Analyzing the History and Current Status of Invasive Species Management Efforts in the Hawaiian Islands

An Interactive Qualifying Project Submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE completed at the Hawai‘i Project Center

in partial fulfillment of the requirements for the Degree of Bachelor of Science

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Abstract

Invasive species threaten the delicate Hawaiian ecosystems; therefore, a structured network of organizations focuses on mitigating damage caused by new and persistent invasive species. This project examined how management agencies and initiatives are organized to combat invasive species in Hawai‘i. Our team researched and interviewed 25 organizations to determine which groups are involved in the network, their collaborative efforts, and opportunities for WPI involvement on O‘ahu. Using this information, we created characterization profiles for 25 organizations, a social network analysis, and a block analysis of the network. We also determined potential partners for WPI student projects and identified areas for organizations to improve collaboration and operations.

Executive Summary

Invasive species are non-native species that threaten the environment, economy, and health of humans, plants, and animals (Beck et al., 2008; Stein & Flack, 1996; Prentis et al., 2008). The isolation of the Hawaiian Islands has made them highly susceptible to the negative impacts of invasive species (Rago & Sugano, 2015). Management efforts aim to mitigate these devastating effects (Pennsylvania Land Trust Association, 2015). A network of federal government, state government, non-profit, university, partnership, and private-sector organizations exists in Hawai‘i to focus on invasive species research and management. The project goal was to examine how invasive species management agencies and initiatives are organized to combat invasive species in Hawai‘i. We completed three objectives to achieve the project goal.

Our first objective was to characterize and analyze organizations involved in past and present invasive species research and management in Hawai‘i. To achieve this objective, we researched organizations using publicly available resources. Our team also conducted semi-structured interviews with 25 organizations involved in invasive species management. We used the preliminary research and interview information to populate characterization profiles and analysis tables for each organization (see Appendices C.1-C.25). Next, we used thematic coding to identify several common themes regarding organizational operations and the current state of invasive species management in Hawai‘i. Many organizations mentioned the role of climate change, a lack of funding and capacity, the impact of COVID-19, issues in biosecurity, the use of biocontrol, and the management focuses within their organizations. Based on the interviews and research, our team determined that many invasive species management organizations have different mission statements and responsibilities but work synergistically towards protecting the precious resources in Hawai‘i.

Our second objective was to analyze collaboration among invasive species organizations in Hawai‘i. To achieve this objective, we used our research and interview information to create two visual representations of the organization network. We constructed a social network analysis, found in Appendix D, to display the individual organizations and the extent of their interactions with other organizations in the network. We color-coded the ties between organizations based on five degrees of collaboration: networking, coordinating, cooperating, collaborating, and integrating. We also included a classification for insufficient information,

where there was a known interaction but not enough information to make a distinction. Based on the social network analysis, there is a vast network of invasive species management organizations interacting in Hawai‘i, but few organizations are fully collaborating. The social network analysis is not comprehensive of the entire network, as it only includes organizations we interviewed and their partners. We must also consider the inherent bias since we have more information about the collaborative efforts of the organizations we interviewed. Despite these limitations, the social network analysis helps identify some of the principal organizations involved in invasive species management in Hawai‘i.

We also created a block analysis, Figure 1, to visualize the interactions among and within each organization type. We calculated the thicknesses of the lines using data from the social network analysis. The thicker the line, the more interactions there are among organizations of the indicated types. We determined that partnership organizations have the most internal and external interactions with other organization types, while federal and state agencies tend to interact more internally. Universities and non-profit organizations have fewer ties than partnerships, and we inferred that this was due to their limited resources and localized role within invasive species management. Organizations in the “other” category have the least amount of ties, which could be because we did not interview organizations in the “other” category and do not know the full extent of their collaboration. Overall, most organizations are collaborating more internally than with organizations of different types. The block analysis shows, more generally, how organizations are interacting within the invasive species network.

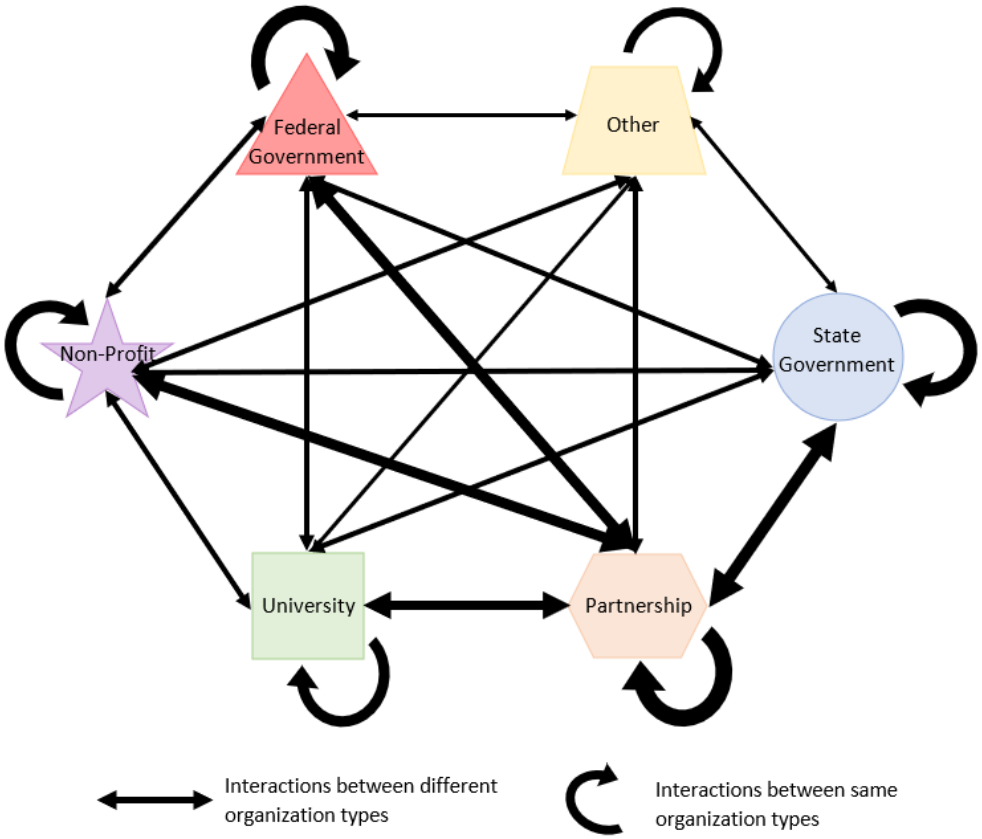

Figure 1: The block analysis visually represents the collaboration among and within the types of invasive species management organizations in Hawai‘i. The different lines show interactions between organizations of the same type and interactions between different organization types. The thicknesses of the lines correspond to the number of ties each organization type has on the social network analysis.

Additionally, we identified several common themes regarding the current state of collaboration among invasive species management organizations in Hawai‘i. Many organizations mentioned positive themes such as effective collaboration strategies among the organizations, strong communication within the state conservation community, and the importance of the public within invasive species management. The organizations also discussed issues such as a lack of communication between Hawaiian invasive species management organizations and the federal government, a lack of invasive species education provided to landscapers and nurseries, and collaboration issues among organizations.

Finally, our third objective was to outline opportunities for WPI Hawai‘i Project Center involvement with invasive species management organizations on O‘ahu. To achieve this

objective, we used the interviews to identify organizations interested in working with WPI students through the WPI Hawai‘i Project Center. We then created a map, Figure 7 in Section 3.3, to indicate which of the interested organizations have locations on O‘ahu.

Based on our results, we made two recommendations for the Hawai‘i Project Center director. We recommend WPI students work with federal government organizations if the project focuses on increasing effective collaboration among the organizations involved in invasive species management. We also recommend the WPI Hawai‘i Project Center director contact the organizations on O‘ahu that expressed interest in working with WPI students in the future because the WPI Hawai‘i Project Center will be located on O‘ahu the following year.

Our team concluded that the network of invasive species management organizations in Hawai‘i must continue collaborating and increase collaboration in certain areas for effective invasive species management. We intend to provide a resource for organizations involved in invasive species management and the Hawai‘i Project Center director to learn about other organizations in the network and establish connections between groups to increase collaboration. We hope this project helps organizations involved in the network and the WPI Hawai‘i Project Center director gain a deeper understanding of the structured network of invasive species management organizations in Hawai‘i. We also hope that our project identifies areas for organizations to increase collaboration and improve operations within the invasive species management network.

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Authorship

This report is the combined effort of Sabine Garcia, Marissa Langille, Jessica Netto, and Lauren Sowerbutts. Every group member drafted and edited each chapter and section of this report.

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1.0 Introduction

Invasive species are non-native organisms that cause harm where they are introduced (Beck et al., 2008; Stein & Flack, 1996). Island ecosystems are particularly susceptible to the devastation caused by invasive species; therefore, Hawai‘i has a structured network of organizations focused on invasive species control and mitigation (L. Mathews, personal communication, October 28, 2020). Interactions among these invasive species management organizations vary from simple communication to working in unison through interorganizational collaboration. Collaboration among invasive species management organizations can strengthen relations among science, policy, and practice to effectively manage these species (Abrahams et al., 2019).

This project examined how invasive species management agencies and initiatives are organized to combat invasive species in Hawai‘i. This evaluation required knowledge of the responsibilities, types of organizations, and interactions among the organizations involved in invasive species management. This chapter begins by defining invasive species and the impact they have on an area. Next, the chapter describes invasive species management and the classifications of the different types of organizations involved. The chapter then outlines areas of conflict in invasive species management. Finally, since this project focused on the effectiveness of collaboration among invasive species organizations in Hawai‘i, the chapter addresses interagency collaboration.

1.1 Invasive Species

Invasive species are non-native species whose populations are not under human control and whose adverse effects outweigh their benefits (Beck et al., 2008). Human activities have substantially increased the prevalence of invasive species and their successive destruction (Lodge & Shrader-Frechette, 2003). Globalization has increased the introduction rate of invasive species. The increase in trade, travel, and technology allows invasive species to spread to areas they may not have previously been able to reach (Myerson & Mooney, 2007). An estimated one new species is established in Hawai‘i every 18 days due to Hawai‘i’s vulnerable position as a center of commerce and travel (Hawaii Invasive Species Council & Coordinating Group on Alien Pest Species, 2020). Figure 2 shows the central location of Hawai‘i and the shipping routes that pass through the Islands in a year. Invasive species can be introduced unintentionally,

through imports and exports, and intentionally, for recreation or to solve other environmental or economic problems (Bax et al., 2003; Secretariat of the Pacific Regional Environment Programme, 2009; Stein & Flack, 1996). Adaptability, tolerance to environmental changes, and a lack of natural predators are often characteristics of successfully established invasive species (Pearson, 2009; Russell et al., 2017).

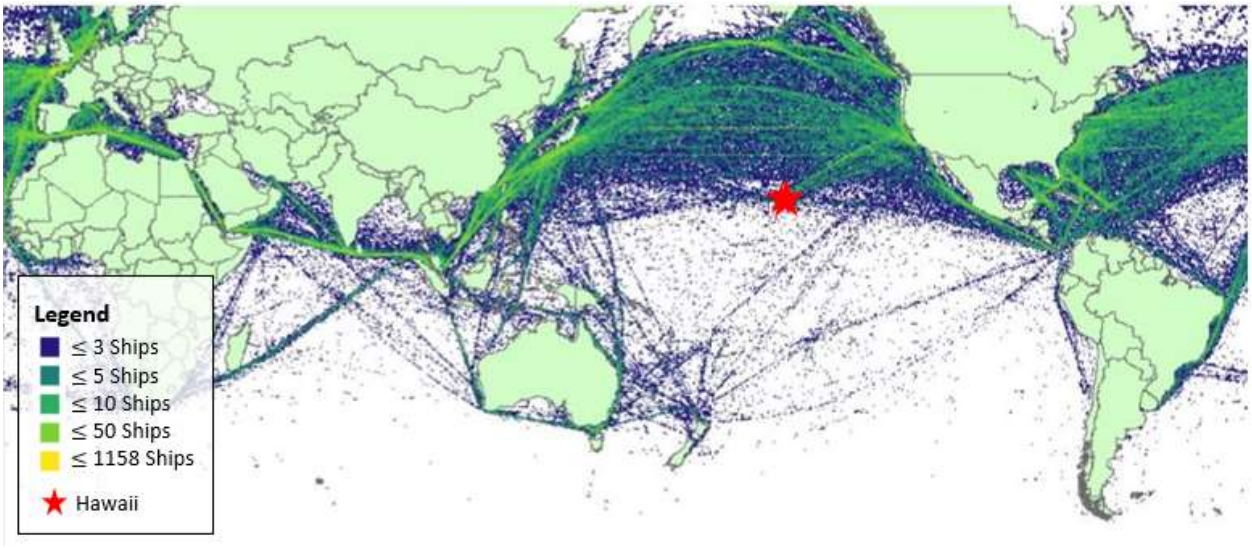

Figure 2: This graph shows cumulative shipping routes over one year. The map does not represent all commercial shipping traffic routes, only those of ships that voluntarily participated in the data collection. The different colored lines correspond to the number of vessels taking the course, indicated in the legend. The red star marks Hawai'i (Data taken from Halpern et al., 2015 and manipulated in ArcGIS).

