough maidenhair fern	Infrequent on the ground.
<i>Blechnum appendiculatum</i> Willd.		Forms a dense ground cover in patches.
<i>Cyrtomium falcatum</i> (L.f.) C.Presl	Holly fern	Several plants grow in a cluster on rocks near the shore.
<i>Diplazium esculentum</i> (Retz.)	"Hō‘i‘o", paca Sw.	Along the road only, but will probably spread into the forest..
<i>Nephrolepis brownii</i> (Desv.) & Miyam.	Asian sword fern Hovenkamp	Common in the forest but not pervasive as it can be in environments with more light.

Naturalized Plants		
Scientific name	Common name(s)	Notes
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	Laua'e, syn. <i>Microsorium grossum</i>	Common, usually terrestrial near the shore and epiphytic in the forest.
<i>Phlebodium aureum</i> (L.) J.Sm.	Laua'e haole	Occasional to fairly common epiphyte.
<i>Tectaria incisa</i> Cav.		Fairly common on the forest floor.
<i>Thelypteris dentata</i> (Forssk.) Brownsey & Jermy	Pa'i'ihā, syn. <i>Christella dentata</i>	Fairly common but not as abundant as <i>T. parasitica</i> , with which it may hybridize..
<i>Thelypteris parasitica</i> (L.) H.Lév.	Downy wood fern, syn. <i>Christella parasitica</i>	The most abundant ground cover species, common throughout the forest area.
Monocots		
<i>Alpinia pupurata</i> (Vieill.) K.Schum.	Red ginger	A patch along road.
<i>Ananas comosus</i> (L.) Merr.	Pineapple	A few plants along southern border.
<i>Areca cf. catechu</i> L.	betel	A single plant without flowers along the southeast border.
<i>Chrysaliocarpus lutescens</i> H.Wendl.	Syn. <i>Dypsis lutescens</i>	A single patch along the southeast boundary.
<i>Commelina diffusa</i> Burm.f.	Honohono	Relatively infrequently appearing in less shady spots.
<i>Costus guanaiensis</i> Rusby		A patch along the road seems to be spreading by rhizomes into the forest.
<i>Digitaria ciliaris</i> (Retz.) Koeler	Crab grass	A few small patches along shoreline.
<i>Epipremnum pinnatum</i> (L.) Engl.	Taro vine	Along road and southeast boundary.
<i>Oplismenus hirtellus</i> (L.) P.Beauv.	Honohono kukui, basket grass	Abundant, along with <i>Thelypteris</i> spp. (syn. <i>Christella</i>) ferns forms the dominant ground cover throughout the forest.
<i>Phaius tankarvilleae</i> (Banks exNun's orchid, L'Hér.) Blume	Chinese ground orchid	One plant seen near road.
<i>Philodendron pinnatifidum</i> (Jacq.) Schott		This and the other three hemiepiphytic aroids were introduced along the road and now tend to spread vegetatively into the adjacent forest.
<i>Philodendron scandens</i> K.Koch & Sello		Spreading into the forest from roadside.

Naturalized Plants		
Scientific name	Common name(s)	Notes
<i>Rhynchospora radicans</i> (Schltdl. & Sham.) H.Pfeiff.		A single small, dense patch was spreading by
subsp. <i>microcephala</i> W.W.Thomas		plantlets that form in the inflorescence. (Bertero ex Spreng.)
<i>Syngonium auritum</i> (L.) Schott		Spreading into the forest from roadside.
Dicots		
Herbs		
<i>Arthrostemma ciliatum</i> Pav.	A rapidly spreading weed that forms dense ex D.Don	patches, encroaching in south area of forest.
<i>Begonia hirtella</i> Link.		Common shade lover.
<i>Begonia</i> sp.		A plant seen growing on a rock wall near southeastern boundary. Stems about 120cm tall. (see photo)
<i>Chloranthus spicatus</i>	A small patch about 30 m in from the road. (Thunb.) Makino	Apparently does not set seed in Hawai'i.
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore		Infrequent.
<i>Kalanchoe pinnata</i> (Lam.) Pers.		A few plants along alanui kahakai trail.
<i>Nicotaba betonica</i> (L.) Lindau syn. <i>Justicia betonica</i>		Large patch directly at the southern border.
<i>Oxalis debilis</i> Kunth var. <i>corymbosa</i> (DC.) Lourteig		Infrequent.
<i>Pseudelephantopus spicatus</i> (B.Juss. ex Aubl.) C.F.Baker		A single patch and a few isolated plants noticed.
<i>Ruellia blechum</i> L.		Single small patch seen in forest.
<i>Synedrella nodiflora</i> (L.) Gaertn.		Infrequently scattered in forest.
Vines & Lianas		
<i>Ipomoea alba</i> L.	Moon flower	Scattered in forest and in hau thicket.

Naturalized Plants

Scientific name	Common name(s)	Notes
<i>Ipomoea violacea</i> L.		Patches occurring along southeast end of the shoreline zone.
<i>Momordica charantia</i> L.		Scattered, common.
<i>Paederia foetida</i> L.	Maile kukae	Scattered.
<i>Passiflora edulis</i> Sims	Lilikoi	A few vines seen in forest.
<i>Passiflora laurifolia</i> L.	Jamaican lilikoi	A largish patch of vines high-climbing and on ground seen near center of forest.
<i>Passiflora quadrangularis</i> L.	Giant granadilla, giant lilikoi	A single vine along the southeast border.
<i>Stictocardia tiliifolia</i> (Desr.) Hallier f.	Pilikai	Scattered, occasional.
<i>Thunbergia fragrans</i> Roxb.	Clock vine	Common, scattered.
<i>Vigna hosei</i> (Craib) Backer		Plants seen covering a small area near northwest border.
Shrubs		
<i>Cestrum nocturnum</i> L.	Night-blooming jasmine	Fairly common understory shrub in the forest.
<i>Lantana camara</i> L.		Relatively infrequent, not thriving in the shady forest.
<i>Miconia crenata</i> (Vahl) Michelang.	Clidemia, syn. <i>Clidemia hirta</i>	Occasional mostly in northeast
Trees		
<i>Annona mucosa</i> Jacq.	Rollinia, syn. <i>Rollinia mucosa</i>	Small trees directly along Govn't Beach Rd
<i>Annona muricata</i> L.	Soursop	Seedlings along southeast border.
<i>Artocarpus heterophyllus</i> Lam.	Jak tree	Occasional, scattered, mature trees and seedlings seen
<i>Calliandra houstoniana</i> (Mill.) Standl. var. <i>calothyrsa</i> (Meisn.) Barneby		Several plants seen in east area of forest, with spreading seedlings. This plant, a recent invader of Puna forests, is capable of forming koa haole-like thickets and has the potential to become a serious pest.
<i>Cecropia obtusifolia</i> Bertol.		Abundant, filling much of the space between the larger mango and monkeypod trees. The trees appeared unhealthy with sparse foliage and dead trees common. They may be being attacked by the Queensland long-horned beetle (<i>Acalolepta aesthetica</i>).

Naturalized Plants

Scientific name	Common name(s)	Notes
<i>Citrus</i> sp.		2 saplings seen in separate parts of south area, one with the leaf-pattern of <i>C. maxima</i> .
<i>Coffea arabica</i> L.	Coffee tree	2 dense patches seen in the forest understory.
<i>Falcataria moluccana</i> (Miq.) Barneby & J.W.Grimes	Albizia	A tree with 20cm trunk diameter reported in west corner. Will be eradicated.
<i>Ficus microcarpa</i> L.f.	Chinese banyan	Occasional young trees scattered in forest. This species, with its gigantic mature size and aggressively invasive nature, is likely to dominate the forest in the future if left unchecked.
<i>Heliotropium foertherianum</i> Diane & Hilger	Tree heliotrope	Common along the shore.
<i>Macaranga mappa</i> (L.) Müll.Arg.		Some young plants seen in east area of forest.
<i>Macaranga tanarius</i> (L.) Müll.Arg.		This tree has recently appeared in the area and is rapidly spreading. It has gained a foothold in the forest among the cecropia and melochia.
<i>Mangifera indica</i> L.	Mango	Numerous large, old mango trees grow throughout the forest, forming a major component of the canopy. The larger individuals commonly exceed 100cm diameter at breast height, dbh
<i>Melochia umbellata</i> (Houtt.) Stapf		Common but not dominating.
<i>Persea americana</i> Mill.	Avocado	Clusters of old and young trees in several places.
<i>Pouteria caimito</i> (Ruiz & Pavón) Radlkofer	Abiu	A young tree seen along the road where it presumably has been planted.
<i>Psidium cattleianum</i> Sabine	Waiawī, strawberry guava	In dense stands of large, old trees that often seemed to be enclosed within rock walls that may have been used as cattle paddocks in early post-contact times. A few of the plants seen may represent the common round redfruited type, but no fruit was seen to confirm this.
<i>Psidium guajava</i> L.	Guava	Occasional.

Naturalized Plants

Scientific name	Common name(s)	Notes
<i>Samanea saman</i> (Jacq.) Merr.	Monkeypod	Several large trees scattered around the forest.
<i>Schinus terebinthifolius</i> Raddi	Christmas berry	Some shrubby plants seen near northwestern corner of forest.
<i>Schefflera actinophylla</i> (Endl.) Harms	Octopus tree	Not yet common.
<i>Spathodea campanulata</i> P.Beav.	African tulip tree	Not yet common.
<i>Syzygium cumini</i> (L.) Skeels	Java plum	A few trees along southwestern boundary. Seedlings and young trees scattered, fairly
<i>Syzygium jambos</i> (L.) Alston		Rose apple common; mature trees seem to be absent.
<i>Terminalia catappa</i> L.		Grove behind boulder beach at southeast False kamani, Indian almond corner and scattered somewhat inland from there.
<i>Trema orientalis</i> (L.) Blume	Gunpowder tree	Fairly common. Some large, old trees.

ANIMALS

Scientific name	Common name(s)	Notes
<i>Heteroscelus incanus</i>	‘Ūlili	Few seen on shoreline rocks.
<i>Cardinalis cardinalis</i>	Cardinal	Seen along edge of hau thicket.
<i>Carpodacus mexicanus</i>	House finch	Flocks heard singing in treetops.
<i>Streptopelia chinensis</i>	Spotted dove	Heard in trees, small flock seen descending to ground in forest.
<i>Eleutherodactylus coqui</i>	Coqui frog	Heard during rain.
<i>Sus scrofa</i>	Pig	Common in the forest, seen on most Wai‘ele expeditions. Trails, rooted-up ground, and wallows abundant.
<i>Herpestes javanicus</i>	Mongoose	Occasional.

Naturalized Plants		
Scientific name	Common name(s)	Notes
<i>Acalolepta aesthetica</i>	Queensland longhorn beetle	Adults not seen but a large grub that we believe to be of this species was heard clicking and was dug out of a kukui tree. Exit holes and large frass were observed on trunks of several tree species.
<i>Aedes albopictus</i>	Forest day mosquito	Present but not overwhelming.
<i>Wasmannia auropunctata</i>	Little fire ant	These ants were noticed in a small area along the northwest boundary. Efforts are underway to eradicate them from this area. Unidentified black ants were widespread in the forest.
Animals were not a focus of this study, but we did incidentally notice a few species. Undoubtedly more species occur. The Polynesian rat (<i>Rattus exulans</i>), the black rat (<i>Rattus rattus</i> L.) and the mouse (<i>Mus musculus</i> L.) are presumably present, but not encountered in our survey.		

MOSSES

Wai'ele provides a variety of micro-habitats ideal for mosses to thrive. A few are shown here. Moist plants are pictured. Most look quite different when dry.



- A. ***Octoblepharum albidum*** Forms cushions on tree trunks.
- B. ***Racopilum cuspidigerum*** Abundant on tree trunks, rocks, and debris on the ground.
The most common moss in the forest.
- C. ***Pyrrhobryam spiniforme*** Common on fallen debris on the ground or on lower tree trunks.
- D. ***Calymperes tenerum*** On rocks and trees near the shore.



Unidentified mosses Additional moss species found on tree trunks and logs in the Wai'ele forest.
Scale in millimeters.

LIVERWORTS

Liverworts are abundant in the shady, moist forest zone. They grow among mosses and lichens on tree trunks, branches, rotting logs, and rocks. A few of the common species growing on tree trunks and logs are shown here.



