Creating Interpretive Tour Resources for Lyon Arboretum

An Interactive Qualifying Project
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Abstract

In order to fulfill their mission, the Lyon Arboretum utilizes interpretive learning to educate their visitors on conservation, ecology, and Hawaiian culture. The goal of this project was to create an interpretive resource that would best fit the Arboretum's needs. Our team developed a digital, educational brochure with interactive features and content focusing on history, plant information, wildlife, and various attractions at the Arboretum. To do this, we researched existing interpretive material and interviewed staff and visitors to determine the contents of the brochure. After creating our brochure, we conducted a beta test with 25 visitors to receive feedback and also consulted with staff from the Arboretum. We revised our brochure based on feedback from both visitors and staff.

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Lastly, we would like to thank our interviewees, Derek Higashi, Taylor Amalato, Aziz Agis, Richard Sears, and Līloa Dunn, for helping us determine the contents of our brochure, along with Timothy Kroessig and Cindy Yamamoto for educating us about the Arboretum and its mission and providing us feedback on our project.

Executive Summary

Places such as arboreta and botanical gardens attract many visitors who are looking to study plants or simply spend time in nature. Arboreta can be great places for people to learn about ecology, conservation, and local culture and history (Ballantyne et al., 2008). Many arboreta employ informal learning to educate their visitors. Studies have found that at organizations like arboreta, informal learning is often more effective than formal learning because it allows visitors to learn by exploring exhibits themselves (Tal and Morag, 2007: Rickinson et al., 2004).

The Harold L. Lyon Arboretum, located in Mānoa Valley, Honolulu, was seeking to create educational material in order to help fulfill their mission of educating their guests about conservation and culture. We interviewed the Arboretum's Education Manager, Raedelle Van Fossen, to determine expectations of our deliverable and to understand the constraints they are facing, such as poor internet access, tropical weather conditions, and limited budget. From this interview, we identified the best option for the Arboretum would be a downloadable, educational brochure. To combat the lack of internet and budget, we decided on a PDF format so all of the brochure's contents can be easily downloaded, and it can be used reliably without internet connection.

Our team conducted an on-site analysis at the Arboretum to learn about their current educational offerings for general visitors, as well as learn about the most notable attractions and gardens. This allowed us to identify effective features of the Arboretum's materials along with any plants or topics of interest that were not highlighted. This on-site analysis provided a foundation to begin determining the contents of the brochure.

We interviewed staff from the Education Department, Grounds and Collections Department, and Main Office in order to determine the contents of our brochure. We conducted semi-structured interviews to learn what the staff wants visitors to take away from their experiences at Lyon, and their personal preferences on brochure content. We also asked the staff about their interactions with guests to gain insight on visitor habits. Some valuable information from the interviews included the most frequently visited gardens and how locals interact with the Arboretum differently than tourists.

We surveyed visitors after they finished their hikes to further help determine the contents of the brochure. We asked about their knowledge of plants and culture, quality of learning

experience during their visit, and anything they would like to see included in the brochure. The respondents included both first time and returning visitors, people of various ages, and people with varying levels of botanical and cultural knowledge. After conducting these surveys, we analyzed our data to determine what visitors are most interested in. We received suggestions such as implementing a bird guide or garden history sections. We also gained insight on what parts of the Arboretum's current educational material were beneficial so we could feature this in our brochure.

In addition to the Arboretum's materials, our group conducted research on digital, educational material and brochures at other organizations. We visited the Waikiki Aquarium and the Bishop Museum, and evaluated the educational material that they provided. We also evaluated digital brochures from four other organizations that were available on their websites. We analyzed both digital and physical materials from our perspectives as visitors and determined positive and negative qualities of their brochures and digital resources. We used those qualities to help guide us in the designing of our brochure and to get a broader scope of what makes interpretive material effective. We analyzed the format and layout of these organizations' materials and identified aspects of effective, informal learning such as clarity of information, low text to image ratio, and the use of themes.

In order to create and design the layout of the digital PDF brochure, we used Adobe InDesign, Adobe Acrobat and Adobe Illustrator. The brochure was curated with interactivity in mind and features links for seamless navigation through sections of the brochure. The navigation is done through the use of a table of contents where each subsection can be clicked, redirecting the user to that portion of the brochure. Each section corresponds to an important topic or a garden with a list of plants that can be found there. Each page is also equipped with "Back" and "Home" buttons, leading to each garden's plant menu and the main Table of Contents respectively.

The brochure covers safety information, the history of Lyon Arboretum, prominent gardens with key plant information, as well as various attractions and wildlife. Most of the content was provided to us by the Arboretum, but we also conducted additional research on some of the plants. Our team spent a significant amount of time visiting the gardens to learn about the collections and take photos for the brochure. Each garden has a short description with a list of

prominent plants in that collection. Each plant has a photo and information on origin, scientific name, and family along with a description, as shown in **Figure 1.**

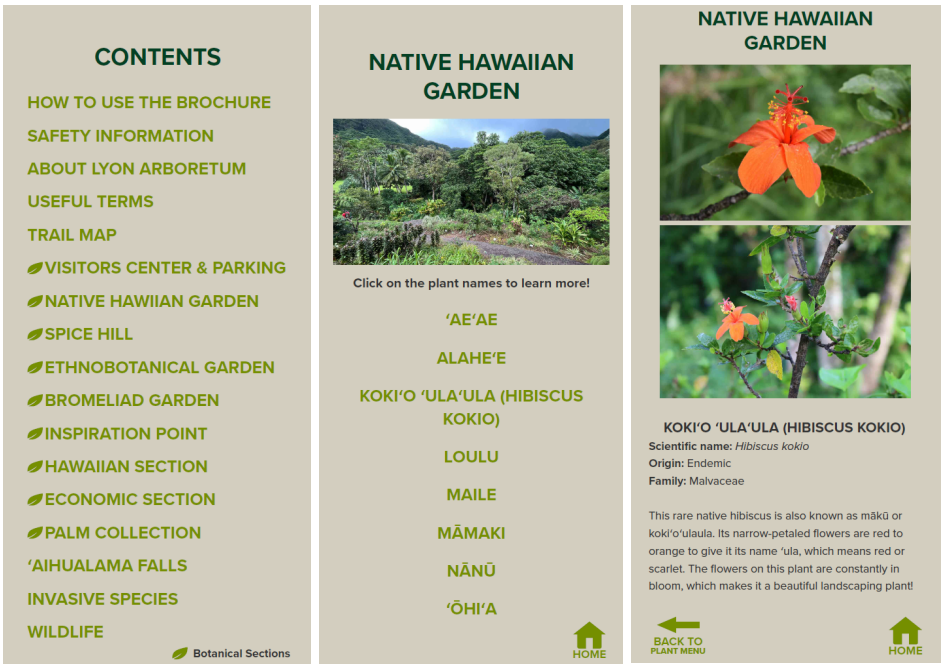

Figure 1: Table of Contents, Plant Table of Contents and Plant Description

To evaluate our deliverable, we received feedback from staff members across multiple departments and applied the necessary changes to the brochure. We conducted a beta test by having 25 visitors use our brochure while walking through the gardens and completing a survey at the end of their visit. The survey included questions on how the brochure impacted their experience, information they enjoyed, and additional features they would like to see in the brochure. We used these results to further edit and improve our brochure, and shared the editable files with the Education Department so they can update it in the future.

Authorship

The contents of this report are a result of the collaboration among all authors. Since we completed all writing and editing together, we all take equal authorship of all sections of this report.

Table of Contents

1.0 Introduction

People around the world enjoy visiting arboreta whether it is to study rare plants, immerse themselves in nature, or simply spend time in a peaceful setting. Regardless of their reason for visiting, arboreta can be great places for people to learn about ecology, conservation, and local culture and history (Ballantyne et al., 2008).

One style of learning that arboreta utilize to educate their guests is informal learning, which happens when people use their own interests and existing knowledge of a subject to guide their learning rather than following a curriculum. Studies have found that at organizations like arboreta, informal learning is often more effective than formal learning because it allows visitors to learn by exploring exhibits themselves (Tal and Morag, 2007: Rickinson et al., 2004). Doing so helps them form deeper connections with the topic (Kim et al., 2022).

One way to promote informal learning at arboreta is through interpretive material including signs, brochures, or other media that convey information. Educational, interpretive material enhances the overall guest experience and often piques the interest of casual visitors, regardless of their initial intentions (Jamaliah et al., 2021).

The Lyon Arboretum utilizes interpretive material to engage their visitors in informal learning. However, the Arboretum is in need of new material for their self-guided tours. There are a number of logistical concerns including cost of production, durability issues in tropical weather conditions, and internet accessibility. Thus, the Arboretum is looking for an alternative digital solution that will address these concerns. Among the various digital mediums, a digital brochure is the most viable option for the Arboretum. Therefore, the goal of our project was to develop a digital brochure for the Lyon Arboretum to improve their self-guided tours and contribute to their mission of educating visitors about conservation, culture, and history.

2.0 Background

2.1 Lyon Arboretum

The Harold L. Lyon Arboretum, located in Mānoa Valley, Honolulu, promotes the conservation of tropical plants from around the world and uses education and research to uphold the culture of Hawai'i (University of Hawai‘i at Mānoa, 2022). The Arboretum was originally founded in 1918 by the Hawaiian Sugar Planters' Association (HSPA) with the help of Dr. Harold L. Lyon, who was a researcher working for the HSPA. The HSPA sought to restore the vegetation that was lost due to changes in land use and thus used the acquired land as a testing site to research different plants for reforestation (University of Hawai‘i at Mānoa, 2022). Once their research concluded in 1945, Dr. Lyon proposed to turn the area into an arboretum to allow visitors to appreciate the beauty of Hawai‘i.

Spanning 194 acres, the Lyon Arboretum houses a variety of plants with hiking trails throughout the forest. With its grand collection of plants, visitors coming to the Arboretum can immerse themselves in the forest and educate themselves on the collection with the Arboretum's interpretive material. Additionally, botanic tourism brings awareness to endangered species and environmental preservation to visitors (Atik et al, 2016). Thus, the Lyon Arboretum has made it part of their mission to educate and to promote environmental conservation.

2.2 Current Interpretive Material at the Lyon Arboretum

Despite being a popular destination for tourists, the Arboretum still experiences challenges in providing the optimal experience for their visitors. The Arboretum faces a lack of educational material and many of their current offerings are outdated. Therefore, the Lyon Arboretum is looking to improve their self-guided tours by creating new interpretive tour material. Interpretive material includes signs, brochures, or other media that convey information to visitors. Educational interpretive material is utilized at organizations such as arboreta to teach visitors about gardens and exhibits.

The resources currently available to visitors are a map to navigate the grounds, plant labels with their common and scientific names, and a printed brochure that displays the Arboretum's collection. While the labels do include plant names and countries of origin, there is no additional information provided, and only two gardens include historical and cultural signage.

This material is outdated, limited in educational value, and prevents visitors from getting the most out of their trip to the Arboretum. To fulfill the Arboretum's educational needs, new interpretive material must be implemented.

2.3 Educational Need for Interpretive Material

In order to promote effective learning, it is important to develop interpretive material that caters to all visitors' needs. Studies have shown that most people visit arboreta or botanical gardens for "general reasons rather than specific pursuits" (Connell, 2004). While many people may come to the Arboretum with no intention of learning about botany, history, or culture, the Lyon Arboretum hopes to encourage learning among their visitors. Implementing additional interpretive material to supplement their current offerings will provide visitors with new opportunities to build connections with their environment and to learn more about Hawaiian culture and history.

In addition to the casual visitor, the Arboretum is often visited by those seeking educational fulfillment such as school groups. For instance, Dr. Hank Trapido-Rosenthal, a professor at Chaminade University of Honolulu, led a field trip to the Arboretum where "...students learned how to recognize the difference between plants that were endemic[1]..., indigenous[2]... and canoe plants[3]". Trapido-Rosenthal shared, "My goal was to get them deep into the valley to see the geology, biology and history of our area" (Chaminade University of Honolulu, 2018). In contrast to casual visitors, visitors seeking to learn require more in-depth educational material. Therefore, the Arboretum must provide interpretive material for their diverse audience. Whether visitors are looking for recreational or educational fulfillment, it is vital for the Lyon Arboretum to provide effective interpretive material in order for visitors to gain the most out of their experience.

2.4 Qualities of Effective Interpretive Material

Effective interpretive material creates connections between visitors and the messages being conveyed. Whether the material relates back to guests' values, experiences, or culture,

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[1] native to the Hawaiian Islands and only found here
[2] native to the Hawaiian Islands but also found elsewhere
[3] brought to the Hawaiian Islands by Polynesian voyagers

these connections allow for much deeper learning opportunities for visitors (Ballantyne et al., 2008).

To maximize the number of potential connections, interpretive material should use user-friendly language and visuals. This involves defining technical terms and using simple language. Part of making information accessible is making it inviting to view and not overwhelming visitors with too much information. Well-designed interpretive material is accessible enough that visitors only need to interact with it for a short period of time to learn something new (Xu et al., 2013).

Effective interpretive material should be organized in a way that makes sense to the visitors and should only contain relevant information (Xu et al., 2013). Well-organized information is more inviting to visitors because it allows them to focus their attention on the sections they are most interested in (Ballantyne et al., 2008).

2.5 Forms of Interpretive Material

The Lyon Arboretum's location poses challenges that limit the efficacy of both digital and non-digital material. The grounds' unreliable internet access restricts the use of digital media. The heavy rain that the tropical forest experiences also limits the use of printed brochures and maps. Exploration of digital and non-digital material that other organizations have implemented can provide greater insight on how to address the Arboretum's challenges.

2.5.1 Digital Material

Digital material has the potential to improve both the volunteer-led and self-guided tours at the Arboretum. The Arboretum previously implemented technology with the use of a QR code tour and an audio-guided tour. These resources were available via the Arboretum's mobile app; however both were hindered by unreliable internet access. The Lyon Arboretum is interested in using improved digital material that addresses the issue of limited internet access to improve their visitors' experiences.

In addition to arboreta, digital interpretive resources have been successfully used at venues such as botanical gardens, museums, and zoos; one such venue is the Cape Flats Nature Reserve in Western Cape, South Africa which is home to several different species of indigenous plants and animals (Kondlo et al., 2020). The nature reserve utilized technology to improve their

self-guided tours. For instance, the nature reserve's mobile app used augmented reality and digital enhancements to highlight the features of the nature reserve.

2.5.2 Contents of a Mobile App

Today, mobile apps are one of the most common interpretive resources used at educational sites such as botanical gardens and arboreta, as mobile apps can immerse visitors in the educational content while also providing them with supplemental information. Several factors go into making an effective app such as a theme, an emphasis on points of interest, a positioning system, accurate data, and reliable software (Postolache et al., 2022). These elements can be applied to other digital media as well.

The theme of an app is important because it contributes to the cohesiveness and completeness of a tour. An app's theme refers to its user interface (UI), which is affected by the app's color scheme, layout, presentation of information, and other visual characteristics (Falchuk, 2009). An app's UI should complement the organization it was created for. The theme of an app can also help highlight points of interest and attract visitors to specific areas of a site. This is one way that organizations can promote specific attractions and topics (Fyall et al., 2008). In the case of an arboretum or botanical garden, this may be a garden that has rich cultural or historical value. One way to promote popular attractions is through interactive features such as trivia questions. Self-guided tour apps also provide a means of navigating through the site. Due to the widespread availability of mobile devices, educational venues are implementing information systems that coincide with location (Miyamoto et al., 2016). This is often done with a GPS signal.

An integral part of making a successful app is ensuring all of the information is accurate and organized. If the contents of an app are incomplete and inaccurate, users may not trust the resource (Postolache et al., 2022). Similarly, the fundamental software features of the app must work reliably. Any link or button leading to another section should be clearly labeled and direct the visitor to the desired page. If the software of the mobile app poses any conflicts, the visitor's experience will be negatively affected. Due to the many requirements of creating a successful app, the resource can be complex and difficult to build. However, if done correctly, it can greatly improve visitors' experiences.

2.5.3 Non-Digital Material

Visitors at the Arboretum have expressed that they would like more signage to aid their learning about plants as well as more consistency in the information shared in tours (R. Van Fossen, sponsor interview, November 9, 2022). Non-digital material such as a signage system can help improve the quality of learning for visitors.

Signs can be an effective way to convey educational information. Wandersee and Clary (2007) published a study on a university arboretum that displayed a "large and engaging interpretive signage system." The study found that effective interpretive signs can stimulate educational conversations and plant-related discussions. With this research, they developed a set of criteria for arboreta, botanical gardens, and nature trails to follow when conveying information via signs.

The criteria for signage systems includes a 70 word limit, average sentence length of 8 words, and recommends one main topic per sign. The writing should be in a conversational style that includes questions in order to encourage critical thinking. Signs should be placed frequently and in a way that simulates having a tour guide along the paths, and topics should vary instead of strictly following a theme. Content should include scientific and common names of species as well as pictures to aid in the identification of plants (Wandersee and Clary, 2007).

We incorporated all of the findings from our research regarding the design of interpretive material to develop a digital, educational brochure based on the Lyon Arboretum's needs and limitations. Our brochure addressed the Arboretum's challenges of limited funding, unreliable internet, and tropical weather conditions. With this, we were able to achieve our goal of improving the Lyon Arboretum's self-guided tours and contribute to their mission of educating visitors about conservation, culture, and history.

3.0 Methodology

The goal of this project was to improve the Lyon Arboretum's self-guided tours by creating a digital, educational brochure. In order to do so, we identified the following objectives:

1. Determining the contents of the digital brochure
2. Researching different characteristics of digital interpretive material
3. Producing and evaluating the digital brochure

This chapter outlines the methods for gathering the information needed to complete our project objectives and the methods in producing our digital brochure.

3.1 Determining the Contents of the Digital Brochure

To determine the contents of the digital brochure, we established the Arboretum's educational goals and their target audience. This process included an on-site analysis, as well as a series of semi-structured interviews and surveys. After speaking to Raedelle Van Fossen (Lyon Arboretum's Education Manager), she clarified that the digital brochure should target any general visitor, as opposed to those within a certain age group or with a specific level of knowledge. With the target audience in mind, we proceeded to conduct an on-site analysis to assess the Arboretum's current offerings and gain perspective on the visitor experience. We toured the Arboretum and utilized their current trail map and signage which are the most frequently used visitor resources (R. Van Fossen, personal communication). This allowed our team to identify interesting attractions, as well as topics not highlighted in the material. These observations were used to supplement the responses we got from our semi-structured interviews.