The geographic isolation of islands, such as the Hawaiian Islands, makes them highly susceptible to ecological alterations caused by invasive species. Due to island seclusion, indigenous species grow and adapt with limited competition from foreign species (Rago & Sugano, 2015). Specifically, in Hawai'i, the geographic isolation and adaptation of native species to a wide variety of habitats have created an ecosystem with rich biodiversity that is more vulnerable to invasive species (Duffy & Martin, 2019; Stein & Flack, 1996). Overharvesting, extensive habitat clearing, and increased urbanization make native island species increasingly jeopardized (Russell et al., 2017). Today, Hawai'i has more than 30 percent of all threatened or endangered species in the United States, 45 percent of the threatened or endangered plants in the

United States, and 75 percent of all animal and plant species documented as extinct in the country (Hawaii Invasive Species Council & Coordinating Group on Alien Pest Species, 2020).

Invasive species threaten the environment, the economy, and the health of humans, plants, and animals (Prentis et al., 2008). These species compete with native species for food and space (Stein & Flack, 1996). Destruction of native habitats by invasive species also leads to local extinctions and threatens biodiversity (Russell et al., 2017). Additionally, invasive species negatively impact the economy, costing the United States about $137 billion per year. These costs could be related to the price of controlling and eradicating the species or the damages caused by the species (Rago & Sugano, 2015). Figure 3 shows examples of the economic impact of invasive species in Hawai‘i. Invasive species negatively affect the agriculture, tourism, ranching, forestry, and fishing industries (Stein & Flack, 1996). Furthermore, diseases spread by invasive species to native species and humans negatively impact their health and safety (Russell et al., 2017).

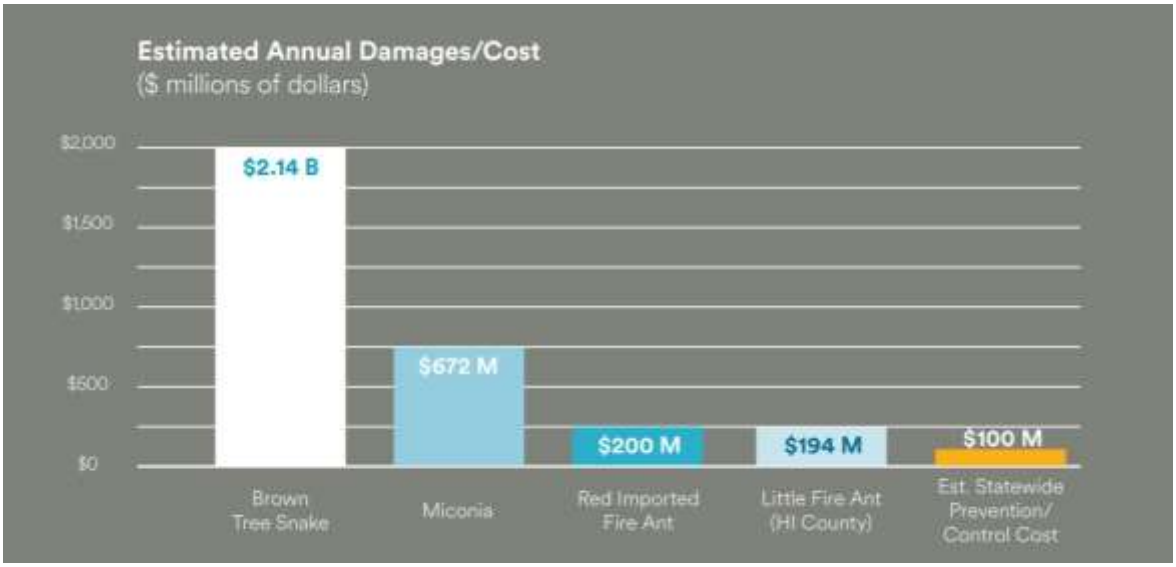

Figure 3: The annual damages and costs of four established invasive species in Hawai‘i, including statewide prevention and control costs. These estimated costs came from the University of Hawai‘i and the Department of Land and Natural Resources employee reports of the effects on habitats, tourism, and agriculture (Hawaii Invasive Species Council & Coordinating Group on Alien Pest Species, 2020).

1.2 Invasive Species Management

Invasive species management is a multi-stage process meant to minimize the negative impacts caused by invasive species (Pennsylvania Land Trust Association, 2015). Each stage of

the invasion process requires a corresponding method of invasive species management, as shown in Figure 4 (Lodge et al., 2006).

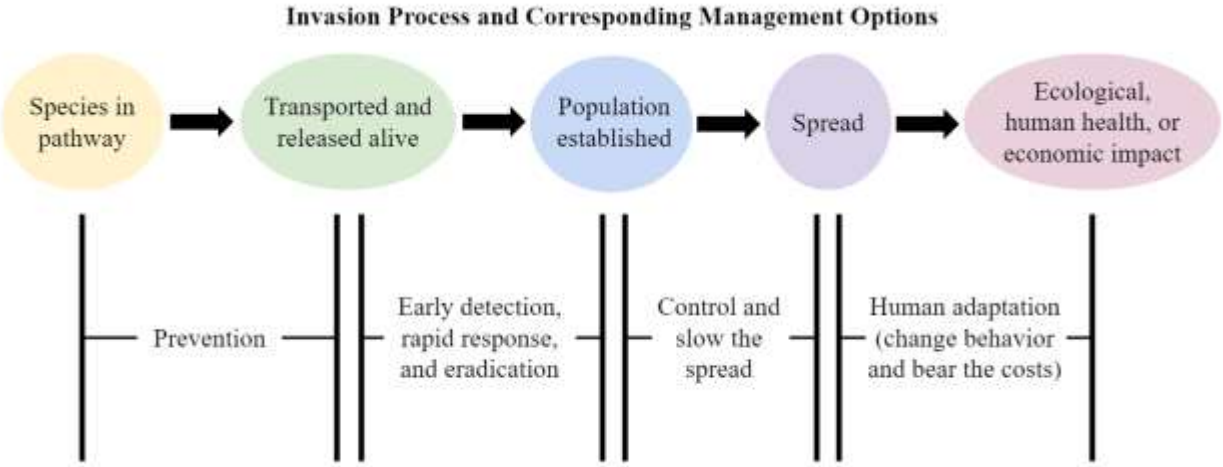

Figure 4: These are the steps in the invasion process and corresponding management strategies. The invasion process is the driving force for the management methods used at a given time (Adapted from Lodge et al., 2006).

A network of organizations in Hawai‘i focuses on invasive species research, prevention, control, and mitigation. There are four main types of organizations: federal government, state government, university, and non-profit. In general, federal and state government organizations implement and enforce legislation, universities conduct research, and non-profit organizations organize volunteer work and public outreach to aid in invasive species management (Oahu Invasive Species Committee, 2017; Ikuma et al., 2002; Wieczorek, n.d.). These organizations can also form partnerships, where the different types of organizations work together. While each organization has distinct responsibilities and roles, all invasive species management organizations aim to eliminate threatening species. These organizations, the general public, tourists, researchers, elected officials, and businesses are stakeholders in invasive species management. A stakeholder is any person, organization, or group impacted by invasive species or involved in the spread or control of invasive species (Shackleton et al., 2019).

1.3 Conflict in Invasive Species Management

Disagreements related to efficiency, ethics, social justice, and feasibility of management efforts create conflicts in invasive species management (Crowley et al., 2017). Conflicts between invasive species management organizations and the public arise when organizations overlook the social, historical, cultural, and political contexts of an area (Crowley et al., 2017). People or communities may see cultural, ecological, or other benefits of an invasive species and disregard or disagree with the risks they pose (Estévez et al., 2017). Also, the history of invasive species management successes or failures can affect how the public perceives proposed management strategies (Crowley et al., 2017). Failure to effectively eradicate invasive species in the past and the uncertainty of predicted invasion rates impacts public perception of this management, leading to distrust of management organizations (Crowley et al., 2017; Estévez et al., 2017). Conflicts can also occur between all stakeholders involved in invasive species management when management objectives and control methods vary between groups (Ford-Thompson et al., 2012). Considering conflicting backgrounds and beliefs is essential to facilitate effective collaboration among invasive species management organizations and the public (Crowley et al., 2017).

Consultations, where experts in invasive species management receive feedback on possible management options from different interest groups, can help reduce conflict between invasive species management organizations and other stakeholders. However, conflict can still occur if people do not feel accurately represented in the consultation process. Improper communication by invasive species management organizations can also lead to conflict or opposition to management practices. Increased attention to the social environment, inclusive public engagement early on, and open communication from invasive species management experts to the public may mitigate any conflicts that could be reducing the effectiveness of invasive species management efforts (Crowley et al., 2017). Increased inclusivity of different stakeholder groups in invasive species management could also reduce conflicts related to management strategies (Ford-Thompson et al., 2012). It is necessary to recognize how conflicts can occur and decrease their occurrences in invasive species management.

1.4 Interorganizational Collaboration in Invasive Species Management

Collaboration increases general knowledge, expands trust, resolves conflict, builds connections across different disciplines, and helps create agreements by achieving common goals

through joint effort, inclusive decision making, and sharing resources and ownership. Furthermore, collaboration can improve the execution of policies and agreements (Bodin et al., 2020). Interorganizational collaboration benefits organizations by enhancing operations and performance. For example, interorganizational collaboration can increase access to resources or information, promote learning, save money, and provide more support for the organizations involved. Complicated issues, such as invasive species management, can be more effectively addressed by involving multiple stakeholders (Witte, 2012).

Interorganizational collaboration can be beneficial for invasive species management organizations in Hawai‘i that share a mission. One way to manage complex and unpredictable ecosystems is for organizations to adapt and continue to learn (Bodin et al., 2020). This flexible approach relies heavily on cooperation. In research and management, different groups of stakeholders should come together in a collaborative effort instead of as single entities because issues involving ecosystems cross jurisdictional borders and do not impact one specific set of stakeholders (Bodin et al., 2020).

There are various approaches to collaboration, and the word collaboration can serve as an overarching label for different relationships between individuals, departments, and organizations (Mashek, 2015). A collaboration continuum, Figure 5, explains the different levels of collaboration among organizations.

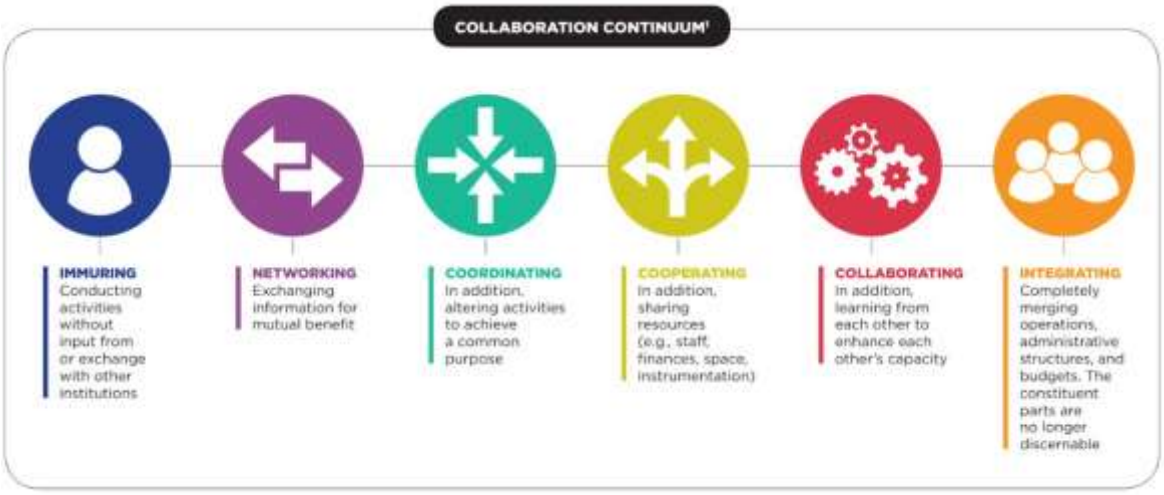

Figure 5: The collaboration continuum that will be referenced for the duration of this project (Mashek, 2015).

