Visitor Management Strategies: Hoʻomaluhia Botanical Garden

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Abstract

In recent years, Hoʻomaluhia Botanical Garden in Kāneʻohe, Oʻahu, has faced many problems resulting from increasing visitation. The management staff at Hoʻomaluhia has a long-term goal to develop a visitor management (VM) plan to address these issues. Our role was to help inform their future long-term VM plan through data collection and a set of recommendations. To do so, we reviewed VM plans from similar outdoor recreational sites, collected and analyzed Hoʻomaluhia visitor data to identify visitor trends, and gathered feedback from stakeholders (visitors, garden staff, and residents of the nearby neighborhood) to help develop controlled access management and VM strategies. Our final recommendations aim to manage increased visitation to the garden and its impact on the local community.

Executive Summary

Increasing visitation has caused problems in outdoor recreational areas around the world. A growing number of these sites have had to develop management strategies to avoid damaging the area, guarantee the safety of its visitors, and improve the overall visitor experience. In recent years, Hoʻomaluhia Botanical Garden in Kāneʻohe, Oʻahu, has faced many issues resulting from increasing visitation.

Hoʻomaluhia was founded in 1982 by the U.S. Army Corps of Engineers as a flood control project. The facility doubles as a 400-acre botanical garden including a lake, hiking trails, a two-mile road, six parking lots, and 30 campsites. Annual visitation has tripled since the garden's opening, leading to an overwhelming number of visitors for the management team to oversee. During their visit, many visitors remain on the garden's main road, resulting in overcrowding. Residents of the nearby community have also complained about vehicular traffic and visitors' cars parked or lined up outside their homes. As Hoʻomaluhia lacks a definitive plan for the future, the management team has expressed concerns about not being able to keep up with visitor and neighbor needs.

Hoʻomaluhia can address the concerns of its visitors, staff, and neighbors by utilizing visitor management (VM) strategies. VM focuses on preserving the site and optimizing the visitor experience through proactive, sustainable measures (Kohl et al., 2015). The management staff at Hoʻomaluhia has a long-term goal to develop a VM plan and is expecting budget requests and years of planning. Our role was to help inform their future long-term VM plan through data collection and a set of recommendations. To do so, we identified the following objectives:

1. Review and analyze VM plans from similar outdoor recreational sites
2. Collect and analyze visitor data at Hoʻomaluhia Botanical Garden
3. Identify stakeholder concerns surrounding current garden infrastructure

Review and analyze VM plans from similar outdoor recreational sites

The initial research phase focused on reviewing VM plans from other outdoor recreational sites that faced problems managing visitation. Our team analyzed the VM plans at Zion and Haleakalā National Parks, both of which are sites with accessible and informational VM plans readily available online. Examining these plans helped our team gain an initial understanding of what VM plans typically consist of. The two plans utilize easy-to-follow formats that provide a suitable outline for Hoʻomaluhia's recommended VM plan.

To gather first-hand knowledge about the VM plan development process, our team interviewed park managers who have designed and applied VM plans in Hawaiʻi. Our interview with two representatives from the Hawaiʻi Department of Land and Natural Resources (DLNR),

which oversees Hā'ena State Park, Diamond Head State Monument, and Waiʻānapanapa State Park, highlighted the importance of collaborating with the local community to limit overcrowding. We also discussed the value of practicing "adaptive management," or gradually changing a managerial approach based on feedback and results (Williams et al., 2009).

Our team conducted an interview with Lyon Arboretum's acting director about the site's reservation system and suggested donation model. Lyon's management team has found that their combination of a reservation system and donation system has not only eased the stress placed on staff, but has improved the visitor experience.

Finally, we interviewed the manager of Hanauma Bay State Park about the park's reservation system and admission fee. The park implemented an online reservation system to cap visitation at a manageable number. Hanauma Bay also employed strategies to directly influence visitor behavior, such as limiting the number of arriving visitors two hours before the park closes.

Collect and analyze visitor data at Hoʻomaluhia Botanical Garden

To understand visitation patterns at Hoʻomaluhia, we utilized daily visitor data from January 1, 2022, to January 31, 2023. We determined that there is an approximate 50/50 split in resident/non-resident visitation every month, and visitation is the highest during the weekend and the lowest on Wednesdays. To supplement the data we received regarding total visitation, we focused on collecting visitation data at four distinct locations in the garden throughout the week. This data showed that the education center typically receives the most visitors, but only a fraction of these visitors interact with staff to find out more information about the garden. These findings also confirmed that areas that deviate from the main road typically receive fewer visitors than areas that are easily accessible from the main road.

Identify stakeholder concerns regarding current garden infrastructure

Current stakeholders of the garden include staff, visitors, and nearby residents. Gathering feedback from visitors to Hoʻomaluhia was vital to understanding visitor priorities regarding their experience. Our interviews revealed that a majority of first-time visitors and only 40% of returning visitors would be willing to make a reservation and/or pay an admission fee in order to visit the garden.

We surveyed the garden's staff and management team to better understand their current visitor processes and VM policies. Of the garden's 28 employees, we received nine survey responses. These responses addressed concerns about rule enforcement, social media and unauthorized photography, visitor experience, and operational practices among staff.

Surveying residents who live nearby Hoʻomaluhia helped us understand the direct impact of growing visitation on the community. We analyzed 25 survey responses to identify common

concerns among the community. Of these respondents, 60% discussed traffic-related disturbances caused by visitors' vehicles, such as illicit parking and rideshare services. Safety concerns have arisen among seven respondents due to unsafe driving and disregard for the speed limit. The survey responses from residents confirmed that traffic, safety, and other disturbance-related issues are commonplace among the garden's neighbors.

Short-term suggestions

Ho'omaluhia could implement the following suggestions without major funding or other external sources, including the city, county, state, or federal parties. For example, adjusting Ho'omaluhia's hours of operation could provide the staff with more time for maintenance, facilitate the garden's closing procedure, and provide neighbors with more opportunities to utilize the garden while it is less crowded. One option would be to close the garden to public access for one day of the week, while a second option would involve limiting entry to the garden an hour before closure.

Additionally, restructuring the garden's website to include detailed descriptions of the garden's rules could reduce unsafe or unwanted visitor behavior. The garden's restrictions, specifically its rules regarding photography, should be clearly explained to potential visitors on its website. Similarly, Ho'omaluhia should work on expanding its social media presence to share its regulations.

Ho'omaluhia should clearly communicate its rules to decrease the number of visitors who do not abide by the garden's regulations. Specifically, the security guard stationed at the entrance could tell visitors a quick overview of the rules before they enter. The garden's staff will need to develop a standard list of rules that are accessible to visitors prior to and upon their arrival, digitally and physically.

Visitors and staff who participated in our team's interviews provided suggestions for additional activities and offerings, such as a guided tour program and concessions. These additions would enhance the overall visitor experience.

Long-term suggestions

Long-term suggestions may require lots of resources, funding, or approval from the city of Honolulu. Because of this, implementing any of the following solutions would be done over a long period of time. For example, a reservation system would allow Ho'omaluhia to cap visitation at a certain number of visitors each day or cap the number of new arrivals during certain time blocks. This system could reduce overcrowding and facilitate communication between staff and visitors. A large majority of visitors indicated that they would prefer to make a reservation online rather than in person; therefore, we recommend that Ho'omaluhia creates an online reservation system. The garden could also reserve some space for walk-up visitors, similar

to the approach employed at Hanauma Bay. This accommodates some last-minute visitors while still providing a large degree of predictability and control over total daily visitation.

If necessary, Hoʻomaluhia should consider eventually pairing its reservation system with a form of admission payment to further influence the number of visitors coming into the garden. This model would discourage visitors who only want to briefly enter the garden for photography purposes from coming to Hoʻomaluhia. We recommend that Hoʻomaluhia does not charge Hawaiʻi residents, children aged 12 and under, or active-duty military members for entry.

Paving a designated pedestrian lane on the side of the main road would alleviate safety concerns caused by visitors taking photographs and walking in the middle of the road. Since many vehicles do not abide by speed regulations within the garden, a pedestrian lane would reduce the threat of careless drivers to walkers. A pedestrian lane would also allow the garden to pave areas catered for pedestrian photography and make the garden more accessible for visitors with mobility challenges.

Implementing more directional signage around the garden would facilitate navigation and enhance the visitor experience. Signage that specifies which trails are nearby and indicates the locations of trailheads would encourage visitors to deviate from the main road and explore more of the garden. Staff members have shared that they feel there is an overabundance of signs that tell visitors what not to do, disrupting the natural serenity of the garden. We recommend that the garden reassess the clarity, usefulness, and potential repetitiveness of its existing signage to determine whether to keep, update, or remove each sign.

Our team identified possible areas of further research. These areas include utilizing carrying capacity in the creation of a reservation system, determining how an admission fee would impact the garden's funding, interviewing visitors to determine potential tour routes and lengths for guided tours, and utilizing a suggested donation system. The garden can conduct more in-depth interviews with stakeholders, VM experts, and the city to gather information regarding these areas.

Conclusion

Hoʻomaluhia Botanical Garden's management team must address the problems caused by increasing visitation by implementing a comprehensive VM plan. Our team hopes that this project will facilitate the creation of a VM plan that aims to manage the total number of visitors to the garden, improve the visitor experience, and address the concerns of staff members and the nearby community

Acknowledgments

Our team would like to thank the following individuals for their involvement and assistance with our project.

Authorship

All authors have collaborated to produce the contents of this report and take equal responsibility for the authorship of each section. The opinions expressed in this report are those of the authors and do not necessarily reflect the opinions or course of action taken by Honolulu Botanical Gardens.

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1. Introduction

Hoʻomaluhia Botanical Garden, located in Kāneʻohe, Oʻahu, was founded in 1982 by the U.S. Army Corps of Engineers as a flood control project. The facility doubles as an expansive botanical garden and outdoor recreation area, showcasing a wide variety of plants from tropical regions around the world. Hoʻomaluhia allows guests free admission to explore all it has to offer. The garden has become an extremely popular visitation site due to its beautiful landscape, various classes and activities, and photo opportunities. Annual visitorship has tripled since the garden's opening in 1982, leading to an overwhelming number of visitors for the management team to oversee and overflow activity in the surrounding neighborhood. A sustainable visitor management plan must address the issues caused by rising visitation.

Visitor management (VM) planning allows area managers to control the number of people that visit a site and influence how visitors interact with the area. Visitor flow, or the physical movement of guests, impacts the distribution of people and determines which areas become the most populated. Area managers can regulate visitor flow through the layout of trails, the placement of visitor resources, and informative signage and maps. While optimized visitor flow can substantially reduce overcrowding, managers may have to limit the number of guests allowed in a certain area at a time or restrict visitor access through a reservation system. VM plans should also facilitate an informed visitor experience. Informed visitors are familiar with the general layout of the park, have an idea of which sections they would like to go to and/or activities they would like to partake in, and know the site's rules and restrictions. Hoʻomaluhia would greatly benefit from a VM plan that includes a well-informed combination of these methods and policies.

Our goal was to provide the management team at Hoʻomaluhia with a flexible VM plan with suggested methods to address their current challenges. In order to achieve this goal, we identified effective visitor management strategies, observed visitor trends within the garden under its current policies, and interviewed stakeholders including visitors, staff, and neighbors to determine the strengths and weaknesses of their current operation methods.

2. Background

2.1 Rising visitation to Hoʻomaluhia Botanical Garden

Hoʻomaluhia Botanical Garden covers 400 acres of land, including a lake, hiking trails, a two-mile road, six parking lots, and 30 campsites. The garden is open seven days a week for vehicles from 9:00 a.m. to 4:00 p.m., and open for walkers from 6:30 a.m. to 6:30 p.m. Extended walk-in hours are intended to accommodate local residents. The garden is free for residents and tourists and welcomes groups of all sizes from around the world.

Visitation to Hoʻomaluhia has drastically increased in recent years. The garden welcomed 193,996 visitors in 2015, but visitation grew by 196.94% to 576,054 visitors in 2022. These visitors are nearly evenly composed of residents of Hawaiʻi and tourists, with a 12:13 ratio in January 2023. The rise in visitation raised concerns among the garden's management team and the nearby residential community (J. Sand, personal communication, November 10, 2022). Visitors have demonstrated difficulty with wayfinding and many do not deviate from the garden's main road, resulting in overcrowding in popular areas. Overcrowding can impact visitors' use of areas throughout the garden, disrupt Hoʻomaluhia's peaceful atmosphere, and risk damage to the garden. As the garden lacks a definitive plan for the future, the management team has expressed concerns about not being able to keep up with visitor needs.

The neighboring community greatly values Hoʻomaluhia. Many locals enjoy morning walks on the property before it opens to the public. However, garden management has received concerns about increasing "spill-over" activity from visitors (J. Sand, personal communication, November 10, 2022). Residents have primarily complained about vehicular traffic and cars parked outside their homes. While the garden and its parking lots open to the public at 9:00 a.m., cars tend to line up outside the gates before it opens. Some visitors will leave vehicles parked near private residences in order to walk in the garden before it opens for vehicles. The vehicles block driveways, rendering residents unable to leave their homes. Hoʻomaluhia's management team seeks to promote respectful treatment for the surrounding neighborhoods (J. Sand, personal communication, November 10, 2022).

2.2 Visitor management

Hoʻomaluhia can address the concerns of its visitors, staff, and neighbors by developing a visitor management plan. Managers of natural areas that host visitors must employ strategic VM plans to ensure sustainable use of the property and its surrounding areas. VM focuses on preserving the site and optimizing the visitor experience through proactive, sustainable measures (Kohl et al., 2015). Attributes of VM plans include dictating what, where, and when certain activities are allowed, influencing the movement of crowds through trails and signage, and

thoughtfully arranging visitor resources such as visitor centers or bathrooms (Kohl et al., 2015). With these measures comes the meticulous practice of creating and upholding an advantageous framework that neither worsens the visitor experience nor damages the site (Shackley, 2000).