We conducted in person, semi-structured interviews with the Arboretum staff to gain insight on what content to include in the brochure. Using this format, we were able to ask open-ended questions and follow-up questions based on people's responses. We interviewed staff from the Main Office, the Grounds and Collections Department, and the Education Department. Questions included topics such as visitor learning preferences and information that should be prioritized in the brochure. Refer to **Appendix A** for our interview questions.

Additionally, we conducted a survey with visitors to learn about their experiences at the Lyon Arboretum and to gain further knowledge on visitor opinions on the content of the Arboretum's current educational material. Due to the limitations of the Arboretum's capacity,

and the short timeline of this project, we surveyed 14 visitors. We approached visitors who were coming down from the main trail and into the parking lot, as this often signified the end of their visit. We also approached visitors who returned to the Visitor Center after their hike. We conducted our surveys across two weekdays since the Arboretum is not open on weekends, and between the hours of 9:00 AM and 12:00 PM. We chose the morning because we were informed by Office Manager Derek Higashi that the Arboretum sees the most visitors during that time. We informed the visitors that we were a student team from WPI working with the Education Department and asked for their consent to take part in a quick survey. Afterwards, we proceeded with the survey. Questions included topics such as popular attractions, learning preferences, as well as opinions on the current educational material. This allowed us to identify areas of improvement of the current educational material and gain insight on overall visitor experience. Refer to **Appendix B** for our survey questions.

We also regularly consulted with Van Fossen as we developed our brochure. As the Education Manager, she provided us with an in-depth idea of the Arboretum's educational needs and helped us refine our brochure to meet these expectations.

Once we had conducted our interviews with staff and our visitor surveys, we coded the responses we received by question and frequency of response. For free response questions, we counted the number of respondents who mentioned a specific idea or topic (for example, hiking or botany) in their answer. See **Appendices C and D** for the results of our interview and survey coding. After coding our interview and survey results, we identified common themes and outliers and determined which topics we should focus on based on how many respondents expressed interest.

3.2 Researching Different Characteristics of Digital Interpretive Material

In order to determine characteristics of effective, digital interpretive material, we researched existing digital material that other organizations across the United States use. The study of digital material included research on what makes the material effective and how other organizations use it within their self-guided tours.

We visited two organizations and took self-guided tours to analyze the interpretive material at these sites. These organizations were the Waikiki Aquarium and the Bishop Museum. We considered what features of the material we found most engaging and informative and which

features were not as effective from our perspectives as visitors. Analyzing how other organizations have utilized digital media provided insight on how information is conveyed effectively. We used this research to implement features from other digital media into our digital brochure.

3.2.1 Determining Characteristics of a Successful, Digital Brochure

To determine characteristics of successful, digital brochures we looked at examples from other organizations that promote learning about conservation or culture. We evaluated these brochures from our perspectives as potential visitors and decided if they were successful based on how they contributed to our learning. Our research included brochures from the San Luis Obispo Botanical Garden, the United States Botanic Gardens, the Regional Parks Botanic Garden, and the Art Institute of Chicago as shown in **Table 1**. We focused on brochure layout and design, and methods to present information. This included elements such as text to image ratio, visual presentation and layout, as well as interactive activities that could promote user engagement with the site. Along with positive characteristics of each example, we also identified negative characteristics to avoid. Our full results of this research are detailed in the following chapter.

Table 1. Example Brochures and Characteristics

Organization, Brochure	Contents of Brochure
San Luis Obispo Botanical Garden Fire Safe Garden Brochure (San Luis Obispo, CA)	Guide to the Fire Safe Garden, its features, and the plants it contains
United States Botanic Gardens (Washington, D.C.)	General overview of attractions and gardens
Regional Parks Botanic Garden (Berkeley, CA)	Notable attractions, safety, rules, general information, map, map guide
Art Institute of Chicago (Chicago, IL) Monet Paintings and Drawings at the Art Institute of Chicago	A digital catalog of the Art Institute of Chicago Monet Exhibit.

3.3 Producing & Evaluating the Digital Brochure

To develop our digital brochure, we combined our findings from our interviews (3.1) and our research of digital interpretive material (3.2). We used insights from these analyses to create a draft of our educational brochure and evaluated its effectiveness through a series of visitor surveys and consultations with the Arboretum staff. Revisions were made according to visitor and staff feedback.

3.3.1 Producing the Digital Brochure

To produce the digital brochure, we used Adobe InDesign, Adobe Illustrator, and Adobe Acrobat. Adobe InDesign was used to produce the brochure layout, and Adobe Illustrator helped create additional graphics to accompany the educational material. Adobe Acrobat was used to create interactive links on the digital file for users to navigate through the brochure. These links allow users to jump to sections of interest to easily navigate through the digital file. To organize the information, we referred to our research of digital brochures and our observations of effective brochure layout and design.

Information in the brochure was primarily provided by the Education Department of the Arboretum. However, we used the results of our visitor interviews to refine the existing information according to visitor preferences. If the Arboretum did not have information on a certain plant or topic, our team did our own research and took photos of the plants. Overall, the information provides visitors with an informal learning experience on the Arboretum's collection of plants, as well as the history and culture of Hawai‘i.

3.3.2 Evaluating the Draft Digital Brochure

In order to assess the quality of our draft digital brochure, we tested the efficacy of our brochure through a series of beta tests and surveys for two weeks, Tuesday-Friday from 9:00 AM to 1:00 PM. In order to determine efficacy, we asked visitors how informative they found the brochure and if they found it easy to use. We selected a sample of self-guiding visitors at the Arboretum. The sample group included both first-time guests and returning guests, and guests of different ages. To recruit the visitors for the sample, we approached guests at the start of their visit and asked them if they had a mobile device and would like to participate in our beta test. We informed them that the digital brochure we were testing would provide educational content about

the Arboretum. After receiving consent, we helped them download the brochure onto their mobile devices.

To give them access to the brochure, we had a QR code that they scanned with their mobile device to download it. We made sure that they were near enough to the Visitor Center to download the brochure without experiencing significant connectivity issues. For visitors that had issues loading the brochure onto their Apple devices, we offered them the option to allow us to Airdrop the brochure to their phones, as it allowed them to load the brochure instantly. Once they downloaded it, we instructed them to use the brochure throughout the Arboretum as they saw fit and to return back to the Visitor Center at the end of their visit to complete an online survey. Questions included topics such as ease of use, learning effectiveness, and whether the digital brochure positively or negatively affected their experience at the Lyon Arboretum. Refer to **Appendix E** for our survey questions.

Once we had conducted our beta test, we coded the responses we received by question and frequency of response. See **Appendix H** for the results of our survey coding. After coding the responses, we identified common themes and outliers in the feedback.

Based on the visitor responses to this survey, we revised our digital brochure to account for any limitations, while making sure to not remove any features that they found effective. After completing our revisions, we conducted a second round of beta tests. We followed the same procedure that we used for our initial beta tests.

3.3.3 Future Maintenance of the Digital Brochure

After our team developed a final brochure for the Lyon Arboretum, we implemented a plan for the Arboretum to maintain the digital brochure. The plan ensured that the brochure will be accessible and can be edited by the Arboretum staff. We also created a QR code that directs users to the PDF file. This can be printed and displayed in the Visitor Center.

Along with the PDF of the brochure, we provided the Arboretum with the editable Adobe Illustrator and Adobe InDesign files for the digital brochure. This will allow the Arboretum to make future revisions and updates to the digital brochure.

3.4 Ethical Considerations

As much of our knowledge of visitor preferences and the Arboretum's needs came from semi-structured interviews and surveys, we maintained a standard of ethical interview practices. All interviewees provided verbal consent before beginning an interview. They were also informed of what we intended to do with their responses. We asked for permission before recording the interview or quoting them in our findings, and we let them know that they are not obligated to answer all of our questions. By doing this we hoped to foster a relationship of gratitude and mutual consideration with our interviewees.

Since the Arboretum is popular among students and families, we also took special consideration when working with children and did not interview anyone under the age of 18.

Since we also interviewed employees of the Arboretum and presented our findings to some of the department managers, we took special consideration so as to avoid asking questions that may jeopardize their employment or reputation at the Arboretum. In addition to this, employees were also extended the offer of anonymity. Our research and methodology was approved by WPI's Institutional Review Board IRB-23-0323.

4.0 Findings and Analysis

In order to achieve our goal of improving the Lyon Arboretum's self-guided tours by creating a digital, educational brochure, we accomplished the objectives detailed in the Methodology chapter. This chapter outlines the findings we gathered for each objective.

4.1 Determining the Contents of the Digital Brochure

Figure 2. Lyon Arboretum Trail Map

Our first step in achieving this objective was conducting an on-site analysis of the Arboretum's current educational material for visitors. This involved utilizing the Arboretum's trail map (shown in **Figure 2**) and signage to navigate through the gardens and learn about the plants. Only two out of the ten gardens provided signs with more information than just basic plant names and origin.

One of these gardens is the Ethnobotanical Garden. We found the signs to be informative and engaging, and we particularly liked the icons they use to indicate the cultural significance and uses of each plant. This sign is shown in **Figure 3**. We found it interesting to learn about all of the uses of the plants but sometimes struggled to remember what each icon represented after we had walked away from the sign.

Figure 3. Ethnobotanical Garden Key

There were other informative signs as well. **Figure 4** shows another one of the Arboretum's educational signs. Beyond the signs in the Ethnobotanical and Native Hawaiian Gardens, the signs only displayed plant names and origins and had no information about uses, history or culture.

Figure 4. Lyon Arboretum Educational Sign

By conducting our on-site analysis we determined that the Arboretum does not have an even distribution of educational signs throughout all of their gardens. In order to address this, we included educational information about the prominent sections of the Arboretum in our brochure. In addition to identifying effective features such as the labels in the Ethnobotanical Garden, we determined some aspects of the Arboretum's existing educational material that we wanted to avoid.

We noticed that some of the educational signs in the gardens had large paragraphs of text with few images. We found these signs less inviting to read and therefore less engaging. When we were creating our brochure, we made sure not to fill pages up with text and include plenty of photos to make the information less overwhelming for visitors.

Our second step was conducting semi-structured interviews with the Arboretum staff. We interviewed five staff members in total and coded the results of each interview to identify themes and patterns in their responses. We interviewed Derek Higashi (Office Manager), Taylor Amalato (Front Office Associate), Aziz Agis (Education Associate), Richard Sears (Research Support in Grounds and Collections), and Līloa Dunn (Grounds and Collections Manager). See **Appendix C** for the results of our staff interview coding.

Our interviews with the Arboretum staff gave us information about their interactions with visitors. These interviews gave us insight into what visitors are most interested in, as well as what topics are important to the Arboretum staff. This information will help us cater our brochure to our target audience.

From our interviews, we noticed a contrast between visitor interests and the Arboretum's educational goals. According to the staff members, visitors are most interested in native Hawaiian plants, birds, and hiking/the waterfall. We also learned from staff members that tourists often go to the Arboretum for hiking or walking through the gardens, while locals may come simply to get away from the city, to have a picnic, or to bring their families. In contrast, the staffs' priorities were for visitors to learn more about the history of the Arboretum and the research and conservation efforts that are taking place there. They also wanted visitors to leave with a greater cultural understanding and to encourage them to respect the land and work to protect it. In order to address this issue, we included information and topics that are important to both of these groups. That way, visitors have an opportunity to learn about the history and mission of the Arboretum in addition to the topics they are interested in.

Our third step in determining the contents of the brochure was to conduct a survey with arboretum visitors. We surveyed a total of 14 visitors; half of the visitors were over the age of 50, with the rest being primarily between the ages of 26-40 years old. A total of 71.4% of the surveyed visitors were tourists, and 57.1% (of the total surveyed visitors) were visiting the Arboretum for the first time. Most of the surveyed visitors completed the survey alone (not with another person within their group), though we had two groups where more than one member completed the survey. We coded the responses from the surveys to determine themes and patterns and utilized the analytical features built into Google Forms. See **Appendix D** for the complete table of coded survey responses.

From this survey, we learned that only two out of the fourteen respondents had never been to a botanical garden or arboretum before while the rest had at least been to a few. The respondents also had a wide variety of reasons for visiting. Three came to enjoy nature, three came to see plants, and the rest were mostly varied. We also learned that many of the visitors we surveyed considered themselves to have a minimal understanding of botany or Hawaiian culture, as shown in **Figure 5**.

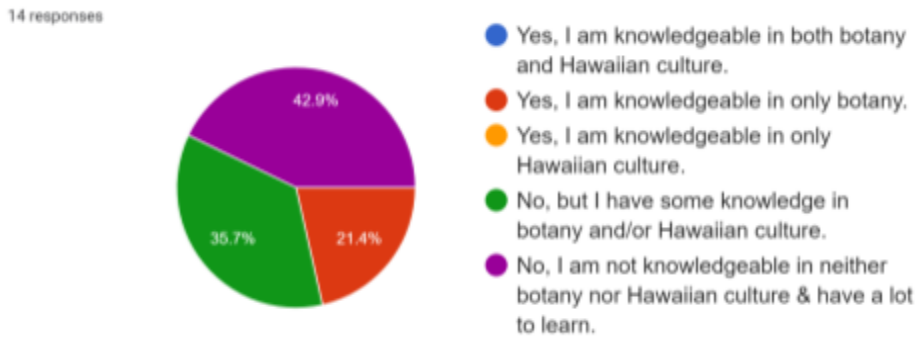


Figure 5. Responses to Survey Question "Do you consider yourself knowledgeable in botany and/or Hawaiian culture. Or do you feel like you have a lot to learn?"

While visitors may be generally uninformed about botany and Hawaiian culture, many are interested in these topics. Knowing this, we made sure to present information about these topics in a way that was not overwhelming. We used pictures to accompany text, and refrained from using complex words so that uninformed visitors could understand and learn something new from the material.

In terms of what the visitors think of the existing material, almost half of them found the signs and trail map to be helpful, but multiple respondents indicated that they could both be improved. Some respondents also said that they would have liked more plant labels. When visitors were asked in an open-ended question what they would have liked to see, the two most popular responses were plant information and a bird guide while the other responses varied, as shown in **Figure 6**. The full results of the survey coding can be seen in **Appendix D**.

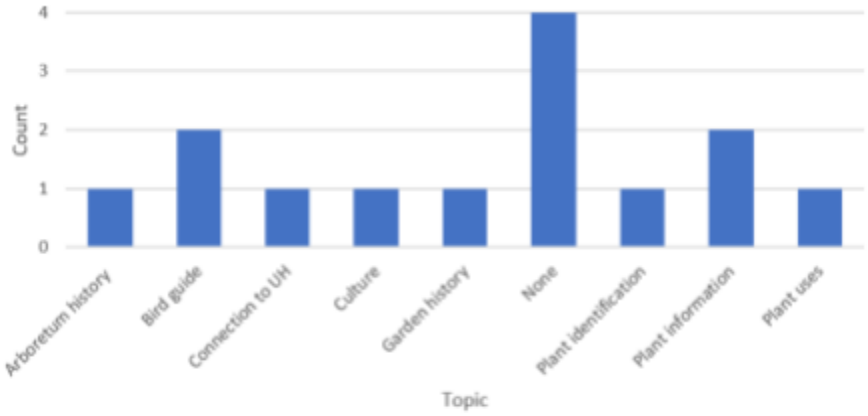


Figure 6. Number of Responses Per Topic (out of 14)

4.2 Researching Different Characteristics of Digital, Interpretive Material

In order to determine positive and negative characteristics of digital, interpretive material we looked at what other organizations across the United States are providing to their visitors. We evaluated a total of six different interpretive materials from different organizations. Four were digital brochures, while two were interactive tablets located throughout exhibits. Each organization was related to either education or botany. We were able to visit two sites in person while we evaluated the others through their available online materials. We conducted on-site

analyses at the Waikiki Aquarium and the Bishop Museum to evaluate their digital, interpretive material from our perspectives as visitors.

From our analysis, we identified positive characteristics such as clear information, interactive display, and ease of use. Characteristics that hindered our experience included a high text to image ratio, disorganized content, and too much or too little information. For example, at the Bishop Museum, there was a tablet that displayed a large tree where each of the branches presented information. The interactive tablet was engaging as visitors could zoom in to the branches that interested them the most. A downside to this exhibit was that because there were so many branches, it was difficult to read all the information within a reasonable period of time or select which branch to prioritize. For a more detailed explanation of all the material analyzed, see **Appendix F**.

When we visited the Waikiki Aquarium and the Bishop Museum, we found their interactive elements to be the most engaging. For this reason we wanted to incorporate similar features in our brochure. This allows visitors to choose what they want to learn about and helps to not overwhelm them with information.

When we reviewed online brochures from other organizations we found that diagrams and timelines were an effective way of communicating information. They caught our attention more than plain text with images. We applied this thinking to our digital brochure and used a timeline to illustrate the history of the Arboretum in a more dynamic and concise way. We also noted how the Regional Parks Botanical Garden maintained a consistent theme throughout their brochure. We found this helped the brochure feel complete and professional, so we chose a theme for our digital brochure and kept it consistent throughout each page.

4.3 Producing and Evaluating the Digital Brochure

After concluding our staff interviews, visitor surveys, and interpretive material research, we used our findings to create our digital, educational brochure. We had to find a balance between informational content and visual design. We curated the informational content based on our staff interviews and visitor surveys. The inspiration for our brochure design was based on our interpretive material research and personal observations.

4.3.1 Producing the Brochure

After determining the contents of the brochure, we began producing the brochure and laying out the information. We had to create a balance between botanical and cultural information. Using our previous research on interpretive material, we also made sure that our brochure was intuitive, clear and concise, and would not overwhelm visitors. We also considered the order in which the content would be presented in the brochure to best communicate the information and ideas.

We started the brochure with a title page, followed by a contact page and the Table of Contents. We wanted our brochure to be clear and straightforward to use so that visitors can utilize the brochure with ease, and so we included an instructional guide to aid those less familiar with the technology. The instructional pages explain how to use the links within the brochure. It also provides visitors with two different ways they may navigate through the brochure, as shown in **Figure 7**. We realized that individuals may utilize the brochure differently based on their learning preferences. Option 1 "Scroll as you go" involves visitors scrolling through the entire brochure and is catered to visitors who enjoy looking at every plant in each garden. Option 2 "Choose your own adventure" gives visitors the ability to jump to their topics of interest without having to scroll through the entire brochure. The Table of Contents consists of a section about the Lyon Arboretum, historical context, a trail map, and sections for each garden and attraction. The list of the gardens is ordered based on when they appear along the trail, with the Visitor Center and Parking Lot paths being the first area that visitors encounter and ʻAihualama Falls being the last attraction on the main trail. We did this so that visitors who choose to utilize the brochure with Option 1 can follow the brochure easily as they make their way through the trails. After the instructional guide, the brochure has a few pages on safety information that includes a link to the Lyon Arboretum website for additional information.