1.5 Networks in Invasive Species Management and Stakeholder Engagement

Collaboration networks in invasive species management and research can improve responses to the invasions (Simpson et al., 2009). Collective action among stakeholders in invasive species management is a recommended collaboration method. Collective action shares responsibility and participation among groups of people with a common objective. There are four types of collective action: externally led, community-led, co-managed, and organizational coalitions (Graham et al., 2018). In an externally led collective action, outside agencies, such as government organizations, non-government organizations (NGOs), and researchers at universities, finance and encourage invasive species management practices for landowners. This assistance helps form connections with private landowners and gives landowners access to resources to address species invasions on their property that would typically be unavailable. This type of collective action helps overcome the cross-boundary issue of invasive species but only lasts as long as the supplied funding. In a community-led collective action, landowners or citizens collaborate without the involvement of external organizations. Involved parties collaborate because they agree that invasive species are a threat to the community. Examples of this type of collective action include neighbors sharing information and management strategies for invasive species or community workshops. The success of community-led collective action in invasive species management depends on the social context. The third type of collective action, co-managed collective action, is a combination of externally led and community-led collaborations and involves multiple groups interacting to form rules in a specific location. External organizations collaborate with landowners through regulations, legal action, incentives, educational outreach, and technical assistance. This form of collective action promotes a sense of responsibility for managing invasive species; however, it may also lead to distrust if landowners fear consequences for not being prepared or willing to control invasive species. The fourth type of collective action, organizational coalitions, occurs when organizations with a moderate level of authority collaborate with government agencies on invasive species management efforts at a regional scale (Graham et al., 2018). Invasive species management programs, resource pooling, regulation, and engagement constitute organizational coalitions. Effective collaboration in invasive species management uses a range of collective action strategies and clear objectives (Graham et al., 2018).

For example, Hawai‘i utilizes partnerships between public and private landowners for their management efforts because invasive species do not stay within property lines. The Hawai‘i Association of Watershed Partnerships (HAWP) was established when public and private landowners realized the benefits of combining efforts to protect their shared watershed, an area of land that channels rainwater into a common outlet point. There are currently ten partnerships on five of the major islands, involving over 74 private landowners and public agencies. These partnerships are necessary for managing invasive species that span across different ownership boundaries (Hawaii Association of Watershed Partnerships, n.d.; State of Hawai‘i Division of Forestry and Wildlife, 2015).

In addition to collective action strategies, information sharing between stakeholders improves invasive species management by promoting the creation and pooling of detection and response methods. It also helps create comprehensive occurrence records for invasive species to improve detection (Simpson et al., 2009). Sharing which species are invasive and the threats they pose can also help increase public involvement. Collaboration through information sharing helps stakeholders effectively prevent, detect, and respond to an invasion. By annealing prevention and detection efforts, information sharing can reduce the costs associated with these invasions (Simpson et al., 2009).

Stakeholder engagement is essential for effective invasive species management as well. The involvement of stakeholders brings a broader range of perspectives to invasive species management, improves understanding of the species, and influences management policies and strategies (Shackleton et al., 2019). Stakeholder engagement is a vital component of collaborative research, data collection, and management strategies. Researchers should engage stakeholders through questionnaires, focus groups, interviews, and workshops. To improve stakeholder engagement in research, they should partake in the design, production, and execution of invasive species management strategies. Stakeholders should also receive responses from researchers about findings and participate in more interdisciplinary collaboration. Additionally, policies should increase stakeholder engagement in invasive species management. Stakeholder engagement can lead to more successful responses to invasive species and should be considered a necessary component of invasive species management (Shackleton et al., 2019).

2.0 Methodology

The goal of this project was to examine how invasive species management agencies and initiatives are organized to combat invasive species in Hawai‘i. Our team completed the following objectives to achieve this goal:

1. Characterize and analyze organizations involved in past and present invasive species research and management in Hawai‘i.
2. Analyze collaboration among invasive species organizations in Hawai‘i.
3. Outline opportunities for WPI Hawai‘i Project Center involvement with invasive species management organizations on O‘ahu.

The following chapter describes the methodology used to achieve the above objectives.

2.1 Objective 1 - Characterize and Analyze Organizations Involved in Past and Present Invasive Species Management in Hawai‘i

To develop a deeper understanding of how invasive species management agencies are organized to combat invasive species, our team collected information about organizations involved in invasive species management in Hawai‘i and created characterization profiles, in Appendix C. These characterization profiles have the following criteria: name, type (federal government, state government, university, non-profit, or partnership), location, contact information, date established, number of employees, volunteer opportunities, public involvement, budget and funding, collaborating partners, goal or mission, responsibilities, and management plan. If an organization had sub-organizations with different missions, each sub-organization was treated as a separate entity. We gathered the information to populate the characterization profiles by researching the organizations using publicly available resources and interviewing key informants at each organization. We discovered these organizations in several ways. We first used Facebook to learn about smaller, non-profit organizations by using the search terms “invasive species [in] Hawai‘i” and “invasive species management [in] Hawai‘i.” We then researched other organizations we discovered through the “Related Pages” sections on Facebook that list similar organizations. We also used the search terms “‘invasive species management organizations’ AND ‘Hawai‘i’” in Google. Finally, we found more organizations through partners listed on organization websites, in reports or strategic plans, and interviews.

Our team conducted semi-structured interviews with professionals from government agencies, non-profit organizations, universities, and partnerships involved in invasive species management to learn more about their work and gather information to achieve each project objective. These professionals included researchers, volunteers, and employees. We contacted every organization or individual involved in invasive species management that we came across during research and previous interviews. We emailed each organization or individual to set up a one-hour Zoom video interview. Our interview schedule is in Appendix A, and template interview scripts are in Appendix B. Using semi-structured interviews allowed for flexibility in the wording of questions and the omission of questions during the interview (Berg, 1995). In achieving Objective 1, we asked about the organization's mission, management plan, establishment, employees, volunteer opportunities, funding, and invasive species management methods to complete the characterization profiles. Also, to gather more information for the analysis of these organizations, we asked questions regarding the revision process of management plans or mission statements, organizational development, and the effectiveness of invasive species management in Hawai‘i.

Following the interviews, we analyzed the interview responses using thematic coding. The process included a repeated review of interview transcripts, assembling thematic codes, categorizing responses, quantifying results, and interpreting results (Alsaawi, 2014; Wolff, 2004). We coded for information about the following themes: funding, collaboration and partners, responsibilities, mission and management plan, employees, volunteer opportunities, public involvement, student involvement, interviewee background, and invasive species management issues. The information selected from the coded interviews helped our team understand how the organization operates and collaborates, its role in invasive species management in Hawai‘i, and possible areas for future WPI Hawai‘i Project Center involvement. We filled out Tables 3-27 in Appendices C.1-C.25 to qualitatively analyze each organization. To fulfill the first objective, we focused on analyzing how the invasive species management agencies are organized and operate. Although we discovered other invasive species management organizations during our research, we only had enough information to characterize and analyze the organizations we interviewed.

2.2 Objective 2 - Analyze Collaboration Among Invasive Species Organizations in Hawai‘i

To collect data for the second objective, our team also coded the interviews, as mentioned in Objective 1, for information about how the organizations collaborate with other organizations and if these collaboration strategies were effective or ineffective. Based on the thematic coding approach, we isolated information about interactions with other organizations and the extent of those interactions. The thematic codes used to gather this information were “funding” and “collaboration and partners.” We focused on common themes among the answers, such as the use of interagency meetings to collaborate and how collaboration within the state has been more effective than with the mainland, to summarize the collaboration efforts among invasive species management organizations in Hawai‘i. The analysis of this information is in Section 4.1.

Our team created a social network analysis (SNA) to analyze the network of invasive species management organizations in Hawai‘i and the extent of their collaboration. This SNA is in Appendix D. A social network analysis examines how organizations or individuals communicate, interact, and impact one another (Prochnow et al., 2020). We used Google Draw to create the SNA. This application gave us the freedom to electronically draw and hand-place the nodes representing the organizations and the lines connecting them based on our needs. To create this SNA, we collected information about an organization’s partners and collaborators from the organization’s website. Also, our interviews provided us with critical information for Objective 2. Specifically, we asked about who the organizations collaborate with, the types of projects they collaborate on, their methods for collaboration, the ease of this collaboration, the potential for increasing collaboration, and redundancies in the focus of different invasive species management organizations. We used the interview information and the collaboration continuum, Figure 5 in Section 1.4, to classify the interactions between the organizations. Based on this information, we individually assessed these interactions, judging the extent of collaboration, and finalized the designations as a team. These interaction designations are as follows (Mashek, 2015):

1. Immuring: Organizations have no connection, and they are not sharing any information or receiving input from other organizations.
2. Networking: Organizations only provide knowledge, research, or funding.
3. Coordinating: Organizations are networking, and they have the same goal but do not work together.

4. Cooperating: Organizations are coordinating, and they share resources, staff/volunteers, space, and equipment.
5. Collaborating: Organizations are cooperating, and they have shared responsibility and operations but remain separate organizations.
6. Integrating: This is for sub-organizations that are part of a larger organization.
7. Insufficient Information: There is a known interaction, but there is not enough information to decide the extent of this interaction.

In addition to the social network analysis, our team created a structural block analysis as another visual representation of the collaborative network among invasive species management organizations in Hawai‘i. We used Google Draw to make the block analysis as well. The block analysis relied on the SNA; we used the ties between each organization on the SNA to determine how many interactions existed between the different organization types. The SNA depicts each interaction between individual organizations in the network of invasive species management and the extent of these interactions. Instead, a structural block analysis helps visualize the interactive relationships among and within different organization types (Tang et al., 2018). The block analysis is Figure 6 in Section 3.2. We included some organizations in the SNA and block analysis that we did not characterize and analyze because they are known to collaborate with the organizations we interviewed.

2.3 Objective 3 - Outline Opportunities for WPI Hawai‘i Project Center Involvement with Invasive Species Management Organizations on O‘ahu

Finally, to accomplish Objective 3 and determine which invasive species management organizations would be open to working with WPI Hawai‘i Project Center students, we again used the information from the researchers, volunteers, and employees we interviewed, described in Objective 1. Specifically, at the end of the interview, we described the nature of past projects completed by students through the WPI Hawai‘i Project Center. We then inquired if the organization would be interested in working with WPI students in the future. We also determined if the organization had worked with students before as interns or researchers. We asked these questions to all of the organizations we interviewed, even those not located on O‘ahu. Finally, we created a map, Figure 7 in Section 3.3, using the software ArcGIS to show locations of all the

organizations interested in future collaborations with students through the WPI Hawai‘i Project Center.

3.0 Results and Analysis

The following chapter presents an analysis of our research and interviews related to the three project objectives used to examine how invasive species management agencies and initiatives are organized to combat invasive species in Hawai‘i.

3.1: Objective 1 - Characterize and Analyze Organizations Involved in Past and Present Invasive Species Management in Hawai‘i

We contacted 46 organizations, and 34 of them responded to us. We were able to interview 25 of these organizations. The federal government organizations we interviewed included USGS PIERC, NPS, USFS PSW IPIF, USDA APHIS PPQ, and USFW PIFWO. The state government organizations we interviewed were HISC, DLNR DAR AFRS, and HFNWR. We interviewed university groups including OMGP, OMKM, HAL, and the Daehler Lab. The non-profit organizations we interviewed included CCH, TNC Hawai‘i Chapter, Laukahi, PRC, IC, PEPP, FOHF, and KRCP. We interviewed partnerships including CGAPS, MISC, OISC, CRB Response Team, and BIISC. The full names of these organizations are in Appendix E. A list of the name of each interviewee and the website used for research is in Appendix A. We completed a characterization profile and analysis table for each organization based on the research and interview information collected. These characterization profiles and analysis tables are in Appendices C.1-C.25.