VM plans must take into account the quality of the visitor experience, which begins even before they arrive at the entrance. Providing informational resources to visitors prior to their arrival, such as maps or a list of rules, allows them to come to the site with a clear idea of the areas they would like to go to and the activities they would like to participate in (Reid et al., 2009). Pre-visit information particularly benefits disabled visitors as they plan their trips (Fryer, 2021). Area managers can improve the visitor experience by providing well-articulated, accessible pre-visit resources to all visitors.

Visitors should feel confident enough to explore even the most distant areas when they arrive at a site. For this reason, the placement of visitor resources throughout the garden is crucial in maintaining visitor movement and a comfortable "flow." Orienting visitors through a brief presentation at the entrance of the site can set the foundation for a well-informed visit (Honig, 2000). Maps should be posted throughout the site and should be available digitally or as a physical brochure to ensure that visitors are never lost. Each path of the site should also be clearly laid out with directional signs that allow visitors to confirm their location and navigate to where they would like to go (Soh & Smith-Jackson, 2003). If visitors spread throughout the entire area, then less crowding will take place, allowing for the site to be utilized at its full capacity with effective visitor flow. While signage can enhance the visitor experience and distribution of visitors, the desired ambiance of a natural attraction like a botanical garden must be taken into account. Signage that forcefully reprimands visitors, for example, is likely to disrupt a peaceful atmosphere. An overabundance of signage can have this same effect. For this reason, the tone and location of the signage must be considered carefully.

VM plans help ensure the site never exceeds the carrying capacity, or the number of visitors that an area can maintain without becoming overcrowded (Weeks et al., 2014). Carrying capacity is most commonly defined as the total accessible area of the park divided by the average area that a single visitor occupies (University of the Aegean, 2002). When a park maintains carrying capacity, it guarantees the comfort and safety of all guests and prevents areas from becoming underutilized or overrun (Weeks et al., 2014). Area managers typically uphold carrying capacity by restricting access to certain areas and influencing visitor movement patterns (Weeks et al., 2014). Entrances, visitor resources, and areas with cultural, historical, or scientific significance often attract the most visitors. Therefore, managers should consider controlling the capacity and flow of these areas through effective signage, maps, the placement of visitor resources, and appropriate scheduling and/or admission policies.

2.3 Controlled access management

To create an effective VM plan, managers must employ controlled access strategies specifically tailored to the needs of their park. This section describes various controlled access management strategies that improve the visitor experience while limiting daily visitation.

Restrictions on visitor access limit the total number of visitors allowed in a site—or a specific area of the site—at one time. Visitor restrictions serve as a response to overcrowding, a phenomenon that may jeopardize visitor safety, damage the environment, or compromise the visitor experience (Buckley, 2003). One way to restrict visitor access is by implementing an admission fee or a reservation system.

Admission fees, or park user fees, are a common attribute of VM plans. Visitors pay a set price for park entrance; this revenue may be used to maintain, conserve, and manage the park (Steckenreuter & Wolf, 2013). An entrance fee drives away potential visitors who may view a fee as financially unreasonable or economically restrictive (Steckenreuter & Wolf, 2013). When visitors respond negatively to the introduction of an admission fee, resentment toward park management may rise and visitation rates may drop. (Steckenreuter & Wolf, 2013). If park management successfully introduces a fee, the resulting revenue can improve the visitor experience by limiting overcrowding and encouraging visitor activity in specific areas of the park (Chung et al., 2011).

In any case, the park must consider a visitor's willingness to pay an admission fee. Factors that influence a visitor's willingness to pay (WTP) an admission fee include the perceived fairness of the entry price and place attachment (Chung et al., 2011). Visitors will likely perceive an entry fee as fairer if they are told how the revenue will be used to benefit the park (Chung et al., 2011). A visitor's emotional attachment to a geographical location can also impact their willingness to pay (Chung et al., 2011). Persuasive communication has proven to increase the perceived fairness of an entry fee and WTP (Steckenreuter & Wolf, 2013). When the revenue's use is made clear and meaningful, visitors may be more willing to pay admissions fees.

A reservation system also serves as a form of controlled access VM. Reservation systems are typically available online and require guests to register before visiting the site, usually for a certain date and/or time (Zhao et al., 2022). Area managers benefit from reservation systems because they limit the number of guests that can enter the site and thus reduce overcrowding (Zhao et al., 2022). In turn, smaller crowds can facilitate movement and sightseeing, enhancing the visitor experience (Zhao et al., 2022). A reservation system's perceived usefulness and perceived ease of use can influence whether visitors respond positively to the system (Lee et al., 2006). Therefore, an effective reservation system must clearly show its ability to reduce overcrowding to potential visitors and be simple to use (Lee et al., 2006).

These strategies can be implemented independently or in combination to control visitation numbers and enhance the visitor experience. VM strategies can be seen in action through real-world examples.

2.4 Applications of VM to Hoʻomaluhia

VM plans provide effective strategies for regulating visitor density and enhancing the visitor experience. Many popular sites around the world utilize VM plans, and critical evaluation of plans from other sites with missions similar to Hoʻomaluhia's could inform the development of their own plan. As Hoʻomaluhia currently lacks a sufficient VM plan, the garden would benefit from a plan specifically designed to manage increased visitation and its impact on the surrounding neighborhoods. The plan should be informed by stakeholder concerns, findings from visitation data analysis, and an understanding of effective VM strategies. The garden's VM plan should ideally be perennial and applicable for many years to come. With these focuses in mind, our team created effective VM and controlled access management strategies for Hoʻomaluhia Botanical Garden.

3. Methodology

3.1 Introduction

This chapter outlines the steps we took to collect information, analyze data, and develop suggestions for a visitor management (VM) plan for Hoʻomaluhia Botanical Garden. The management staff at Hoʻomaluhia has a long-term plan to develop and implement a VM plan, which involves budget requests and years of planning. Our role was to collect data and develop recommendations to help inform their future long-term VM plan. Before conducting research, we outlined the objectives needed to fulfill this goal. We identified the following objectives:

1. Review and analyze VM plans from similar outdoor recreational sites
2. Collect and analyze visitor data at Hoʻomaluhia Botanical Garden
3. Identify stakeholder concerns regarding current garden infrastructure

3.2 Review and analyze VM plans from similar outdoor recreational sites

The initial research phase focused on reviewing VM plans from other outdoor recreational sites that faced problems managing visitation. Our team analyzed the VM plans utilized at Zion and Haleakalā National Parks: locations that had accessible and informational VM plans readily available online. While we did not have contact information for representatives from these sites, we used the documents to understand the general format and content of VM plans. Examining existing VM plans helped our team gain an initial understanding of what VM plans typically consist of. We used this insight to make suggestions that fit the needs of Hoʻomaluhia and their future VM plan.

To gather first-hand knowledge about the VM plan development process, our team interviewed park managers who have designed and applied VM plans in Hawaiʻi. Through these interviews, we learned about the VM plan development and implementation processes (see Appendix A). Interview contacts included people who worked on the VM plans for Hāʻena State Park, Diamond Head State Monument, Waiʻānapanapa State Park, Lyon Arboretum, and Hanauma Bay State Park.

We were provided these contacts by Joshlyn Sand, the director of Honolulu Botanical Gardens. Given the similar context, interviewing park managers who contributed to these sites' VM helped to inform how our team designed a VM plan for Hoʻomaluhia. See Table 1 for an outline of our VM plan research.

	Analysis of VM plan structure	Analysis of VM strategies	Interview with manager
Zion National Park	✓	✓	
Haleakalā National Park	✓	✓	
Diamond Head State Monument		✓	✓
Hā'ena State Park		✓	✓
Waiʻānapanapa State Park		✓	✓
Lyon Arboretum		✓	✓
Hanauma Bay State Park		✓	✓

Table 1. Method of data collection for visitor management strategies across Hawaiian state parks and monuments.

3.3 Collect and analyze visitor data at Hoʻomaluhia Botanical Garden

In order to understand visitation patterns, our team used a combination of different approaches. First, we utilized daily visitor data collected by the entrance security guard from January 1, 2022, to January 31, 2023. Second, we collected additional data ourselves within the garden from January to February 2023. We collected our own data to supplement the coarse information provided by the garden, which only included the number of vehicles, total visitors, walk-ins, Hawaiʻi residents, and non-residents. The additional data helped us identify potential visitation patterns and preferences. We divided our data collection into three time periods throughout the week: early weekday (Monday through Wednesday), late weekday (Thursday and Friday), and the weekend (Saturday and Sunday). This categorization was based on historical visitor trends where certain points of the week (i.e., the weekend) typically experienced higher visitation. We reasoned that the beginning of the week (Monday through Wednesday) would receive fewer visitors due to it being the beginning of the work week, so we separated these days from the end of the week (Thursday and Friday). We spent at least one day during each section of the week collecting visitation numbers via a clicker app at four locations. These locations were chosen based on their popularity, generally equal distance from each other, and recommendations

from garden staff: the Paul R. Weissich Education Center, a trail near the Kahua Kuou parking lot, the overlook, and the pavilion next to the Kahua Nui parking lot (see Figure 1). Data collection took place in one-hour increments during the afternoon on Sunday, January 22; Monday, February 6; and Thursday, January 26.
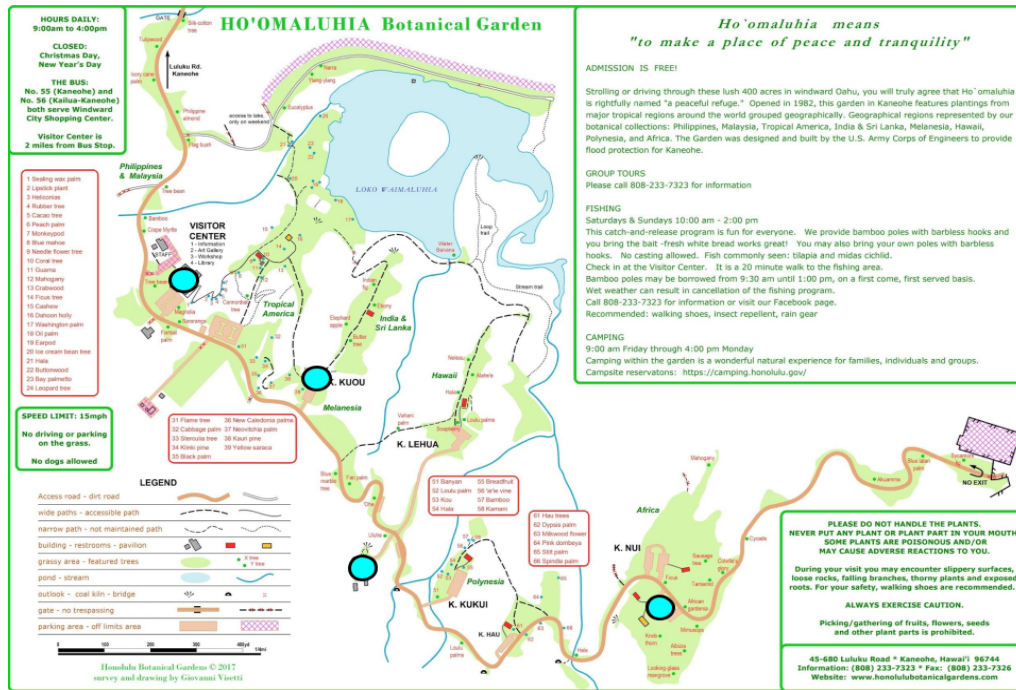
Figure 1. The map above displays the survey locations, indicated by blue dots, utilized for clicker-based data collection and visitor interviews.

3.4 Identify stakeholder concerns regarding current garden operations

Current stakeholders of the garden include visitors, staff, and nearby residents. We identified the stakeholders' current opinions, needs, suggestions, and feedback regarding visitation.

Gathering feedback from the visitors of Hoʻomaluhia in the form of interviews and survey responses was vital to understanding the current visitor experience. We arbitrarily aimed for at least 10 interviews on each field work day, one for each section of the week. There are two primary groups of visitors to the gardens, attending at a roughly 1:1 ratio, tourists and residents of Hawaiʻi (J. Sand, personal communication, November 10, 2022). We collected feedback from both of these groups because we expected their opinions to differ in some areas. Our survey asked questions regarding how much visitors knew about navigating the garden, what activities and trails they utilized, and how they felt their experience could have been improved (see Appendix B). Our team used this feedback to determine how much pre-visit knowledge visitors had, areas of improvement, and how perceptive they were to potential changes.

One challenge to interviewing visitors was their willingness to take the time to stop and thoughtfully answer the questions we presented to them. Therefore, we began our conversation with visitors by asking if they would have time for a five-minute interview. We first asked visitors about their experience at the garden and their willingness to pay an admission fee in the future (see Appendix B). Since many visitors may not want to participate in a full interview, we continued on to the additional semi-structured interview questions if they demonstrated a willingness to continue with the interview (see Appendix C).

We surveyed the garden's staff and management team to better understand their current visitor processes and VM policies. We asked staff how their roles have been impacted by the rise in visitation and areas of concern (see Appendix D). Through these surveys, we determined the biggest stressors on garden management are due to the current visitation patterns. Our team incorporated these insights into our recommendations for a future VM plan.

Members of the local community are also stakeholders in the evolution of the garden. Surveying residents who live nearby Hoʻomaluhia helped us understand the firsthand impact of rising visitation on the community (see Appendix E). We distributed envelopes containing a physical copy of our neighborhood survey, a QR code to access a digital copy of the survey, and a note explaining the purpose of our data collection to the four houses closest to Hoʻomaluhia. To reach a wider audience, the garden staff printed 12 physical copies of the same survey and QR code to hand out to walkers, as the staff recognized which walk-in visitors are nearby residents. We also shared a digital copy of our neighborhood survey for participants to fill out at a virtual Kāneʻohe Neighborhood Board meeting on February 16, 2023.