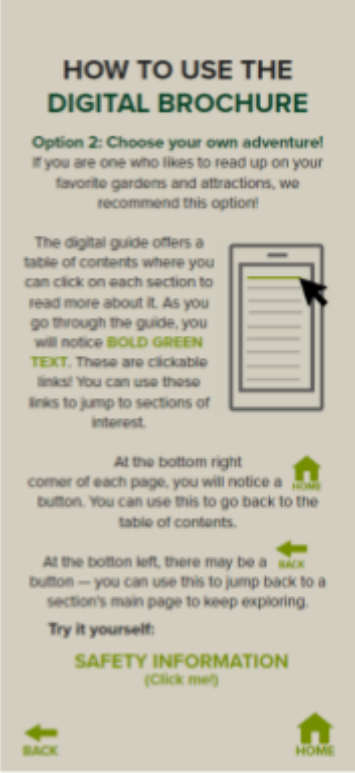


Figure 7. Page from Digital Brochure Instructional Guide

We divided the brochure based on the individual gardens to allow visitors to familiarize themselves with the different plants in those sections. Each garden has a short description of the

collection, an overview photo, and interactive links to various prominent plants in the collection. Each plant includes a photo, common and scientific name, origin, family, and a description, as shown in **Figure 8**. Some descriptions are short, while others are longer, especially those in the Native Hawaiian and Ethnobotanical sections since we wanted to incorporate as much about Hawaiian culture as possible. A long description of kalo was included because of its cultural significance (R. Sears, personal communication), as well as long descriptions of *Albizia*, a common ornamental tree that has become invasive in Hawai'i, and other invasive plant species to emphasize their impacts.

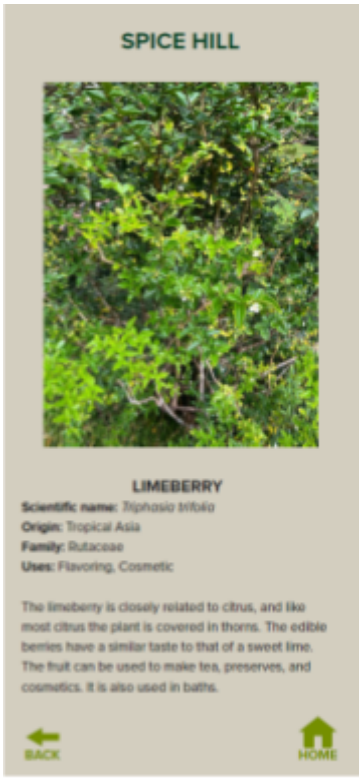


Figure 8. Example of Plant Description Page

Although the primary focus of the brochure is to educate visitors on botany, culture, and wildlife, we included a trail map to provide an overview of the Arboretum. However, we included a statement that we recommend to use the digital brochure alongside the paper trail map that is provided at the Visitor Center, as our brochure is not intended to be used for navigation.

To collect the content of the brochure, most of the information came from the Lyon Arboretum website or was sent to us directly from the staff. In the case that a plant did not have any information, we researched and wrote a brief description about it. The Arboretum provided many of the photos, however, for some gardens they had few or no photos of the plants. Thus, our team took our own photos of the prominent plants in that section. One downside to this was that many plants at the Arboretum were not in bloom at the time, and so the photos we took were less recognizable and would need to be replaced in the future. The last sections highlighted ‘Aihualama Falls, which is the Arboretum’s waterfall, and additional wildlife. We made sure to include information about birds as that was a common suggestion from our visitor surveys. Other wildlife such as mongooses and poison dart frogs were also highlighted in this section.

After we collected all of our information, we began to organize it in the PDF file. Before we could settle on a consistent theme for our brochure layout and design, we had to determine if it was accessible. See **Appendix G** for details on this aspect of producing the brochure.

Once most of the content and layout of the brochure was finalized, we presented it to Van Fossen and other staff members from the Education Department. They gave us some initial notes and we made a few adjustments before sending the next draft to the rest of the Arboretum staff for additional feedback.

4.3.2 Evaluating and Revising the Brochure

In order to evaluate our brochure, we had the staff review our digital brochure and provide feedback. In this feedback, there were many content-related suggestions. Some of these suggestions included adding and removing specific plants, proper formatting of scientific plant names, and updating information on the layout of certain gardens.

We also conducted a beta test of our brochure and surveyed visitors about their experiences using it. We received feedback from visitors about features they liked or did not like, how easy it was to use, and what they would like us to improve. Visitors expressed that the brochure was well organized, though some improvements could be made to help them navigate through the brochure easier. One visitor suggested including the mainland common name of the plants to help users easily identify them. Throughout the brochure, we included the Hawaiian common names of the plants as a way to promote Hawaiian culture. However, one visitor expressed that they had difficulty identifying certain plants in the brochure that they otherwise would have recognized if they were provided with the plants mainland common name (for example, turmeric in our brochure is labeled with its Hawaiian name, ʻolena). Thus, we decided to include the Hawaiian name of the plant along with the name that mainlanders may be more familiar with in parenthesis, for example, ʻolena (turmeric). That way, the brochure can still promote Hawaiian culture while also making it easy to navigate for the average touring visitor. Similarly, the visitor also shared that alphabetizing the plant names on the garden menu would help promote easier navigation. Thus, we also took this into consideration and made changes accordingly.

In regards to staff feedback, they suggested adding more plants, particularly those that were culturally significant to Hawaiʻi and the Arboretum as a whole, as well as correcting misspelled Hawaiian words. We made revisions accordingly before conducting our second round of beta tests.

One challenge that we had during our first round of beta tests was the internet connectivity issues. Due to the lack of cellular service in the mountains, visitors had issues loading and downloading the brochure. We noticed a contrast between Android and Apple devices, however. When Android users would scan the QR code, the brochure would immediately download and save onto their device, allowing them to use the brochure offline immediately. In contrast, when Apple users would scan the QR code, the brochure would first load into their browser, which did not guarantee that the brochure would be available to them offline. Therefore, we advised Apple users to save the brochure to their "Files" app so that users can access the brochure without internet connection.

With the internet issues in mind, we also offered Apple users the option of having our team AirDrop (Apple's file sharing software) the brochure to their phone so visitors could access the brochure instantly. This may not be the most efficient way for the Arboretum to distribute the brochure in the future, however our team utilized this method to increase the number of visitors able to participate in our beta test.

After we completed the revisions, we conducted a second round of beta tests with the revised brochure. Visitor feedback included improving the trail map, incorporating trivia questions, and adding more cultural information. See **Appendix H** for the full beta test results coding. With all of the feedback, we made final revisions to the digital brochure before presenting it to the Arboretum. See **Appendix I** for our final draft of the digital, educational brochure.

5.0 Recommendations

The following chapter contains our recommendations for maintenance, revision, and implementation of the brochure in the future. We also discuss suggestions we have for alternative uses for the brochure, such as with students and tour groups.

5.1 Future Maintenance and Revisions

We recommend that the Arboretum continues to evaluate and update the digital brochure we have developed. They have access to the editable Indesign file, allowing them to edit it as they see fit and to accommodate changes at the Arboretum. Although we have used our research to cater to the Arboretum's typical visitor, employees of the Arboretum may be able to use their expertise to highlight important aspects of plants or attractions we may have missed. This may also include updating the garden and plant information if changes occur. For example, if a plant is removed from a garden, it should be removed from the brochure, or relocated to another section. To make such edits, the Arboretum should maintain access to Adobe Acrobat and Indesign, as well as ensure that someone on staff has experience with Adobe Creative Cloud software.

Since some photos needed for the brochure were not a part of the Arboretum’s archive of photos, our team went out and took photos of plants ourselves. Some of our photos do not allow easy identification of the plants because they were not in bloom at the time. While these photos can be used temporarily, we recommend that the Arboretum staff take photos of those plants once they bloom and replace the existing photos in the brochure.

Additionally, due to the limited timeline of our project, there were some elements that we would have liked to incorporate but could not. For instance, our team enjoyed the icons from the Ethnobotanical Garden and wanted to include them in our brochure since they provided information related to culture and plant use. However, due to the limited time, we were not able to receive the files of the icons. Once the Arboretum is able to locate these files, we recommend they revise the brochure and incorporate them in that section. That way, visitors will be able to refer back to the information as they travel through the Ethnobotanical Garden, as opposed to having to walk back to the sign, which will help provide visitors with an immersive educational experience.

5.2 Implementing the Brochure

While testing our brochure, we approached visitors at the Visitor Center and had them download the brochure there. The poor cellular connection prevented many people from downloading the brochure, and currently there is no guest WiFi for them to use. During rainy weather, the connection becomes even worse. To ensure that visitors are able to download the brochure, we recommend they do so before coming to the Arboretum and store it on their device. To implement this, we recommend that the Arboretum provide a link to the digital brochure on their website, particularly on their "Visit" page, on their homepage (where the reservation link is), as well as on their booking confirmation page. That way, visitors who are planning their trip to the Arboretum will have access to the digital brochure and will be able to load it onto their device before their arrival.

In addition to distributing the brochure, providing visitors with guidance on how to use it will be vital. Although we provide an instructional page in our brochure, visitors often do not read the information thoroughly. Thus, we recommend that the Visitor Center provides visitors with a brief, verbal instructional guide on how to use the brochure such as informing visitors on how to use the clickable links. It may also be helpful to have instructions printed and hung up inside the Visitor Center along with a QR code for visitors who may not have downloaded the brochure prior to their arrival.

5.3 Using the Digital Brochure with Tour Groups

The Arboretum offers guided tours for visitors, often led by docents or staff from the Education Department. We recommend the Arboretum to offer the digital brochure to the visitors so they can follow along the tour with their phones. As the Arboretum will have access to the editable file of the brochure, they may add or remove plants to better correspond with the guided tours. Therefore, if a plant or topic were to come up during the tour that a visitor would like to learn more about, they can use the digital brochure to fulfill this.

Similarly, higher level school groups, such as university groups, come to the Arboretum to go on self-guided tours. Thus, we recommend that the Arboretum offers the digital brochures to these school groups as well. Professors bringing students to the Arboretum have their own expertise and knowledge on the plants, and may follow a certain itinerary to match the curriculum. However, having the digital brochure may bring certain plants, topics, and

attractions to attention that professors may have otherwise overlooked, such as culture and conservation. Encouraging use by visitors that opt to do self guided tours will help the Arboretum achieve their mission of educating visitors on botany, culture, and conservation.

6.0 Conclusion

Throughout this project our team used various resources to create an interpretive, digital brochure for the Lyon Arboretum. We created our brochure based on direct feedback from Arboretum visitors and staff, and we applied what we learned about best practices in the design of materials for informal learning

With our brochure, the Arboretum can now put information at the fingertips of their visitors. This resource will encourage learning and hopefully lead to more curiosity in regards to botany, conservation, and Hawaiian culture among Arboretum visitors. We hope our digital brochure will help Lyon Arboretum achieve its mission “to inspire and cultivate the conservation of tropical plant biodiversity, and connect it to the culture of Hawai‘i through education and research.”

References

Atik, D., Zülfikar, H. C., & Bayrak, G. (2016). A research on arboretums within tourism concept. *International Scientific Conference, 4*, 240-243. https://avesis.istanbul.edu.tr/yayin/9d7f94b3-5130-46a9-a871-9b62e59fa9ac/a-research-on-arboretums-within-tourism-concept

Ballantyne, R., Packer, J. & Hughes, K. (2008). Environmental awareness, interests and motives of botanic gardens visitors: implications for interpretive practice. *Tourism Management, 29*(3), 439-444. 10.1016/j.tourman.2007.05.006

Chaminade University of Honolulu. (2018). Out in the field at Lyon Arboretum. *Chaminade University of Honolulu*. https://chaminade.edu/5327/out-in-the-field-at-lyon-arboretum/.

Connell, J. (2004). The purest of human pleasures: the characteristics and motivations of garden visitors in Great Britain. *Tourism Management, 25*(2), 229-247. https://doi.org/10.1016/j.tourman.2003.09.021

Falchuk, B. (2009). Visual and interaction design themes in mobile healthcare. *6th Annual International Conference on Mobile and Ubiquitous Systems: Computing, Networking and Services*, 1-10. https://doi.org/10.4108/icst.mobiquitous2009.6751

Kim, E., Gassenheimer, J., Theofilou, A., & Campbell, S. (2022). Creating an educational exhibit on pollinator ecology. *Worcester Polytechnic Institute*. https://digital.wpi.edu/show/9593tz18c

Kondlo, A., Henney, A., Bagula, A., Ajayi, O. & Van Breda, L. (2020). Self-guided virtual tour using augmented reality. *ITU Kaleidoscope: Industry-Driven Digital Transformation (ITU K)*, 1-5. DOI: 10.23919/ITUK50268.2020.9303209.

Postolache, S., Torres, R., Afonso, A.P., Carmo, M.B., Cláudio, A.P., Domingos, D., Ferreira, A., Barata, R., Carvalho, P., Coelho, A.G. & Duarte, M.C., (2022). Contributions to the design of mobile applications for visitors of botanical gardens. *Procedia Computer Scienc*e, *196*, 389-399. https://doi.org/10.1016/j.procs.2021.12.028

Rickinson, M., Dillon, J., Teamey, K., Morris, M., Choi, M.-Y., Sanders, D., & Benefield, P. (2004). A review of research on outdoor learning. *London: National Foundation for Educational Research.* https://resources.informalscience.org/sites/default/files/Review%20of%20research%20on%20outdoor%20learning.pdf

Tal, T., & O. Morag. (2007). School visits to natural history museums: teaching or enriching? *Journal of Research in Science Teaching* 44(5), 747–769. https://doi.org/10.1002/tea.20184

University of Hawai‘i at Mānoa. (2022). Lyon Arboretum: history and mission. *University of Hawai‘i at Mānoa.* https://manoa.hawaii.edu/lyon/about/history-and-mission/.

Wandersee, J. H., & Clary, R. M. (2007). Learning on the trail: a content analysis of a university arboretum’s exemplary interpretive, science signage system. *The American Biology Teacher*, *69*(1), 16–23. https://doi.org/10.2307/4452076

Xu, H., Cui, Q., Ballantyne, R., & Packer, J. (2013). Effective environmental interpretation at Chinese natural attractions: the need for an aesthetic approach. *Journal of Sustainable Tourism, 21*(1), 117-133. https://doi.org/10.1080/09669582.2012.6817

Appendices

Appendix A: Interview Questions for Arboretum Staff

Below are the interview questions our team asked the Arboretum staff. These interviews provided us insight on popular attractions, topics visitors often ask questions about, and what topics staff members would like to see in the brochure.

Introduction:

Hello! We are a team of students from Worcester Polytechnic Institute who are working with the Lyon Arboretum to develop a new digital, educational brochure for visitors. Thank you for agreeing to sit down with us and answer a few of our questions about your experiences as an employee at the Lyon Arboretum, particularly in regards to visitor preferences. Your responses will inform our decisions about the content we will include in our digital brochure. Before we get started with our questions, we wanted to ask for your permission to record the interview and take notes. With your permission we might also quote your responses, but if you prefer to remain anonymous then we will not reveal your name. Also, you do not need to answer every question if you do not want to, and you can leave the interview at any time.

Question	Target Group
How long have you worked/been volunteering at the Arboretum?	Education Department, Main Office, Grounds Department
How many visitors do you interact with a day?	Education Department, Main Office, Grounds Department*
Can you walk us through your process of deciding what to talk about during a tour? Do you change topics depending on the interests of your audience?	Education Department
From your perspective, do visitors seem satisfied with the tour guide experience? Do they often request additional information? If yes, how do you typically go about supplying that?	Education Department, Main Office

Are there some specific topics that visitors are often most interested in?	Education Department, Main Office, Grounds Department*
What are some attractions that are particularly popular with visitors?	Education Department, Main Office, Grounds Department*
Do you find that there is often a large difference in preferences and intentions between local visitors and tourist visitors?	Education Department, Main Office, Grounds Department*
If you were making a comprehensive educational brochure, what are some topics or facts that you would make sure to include? Is this topic typically interesting to visitors, helps further the Arboretum's mission, or just a personal favorite?	Education Department, Main Office, Grounds Department
From your perspective as a local, what Hawaiian cultural aspects and lessons would you want tourists to learn about/take away from their time at Lyon Arboretum?	Education Department, Main Office, Grounds Department

*The Grounds Department may not have a lot of visitor interaction, however their knowledge of the grounds and experience at the Arboretum provided useful information.

Appendix B: Survey Questions for Arboretum Visitors

Below are the survey questions we asked Arboretum visitors. These survey responses provided us insight on attractions and topics that visitors are interested in and would like to learn more about. In addition to this, these surveys also provided insight on the visitor's opinions and experiences on the current educational material at the Arboretum.

Introduction:

Hello! Thank you for participating in the survey. We are a team from Worcester Polytechnic Institute in Massachusetts, and we are working with Lyon Arboretum to improve their self-guided tours by creating a new digital, educational brochure. We are collecting data on visitor experience and learning preferences to help determine the contents of the brochure.

Participants do not have to answer all of the questions if they are not comfortable, though we greatly appreciate as much feedback as possible. Data gathered from the survey will be used to help develop the digital brochure and will be referenced in our final report, though will not be published elsewhere.

Once again thank you for your time,
WPI Team

Questions:

- First name, last initial?
- Age range?
- How did you hear about this survey?
- Are you a Hawai‘i resident?
- Is this your first time visiting the Lyon Arboretum? If not, how many times have you visited?
- Have you been to a lot of other arboreta or botanical gardens?
- What motivated you to visit the Lyon Arboretum today? Do you feel as if you got as much out of your visit as you were hoping to?
- Do you consider yourself knowledgeable in botany and/or Hawaiian culture? Or do you feel like you have a lot to learn?

- Would you say you have high, moderate, or little interest in learning about wildlife conservation?
- Would you say you have high, moderate, or little interest in learning about Hawaiian culture and history?
- Which of the Arboretum's educational material have you utilized? For example, have you used the trail map, the brochures, or the signage in the gardens?
- Do you feel that your use of educational material helped or hindered your experience and why?
- What were some effective qualities of the material you interacted with, and what qualities do you think need improvement?
- What additional topics would you have liked to be included in the educational material?
- Have you used digital, educational or guide material at these other establishments (museums, zoos, other botanical gardens)? If yes, what kind of material was it and what aspects did you enjoy about it?

Appendix C: Staff Interview Response Coding Table

Below are the full results of our interview coding of the staff responses. This provided us insight on the staff's perspectives of the visitors and the topics that they want visitors to learn about. The "Totals" column shows the count of each topic/category for each question, which allows us to identify responses that share similar sentiments.