3.2: Objective 2 - Analyze Collaboration Among Invasive Species Organizations in Hawai‘i

We created a social network analysis to visually represent how each organization collaborates with other organizations based on our interviews and research. The SNA is in Appendix D. In the SNA, the nodes, shown as shapes on the diagram, represent state government agencies, federal government agencies, non-profit organizations, university groups, and partnerships involved in invasive species management. We used circular, triangular, star, square, and hexagonal nodes to represent the five different organization types respectively. Any organizations that did not fall into the five categories were represented by a trapezoid, indicating

the “other” category. The nodes for the organizations that we interviewed are colored blue in the SNA. The ties, represented as lines between the nodes, show the different interactions and relationships among organizations (Bodin et al., 2020; Prochnow et al., 2020; Tang et al., 2018). We color-coded these ties based on the collaboration approaches shown in the collaboration continuum, which we defined in Section 2.2. The color-coded lines and corresponding degree of collaboration are as follows:

1. Immuring: No Line
2. Networking: Purple Line
3. Coordinating: Green Line
4. Cooperating: Yellow Line
5. Collaborating: Red Line
6. Integrating: Orange line
7. Insufficient Information: Black Line

Our team used a solid line with double-sided arrows to connect two organizations we interviewed. We used dashed, single-sided arrows to connect organizations we interviewed to ones mentioned but not interviewed. We did not have enough information to connect mentioned organizations to other organizations. The mentioned organizations could be collaborating with other organizations on the SNA, but we were unable to make these connections due to a lack of information. Originally we structured the SNA in a tiered system, with the federal agencies at the top followed by state, university, and non-profit organizations. Initially, partnerships were near university organizations, and groups that fell into the “other” category were on the perimeter. To organize the SNA, we decided to reposition the organizations such that those with more ties were towards the center, and those with fewer connections were around the perimeter.

Our team created a block analysis, Figure 6, to visually represent collaboration among and within the five types of invasive species management organizations and the “other” category. We used the same node shapes from the SNA in the block analysis to represent the five organization types and the “other” category. We counted the number of ties between each organization type using the SNA and then divided those totals by the number of organizations with the corresponding type. We did this division to ensure that each number of ties was scaled proportionally, as organization types with more organizations represented on the SNA should theoretically have more ties. The straight lines represent collaborative relationships among

organizations of different types, while the curved lines represent collaborative relationships among organizations of the same type. The thickness of the lines indicates the number of network ties an organization has; more ties led to a thicker line (Tang et al., 2018).

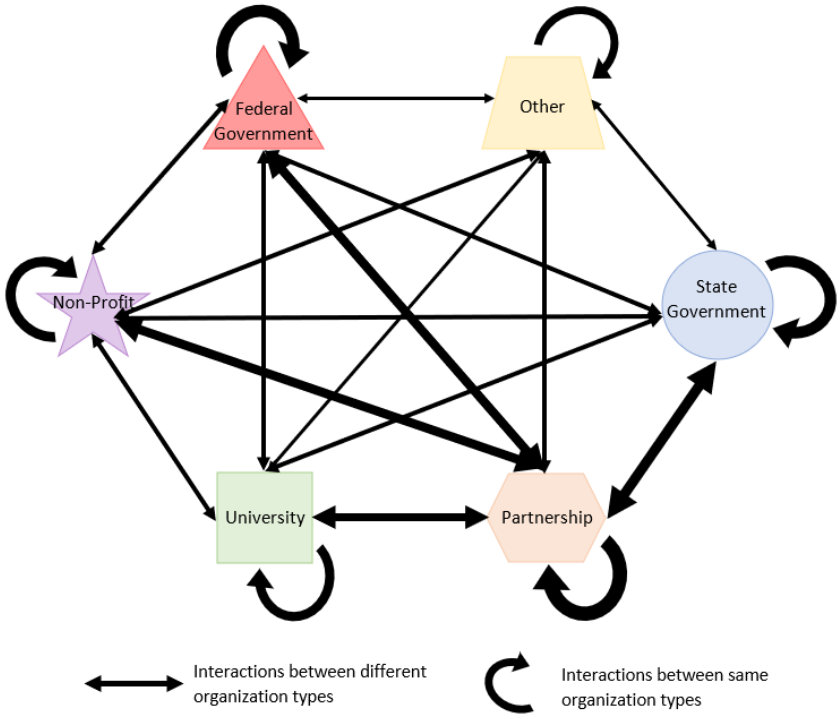

Figure 6: The block analysis visually represents the collaboration among and within the types of invasive species management organizations in Hawai'i. The different lines show interactions between organizations of the same type and interactions between different organization types. The thicknesses of the lines correspond to the number of ties each organization type has on the SNA.

3.3: Objective 3 - Outline Opportunities for WPI Hawai'i Project Center Involvement with Invasive Species Management Organizations on O'ahu

Out of the 25 organizations that we interviewed, 22 organizations expressed interest in working with WPI students through the WPI Hawai'i Project Center. Out of these 22 organizations, 16 have locations on O'ahu. Figure 7 displays all the organizations interested in future collaborations with students through the WPI Hawai'i Project Center. Although the WPI Hawai'i Project Center will be on O'ahu during the 2021-2022 academic year, a team could work with an organization on O'ahu and one on another island if collaboration exists between them.

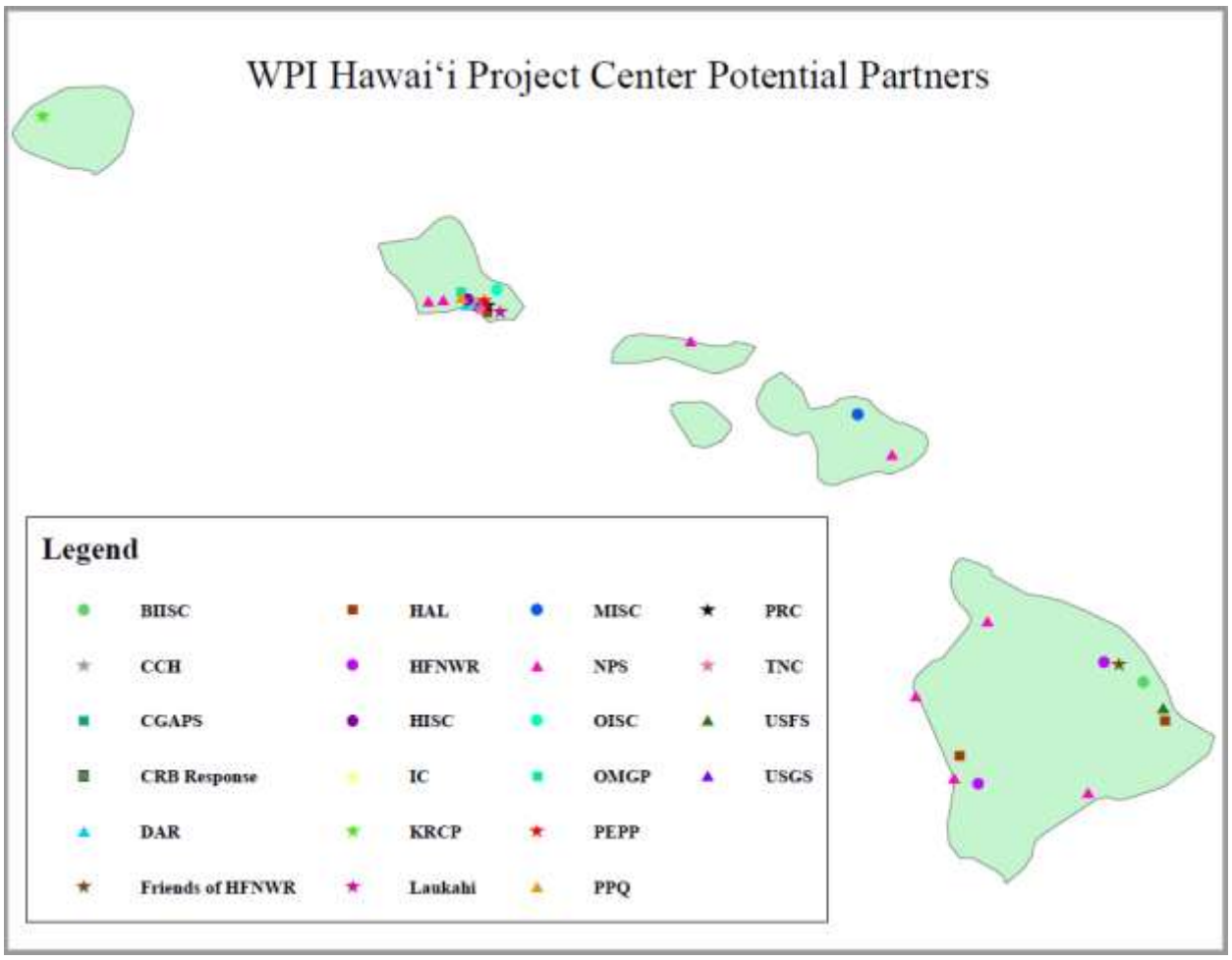

Figure 7: A map of the organizations that expressed interest in future collaborations with WPI Hawai'i Project Center students. Different office locations for the same organization have the same shape and color marker. See Appendix E for the full names of the organizations shown on the map.

4.0 Discussion and Recommendations

4.1: Discussion of Organizational Operations and Collaborative Efforts

Objective 1: Characterize and Analyze Organizations Involved in Past and Present Invasive Species Management in Hawai‘i

Throughout the interviews, we came across several common themes regarding organizational operations and the current state of invasive species management in Hawai‘i. Many organizations mentioned the role of climate change, a lack of funding and capacity, the impact of COVID-19, issues in biosecurity, the use of biocontrol, and the management focuses within their organizations. Climate change is an environmental issue expected to have devastating effects on invasive species management organizations. Several organizations we interviewed explicitly discussed how the consequences of climate change will directly impact their future management strategies. Native species already compete with invasive species; therefore, changes to their unique habitat make them increasingly vulnerable to invasions and extinction. With the increased temperatures, invasive species can expand their range, specifically spreading to higher elevations. For example, several interviewees mentioned that the warmer temperatures will allow mosquitoes to move higher up the mountain ranges and threaten species, such as native birds. In addition to expanding the areas they manage, invasive species management organizations will have to reallocate resources to respond to adverse effects caused by climate change, such as natural disasters and erosion.

Based on our interviews, we determined that all invasive species management organizations in Hawai‘i, excluding federal agencies, lack funding and capacity. When asked about the effectiveness of invasive species management in Hawai‘i, several interviewees expressed how capable and passionate the people involved are but communicated how this lack of funding hinders their abilities to combat invasive species. Many invasive species management organizations have to compete for a limited amount of funding, meaning that it is common to postpone projects and initiatives until funding is available. Organizations have to apply for grants for their projects because there is only a set amount of money allocated for invasive species management in Hawai‘i. This lack of funding makes it difficult for many organizations to carry out vital projects or hire necessary staff.

Almost all of the invasive species management organizations we interviewed have been impacted by the COVID-19 pandemic. More people meet remotely and better understand how to

use online platforms, such as Zoom; therefore, it has become easier to collaborate with people working in different locations. Since everyone had to refrain from travel and in-person interactions, there was a necessity for virtual meetings and rapid acceptance of the virtual world. This shift in meeting culture engendered collaboration among geographically distant organizations, adversely expanding the network of invasive species management in Hawai‘i. However, while remote meetings have had the positive impacts of saving resources and facilitating increased collaboration, many organizations have unfortunately had to suspend their outreach and volunteer programs. Although a lot of outreach and volunteer work was canceled, some organizations were still able to engage the public through innovative, remote initiatives, such as a community-driven early detection trail survey using a smartphone application (E. Bishop, personal communication, February 9, 2021). Many organizations even stated that implemented virtual programs might be permanent features in their collaborative and outreach efforts. From several of the interviews, we gathered that the travel restrictions put in place due to the pandemic have allowed the native Hawaiian wildlife to thrive; however, invasive species have also prospered. COVID-19 has limited some aspects of invasive species management operations but has created an opportunity to try innovative ways of collaborating.

Through interviews and research, our team learned that all imported goods are inspected based on the federal invasive species list before being brought into Hawai‘i. USDA APHIS PPQ works with the U.S. Customs and Border Protection (CBP) to inspect incoming foreign produce, people, and other products to Hawai‘i. The interviews helped our team identify a possible disconnect between the mainland United States and Hawai‘i. Hawai‘i has prioritized the most habitat-modifying target invasive species; however, the federal invasive species list targets species for the entire United States and does not include all of Hawaii’s priority species. Federal inspectors are limited to alerting other organizations about the presence of species that are on the federal invasive species list and are unable to intervene to control species that are only targets for Hawai‘i. If import biosecurity is not strong enough to be the first line of defense, the responsibility to detect these species falls to organizations with less funding. Unfortunately, some invasive species have established permanent populations in Hawai‘i, but increasing biosecurity will prevent other invasive species from continuing to invade native lands. Many of the invasive species management organizations we interviewed expressed that increased funding and legislative action are needed to strengthen biosecurity in Hawai‘i. There are current efforts to

improve biosecurity in Hawai‘i. For example, the 2027 Hawai‘i Interagency Biosecurity Plan addresses the gaps that are present in Hawai‘i’s current biosecurity system and provides coordinated actions and policies for the different agencies and stakeholders in Hawai‘i (Hawaii Invasive Species Council, 2021).