We coded interview responses and reviewed survey responses to identify common concerns among stakeholders. We categorized the data using tables and charts to help organize and visualize the responses. Using these categories and our research regarding VM strategies, we compiled a list of short-term and long-term recommendations.

3.5 Ethics

As an Interactive Qualifying Project completed through Worcester Polytechnic Institute (WPI), all information collected was used strictly for academic research. Data and interview responses remained anonymous unless permission was granted by the interviewee. The opinions expressed in our methodology and any future documents do not represent the opinions of WPI or Hoʻomaluhia Botanical Garden. This project was carried out with the approval of the WPI Institutional Review Board (IRB-23-0296).

4. Results & Discussion

Our team worked closely with Hoʻomaluhia Botanical Garden staff, visitors, and nearby residents to analyze data and determine beneficial visitor management (VM) techniques to regulate the garden's visitor density. This chapter presents the findings of our research process to create VM strategy suggestions for Hoʻomaluhia.

4.1 Review and analyze VM plans from similar outdoor recreational sites

The team first examined publicly available VM plans from Haleakalā National Park in Maui, Hawaiʻi, and Zion National Park in Utah to help us to understand the key components of a VM plan. The remainder of our analysis of VM plans from other sites consisted of interviews with park managers who have experience with the process of creating a VM plan. These interviews allowed us to understand how VM strategies are planned, designed, and implemented. We also considered if any of the presented strategies may be applicable to Hoʻomaluhia.

Analysis of VM plans from Haleakalā and Zion National Parks

Haleakalā National Park created a VM plan to reduce overcrowding and limit visitor impact on the local environment. The plan begins with a detailed background section that includes an overview of the park, why a VM plan is needed, and the desired results of a finalized plan (National Park Service, 2018). We found that Haleakalā's reasons for creating a VM plan paralleled reasons for Hoʻomaluhia's need for a VM plan, such as overcrowding at its facilities and visitor safety. The second section presented a series of visually-appealing charts intended to describe each suggested management strategy. The first chart described what would happen if management made no changes to existing operations. The following three charts described recommended action items from most to least favorable. These charts allow readers to easily identify each solution and understand their respective strengths and drawbacks. While Haleakalā organized its VM plan in a logical manner, the division between the two sections may force the reader to switch back and forth to read about the problem and its applicable suggestions. Management strategies proposed in Haleakalā's VM plan could be considered in Hoʻomaluhia's VM plan, such as enhancing trail markings and signage, communicating important information and rules on the park's website, and adding borders and pavement when appropriate.

Zion National Park created a VM plan to address issues caused by increased visitation, including infrastructure strain and traffic congestion (National Park Service, 2017). Similar to Haleakalā's plan, Zion's plan described why a VM plan is needed and a series of objectives. Zion's most pressing issues revolved around visitor safety, the impact of visitation on adjacent residential communities, and the strain on the park's facilities and daily operations. The park's objectives included developing long-lasting management strategies, maintaining the visitor

experience, and consistently collaborating with stakeholders. Notably, Zion's VM plan did not indicate a preferred approach, instead suggesting alternative solutions through a comparative chart that explored the potential effects of each solution on the current issues. These comparison charts allowed the reader to easily skim through the text and identify how the action items relate to one another. Alternative suggestions included multiple strategies to limit visitors based on accessible or popular areas. Zion's VM plan concluded with a chart displaying the next steps for the VM planning team and the park's management team to take. Zion's management team considered public opinion, collecting over 900 comments through open houses, meetings, and webinars. Zion's VM plan displays many contextual similarities to Hoʻomaluhia, especially regarding its reasons for developing a plan and its objectives. Therefore, the garden could utilize a similar organizational structure.

Interviews with VM plan experts

We conducted an interview with two representatives from the Hawaiʻi Department of Land and Natural Resources (DLNR): Alan Carpenter, Assistant Administrator of the Division of State Parks, and Korrine Gowin, Property Manager of the Division of State Parks. Carpenter worked on designing and implementing VM strategies for Hāʻena State Park on Kauaʻi, Waiʻānapanapa State Park on Maui, and Diamond Head State Monument on Oʻahu. A key portion of Carpenter's statements focused on collaborating with the local community to limit overcrowding. Prior to instating a reservation system and a daily capacity limit in Hāʻena State Park, its trails experienced heavy foot traffic and litter from about 3,000 daily visitors. Crowded, unkempt trails diminished the overall visitor experience. Residents nearby Hāʻena dealt with similar car-related problems as neighbors of Hoʻomaluhia, with visitors parking on their private property and blocking driveways. To ensure a high-quality visitor experience while maintaining the sanctity of the park and its nearby neighborhoods, DLNR collaborated with the residential community to develop solutions. The resulting policies capped daily visitation at 900 visitors per day, reduced Hāʻena's parking lot to 100 parking spaces, and introduced a mandatory reservation system. Since implementing these changes, the park has never reached 900 daily visitors due to the smaller parking lot. The policies have resulted in a less crowded visitor experience and less negative impact on the surrounding neighborhood. Waiʻānapanapa State Park and Diamond Head soon implemented their own reservation systems to address similar problems regarding overcrowding and disruption to nearby neighborhoods.

Carpenter highlighted an important approach that DLNR practices: "adaptive management," or incrementally changing their managerial approach based on feedback and results (Williams et al., 2009). Adaptive management allows staff to freely alter or discontinue a strategy if it does not achieve the desired outcome. Additionally, DLNR utilizes advisory

committees composed of local residents of nearby neighborhoods and Native Hawaiian residents. These committees are composed of 30 or more members who meet dozens of times throughout the planning process to discuss requests and progress and provide feedback. As Carpenter explains, "in Hawai'i, [organizations] can't get really far without community buy-in" (A. Carpenter, personal communication, January 19, 2023). Community input during the VM planning process allowed DLNR to actively reduce the negative impact caused by visitation. Engaging with the local community while developing a VM plan would allow Ho'omaluhia to make similar efforts toward reducing the impact on its neighbors.

We also conducted an interview with Lyon Arboretum's Acting Director, Nellie Sugii, about the arboretum's experience implementing VM strategies, particularly its reservation system. Because Lyon's parking lot cannot accommodate more than 30 vehicles at a time, parking was a major issue among visitors, employees, and volunteers for many years prior to instating a reservation system. Management believed that a reservation system would not only ease the stress placed on staff, but improve the visitor experience. When reopening after the COVID-19 pandemic, the arboretum's management team decided to instate a reservation system through the cost-free version of Eventbrite. Lyon's management did not collect any formal visitor feedback to inform this decision. The system limits visitation to 25 cars per designated time block each day, while a QR code at the gate allows walkers without vehicles to make reservations upon arrival. Two administrative staff members manage the reservation system; Sugii states that this structure minimizes interference by those who are not familiar with the system. The staff continues to refine this system as they discover which aspects work well and which do not.

In addition to the reservation system, Lyon Arboretum utilizes a suggested donation model rather than an admission fee. Upon checking in at the visitor center, a staff member has each party sign in and encourages a $5 donation per person. When we asked Sugii about visitors' willingness to donate, she clarified that the reservation system ensures that the majority of visitors to the arboretum are genuinely interested in the site. These visitors are primarily "plant-lovers and botanical garden people," meaning that most are willing to donate upon arrival (N. Sugii, personal communication, February 7, 2023). All donations stay within the arboretum's budget for maintenance and inventory since Lyon is a university-funded institution. On the contrary, implementing a donation system at Ho'omaluhia would not allow all revenue to stay within the garden's use because the garden is a city-funded institution.

Finally, we interviewed Joann Beall, the Regional Park Manager of Hanauma Bay State Park in East Honolulu, O'ahu, about the park's reservation system and admission fee model. Beall described how Hanauma Bay received as many as 3,000 to nearly 5,000 visitors a day prior to implementing a reservation system, creating long lines of traffic on the highway that leads to

the park. The traffic evoked visitor complaints and interfered with both residents' and park workers' abilities to get to work on time. The online reservation system that caps visitation at 1,400 groups per day, with 1,050 being online reservations and 350 being walk-up visitors who do not have reservations. Groups are limited to 10 members each, with no more than five children and five adults. Hanauma Bay currently charges $25 for each visitor except for Hawaiian residents, children under the age of 13, and active military members, who may enter the park for free. In collaboration with the Department of Information & Technology, the park added a CAPTCHA test that prevents touring companies from overtaking the system.

Hanauma Bay also employs strategies directly catered toward influencing visitor behavior. All visitors must watch a nine-minute-long educational video once they arrive that describes the park's background and regulations. This video is intended to improve visitor knowledge of and compliance with the park's rules and restrictions. Although the park closes at 3:30 p.m., no visitors are allowed entry past 1:30 p.m. This prevents last-minute visitors from being unprepared to leave and allows enough time for visitors to begin leaving the park voluntarily before closure.

4.2 Collect and analyze visitor data at Hoʻomaluhia Botanical Garden

Analyzing data from visitors to Hoʻomaluhia allowed us to identify patterns of visitor behavior. Data collection and analysis consisted of quantitative visitation metrics, including total daily visitor numbers and the number of visitors to specific areas of the garden during hour-long increments.

The first section of our visitation data analysis consisted of daily visitor metrics provided by the garden from January 1, 2022, to January 31, 2023. Information collected included the number of vehicles, number of visitors, number of Hawaiʻi residents and non-residents, and number of walk-in visitors. Through these metrics, we found that there is an approximate 50/50 split in resident/non-resident visitation every month, with visitation for January 2023 being a 47.2/52.8 split between residents/non-residents. We also analyzed weekly visitation patterns to determine the weekdays that typically receive the most and least visitors (see Appendix F). We found that Saturdays and Sundays have the highest visitation while Wednesdays have the lowest, with some disparities across different months.

Additionally, we looked at visitation during the summer (May–August), winter break, and spring break, periods when tourism increases and Hawaiʻi residents are on break from school and work. Although none of the summer months were statistically different from the monthly visitation per year, May 2022 and July 2022 had the largest positive z-scores, which were approximately 1.6 and 1.4 respectively (see Table G1 in Appendix G). This indicates that visitation during these months was highest above average when compared to all other months.

The team analyzed visitation in December 2022 and January 2023 to see how visitation varies during winter break. Visitation increased significantly on the days following Christmas Day and New Year's Day, days when the garden is closed (see Figure G1 in Appendix G). When analyzing visitation during spring break (March 12–20, 2022), we found that drive-in visitation did not decrease as much as usual during the week (Monday–Friday) after the first weekend (see Figure G3 in Appendix G). Contrarily, walk-in visitation decreased as usual after the first weekend (see Figure G4 in Appendix G). Weekly drive-in visitation trends remained relatively similar during the summer months, with visitation decreasing from Monday to Friday and increasing during the weekend (see Figure G5 in Appendix G). However, walk-in visitation increases significantly more during the weekends in May and August compared to June and July (see Figure G6 in Appendix G).

To understand how visitors disperse throughout the garden, we focused on visitation to four distinct locations in the garden, as advised by garden staff: the Paul R. Weissich Education Center (the education center), a trail off of the Kahua Kuou (K. Kuou) campgrounds parking lot, the overlook, and the pavilion next to the Kahua Nui (K. Nui) parking lot (see Figure 3).
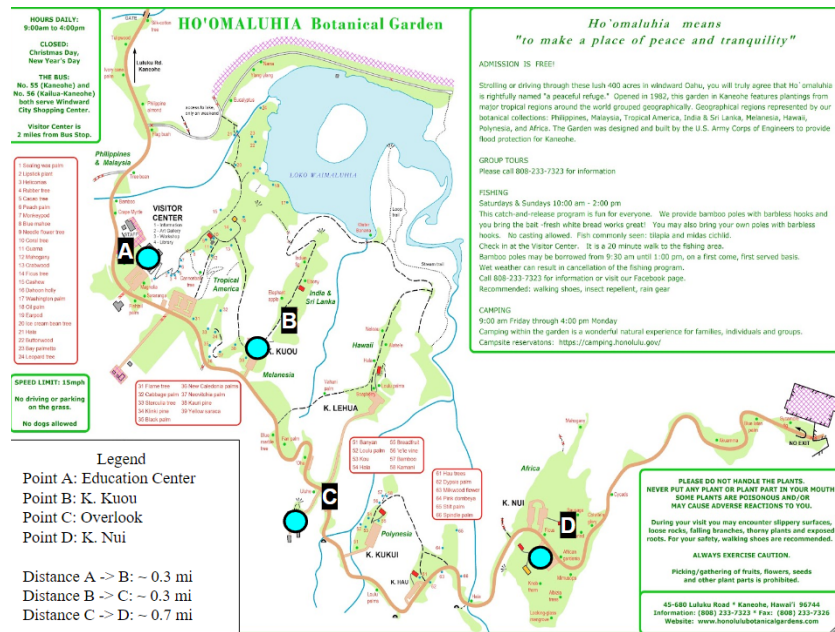
Figure 3. Surveying locations and their proximity to each other in the garden.