Question	Categories	Derek Higashi (Office Manager)	Taylor Amalato (Front Office Associate)	Aziz Agis (Education Associate)	Richard Sears (Research Support in Grounds and Collections)	Līloa Dunn (Grounds and Collections Manager)	**TOTALS**
How long have you worked/been volunteering at the Arboretum?	n/a	14 years	three weeks	since 2017	since 1995	15-16 years	
How many visitors do you interact with a day?	n/a	60 to 100 (one person from each party)	about 50	biggest tour is 30, minimum 3	average of 5	a couple visitors a week	
Can you walk us through your process of deciding what to talk about during a tour? Do you change topics depending on the interests of your audience?	Topics change based on the audience			x			1

	Try to stay on topic			x			1
From your perspective, do visitors seem satisfied with the tour guide experience? Do they often request additional information? If yes, how do you typically go about supplying that?	Visitors want more plant information	x					1
	We refer them to the website	x					1
	Visitors seem satisfied		x				1
	Yes, when the guide is knowledgeable			x			1
	Visitors often ask for more information			x			1
	Get job inquiries			x			1

	Curious about how plants are/were used				x	x	2
	People are interested in stories				x		1
Are there some specific topics that visitors are often most interested in?	Hiking	x				x	2
	Native plants	x	x	x		x	4
	Birds	x	x			x	3
	Rainbow eucalyptus		x				1
	Plants in specific regions			x			1
	"What is an arboretum?"			x			1
	Palms			x			1
What are some attractions that are particularly popular with visitors?	Inspiration point	x					1
	Buddah statue	x					1

	Waterfall	x		x		x	3
	Hiking	x		x			2
	General scenery			x			1
Do you find that there is often a large difference in preferences and intentions between local visitors and tourist visitors?	Tourists are more interested in plants	x					1
	Locals bring their families	x					1
	Locals are interested in native plants	x		x			2
	Tourists take pictures and view nature		x	x			2
	Locals come more casually		x				1
	Locals feel entitled to the land			x			1

	Tourists see it as a vacation opportunity			x			1
	Locals are interested in cultural practitioners			x			1
If you were making a comprehensive educational brochure, what are some topics or facts that you would make sure to include? Is this topic typically interesting to visitors, helps further the Arboretum's mission, or just a personal favorite?	The number of plants/total acreage	x					1
	How long the trails are	x					1
	More detailed map with all of the trails	x					1
	Arboretum history		x	x	x		3

	Emphasize goal of protecting plants		x			x	2
	Watershed restoration history			x	x		2
	Hawaiian rare plant program			x		x	2
	Research aspect			x	x		2
	Safety information			x			1
	Hiking etiquette			x			1
	Recommended attire			x			1
	Mission of conservation, education, outreach				x	x	2
	Micropropagation lab					x	1

From your perspective as a local, what Hawaiian cultural aspects and lessons would you want tourists to learn about/take away from their time at Lyon Arboretum?	Ethnobotanical Garden	x					1
	Appreciating the land (mālama ʻāina)	x		x	x		3
	Take care of plants and animals		x				1
	This land is sacred and should be respected		x		x		2
	The real meaning of aloha			x	x		2
	The definition of ʻāina			x	x		2
	The importance of being in a collective				x		1
	Taro collection					x	1
	Traditional house					x	1

Appendix D: Visitor Survey Response Coding Table

Below are the full results of our survey response coding for our visitor surveys. This provided us with insight on the demographic information of our respondents, their levels of background knowledge and interests, and their preferences for certain topics and attractions. The “Totals” column shows the count of each topic/category for each question, which allows us to identify responses that share similar sentiments.

Question	Categories	1	2	3	4	5	6	7	8	9	10	11	12	13	14	**TOTALS**
First name, last initial?	n/a															
Age Range?	<18															0
	19-25						x									1
	26-30			x						x					x	3
	31-39		x			x								x		3
	40-50															0
	>50	x			x			x	x		x	x	x			7
How did you hear about this survey?	WPI Student Team Member	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14
Are you a Hawai'i resident?	Yes					x			x			x		x		4
	No	x	x	x	x		x	x		x	x		x		x	10
Is this your first time visiting the Lyon Arboretum? If not, how	Yes			x	x		x	x			x		x	x	x	8
	No, I have been here twice					x			x	x						3

many times have you visited?	No, I have been here more than twice	x	x								x				3
Have you been to a lot of other arboreta or botanical gardens?	Yes, I have been to many	x	x						x		x			x		5
	No, this is my first time										x				x	2
What motivated you to visit the Lyon Arboretum today? Do you feel as if you got as much out of your visit as you were hoping to?	Peaceful setting/leave town	x				x										2
	Enjoy nature	x						x						x		3
	I visit whenever I am on the island		x													1
	Convenient location (right up the street)			x												1
	Brought by a friend				x					x						2
	See plants					x		x		x						3
	Birding							x								1
	Bringing a friend								x			x				2
	Interest in Hawaiian tropics												x			1
	Bring 2 year old son													x		1
	Waterfall														x	1
Do you consider yourself knowledgeable in botany and/or Hawaiian culture?	Yes, I am knowledgeable in both															0

Or do you feel like you have a lot to learn?	Yes, botany		x					x				x				3
	Yes, Hawaiian culture															0
	No, but some knowledge in either one	x			x		x			x	x					5
	No, I have a lot to learn about both			x		x			x				x	x	x	6
Would you say you have high, moderate, or little interest in learning about wildlife conservation?	Low interest															0
	Moderate interest				x	x			x			x	x	x	x	7
	High interest	x	x	x			x	x		x	x					7
Would you say you have high, moderate, or little interest in learning about Hawaiian culture and history?	Low interest														x	1
	Moderate interest				x	x	x	x					x	x		6
	High interest	x	x	x					x	x	x	x				7
Which of the Arboretum's educational material have you utilized? For example, have you used the trail map, the brochures, or the signage in the gardens?	Trail map	x	x	x	x		x	x	x	x	x	x	x	x		12
	Brochure					x										1
	Signage	x			x		x	x	x	x	x	x	x		x	10
	Other															0

Do you feel that your use of educational material helped or hindered your experience and why?	Signs are helpful	x							x	x	x	x			x	6
	Signs are informational	x														1
	Information corresponds to what is seen in the gardens	x														1
	Trail map is helpful			x			x		x			x		x		5
	Learned plant names				x											1
	Still got lost								x							1
	Connected to culture and history										x					1
What were some effective qualities of the material you interacted with, and what qualities do you think need improvement?	Better trail signage	x									x			x		3
	Good cultural/botanical signs	x			x					x						3
	More detailed trail map		x					x					x	x		4
	More plant labels			x						x			x			3
	The key for Ethnobotanical Garden plant uses should be posted so that people can refer to it later						x									1
	More variety								x							1

	Good plant labels										x			x		2
	Use of Hawaiian names										x					1
	Bigger signs											x				1
	Had unanswered questions												x			1
What additional topics would you have liked to be included in the educational material?	Plant information			x										x		2
	Garden history			x												1
	Plant identification						x									1
	Bird guide							x				x				2
	Arboretum history and maintenance							x								1
	Learn about the connection to UH								x							1
	Culture									x						1
	Plant uses									x						1
Have you used digital, educational or guide material at these other establishments (museums, zoos, other botanical gardens)? If yes, what kind of material was it and what aspects did you enjoy about it?	Weather-beaten signs	x														1

	Access to lots of in-depth information	x											x			2
	Plant or animal reference sheet						x									1
	Different gardens were easier to identify							x								1
	More plant information							x		x						2
	Maps had good visuals								x							1
	Easy to use										x					1
	QR code										x					1
	Saves paper										x					1
	Picture this App													x		1

Appendix E: Survey Questions for Visitors (During Beta Testing Stage)

Below are the survey questions we asked visitors when we beta tested our draft digital brochure. These questions were distributed after the visitors used the digital brochure as they hiked and walked through the gardens. This provided us with insight on how effectively our brochure was able to present information, how easy it was to use, as well as any overall feedback from the visitors. Answers from this survey were used to make revisions in our brochure.

Introduction:

Hello! Thank you for participating in the survey. We are a team from Worcester Polytechnic Institute in Massachusetts, and we are working with Lyon Arboretum to improve their self-guided tours by creating a new digital, educational brochure. We are beta testing our digital brochure, and would like visitors to participate. Visitors will be able to use the digital brochure however they see fit, and will fill out a feedback survey at the end of their hike.

The feedback from the survey will help us make revisions to the digital brochure and will be referred to in our final report. However, participants are not required to answer every question if they do not feel comfortable doing so.

Once again thank you for your time,

WPI Team

Questions:

- Please enter your first name and last initial (example: John S)
- How did you gain access to this survey?
- Age range
- Do you live locally? If not, where are you from?
- Is this your first time visiting the Lyon Arboretum? If not, how many times have you visited?
- What motivated you to visit the Lyon Arboretum today?
- Have you been to a lot of other arboreta or botanical gardens?
- Would you say you have high, moderate, or little interest in learning about wildlife conservation?

- Would you say you have high, moderate, or little interest in learning about Hawaiian culture and history?
- In general, would you say your experience with our digital brochure was positive, negative or neutral?
- Can you briefly summarize your experience at the Arboretum today and tell us how you utilized the brochure?
- What were some effective qualities of the brochure you used, and what qualities do you think need improvement?
- Which of the two options for using the brochure did you primarily use?
- What additional topics would you have liked to be included in the brochure?
- How do you feel about the amount of information presented in the brochure?
- Do you have any additional comments or feedback you would like us to consider?

Appendix F: Research on Digital Interpretive Material

Below are the results of our evaluation of digital, interpretive material at six different organizations: the Waikiki Aquarium, the Bishop Museum, San Luis Obispo Botanical Garden, United States Botanic Gardens, Regional Parks Botanic Garden, and the Art Institute of Chicago. We used the following examples to research the different characteristics of digital interpretive material and determine characteristics of a successful digital brochure.

Waikiki Aquarium

The Waikiki Aquarium utilized digital interpretive material in the form of tablets to provide additional information to their visitors. Some of the tablets were interactive while others were static. **Figure 9** shows one of the interactive tablets we engaged with.

Figure 9. Waikiki Aquarium Interactive Digital Material

The tablet allows visitors to view additional information on a variety of the aquarium's marine life. There were multiple interactive tablets throughout the aquarium. The main screen had clickable options for different animal species, and once an option was selected you could choose between a few options of specific animals within that species to read about. The information was concise and clear which we found particularly engaging. Going back to look at information about other creatures was easy with the "Back", "Next", and "Close" buttons, as shown in **Figure 9**.

The Aquarium also had tablets that were not interactive but still displayed information to the visitors. They often utilized diagrams and images which helped us to not feel overwhelmed with information. **Figure 10** shows an example of one of these non-interactive tablets. We also found the

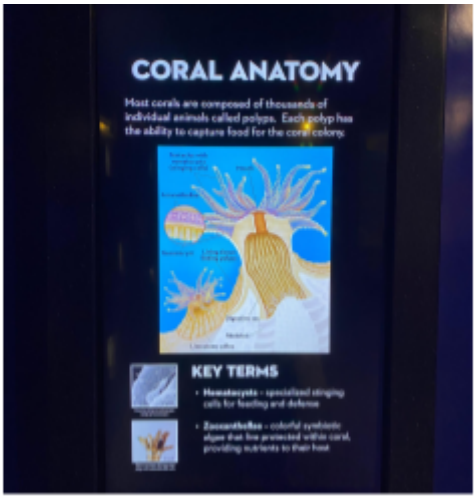


Figure 10. Waikiki Aquarium Digital Material

separation of the key terms to be effective, since it broke up the text and called our attention to this section that has new information.

Bishop Museum

The Bishop Museum utilized various digital interpretive materials in order to educate and convey information to their visitors. One exhibit was focused on taxonomy and featured a large touch screen with the ability to zoom in and out. The touch screen displayed a large tree depicting all life with various branches splitting off to show the classification and naming of living beings along with pictures. This was a great visual representation to help understand taxonomy with fun interactive features. A downside to this exhibit was the tree was so large that it was impossible to zoom in to each section and view all the information the exhibit had to offer within a reasonable amount of time. See **Figure 11**.

Figure 11. Bishop Museum Digital Interpretive Material

Another exhibit with a more cultural focus used digital tablets initially displaying a table of contents. From there, visitors could click topics they are interested in to be led to another page. That page included buttons leading to topics with educational descriptions or pictures and a button to return to the main menu, similar to what the Waikiki Aquarium has. This layout was helpful as visitors can go through to learn more about information they are most interested in by clicking those specific topics. See **Figure 12**.

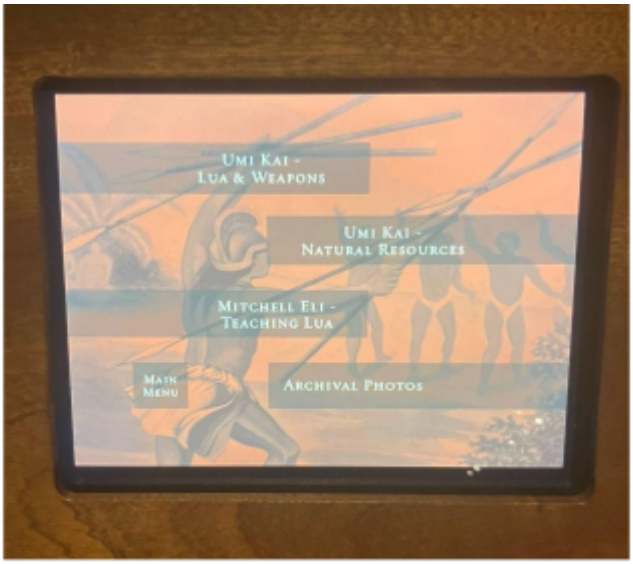


Figure 12. Bishop Museum Digital Interactive Material

Determining Characteristics of a Successful Digital Brochure

We looked at various digital brochures from our perspectives as potential visitors to determine if they were successful at conveying information. We evaluated each brochure based on our personal judgment of how easy to read, engaging, and well-designed they were. **Table 2** shows the positive and negative characteristics that we observed in each digital brochure.

Table 2. Example Brochures and Characteristics

Organization, Brochure	Contents of Brochure	Positive Characteristics	Negative Characteristics
San Luis Obispo Botanical Garden Fire Safe Garden Brochure	Guide to the Fire Safe Garden, its features, and the plants it contains	Concise plant name index, informative diagram, useful map to indicate location	High text to image ratio, no interactive features
United States Botanic Gardens	General overview of attractions and gardens	Concise history section, highlighting of popular attractions, and easy to use map	No interactive features, little information on the individual gardens
Regional Parks Botanic Garden	Notable attractions, safety, rules, general information, map, map guide	Consistent theme, practical pictures, clear information, easy to use map	High text to image ratio, no interactive features
Art Institute of Chicago Monet Paintings and Drawings at the Art Institute of Chicago	A digital catalog of the Art Institute of Chicago Monet Exhibit.	Displayed the artwork very clearly, provided a timeline of Monet's art	Certain sections had high text to image ratio, figures/paintings did not directly correspond with text

Across all of our examples some common themes for the positive characteristics were clear information and ease of use. Some characteristics we are looking to avoid include a high text to image ratio and lack of interactive features. **Figure 13** shows the example brochure we looked at from the San Luis Obispo Botanical Garden.

Figure 13. San Luis Obispo Botanical Garden Fire Safe Garden Brochure (page two)

Appendix G: Producing the Digital Brochure

Below we describe part of our process of producing the digital brochure and how we determined if it was color blind safe.

To create the brochure, we used Adobe InDesign for the layout and Google Docs to organize the information. An easy to read font size and color was chosen as well as a background that would not cause glare issues in the sun. To ensure accessibility for those that are color blind, we tested the color palette that we used in the brochure with Adobe's Color Blind Safe tool. The test showed that our color palette is color blind safe, as shown in **Figure 14**. Once most of the content was laid out, Adobe Acrobat was used to add the interactive links.

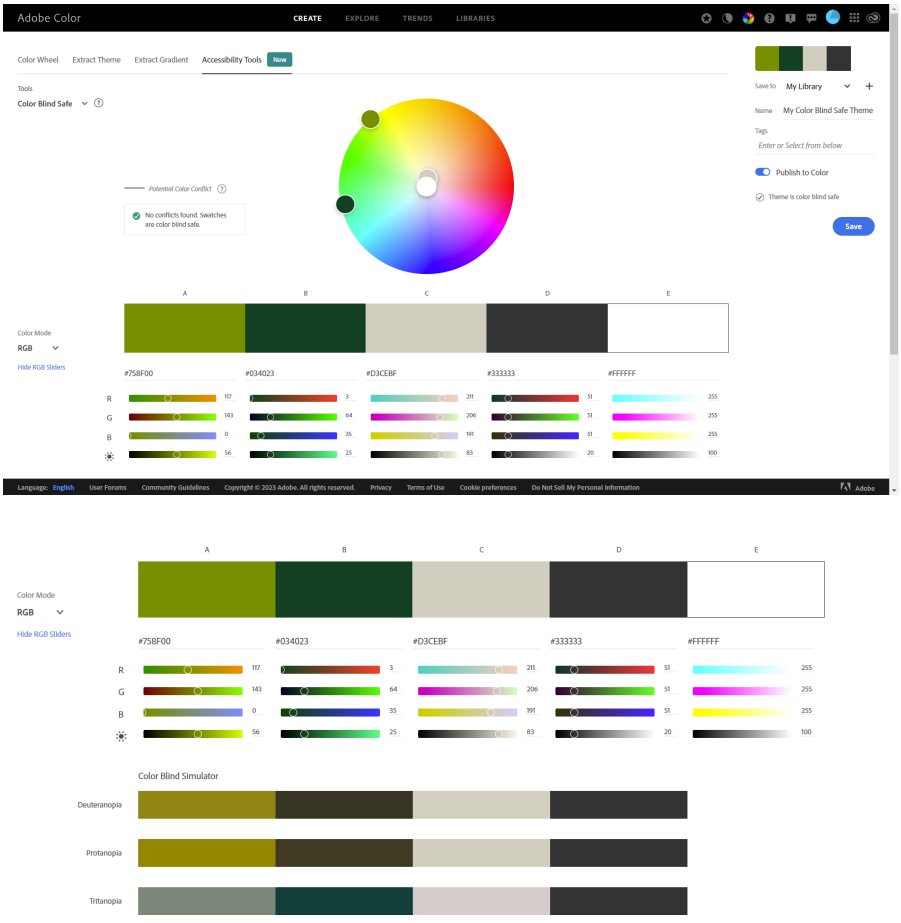


Figure 14. Adobe Color Blind Safe Tool

Appendix H. Beta Test Feedback Survey Coding Table

Below are the full results of our survey response coding for our visitor surveys that we conducted during our beta test. This provided us with insight about the demographic information of the participants, feedback about their experiences with the digital brochure, and any recommendations they have for improvement. The results have been split into two tables for each round of beta testing that we conducted. The "Totals" column shows the count of each topic/category for each question, which allows us to identify responses that share similar sentiments.