A specific invasive species management strategy that many organizations discussed during their interview is biocontrol, the process of introducing a second species to prey on or compete with the invasive species (Congressional Research Service, 2015). Biocontrol rarely eradicates the target species; instead, the introduced population and the target population have an oscillating effect on each other’s size (S. Gon, personal communication, February 17, 2021). From the interviews, our team determined that biocontrol approaches can be very successful in invasive species management, but they are often met with skepticism and mistrust by the public. Ineffective biocontrol attempts, such as introducing a species that adversely impacts the native ecosystem, have left a lasting negative perception on the general public. The failures in biocontrol, such as introducing invasive mongoose to combat rodents, occurred decades ago. With continued research in dedicated biocontrol labs before implementation, the current risk of failure is minimal. For example, after fifteen years of research, a Brazilian insect was released to control the growth and spread of invasive strawberry guava, and there have been early signs of success (Matsumoto et al., 2020; U.S. Forest Service, n.d. c). It is apparent to our team that it is vital to conduct this research carefully because enough data needs to be collected to confidently conclude that the introduced organism or virus will only impact the target invasive species and nothing else. With the increase in biocontrol research in Hawai‘i, some of the organizations we interviewed expressed interest in expanding their capacities for this type of management.

The organizations we interviewed had different approaches to invasive species management. Some invasive species management organizations focus on outreach and educating the public, while others do on-the-ground fieldwork. Other organizations have management efforts based on legislature, regulations, and policy-making. Additionally, some of the organizations we interviewed conduct research related to invasive species. Many of the organizations we interviewed utilize a combination of these management strategies. Organizations such as CGAPS, HISC, and Laukahi coordinate the broader invasive species community. Based on the interviews and research, our team determined that many invasive species management organizations have different mission statements and responsibilities but

have a shared understanding that they work synergistically towards protecting the precious resources in Hawai‘i.

Objective 2: Analyze Collaboration Among Invasive Species Organizations in Hawai‘i

Throughout the interviews we conducted, we also came across several common themes regarding the current state of collaboration among invasive species management organizations in Hawai‘i. Many organizations mentioned positive themes such as effective collaboration strategies, strong communication within the state, and the importance of the public. They also discussed issues such as a lack of communication with the federal government, a lack of education provided to landscapers and nurseries, and collaboration issues. Based on the interviews, our team determined multiple effective collaboration strategies used by invasive species management organizations and possible areas to increase collaboration. Many organizations plan to increase collaboration by communicating and working with groups outside of their usual contacts. Motivations to increase collaboration seem to vary. We inferred that some organizations might value the benefits of collaborating and wish to continue to expand their connections, while others might seek new connections because they rely on collaboration for resources and funding, both of which are currently in short supply due to the COVID-19 pandemic. Multiple interviews also uncovered that partnerships between public and private groups have proven to be effective in Hawai‘i and are expected to increase over the next few years. Partnerships, such as CGAPS and HCA, can help decrease any redundancies or gaps present in invasive species management and lead to more effective resource use. Additionally, our team discovered that while there may be redundancies and overlap in invasive species management strategies and initiatives, this redundancy can be beneficial. A majority of the organizations we interviewed mentioned that the issue of invasive species is too vast in Hawai‘i, and this overlap is essential for increasing the number of resources put towards invasive species management. Involving landowners in collaboration is also crucial in invasive species management because invasive species do not adhere to property lines. Interagency and informal meetings, community outreach, and public education are effective collaboration strategies among invasive species management organizations in Hawai‘i. The invasive species management organizations that we interviewed appeared to be collaborating effectively within Hawai‘i

through various methods, specifically through CGAPS, and are constantly identifying areas to increase collaboration.

Using the information from our interviews and research, we determined that there is effective collaboration within Hawai‘i, especially in conservation work. This strong collaboration occurs at the local, island, and state levels. Many organizations attribute this effective collaboration in Hawai‘i to the local culture and the close-knit conservation network, where many groups know each other. There are also partnerships, such as CGAPS, that coordinate collaboration and increase communication between organizations involved in invasive species management in Hawai‘i. This effective collaboration within the state is beneficial in achieving similar goals in invasive species management.

Many organizations we interviewed mentioned strong communication within the state; however, some expressed a few collaboration issues. From the interviews, our team determined that the collaboration issues stem from a lack of overarching leadership. There are many opportunities for the organizations to collaborate during meetings; however, it can sometimes be challenging to establish action items and define ways to improve collaboration during these meetings. We found that having a general, overarching organization for invasive species management, such as CGAPS, helps with policymaking and organization. We also discovered that a lack of staff and funding causes time constraints that make collaboration difficult. Organizations are constantly working with different stakeholders based on their current focus or project. As priorities are regularly changing, it is arduous to devote a substantial amount of time and funding to one specific partner. Many of the collaboration issues mentioned come from insufficient operational systems, such as a lack of funding, but not from a lack of communication.

The isolation of Hawai‘i from the mainland United States presented some challenges for the organizations we interviewed. A lack of communication between the federal government and organizations in Hawai‘i makes the unique Hawaiian ecosystem even more vulnerable to pests. The physical separation of Hawai‘i from the mainland U.S. means that federal regulations regarding invasive species tend to focus on mainland priority species, excluding many of the common invasive species of concern in Hawai‘i. Much of this disconnect is evident in funding. The vulnerability of Hawaiian ecosystems compared to the mainland requires more funding to manage invasive species. If an invasive species is not a federally regulated pest, then the federal

government cannot give Hawaiian agencies much needed funding to manage their unique invasive species. The vast ocean between the contiguous United States and Hawai‘i has left many invasive species management organizations feeling marginalized and underrepresented at the federal level.

A principal role of invasive species management discussed by many organizations we interviewed was collaboration with the community. Many of these organizations have incorporated educating the public about invasive species into their missions. Bio-culture approaches, in which organizations respect and understand the community's culture and incorporate it into the management systems, are becoming more common in invasive species management. These approaches help engage the public and build a community that genuinely values and helps care for their natural resources. Gaining and maintaining community engagement is vital for the long-term success of the organizations we interviewed. The public helps monitor by reporting findings of known invasive species and permitting access to private properties. The organizations rely on public feedback to understand the area's needs and the legislature they should develop. By engaging the community and answering their inquiries, invasive species management organizations acquire a dedicated group of people to aid in policy-making, early detection, control efforts, and awareness-building to frame a positive perception of invasive species management.

The public works with many invasive species organizations to help mitigate specific invasive species issues that arise. Many of the organizations we interviewed claim that the public accepts the management of invasive plants. In general, the public agrees that invasive plants are devastating to Hawai‘i; however, there is some controversy about the control of invasive ungulates, such as feral pigs. Some people view the pigs as a game species that should not be treated as an invasive species, making their management even more challenging. While invasive species management organizations build fences to control the pigs, some hunters tear them down. Invasive species management organizations have stated that the pigs are destroying native Hawaiian plants and animals. There have been proposals to accommodate both parties, such as creating fenced-in areas for hunting. These areas would protect the native habitat and allow the pig hunting to continue. Another disconnect between the public and invasive species management organizations arose from the lack of invasive species education for landscapers and nurseries. This lack of education resulted in many landscapers and nurseries unknowingly selling

invasive plants or plants infested with invasive species. There have also been some cases where landscapers have planted invasive plants in parks while organizations are trying to remove them in the forests. This issue could stem from the disconnect between the federal invasive species list and the Hawaiian target species, as mentioned previously. It is easy to import and sell invasive species unique to Hawai‘i because they are not federally regulated. The ease of selling these invasive species makes it apparent how important it is to educate the local nurseries and landscapers on the invasive species that can be detrimental to the Hawaiian ecosystem. Educational programs to inform the public, nurseries, and landscapers about the risk that invasive species pose to Hawai‘i helps build a community that cares for its environment, culture, and economy.

4.2: Discussion of the Social Network Analysis and Block Analysis

Our team used the social network analysis and the block analysis to visually interpret the state of collaboration among invasive species management organizations in Hawai‘i. The SNA in Appendix D shows specific relationships among the organizations involved in invasive species management in Hawai‘i. We only included interviewed organizations and their collaborative partners in the SNA. By analyzing the SNA, our team determined that while there is an abundance of communication between invasive species management organizations in Hawai‘i, a limited number of organizations are fully collaborating by our definition. A majority of organizations are instead networking, coordinating, and cooperating. Table 1 includes the interaction distinctions, their definitions, and examples of each type of collaboration.

Table 1: The levels of collaboration used in the SNA, their definitions, and examples of each interaction distinction.

Collaboration Level	Definition	Example(s)
Networking	Organizations only share funding, research or knowledge.	● OMKM is informed about research findings by the Hawai‘i Ant Lab. ● The USFWS provides funding for the DLNR DAR AFRC.
Coordinating	Organizations are networking, and they have the same goal but do not work together.	● The Invasive Species Committees are all working towards the same goal, but work separately on each island. ● USDA APHIS PPQ is on the steering committee for CGAPS, so they share knowledge and have the same goal but still remain separate.
Cooperating	Organizations are coordinating, and they share resources, staff/volunteers, space, and equipment.	● OISC and Māmalu PoePoe work together to detect africanized honey bees at airports and harbors by doing trap checks. ● HAL and MISC work together to apply bait aerially.
Collaborating	Organizations are cooperating, and they have shared responsibility and operations, but remain separate organizations.	● HISC and CGAPS have the shared responsibility and operations of coordinating and catalyzing action among invasive species management organizations in Hawai‘i. ● FOHF and HFNWR have shared responsibility and operations of conserving and protecting Hawaiian forest birds and their habitats.
Integrating	This is for sub-organizations that are part of a larger organization	● One of USDA APHIS PPQ’s programs and their funding and staff became part of the U.S. Customs and Border Protection. ● PIFWO is a sub-organization within USFWS
Insufficient Information	There is a known interaction, but there is not enough information for us to decide the extent of this interaction.	● The U.S. Navy is listed as one of the partners of USGS PIERC. This partnership was found through research but not discussed in the interview, so we were unable to determine their level of interaction. ● USFS PSW IPIF mentioned that one of their partners is Laukahi in the interview, but we were unable to determine their level of interaction from the interview and research.

The abundance of black arrows throughout the SNA shows the limitations our team faced when defining collaborative efforts between organizations. A cluster of black arrows coming from an organization indicates that although it has many connections, there is not enough

information to determine the extent of each interaction. The limitations in defining these interactions come from not interviewing all the organizations included in the SNA, as well as insufficient detail about the extent of each interaction provided by the interviews and research. Despite these limitations, the SNA can help determine some of the key players in the network. Organizations with more connections were positioned in the center, while those with fewer connections were on the perimeter. Many of the organizations we interviewed are towards the center. This central positioning of organizations we interviewed could result from a correlation between their responsiveness and desire to collaborate. We also must consider the inherent bias in the SNA, as we have more information about the collaborative efforts of organizations we interviewed. Organizations connected with only one tie could have a more extensive role in the collaborative network that our team did not uncover through our interviews and research.

The block analysis shows, more generally, how many organizations are interacting through line thickness. We analyzed the number of interactions between organizations of different types and the same type. From the block analysis, our team determined that partnership organizations had the most interactions with different organization types, specifically with state, federal, non-profit, and university groups. State organizations and partnerships had the thickest line between them in the block analysis, indicating that these two types have the highest number of ties with each other. Partnerships also had the most internal interactions compared to the other organization types. Based on these observations, our team inferred that partnerships are involved in many collaborative efforts in Hawai‘i. Naturally, partnerships would have the most interaction with other organizations because, in partnerships, the different organization types work together to achieve a common goal. Federal and state organizations appear to be collaborating more internally than with organizations of other types, excluding partnerships. University and non-profit organizations appear to have fewer ties than partnership, federal government, and state government organizations. Our team inferred that this lack of ties could be due to their limited resources and localized role in the invasive species management network. Organizations in the “other” category have the fewest ties, indicating the least amount of collaboration. Their low number of ties could be a result of not interviewing organizations in the “other” category, and not knowing the full extent of their collaborative efforts. Overall, the organizations collaborate more internally, with organizations of the same type, than externally.

4.3: Recommendations

Based on our characterization and analysis of 25 organizations involved in invasive species management in Hawai‘i and their collaborative efforts, we developed two specific recommendations for our sponsor:

1. We recommend **WPI students work with federal government organizations if the project focuses on increasing effective collaboration among the organizations involved in invasive species management**. As evident in the SNA, many of the organizations expressed that invasive species management within Hawai‘i is very collaborative. However, there may be a disconnect between the federal offices involved in invasive species management and the other organization types. The federal government organizations interested in working with WPI students in the future are NPS, USDA APHIS PPQ, USFS PSW IPIF, and USGS PIERC. Each of these organizations has locations on O‘ahu except USFS PSW IPIF.
2. We recommend **the WPI Hawai‘i Project Center director contact the organizations on O‘ahu that expressed interest in working with WPI students in the future**. Many of the interested organizations have worked with students in the past and have potential opportunities for WPI Hawai‘i Project Center involvement. The interested organizations are all doing exciting work in the invasive species management field, and our team does not see any that our project sponsor should eliminate. To develop future projects, our project sponsor should determine project areas of interest and reach out to the interested organizations on O‘ahu whose work closely aligns with those areas.