A. *Riccardia* sp. Scale in millimeters.

B. *Frullania* sp.

C. Liverwort sp. a

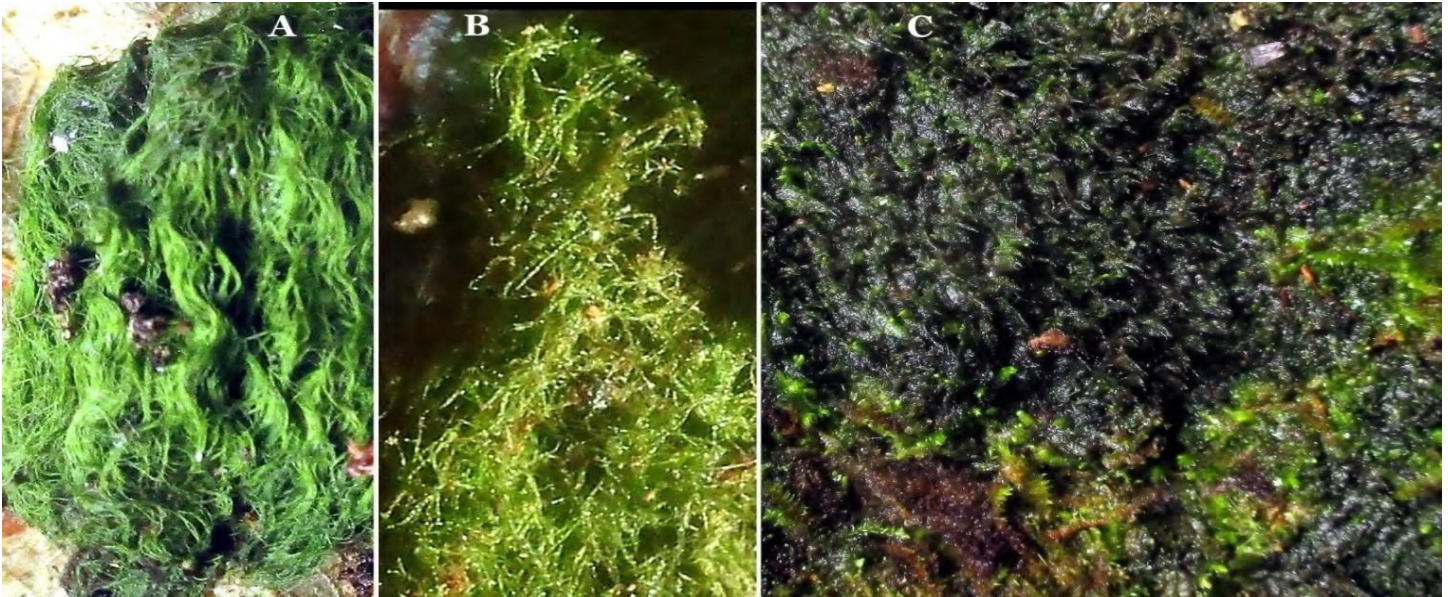
D. Liverwort sp. b



A, B. Liverwort sp. c Differs from sp. a in having sprigs assurgent in tiers rather than appressed to substrate.

C. Liverwort sp. d Scale in millimeters.

D. Liverwort sp. e Scale in millimeters.

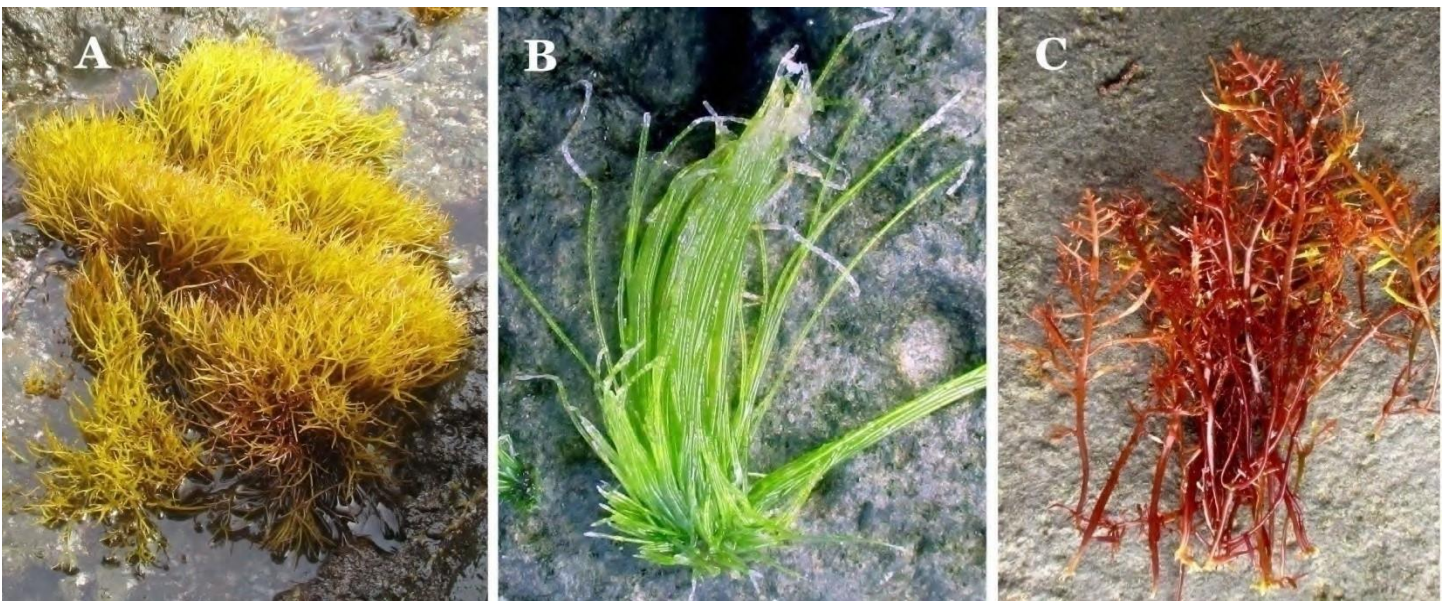


A, B. *Chlorophyta* sp. This terrestrial green alga grows on shaded shoreline rocks and wood in reach of salt spray. Magnified view shows strands consisting of single $\pm$ round cells joined end to end in chainlike filaments.

C. *Nostoc* sp. This cyanobacterium is overgrowing a mat of mosses and liverworts on a kukui trunk. Almost black wet, it acquires a dark blue-greenish color when dry.

MARINE ALGAE

Numerous species of algae grow in the intertidal zone along Wai'ele's shoreline, despite being frequently scoured by high surf. These are a few of the more conspicuous species.



A. *Ahnfeltiopsis concinna* Limu 'aki'aki This yellowish limu dominates the upper intertidal zone and is abundant all along the coast.

B. *Chaetomorpha antennina* A limu of intertidal rocks exposed to strong surf.

C. *Pterocladia capillacea* A common limu of the lower intertidal zone along exposed rocky shorelines.

LICHENS

Many kinds of lichens grow on trunks, branches, and rocks in the forest and along the shore. See supplement for more lichens.



A. *Chrysothrix candelaris* Occasional on bark or wood.

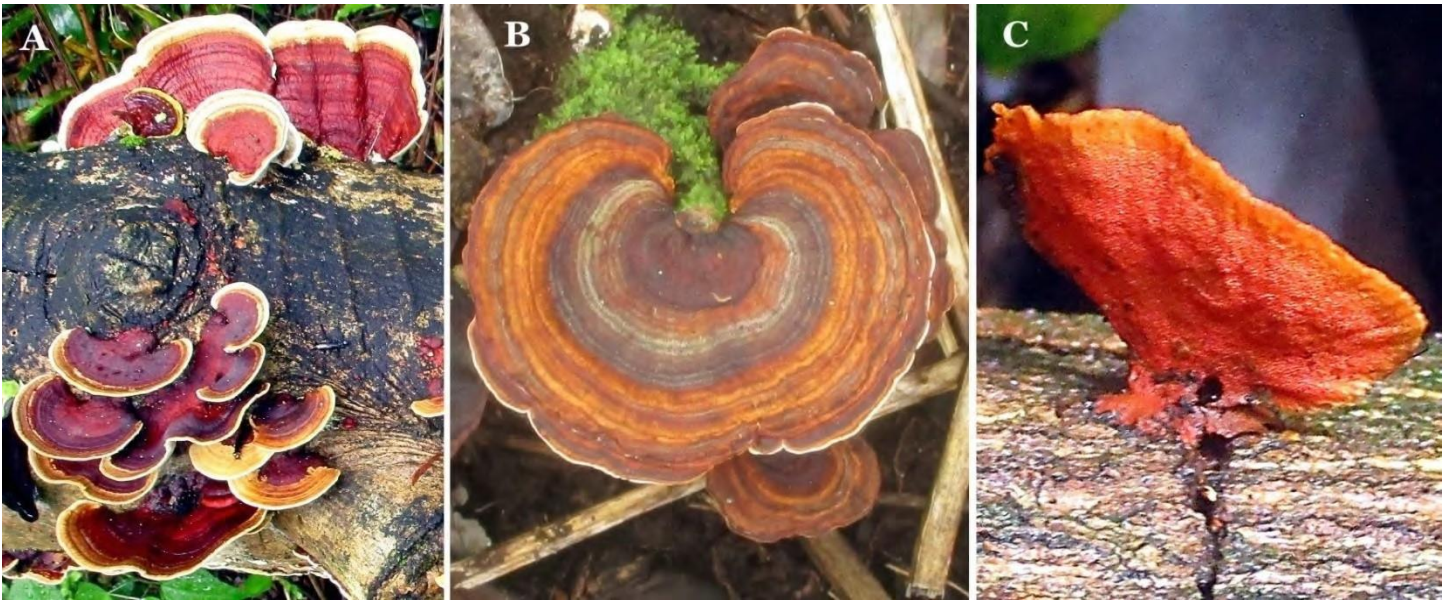
B. *Coenogonium* sp. a On tree trunks along the shore.

C. *Coenogonium* sp. b On tree trunks along the shore and within the forest. This cottony lichen can occur as isolated minute tufts or even single filaments, or may cover nearly the entire trunk of a tree.

D. *Thelotrema lepadinum* Recognized by the double-lipped, volcano-like perithecia. On trees, especially hala.

MUSHROOMS

Mushrooms were fruiting during the survey. See supplement for more mushrooms.



- A. *Earliella scabrosa*** Very common on kukui and mango logs, here seen on a cecropia log. (Wai'ele 12-23).
- B. *Microporus flabelliformis*** Another common polypore on logs in the forest. (Wai'ele 12-23).
- C. *Pycnoporus cinnabarinus*** This species can be abundant, but this small specimen was the only individual seen during the survey, (Wai'ele 12-23).