Beta Test: Round 1

		Beta Test Round 1										
Question	Categories	1	2	3	4	5	6	7	8	9	10	TOTALS
First name, last initial?	n/a											
How did you gain access to this survey?	QR code at Visitor Center											0
	Email from WPI Team											0
	Link embedded in brochure	x		x		x	x	x	x	x	x	8
	Other: WPI member fill in		x		x							2
Age Range	<18											0
	19-25										x	1

	26-30					x	x					2
	31-39			x								1
	40-50	x	x					x	x			4
	>50				x					x		2
Do you live locally? If not, where are you from?	Yes		x							x		2
	California	x		x								2
	Michigan				x						x	2
	Texas					x	x					2
	Maine							x				1
	New Hampshire								x			1
	Connecticut											0
	Massachusetts											0
	New Jersey											0
	Missouri											0
	Delaware											0
	Colorado											0
	Idaho											0

Is this your first time visiting Lyon Arboretum? If not, how many times have you visited?	Yes	x		x		x	x	x	x		x	7
	No, I have been here twice (including today)				x							1
	No, I have been here more than twice		x							x		2
What motivated you to visit Lyon Arboretum today?	Recommended by a friend	x							x			2
	Valentines day		x									1
	Close to Waikiki			x								1
	Good for kids			x								1
	Shade			x								1
	n/a				x	x						2
	Flora and/or fauna						x					1
	Beautiful natural spaces							x				1
	Learning about plants							x				1
	Bringing a visiting friend									x		1
	Internet reviews										x	1
	Love the Arboretum											0
	Walk around											0

	Tropical plants											0
	Saw the signs outside											0
	Goes regularly											0
	Hear the birds and rain											0
Have you been to a lot of other arboreta or botanical gardens?	Yes, I have been to many botanical gardens/arboreta		x					x		x		3
	No, but I have been to a few botanical gardens/arboreta	x		x		x	x		x			5
	No, this is my first time at a botanical garden/arboretum										x	1
Would you say you have a high, moderate, or low interest in learning about wildlife conservation?	High interest		x				x	x	x	x		5
	Moderate interest			x		x						2
	Low interest	x									x	2
Would you say you have a high, moderate, or low interest in learning about Hawaiian culture and history?	High interest		x			x	x	x	x			5
	Moderate interest			x						x	x	3
	Low interest	x										1
In general, would you say that your experience with our	Positive		x	x		x	x	x	x	x	x	8
	Negative											0
	Neutral	x										1

digital brochure was positive, negative, or neutral?												
Can you briefly summarize your experience at the Arboretum today and tell us how you utilized the brochure?	Bad connection	x										1
	Looked at sections as they came across them		x				x		x		x	4
	Read about plants		x	x			x		x	x	x	6
	Filled informational gaps		x						x			2
	Map feature			x						x	x	3
	n/a				x							1
	Walked and read					x						1
	Brief stay							x				1
	Walked main trail to waterfall								x			1
	Read history information									x		1
	Enjoyed plants and wildlife											0
	Used as a take home guide to ID photos they took											0
What were some effective qualities of the brochure you	n/a	x								x		2
	Good photos		x					x				2

used, and what qualities do you think need improvement?	Fast buttons		x								1
	Easy download		x								1
	Map is useful			x							1
	Map should be clickable			x							1
	Alphabetizing plant names				x						1
	Include mainland common names of plants				x						1
	Good grouping based on garden				x						1
	Informative					x		x			2
	Jumping to each section was useful						x		x	x	3
	Well organized								x		1
	Should have a map for each section								x		1
	Convenient PDF format									x	1
	Home button is convenient									x	1
	Photos could be improved										0
	Grammar consistency										0

	Remind people they can zoom in											0
	Formatting consistency											0
	Map numbering system is re-used											0
	Brochure should include trail markers to help visitors orient themselves											0
	Couldn't find Spice Hill on the map											0
	Easy to navigate											0
	Hard to connect brochure to what they were seeing											0
	More photos											0
	Good labeling											0
Which of the two options for using the brochure did you primarily use?	Option 1 (Scroll as you go)	x				x		x		x	x	5
	Option 2 (Choose your own adventure)		x	x	x		x		x			5
What additional topics would you have liked to be included in the brochure?	n/a	x		x		x	x			x	x	6
	Albizia removal process		x									1
	Sugar cane				x							1
	Traditional and current uses of plants				x							1

	Conservation efforts/ways to help							x				1
	Blue marble tree								x			1
	Distance/time away from other attractions											0
	Audio/photo ID guide to birds											0
	More information on taro efforts and what it represents											0
	More cultural and historical facts											0
How do you feel about the amount of information presented in the brochure?	Too much information											0
	Too little information											0
	Perfect amount of information	x	x	x		x	x	x	x	x	x	9
Do you have any additional comments or feedback you would like us to consider?	n/a	x	x	x			x	x		x	x	7
	Had difficulty locating plants from photos in the brochure				x							1
	Internet access was rough					x						1
	Would like to download prior to trip								x			1
	Prefer white background											0

	Focus on how you can use the brochure to answer questions about plants, research, or history											0
	Easy to use, intuitive layout											0
	Integrate map with GPS capability											0
	Explain how to make it back by aiming for downhill paths											0
	Brochure should have the same numbering as the Arboretum maps											0

Beta Test: Round 2

		Beta Test Round 2															
Question	Categories	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTALS
First name, last initial?	n/a																
How did you gain access to this survey?	QR code at Visitor Center																0
	Email from WPI Team																0
	Link embedded in brochure	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15
	Other: WPI member fill in																0
Age Range	<18																0

	19-25							x	x							x	3
	26-30				x												1
	31-39									x							1
	40-50	x				x	x						x				4
	>50		x	x							x	x		x	x		6
Do you live locally? If not, where are you from?	Yes	x			x							x				x	4
	California												x				1
	Michigan																0
	Texas																0
	Maine																0
	New Hampshire																0
	Connecticut		x	x													2
	Massachusetts					x	x	x									3
	New Jersey								x								1
	Missouri									x							1
	Delaware										x						1
	Colorado													x			1
	Idaho														x		1

Is this your first time visiting Lyon Arboretum? If not, how many times have you visited?	Yes		x	x		x	x	x	x	x	x		x	x	x		11
	No, I have been here twice (including today)																0
	No, I have been here more than twice	x			x							x				x	4
What motivated you to visit Lyon Arboretum today?	Recommended by a friend		x			x	x				x			x	x		6
	Valentines day																0
	Close to Waikiki																0
	Good for kids																0
	Shade																0
	n/a				x												1
	Flora and/or fauna			x				x									2
	Beautiful natural spaces									x			x				2
	Learning about plants																0
	Bringing a visiting friend																0
	Internet reviews																0
	Love the Arboretum	x															1
	Walk around							x									1

	Tropical plants								x				x				2
	Saw the signs outside									x							1
	Goes regularly											x					1
	Hear the birds and rain															x	1
Have you been to a lot of other arboreta or botanical gardens?	Yes, I have been to many botanical gardens/arboreta		x	x		x				x	x		x			x	7
	No, but I have been to a few botanical gardens/arboreta	x			x		x	x	x			x		x	x		8
	No, this is my first time at a botanical garden/arboretum																0
Would you say you have a high, moderate, or low interest in learning about wildlife conservation?	High interest	x						x	x	x	x		x				6
	Moderate interest		x	x	x	x	x					x		x	x	x	9
	Low interest																0
Would you say you have a high, moderate, or low interest in learning about Hawaiian culture and history?	High interest	x			x		x	x	x	x	x		x				8
	Moderate interest		x	x		x						x		x	x	x	7
	Low interest																0

In general, would you say that your experience with our digital brochure was positive, negative, or neutral?	Positive	x	x	x	x	x	x	x	x	x		x	x	x	x	x	14
	Negative																0
	Neutral										x						1
Can you briefly summarize your experience at the Arboretum today and tell us how you utilized the brochure?	Bad connection																0
	Looked at sections as they came across them		x	x									x				3
	Read about plants		x	x		x			x	x			x	x	x		8
	Filled informational gaps				x												1
	Map feature					x				x		x		x			4
	n/a	x															1
	Walked and read																0
	Brief stay																0
	Walked main trail to waterfall							x									1
	Read history information																0
	Enjoyed plants and wildlife						x				x					x	3
	Used as a take home guide to ID photos they took											x					1

What were some effective qualities of the brochure you used, and what qualities do you think need improvement?	n/a																0
	Good photos													x			1
	Fast buttons																0
	Easy download																0
	Map is useful																0
	Map should be clickable																0
	Alphabetizing plant names																0
	Include mainland common names of plants																0
	Good grouping based on garden																0
	Informative										x			x		x	3
	Jumping to each section was useful	x		x	x	x		x					x	x			7
	Well organized	x							x								2
	Should have a map for each section																0
	Convenient PDF format	x															1
	Home button is convenient			x	x												2

	Photos could be improved	x														1
	Grammar consistency	x														1
	Remind people they can zoom in	x														1
	Formatting consistency	x														1
	Map numbering system is re-used		x													1
	Brochure should include trail markers to help visitors orient themselves					x				x						2
	Couldn't find Spice Hill on the map						x	x								2
	Easy to navigate									x				x		2
	Hard to connect brochure to what they were seeing										x					1
	More photos											x				1
	Good labeling												x			1
Which of the two options for using the brochure did you primarily use?	Option 1 (Scroll as you go)		x						x	x	x			x	x	6
	Option 2 (Choose your own adventure)	x	x	x	x	x	x	x				x	x			x	10

What additional topics would you have liked to be included in the brochure?	n/a	x	x		x	x	x	x	x	x	x			x	x	x	12
	Albizia removal process																0
	Sugar cane																0
	Traditional and current uses of plants																0
	Conservation efforts/ways to help																0
	Blue marble tree																0
	Distance/time away from other attractions			x													1
	Audio/photo ID guide to birds											x					1
	More information on taro efforts and what it represents											x					1
	More cultural and historical facts												x				1
How do you feel about the amount of information presented in the brochure?	Too much information							x						x			2
	Too little information											x	x				2
	Perfect amount of information	x	x	x	x	x	x		x	x	x				x	x	11

	n/a		x	x	x	x	x	x	x	x					x	x	10
	Had difficulty locating plants from photos in the brochure																0
	Internet access was rough																0
	Would like to download prior to trip																0
	Prefer white background	x															1
Do you have any additional comments or feedback you would like us to consider?	Focus on how you can use the brochure to answer questions about plants, research, or history										x						1
	Easy to use, intuitive layout											x		x			2
	Integrate map with GPS capability											x					1
	Explain how to make it back by aiming for downhill paths											x					1
	Brochure should have the same numbering as the Arboretum maps												x				1

Appendix I: Final Draft of Digital, Educational Brochure

The following pages contain a copy of our final draft of the digital, educational brochure that we created for the Lyon Arboretum.

HAROLD L. LYON ARBORETUM

GARDEN GUIDE

CONTACT

Address: 3860 Manoa Rd, Honolulu, HI 96822

Phone: (808) 988-0456

Stay Connected!

Newsletter: Subscribe to our Email List

Instagram: @uhlyonarboretum

Facebook: @uhlyonarboretum

YouTube: @Lyon Arboretum and @Lyon Education

TikTok: @uhlyonarboretum

For more information, visit our website.

CONTENTS

Botanical Sections

HOW TO USE THE DIGITAL BROCHURE

Aloha! Welcome to Lyon Arboretum's Digital Garden Guide. Here are some ways you can use this digital guide:

Option 1: Scroll as you go!

This digital guide goes in order of the attractions along the trail. So, if you like to stop and observe everything, you can scroll through the digital guide as you hike.

Simply just scroll to the next page of the digital guide to view the attractions along the trail! Be sure to pick up a paper map at the Visitors Center to follow along.

HOW TO USE THE DIGITAL BROCHURE

Option 2: Choose your own adventure!
If you are someone who likes to read up on your favorite gardens and attractions, we recommend this option!

The digital guide offers a table of contents where you can click on each section to read more about it. As you go through the guide, you will notice **BOLD GREEN TEXT**. These are clickable links! You can use these links to jump to sections of interest.

At the bottom right corner of each page, you will notice a HOME button. You can use this to go back to the table of contents.

At the botton left, there may be a BACK TO MENU button — you can use this to jump back to a section's main page to keep exploring.

Try it yourself:

SAFETY INFORMATION
(Click me!)

SAFETY INFORMATION

Before your hike, here are some safety DO's and DONT's:

DO

Plan accordingly:
- Wear close-toed footwear
- Check weather conditions and pack accordingly
- Bring water and stay hydrated! We have two public water fountains, one near the main trailhead and another near the entrance to the main greenhouse.
- Prepare for bugs and use insect repellent

Once you are here:
- Walk carefully, trails may be narrow, slippery, and uneven
- Beware of falling branches, especially in windy weather
- Know your limitations, be aware of your surroundings
- Stay on the designated pathways and trails
- Pay attention to and follow all posted signs and warnings

HOME

SAFETY INFORMATION

DON'T

- Enter streams or ponds
- Drink stream water or eat plants or plant parts
- Bring your pets, only service animals are allowed
- Smoke on Arboretum grounds. The use of vaping and e-cigarettes is also prohibited
- Take soil, rocks, water, animals, plants, or plant parts from the Arboretum
- Obstruct, disturb, or deface the trails, plants, signage, water features, equipment, structures, or facilities
- Bring drones or fly them on the property

For a full list of safety regulations and policies see OUR WEBSITE.

HOME

ABOUT LYON ARBORETUM

Lyon Arboretum is a public botanical garden with a special emphasis on trees—hence the *arbor* in arboretum. The Arboretum is also a research unit of the University of Hawai'i and provides many opportunities to the scientific community.

HOME

OUR MISSION

To inspire and cultivate the conservation of tropical plant diversity, and connect it to the culture of Hawai'i through education and research.

HAWAIIAN RARE PLANT PROGRAM

As part of Lyon Arboretum's mission to conserve the tropical plant diversity in Hawai'i, the Arboretum established the Hawaiian Rare Plant Program. The Hawaiian Rare Plant Program aids in the prevention of further extinction of Hawaiian plant species by initiating and maintaining an in vitro plant and seed bank collection and propagating plants for use in approved restoration and reintroduction projects.

CLICK HERE TO LEARN MORE.

HOME

HISTORY OF LYON ARBORETUM

Over 100 years ago, cattle grazing resulting from post-contact agriculture damaged the landscape of the rich valley of Mānoa. This caused rainwater to flow to the ocean rather than recharging the ground water table, the primary source of potable water in Hawai'i. Dr. Harold Lyon, a plant pathologist hired by Hawaiian Sugar Planters Association (HSPA), concluded that damaged watersheds could be restored with introduced plants.

HOME

HISTORY OF LYON ARBORETUM

1900

1918
HSPA purchased 124 acres of land for a test site to evaluate trees to be used for reforestation.

1940s
The HSPA finished their research and no longer needed the site. Dr. Harold L. Lyon saw this as an opportunity for the state of Hawai'i to have a botanical garden.

1953
The University of Hawai'i accepted the land from the HSPA to use the land for an arboretum.

1957
Dr. Harold L Lyon passed away and left part of his estate in trust to help fund the Arboretum.

HOME

1960s
The main greenhouse was built, and trees were inventoried, but the Arboretum was strictly a research station.

1972
The Lyon Arboretum Association (now known as Friends of Lyon Arboretum) was formed.

Staff and volunteers established education and outreach programs.

1990s
Research expanded to include micropropagation of rare and endangered Hawaiian plants.

Several ancient Hawaiian lo'i (taro growing fields) were reopened.

Classes are offered that perpetuate cultural knowledge.

2018
The Arboretum celebrated 100 years of operation!

The Micropropagation Lab was renovated and open for operation.

To date, the lab has grown approximately 300 of the 1400+ Hawaiian plant taxa using micropropagation techniques.

TODAY

HOME

FAST FACTS ABOUT LYON ARBORETUM

Area: 193.5 acres (78.3 hectares)

Elevation: 450 to 1850 feet (137 to 564 meters)

Average Temperature: 78° F; 25.6° C

Temperature: ranges from 52° F to 90° F; 11.1° C to 32.2° C

Average Rainfall: 165 inches annually; 4190 mm annually

Annual Rainfall: ranges from 90 to 210 inches; 2280 to 5330 mm

HOME

USEFUL TERMS

Mauka [**mow-***kuh*]**:** mountainside; towards the mountains

Makai [m*uh*-**kai**]**:** seaward; towards the sea

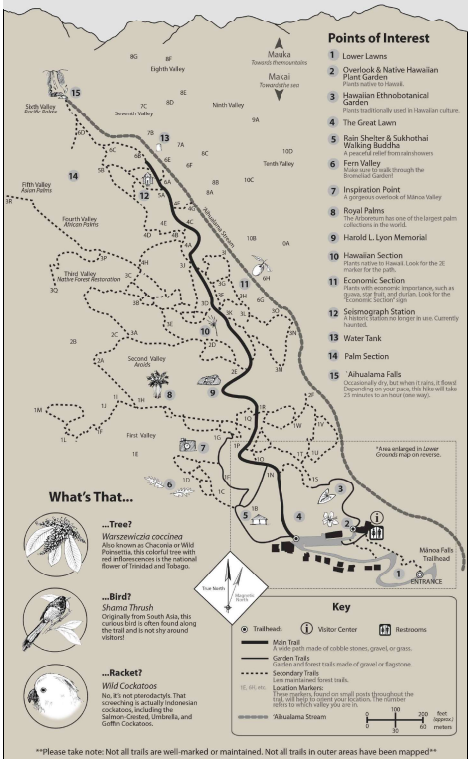
Endemic: native to the Hawaiian Islands and only found on Hawai'i

Indigenous: native to the Hawaiian Islands but can be found elsewhere (outside of Hawai'i)

HOME

TRAIL MAP

We highly recommend picking up a paper trail map at the Visitors Center to use alongside this brochure!



Please take note: Not all trails are well-marked or maintained. Not all trails in outer areas have been mapped

Pinch to zoom the map for better a better viewing experience.

HOME

VISITORS CENTER & PARKING LOT

The Betty Ho Garden is located on the path just downhill from the Visitors Center, and it is lined with a collection of beautiful, antique Chinese pots and a variety of colorful bromeliads. The path leads to the Young Memorial Garden. Sit in the gazebo in the Young Memorial Garden and enjoy the tranquility of our pond.

The Arboretum also features many plants surrounding the Visitors Center and along the parking lot!