The number of visitors to K. Kuou and the pavilion each remained relatively consistent on different weekdays. However, both areas experienced increased visitation during Sunday afternoon (see Figure 4). K. Kuou experienced a 126% increase and the pavilion experienced a 150% increase in visitation during the weekend, compared to average weekday visitation. From

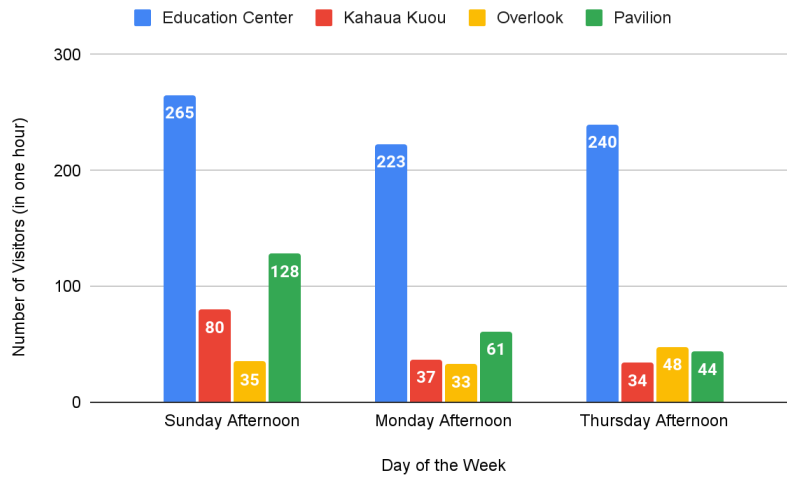this, we can infer that the weekend generates significantly higher visitation to K. Kuou and the pavilion.

Figure 4. *Visitation to each of the four locations throughout the week.*

The education center consistently attracted the most visitors, while areas further from the main road, such as K. Kuou and the overlook, received fewer visitors. Only a small percentage of visitors interacted with staff at the education center, and nearly half of the visitors to the education center walked on the nearby path to the lake, indicating that some visitors deviated from the main road (see Figure 5). This path is within eyeshot of the education center and it takes approximately 10 minutes to walk from the education center to the lake.
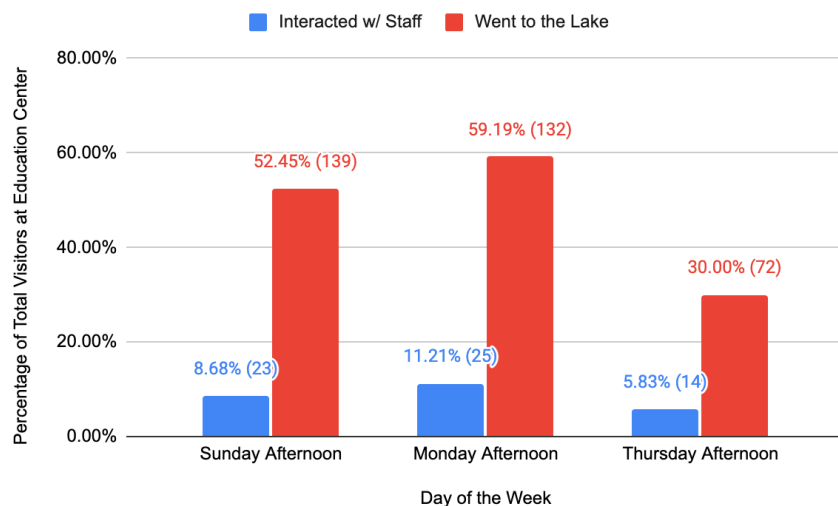

Figure 5. *Visitors to the education center who interacted with staff and walked on the trail to the lake. The percentage and the number over each bar represent the portion and the total number of visitors to the education center who engaged in each activity, respectively.*

4.3 Identify stakeholder concerns surrounding current garden operations

Interviewing each group of Hoʻomaluhia's stakeholders (visitors, staff, and residents of the surrounding neighborhoods) provided insight into each party's experience at the garden and their opinions on its current state. We aimed to gather feedback from each group to make suggestions that address the needs of the garden while still considering all stakeholders.

4.3.1 Visitor feedback

Our team interviewed 36 visitor groups consisting of 110 people, meeting our baseline of at least 30 interviews. We arbitrarily aimed for at least 10 interviews on each field work day, one for each section of the week, as outlined in our methodology. First-time visitors made up 26 of the groups, while the remaining 10 groups were composed of returning visitors. Through our interviews, we aimed to understand how visitors interact with the garden and their opinions about instituting a reservation system or an admission fee.

When analyzing the demographic information of our interviewees, we considered the 110 visitors as individuals rather than 36 collective groups. A slight majority of respondents (60%) were visiting Hawaiʻi, while 40% were residents of Hawaiʻi. Additionally, 68% of interviewed visitors were visiting Hoʻomaluhia for the first time, 84% of whom were not Hawaiʻi residents. The remainder of the respondents (36%) were returning visitors, of which 91% were residents of Hawaiʻi (see Figure 6).
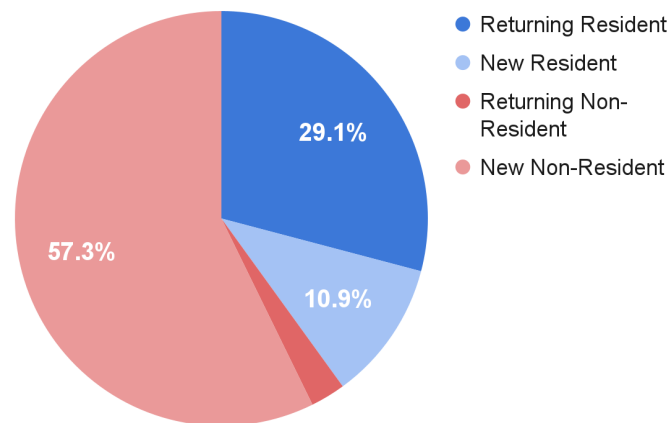
Figure 6. *Breakdown of 110 interviewed visitors into residential and visitation status.*

Of the 36 groups that our team interviewed, 24 groups provided information about which areas they visited. The education center was the most popular location, attracting 21.7% of respondents (see Appendix H). The K. Kuou and K. Nui parking lots were also frequently visited, while the hiking trails were not used by any respondents. These responses show that visitors tend to congregate toward the beginning and the end of the main road, leaving the areas

located in between underutilized. We found that 51% of visitors traveled the garden primarily by foot and the remaining 49% traveled primarily by car.

Out of the 26 groups of first-time visitors, 65% would be willing to make a reservation to come to the garden, while only 40% of returning groups would be willing to make a reservation. Some respondents preferred the freedom to explore the garden at their own pace and found timed reservations to be inflexible. The most common group size was two people (44%), followed by three people (28%), and the largest group was 10 (see Figure I1 in Appendix I).

When asked if they would still visit the garden if there was an admission fee, 73% of first-time visitors and only 40% of returning visitors indicated that they would pay to visit the garden (see Figure 7). A majority of returning visitors, most of whom were Hawaiʻi residents, would not visit the garden if they were required to pay a fee. Regardless of willingness to pay, we asked all interviewees about a fair price for admission, both per person and per vehicle. Responses showed that 83% of returning visitors and 39% of new visitors favored a fee range of $1-$5 for the per-person model, while 60% of returning visitors and 53% of new visitors favored a $10-$19 fee range for the per-vehicle model.
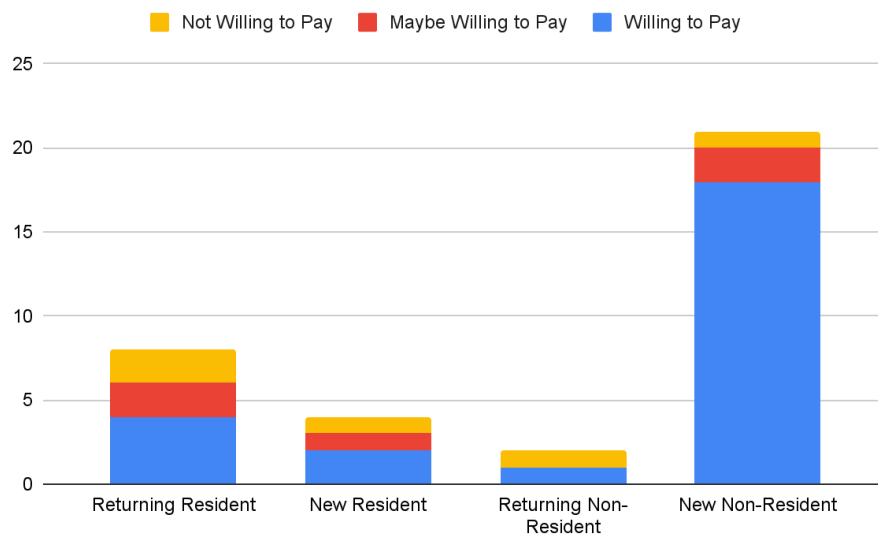
Figure 7. *The breakdown of willingness to pay from 36 visitor groups.*

We received responses from 25 groups of first-time visitors about their main influence in deciding to visit the garden (see Figure I2 in Appendix I). Of these groups, 16 used Google, with three of them visiting the garden's website for more information. We also asked all 26 groups to rate their knowledge of the garden before visiting on a scale of 1 to 10. The average rating was 1.42, indicating limited prior knowledge. Only nine groups knew about specific areas of the garden before visiting.

4.3.2 Staff feedback

At the time of the project, Hoʻomaluhia's staff included 13 part-time program aides, three full-time recreational specialists, three part-time park attendants, five nursery workers, two maintenance volunteers, one propagator, and one garden supervisor. Of these 28 employees, we received nine survey responses (a 32% response rate) from staff members with various years of experience working at Hoʻomaluhia, ranging from six months to 21 years. Upon reviewing the responses from these surveys, we identified staff members' main concerns.

Rule enforcement

When asked about the effects of increased garden visitation on their daily tasks, five staff members noted that it has become increasingly difficult to monitor visitors and discourage them from behavior that potentially jeopardizes their safety or the condition of the garden. Three staff respondents mentioned speeding on the main road as a prominent concern. One program aide stated that "visitors treat the garden as a park and expect to be able to [...] ride boards/bikes, pick foliage, and set up tents/play activities as they want" with disregard for the garden's rules. Visitors behave in ways that require constant monitoring because they are unfamiliar with the garden's rules. Currently, one to two program aides greet visitors within the education center and answer questions while park security drives on the garden's main road to patrol visitors. Staff members expressed that the sheer number of visitors makes it difficult to properly educate and correct visitors without rushing.

All respondents agreed that the current process of closing the garden and communicating the closing time to visitors is inefficient. Some visitors do not comply with staff orders during the closing process, thus adding more stress to the staff's work. Four staff members recommended that visitors should not be allowed to enter the garden after 3:30 p.m. or even 3:00 p.m. This way, visitors are able to plan their visit within the garden's operation hours and ease the staff's work while clearing the garden.

Social media and unauthorized photography

Four staff respondents mentioned issues with visitors engaging in social media-related photography in areas where photos are not permitted, especially on the main road near the garden's entrance. One respondent described that even though this is a driving factor for visitation, it causes some visitors to only use the garden as a "social media backdrop." This behavior leads to "inappropriate exposure," referring to how unauthorized photos promote disrespecting the garden's rules. One respondent suggested that the garden could create designated areas for photography to alleviate the issues caused by visitors who only come for photo opportunities. Another respondent believes that the garden should take the initiative to control its own social media presence. The garden can directly inform visitors of its rules and

correct practices through a greater presence on social media. Many employees also raised concerns about visitor safety within the garden due to photography. Visitors reportedly ignore signage and take photos on the main road, endangering themselves and oncoming vehicles. The staff recommended a pedestrian lane to address safety concerns.

Operational practices

Two staff members with experience ranging from under one year to over two years expressed a lack of consistent training and focus among staff members. One respondent who had worked at the garden for less than a year explained that relying on older employees to inform newer employees of the garden's rules has promoted inconsistent strategies among staff. To address this problem, the respondent suggested the creation of a primary reference for employees to view the official rules and information about the garden. Another respondent noted the lack of centralized goals and operational practices. Five program aides pointed out the lack of consistent grounds upkeep, including trash removal. Their suggestions included closing the garden for a day each week to focus on grounds maintenance.

Visitor experience

Three program aides who have worked at the garden for more than six months mentioned problems related to accessibility throughout the garden. Accessibility on the main road is a major concern, with one respondent recommending handrails or other accessible implementations for pedestrians that will make the road ADA-compliant. Two staff members specified that erosion and lack of pavement on the main road hinder the garden's accessibility. Staff members suggested that more directional signage could facilitate an informed visitor experience.

Another accessibility-related issue that five staff members mentioned was the lack of an educational visitor experience. One respondent noted that many visitors expect the garden to have guided tours and they often express confusion about where to start exploring such an expansive area. A guided tour program would aid demographic groups that may have more trouble exploring the garden independently, such as the elderly and those needing sensory and mobility accommodations.

4.3.3 Neighborhood feedback

We received a total of 25 responses to our neighborhood survey. Of these responses, 20 were completed on paper and returned to the guard at the entry gate. Five were completed online after our brief presentation at the Kāneʻohe Neighborhood Board meeting via Webex on February 16, 2023. All respondents live within five miles of Hoʻomaluhia, while approximately 20% of respondents live in the immediate neighborhood (within one mile of the garden).

When asked about their personal use of the garden, 18 neighbors reported regular use of the garden before or after official hours, meaning that they utilize the garden during its walk-in hours from 6:30 a.m. to 9:00 a.m. and 4:00 p.m. to 6:30 p.m. This response indicates that most neighbors try to utilize the garden at a separate time from a majority of other visitors. While 13 neighbors feel confident navigating the entire garden, 10 respondents only feel comfortable staying on the main road rather than the entirety of the garden. Those who primarily utilize the main road explained that they do so for exercise rather than utilizing the garden for exploration or educational purposes.

Within our surveys with neighbors of the garden, 60% of respondents discussed traffic-related disturbances. Three respondents expressed frustrations with rideshare services dropping off and picking up visitors outside of their houses. Five respondents mentioned visitors parking on their property. Safety concerns have arisen among seven respondents due to unsafe driving and disregard for the speed limit.

Regarding a reservation system or an admission fee for non-residents, 20 respondents indicated they would be in favor of either or both systems, while one expressed indifference. Seven respondents recommended roadway changes, and two expressed major concerns with parking. Two respondents expressed major concerns with parking, with one of them suggesting that Hoʻomaluhia ensures that the city communicates a requirement for all visitors to park within the garden. Two respondents suggested that any visitor who wants to enter the garden before or after official visitor hours should have to present a form of identification that confirms they are a Hawaiʻi resident. One neighbor also expressed that they "feel like the priority for Hoʻomaluhia staff is the visitors, and not serving the people of the community."