4.4 Conclusion

Invasive species have been detrimental to the Hawaiian Islands. Our project determines current approaches to invasive species management and issues affecting the operations of invasive species management organizations. We also assessed the collaborative efforts of invasive species management organizations in Hawai‘i. We created a social network analysis and a block analysis to visually represent the network of invasive species management organizations in Hawai‘i using information from research and interviews. We then used the information gathered to analyze the network and effectiveness of invasive species management in Hawai‘i overall. This network of invasive species management organizations must continue collaborating

and increase collaboration for the effective management of invasive species. We intend to provide a resource for organizations involved in invasive species management and the Hawai‘i Project Center director to learn about other organizations in the network and establish connections between groups to increase collaboration. We hope our project provides the organizations involved in invasive species management in Hawai‘i and the WPI Hawai‘i Project Center director insight into the structure of the invasive species management organization network and how they combat invasive species in Hawai‘i. We also hope our project identifies areas for organizations to increase collaboration and improve operations within the invasive species management network, and characterizes potential partners for these organizations.

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Appendix A: Interview Schedule

Table 2: The schedule of interviews with invasive species management organizations. We interviewed 25 organizations involved in invasive species management across the Hawaiian Islands.

Organization Name	Interviewee Name and Title	Interview Date and Time
Coordinating Group on Alien Pet Species (CGAPS)	Christy Martin Program Manager and Public Information Officer	2/5/21 at 2pm EST
Oʻahu Master Gardeners Program (OMGP)	Kalani Matsumura Junior Extension Agent in Urban Horticulture	2/8/21 at 4pm EST
Maui Invasive Species Committee (MISC)	Adam Radford General Manager	2/8/21 at 8pm EST
Conservation Council for Hawaiʻi (CCH)	Moana Bjur Executive Director	2/8/21 at 8pm EST
U.S. Geological Survey Pacific Island Ecosystems Research Center (USGS PIERC)	Gordon Tribble, Ph.D. Center Director	2/9/21 at 12pm EST
Office of Maunakea Management (OMKM)	Jessica Kirkpatrick Natural Resource Specialist	2/9/21 at 2:30pm EST
Oʻahu Invasive Species Committee (OISC)	Erin Bishop Outreach Coordinator	2/9/21 at 3pm EST
Hawaiʻi Invasive Species Council (HISC)	Randal T. Bartlett HISC Interagency Coordinator	2/9/21 at 6:30pm EST
Hawaiʻi Ant Lab (HAL)	Heather Forester Hilo Office Extension Specialist	2/11/21 at 3pm EST
Plant Extinction Prevention Program (PEPP)	Kobey Togikawa Oʻahu Plant Technician	2/11/21 at 3pm EST
National Park Service: Region 12- Pacific Islands (NPS)	Jadelyn J. Moniz Nakamura, PhD Research Coordinator/Science Advisor National Park Service, Regions 8, 9, 10 and 12	2/12/21 at 2pm EST
Friends of Hakalau Forest National Wildlife Refuge	J.B. Friday, PhD President	2/12/21 at 4pm EST
Department of Land and Natural Resources Hawaiʻi Division of Aquatic Resources Ānuenue Fisheries Research Center (DLNR DAR AFRC)	Kimberly Fuller Aquatic Invasive Species Biologist	2/15/21 at 3pm EST

Kōkeʻe Resource Conservation Program (KRCP)	Katie Cassel Founder/Project Coordinator	2/16/21 at 3pm EST
Coconut Rhinoceros Beetle Response Team (CRB Response)	Koki Atcheson and Kaili Kosaka Outreach Specialists	2/16/21 at 8pm EST
Hakalau Forest National Wildlife Refuge (HFNWR)	Thomas Cady Refuge Manager	2/17/21 at 2pm EST
The Nature Conservancy (TNC) Hawaiʻi	Samuel M. ʻOhukaniʻōhiʻa Gon Senior Scientist/Cultural Advisor	2/17/21 at 7pm EST
Laukahi	Emily Grave Network Coordinator	2/18/21 at 3pm EST
Big Island Invasive Species Committee (BIISC)	Franny Brewer BIISC Outreach Coordinator	2/18/21 at 4pm EST
U.S. Forest Service, Pacific Southwest Research Station Institute of Pacific Islands Forestry (USFS PSW IPIF)	Susan Cordell, PhD Director and Research Ecologist	2/18/21 at 5pm EST
U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA APHIS PPQ)	Dorothy Alotonga State Operations Coordinator in the State Plant Health Director's Office	2/18/21 at 6pm EST
Island Conservation (IC)	Patty Baiao U.S. Head of Operations	2/19/21 at 5pm EST
U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office (USFW PIFWO)	Benton Kealii Pang, Ph.D. Invasive Species Team Manager	2/22/21 at 4pm EST
Pacific Rim Conservation (PRC)	Dr. Lindsay Young Executive Director	2/23/21 at 3pm EST
The Daehler Lab	Curtis Daehler Professor of Botany School of Life Sciences Botany and EECB Graduate Programs	2/23/21 at 4pm EST

Appendix B: Interview Questions Templates

This appendix displays the script for interviews with professionals from invasive species management organizations. We used two interview templates: one for government agencies, non-profit organizations, and partnerships, and one for university researchers. These two templates have some differences based on the nature of invasive species management done by organizations and individuals that fall into each type.

Appendix B.1: Interview Template for Government and Non-Profit Organizations

Hello, our names are _____ (Introductions). As I mentioned through email, we are a team of WPI students working with the WPI Hawai‘i Project Center. We are currently working on a project examining how invasive species management agencies and initiatives are organized to combat invasive species in Hawai‘i. We would like to ask you some questions regarding your work at _____. We have general knowledge of _____ from research we have conducted; however, we would like to speak with you directly to get a deeper and authentic understanding of the organization’s operation that might not be apparent from the website and literature resources. With your permission, we would like to record and quote your responses, but if you prefer to remain anonymous then we will not reveal your name. You do not need to answer the questions if you do not want to, and you can leave this interview at any time. Do we have permission to transcribe and record our conversation?

This will take approximately 30 minutes, I will be conducting the interview primarily, while _____ transcribes. Do you have any questions before we start?

1. What is the mission of your organization?
    a. Has your mission statement and/or management plan evolved?
    b. What is the process for reviewing and revising the mission statement and management plan?
    c. How is the plan documented, and is there a specific timeline for it?
2. What is your role at the organization and how long have you worked here?
    a. What other experience have you had in invasive species management or related fields?

3. How and when was your organization established?
    a. How many employees/volunteers do you have currently?
    b. How has your organization developed throughout the years to become well-known in invasive species management?
    c. How do you see your organization continuing to develop and changing in the next five years or so?
    d. How do you think the larger field of invasive species management will change over the next five years?
4. Do you receive funding from the government or other agencies?
    a. If so, from where?
5. How has your organization changed since you have been at the organization?
6. How does your organization currently manage invasive species?
7. How effective do you think the system of invasive species management is in Hawai‘i overall?
8. Could you explain the role of the public in your organization?
    a. Do they provide input?
9. Do you have volunteer opportunities?
    a. Could you walk us through the volunteer process? What support and training do volunteers receive?
    b. What are the general responsibilities of volunteers? Which jobs do they do?
    c. How do you make sure volunteers are completing their job well? Is there a feedback system?
10. Does your organization currently work with any other groups to manage invasive species?
    a. If they work with other organizations:
        i. Do you work with other organizations on the same goal/project?
        ii. Do you have indirect interactions or influence over other organizations or vice versa?
        iii. Which groups does your organization work with and to what extent?
        iv. What are the methods your organization uses to collaborate?
            1. Can you see any areas that could be improved?

v. How easy is it for another organization to collaborate with your organization?
    1. In your opinion, are there any ways of improving the ease of collaboration?
vi. Could you see your organization increasing collaboration with other groups?
    1. If so, which specific groups or organizations would you be especially interested in collaborating with?

b. If they don't work with other organizations:
    i. What is your opinion on collaboration with other groups or organizations?
    ii. Have you collaborated with other groups or organizations in the past?
        1. Why did this collaboration end?
    iii. Do you see any benefits of collaborating in your line of work?
    iv. Could you see your organization increasing collaboration with other groups?

11. Is there any redundancy in the focus of different invasive species organizations?
    a. Do you think this is useful redundancy or is it not an ideal use of resources?
12. Can you give us a specific example of a way in which collaboration among different organizations has been useful in the mission?
13. What is your opinion of the effectiveness of the collaboration of invasive species management organizations in Hawai‘i?
    a. Could you provide some specific examples of ways that organizations in Hawai‘i are collaborating effectively?
    b. Could you also provide some specific examples of ways that a lack of collaboration is inhibiting the progress of these organizations?
14. Our program sends students from our university to work on projects in social and environmental science with local organizations in many locations, including Hawai‘i. Our partner organizations identify project topics based on their needs at the time. For example, a student group last year worked with restaurants in Hilo to implement a reusable takeout container system to reduce plastic waste. Do you think that your organization could benefit by working with our student project program in the future?

    a. We can provide additional information about the program and share your thoughts about working with WPI students in the future if you would like.
    b. Do you currently, or have you had any past involvement of students as interns or researchers?
15. Who else do you think is doing exciting work in the field locally?
16. Is there anyone else you think we should contact within your organization or from other organizations?
17. Do we have your permission to quote your responses? Do you wish to remain anonymous?

Appendix B.2: Interview Template for University Researchers

Hello, our names are _____ (Introductions). As I mentioned through email, we are a team of WPI students working with the WPI Hawai‘i Project Center. We are currently working on a project examining how invasive species management agencies and initiatives are organized to combat invasive species in Hawai‘i. We would like to ask you some questions regarding your research at ____ related to invasive species. We have general knowledge of your research for Hawai‘i from research we have conducted; however, we would like to speak with you directly to get a deeper and authentic understanding of your work that might not be apparent from the website and literature resources. With your permission, we would like to record and quote your responses, but if you prefer to remain anonymous then we will not reveal your name. You do not need to answer the questions if you do not want to, and you can leave this interview at any time. Do we have permission to transcribe and record our conversation?

This will take approximately 30 minutes, I will be conducting the interview primarily, while _____ transcribes. Do you have any questions before we start?

1. What is your role at the university and how long have you worked here?
    a. Do you work in a lab?
        i. What work is done in your lab?
    b. What academic departments are you involved with?
2. What is the nature of your research?

a. I saw that some of your research is related to invasive species, are you actively involved in the management of invasive species or do you primarily study the biology of invasive species?

3. You mentioned working with policy makers, do you currently work with any other groups or organizations within your university, other universities, or outside of academia? For instance, do you do any work with non-profit, governmental organizations, or other lab groups?
    a. If they work with other organizations:
        i. Do you have indirect interactions or influence over other groups or vice versa?
        ii. Which groups do you work with and to what extent?
        iii. What are the methods you use to interact with other groups?
            1. Can you see any areas that could be improved?
            2. Do you use different methods of communication for different levels of interaction?
        iv. How easy has it been to collaborate with other groups?
            1. In your opinion, are there any ways of improving the ease of collaboration?
        v. Could you see yourself increasing your collaboration with other groups?
            1. If so, which specific groups or organizations would you be especially interested in collaborating with?
4. What is your opinion of the effectiveness of collaboration in invasive species management in Hawai‘i overall?
    a. Could you provide some specific examples of ways that organizations in Hawai‘i are collaborating effectively?
    b. Could you also provide some specific examples of ways that a lack of collaboration is inhibiting the progress of these organizations?
    c. If they don’t work with other organizations:
        i. What is your opinion on collaboration with other groups or organizations?
        ii. Have you collaborated with other groups or organizations in the past?
            1. Why did this collaboration end?

iii. Do you see any benefits of collaborating in your line of work?

iv. Could you see yourself increasing your collaboration with other groups?

5. Our program sends students from our university to work on projects in social and environmental science with local organizations in many locations, including Hawai‘i. Our partner organizations identify project topics based on their needs at the time. For example, a student group last year worked with restaurants in Hilo to implement a reusable takeout container system to reduce plastic waste. In your research, do you ever work with students from other universities, or do you see any way that the involvement of students from other universities could be beneficial to your work?
6. Who else do you think is doing exciting work in the field locally?
7. Is there anyone else you think we should contact within your university or from other organizations?
8. Do we have your permission to quote your responses? Do you wish to remain anonymous?