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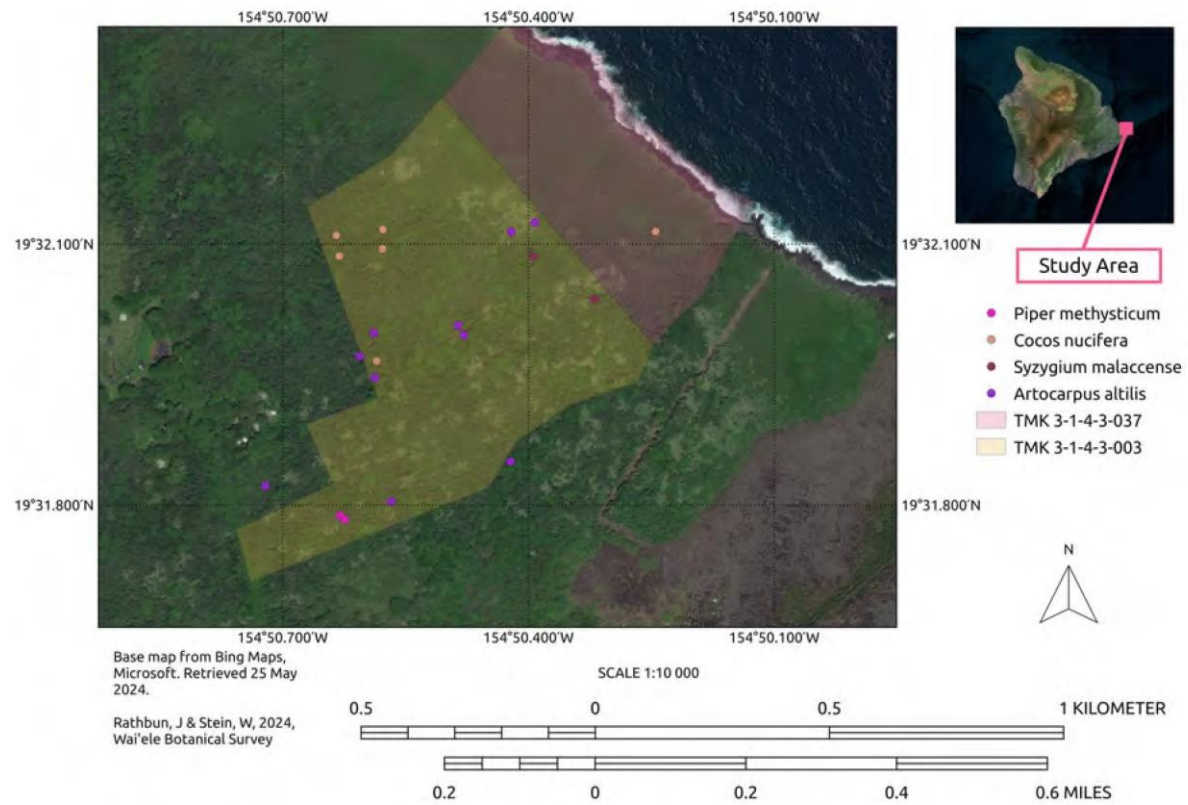
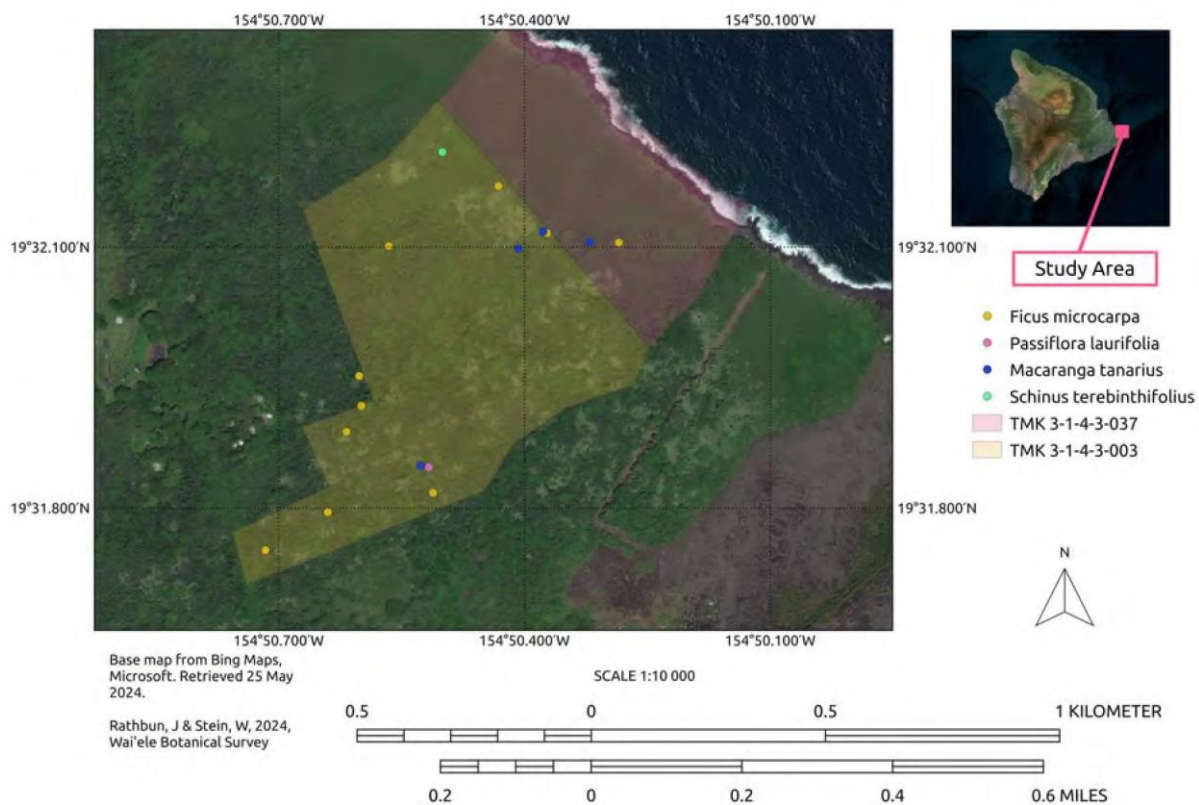


Figure 7: Top, Selected patches of notable size of Hawaiian crops. Bottom, target species for removal.



Species	Year of Introduction	Credited to	Citation
<i>Psidium guajava</i>	1795	Don Francisco de Paula Marin	Herbst & Staples 2005
<i>Coffea arabica</i>	1815 ¹ & 1825	Don Francisco de Paula Marin & <i>HMS Blonde</i>	Herbst & Staples 2005
<i>Syzygium jambos</i>	1825	<i>HMS Blonde</i>	Herbst & Staples 2005
<i>Psidium cattleianum</i>	1825	<i>HMS Blonde</i>	Herbst & Staples 2005
<i>Persea americana</i>	1825	<i>HMS Blonde</i>	Herbst & Staples 2005
<i>Mangifera indica</i>	1825	<i>HMS Blonde</i>	Herbst & Staples 2005
<i>Samanea saman</i>	1847	Peter A. Brinsmade	Herbst & Staples 2005
<i>Heliotropium foerthianum</i>	1851	Herbst & Staples 2005	
<i>Terminalia catappa</i>	1861 ¹	Hillebrand	Herbst & Staples 2005
<i>Trema orientalis</i>	1870		Wagner <i>et al.</i> 1999
<i>Syzygium cumini</i>	1870		Herbst & Staples 2005
<i>Melochia umbellata</i>	1871	Hillebrand	Wagner <i>et al.</i> 1999
<i>Schefflera actinophylla</i>	1900		Wagner <i>et al.</i> 1999
<i>Schinus terebinthifolius</i>	1911		Wagner <i>et al.</i> 1999
<i>Falcataria moluccana</i>	1917	J. F. Rock	Herbst & Staples 2005
<i>Cecropia obtusifolia</i>	1926		Wagner <i>et al.</i> 1999
<i>Macaranga mappia</i>	1927		Wagner <i>et al.</i> 1999
<i>Macaranga tanarius</i>	1930		Wagner <i>et al.</i> 1999
<i>Ficus microcarpa</i>	1935 ¹	Sugar Planters Association	Herbst & Staples 2005
<i>Calliandra houstoniana</i> ²	2008		Imada 2019
<i>Artocarpus heterophyllus</i> ²	2012	Imada 2019	
Mean Year of Intro.	1883		

Table 2: Selected naturalized tree taxa and their dates of import/naturalization to the Hawaiian Islands. The *HMS Blonde* was sent as a diplomatic mission sent from Britain to return Kamehameha II's body to the Hawaiian Islands. Aboard, James Macrae, ship botanist, imported a variety of plants on behalf of the Horticultural Society of London. The mean year of introduction shows the relative antiquity of Wai'ele's naturalized species.

¹These entries represent the mean of the conjectured dates.

²*These dates reflect only the publishing of confirmation of naturalization status. These taxa may have been reproducing on their own in the wild for some years prior.*

Natural Resource Assessment
Wai‘ele, Halepua‘a, Puna, Hawai‘i

Ke Aloha ‘Aina Foundation, LLC

October 2024



Hala (Pandanus sp.)

1. Introduction

- ***Purpose and Scope:***

The Natural Resource Assessment is being provided for Malama o Puna a 501(c)3 nonprofit who has applied for the stewardship of Wai'ele through the Public Access, Open Space and Natural Resources Preservation Commission (PONC) Program. This commission is part of the County of Hawai'i and is responsible for advising on the acquisition and management of lands to preserve and protect natural, cultural, and recreational resources.

Wai'ele is an ancient Hawaiian fishing village. The *'ili* (land division within an ahupua'a) Wai'ele is located in the *ahupua'a* (land division in a district) of Halepua'a within the *moku* (district) of Puna on the *mokupuni* (island) of Hawai'i. The region of Halepua'a extends up to the Nanawale Forest reserve which is the watershed that feeds Wai'ele. Uli i ka uli is a concept that shares about the conditions from *mauka* (mountain) to makai (sea). It is said that if the water in the mountains is healthy, then the water at the sea will be healthy and everything in between. *Kanaka maoli* (Indigenous people) believe the health of an ecosystem is directly related to the health of the people. If the environment is healthy, so are the people.

A Natural Resource Assessment (NRA) at Wai'ele was conducted to identify significant cultural and natural resources at Wai'ele. This report highlights the resources that were observed. It also shares *'Ike Hawaii* (traditional knowledge) and the reader shall take into account the understanding that these cultural and natural resources are directly related to traditional protocols, biocultural practices and stewardship management.

- **Biocultural Practices** refer to the *methods* and *techniques* employed to maintain and use these resources in ways that reflect cultural values and traditions.

Biocultural practices in stewardship involve the integration of cultural traditions, knowledge, and values with the sustainable management and care of natural resources. These practices are rooted in the understanding that the well-being of the environment is closely tied to the cultural identity and practices of the people who interact with it.

Wai'ele, a wahi pana (storied and sacred place), would have likely been a site for various biocultural practices deeply intertwined with *Kanaka maoli* lifeways, honoring

both the land's ecological vitality and its cultural significance. Here are some practices that might have occurred in Wai'ele:

A. Traditional Plant Gathering (La'au Lapa'au)

- Wai'ele's native and Polynesian-introduced plants would have been used in traditional Hawaiian medicine, known as la'au lapa'au. Plants like kukui (*Aleurites moluccanus*), 'Ōlena or turmeric (*Curcuma longa*), and other native flora might have been gathered and prepared by kahuna *la'au lapa'au* (traditional healers) for various ailments. These practices not only provided medicine but also preserved the knowledge and sustainable gathering methods for healing. There is an abundance of kukui at Wai'ele.

B. Cultivation and Propagation of Polynesian-Introduced Crops

- Wai'ele was a place for cultivating key plants brought by Hawaiians, such as Niu (Coconut), 'Uala (sweet potato), and Ulu (breadfruit). These crops were cultivated using sustainable techniques that preserved soil health and prevented erosion. Terracing, mulching, and water management techniques maintained the landscape's health and fertility, embodying the practice of *mālama 'āina* (caring for the land). Traditional sites used for planting are likely found throughout the property.

C. Forest Management and Resource Conservation

- Native birds and plants would have been protected through traditional forest management practices. *Kanaka maoli* would selectively gather, prune, and control growth to ensure the vitality of the native forest). Only certain species might have been harvested, ensuring that the forest ecosystem remained balanced and resilient.

D. Spiritual Ceremonies and Cultural Protocols

- As a wahi pana, Wai'ele may have been a place for ceremonies honoring the akua (deities) and ancestral spirits associated with the land. Ceremonial practices might include offering food, chants (mele), and dances (hula) to acknowledge the area and the ancestors. This biocultural connection deepens the relationship between people and place, reinforcing the idea that the health of the land is directly tied to the well-being of the people.

E. Invasive Species Control and Habitat Restoration

- In Wai'ele, invasive plant species should be managed by removing non-native growth to protect native and culturally-significant species, such as Hala (*Pandanus tectorius*), 'Ekaha (*Asplenium nidus*), Niu (*Cocos nucifera*) and Ulu (*Artocarpus altilis*). Native Hawaiians managed forest resources sustainably, often planting or encouraging the growth of native and Polynesian-introduced species to keep invasive species at bay. Hau (*Hibiscus tiliaceus*) is not considered an invasive species, yet when not managed it becomes very aggressive. Hau is overgrown and has taken over acres of land that have made the area inaccessible.

F. Use of Wauke (Paper Mulberry) and Other Plants for Crafting and Weaving

- Plants like Wauke (*Broussonetia papyrifera*), used to make kapa (bark cloth), and Hala, used in weaving mats, baskets, and hats, would have been gathered and cultivated. Niu is one of the most commonly used plants in Hawaiian culture, every part of the tree is used. This practice required a close understanding of seasonal cycles and an intimate knowledge of harvesting techniques that ensured the plants' regeneration. Although Wauke was not identified in Wai'ele, it could be a plant of consideration for restoration efforts.

G. Educational Stewardship and Knowledge Sharing (Kuleana)

- Wai'ele would have been a place for teaching younger generations about traditional ecological knowledge, biocultural practices, and the spiritual connections to the land. This passing down of knowledge, known as *kuleana*, ensured that each generation learned to *mālama* (care for) Wai'ele and understood its sacred history, sustaining the continuity of both ecological and cultural integrity.

Wai'ele's role as a wahi pana and of biocultural practice exemplifies the deep connection *Kanaka maoli* maintained with the land. Such practices reflect a commitment to both ecological stewardship and cultural responsibility, ensuring the vitality of Wai'ele's unique landscape for generations.

Objectives:

1. Conduct an overview of the natural and cultural resources at Wai'ele
2. Define how these resources are integrated into *Kanaka maoli* and bio-cultural practices
3. Provide recommendations for the management of the cultural and natural resources of Wai'ele

This report outlines the inventory of findings of natural and cultural resources found at Wai'ele and identifies how these resources may have been used. The inventory will share about uses of the resources, how they may have been used traditionally and provide recommendations of land use through a Hawaiian cultural context.

Geographic Overview: Description of Wai'ele's location, climate, topography, and any unique environmental features that influence its ecosystems.

Wai'ele consists of two parcels of land, TMK # 3-1-4-3: 003 and 3-1-4-3: 037 with a total area of 157.8 acres. This lowland moist mesic forest encompasses many groves of Polynesian introduced species that were used by the *Kanaka maoli* who lived here.