On Thursday, February 16, 2023, our team attended the monthly Kāneʻohe Neighborhood Board meeting to introduce our project and invite community members to share their recommendations or feedback through our survey. All three verbal comments we received from community members immediately after our announcement related to safety on the road. These comments also addressed how some visitors are prone to ignoring the garden's rules, especially to engage in unauthorized photography.

5. Recommendations

The following chapter outlines our recommended strategies that Hoʻomaluhia should use to help develop the garden's future long-term VM plan. These recommendations are informed by our team's research and findings and are categorized based on whether they are short-term or long-term suggestions.

5.1 Short-term suggestions

Hoʻomaluhia could implement the following suggestions without major funding or assistance from external sources, including the city, county, state, or federal parties.

5.1.1 Controlled access strategies

The following strategy aims to address issues caused by rising visitation at Hoʻomaluhia via a controlled access management approach.

Hours of operation

Adjusting Hoʻomaluhia's hours of operation could provide the staff with more time for maintenance, facilitate the garden's closing procedure, and provide neighbors with more opportunities to utilize the garden while it is less crowded. One option would be to close the garden to public access for one day of the week, while a second option would involve limiting entry to the garden an hour before closure. These adjustments could be implemented in tandem or independently.

Ideally, the garden would remain open from Friday to Monday due to higher visitation during the weekends and to continue to accommodate camping permits that last from Friday to Monday. Based on data from 2022 and January 2023, we found that Wednesdays consistently received the lowest number of visitors. Closing the garden on Wednesdays would impact overall visitation the least and provide a day dedicated to maintenance and other duties that cannot be fulfilled while visitors are in the garden. Hoʻomaluhia could consider leaving the walk-in gate open to neighbors while the garden is closed to the public, allowing local residents more time to utilize the park. Garden staff would have to determine what maintenance equipment can be safely used while non-staff members are in the garden. In the case that unsafe equipment must be used to maintain areas of the garden, Hoʻomaluhia could notify neighbors that the garden is closed to walkers via signage on the entrance gate and an online announcement. Ultimately, closing the garden for one day of the week would provide staff with more time to maintain the grounds.

Another adjustment to Hoʻomaluhia's hours of operation would be closing the entrance gate that allows vehicles into the garden at 3:00 p.m. Staff members estimate that the shortest

amount of time that a visitor could explore the garden (i.e., walking to the lake area or driving up the main road) is 30 minutes. Closing the gate at 3:00 p.m. would ensure that all visitors have enough time to explore at least one part of the garden. This also allows time for visitors to begin leaving the garden voluntarily before its closure at 4:00 p.m.

Our team suggests that Hoʻomaluhia incorporates both of these strategies. These changes would require the garden to notify all of its visitors and staff ahead of time, as well as share a specific date that these changes will be implemented. Hoʻomaluhia should announce these changes via in-person communications (i.e., physical signage at the front gate and the education center, verbal warning by the entrance security guard when the changes are first implemented, etc.) and online communications (i.e., updating the garden's website and social media pages) to ensure there is as little confusion as possible.

5.1.2 Visitor management strategies

Many first-time visitors lack knowledge about Hoʻomaluhia's rules and restrictions upon their arrival. This common situation signals a need for official, easily accessible information about the garden. The following short-term strategies could help address this issue.

Online presence

Restructuring the garden's website to include detailed descriptions of the garden's rules could reduce unsafe or unwanted visitor behavior. Our visitor interviews indicated that most visitors found out about the garden through Google, where the garden's government website is the first page listed when one searches the keywords "Hoʻomaluhia Botanical Garden." Therefore, it is crucial that the garden updates its website to include up-to-date information to reach a large number of future visitors. The garden's restrictions, specifically its rules regarding photography, should be clearly explained to potential visitors on its website. Similarly, Hoʻomaluhia should work on expanding its social media presence. Posting its regulations on social media would inform more visitors about specific rules such as where photography is authorized.

To make effective changes to the garden website and social media, the staff will have to spend time deciding what information to make visitors aware of before their visit. This process will require drafting, revision, and collaboration with the city to edit the garden's government-run webpage.

Communication of rules

Hoʻomaluhia should clearly inform visitors of its rules to decrease the number of visitors who do not abide by the garden's regulations. Before entering the garden, the security guard at the entrance should give a quick overview of the rules to each party. This overview should

emphasize the garden's closing time, speed limit, and rules about photography. The garden should also post a QR code at the entrance and education center that leads to a digital copy of the rules. If Hoʻomahlia implements a reservation system (discussed in section 5.2.1), a list of rules could be shared with visitors in the confirmation message. Receiving an explanation of the rules upon their arrival and being able to access pre-visit information leading up to their arrival will prompt more visitors to abide by garden regulations. Since many staff members' frustrations are rooted in visitors disobeying the garden's rules, we strongly recommend that Hoʻomaluhia incorporates these strategies.

Hoʻomaluhia's staff will need to develop a standard list of rules that will inform the guard's speech and the reservation confirmation message. These rules should be accessible to visitors prior to and upon their arrival, digitally and physically. The management team could conduct interviews with staff members to determine what rules they feel should be included in this list, ensuring to collaborate with staff members throughout the development process. Educating the security guards on how best to communicate these rules to visitors will require time and specific training.

5.1.3 Additional activities and offerings

Visitors and staff who participated in our team's interviews provided suggestions for additional activities and offerings that would benefit visitors' experiences. Both of these parties showed interest in a guided tour program to improve the visitor experience. Many visitors expressed interest in learning about native plants and birds through tours from a knowledgeable guide who could provide interesting facts beyond what the garden's signage provides. Since we found that only a fraction of visitors who visit the education center interact with staff members stationed there, some staff could be reassigned to lead tours around areas of the garden. This would also allow staff members to become more knowledgeable about and familiar with Hoʻomaluhia. Free tours would likely attract the most visitors if they begin at the most popular visitor area, the education center. The garden should also clearly communicate the starting time of each tour online and through physical signage. Tours could be offered to all visitors on a first-come, first-served basis. If the garden utilizes a reservation system, the number of reservation spots can be utilized to establish a capacity for each tour group and the number of tours offered per reservation spot.

Concessions are another potential offering that staff and visitors share an interest in. Currently, the garden does not offer any food options and only has a water fountain and a vending machine for drinks. On-site concessions would give guests more incentive to picnic in the garden, one of Hoʻomaluhia's original intended uses. However, concessions would likely increase littering and waste production and thus increase the need for grounds maintenance.

Hoʻomaluhia would also need to determine a feasible location to place a concessions stand, contract a company or small business to supply the concessions, and hire staff to work the concession stand. First-time visitors generally preferred the idea of concessions more, while most returning visitors indicated that they would not be likely to buy concessions.

5.2 Long-term suggestions

The following suggestions may require resources such as funding, personnel, or authorizations from the city of Honolulu. Because of this, we predict that implementing any of these solutions would take an extended period of time.

5.2.1 Controlled access strategies

These strategies could help address issues caused by rising visitation at Hoʻomaluhia. Each suggestion aims to reduce high levels of daily visitation.

Reservation system

A reservation system would allow Hoʻomaluhia to cap visitation at a certain number of visitors each day or cap the number of new arrivals during certain time blocks. This system could reduce overcrowding and facilitate communication between staff and visitors. A vast majority of visitors indicated that they would prefer to make a reservation online rather than in person; therefore, we recommend that Hoʻomaluhia creates an online reservation system. This would require a website built and maintained by garden staff and contractors, similar to Hanauma Bay and Diamond Head State Monument. Alternatively, management could utilize a pre-existing service such as Eventbrite, which is used by Lyon Arboretum. Hoʻomaluhia could consult further with these points of contact to determine whether a custom-made or pre-existing reservation system would work best for them. We suggest that only one or two staff members oversee this system for simplicity. The garden could also reserve some space for walk-up visitors who do not have reservations, similar to the approach used by Hanauma Bay. This accommodates last-minute visitors while still providing a large degree of predictability and control over total daily visitation.

Hoʻomaluhia could implement a reservation system independently or pair it with a form of admission payment. Hanauma Bay and Diamond Head use a reservation system that requires visitors to pay admission online upon reservation. Since a reservation system requires visitors to plan their visit ahead of time, online payment would be easiest for visitors to complete in conjunction with online booking. As there are many decisions involved in refining a reservation system, we recommend that Hoʻomaluhia first introduces a reservation system that does not involve payment. The garden can explore the challenges associated with collecting fees after

implementing this system. If the garden finds that a reservation system alone does not decrease its visitor numbers, a payment model can be added to the existing system.

Ho'omaluhia should still consider the challenges of implementing a reservation system without a payment model. A reservation system should still aim to accommodate some walk-in visitors. The garden could take a similar approach to Hanauma Bay and set aside a certain number of reservation spots available to walk-in groups. The exact number of reservation spots should be informed by further research regarding the garden's carrying capacity. Our interview with Hanauma Bay's park manager showed that a free reservation system may also require the staff to account for no-shows, which may influence the number of walk-in visitors that the garden can accommodate at a certain time.

Admission fee model

If necessary, we recommend that Ho'omaluhia eventually implements an admission fee model to further influence the number of visitors coming into the garden. This would only be necessary if the garden finds that a reservation system does not substantially reduce unmanageable visitation. This model would discourage visitors who only want to briefly enter the garden for photography purposes from coming to Ho'omaluhia, a behavior that is widely reported by staff members. Honolulu Botanical Garden's management staff has experience implementing this system, as Foster Botanical Garden in Honolulu requires an admission fee. We recommend that Ho'omaluhia does not charge Hawai'i residents, children aged 12 and under, or active-duty military members for entry, similar to the systems used by Hanauma Bay, Diamond Head, Hā'ena State Park, and many other parks.

The garden will need to investigate further before deciding whether to charge an admission fee per person or per vehicle. Charging admission per person could help manage the total number of visitors to the garden, dissuading large groups due to the cost. However, this may garner a negative reaction from many returning and potential visitors and reduce the number of weddings and social gatherings, which are commonly hosted within the garden. While charging admission per vehicle would likely garner a more positive response among large groups, this model may increase the usage of neighborhood property for parking and rideshare services. The garden could work with the city to mitigate this issue through signage. This admission model would also help Ho'omaluhia manage the number of vehicles on the garden's main road at a time. Walk-in visitors would not have to pay for admission, facilitating garden access for local residents. Based on visitor feedback, we recommend that the garden charges around $1-5 per person or $10-$15 per vehicle for admission.

Implementing an admission fee model may present structural challenges. Ho'omaluhia does not have electricity at the entrance gate, meaning that an on-site payment station would

have to be elsewhere. The education center has access to electricity and thus could support a payment system. To address this issue, the garden could instead utilize an online-only payment system. A system that operates completely online must allow staff to account for walk-up visitors who do not have a reservation, as well as allow walk-up visitors to pay. The admission fee system would have to be programmed and maintained by staff and/or contractors, which would require additional time and money. Although this cost could potentially be covered with the revenue earned from the fee, management should fully understand how an admission fee would potentially impact the garden's budget before instating one. Financial problems could arise if the garden receives a cut to its funding while its admission fee revenue is pooled into the city's funds or is lower than expected.

5.2.2 Visitor management strategies

The following long-term strategies could help address issues caused by patterns of visitor behavior at Hoʻomaluhia. Each suggestion aims to reduce unsafe behavior and encourage visitors to fully utilize all areas of the garden.

Pedestrian lane

To address safety concerns caused by visitors walking in the middle of the road and reckless drivers, a pedestrian lane could be paved alongside the main road in the garden. This would also make the garden more accessible to all visitors, including those in wheelchairs. A pedestrian lane would also allow the garden to pave areas catered for pedestrian photography, which would further deter visitors from taking photos in the middle of the road.

Hoʻomaluhia would have to consider potential challenges when considering a paved pedestrian lane, such as encroachments on plants and clearing overgrown vegetation to make room for this addition. In some areas, the road may not be wide enough for a pedestrian lane, forcing staff to make the decision between removing obstacles that may be in the way, reducing the width of the main road, or leaving a gap in the pedestrian lane. The paving process would require significant financial investment and likely necessitate the closure of the garden during construction.

Signage

Implementing more directional signage around the garden would facilitate navigation and enhance the visitor experience. Currently, only the path to the lake has sufficient directional signage, allowing visitors to easily follow it. This is likely the reason why more people are comfortable walking this path compared to trails in other areas with less signage. Hoʻomaluhia should include clear directional signage throughout the garden to encourage visitors to fully explore the area, as visitors and neighbors reported a lack of confidence in navigating the

garden's trails. Signage that specifies which trails are nearby and indicates trailheads would encourage visitors to deviate from the main road and explore more of the garden.

Signage that discourages visitors from taking photographs can be found lining sections of the garden's main road. Staff members have shared that they feel there is an overabundance of signs that tell visitors what not to do, disrupting the natural serenity of the garden. This signage may be perceived by visitors as unhelpful or overly harsh, as the signs do not clarify that photography is discouraged for safety purposes. We recommend that the garden reassess the clarity, usefulness, and potential repetitiveness of its existing signage to determine whether to keep, update, or remove each sign. The garden's staff should aim to enhance the quality of their signage rather than the quantity.

Staff members would have to dedicate time to reviewing current signage and, if necessary, planning new signage. If Hoʻomaluhia decides to create new signage, external parties who specialize in designing signage may be needed. Removing current signage and adding additional signage would require the help of the maintenance team. All of these efforts would require funding from the city.

5.3 Areas of further research

In addition to considering our recommendations, Hoʻomaluhia should consider performing an in-depth analysis of each accepted recommendation while developing its full VM plan. This analysis should especially focus on each strategy's timeline and feasibility, including the exact costs, resources, and authorizations needed from the city of Honolulu. Using this information, the garden can create a VM plan that outlines the best course of action to address rising visitation.