HOME

VISITORS CENTER & PARKING LOT

Click on the plant names to learn more!

ALLSPICE

ANDREW JACKSON MAGNOLIA

ANGEL WINGS

ARENGA PORPHYROCARPA

BUSH LILY / NATAL LILY

CALATHEA

COMPACT BROMELIAD

GOLDEN DWARF HELICONIA

LIRIOPE

MANDARIN ORANGE

ORANGE TULIP GINGER

VELVET PHILODENDRON

WILLOWMORE CEDAR

HOME

VISITORS CENTER & PARKING LOT

BETTY HO GARDEN

Click on the plant names to learn more!

BETTY HO GINGER LILY

DWARF FAN PALM

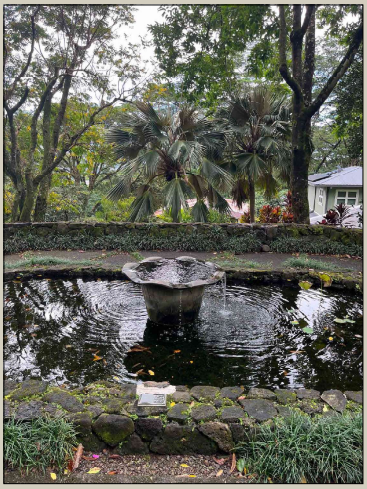
DWARF TI

IMPERIAL BROMELIAD

HOME

VISITORS CENTER & PARKING LOT

YOUNG MEMORIAL GARDEN



Click on the plant names to learn more!

AZALEA

WATER LILY

HOME

VISITORS CENTER & PARKING LOT

ALLSPICE

Scientific name: *Pimenta dioica*
Origin: W. Indies & Central America
Family: Myrtaceae

Allspice was introduced to Hawai'i in 1865 and is now a known invasive tree. Its flowers are a dark red to maroon color. Clusters of small berries grow in early summer, and the green fruits are harvested before ripening and dried until the aroma develops.

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HOME

VISITORS CENTER & PARKING LOT

ANDREW JACKSON MAGNOLIA

Scientific name: *Magnolia grandiflora 'Andrew Jackson'*
Origin: SE USA
Family: Magnoliaceae

The leaves are dark green and leathery on top and rusty brown underneath. The tree has large, showy, white cup-shaped flowers known for their fragrance. President Andrew Jackson planted the iconic southern magnolia tree outside of the White House, however the original tree is no longer there.

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VISITORS CENTER & PARKING LOT

ANGEL WINGS

Scientific name: *Xanthosoma lindenii* 'Magnificum'
Origin: Columbia
Family: Araceae

This plant's large leaves are arrow-shaped with prominent white veins. It is a tuberous plant, which means its leaves die back and go dormant.

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VISITORS CENTER & PARKING LOT

ARENGA PORPHYROCARPA

Scientific name: *Arenga porphyrocarpa*
Origin: Asia
Family: Palmae

This is a type of dwarf, clumping palm. It has oblong fruit that are red-purple and smooth. Its leaves are bright green and silvery underneath.

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HOME

VISITORS CENTER & PARKING LOT

Photo from Forest & Kim Starr

BUSH LILY / NATAL LILY

Scientific name: *Clivia miniata*
Origin: S. Africa
Family: Amaryllidaceae

This plant is stemless and has shiny strap leaves. Its flowers are inflorescent and orange-red with yellow centers and stamens.

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HOME

VISITORS CENTER & PARKING LOT

CALATHEA

Scientific name: *Calathea lietzei x C. albertii*
Origin: Cultivated
Family: Marantaceae

Its leaves are variegated dark and bright green in stripes. Calatheas are also popular house plants.

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HOME

VISITORS CENTER & PARKING LOT

COMPACT BROMELIAD

Scientific name: *Neoregelia compacta*
Origin: Cultivated
Family: Bromeliaceae

This plant's leaves are green, but the middle of the plant can be bright pink-red when flowering. Their central cups are used to store water.

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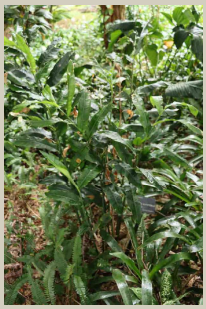
VISITORS CENTER & PARKING LOT



GOLDEN DWARF HELICONIA

Scientific name: *Heliconia aurantiaca*
Origin: Central America
Family: Heliconiaceae

This plant has inflorescent flowers that grow upright and are distichous (bracts grow on opposite sides of the stem, instead of around). Its flowers are orange-yellow.

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VISITORS CENTER & PARKING LOT

LIRIOPE

Scientific name: *Liriope muscari* 'Moore's Majestic'
Origin: Japan & China
Family: Liliaceae

This plant is also known as Lilyturf. It has clumps of dark green grass-like leaves. In Hawai'i, it only flowers regularly in higher (cooler) elevations.

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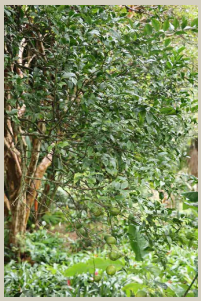
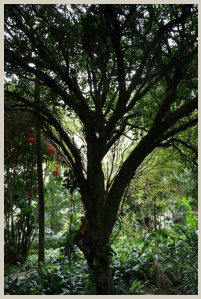
VISITORS CENTER & PARKING LOT





MANDARIN ORANGE

Scientific name: *Citrus reticulata*
Origin: SE Asia
Family: Rutaceae

This plant has fragrant white flowers that bloom in the spring. The fruits are bright orange when ripe and can be eaten, used in essential oils, and more.

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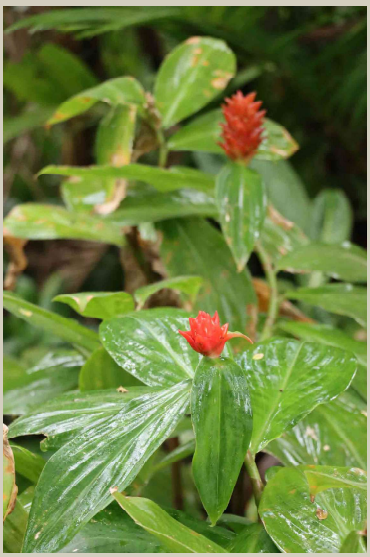
VISITORS CENTER & PARKING LOT



ORANGE TULIP GINGER

Scientific name: *Costus productus*
Origin: Eastern Peru
Family: Costaceae

This plant is in the genus Costus of spiral gingers. Its stalks are bamboo-like with bright green leaves. Orange flowers grow out of the short red cone one at a time.

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VISITORS CENTER & PARKING LOT

VELVET PHILODENDRON

Scientific name: *Philodendron gloriosum*
Origin: Colombia
Family: Araceae

This plant's large heart-shaped leaves are bright-dark green and velvety to the touch. Unlike other common household Philodendron species that like to climb upwards, this one grows along forest floors. The leaves may not get as large when grown in a household setting.

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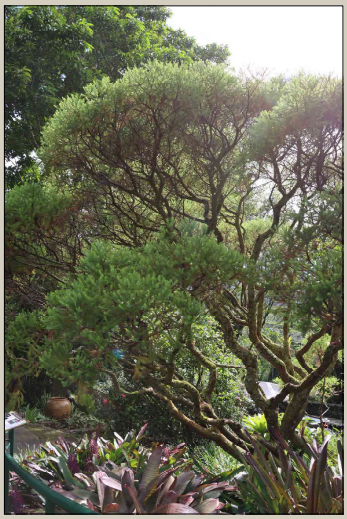
VISITORS CENTER & PARKING LOT



WILLOWMORE CEDAR

Scientific name: *Widdringtonia schwarzii*
Origin: South Africa
Family: Cupressaceae

The juvenile leaves on this tree are needle-like, while the adult leaves are decussate (make an X). The seed cones are nearly spherical and can be found on the trees in varying stages of development throughout the year.

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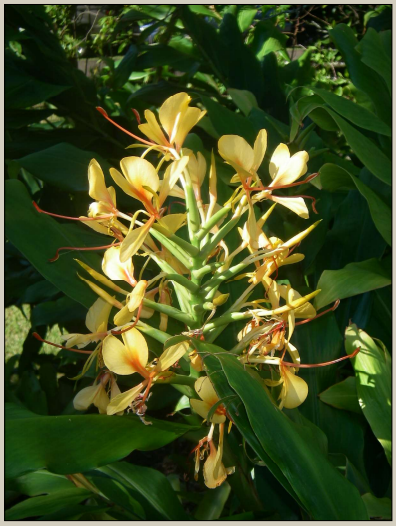
BETTY HO GARDEN



BETTY HO GINGER LILY

Scientific name: *Hedychium* sp. 'Betty Ho'
Origin: Cultivated
Family: Zingiberaceae
The Betty Ho ginger lily is a butterfly ginger that was cultivated at Lyon Arboretum. Its flowers are a light creamy yellow with an orange stamen, and it has a fragrance similar to gardenia.

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BETTY HO GARDEN

DWARF FAN PALM

Scientific name: *Chamaerops humilis*
Origin: Mediterranean
Family: Arecaceae
The dwarf fan palm is also known as the Mediterranean fan palm or European fan palm. It has grayish green palmate fronds and is one of the more cold-tolerant palms.

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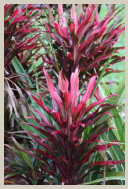
BETTY HO GARDEN


C. Nii #3




H.Y. #12

DWARF TI

Scientific name: *Cordyline fruticosa*
Origin: Cultivated
Family: Asparagaceae
There are two ti varieties around the Betty Ho Pond: 'C. Nii #3' (mauka side) and 'H.Y. #12' (Diamond Head side).

Cordyline fruticosa 'C. Nii #3' named after Charles Nii, a nurseryman from Hawaii Kai, and Cordyline fruticosa 'H.Y. #12' named after its hybridizer Harold Yamamoto.

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HOME

BETTY HO GARDEN


IMPERIAL BROMELIAD

Scientific name: *Alcantarea imperialis*
Origin: Brazil
Family: Bromeliaceae
The imperial bromeliad is one of the largest species of bromeliads. It has leathery red to green leaves. Its name is a tribute to the Emperor of Brazil who made the Imperial City.

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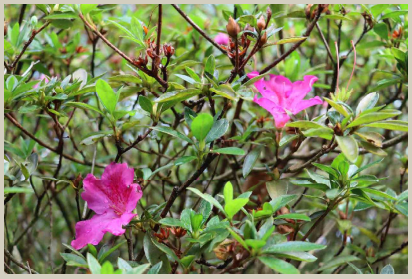
YOUNG MEMORIAL GARDEN



AZALEA

Scientific name: *Rhododendron sp.*
Origin:
Family: Ericaceae

Bright pink-magenta flowers with pink stamens.

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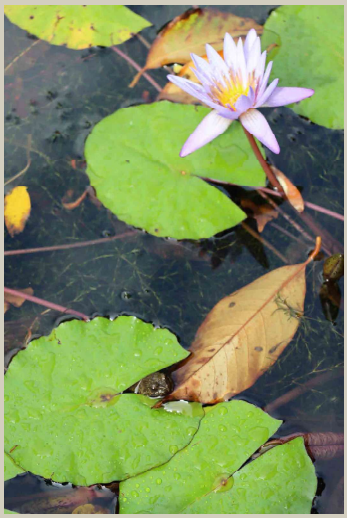
YOUNG MEMORIAL GARDEN



WATER LILY

Scientific name: Nymphaea sp.
Origin:
Family: Nymphaeaceae

These water lilies are of the 'Edward D. Uber' variety, and are light blue-purple flowers with yellow stamens. You may find some frogs hanging around the lily pads!

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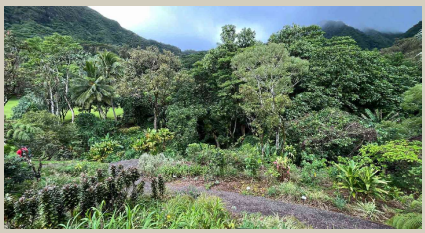
NATIVE HAWAIIAN GARDEN

The Native Hawaiian Garden is a collection of indigenous and endemic Hawaiian plants that will grow at the elevation of the Arboretum, approximately 500 feet (152.4 meters). It is designed to help visitors to the garden learn to identify native species and to encourage their use in landscaping. The garden is also an important source of propagation and research material for the Arboretum. Most of the species in the garden were collected from the wild on O'ahu but a few are from other islands in the chain.

HOME

NATIVE HAWAIIAN GARDEN



Click on the plant names to learn more!

'AE'AE

ALAHE'E

KOKI'O 'ULA'ULA (HIBISCUS KOKIO)

LOULU

MAILE

MĀMAKI

NĀNŪ

'ŌHI'A

HOME

NATIVE HAWAIIAN GARDEN

ʻAEʻAE

Scientific name: *Bacopa monieri*
Origin: Indigenous
Family: Plantaginaceae

ʻAeʻae is a dense and low-growing ground cover. Its leaves and stems are light green and succulent. It grows naturally on all main islands except Kahoʻolawe and Pihemanu. ʻAeʻae can grow directly in water and the cuttings can float, making a free-floating mat. It can be a great addition to aquarium tanks, but be careful as it may cause excessive algae!

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NATIVE HAWAIIAN GARDEN

ALAHEʻE

Scientific name: *Psydrax odorata*
Origin: Indigenous
Family: Rubiaceae

Alaheʻe is a large shrub to small tree with glossy green leaves. The flowers are small and white and have a strong fragrance when in bloom. This plant looks and smells similar to mock orange but is not related. It is actually a member of the coffee family!

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NATIVE HAWAIIAN GARDEN

KOKIʻO ʻULAʻULA (HIBISCUS KOKIO)

Scientific name: *Hibiscus kokio*
Origin: Endemic
Family: Malvaceae

This rare native hibiscus is also known as mākū or kokiʻoʻulaula. Its narrow-petaled flowers are red to orange to give it its name ʻula, which means red or scarlet. The flowers on this plant are constantly in bloom, which makes it a beautiful landscaping plant!

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NATIVE HAWAIIAN GARDEN

LOULU

Scientific name: *Pritchardia sps.*
Origin: Endemic
Family: Arecaceae

Loulu are palms with fan-shaped leaves that can grow anywhere from 25 to 60 feet tall (7 to 18 meters). There are 19 endemic species of Prichardia in the Hawaiian islands, some of which are endangered or vulnerable. If this palm looks familiar, you may have seen it in our logo!

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HOME

NATIVE HAWAIIAN GARDEN

MAILE

Scientific name: *Alyxia stellata*
Origin: Endemic
Family: Apocynaceae

Under the Pomelo tree is a maile plant, endemic to all main Islands except for Niʻihau and Kahoʻolawe. Maile leaves are highly variable in size and range from light to dark green. The new growth on the maile was used to make a very fragrant lei. Today, the maile used to make lei are not of the Hawaiian variety, but come from the Cooke Islands. Maile lei is one of the most significant lei in Hawaiian culture and was used to signify peace between opposing chiefs. Now maile lei is worn on special occasions, such as a wedding.

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NATIVE HAWAIIAN GARDEN

MĀMAKI

Scientific name: *Pipturus albidus*
Origin: Endemic
Family: Urticaceae

Across from the maile is māmaki which is a culturally significant plant. The fibers in the bark were used to make kapa, the roots were used in dyes, and the leaves were used as tea and medicine. The medicine was used as a tonic or preventative medicine, especially for pre-natal and post-natal care for mothers and infants. This plant is in the nettles family, but Hawaiian nettles do not have stinging hairs. Kamehameha butterflies like to spend their larval caterpillar stage on this plant, mimicking the look of the fruit with its head.

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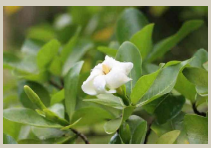
NATIVE HAWAIIAN GARDEN



NĀNŪ

Scientific name: *Gardenia brighamii*
Origin: Endemic
Family: Rubiaceae

Nānū is a rare native gardenia that is thought to have once been present on all of the main Hawaiian islands. Currently there are less than 50 mature individuals in the wild, with only one tree on Oahu. They are threatened by rats, goats, deer, cattle, loss of habitat, and competition from invasive species.

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NATIVE HAWAIIAN GARDEN

ʻŌHIʻA

Scientific name: *Metrosideros polymorpha*
Origin: Endemic
Family: Myrtaceae

ʻŌhiʻa is a species of evergreen tree that produces flowers that can be either red or yellow. Native Hawaiian traditions say that this tree is sacred to Pele, the volcano goddess, and to Laka, the goddess of hula. These trees grow easily on lava.

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HOME

SPICE HILL

Spice Hill showcases a collection of culinary and medicinal trees and plants. Some of these plants include nutmeg, rosemary, and a variety of peppers.

HOME

SPICE HILL

Click on the plant names to learn more!

HOME

SPICE HILL

CHILI PEPPER

Scientific name: *Capsicum annuum*
Origin: S & Central America, Cultivated
Family: Solanaceae
Uses: Flavoring, Food

This plant is a source of popular sweet peppers and hot chilis. Numerous varieties are cultivated all around the world. They are a source of popular spices such as cayenne, chili, paprika, and pimento.

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SPICE HILL

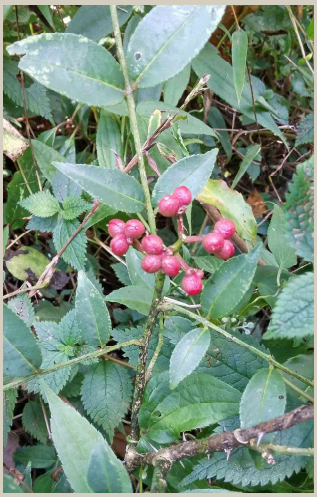

Photo from Kristof Zyskowski & Yulia Bereshpolova

CHINESE PEPPER TREE

Scientific name: *Zanthoxylum beecheyanum*
Origin: Nansei-shoto & Ogasawara-shoto
Family: Rutaceae
Uses: Flavoring

The Chinese Pepper is a subtropical tree with small paripinnate leaves. This means that the leaves have an equal number of leaflets on either side of the central stalk. It is a common indoor bonsai.

BACK TO PLANT MENU

HOME

SPICE HILL

JABOTICABA TREE

Scientific name: *Plinia cauliflora*
Origin: Brazil
Family: Myrtaceae
Uses: Eaten raw, jams and jellies, ice cream, juice, syrups and more

The Jaboticaba tree displays its flowers along its trunk and main branches. It has small white flowers that grow in clusters and fruit that looks like glistening dark-purple grapes. The fruit have a delicate flavor and are popular amongst both birds and people. There is Jaboticaba jam, made by the Arboretum's volunteer jam and jelly group for sale in the giftshop!