Wai'ele is located on the shoreline of Puna in between Kumukahi and Keonepoko. The area receives approximately 100 inches of rainfall annually with predominant Northeast trade winds. The topography consists mainly of pahoe-hoe lava and is laden with rich dark soil intermixed with cinder likely from the 1960 Kapoho eruption.

The area is host to many archaeological sites and it is highly recommended to conduct an archaeological inventory of the area. The inventory will share what sites are found in Wai'ele and types of practices that would have occurred there. This will provide invaluable recommendations about how to properly manage the site. At the base of the shoreline, there is an intact *Kū'ula* (fishing shrine). These types of intact sites are not very common anymore and they should be preserved and protected.

This intact ancient Hawaiian fishing village was once occupied by *Kanaka maoli*. The natural resources found in Wai'ele provide a rich history as to what types of land uses occurred there. Recent introductions of alien species has altered the landscape and is a detriment to the overall use of the area. Large alien tree species such as *Cecropia* (*Cecropia obtusifolia*) are found throughout the area that detract from the natural beauty of the area and have encroached on archaeological sites. The management of the introduced species *hau* near the shoreline has been unmanaged for decades and it has become a species that needs special attention.

2. Ecological Inventory

Introduction

The ecological and site inventory of Wai'ele was conducted with a focus on preserving the integrity of its natural and cultural resources. Given the archaeological and ecological significance of the area, the methodology was

designed to minimize disturbance while ensuring thorough documentation of species and features.

Methodology

The ecological inventory was conducted during three site visits by a team of five individuals. Observations were recorded systematically, and care was taken to account for archaeological sites and ecological features. Key methods included:

- **Species Documentation:**
 - Species were recorded at each plot along transect lines. If specific vegetation was dominant in a particular area, it was noted
- **Archaeological Sites:**
 - Significant archaeological features were documented if observed during the survey
- **Mapping and Data Collection:**
 - Avenza maps were utilized to log transect lines, significant features, and species presence

Transect Design

Transects were established with a focus on achieving comprehensive coverage of the property.

- **Orientation:**
 - Transect lines were aligned at 320 degrees and 140 degrees, running parallel to the northern and southern boundaries of the property
- **Spacing:**
 - Transects were spaced 100 meters apart, except for transects seven and eight, which had a 200-meter gap due to dense hau vegetation
- **Plot Design:**
 - Plots extended 10 meters off each transect line

Transect and Plot Details

1. **Transect Lines 1–4:**
 - Transects 1 and 2: Each measured 100–125 meters in length with five plots spaced every 25 meters
 - Transects 3 and 4: Each measured 250 meters in length with 11 plots spaced every 25 meters

2. **Transect Lines 5–8:**

- Transect 5: Plots spaced 50 meters apart, totaling eight plots
- Transects 6 and 7: Plots spaced 100 meters apart, totaling eight plots each
- Transect 8: Conducted along the shoreline with plots spaced 25 meters apart, totaling four plots

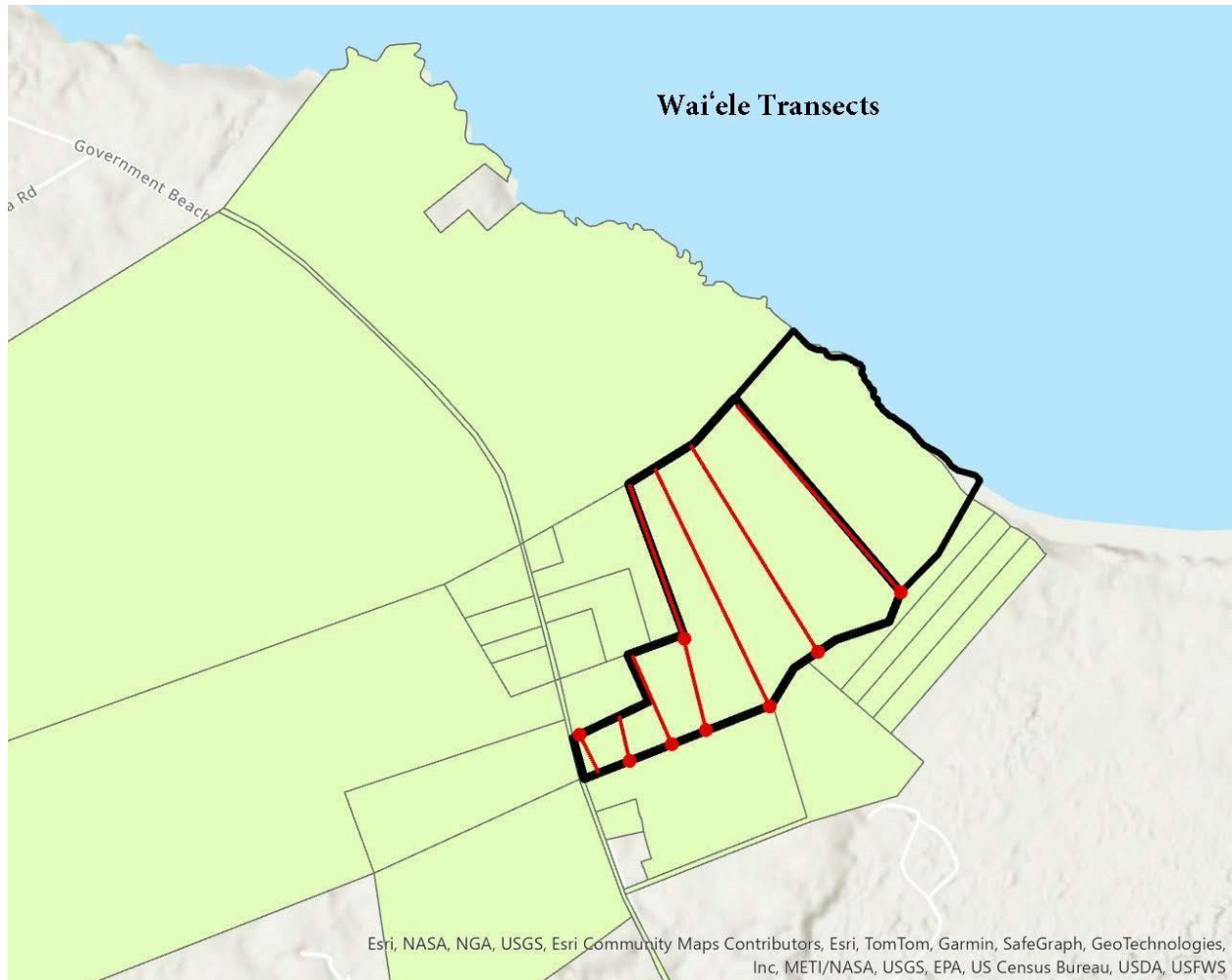
3. **Hau Thicket:**

- The area between transects seven and eight consisted of dense hau (*Hibiscus tiliaceus*) vegetation, rendering it inaccessible for surveying

Summary of Effort

- **Transects Completed:** Eight transect lines established
- **Plots Recorded:** A total of 60 plots were surveyed
- **Survey Adjustments:** Transect methodology was modified for transects five through eight to account for ecological and logistical constraints, ensuring accurate data collection

The ecological inventory of Wai'eale was conducted with precision and respect for the natural and cultural significance of the area. The inventory's systematic approach provided a record of species distribution and archaeological features, forming a foundation for future management and conservation efforts.



Map of Transect lines

Flora and Fauna Overview

The ecological survey conducted at Wai'ele provided a comprehensive inventory of the plant and animal species present in the forested area, while also identifying significant archaeological sites and culturally important flora. The forest composition reflects a blend of Polynesian introduced, native, and alien species, with notable biocultural and ecological features observed across the property.

Species Inventory

- **Total Species Recorded:** 46
 - Native Species: 5 (10.9%)
 - Polynesian Introduced Species: 7 (15.2%)
 - Alien Species: 34 (73.9%)

- See appendix for detailed information

Fauna Observations

Io (Hawaiian Hawk, *Buteo solitarius*): One individual was observed multiple times during site visits, emphasizing the area's ecological significance

Feral Pigs (*Sus scrofa*): While no pigs were directly observed, evidence of ground disturbance indicated their presence in the area

Significant Observations by Transect Lines

Transect Line 1

- Key Features:
 - Large groves of Kukui (*Aleurites moluccanus*) and Hala (*Pandanus tectorius*) at 50 meters
 - Stone wall along the edge of the roadway

Transect Line 2

- Key Features:
 - Dominance of alien species such as Cecropia (*Cecropia obtusifolia*) and guava (*Psidium guajava*)
 - Presence of hala groves throughout the transect

Transect Line 3

- Key Features:
 - Large groves of Ulu (*Artocarpus altilis*), Kukui, Hala, and Mango (*Mangifera indica*) between 50–125 meters
 - Numerous stone walls and structures, particularly along the boundary
 - Ground heavily covered in cinder between Transect Lines 2 and 3

Transect Line 4

- Key Features:
 - Old-growth Mango trees and a large Awapuhi (*Zingiber zerumbet*) patch at the start
 - Extensive Hala and Kukui groves between 50–125 meters
 - First recording of Kakalaioa (*Caesalpinia major*)

- Possible burial sites and other archaeological structures between Plots 1 and 2

Transect Line 5

- Key Features:
 - Alien species such as Cecropia, Macaranga (*Macaranga sp.*), Melochia (*Melochia umbellata*), Gunpowder (*Trema orientalis*), and Waiawi (*Psidium cattleianum*)
 - Multiple sites and walls observed between 50–150 meters
 - Large *Uluniu* (coconut) grove at 300 meters
 - First sighting of the *Io* (Hawaiian hawk).

Transect Line 6

- Key Features:
 - Significant archaeological sites and walls observed at 300–400, 600–700, and 800 meters
 - Large Ulu grove present between 400–800 meters, with extensive Hala groves between 600–800 meters, suggesting a core area of habitation and cultivation
 - Large Bamboo patch along transect line, yet didn't fall into a plot (between transect lines 6 & 7)

Transect Line 7

- Key Features:
 - Sites and walls observed between 100–200 meters, with a large Uluniu (Coconut) grove present
 - Significant Rose apple grove at 300 meters
 - Substantial Kukui grove between 500–700 meters
 - Beginning of Hau establishment.

Between Transect Lines 7 and 8

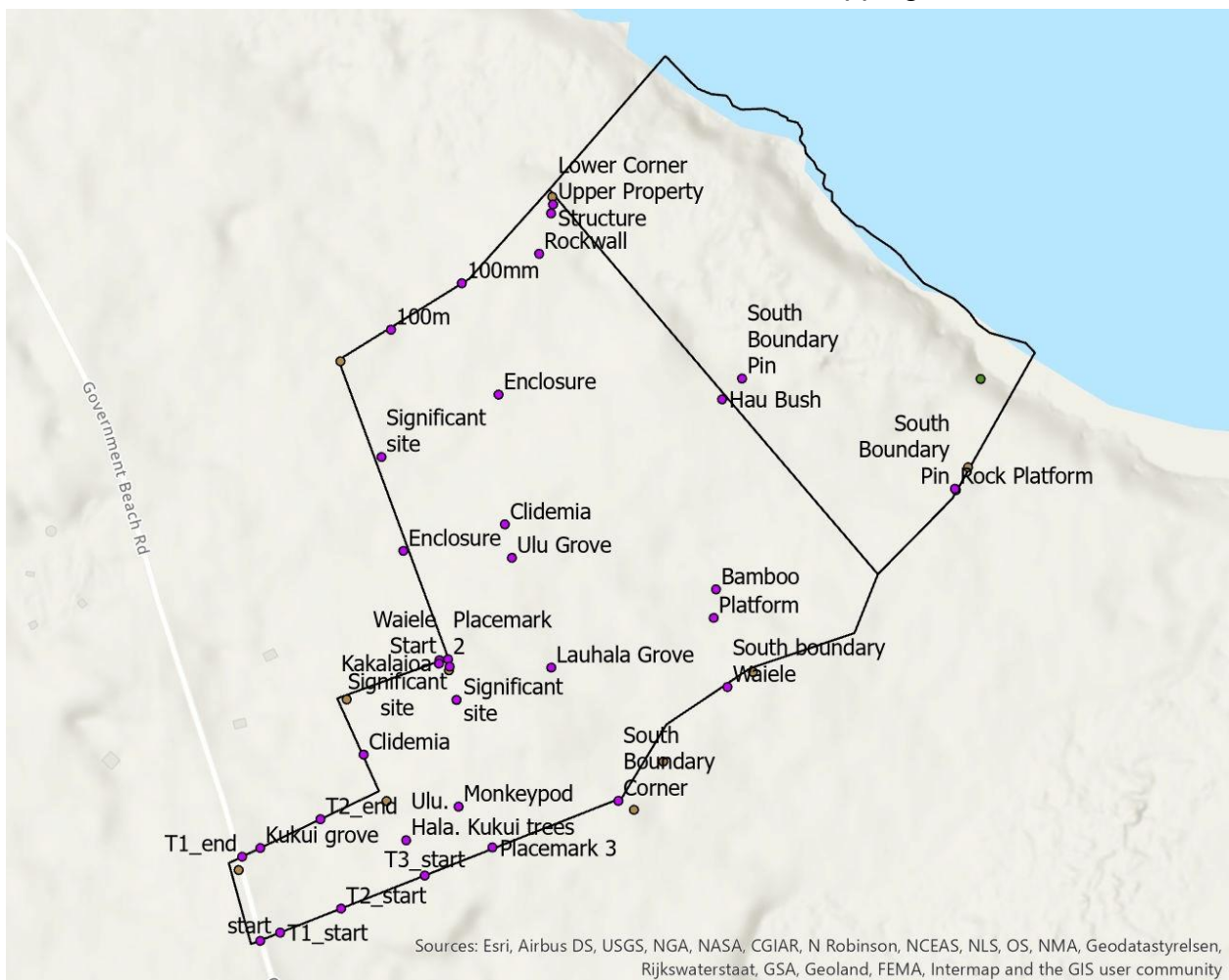
- Key Features:
 - The Waterstone pathway to the beach is lined with Niu and Mango trees, measuring approximately 200 meters