Our team has identified specific areas that may warrant more research. Possible future areas of research include the following:
- The garden should establish and/or refine its estimated carrying capacity to further develop a reservation system. Carrying capacity can be used to inform the maximum number of reservation and walk-in groups that the garden can accommodate at one time, the maximum size of each of these groups, and how the garden spaces out each reservation time slot.
- Hoʻomaluhia should determine how an admission fee may impact the garden's budget due to increased revenue. The management team could speak with representatives from the city to determine potential consequences.
- If the garden decides to implement guided tours, staff members should work with visitors to determine potential tour routes and length. Staff could interview visitors to determine which areas they are most curious about, how long they would be willing to participate in

a guided tour, and if visitors would be interested in specialized tours (i.e., tours regarding wildlife or specific types of plants) or paid tours.

● Instead of an admission fee, Hoʻomaluhia could implement a suggested donation model alongside their reservation system, similar to Lyon Arboretum. This would appease the portion of interview respondents who do not wish to pay for admission. A drawback to this model is that the garden will first need approval from the city, which requires paperwork and takes time to get a response. If interested, Hoʻomaluhia could research the benefits of this model as opposed to a flat admission fee.

The garden can conduct more in-depth interviews with stakeholders, VM experts, and the city to gather information regarding these areas. Focused research will allow Ho'omaluhia's management team to determine which strategies best fit the garden's needs and available resources.

6. Conclusion

Hoʻomaluhia Botanical Garden's management team must address the problems caused by increasing visitation by implementing a comprehensive VM plan. Our team examined existing VM plans, identified visitor trends, and gathered feedback from stakeholders to develop potential controlled access management and VM strategies for Hoʻomaluhia. The garden can examine each of these suggestions and conduct further research to create an effective and sustainable VM plan. Our team hopes that this project will facilitate the creation and implementation of a VM plan for Hoʻomaluhia. We expect that the garden's management team can develop a VM plan that aims to manage the total number of visitors to the garden, improve the visitor experience, and address the concerns of staff members and the nearby community.

References

Buckley, Ralf. (2003). Pay to play in parks: An Australian policy perspective on visitor fees in public protected areas. *Journal of Sustainable Tourism*, 11(1), 56–73.

Chung, J. Y., Kyle, G. T., Petrick, J. F., & Absher, J. D. (2011). Fairness of prices, user fee policy and willingness to pay among visitors to a national forest. *Tourism Management*, 32(5), 1038–1046.

Fryer, L. (2021). Accessing access: the importance of pre-visit information to the attendance of people with sight loss at live audio described events. *Universal Access in the Information Society*, 20, 717–728.

Hanauma Bay (n.d.). *City and County of Honolulu.*
https://www.honolulu.gov/parks-hbay/home.html

Hoʻomaluhia Botanical Garden (n.d.). *City and County of Honolulu*.
https://www.honolulu.gov/parks/hbg.html?id=569:ho

Honig, M. (2000, May). Making your garden come alive: Environmental interpretation in botanical gardens. *Southern African Botanical Diversity Network Report*, 9.

Kohl, J., McArthur, S., Myles, P., Notarianni, M., Paleczny, D., Pickering, C., Spenceley, A., & Worboys, G. L. (2015). Visitor Management. In S. Feary, A. Kothari, M. Lockwood, I. Pulsford, & G. L. Worboys, *Protected Area Governance and Management* (pp. 715–750). ANU Press. https://www.jstor.org/stable/pdf/j.ctt1657v5d.30.pdf

Lee, Y., Lee, H. Y., & Kim, W. G. (2006, May). Testing the detriments of computerized reservation system users' intention to use via a structural equation model. *Journal of Hospitality & Tourism Research*, 30(2), 246–266.

National Park Service. (2018, September). Kīpahulu comprehensive plan and environmental assessment: Haleakalā National Park. https://parkplanning.nps.gov/document.cfm?parkID=306&projectID=27401&documentID=91038

National Park Service. (2017). Visitor use management plan. In *Zion National Park Pre-Alts Newsletter, Summer 2017*. https://parkplanning.nps.gov/document.cfm?parkID=113&projectID=58542&documentID=81614

Reid, M., Croy, G., Wearing, S. L. (2009, January). The integrated pre-visit communication audit: A user guide. CRC for Sustainable Tourism Pty Ltd. http://hdl.handle.net/10453/17700

Shackley, M. (Ed.). (2000). *Visitor Management* (1st ed.). Taylor & Francis Group.

Soh, B. K. & Smith-Jackson, T .L. (2003, October). Designing cues for recreational parks to support wayfinding behaviors. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 47(6), 913–917. SAGE Publications.

Steckenreuter, A. & Wolf, I. D. (2013). How to use persuasive communication to encourage visitors to pay park user fees. *Tourism Management*, 37, 58–70.

University of the Aegean (2002). Defining, measuring and evaluating carrying capacity in European tourism destinations - Material for a document. European Commission. https://ec.europa.eu/environment/iczm/pdf/tcca_material.pdf

Weeks, K., Hetherington, N., & Bakhoum, D. (2014). Visitor management in the Valley of the Kings. In *The Valley of the Kings: A Site Management Handbook* (pp. 195–240). American University in Cairo Press. http://www.jstor.org/stable/j.ctt15m7gmt.10

Williams, B. K., Szaro, R. C., & Shapiro, C. D. (2009). *Adaptive Management*. U.S. Department of the Interior. https://www.doi.gov/sites/doi.gov/files/uploads/TechGuide-WebOptimized-2.pdf

Zhao, Y., Wang, H., Guo, Z., Huang, M., Pan, Y., & Guo, Y. (2022, July). Online reservation intention of tourist attractions in the COVID-19 context: An extended technology acceptance model. *Sustainability*, 14(16). http://dx.doi.org/10.3390/su141610

Appendices

Appendix A: Park manager interview questions

Appendix A includes the interview questions asked to park managers or other management at companies and park locations that have implemented VM plans. We tailored the questions to the specific location or organization that we were interviewing.

Introduction:

Hello! We are a team of students from Massachusetts currently working with Hoʻomaluhia Botanical Garden to develop a visitor management (VM) plan. We want to ask a few questions regarding your experience as a park manager and as a developer of a VM plan. We will use the information collected in this interview to suggest VM strategies for Hoʻomaluhia Botanical Garden and compile these suggestions into a VM plan. You may stop this interview at any time.

Interview questions:

1. How long have you been working as a park manager?
2. When did the need for a VM plan arise?
3. How did you identify the problem, both qualitatively and quantitatively?
4. What did the process look like when you were brainstorming solutions to the visitor management problems?
5. For each proposed solution, did you survey or interview visitors to determine their willingness to comply with new regulations?
6. (If applicable) Has the park always used an admission fee? If not, how did you go about instating one?
7. Did any issues arise when you switched to the admission fee based system? If so, what happened and how did you combat the issues?

Appendix B: Visitor survey questions

Appendix B includes the interview questions asked to Hoʻomaluhia Botanical Garden visitors to get an understanding of their view of the garden and its current policies, as well as their thoughts on potential changes.

Survey introduction:

Hello! We are a team of students from Massachusetts currently working with Hoʻomaluhia Botanical Garden to analyze visitation. We are conducting this survey to gain information about your thoughts about the garden. This interview will ask you questions about your experience in the garden, general statistical questions about your group, and your opinions on some proposed changes to the garden. The information we will be collecting about your group will not make your answers identifiable and will only be used for categorizing the general demographics of our interviewees. All responses are anonymous and you may stop this interview at any time.

Survey questions:

Section 1: Demographic Information

0. Initial of interviewer and location of interview
1. Are you visiting Hawaiʻi or are you a resident of Hawaiʻi?
    a. Resident
    b. Visitor
    c. Other (free response for elaboration, examples being temporary residents such as students or military, should they decide the two previous options did not fit their specific situation)…
2. If you are comfortable sharing, what is your state or country you live in? If from Hawaiʻi, what is your town or zip-code?
3. How many people are in your party?
    a. 1-10 (individual number selection)
    b. 10+
4. What are the age ranges of people in your party (select all that apply)?
    a. Under 18
    b. 19-29
    c. 30-49
    d. 50-69
    e. 70+

5. What is your main mode of transportation throughout the garden?
   a. Car/Vehicle
   b. Walking
6. Are you a repeat or first-time visitor?
   a. First Time
   b. Returning

Section 2: If response was "First Time" on Question #6

1. On a scale from 1-10, what was your level of knowledge of the garden prior to visiting?
2. What resources did you use that influenced your decision to come to the garden today?
   a. Instagram/Social Media
   b. Google/Search Engine
   c. Maps/Google Maps
   d. Garden Website/Gov Website
   e. Travel Site
   f. Other…
3. What areas of the garden did you know about before arriving (select all that apply)?
   (Garden map included for reference)
   a. Education Center (formerly Visitor's Center)
   b. K. Kuou Parking Lot (1st lot)
   c. K. LeHua Parking Lot (2d lot)
   d. K. Kukui Parking Lot (3rd lot)
   e. K. Nui Parking Lot (4th lot)
   f. Camp site at any of the above
   g. Hiking trails
   h. Lake
4. Have you been around the garden yet?
   a. Yes
   b. No

Section 3: Returning visitor (answered "Returning Visitor" to Section 1, Question 6) or visitor who has explored the garden (answered "Yes" to Section 2, Question 4).

1. What areas of the park did you visit today (select all that apply)? (Garden map included for reference)
   a. Education Center (formerly Visitor's Center)

b. K. Kuou Parking Lot (1st lot)

c. K. LeHua Parking Lot (2nd lot)

d. K. Kukui Parking Lot (3rd lot)

e. K. Nui Parking Lot (4th lot)

f. Campsite at any of the above

g. Hiking trails

h. Lake

2. Do you plan on going to other areas of the garden?

a. Yes

b. No

c. Maybe

d. Other…

3. If not, what is your reasoning?

4. What maps or navigational tools did you use today while in the garden?

a. Digital Map (QR code)

b. Physical Map (blue map)

c. On-site signage

d. Google Maps

5. Did you have problems with navigation or dinging what you were looking at?

a. Yes

b. No

Section 4: Reservations & Offerings (for all participants)

1. On a scale from 1-10, how likely would you be to buy snacks or gifts if offered?

2. Would you have visited Hoʻomaluhia if you had to pay an admission fee?

a. Yes

b. No

c. Maybe

d. Other…

3. If you had to pay, would you rather pay online or in person?

a. Online

b. In person

4. Would you be willing to make a reservation to attend?

a. Yes

b. No

     c. Maybe

     d. Other…

Section 5: Admission Fee Pricing

1. How much would you be willing to pay for…?
   a. Admission by person?
   b. Admission by car?
   c. Renting a campsite for 4 days? ($35 current)
   d. Taking a class offered by the garden? (Free or $15 current)
2. How likely are you to return to Hoʻomaluhia, on a scale from 1-10?
3. Why or why not?
4. Semi-structured interview?
   a. If yes, continue to semi-structured interview questions

Appendix C: Visitor semi-structured interview questions

Appendix C includes the semi-structured interview questions asked to visitors at Hoʻomaluhia Botanical Garden to get an understanding of their opinions on the garden and its current policies to a deeper extent.

1. What could improve your knowledge of the garden, in your opinion?
2. What are your thoughts on your experience in the garden?
3. What activities or classes would you like to see in the garden?

Appendix D: Park staff interview questions

Appendix D includes the interview questions asked to park staff and management at Hoʻomaluhia Botanical Garden to get an understanding of their views of the garden and its current policies.

Introduction:

Hello! We are a team of students from Massachusetts currently working with Hoʻomaluhia Botanical Garden to develop a visitor management (VM) plan. This interview will ask you questions about your experience working in the garden and your opinions on some proposed changes to the garden. The information we collect will not make your answers identifiable and will only be used to develop potential recommendations for a VM plan. You may stop this interview at any time.

Interview questions:

1. How long have you worked at Hoʻomaluhia Botanical Garden?
2. (If applicable, based on the previous question) Have you previously worked at other gardens or similar areas?
3. In your opinion, what are the most pressing issues the garden faces due to increased visitation?
4. How has the increased visitation to the garden affected your daily tasks? What are the associated challenges with these changes?
5. If you could change anything about the garden and its structure, what would it be?
6. What is your opinion on the current state of closing the garden? Do you think the last entrance time should be communicated to the visitors?
7. In your opinion, what do you find the visitors are the most confused or frustrated about when visiting the garden? Do you have suggestions to improve this issue?

Appendix E: Neighbor survey questions

Appendix E includes the interview questions asked to the neighbors that live near Hoʻomaluhia Botanical Garden to get an understanding of their views of the garden and its current policies.

Introduction:

Hello! We are a team of students from Massachusetts currently working on a project with Hoʻomaluhia Botanical Garden. We are working to create a visitor management plan so that the garden staff is better equipped to handle the increased number of visitors. We wanted to hear the input of neighbors of the gardens to see how the increased visitation has affected you, as well as any suggestions you may have that you would like to see implemented in our plan. If you have a few minutes to talk, we would love to hear your opinion on the matter. (If yes, mention that we have a few pre-determined questions and that we will be taking notes.)

Interview questions:

1. In our interviews with the garden management, we have heard of neighbors' concerns regarding traffic, parking, noise, and foot traffic, due to the visitation rates at the garden. Could you tell us a little more about how the visitors to the garden have personally affected you?
2. Do you normally utilize the garden before/after official visitor hours (neighbor hours: 6:30 a.m.–6:30 p.m., visitor hours: 9 a.m.–4 p.m.)?
3. Do you feel confident enough to navigate to all areas of the garden, or do you feel as though you mainly utilize the main road of the gardens? If so, why?
4. What is your opinion on the implementation of a reservation/admission fee program for non-local visitors to the gardens?
5. If you could change anything about how the garden and visitors are managed, what would it (they) be?