BACK TO PLANT MENU
HOME

SPICE HILL

Photo from Dick Culbert

KOLA NUT

Scientific name: *Cola acuminata*
Origin: Tropical Africa
Family: Malvaceae
Uses: Flavoring, Medicine

These inflorescences grow in panicles of yellow flowers. Fruits are large, bright green, and very lumpy. The purplish seeds (referred to as Kola nuts) are high in caffeine, and were the original source of cola flavoring in soft drinks. In West Africa, the seeds are important culturally.

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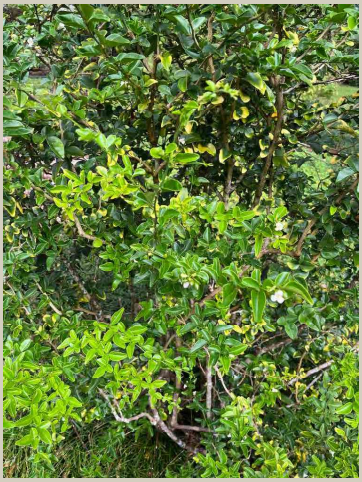
SPICE HILL



LIMEBERRY

Scientific name: *Triphasia trifolia*
Origin: Tropical Asia
Family: Rutaceae
Uses: Flavoring, Cosmetic

The limeberry is closely related to citrus, and like most citrus the plant is covered in thorns. The edible berries have a similar taste to that of a sweet lime. The fruit can be used to make tea, preserves, and cosmetics. It is also used in baths.

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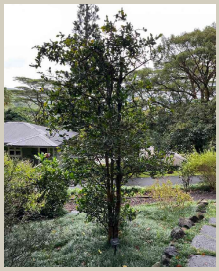
SPICE HILL



MAKRUT LIME

Scientific name: *Citrus hystrix*
Origin: China to Indo-China, New Guinea, & Wallis Island
Family: Rutaceae
Uses: Flavoring, Perfume

The fruit and leaves of the Makrut Lime plant are used in Southeast Asian cuisine, and its essential oils are used to make perfumes. The rind and crushed leaves emit a strong citrus fragrance.

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SPICE HILL

MANGO TURMERIC

Scientific name: *Curcuma mangga (C. Zedoaria SL)*
Origin: Java
Family: Zingiberaceae
Uses: Flavoring, Medicine

Mango Turmeric is a herbaceous perennial plant. It is a popular vegetable in southeast Asia, and the plant also has medicinal properties. It is cultivated as a food crop in Thailand, peninsular Malaysia, and Java.

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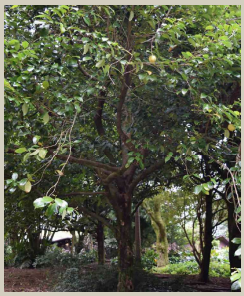
SPICE HILL



NUTMEG

Scientific name: *Myristica fragrans*
Origin: Moluccas
Family: Myristicaceae
Uses: Baking, Soaps, Perfumes

The nutmeg tree grows slowly but can grow up to 60 feet (20 meters). The tree can be either male or female. Two spices come from the tree's fruit, these being nutmeg and mace. The fruit consists of a dark brown nut encased in an outer shell and the nut is covered in aril, a kind of webbing. The dried aril is the mace, while the inside is the nutmeg.

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SPICE HILL

NU'UANU (DAY LILY)

Scientific name: *Hemerocallis lilioasphodelus*
Origin: SE Alps, NE Albania, & Siberia to S Korea
Family: Asphodelaceae
Uses: Flavoring

Nu'uanu, or day lily flowers are edible and are used in Chinese and Japanese cuisine. The plant grows in large clumps and the flowers are yellow and sweetly fragrant.

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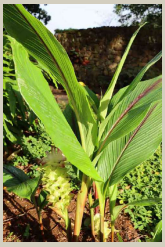

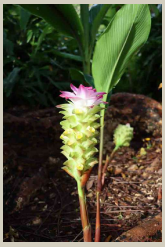

'OLENA (TURMERIC)

Scientific name: *Curcuma longa*
Origin: SE Asia
Family: Zingiberaceae

'Olena, or turmeric, is said to have been one of the plants brought to Hawai'i by early Polynesian settlers. This plant is a member of the ginger family and it was important to the Polynesians and ancient Hawaiians and was used to purify people and cleanse spaces and objects. Today it is known for its powerful anti-inflammatory, anti-bacterials, and antioxidant properties.

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SPICE HILL

ROSEMARY

Scientific name: *Salvia rosmarinus*
Origin: Mediterranean
Family: Lamiaceae
Uses: Flavoring, Medicine

Rosemary is a shrub with fragrant needle-like leaves and white, pink, purple, or blue flowers. It is popular in culinary dishes and also a good source of iron, calcium, and vitamin B-6. The essential oils from this plant are also used to make perfumes.

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SPICE HILL

THYME

Scientific name: *Thymus vulgaris*
Origin: SW Europe & SE Italy
Family: Lamiaceae
Uses: Flavoring, Perfume

Thyme is an herb with a distinct smell, and the flowers, leaves, and oil are commonly used to flavor foods. It can also be used as medicine, as thyme contains chemicals that may help fight bacterial and fungal infections.

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SPICE HILL

WEST INDIAN ARROWROOT

Scientific name: *Maranta arundinacea*
Origin: S. America
Family: Marantaceae
Uses: Cooking

Arrowroot is a large root vegetable that can be used to make flour that is wheat and gluten free. It is rich in iron and phosphorus and very easily digested.

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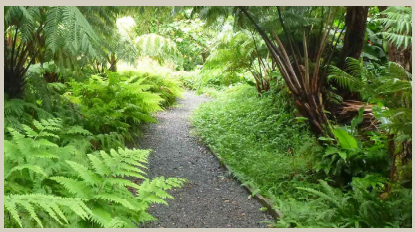
ETHNOBOTANICAL GARDEN

The Beatrice H. Krauss Hawaiian Ethnobotanical Garden is designed to showcase those plants that were important in traditional Hawaiian culture, some of which continue to be of great importance today. The garden currently comprises over 60 different species.



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ETHNOBOTANICAL GARDEN

Click on the plant names to learn more!

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ETHNOBOTANICAL GARDEN

‘ĒKAHA

Scientific name: *Asplenium nidus*
Origin: Indigenous
Family: Aspleniaceae

‘Ēkaha is commonly known as the bird’s nest fern. It got its common name from being rosette shaped, like a bird’s nest. The fronts are light green with a dark brown midrib and can grow as long as 4 feet (approximately 1.5 meters). The ‘ēkaha next to the Beatrice H. Krauss sign is growing terrestrially, but it can also grow on rocks or in crevices (lithophyte), or on tree branches (epiphyte).

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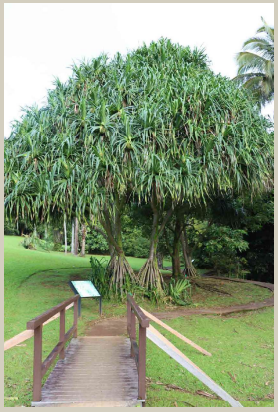
ETHNOBOTANICAL GARDEN



HALA

Scientific name: *Pandanus tectorius*
Origin: Indigenous/Polynesian Intro
Family: Pandanaceae

The hala fruits were used as a famine food, and the seeds are edible. Individual fruits (drupes or keys) were used as paint brushes, and fresh fruits used in lei. Lauhala (leaves) are used as plaiting material and thatching. It’s fashioned into mats, mattresses, pillows, containers, and sails for canoes. Many fine lauhala hats, floor mats, purses, and other products are made by local crafts-makers and lauhala classes are taught at Lyon.

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ETHNOBOTANICAL GARDEN

HĀPU‘U

Scientific name: *Cibotium glaucum* (syn. *Cibotium nealiae*)
Origin: Endemic
Family: Cibotiaceae

Hāpu‘u’s common name is the Hawaiian Tree Fern. The inner starch and young fiddleheads were cooked and eaten in times of drought. The golden downy hairs (pulu) at the center of the fern are very absorbent, and were used medicinally and in embalming. In the 1800’s pulu was exported to the Gold Rush miners in California for bedding, and later as dressings for wounds during the US Civil War. If you visit the Hawai‘i Volcanoes National Park, you can see the foundation of the factory where pulu was processed. We also have two other hāpu‘u species in the Ethnobotanical garden: Hāpu‘u i‘i (*Cibotium menziesii*) and Hāpu‘u (*Cibotium chamissoi*).

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ETHNOBOTANICAL GARDEN

KALO

Hāloanakalaukapalili, who emerged from the earth as the first kalo (commonly known as taro), is the elder brother of Hāloa, the progenitor of the Hawaiian people. It is said that if one takes care of one's elders, including the earth and the plants, the elders will take care of (feed) you.

There are currently 71 varieties of kalo planted at Lyon. Every portion of the plant is edible, but must be cooked before eating.

One square mile of loʻi (irrigated terraces) could feed 15,000 people for a year!

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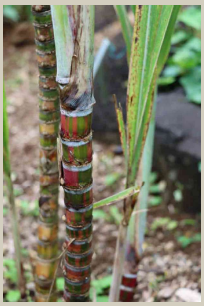
ETHNOBOTANICAL GARDEN



KŌ (SUGARCANE)

Scientific name: *Saccharum officinarum*
Origin: New Guinea
Family: Poaceae

Kō, or sugarcane, is a large species of grass with stalks that are rich in sucrose. *Saccharum officinarum* is one of the most intensely cultivated kinds of sugarcane. It grows in clumps and the stems can be either green, pink or purple. They can reach 16 feet (5 meters) in height.

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ETHNOBOTANICAL GARDEN

KUKUI (CANDLENUT TREE)

Scientific name: *Aleurites moluccanus*
Origin: Polynesian Intro
Family: Euphorbiaceae

One of the most important plants of the early Hawaiians and is now the official state tree. Nuts were strung on coconut frond midribs and used as torches. Roasted kernels are used to make the condiment inamona. Oil was burned in lamps, used for massages, and as wood polish. Wood was used for canoe parts and as firewood. The leaves served as mulch. Sap from green fruit was used to treat sore throat and thrush, and nuts were used as a purgative. Several dyes are obtained from kukui. Kukui is the kinolau of Kamapuaʻa, one of the Hawaiian gods, and symbolizes enlightenment.

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ETHNOBOTANICAL GARDEN

NIU (COCONUT)

Scientific name: *Cocos nucifera*
Origin: Polynesian Intro
Family: Arecaceae

The coconut palms below the path near Caum's Gulch are a variety recently introduced from Sāmoa, with thicker trunks and much larger fruit than the two traditional Hawaiian varieties. Hawaiian coconut palms can be seen across the lawn, near the new hale. All coconuts are introduced to Hawaiʻi.

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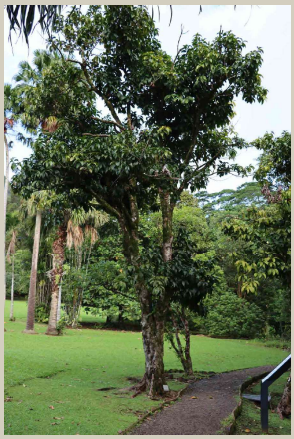
ETHNOBOTANICAL GARDEN



ʻŌHIʻA ʻĀI

Scientific name: *Syzygium malaccense*
Origin: Polynesian Intro
Family: Myrtaceae

The pom pom-like flowers, or ʻŌhiʻa ʻai keʻo keʻo, are a showy pink with white stamens. Delicious fruits are pear-shaped, usually red outside with edible white fleshy pulp. Wood was used for hale construction and the bark is a traditional medicine used to relieve a sore throat, thrush, during childbirth, and to treat cuts and infections. It also yields a red/brown kapa dye.

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ETHNOBOTANICAL GARDEN

PALAPALAI / PALAI

Scientific name: *Microlepia strigosa*
Origin: Indigenous
Family: Dennstaedtiaceae

The lacy green frond can grow to over three feet in length. Leaflets are somewhat hairy. Fronds are broad at the base and narrow at the pointed tip. Palapalai is sacred to Laka patron goddess of hula. It is a favorite lei plant, and is often used in hula and on the hula altar.

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ETHNOBOTANICAL GARDEN

ʻUALA (SWEET POTATO)

Scientific name: *Ipomoea batatas*
Origin: Americas
Family: Convolvulaceae

ʻUala, or sweet potato, is a starchy and sweet-tasting root vegetable and is only distantly related to the common potato. Sweet potato is a popular food in many parts of the world, however many of the other plants within the same family are poisonous. ʻUala has been a staple crop in Hawaiʻi for centuries ever since the Polynesian voyagers brought varieties from South America.

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BROMELIAD GARDEN

The most famous member of the bromeliad family may be the pineapple, but visitors can see many other examples in the Bromeliad Garden. The patterns and colors of the foliage make this garden a year-round visual delight. The garden is on a slope and is close to both Inspiration Point and the Rain Shelter.

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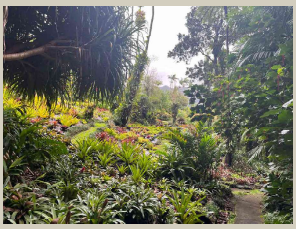
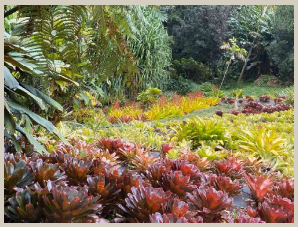
BROMELIAD GARDEN





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INSPIRATION POINT

The slope up to Inspiration Point makes the trail more strenuous than other walks in the Arboretum, but the lush panorama makes the trek worthwhile. If the day is clear and hot, we recommend bringing water, a hat, and maybe even a picnic!

HOME

INSPIRATION POINT

HISTORY OF MĀNOA VALLEY

Upper Mānoa is composed of several smaller valleys, each having its own waterfall. In ancient times, it was said that the entire forest would appear red from the ʻōhiʻa lehua blossoms. Across the valley, ʻAkaʻaka peak can be seen. ʻAkaʻaka was wed to Nālehuaʻakaʻaka, who is represented by the lehua blossoms. They are the ancestors of Kahaukani (Mānoa wind) and Kauatuahine (Mānoa rain), who parented Kahalaopuna, the rainbow princess of Mānoa Valley. Mānoa Valley was one of the favorite spots for Hawaiian Royalty. King Kamehameha lived here during his conquest of the islands, as did his wife Queen Kaʻahumanu.

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INSPIRATION POINT

Click on the plant names to learn more!

WILD POINSETTIA

YELLOW LATAN PALM

HOME

INSPIRATION POINT

WILD POINSETTIA

Scientific name: *Warszewiczia coccinea*
Origin: Cultivated
Family: Rubiaceae

Wild poinsettia is a small evergreen ornamental tree. It is known for its inflorescence with bright red bracts and yellow petals. It is the national flower of Trinidad and Tobago because it blooms on the same day that the country gained independence from the United Kingdom.

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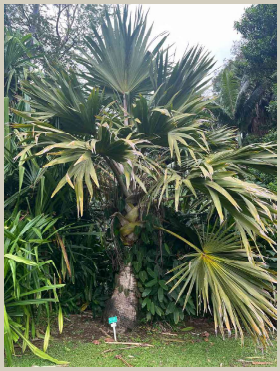
INSPIRATION POINT



YELLOW LATAN PALM

Scientific name: *Latania verschaffeltii*
Origin: Mauritius: Reunion
Family: Palmae: Coryphyoideae
Borasseae: Lataniinae

The yellow latan palm is threatened by habitat loss in the wild, however it is cultivated in other places as an ornamental. The leaves have yellow veins and yellow colored leaf stems. When flowering, this plant has a flower stalk coming from among the leaves that is anywhere from 3 to 6 feet (1 to 2 meters) long. It also produces a brownish green plum-shaped fruit. It is an immensely valuable commodity and is a major crop in Hawai'i, the Caribbean and S. America.

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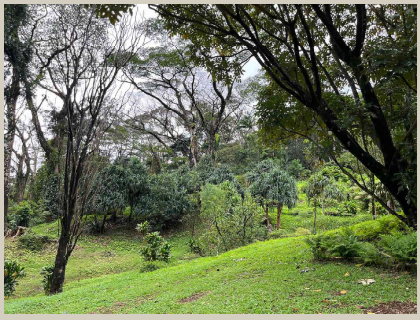
HAWAIIAN SECTION

The Hawaiian Section is a collection of plants native to Hawai'i, including many large and mature trees. This garden offers a stunning view of upper Mānoa valley.



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HAWAIIAN SECTION

Click on the plant names to learn more!

HŌ'AWA

'ILIAHI (HAWAIIAN SANDALWOOD)

KEAHI

KOA

KOKI'O KE'OKE'O (HIBISCUS WAIEMEAE)

ROYAL PALMS

'ŪLEI

HOME

HAWAIIAN SECTION

HŌʻAWA

Scientific name: *Pittosporum hosmeri*
Origin: Endemic
Family: Pittosporaceae

The tree is relatively tall as it can grow up to 25 feet (approximately 7.5 meters). It is crowded with leaves while also having both fruit and flowers. The ʻalalā, which is a Hawaiian crow, has been known to feed on the fruit of the plant. In the past, the wood was used to make the gunwales (railing) of canoes, while the fruit was used for medicine.

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HAWAIIAN SECTION

ʻILIAHI (HAWAIIAN SANDALWOOD)

Scientific name: *Santalum freycinetianum*
Origin: Endemic
Family: Santalaceae

ʻIliahi, or Hawaiian sandalwood, is a root hemi-parasite, which means it derives some of its nutrients from a host plant, such as koa (Acacia koa), koaiʻa (Acacia koaia), and ʻaʻaliʻi (Dodonaea viscosa). The ʻlaʻau ʻala (heartwood) of ʻiliahi contains valuable, aromatic essential oils. Native Hawaiians used the wood to make pola, the deck on a waʻa kaulua (double-hulled canoe).

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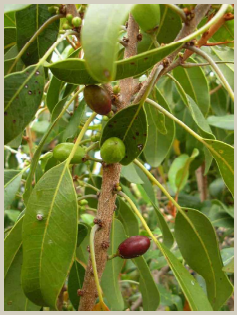
HAWAIIAN SECTION



Photos from Forest & Kim Starr

KEAHI

Scientific name: *Nesoluma polynesicum*
Origin: Indigenous
Family: Sapotaceae

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HAWAIIAN SECTION

KOA

Scientific name: *Acacia koa*
Origin: Endemic
Family: Fabaccae

Koa was once a common component of much of the forest land in Hawaiʻi. Koa trees were one of the largest trees in the Hawaiian forest, and the large trunks were often used for canoes. Koa wood is very hard and was also used to make many tools and implements. Today it is a prized wood used for furniture. The true leaves of koa are small and compound, and present during the seedling stage.