- Numerous walls and other structures along the path
- Hau shrubland rendered certain areas inaccessible

Transect Line 8

- Key Features:

- Coastal front featuring a large Uluniu grove, False kamani (*Terminalia catappa*), Naupaka (*Scaevola taccada*), Hala, Heliotrope (*Heliotropium foertherianum*), and Blechnum ferns (*Blechnum appendiculatum*)
- Significant archaeological features, including a large Kū'ula (fishing shrine) and walls
- Beach laden with water-worn stones consistent with Hānau pōhaku (birthing stones) and tidepools at the shoreline
- These sites were not recorded with the mapping software



Significant features & sites along transect lines

Cultural and Ecological Significance

The flora observed highlights a mix of culturally significant species, including Ulu, hala, kukui, and niu, all integral to the biocultural practices of the area. The archaeological sites, stone walls, and fishing shrine underscore the importance of Wai'ele as a historical and spiritual landscape.

While the inventory focused on identifying significant species and sites, the *Vegetation Analysis and Botanical Survey, Wai'ele* (Rothburn and Stein, 2024) should be consulted for a more detailed account of the area's flora.

Recommendations

- Preservation and restoration of significant sites and old-growth groves
- Management of alien species to protect native and Polynesian-introduced flora
- Continued monitoring of fauna, particularly the *Io* and feral pigs
- Enhanced protection of archaeological features, particularly the *Kū'ula* and stone pathways

Ecosystems and Habitats

Wai'ele, a lowland mesic forest located along the Puna coastline, encompasses a diverse ecological and cultural landscape. The property extends to a bay and marine tide pools at the oceanfront, characterized by waterworn stones typical of the Puna shoreline.

Floral Composition

Wai'ele hosts significant groves of Hala, Kukui, and Ulu, all of which hold cultural importance. Other culturally significant species such as Niu, Noni, Ka'e'e, and Green ti are prevalent across the property.

- The 'Ekaha fern was observed consistently across almost all transects, indicating its widespread presence
- Mango trees, though not native or canoe plants, dominate large areas of the canopy and are valued for their wood
- The lower section of the property, about 200–300 meters from the shoreline, features an extensive thicket of Hau

Invasive Species

Invasive trees pose a significant threat to the forest's health:

- **Large invasive trees:** Cecropia, Gunpowder, Melochia and Macaranga
- **Other invasives:** Rose apple (*Syzygium jambos*), Banyan (*Ficus sp.*), and Koster's curse (*Clidemia hirta*) in the lower sections of the forest. These require urgent removal to prevent further spread

Overall, Wai'ele is predominantly an alien species forest interspersed with Polynesian introduced and native species.

Water Resources

- **Known Freshwater Sources:**

A lineal descendant shared knowledge of a freshwater well near the lower section of the property. While the well was not located during this inventory, it may be identified in future archaeological surveys

- **Other Water Features:**

No rivers, streams, or ponds were observed on the property

Soil and Land Use

Soil Characteristics

- **Lava Substrate:**

The underlying substrate is smooth pāhoehoe lava, dated to AD 1200–1550 (Sherrod et al., 2021)

- **Surface Layer:**

Fertile loamy and muck soil intermixed with cinder covers the area, supporting diverse vegetation

- **Erosion Risks:**

The beachfront shows potential for erosion due to seasonal wave action and swells. Soil erosion is affected by large alien species growing in the forest. Feral pigs also play a factor in the degradation of the soil. It is likely that flooding from heavy rains contributes to soil erosion.

Land Use Patterns

- **Past and Present Uses:**

While past land use patterns require further research, the archaeological inventory will provide guidance for appropriate future activities

- **Conservation and Agriculture:**
 - Coastal areas and significant archaeological sites should be prioritized for conservation efforts
 - The upper sections of Wai‘ele are suitable for agricultural use, particularly for cultivating culturally significant species such as Kukui, Ulu, Hala, and Niu

Recommendations

1. **Conservation and Restoration:**
 - Preserve and restore groves of Hala, Kukui, Ulu, and other culturally significant species
 - Remove invasive species such as Cecropia, Gunpowder, Macaranga, Melochia, and Koster’s curse to protect native habitats
2. **Archaeological Mapping:**
 - Conduct a comprehensive survey to identify and map significant sites, ensuring land use plans align with cultural preservation goals
3. **Agricultural Development:**
 - Encourage the cultivation of culturally valuable crops in upper sections to support sustainable and culturally respectful land use
4. **Water Resource Exploration:**
 - Investigate and document potential freshwater sources, such as the descendant-reported well, to support future conservation and habitation efforts

3. Cultural and Historical Resources

● Cultural Significance

Waiele, as a culturally and ecologically significant site, hosted a variety of biocultural practices that reflect the deep connection between *Kanaka maoli* and their environment. These practices blend cultural traditions with sustainable resource management, supporting both the spiritual and physical needs of the community. Below are some examples of biocultural practices likely to have occurred at Waiele:

1. Agriculture and Food Cultivation

- **‘Ulu Orchards:** Breadfruit trees were likely cultivated as a staple food source. These trees were traditionally grown in agroforestry systems alongside other culturally significant plants like Kalo or taro (*Calocasia esculenta*) and Niu
- **Polyculture Farming:** Hawaiian agricultural systems often utilized Kalo patches (wet or dry lo‘i) and diversified upland plantings with Mai‘a or banana (*Musa pudica*), ‘Uala, and Kukui in integrated systems
- **Shifting Cultivation Practices:** In some forested areas, *ka‘a ‘āina* (shifting cultivation) may have occurred, where small patches were cleared for planting and later left to regenerate

2. Gathering and Crafting

- **Hala (Pandanus) Weaving:** Leaves from Hala trees were gathered and processed for weaving *moena* (mats), *‘ie* (sails), baskets and other cultural items. Gathering practices would have been guided by protocols that respected the tree’s health
- **Kukui Nut Harvesting:** Kukui nuts were collected for oil, which was used for light, medicine, and food preparation. The tree’s bark and leaves were also used for dyes and traditional remedies
- **Niu (Coconut) Harvesting:** Niu provided materials for food, drink, fibers, and tools, such as cups and ropes, contributing to the daily life and ceremonies of the community

3. Forest Stewardship

- **Maintaining Native and Polynesian-Introduced Plants:** *Kanaka maoli* likely tended to areas with culturally important plants like Ka‘e‘e (a vine with ceremonial uses) and ‘ēkaha (bird’s nest fern) to ensure their abundance for rituals and practical uses
- **Selective Forest Clearing:** Clearing forested areas for habitation or agriculture was done with care, using traditional tools like *ko‘i* (adzes) while preserving trees and plants that were ecologically or spiritually important
- **Planting Practices for Biodiversity:** *Kanaka maoli* would likely outplant significant species, including native trees (Alahe‘e, Lama,

and 'Ōhi'a) to maintain biodiversity and reinforce the land's resilience

4. Coastal and Marine Practices

- **Tide Pool Harvesting:** Tide pools along Wa'iele's coastline would have been a source of *limu* (seaweed), small fish, and crustaceans. Harvesting practices were likely guided by the *kaulana mahina* (lunar calendar), which dictated the best times for gathering to ensure resource sustainability
- **Fishing Practices with Cultural Protocols:** Surrounding coastal areas might have supported *ko'a* (fishing shrines) and specific rules about when and how fish could be caught. These practices ensured healthy fish stocks and maintained balance in the ecosystem

5. Cultural and Spiritual Practices

- **Ceremonial Use of Plants and Stones:** Many plants in Wai'ele, such as Hala, Kukui, and Ka'e'e, have ceremonial significance, being used in blessings, lei-making, and offerings at heiau (temples). Stones along the coastline may have been incorporated into *ko'a* or used in tool-making
- **Sacred Protocols at Wahi Pana (Storied Places):** Wa'iele's designation as a *wahi pana* suggests that rituals, storytelling, and mele (chants) were likely practiced here to honor its sacred nature and maintain the spiritual health of the land

6. Invasive Species Management and Ecological Maintenance

- **Traditional Land Clearing Techniques:** Fire and stone-wall building was employed to manage the land and create boundaries for cultivated areas, limiting the spread of invasive plants
- **Targeted Gathering of Problematic Species:** Plants, such as hau a fast-growing species, would have been harvested for materials or removed to maintain the health of native ecosystems

7. Water Resource Management

- **Mālama Wai (Caring for Water):** Springs, streams, and wetland areas would have been carefully managed to ensure clean water for agricultural and domestic use. Features like terraced walls may

have been present, with channels to divert water sources. Uli i ka uli, healthy water in the mountains, means healthy water in between and at the ocean

- **Tide Pool Protection:** The coastline's tide pools likely required ongoing stewardship to protect their integrity from overuse or natural erosion

8. Community-Based Stewardship

- **Transfer of Intergenerational Knowledge:** *Kūpuna* (elders) teach younger generations about the significance of plants, gathering and planting practices and traditions, lunar cycles and harvesting and ceremonial protocols which fosters a strong sense of *kuleana* (responsibility) for the land
- **Ahupua'a-Based Management:** Waiele is part of a larger ahupua'a system, the resources were shared and managed collaboratively from the mountains (*mauka*) to the sea (*makai*). Such systems balanced resource use and conservation.

9. Seasonal and Lunar-Based Practices

- **Lunar Calendar Alignment:** Many practices, such as planting, fishing, and harvesting, were tied to the Hawaiian lunar calendar, ensuring activities aligned with natural cycles for maximum abundance and sustainability
- **Seasonal Resource Management:** Seasonal protocols may have limited access to certain resources, allowing ecosystems to replenish and recover during specific times of the year

By reviving and adapting these traditional biocultural practices, Wai'ele can become a living classroom and an example of how cultural heritage and ecological stewardship work together. Through thoughtful, community-led efforts, Wai'ele can continue to thrive as both a *wahi pana* and a resource-rich ecosystem.

● Historical significance

Wai'ele, a *wahi pana* (sacred and storied place), holds deep historical significance rooted in the cultural, spiritual, and ecological practices of the *Kanaka maoli*. Its location, natural resources, and archaeological features

provide insights into traditional Hawaiian lifeways and the adaptive strategies of its people in Puna's unique environment.

1. Cultural and Spiritual Importance

- **Wahi Pana:** Wai'ele is not just a physical space; it served as a place where *Kanaka maoli* honored their connection to the land and the deities associated with natural elements, particularly Kū (god of war and fishing) and Lono (god of agriculture and peace)
- **Ceremonial Practices:** The presence of a *kū'ula* (fishing shrine) along the coastline highlights Wai'ele's role in spiritual practices, particularly in invoking success in fishing. Offerings and rituals would have been conducted here to maintain harmony between people and the ocean
- **Seasonal and Lunar Observances:** Wai'ele would have been a site where people observed the changing seasons and moon cycles to guide planting, harvesting, and ceremonial activities

2. Subsistence and Resource Use

Wai'ele's landscape was integral to traditional subsistence practices:

- **Agriculture:** The rocky terrain of Puna made it ideal for cultivating staple crops like 'Uala and Ulu. Agricultural mounds and groves of Ulu reflect a history of careful land stewardship
- **Fishing and Coastal Activities:** Wai'ele's proximity to the ocean supported fishing, gathering of marine resources, and the construction of paths like the beachfront stone pathway to access the shoreline
- **Gathering, Crafting, Medicine:** The abundance of culturally significant plants, such as Hala, Kukui, Noni, and Niu, supported a range of activities, including medicine, weaving, lei-making, and crafting tools

3. Archaeological Legacy

Wai'ele is rich in archaeological sites that provide a window into the lives of its early inhabitants:

- **Kū'ula Shrine:** A fishing shrine dedicated to Kū underscores the site's role in ensuring abundance from the sea

- **Stone Pathways:** The large beach stone path suggests organized access to the ocean for fishing and/or trade
- **Other Sites:** Additional archaeological features, such as agricultural terraces and habitation sites, share that this was a once-thriving community connected to both land and sea. The beach hosts significant rocks that are found in sizes from small to large along the shore. It is likely that there are hānau (birthing) rocks or rocks that give birth to others.