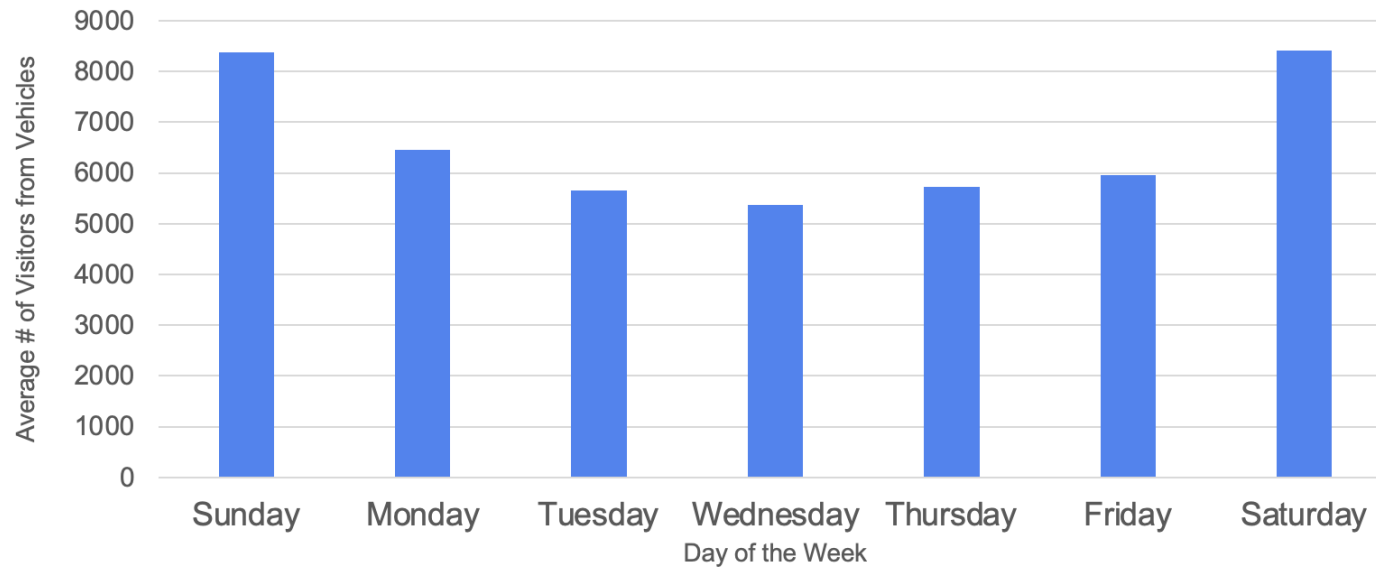**Appendix F: Visitation by day of the week at Hoʻomaluhia Botanical Garden**

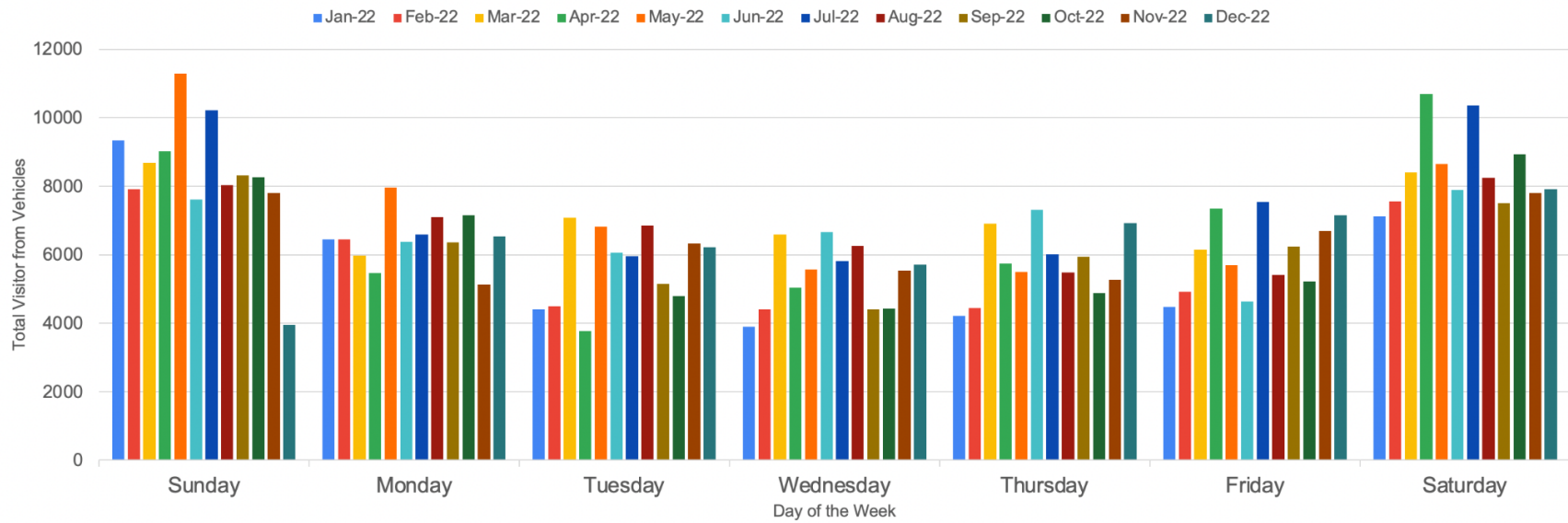*Figure F1.* Average number of visitors entering the garden by vehicle during each day of the week in 2022.

Figure F2. *Total monthly visitation during each day of the week.*

Appendix G: Seasonal breakdown of visitation at Hoʻomaluhia Botanical Garden

The graphs in Appendix G show the number of total visitors during periods of higher visitation in 2022: winter break, spring break, and summer break. As advised by our sponsors, these are times of the year when tourism increases and residents of Hawaiʻi are off from school and work.

We set the alpha level to 0.10, and none of the months' p-values are below this threshold. Therefore, we cannot say that any of the month's visitation totals are significantly above or below the monthly average in 2022 (which is 45,444 visitors/month).

Month	Total Visitation	Z-Score	P-Value
January 2022	39920	-1.44	0.178
February 2022	40203	-1.37	0.199
March 2022	49801	1.14	0.280
April 2022	47086	0.43	0.677
May 2022	51487	1.58	0.143
June 2022	45246	-0.05	0.960
July 2022	50976	1.44	0.177
August 2022	46035	0.15	0.880
September 2022	43906	-0.40	0.696
October 2022	43649	-0.47	0.649
November 2022	42618	-0.74	0.477
December 2022	44396	-0.27	0.790

Table G1. *Each month's total visitation, z-score, and p-value.*

Winter break

Hawai'i Public School's winter break occurred from December 20–31, 2022. Winter break is defined as starting on the weekend before the break and ending on the weekend after the break.
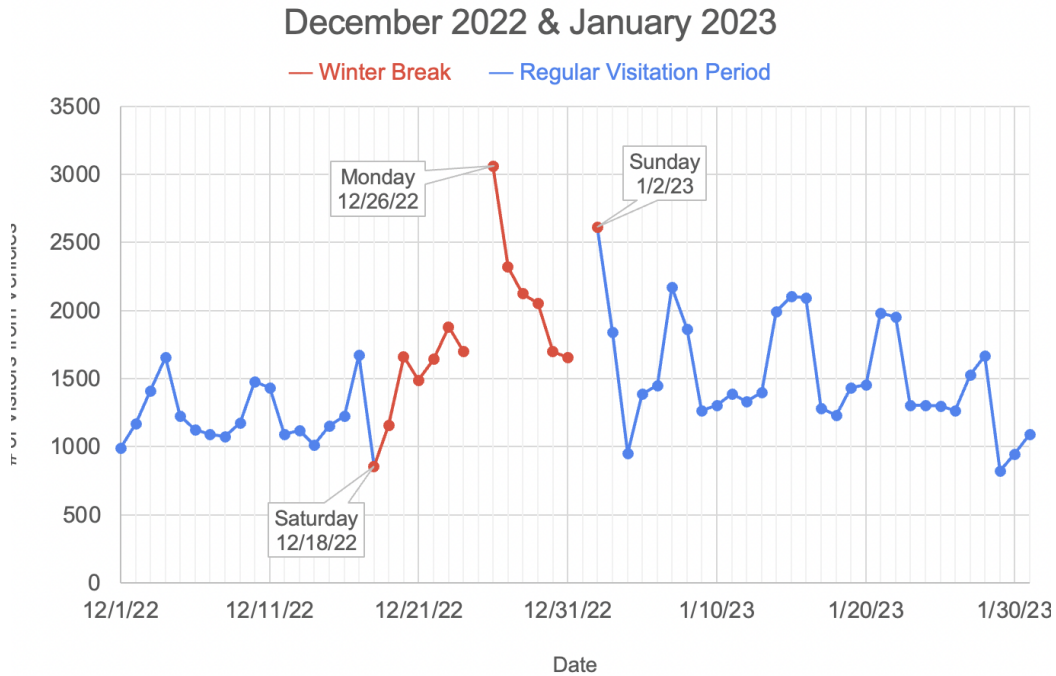

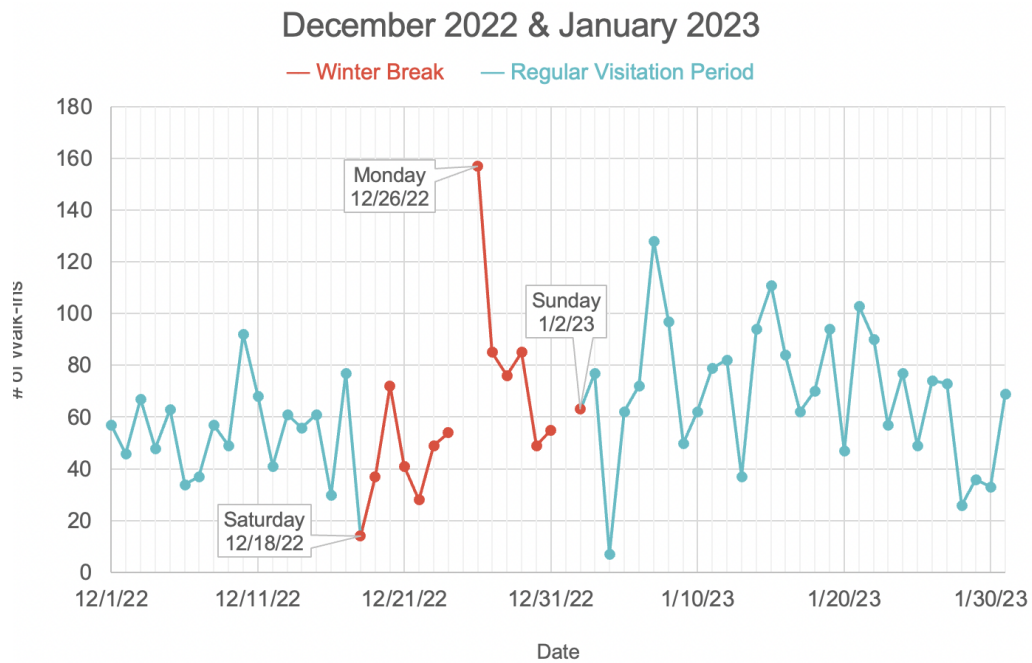***Figure G1.*** *Visitation in December 2022 and January 2023 from visitors entering by vehicles.*