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HAWAIIAN SECTION

KOKIʻO KEʻOKEʻO (HIBISCUS WAIMEAE)

Scientific name: *Hibiscus arnottianus*
Origin: Endemic
Family: Malvaceae

The plant typically stands at about fifteen to twenty feet and is covered in oval shaped leaves. The plant also has white flowers with a pink stem. The plant is found in wet forests, specifically those on the Hawaiian islands of Molokaʻi and Oʻahu.

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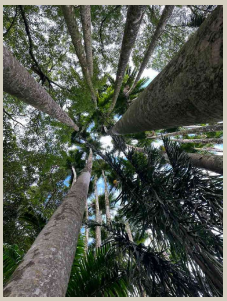
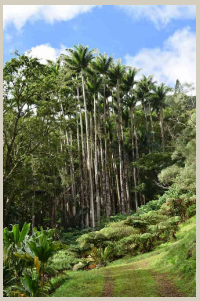
HAWAIIAN SECTION





ROYAL PALMS

Scientific name: *Roystonea oleracea*
Origin: Lesser Antilles, Colombia, Venezuela, and Trinidad and Tobago
Family: Arecaceae

This palm is large and can reach heights of 130 feet, or 40 meters tall. The largest recorded royal palm was 187 feet (57 meters). It has gray or whitish-gray stems that range from 18-26 inches (46-66 centimeters). The upper portion of the stem is encircled by leaf sheaths, which forms the crownshaft.

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HAWAIIAN SECTION

ʻŪLEI

Scientific name: *Osteomeles anthyllidifolia*
Origin: Indigenous
Family: Rosaceae

A shrub with glossy leaves and white flowers. Used medicinally to treat ʻea (thrush) and paʻaoʻao (childhood diease) and a mix of bark, leaves and salt are pounded together to treat wounds. The wood can be used for making instruments, fishnet loops, and spears.

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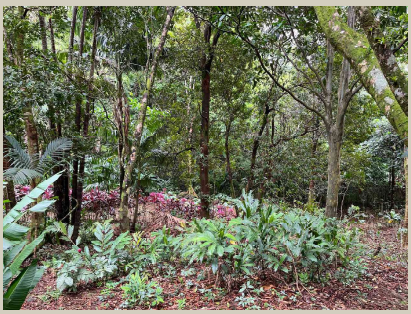
ECONOMIC SECTION



The Economic Section, located along the main trail, features tropical trees and plants that are economically important, including trees used for timber, food, and medicine.

Trees in the Economic Section include açaí palm, cassava, durian, lipstick plant, and many other interesting and economically significant plants!

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ECONOMIC SECTION

Click on the plant names to learn more!

AÇAÍ PALM

ALECTRYON MACROPHYLLUS

CASSAVA

DURIAN

FIREBIRD HELICONIA

GANDARIA

LIPSTICK PLANT

TACHIBANA TI

HOME

ECONOMIC SECTION

Photo from Forest & Kim Starr

AÇAÍ PALM

Scientific name: *Euterpe oleracea*
Origin: South America
Family: Oleracea

This is a canopy palm with black fruits about the size of a blueberry. Many plants have multiple trunks or canes that grow outwardly and can be used for construction. This plant needs ample water and does not tolerate drought very well.

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ECONOMIC SECTION

ALECTRYON MACROPHYLLUS

Scientific name: *Alectryon macrophyllus*
Origin: New Guinea
Family: Sapindaceae

Height can vary from a shrub size to up to 100 ft (about 30 meters). Small flowers can sometimes be found at the end of stems.

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ECONOMIC SECTION

Photos from Forest & Kim Starr

CASSAVA

Scientific name: *Manihot esculenta*
Origin: South America
Family: Euphorbiaceae

Also known as yuca. Cassava have long, brown roots that have a rough exterior, and the interior is a fleshy yellow/white. The roots are very rich in calcium and starch while the leaves are a good protein source for both humans (with proper preparation) and animals. There are both bitter and sweet varieties.

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ECONOMIC SECTION

Photo from Amani Hasan

DURIAN

Scientific name: *Durio zibethinus*
Origin: South America
Family: Malvaceae

The flesh of the plant has an odor that people find pleasing, or strongly repulsive. Descriptions of the smell range from sweet to sewer-like. This smell has led to this fruit being banned in various hotels and public transportation in Asia. *Durio zibethinus* is the only species of the 30 Durio species that is available in the international market.

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ECONOMIC SECTION

FIREBIRD HELICONIA

Scientific name: *Heliconia stricta 'Firebird'*
Origin: South America
Family: Heliconiaceae

Beautiful red lobster claw-looking blooms. This plant will grow just under 6.5 feet (about 2 meters tall).

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ECONOMIC SECTION

GANDARIA

Scientific name: *Bouea macrophylla*
Origin: Malaysia
Family: Anacardiaceae

An evergreen tree with dense foliage. The fruit of this tree is edible and can be eaten raw or cooked. Flavor can be sour or sweet. The leaves can also be eaten and are typically eaten raw and with rice.

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ECONOMIC SECTION

LIPSTICK PLANT

Scientific name: *Bixa orellana*
Origin: South and Central America
Family: Bixaceae

This plant yields spiny red fruit with seeds that are used as a spice, in cosmetics, and as an industrial dye. The spice is called annatto and has a distinct earthy taste. The fruit is usually red but on rare occasions one can find yellow and green fruiting plants.

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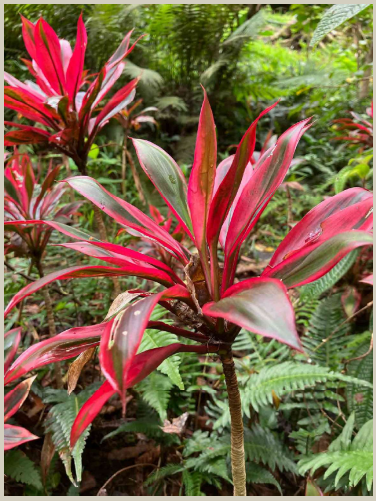
ECONOMIC SECTION



TACHIBANA TI

Scientific name: *Cordyline fruticosa 'Tachibana'*
Origin: Cultivated
Family: Asparagaceae

A shrub to a small tree with pink leaves. This plant is believed to bring good luck and is very popular in Hawaiian gardens. The leaves can be used as wrappers for cooking. It is also a common house plant.

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PALMS

Lyon Arboretum features North America's largest palm collection in a public garden!

The palms were orignally brought to the Arboretum from 1919 to 1943 by Harold L. Lyon, with the help of Joseph F. Rock. They brought 134 palm trees representing 98 species unique to the Arboretum.

Today, the collection has now grown to 2,519 individual palm trees representing 615 unique species. As you walk along the gardens, be sure to admire the vast collection Lyon Arboretum has to offer!

HOME

PALMS

Click on the plant names to learn more!

HOME

PALMS

BODHI TREE

Scientific name: *Ficus religiosa*
Origin: Pakistan to Thailand
Family: Moraceae

Ficus religiosa (JPN: Bodaiju) is the tree said to have appeared and grown when Buddha was born, and Buddha is said to have meditated under the bodhi tree for 6 years, seeking enlightenment. Also known as the bo tree or peepul tree, it is often planted near Buddhist temples. There is a walking Sukhothai Buddha, a donation from the King of Thailand. Lyon's bodhi tree is a direct descendent of the tree in Bodhgaya, India, under which Shakyamuni Buddha attained enlightenment.

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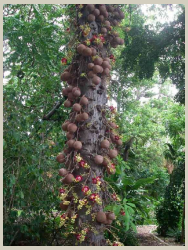
PALMS



CANNONBALL TREE

Scientific name: *Couroupita guianensis*
Origin: South America
Family: Lecythidaceae

This unusual tree gets its name from its fruits, which resemble cannonballs. The 6 to 8 inches (15 to 20 cm) round fleshy fruits are found on the branches and trunk, dangling on tangled stems below the foliage. Large waxy white and rose-colored flowers are fragrant, but the ripe fruits have a distinctly unpleasant smell. The tree (related to the Brazil nut tree) is deciduous, with oblong leaves clustered at the branch tips. The wood is used for lumber, and the fruits were used traditionally as gourd-like containers.

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PALMS

Photo from Forest & Kim Starr

CHINESE FAN PALM

Scientific name: *Livistona chinensis*
Origin: Southern Islands of Japan
Family: Arecaceae

This young fan palm atop the hillside on the right side of the trail acts as a canopy for the more delicate plants below. The large fan-shaped fronds are relaxed towards the tips. The olive-shaped fruit is blue-green and carpets the ground. *Livistona chinensis* makes a good pot plant when young.

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PALMS

FOOT STOOL PALM

Scientific name: *Livistona rotundifolia*
Origin: Indonesia to Philippines
Family: Palmae

This small palm has large fan-like leaves, while its stem is very thorny. When in its natural habitat the tree can grow far taller than when it's used as a houseplant, as it often is. The ends of the leaves sometimes turn brown in which case they are usually trimmed.

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PALMS

MAJESTIC PALM

Scientific name: *Rhopaloblaste ceramica*
Origin: Maluku to New Guinea
Family: Arecaceae

This tree can grow to about thirty-five feet and has a relatively thin trunk. At the top of the tree there are typically about fifteen leaves. The tree's shoot is edible, and its wood has been used for flooring, arrowheads, and ornamental uses.

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PALMS

PUERTO RICAN HAT PALM

Scientific name: *Sabal causiarum*
Origin: Hispaniola and Puerto Rico
Family: Palmae

This tree grows very slowly, but can eventually reach up to fifty feet. This palm has a very thick trunk that's covered with fibers and leaves that can grow off the trunk up to nine feet. The tree gets its name as its leaves used to be woven into hats.

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PALMS

SAGO PALM

Scientific name: *Metroxylon sagu*
Origin: Maluku to New Guinea
Family: Palmae

This plant is small and grows low to the ground however in time they can grow up to ten feet. Despite its name, it is not technically a palm tree. The plant doesn't branch and has nuts, but no fruit. They are often kept by people as houseplants.

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PALMS

SALMON LEAF PALM

Scientific name: *Calyptrocalyx leptostachys*
Origin: Papua New Guinea
Family: Arecaceae

The tree is small for a palm as it only grows to about six feet. The plant grows slowly and is also very rare. The tree gets its name from the color of its leaves, as the leaves start out as a salmon color. These trees are often kept as house plants or in gardens.

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PALMS

SUNSET PALM

Scientific name: *Calyptrocalyx albertisianus*
Origin: New Guinea to Bismarck Archipelago
Family: Arecaceae

The sunset palm is a midsized pinnate palm. This means it has leaflets arranged on either side of the stem, typically in pairs opposite each other. Its distinguishing features are a long and undivided flower spike that carries fairly large, red fruits when mature, and a beautiful pinkish red, new leaf with wide leaflets.

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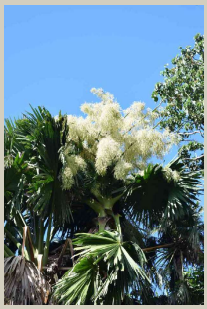
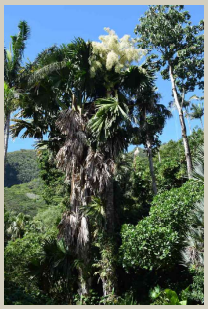
PALMS





TALIPOT PALM

Scientific name: *Corypha umbraculifera*
Origin: India
Family: Arecaceae

The talipot palm is found directly mauka of the rainshelter. This is a giant of the palm family. These trees are only about 45 years old and can grow to 25 meters (about 82 feet). They can live to about 80 years old, flower once, then die. When in flower, the inflorescence plume can bear several million flowers, the largest inflorescence in the plant kingdom. Each will take a year to fruit, then the tree dies—with millions of progeny left behind.

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PALMS

VONITRA PALM

Scientific name: *Dypsis fibrosa*
Origin: Madagascar
Family: Arecaceae

This palm tree can grow up to thirty feet with a width of up to ten feet. The upper portion of the tree's trunk is covered in fibers, and there are typically branches towards the bottom. The tree's fruit has been known to be eaten by wild pigs.

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PALMS

WALKING STICK PALM

Scientific name: *Linospadix monostachyos*
Origin: New South Wales
Family: Palmae

This palm tree is relatively small and has edible fruit. The fruit of this tree is bright red, and this red color is how you can tell if the fruit is ripe to eat. Its trunk is thin and is covered in rings which gives it an interesting appearance. This thin, straight stem is where the plant gets its name.

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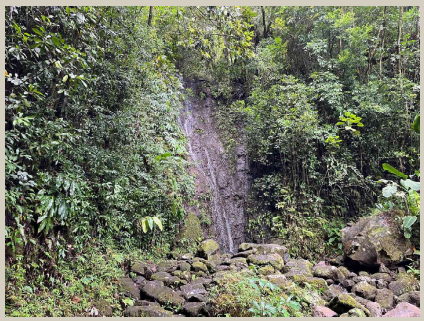
‘AIHUALAMA FALLS

Lyon Arboretum does have its own waterfall: ‘Aihualama Falls.

Those interested in visiting ‘Aihualama Falls can find it by following the main trail all the way back into the valley. The trail becomes more rugged farther into the forest, and visitors should wear sturdy footwear suitable for navigating roots and possibly mud. ‘Aihualama Falls is relatively dry; unless it has rained recently, visitors should expect very little water flow.



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INVASIVE SPECIES

Being the most isolated major land mass in the world, Hawai'i's endemic plants are especially sensitive to the impacts of invasive species. The introduction of invasive plants and animals has caused numerous extinctions over the years.

While many species were introduced accidentally, such as rats and mosquitoes, many were brought intentionally. Animals such as pigs and goats were brought in for cultivation while others such as the mongoose were brought for pest control.

Albizia is one of the most prominent invasive species at the Arboretum.

Albizia
Click to learn more!

For more information on invasive species in Hawai'i, please visit the **Oahu Invasive Species Committee website**.

HOME

INVASIVE SPECIES

ALBIZIA

Falcataria moluccana, also known as albizia, this tree dominates the canopy layer in parts of the arboretum and now in much of Mānoa Valley. It was one of the first species of trees brought to the Mānoa Experiment Station, as Lyon Arboretum was called then, by Joseph Rock. Native to the Moluccas Islands of Indonesia. It proved to be successful as a reforestation tree due to its extremely fast rate of growth, with little commercial timber value. It has proven to be highly invasive over the years, and can now be found growing on all of the major Hawaiian Islands.

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INSPIRATION POINT

ALBIZIA REMOVAL PROJECT

A large tree removal project was undertaken in 2014, when 18 very large trees were removed, (the tallest was 170 feet, or around 52 meters) allowing light into the once heavily shaded forest floor of the Upper Lawn areas. These include the Helber Palm Walk, Harrison Road, the Rain Shelter, and Inspiration Point. The remnant tree stumps can be seen dotting this area.

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INVASIVE SPECIES

Some of the other invasive plants at the Arboretum include:

Fiddlewood

Mules Foot Fern

Schefflera

Spiral Ginger

Velvetleaf Glorybower

HOME

WILDLIFE

BIRDS

Click on the bird names to learn more!

- ‘AMAKIHI
- COCKATOO
- COMMON WAXBILL
- JAPANESE WHITE-EYE (MEJIRO)
- JAVA FINCH
- KOLEA
- MYNA (MYNAH)
- RED-VENTED BULBUL
- RING-NECKED PARAKEET
- WHITE-RUMPED SHAMA

HOME

WILDLIFE

Click on the animal names to learn more!

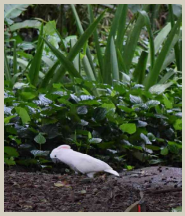
- FERAL PIG
- JAVAN MONGOOSE
- POISON DART FROG

HOME

WILDLIFE
BIRDS

‘AMAKIHI

This is a small bird with a green or olive body, sometimes with a yellowish tint. It looks similar to the Japanese White-eye, but has no ring around its eye. They are one of the birds native to Hawai‘i that are found at the Arboretum.



COCKATOO
(several species)

This is a very large white bird—sometimes a yellow, pink, or white crest is visible. They often squawk loudly.

BACK TO BIRD MENU

HOME

WILDLIFE
BIRDS

COMMON WAXBILL

This bird is very small in size. It has a brown-gray body with a gray neck, red beak, and a red streak across its eyes. They are usually seen in flocks in the grass.

JAPANESE WHITE-EYE (MEJIRO)

This is a small bird with a green body, sometimes with a yellowish tint. It has a white ring around its eye, and looks similar to ‘Amakihi, but with a different bill shape.

BACK TO BIRD MENU

HOME

WILDLIFE
BIRDS


KOLEA

This is a medium sized bird. During the fall and winter (non-breeding plumage), it will have aspeckled black and brown back, and a tan underside. During late spring and summer (breeding plumage), it will have a black face and chest, and white border underside. It also has a black and gold speckled back. They are one of the birds native to Hawai'i that are found at the Arboretum.

JAVA FINCH

This is a very small bird with a black head, white cheeks, a gray body, and a pink or red bill. They are usually seen in flocks in the grass.

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HOME

WILDLIFE
BIRDS

MYNA (MYNAH)

This is a medium-sized bird. It has a black head, brown body, and a yellow beak and feet. It likes to walk and hop, and can be troublemakers.

RED-VENTED BULBUL

This is a medium-sized bird. It has a black head with a pointy crest, a brown body, and a red patch under its tail.

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HOME

WILDLIFE
BIRDS

RING-NECKED PARAKEET

This bird is a big green parrot with a red beak. Its long tail is easily seen in flight, and it flies in flocks.

WHITE-RUMPED SHAMA

This is a medium-sized bird. It has a shiny black head and back and an orange belly. Its long black tail has white underneath. It also has a pretty song of variable length and pattern.

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HOME

WILDLIFE
FERAL PIGS

FERAL PIG (Sus scrofa)

The feral pigs in Hawai'i today are descended from two types of pigs that were brought to the islands at different points in history. The first pigs were brought by the Polynesians in the fourth century AD. The second pigs were European breeds that arrived with Captain James Cook in 1778.

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WILDLIFE
JAVAN MONGOOSE

JAVAN MONGOOSE
(Herpestes javanicus)

The mongooses found in Hawai'i are native to India and were introduced to the islands in 1883 to control the rat populations in sugarcane fields.

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WILDLIFE
POISON DART FROGS

POISON DART FROG
(Dendrobates auratus)

These green and black poison dart frogs were introduced to the Hawaiian islands in 1932 as a form of mosquito control. Despite their name, these frogs are not considered to be toxic. Their toxicity is dependent on their diet, which is different in Hawai'i than it is in their native environment.

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