4. Connection to Broader Hawaiian History

Wai'ele is part of the larger narrative of Puna's historical significance:

- **Adaptation to Environment:** The region's volcanic soil and rugged coastline required ingenuity and adaptability, reflected in the traditional agricultural practices and resource use at Wai'ele
- **Trade and Exchange:** While Kalo (taro) was more commonly grown in upland areas, evidence suggests trade relationships between Wai'ele and mauka (upland) regions, highlighting its role in a broader network of resource exchange
- **Impact of Colonization:** Over time, changes in land use, the introduction of invasive species, and disruptions to traditional practices have impacted Wai'ele, making its preservation a critical effort to honor and restore Hawaiian heritage

5. Ecological and Historical Resilience

The abundance of native and Polynesian-introduced plants at Wai'ele speaks to the ecological harmony maintained by its early stewards. This resilience underscores the importance of Wai'ele as a model of sustainable living, rooted in a reciprocal relationship between people and the land.

Wai'ele stands as a testament to the ingenuity, spirituality, and resilience of the *Kanaka maoli*. Its rich history, marked by traditional practices, sacred sites, and ecological stewardship, offers invaluable lessons for contemporary conservation and cultural revitalization. Preserving Wai'ele ensures that future generations can continue to honor and learn from its profound historical and cultural legacy.



- **Traditional Practices**

- Sustainable Resource Use**

- Kanaka maoli* engaged in diverse practices that integrated their daily lives with the environment, ensuring a harmonious relationship between people and the land (*‘āina*). Wai‘ele’s resources were used for:

- **Farming:** Staple crops such as Ulu and ‘Uala were cultivated. Agricultural mounds in the rocky terrain were likely utilized for planting ‘Uala, a crop well-suited to Puna’s rugged landscape. Ulu

was also a common source of poi, a staple food in the area, and the groves of Ulu at Wai'ele suggest its prominence

- **Fishing and Gathering:** The beachfront area was central to fishing activities, supported by the presence of the *kū'ula* dedicated to Kū, the fishing god. Gathering of marine resources and harvesting of *limu* would have complemented the diet
- **Crafting and Medicine:** Trees such as Kukui, Hala, Noni, and Hau provided materials for crafting tools, lei-making, and medicine. Kukui was particularly versatile, used for lighting, food, dyeing fishnets, and making lei. Ti leaves were used in rituals, wrapping food, and as coverings for structures
- **Spiritual Practices:** Ceremonial offerings (*ho'okupu*) to deities, as well as rituals connected to fishing, farming, and seasonal cycles, would have taken place in Wai'ele. The presence of sacred sites underscores the spiritual importance of this area

Plant and Resource Diversity

Wai'ele's landscape features groves of culturally significant plants, including Hala, Ulu, Niu, Kukui, Noni, and Hau. The overabundance of Hau indicates its widespread use in crafting, such as for cordage and structures. Although Mai'a was not observed during the survey, it likely grew in the area, serving as a significant food source and contributing to *imu* (underground oven) preparation and mulching.

Archaeological Features

Wai'ele is home to many archaeological sites, including:

- **Kū'ula Shrine:** A beachfront structure dedicated to Kū, used to honor and ensure successful fishing endeavors
- **Beach Stone Path:** A large stone path located along the southeastern boundary, used to access the ocean
- **Many other sites include:** walls, house sites, enclosures, agricultural mounds and more

A comprehensive archaeological survey will identify these sites in depth. These features are culturally significant and should be preserved. Restoration efforts must ensure these sites are undisturbed and retain their historical and spiritual integrity.

Seasonal and Lunar Cycles

Traditional practices at Wai‘ele followed the Hawaiian lunar calendar and its two distinct seasons:

- **Kau (Dry Season):**
 - **Timeframe:** May to October.
 - **Associated Deity:** Kū, the god of war, farming, and fishing.
 - **Activities:** Planting and preparing the land for cultivation occurred during Kau. The dry conditions allowed for intensive farming and resource gathering.
- **Ho‘oilō (Wet Season):**
 - **Timeframe:** November to April.
 - **Associated Deity:** Lono, the god of agriculture, peace, and harvest.
 - **Activities:** Makahiki ceremonies celebrate abundance and gratitude. This was a time of peace, during which war was forbidden, and the best harvests were offered to Lono.

The changing of seasons was marked by the rising of the constellation Makali‘i (Pleiades) in November, signaling the start of the Makahiki season.

Wai‘ele represents a vital connection to the traditional knowledge and practices of *Kanaka maoli*. By honoring the cultural and spiritual importance of the land and its resources, restoration efforts can ensure Wai‘ele remains a thriving ecosystem and a testament to Hawaiian heritage. Preservation of its sacred sites and integration of traditional practices will serve as a model for sustainable and culturally aware natural resource management.



Tidepool at the shoreline of Wai'ele

4. Environmental Pressures and Threats

Wai'ele faces numerous environmental pressures and threats. These pressures stem from invasive species and human activities, both of which have negatively impacted the area's natural resources, ecosystems, and cultural integrity. This report provides an analysis of these threats and recommendations for their management and mitigation.

Invasive Species

- **Identification and Impact Assessment**

Invasive species pose one of the greatest threats to Wai'ele's ecological health. Key species of concern include:

1. Invasive Plant Species

○ Large-Scale Invasives:

- Cecropia, Macaranga, Melochia, and Gunpowder dominate large areas of the forest, reducing native biodiversity and these species need immediate attention

○ Other Detrimental Plants:

- Banyan, Rose apple, and Koster's curse were observed and are contributing to ecosystem degradation. Focusing on the removal of these species is advised to prevent further spread

2. Invasive Animal Species

○ Queensland Longhorn Beetle (*Acalolepta aesthetica*)

- Documented in the forest (Rathbun & Stein, 2024), this beetle is particularly harmful to culturally significant plants such as Ulu and Kukui, which serve as host plants. Controlling this beetle is crucial to preserve these species

○ Feral Pigs (*Sus scrofa*)

- Though no pigs were directly encountered during the survey, evidence of their presence was observed. Feral pigs disrupt native ecosystems by:
 - Consuming native plants and spreading invasive seeds
 - Digging and uprooting culturally significant flora, causing soil erosion and compaction

○ Little Fire Ants (LFA) (*Wasmannia auropunctata*)

- Present at Wai'ele (Rathbun & Stein, 2024), these ants disrupt ecosystems by altering habitats and threatening flora and fauna. LFA also poses a threat to humans that will be conducting work in Wai'ele. Current control efforts are being conducted on Wai'ele, but the extensive 158-acre property makes comprehensive management challenging

Management Recommendations

An invasive species management plan should:

- Address the control of species like Macaranga, Cecropia, and Gunpowder while protecting native vegetation and groundwater
- Implement biocontrol and chemical treatments cautiously to avoid harming the ecosystem

Assessment of Human Activities and the Impacts

Human activities have significantly altered Wai‘ele’s landscape and ecosystems. These activities include:

1. Agricultural Practices

- Historic agriculture likely contributed to habitat fragmentation. The introduction of invasive crops and techniques incompatible with traditional stewardship has altered soil health and plant communities

2. Tourism and Recreation

○ Ocean Access and Forest Use

- Activities such as fishing, gathering, and spiritual practices are culturally significant but must be balanced with conservation needs
- Recreation of Wai‘ele is not monitored and a plan for regulated access should be developed

○ Negative Impacts:

- Evidence of all-terrain vehicle (ATV) trails, rubbish left behind, and forest access for unsustainable Kukui gathering indicate human-induced degradation

3. Community and Conservation Efforts

- Activities such as beach clean-ups and cultural ceremonies help preserve Wai‘ele’s cultural and environmental integrity. However, without clear guidelines and education, these efforts can inadvertently contribute to habitat disruption

Recommendations

● Education and Outreach:

- Develop community programs to teach visitors and residents about Wai‘ele’s cultural and ecological significance

● Regulated Access:

- Establish designated access points and trails for ocean and forest activities to minimize ecological disruption

● Cultural Integration:

- Partner with local communities to incorporate traditional ecological knowledge (TEK) into land management practices.

Wai‘ele faces substantial pressures from invasive species and human activities that threaten its natural resources and cultural heritage. Through targeted invasive species management and regulated human activity, Wai‘ele can be restored and protected. Balancing ecological restoration with cultural practices will ensure Wai‘ele remains a thriving ecosystem and a site of spiritual and cultural significance for future generations.

This report underscores the urgency of addressing these challenges and calls for collaborative efforts between conservationists, cultural practitioners, and the local community to ensure the sustainability of Wai‘ele.

- **Analysis of land-use changes and their effects on natural habitats**

Wai‘ele has undergone considerable land-use changes over time. These transformations, shaped by shifts in cultural practices, colonization, urbanization, and invasive species proliferation, have had significant impacts on its natural habitats.

Historical Land-Use Changes

1. Traditional Hawaiian Practices (Pre-Contact Era)

- **Sustainable Stewardship:** Early *Kanaka maoli* (Native Hawaiians) managed Wai‘ele using techniques that maintained ecological balance. Agriculture, fishing, and gathering were conducted in harmony with the seasons, lunar calendar, and local ecosystems. Crops like ‘uala and Ulu were cultivated, while coastal resources were harvested sustainably
- **Habitat Preservation:** Native and Hawaiian-culturally significant forests of Hala, Kukui, and Niu were maintained, and native undergrowth provided habitat for endemic species. This careful land stewardship ensured Wai‘ele’s ecological integrity

2. Post-Contact Era (Colonial and Plantation Influence)

- **Introduction of Invasive Species:** The arrival of Europeans and Americans brought invasive plants (*Macaranga sp.*, *Schinus terebinthifolia*, *Cecropia obtusifolia*) and animals (feral pigs, rats, and cattle), disrupting native habitats
- **Land Conversion:** Portions of Wai‘ele and surrounding areas were likely altered for plantation agriculture or grazing, leading to soil erosion, deforestation, and displacement of native species

- **Decline in Traditional Practices:** The suppression of Hawaiian culture and resource management systems led to the abandonment of sustainable practices that had protected the land

3. Modern Developments (20th–21st Century)

- **Urbanization and Fragmentation:** Increased development in Puna, including roads, housing, and tourism infrastructure, has fragmented ecosystems, reducing habitat connectivity for native species
- **Overgrowth of Invasives:** Without active management, invasive plants like *Macaranga tanarius*, *Melochia umbellata*, and *Passiflora laurifolia* have outcompeted native vegetation, altering the composition and structure of Wai‘ele’s ecosystems

Effects on Natural Habitats

1. Loss of Native Forests

- **Deforestation:** Conversion of land for agriculture, grazing, and development has resulted in the loss of native trees such as Kukui and Hala, reducing critical habitats for endemic species
- **Altered Forest Composition:** Invasive plant species now dominate many areas, reducing biodiversity and the availability of traditional resources

2. Soil Erosion and Degradation

- Clearing of vegetation and the overuse of land have led to soil erosion, particularly on Wai‘ele’s rocky coastal areas, impacting plant regrowth
- Feral pigs are known to have negative impacts on soil erosion and degrade the forests understory

3. Impacts on Coastal Ecosystems

- **Disturbance of Tide Pools:** Increased human activity and runoff have altered coastal habitats, affecting marine life that depends on tide pools
- **Increased Vulnerability to Climate Change:** Habitat degradation has reduced the coastline’s resilience to sea level rise and storm surges

4. Displacement of Native Fauna

- **Loss of Habitat for Native Birds and Insects:** Native forests once provided food and shelter for species like ‘*apapane* and ‘*ōpe‘ape‘a* (Hawaiian hoary bat). Habitat loss has contributed to population declines

- **Spread of Predators and Competitors:** The introduction of feral pigs, rats, and mongoose has placed additional pressure on native fauna, particularly ground-nesting birds and endemic invertebrates

Recommendations for Mitigating Effects

1. Restoration of Native Habitats

- Replant native and Polynesian-introduced species, such as Ulu, Hala, and Kukui, Niu, Noni to restore Wai'ele's ecological and cultural balance

2. Control of Invasive Species

- Implement management strategies such as targeted removal of invasive plants like *Macaranga sp.* and *Cecropia*

3. Soil and Coastal Protection

- Use traditional Hawaiian techniques, such as planting *ti* and other stabilizing plants, to prevent erosion and protect coastal areas.
- Monitor and maintain tide pools to preserve their ecological function

4. Community Engagement

- Foster partnerships with local Hawaiian communities to incorporate traditional ecological knowledge (TEK) into land management
- Encourage cultural practices, such as forest gathering, hula and fishing rituals, that promote stewardship and connection to the land

5. Long-Term Monitoring

- Establish regular assessments of invasive species, habitat health, and resource use to guide adaptive management efforts

The land-use changes at Wai'ele reflect a shift from sustainable, culturally integrated practices to extractive and invasive processes. Restoring Wai'ele requires a balance of ecological science and traditional Hawaiian knowledge to heal the land, honor its cultural significance, and ensure its resilience for future generations. Through proactive management, Wai'ele can once again thrive as a living landscape that supports both natural ecosystems and cultural heritage.