Appendix C: Characterization Profile and Analysis of Each Organization

Each subsection, Appendices C.1-C.25, contain a characterization profile and analysis table for each of the invasive species management organizations in Hawai‘i we interviewed. When characterizing each organization's type, we used the following codes: F for federal government, S for state government, U for university, NP for non-profit, and P for partnership.

Table of Contents Appendix C

Appendix C.1: Big Island Invasive Species Committee

The following section shows the characterization profile and analysis, shown in Table 3, of the Big Island Invasive Species Committee. All of the information was found through research and an interview with Franny Brewer (F. Brewer, personal communication, February 18, 2021; Big Island Invasive Species Committee, 2014; Big Island Invasive Species Committee, 2019; Big Island Invasive Species Committee, 2021; Hawaii Invasive Species Council, 2019; Plant Pono, 2020).

Big Island Invasive Species Committee (BIISC) Characterization Profile:

- **Type:** P
- **Location:** 23 East Kawili St, Hilo, HI 96720
- **Contact Information:** Franny Brewer / BIISC Outreach Coordinator / Email: fbrewer@hawaii.edu
- **Date Established:** Early 2000s
- **Number of Employees:** BIISC has 17 staff members.
- **Volunteer Opportunities:** Currently, BIISC has been less focused on volunteers and more focused on empowering the community to manage invasive species. In the past, BIISC has done a program called Albizia Assassins where the volunteers would treat Albizia in different neighborhoods. BIISC also has regular volunteer workdays.
- **Public Involvement:** The public is important for determining the direction that BIISC takes their work. When BIISC starts programs they do focus groups or surveys with the public to determine challenges, barriers, and benefits. BIISC uses Facebook, which acts as an active news channel on the Big Island, to see what the public is discussing and what issues they are focusing on. BIISC focuses on empowering the community to treat invasive species on their own.
- **Total Budget/Funding:** BIISC receives Kupu Ainia, which is Cares Act funding. Most of BIISC's funding comes from the state, specifically through legislature money appropriated to HISC. BIISC received $515,904 for control projects and $190,970 for outreach projects this past year from HISC. BIISC also received funding from the U.S. Forest Service, the Hawai'i Department of Agriculture, and grants through various sources.
- **Collaboration/Partners:**
    - BIISC acts as a point for collaboration with other groups and agencies.
    - BIISC works with homeowners associations and neighborhood watch groups

because they feel it is much more effective for neighbors to work together.
    - BIISC has worked with the USDA, specifically on the two-lined spittlebug and the queensland longhorn beetle. They work with the USDA Agricultural Research Service on these two insect pests by trying to coordinate resources and do outreach.
    - HISC is supportive of the island Invasive Species Committees, including BIISC, through funding.
    - BIISC also collaborates with the U.S. Forest Service, the Hawai‘i Department of Agriculture, and the Hawai‘i Community Foundation through funding.
    - They work with the Hawai‘i Department of Land and Natural Resources and the National Park Service to control fountain grass in a state area reserve. In this collaboration, BIISC provides labor and the National Park Service provides resources.
    - BIISC works with the Watershed Partnerships by providing field crew labor.
    - BIISC works on the Plant Pono Program.
    - The Invasive Species Committees are projects of the PCSU at the University of Hawai‘i.
    - List of Partners:
        - Pacific Cooperative Studies Unit, University of Hawai‘i (PCSU), Research Corporation of the University of Hawai‘i (RCUH), Big Island Association of Nurserymen (BIAN), Black Sands Community Association, Hawai‘i Army National Guard, Hawai‘i Community College Forest Team, Hawai‘i County, Hawai‘i Department of Agriculture (HDOA), Hawai‘i Department of Land and Natural Resources (HDLNR), Hawai‘i Natural Area Reserve Systems (NARS), Hawai‘i Department of Transportation (HDOT), Hawai‘i Division of Forestry and Wildlife (HDOFAW), Hawai‘i Export Nursery Association (HENA), Hawai‘i Island Landscapers Association (HILA), Hawai‘i Invasive Species Council (HISC), Hawai‘i Tourism Authority (HTA), Hawai‘i Volcanoes National Park, Kamehameha Schools Bishop Estate, The Watershed Partnerships (Kohala Watershed Partnership), Landscape Industry Council of Hawai‘i (LICH), Hawai‘i Master Gardeners Program (HMGP), Mauna Kea Watershed Alliance (MKWA), Malama o Puna, Coordinating Group on Alien Pest Species (CGAPS), Island Invasive Species Committees, U.S. Department of Agriculture (Agricultural Research Service) (USDA ARS), U.S. Forest Service (USFS), Hawai‘i Community Foundation (HCF), Plant Pono, and National Park Service (NPS)
- **Goal/Mission:**
    - BIISC’s current mission is to prevent, detect, and control the threats caused by the establishment and spread of invasive species to the Big Island’s environment,

economy, and lifestyle.
    - BIISC is in the process of revising this mission statement.
- **Responsibilities:**
    - BIISC works to change stakeholder interactions in addressing invasive species.
    - BIISC works to protect native forests, communities, and agriculture from invasive species threats.
    - BIISC has an early detection crew that looks for new plants and assesses how much of a problem they are. They then use ArcGIS to map out the plants and their treatments.
    - They work on species that are eradicable and also support other organizations with species or do outreach on species.
    - In a year, BIISC does 80-100 outreach and education presentations across the Island.
    - They also run a program to treat little fire ants, where they offer free treatment supplies and tutorials if a person could get five neighbors to agree to treat for a year. During that year, BIISC provides support to that neighborhood group through education and troubleshooting.
    - BIISC works to fill gaps that no one is filling, from getting out into the field and eradicating a specific species to teaching people about a specific species.
    - BIISC also works on a program called Plant Pono. The goal of this program is to get nurseries to stop selling invasive plants and to help prevent the spread of invasive plants.
    - BIISC has also done research studies on pesticides that can be used by homeowners.
    - BIISC's Outreach Coordinator also runs an educational program for rat lungworm.
    - BIISC has also worked on fountain grass removal.
    - The structure of BIISC is meant to foster a collaborative environment to solve invasive species problems.
- **Management Plan:**
    - BIISC develops management plans depending on the species and its status. Eradicable plant species will have a plan that outlines actions, a timeline, and the necessary resources. Other species that BIISC works on are more of an outreach species that they educate others about.

Table 3: Analysis of Big Island Invasive Species Committee

Organization: Big Island Invasive Species Committee				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		While BIISC has started to focus more on empowering the community to manage invasive species, they do have volunteer programs, such as Albizia Assassins, where volunteers help control invasive species, such as Albizia.
Does the organization actively inform the public about its programs and services?	✓			BIISC actively informs the public about the invasive species they are working on and programs they are starting. They also have a Little Fire Ant program that they inform the public about.
Does the organization receive community input about its mission and activities?	✓			The public is critical in determining what activities BIISC carries out. They help provide input on programs and tell BIISC about community issues.
Does the organization have opportunities for future student involvement?	✓			There are bigger projects, especially in the intersection of social science and natural resources over the next couple of years where there is room for student involvement.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			BIISC develops documented management plans for eradicable plants that focus their resources and activities. They have even refocused their mission to better match their activities.
Does this plan develop timelines for their accomplishments?	✓			BIISC sets the number of years they think it will take to eradicate a plant species for each management plan.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			BIISC collaborates with other partnerships, such as CGAPS.
Does the organization collaborate with other organizations of different types?	✓			BIISC collaborates with state government organizations and university groups.
Does the organization want to increase collaboration with other organizations?	✓			They are always willing to talk to people and hear them out. They hope to develop new collaboration by applying a team to do field

				work.
Does the organization have interest in working with WPI students?	✓			Yes, especially in an area related to both social science and natural resources.

Appendix C.2: Coconut Rhinoceros Beetle Response Team

The following section shows the characterization profile and analysis, shown in Table 4, of the Coconut Rhinoceros Beetle Response Team. All of the information was found through research and an interview with Koki Atcheson and Kaili Kosaka (K. Atcheson & K. Kosaka, personal communication, February 16, 2021; Coconut Rhinoceros Beetle Response, 2021a; Coconut Rhinoceros Beetle Response, 2021b).

Coconut Rhinoceros Beetle Response Team (CRB Response) Characterization Profile:

- **Type:** P
    - University and State partnership
- **Location:** 1849 Auiki St, Honolulu, HI 96819
- **Contact Information:**
    - Koki Atcheson / Outreach Specialist / Email: crbpr1@hawaii.edu
    - Kaili Kosaka / Outreach Specialist / Email: crbpr2@hawaii.edu
- **Date Established:** 2014
- **Number of Employees:** CRB has approximately 25 staff members (15-20 person data team, two canine teams, two staff members working on outreach, and their leadership team).
- **Volunteer Opportunities:** The CRB Response does not maintain a volunteer list. Instead, they partner with other organizations who have more regular volunteer opportunities.
- **Public Involvement:** The public helps report beetles that they find in the adult or larvae stage or any tree damage. They also report any issues with traps, such as if the traps are not catching beetles. The public communicates with the CRB Response through the phone, online, and through interagency channels such as 643pest.org. The CRB Response participates in outreach to connect with new people and neighborhoods and makes sure that the public is familiar with CRB. The CRB Response also relies on the public for private property access.
- **Total Budget/Funding:** The CRB Response Team is funded through the PPA 7721 grant, also known as the Farm Bill. They were approved for funding for the 2021-2022 year.
- **Collaboration/Partners:**

    - The CRB Response is a partner organization emergency response effort between the University of Hawai‘i, the Hawai‘i Department of Agriculture, and the U.S. Department of Agriculture. These three organizations were involved in the creation of the CRB Response mission statement, which is to control the coconut rhinoceros beetle and remove it from Hawai‘i. The Hawai‘i Department of Agriculture originally provided the staffing for the CRB Response and hiring support was provided by the University of Hawai‘i.
    - The CRB Response has also worked with the O‘ahu Invasive Species Council, which provides volunteers and checks traps on O‘ahu that are in remote locations. The other Invasive Species Committees, specifically MISC and BIISC, check traps at airports on other islands for the CRB Response.
    - The CRB Response also works closely with land managers to create green waste management plans and find coconut rhinoceros beetle (CRB) management methods that work best for each land manager.
    - The Kaulunani Urban & Community Forestry Program and Smart Trees Pacific have been helpful in increasing attendance at the CRB Response webinars.
    - CRB Response also works with the Māmalu Poepoe Project, administered by HISC, to monitor traps on other islands in Hawai‘i.
    - CRB Response works with the U.S. Navy and Department of Defense, specifically in the removal of green waste material, developing a green waste management plan, and checking traps on DOD land.
    - The CRB Response would like to find more partners in Mililani, Central O‘ahu, and West O‘ahu.
    - List of Partners:
        - University of Hawai‘i (UH), Hawai‘i Department of Agriculture (HDOA), U.S. Department of Agriculture USDA), O‘ahu Invasive Species Council (OISC), Maui Invasive Species Council (MISC), Big Island Invasive Species Council (BIISC), Kaulunani Urban & Community Forestry Program, Smart Trees Pacific, Māmalu Poepoe (HISC), U.S. Navy, and Department of Defense (DOD)
- **Goal/Mission:**
    - The CRB Response’s mission is to protect Hawaiian communities, industries, and environments from the damages and impacts of the coconut rhinoceros beetle.
- **Responsibilities:**
    - The CRB Response spreads the word about CRB by going door to door, attending neighborhood board meetings, giving classroom presentations, and setting up informational booths.
    - The CRB Response gives webinars and presents information to staff at other invasive species management organizations.
    - The CRB Response uses canine teams to detect CRB breeding sites.

    - The CRB Response field crew services CRB traps across Oʻahu, identifies breeding sites and tests breeding material, plans treatment methods for land managers, manually searches for and removes larvae, and applies pesticides to areas or injects pesticides into trees.
    - The CRB Response also manages CRB through hot composting, which is heating up compost piles, or burning of compost piles. CRB Response also uses a method of chipping material to remove beetles, but when the material is chipped it needs to be moved to a place safe from CRB.
    - In Honolulu, CRB Response analyzes the information from traps, mulch surveys, and tree damage.
- **Management Plan:**
    - Their management plans are based on funding for the year to meet certain goals. These management plans were not documented on the website.
    - The CRB Response creates green waste management plans.