Figure G2. *Visitation in December 2022 and January 2023 from walk-in visitors.*

Spring break

Hawaiʻi Public School's spring break occurred from March 14–18, 2022. Spring break is defined as starting on the Saturday before the break (March 12, 2022) and ending the Sunday after the break (March 20, 2022).
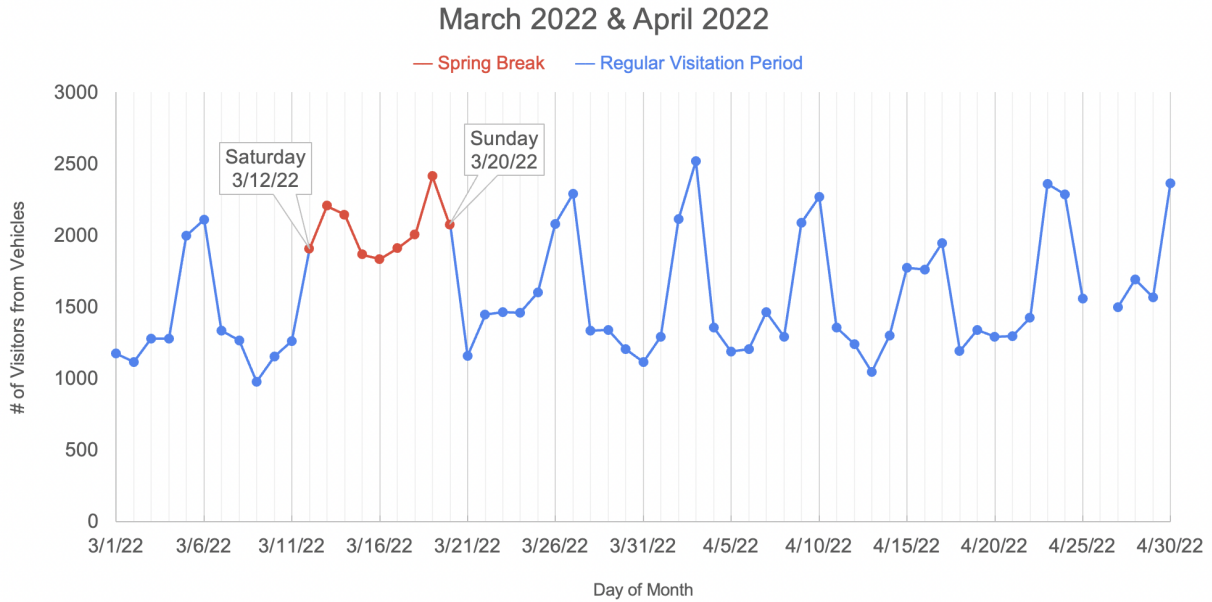
Figure G3. *Visitation in March 2022 and April 2022 from visitors entering by vehicles.*
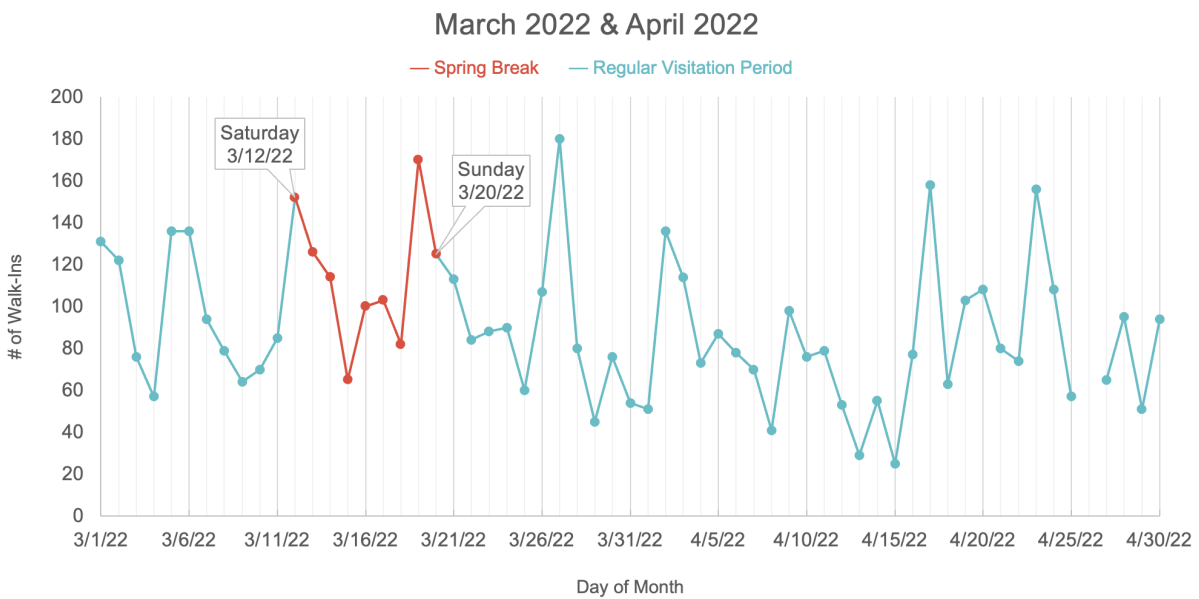
Figure G4. *Visitation in March 2022 and April 2022 from walk-in visitors.*
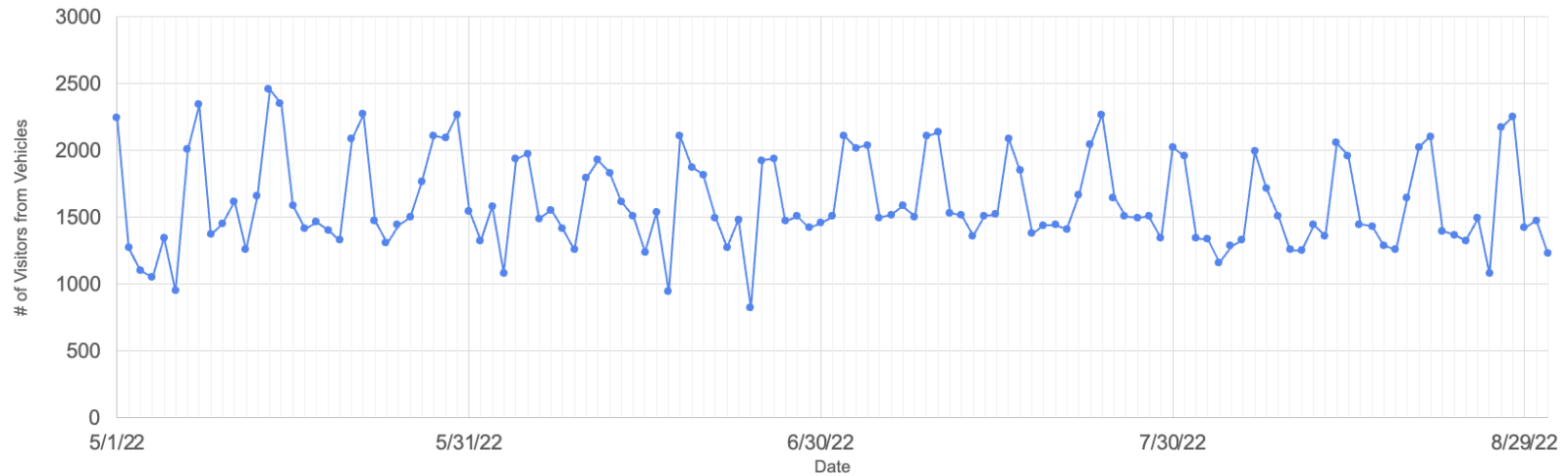
Summer

The summer months include May, June, July, and August.

***Figure G5.*** *Daily visitation from May 1, 2022, to August 31, 2022, from visitors entering by vehicles.*
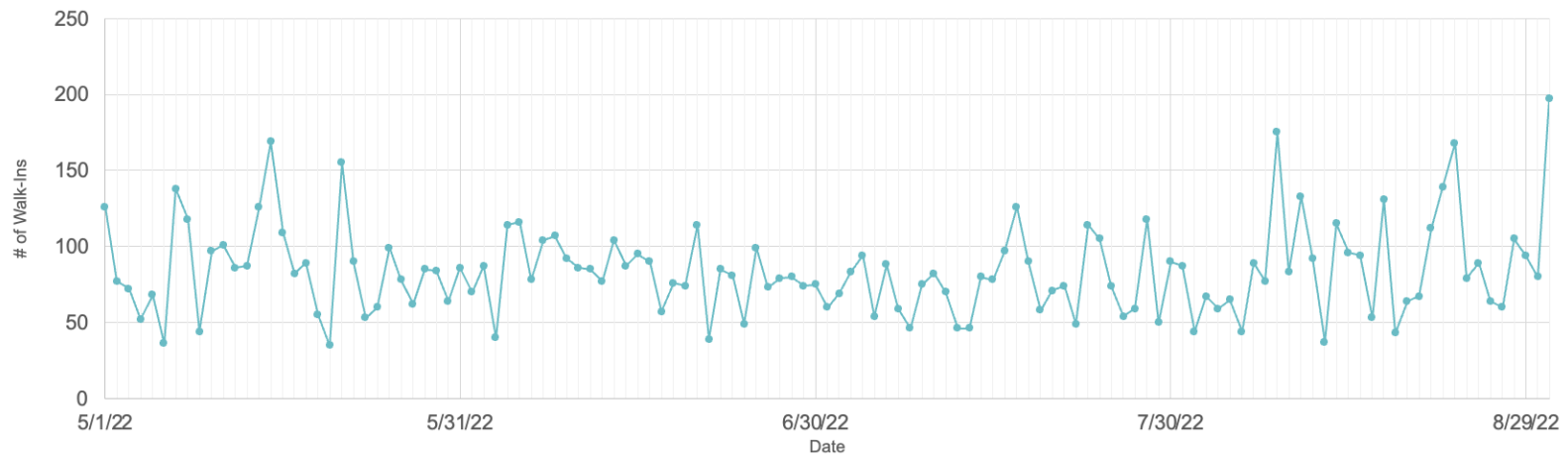
Figure G6. *Daily visitation from May 1, 2022, to August 31, 2022, from walk-in visitors.*

Appendix H: Areas visited from visitor interviews

Appendix H includes a graph that shows which areas the 24 interview groups (who responded) visited. Groups could respond that they visited more than one location.
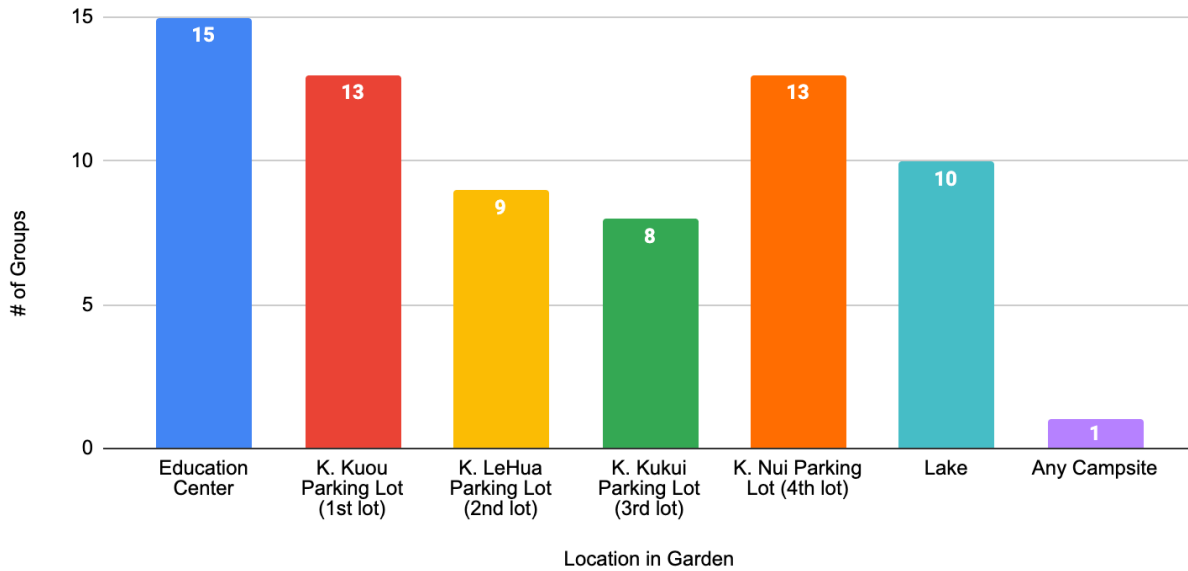
Appendix I: Data visualization of visitor interview responses

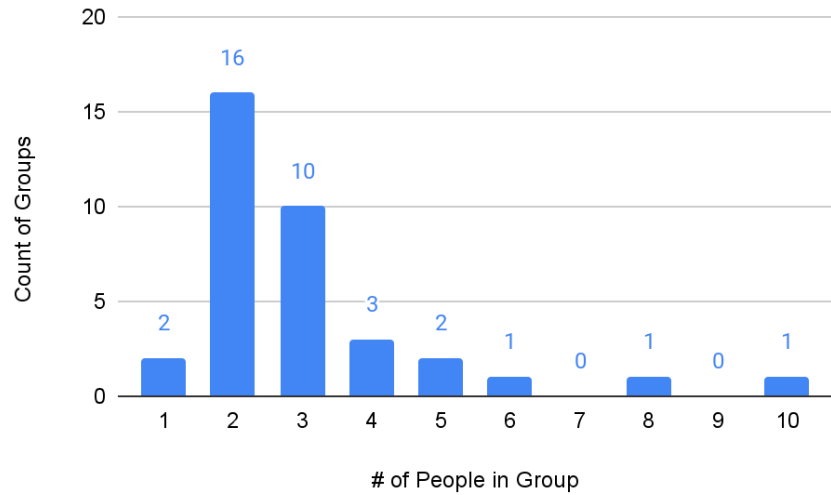Appendix I includes charts representative of the data collected through visitor surveys.

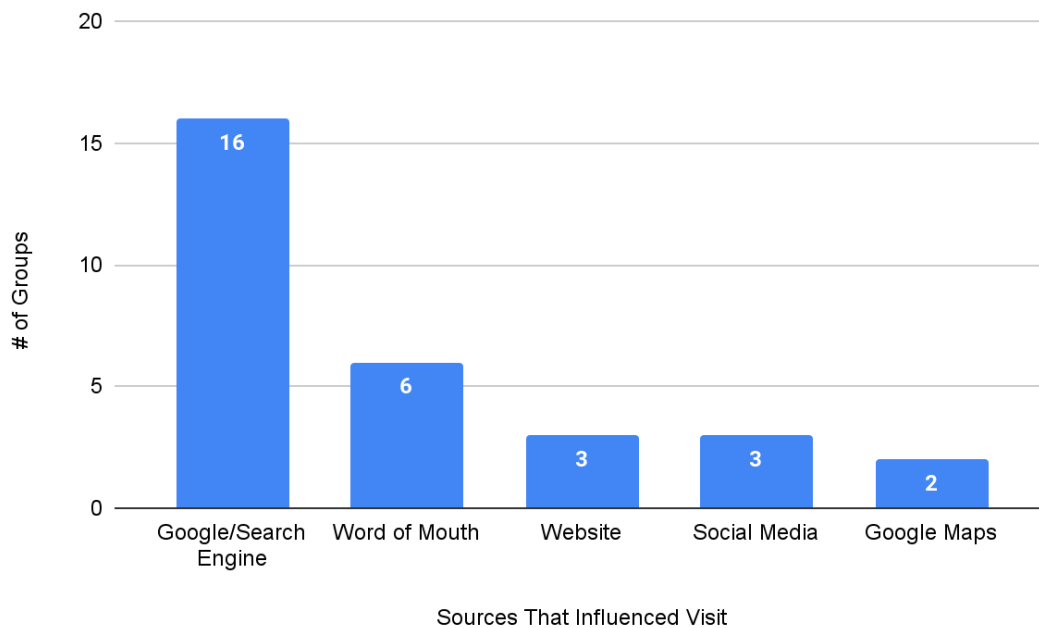*Figure I1.* *The party size of each of the 36 interviewed groups.*

Figure I2. *The sources that influenced the 25 responding groups to visit the garden. Some groups responded with multiple sources.*