5. Conservation and Management Recommendations

Recommendations for Preservation and Restoration

1. Preservation of Archaeological Sites

- Conduct an archaeological survey to identify the sites at Wai'ele. Protect and maintain the kū'ula shrine, stone paths, walls, house

sites, and other significant structures. Avoid activities that may alter or detract from their cultural significance.

2. Restoration of Native Plants

- Promote the outplanting of native and Polynesian-introduced species such as Ulu, Kukui, Ohia'ai and Mai'a while managing the overgrowth of Hau and invasive plants
- Identify methods of protection in areas where rare and endangered species are present
- Remove invasive species such as *Cecropia*, *Gunpowder*, *Macaranga*, *Banyan*, *Koster's curse*

3. Cultural Revitalization

- Incorporate traditional farming and fishing practices into management strategies to reconnect the community with cultural heritage
- Encourage educational programs and ceremonies that honor traditional Hawaiian knowledge and practices

4. Priority Areas for Conservation

- Identification of key areas that require immediate conservation efforts, such as habitats of endangered species or culturally significant sites

5. Sustainable Practices

- Recommendations for sustainable land and resource management practices that align with both environmental preservation and community needs
 1. Manage agricultural crops such as Ulu, Kukui, Niu, and Mango
 2. Plant Native and Hawaiian culturally-significant plant species that are consistent with the archaeological landscape

6. Restoration Efforts

- Suggested strategies for ecological restoration of degraded areas, such as reforestation, invasive species removal, or wetland restoration
- Inventory archaeological sites and preserve or restore areas per the decisions of the lineal descendants of the area

7. Community Involvement

- Develop plans for engaging the local community in conservation efforts, including education, volunteer programs, and traditional knowledge integration

- **Baseline Data Establishment:**
 - Creation of a baseline for ongoing monitoring of natural resources, including indicators for ecosystem health, species populations, and water quality. Use the botanical survey and natural resources assessment as a basis to identify priority areas and methods of management
- **Monitoring Programs:**
 - Design of long-term monitoring programs to track changes in the environment, the effectiveness of conservation efforts, and emerging threats

6. Adaptive Management Approach

- Recommendations for an adaptive management approach that allows for flexible responses to new information or changing conditions. Use the Wai‘ele Steering committee to guide this process

Outline of Adaptive Management for Wai‘ele

1. Introduction to Adaptive Management

- Define adaptive management as a structured, iterative process of robust decision-making in the face of uncertainty
- Emphasize its relevance for addressing the dynamic ecological and cultural challenges at Wai‘ele

2. Core Principles of Adaptive Management

- **Learning by Doing:** Treating management actions as experiments to refine future strategies
- **Flexibility:** Adjusting actions based on new data, ecological feedback, and cultural input
- **Stakeholder Involvement:** Engaging community members, cultural practitioners, scientists, and policymakers in all stages of planning and implementation.

3. Key Components of the Adaptive Management Plan

A. Assessment and Baseline Data Collection

- Conduct comprehensive inventories of flora, fauna, archaeological sites, and land use patterns.

- Monitor invasive species and environmental conditions (e.g., rainfall, erosion, soil health).
- Document cultural practices and historical narratives tied to Wai'ele.

B. Goal Setting

- Define clear, measurable objectives for ecological restoration and cultural preservation.
 - Examples: Reduce invasive plant cover by 50% within 5 years; replant 10 acres with native and culturally significant species.

C. Implementation of Initial Management Actions

- Launch initial projects based on baseline data and input from stakeholders:
 - Invasive species control (mechanical removal, biocontrol, fencing).
 - Restoration planting with culturally significant species like hala, ulu, and kukui.
 - Preservation efforts for archaeological sites and coastal erosion mitigation.

D. Monitoring and Evaluation

- Establish a robust monitoring framework to assess the effectiveness of actions:
 - Track changes in species composition, water quality, and soil stability.
 - Use GPS mapping to track invasive species removal and restoration planting progress.
- Regularly collect and analyze ecological and cultural data.

E. Adjustments and Revisions

- Use monitoring data to identify successes, challenges, and unforeseen impacts.
- Adapt strategies to address new threats, opportunities, or knowledge:
 - Example: If invasive species control methods harm native plants, modify techniques.

- Example: Expand cultural engagement efforts if feedback suggests greater community involvement is needed.

F. Stakeholder Engagement and Feedback Loop

- Host regular meetings with lineal descendants, cultural practitioners, scientists, and local stakeholders.
- Encourage feedback on management actions and incorporate cultural insights into decision-making.

4. Recommendations for Adaptive Management at Wai‘ele

- **Integrate Cultural Practices:** Align ecological restoration with traditional knowledge and known biocultural practices
- **Foster Research Partnerships:** Collaborate with universities and conservation organizations to refine management practices
- **Ensure Flexibility in Funding and Resources:** Develop grant proposals and partnerships to allow adjustments as priorities shift
- **Implement Education Programs:** Train volunteers and stakeholders on adaptive management principles

7. Conclusion

- **Summary of Key Findings:**
 - Overview of the most critical natural resources, threats, and conservation priorities identified in the assessment.

Critical Natural Resources

- **Culturally Significant Plant Species:**
Wai‘ele hosts groves of hala (*Pandanus tectorius*), kukui (*Aleurites moluccanus*), ulu (*Artocarpus altilis*), and niu (coconut), as well as other significant species like noni (*Morinda citrifolia*), green ti (*Cordyline fruticosa*), and the ‘ekaha fern (*Asplenium nidus*). These plants are vital to traditional Hawaiian biocultural practices and provide essential resources for food, medicine, and crafts
- **Marine and Coastal Features:**
The property includes a bay with tide pools, a shoreline of waterworn stones, and significant archaeological features, such as habitation sites, walls, structures and a Kū‘ula fishing shrine. These elements are critical to cultural heritage and ecological balance
- **Freshwater and Soil Resources:**

Fertile loamy and cinder-rich soils across the property offer potential for agricultural use. While no freshwater sources were observed during the survey, a well reported by descendants may exist

Threats to Natural Resources

- **Invasive Species:**

- **Flora:** Cecropia, gunpowder, melochia, macaranga, rose apple, and Koster's curse dominate parts of the forest, threatening native and culturally significant plants

- **Fauna:** Feral pigs and invasive insects, such as the Queensland longhorn beetle and Little Fire Ant (LFA), pose risks to forest integrity and ecosystem health

- **Human Activities:**

- Evidence of resource gathering, trail use, and rubbish left behind by visitors has disrupted the forest's balance

- Unmanaged access to the beach and archaeological sites risks damaging these culturally and ecologically significant areas

- **Coastal Erosion:**

The beachfront is at risk of erosion due to wave action and seasonal swells, potentially impacting the shoreline ecosystem and archaeological features

Conservation Priorities

1. **Restoration and Preservation:**

- Protect and restore groves of Hala, Kukui, Niu, and Ulu while addressing invasive species management
- Preserve significant archaeological sites, including stone walls, fishing shrines, and burial structures

2. **Invasive Species Management:**

- Implement strategies to control and remove invasive trees (cecropia, gunpowder, etc.) and shrubs (Koster's curse)
- Monitor and manage threats posed by the Queensland longhorn beetle, Little Fire Ant, and feral pigs

3. **Sustainable Land Use:**

- Dedicate coastal areas and significant archaeological zones to conservation efforts
- Develop sustainable agricultural practices in upper sections, focusing on native and Polynesian-introduced species

4. **Community and Cultural Engagement**

- Collaborate with lineal descendants and cultural practitioners to ensure management plans align with traditional practices
- Promote community education and stewardship to reduce human impact on natural and cultural resources

This summary highlights Wai‘ele’s ecological and cultural importance while addressing key threats and outlining actionable priorities for conservation and sustainable management.

● **Call to Action**

Wai‘ele is a place of immense ecological, cultural, and historical significance that requires our collective effort to protect, restore, and honor its natural and cultural heritage. The findings of this assessment highlight the urgent need for coordinated action to address threats, preserve native ecosystems, and uphold the traditional biocultural practices that have defined Wai‘ele for generations.

We call upon stakeholders, including community members, cultural practitioners, conservation organizations, and government agencies, to take part in safeguarding Wai‘ele’s unique resources. Together, we can ensure that this land continues to provide for future generations while maintaining its integrity as a place of cultural and ecological harmony.

Immediate Actions Needed

1. **Invasive Species Management:**
Develop and implement a targeted plan to remove invasive plants and animals, protecting Wai‘ele’s native and culturally significant species.
2. **Preservation of Archaeological Sites:**
Map, document, and restore archaeological sites while ensuring their protection from human and environmental impacts.
3. **Restoration of Ecosystems:**
Focus on replanting and fostering the growth of hala, kukui, ulu, and other culturally significant plants, supporting traditional practices and ecological health.
4. **Community Engagement:**
Build partnerships with lineal descendants and cultural practitioners to guide management decisions and foster a sense of shared responsibility.

How You Can Contribute

- **Volunteer:** Join restoration efforts, invasive species removal initiatives, and cultural site preservation projects.

- **Advocate:** Support policies and programs that prioritize conservation and cultural preservation at Wai‘ele.
- **Educate:** Share knowledge about Wai‘ele’s importance with others to inspire collective stewardship.
- **Collaborate:** Work with local organizations, schools, and cultural groups to create a sustainable future for Wai‘ele.

A Commitment to the Future

The preservation of Wai‘ele is not just a task—it is a kuleana (responsibility) that we all share. By acting now, we honor the legacy of the land, its people, and its traditions, ensuring that Wai‘ele thrives as a symbol of balance and harmony for generations to come.

Let us come together to mālama ‘āina (care for the land) and uphold the spirit of Wai‘ele as a place of resilience, abundance, and deep cultural connection.

Role of the Wai‘ele Steering Committee in Implementing the Natural Resources Assessment

1. Oversight and Governance

- Provide leadership and guidance in aligning the natural resource assessment with Wai‘ele’s broader conservation and cultural goals.
- Act as a decision-making body to ensure priorities are set based on community values, ecological needs, and historical significance.
- Establish clear objectives and timelines for implementing recommendations from the assessment.

2. Stakeholder Coordination

- Serve as a liaison between key stakeholders, including:
 - Lineal descendants and cultural practitioners.
 - Environmental scientists and ecologists.
 - Local government and conservation organizations.
 - Volunteers and community members.
 - Facilitate ongoing communication to integrate diverse perspectives into management actions.
-

3. Implementation of Recommendations

- Oversee the execution of the recommendations outlined in the natural resource assessment, including:
 - **Invasive Species Control:** Approve and monitor removal strategies for invasive plants and animals.
 - **Habitat Restoration:** Guide efforts to reintroduce and nurture native and culturally significant species.
 - **Cultural Site Preservation:** Ensure culturally significant sites are protected and restored in alignment with traditional values.
-

4. Adaptive Management Leadership

- Use an adaptive management framework to guide decision-making:
 - Evaluate the effectiveness of implemented actions through regular progress reports.
 - Adjust strategies based on ecological monitoring, community feedback, and emerging challenges.
 - Develop and refine long-term conservation goals as new data or opportunities arise.
-

5. Community Engagement and Education

- Organize outreach efforts to educate the public about Wai‘ele's natural and cultural significance.
 - Encourage active participation in conservation efforts through volunteer programs and community events.
 - Create opportunities for knowledge-sharing sessions that integrate traditional Hawaiian practices with modern ecological science.
-

6. Funding and Resource Mobilization

- Identify and pursue funding opportunities to support conservation and restoration activities.
- Ensure resources are allocated efficiently and transparently to address key priorities.

7. Reporting and Accountability

- Regularly report progress to stakeholders and the community through updates, public meetings, and published materials.
 - Uphold transparency and accountability in decision-making and resource management.
-

The Wai‘ele Steering Committee will act as the backbone of this effort, ensuring that conservation practices honor the cultural and ecological integrity of Wai‘ele while fostering community involvement and sustainable stewardship.

Special Mahalo

Ke Aloha ‘Aina Foundation, LLC would like to thank Fred Aiona, Makani Gregg and Michael Kyser Jr. for their work they contributed to this project. The area of Wai‘ele is special to many ‘ohana of this region. The ecology and archaeology of Wai‘ele that our group encountered is significant and these natural and cultural resources need to be protected, enhanced and managed for the generations to come. We hope that the information provided will help to guide the management decisions for Wai‘ele that will allow for the biocultural practices that were once thriving in this village to be revived once again.

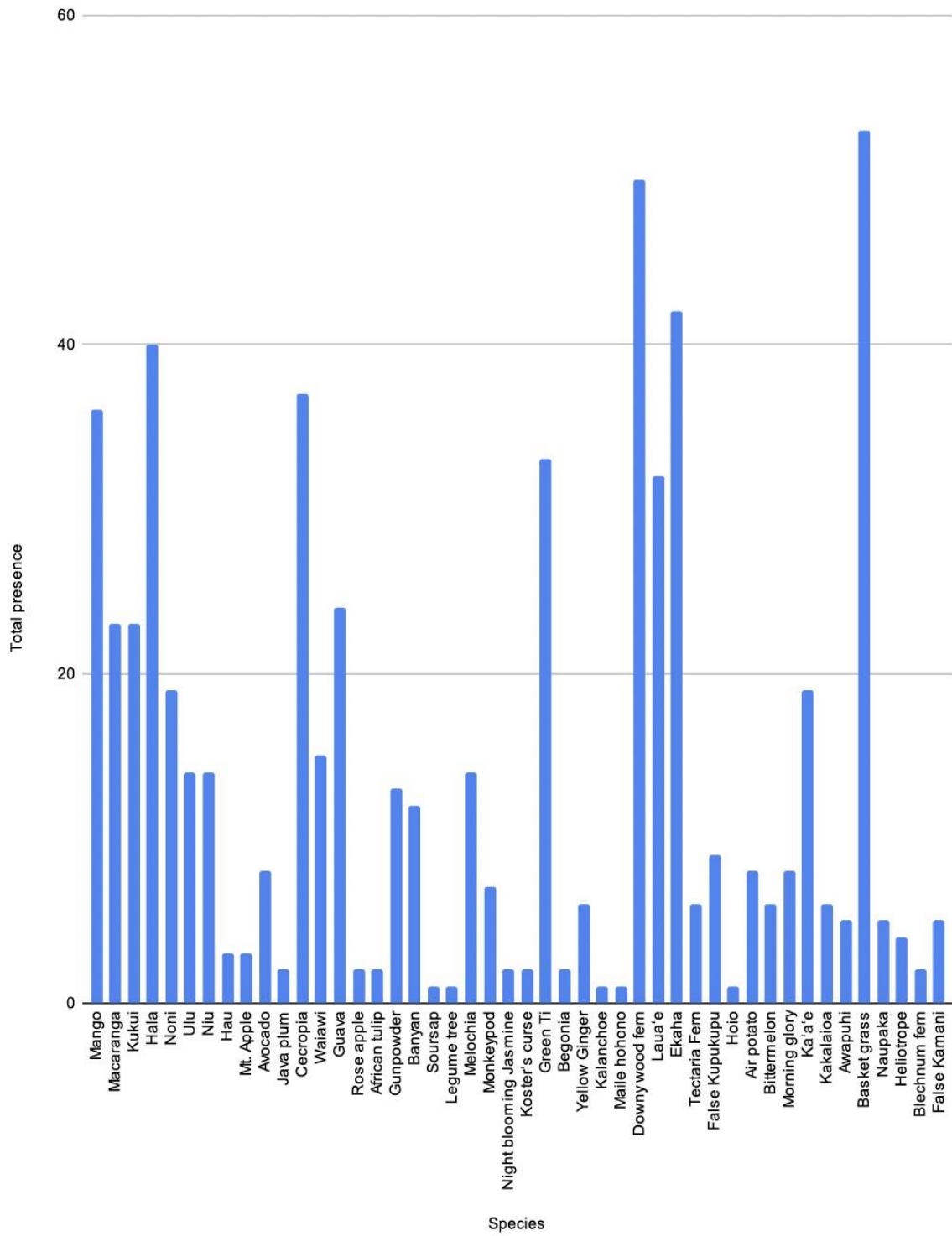
7. Appendices

Rathburn, John, William Stein (2024). *Vegetation Analysis and Botanical Survey, Wai‘ele, Hawai‘i, Technical report.*

Sherrod, David R., John M. Sinton, Sarah E. Watkins, and Kelly M. Brunt (2021). *Geologic map of the State of Hawaii*. USGS Numbered Series Scientific Investigations Map 3143. USGS Publications Warehouse and Volcano Science Center, doi: 10.3133/sim3143.

Flora Species representation			
Species		Total species count	Percentage
Mango	<i>Magnifera indica</i>	36	5.80%
Macaranga	<i>Macaranga sp.</i>	23	3.70%
Kukui	<i>Aleurites molucanna</i>	23	3.70%
Hala	<i>Pandanus tectorius</i>	40	6.44%
Noni	<i>Morinda citrifolia</i>	19	3.06%
Ulu	<i>Artocarpus altilis</i>	14	2.25%
Niu	<i>Cocos nucifera</i>	14	2.25%
Hau	<i>Hibiscus tilieacus</i>	3	0.48%
Mt. Apple	<i>Syzygium malaccense</i>	3	0.48%
Avocado	<i>Persea sp.</i>	8	1.29%
Java plum	<i>Syzygium cumini</i>	2	0.32%
Cecropia	<i>Cecropia obtusifolia</i>	37	5.96%
Waiawi	<i>Psidium cattelianum</i>	15	2.42%
Guava	<i>Psidium guajava</i>	24	3.86%
Rose apple	<i>Syzygium jambos</i>	2	0.32%
African tulip	<i>Spathodea campanulata</i>	2	0.32%
Gunpowder	<i>Trema orientalis</i>	13	2.09%
Banyan	<i>Ficus benghalensis</i>	12	1.93%
Jackfruit	<i>Artocarpus heterophyllus</i>	1	0.16%
Legume tree	<i>Sesbania ?</i>	1	0.16%
Melochia	<i>Melochia ubmellata</i>	14	2.25%
Monkeypod	<i>Samanea saman</i>	7	1.13%
Night blooming Jasmine	<i>Cestrum nocturnum</i>	2	0.32%
Koster's curse	<i>Clidemia hirta</i>	2	0.32%
Green Ti	<i>Cordyline sp.</i>	33	5.31%
Begonia	<i>Begonia sp.</i>	2	0.32%
Yellow Ginger	<i>Hedychium falvescens</i>	6	0.97%
Kalanchoe	<i>Kalanchoe pinnata</i>	1	0.16%
Maile hohono	<i>Ageratum conyzoides</i>	1	0.16%
Downy wood fern	<i>Christella denata</i>	50	8.05%
Laua'e	<i>Phymatosorus scolopendria</i>	32	5.15%
Ekaha	<i>Asplenium nidus</i>	42	6.76%
Tectaria Fern	<i>Tectaria</i>	6	0.97%
False Kupukupu	<i>Nephrolepis sp.</i>	9	1.45%
Hoio	<i>Diplazium esculentum</i>	1	0.16%
Air potato	<i>Dioscorea bulbifera</i>	8	1.29%
Bittermelon	<i>Mormordica charantia</i>	6	0.97%
Morning glory	<i>Ipomoea sp.</i>	8	1.29%
Ka'a'e	<i>Mucuna gigantea</i>	19	3.06%
Kakalaioa	<i>Caesalpineia bonduc</i>	6	0.97%
Awapuhi	<i>Zingiber zerumbet</i>	5	0.81%
Basket grass	<i>Osplimenus hirtellus</i>	53	8.53%
Naupaka	<i>Scaevola sericea</i>	5	0.81%
Heliotrope	<i>Heliotropium arboreum</i>	4	0.64%
Blechnum fern	<i>Blechnum sp.</i>	2	0.32%
False Kamani	<i>Termanlia catappa</i>	5	0.81%
Total		621	

Species Presence



Additional Information

1. Description of Proposed Development: This stewardship work will not involve construction of any structures or creation of new paths or trails on the property. The work being done is to maintain and preserve these parcels and protect the cultural sites and native species from invasive non-native plants and animal species. The only human-built features on the properties are remnants of rock walls, historic access trail crossing the properties mauka to makai, and additional cultural sites such as burials and food storage rock structures. More will be determined once the archaeological study is completed.
2. The objective of this project is to preserve these historic properties which were part of the island's first settlements by Polynesians arriving from the S. Pacific. In doing so, we have formed an initial Steering Committee composed of lineal descendants to guide the preservation and maintenance of the property. The Steering Committee is tasked with developing a replicable model to integrate native Hawaiian practices into the stewardship management plans for coastal properties of significance.
3.
 - a. As mentioned only remains of rock walls and an historic trail are present on the properties. All of the acreage is being maintained by removing invasive plant species and in-planting with natives, keeping the border treated to prevent a LFA incursion, and an ungulate barrier fence on the borders of the property with the exception of the border along the ocean.
 - b. The parcel to the north of the Wai'eale known as the Kahu'wai owned by Bishop Estates/Kamehameha Schools (KSBE) and is the site of one of the oldest village complexes in Hawaii. KSBE has stewards hired to protect, maintain and preserve the property. On the south border of the Waiele are privately held parcels without substantial development.
 - c. This parcel is under the PONC program and subject to its goals and objectives. All Stewardship activities are approved in compliance with the allowed actions under the Stewardship program.
 - d. The project will have little impact on the surrounding properties and community as for years the surrounding community has assisted in marine debris clean-ups and has quietly worked to preserve the integrity of the native vegetation on these parcels.
 - e. The biggest impact on the property of late has been damage by feral pigs. While constructing ungulate fencing along the southern border will be challenging, due to the fact that the historic trail meanders on to the adjacent 10-acre undeveloped parcel owned by Coleman Ohia, it is needed. Thus, a land survey and the archaeological study will need to be done before constructing fencing on or inside the borders to prevent obstructing the historic trail.
 - f. Given the lack of truck access, alternatives to feral pig incursions are limited. Giving permission to hunters to shoot or otherwise kill pigs would invite unwanted damage to plant species; some of which are rare and/or threatened. It could compromise cultural sites. Thus, for the long term protection of the properties, construction of fencing is the best option.
 - g. The proposed stewardship actions do not constitute irreversible or irretrievable commitment of resources but are intended to protect and nurture the existing resources.
4.
 - a. Given the objectives of stewardship on the PONC properties, the proposed activities are aligned with preserving the cultural, historic and natural resources on the land. The Kahuwai managed by KSBE has established a permission system such that native Hawaiian cultural practitioners can access that gated property. A similar system will be established at the Wai'eale.
 - b. These stewardship activities, along with the model for cultural management being developed by the Steering Committee will improve access for those exercising

- c. Conducting the botanical and archaeological studies will assist in the preservation of valued cultural, historical and natural resources on the properties.
- 5.
 - a. Under the stewardship program, access to the property for recreational activities that respect and honor the cultural and historic legacy of the properties will be provided.
 - b. Historic resources will be identified by the archaeological study and through the assistance of Steering Committee members who are also lineal descendants of the properties.
 - c. This property was purchased by the County under the PONC program to allow preservation and maintenance of scenic and open space resources.
 - d. The Stewardship work will maintain access from the nearest roadway (Government Beach Road) to the ocean along a historic trail. Keeping this trail maintained allows community members to access the coastal areas for fishing and collection of marine species, while also allowing for marine debris clean-ups to occur on a regular basis.
 - e. The native species growing on the properties may provide seed/cuttings for preservation of area specific species such as breadfruit and other food bearing plants that have been bred to thrive in the coastal Puna climate. As such there could possibly be an economic opportunity to grow on these special species to provide to other coastal properties that are being restored to original native species.
 - f. The beach area of the Wai'ele is prone to storm surges and coastal erosion due to sea level rise, but there is no built environment on the properties and no human inhabitants so the coastal hazards associated with storms and hurricanes may damage the natural resources only.

Application attachments:

- 1. Is the filing fee of \$50 required when the property is owned by the County of Hawaii? Malama O Puna will provide a check for that amount if so.
- 2. A certified Shoreline Survey for this property is not available. Given this property as owned by the County of Hawaii and acquired as open space, it will not be developed as a residential or commercial property. **Malama O Puna is requesting that the Planning Director waive this requirement.**
- 3. As there is no planned development for the properties, maps of the two parcels provide an adequate view of the parcels. Online aerial views are available through the Planning Department's webpage and show a densely forested property. As explained earlier, the historic access trail from the Government Beach Road to the ocean along the southern border may not be fully aligned with the property borders, but that will be determined by a land survey as applied for in the FY 2024-25 Stewardship grant once the application is approved by County Council and a contract let to Malama O Puna.
- 4. There is historic access along the coastline that connects the Wai'ele to the properties to the north along the coast. The coastal access to the south exists across a few private parcels until you reach the 1960 lava flow where those portions of the coastal trail were covered by lava. One can still access the properties along their coastal accesses, although that trail is not maintained and not easy to traverse. In most cases, individuals wishing to access the Wai'ele beach area do so by negotiating the historic trail from the Government Beach Road to the ocean.
- 5. N/A