Table 4: Analysis of the Coconut Rhinoceros Beetle Response Team

Organization: Coconut Rhinoceros Beetle Response Team				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		The CRB Response does not have their own volunteers and does not maintain a volunteer list. They partner with other organizations and use their volunteer bases.
Does the organization actively inform the public about its programs and services?	✓			The CRB Response gauges the public's familiarity with CRB. They make sure to do outreach, such as presentations so that the public is aware of CRB.
Does the organization receive community input about its mission and activities?	✓			The public informs the CRB Response about beetles they find, tree damages, beetles in the adult or larvae stages, and issues with the beetle traps. They also help keep the CRB Response connected to new neighborhoods through outreach.
Does the organization have opportunities for future student involvement?	✓			They do not actively seek volunteers or interns, but they have had interns in the past and are open to more interns.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			The CRB Response has management plans based on funding that revolve around protecting Hawai'i from CRB. Specifically, they hope to eradicate all CRB.
Does this plan develop timelines for their accomplishments?	✓			The plan is based on the funding period. They receive annual funding, and then create a management plan for that funding period.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			They work with other partnerships, such as OISC.
Does the organization collaborate with other organizations of different types?	✓			The CRB Response works with non-profit organizations, such as the Mamalu PoePoe group.
Does the organization want to increase collaboration with other organizations?	✓			The CRB Response is always looking to form new partnerships, especially with major players in areas affected by CRB.

Does the organization have interest in working with WPI students?	✓			They are open to talking more about the opportunity and seeing if it is a possibility.

Appendix C.3: Conservation Council for Hawai‘i

The following section shows the characterization profile and analysis, shown in Table 5, of the Conservation Council for Hawai‘i. All of the information was found through research and an interview with Moana Bjur (M. Bjur, personal communication, February 8, 2021; Conservation Council for Hawaii, 2020a; Conservation Council for Hawaii, 2020b; Conservation Council for Hawaii, 2020c; Conservation Council for Hawaii, 2020d; Conservation Council for Hawaii, 2021).

Conservation Council for Hawai‘i (CCH) Characterization Profile:

- **Type:** NP
- **Location:** 250 Ward Avenue Suite 215, Honolulu, HI 96814
- **Contact Information:** Moana Bjur / Executive Director / Email: moana@conservehi.org
- **Date Established:** 1950
- **Number of Employees:** CCH has three staff members, seven board members, and over 5,500 members.
- **Volunteer Opportunities:** CCH has approximately 200 volunteers. These volunteers can work a CCH booth at a local event, such as the Manu O Kū Festival, organize a beach clean-up or reforestation project, assemble packs for mailing, do administrative work, be a writer to support CCH efforts, support CCH in legislature by testifying or submitting testimonies, help remove invasive species and plant native species, and work as graphic designers or artists.
- **Public Involvement:** CCH sends a survey to their members and interest groups for feedback on their activities and mission. CCH works for the public and acts as an intermediary between the public and agencies after receiving complaints from the public.
- **Total Budget/Funding:** CCH does not receive government funding. They receive funding from donors and members. Specifically, Patagonia donates annually and a few local family foundations donate.
- **Collaboration/Partners:**
    - CCH members can be a wide range of people such as scientists, farmers and business owners. Members can support legislation, be involved in community activities, and provide funding through dues.
    - CCH is an affiliate of the National Wildlife Federation. CCH works with National Wildlife Federation affiliates in Puerto Rico and the Virgin Islands because island

nations face different problems than the continental U.S.
    - They have a voice on Capitol Hill in D.C.
    - CCH partners with state agencies, federal agencies, and university groups.
    - For invasive species management, CCH partners with the Department of Land and Natural Resources, the U.S. Fish and Wildlife Service, and NOAA.
    - CCH also works with the Hawai‘i Wildlife Center when they get reports of injured animals.
    - CCH has worked with Prime Produce, a New York group, on volunteer based beach clean-ups.
    - CCH has partnered with the Center for Biological Diversity, the American Bird Conservancy, and a local organization on O‘ahu to protect seabird nests from the Kaua‘i Island Utility Commission's work.
    - CCH has also worked with the Hawaiian Monk Seal Preservation Oahana by providing funding for necessary materials.
    - List of Partners:
        - Manu O Kū Festival Sponsors: The Healy Foundation, Laurence H. Dorcy Foundation, and Patagonia Action Works.
        - Manu O Kū Festival Partners: Aloha Aina Conservation Fund- Honolulu Zoo, Aloha Arborist Association, American Bird Conservancy, Center for Biological Diversity, Department of Land and Natural Resources (DLNR), The Friends of Iolani Palace, Friends of Midway Atoll National Refuge, Hawai‘i Audubon Society (HAS), Hawai‘i Nature Center, Hawai‘i Wildlife Center (HWC), Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS), Hawaiian Monk Seal Preservation Ohana (HMSPO), Hui Manu-o-Kū, Kapiolani Community College Ecology Club, Ka Papa Lo‘i O Kānewai, Melody Bentz Photography, National Wildlife Federation (NWF), The Outdoor Circle, Pacific Rim Conservation (PRC), Papahānaumokuākea Marine National Monument (PNMN), Polynesian Voyaging Society, U.S. Fish and Wildlife Service (USFWS), and The Wildlife Society Hawai‘i Chapter (TWS Hawai‘i)
        - Other Partners: National Oceanic and Atmospheric Administration (NOAA), Prime Produce, and the Surfrider Foundation
- **Goal/Mission:**
    - The mission of the Conservation Council for Hawai‘i is to protect native Hawaiian plants, animals, and ecosystems for subsequent generations. They are in the process of revising this mission statement.
    - CCH is committed to educating people about conservation.
- **Responsibilities:**
    - CCH is active in the legislature in Hawai‘i as they participate in legislation and lead lawsuits.

    - CCH acts as an educator and works with artists, educators and authors to create educational pieces for Hawai‘i.
    - CCH works on outreach to the public. CCH’s management practices are focused on education and outreach instead of field work. They engage the public through community events, newsletters, publications, and educational materials.
    - CCH protects native plants, ecosystems, and animals and also fights for climate resilience, food security and biosecurity.
    - CCH puts on the Manu O Kū Festival every year, which is a seven day festival to educate the community about the Manu O Kū seabird.
- **Management Plan:**
    - Previously, CCH did not have a management plan. They are in the process of developing a plan by October 2021.

Table 5: Analysis of the Conservation Council for Hawai‘i

Organization: Conservation Council for Hawai‘i				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			CCH previously did not have a set training process for volunteers. However, CCH is working towards implementing an application process, a background check, and training process for the volunteers. CCH also has varying roles for volunteers depending on the type of work available.
Does the organization actively inform the public about its programs and services?	✓			CCH puts information out to their members to inform them of some of the actions they have taken.
Does the organization receive community input about its mission and activities?	✓			CCH surveys their members about the actions they have been taking to fulfill their mission, and receives feedback from the members. They also act as an intermediary between the public and other agencies when they receive complaints from the public and take action.
Does the organization have opportunities for future student involvement?	✓			CCH has had past interns and has continued to have people reach out for intern positions.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization’s activities around a focused mission?	✓			CCH did not previously have a management plan, but they are in the process of developing a management plan and revising their mission to better fit their activities.
Does this plan develop timelines for their accomplishments?	✓			CCH has targeted to have their management plan by October of 2021.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			CCH partners with other non-profit organizations, such as the Hawai‘i Wildlife Center.
Does the organization collaborate with other organizations of different types?	✓			CCH partners with state agencies, federal agencies, and university groups.
Does the organization want to increase collaboration with other organizations?	✓			CCH plans to increase collaboration, likely further into the South Pacific region. They also would like to grow collaboration with

				organizations they normally would not have talked to.
Does the organization have interest in working with WPI students?	✓			CCH expressed interest in working with WPI students, and brainstormed ideas for potential projects.

Appendix C.4: The Coordinating Group on Alien Pest Species

The following section shows the characterization profile and analysis, shown in Table 6, of the Coordinating Group on Alien Pest Species. All of the information was found through research and an interview with Christy Martin (C. Martin, personal communication, February 5, 2021; Coordinating Group on Alien Pest Species, 2019; Coordinating Group on Alien Pest Species, 2020a; Coordinating Group on Alien Pest Species, 2020b; Coordinating Group on Alien Pest Species 2020c).

Coordinating Group on Alien Pest Species (CGAPS) Characterization Profile:

- **Type:** P
- **Location:** P.O. Box 61441, Honolulu, HI 96839
- **Contact Information:** Christy Martin / Public Information Officer and Program Manager / Email: christym@rocketmail.com
- **Date Established:** 1997
- **Number of Employees:** CGAPS has five staff members.
- **Volunteer Opportunities:** CGAPS has volunteers but does not actively recruit volunteers; however, they have one-day volunteers who help with tasks such as informing the public about a CGAPS display. They also will take volunteers who come to them with a longer-term project topic.
- **Public Involvement:** CGAPS focuses on educating the public about an issue and a call to action instead of educating them about the specifics of CGAPS. The public is welcome at CGAPS' quarterly meetings. They also voice their opinions and amplify invasive species issues. The public also acts as early detectors for invasive species and can report pests on 643pest.org.
- **Total Budget/Funding:** In 2020, CGAPS received approximately $708K in funds supporting staff and projects. They receive funding from agencies, non-profit organizations, and grants.
- **Collaboration/Partners:**
    - To develop their strategic plan, CGAPS consulted their existing partners and those in the community.

- CGAPS was formed to coordinate communications among the different people involved in invasive species management.
- CGAPS is a part of the Research Corporation of the University of Hawai‘i, and they provide CGAPS with five grant-funded staff.
- CGAPS collaborated with the Hawai‘i Invasive Species Council on a strategic planning process to develop the 2025 HISC and CGAPS Joint Strategy.
- CGAPS has a long list of partners, and works most closely with those involved in the CGAPS Steering Committee. This Steering Committee focuses their strategy toward protecting Hawai‘i’s environment, agriculture, economy, lifestyle and culture from invasive species impacts.
- They use interpersonal relationships and phone calls, rather than relying only on email, to collaborate.
- CGAPS has also received volunteers from Kupu.
- CGAPS core funds are administered through the University of Hawai‘i at Mānoa and the University of Hawai‘i Foundation.
- The Hawai‘i Conservation Alliance Foundation and the O‘ahu Economic Development Board also provided funding for CGAPS projects.
- CGAPS worked with the HDOA to revise and update the Noxious Weed Seed Administrative Rules and Species list and the Noxious Weed Administrative Rules Species List. They also supported the HDOA in implementing transitional inspection facilities and opportunities to inspect high-risk commodities.
- CGAPS worked with the DLNR DOFAW and the HDOA in calls with USDA APHIS on the petition to restrict foreign import of certain plants.
- CGAPS worked through the PCSU in partnership with the ISCs and Plant Pono Program to draft a grant for funds for outreach and pest programs.
- CGAPS worked with the DLNR DAR, HISC, HDOT Harbors, and other partners to draft a bill for funds to support a team.
- CGAPS worked with the DLNR DAR in planning and finding partner assistance to recover monitoring units in Honolulu Harbor and in identifying species involved in hull and biofouling.
- CGAPS has received funding from the HMLF on multiple invasive species projects.
- CGAPS has collaborated with the ISCs and HISC to educate the public about invasive species.
- List of Partners:
    - CGAPS Steering Committee: Hawai‘i Department of Agriculture (HDOA), Hawai‘i Department of Land and Natural Resources (Division of Aquatic Resources and Division of Forestry and Wildlife) (HDLNR DAR and HDOFAW), Hawai‘i Conservation Alliance Foundation (HCAF), Hawai‘i Invasive Species Council (HISC), The Invasive Species

Committees of Hawai‘i (ISCs), U.S. Department of Agriculture- Animal and Plant Health Inspection Service (APHIS), U.S. Forest Service (USFS), U.S. Department of Commerce- National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Defense- Naval Facilities Engineering Command Pacific (DOD NAVFAC Pacific), U.S. Department of Homeland Security- Customs and Border Protection CBP), U.S. Fish and Wildlife Service (USFWS), and University of Hawai‘i (UH)- College of Tropical Agriculture and Human Resources (CTAHR).

- Other Partners: Hawai‘i Army National Guard/Environmental Office, Hawai‘i Department of Agriculture (HDOA) (Plant Pest Control Branch and Plant Quarantine Branch), Hawai‘i Department of Transportation (HDOT) (Airports Division and Harbors Division), University of Hawai‘i Economic Research Organization (UH ERO), Pacific Cooperative Studies Unit (PCSU), Bernice Pauahi Bishop Museum, Hau‘oli Mau Loa Foundation (HMLF), Hawai‘i Farm Bureau Federation (HFBF), SWCA Environmental Consultants, H.T. Harvey and Associates Ecological Consultants, O‘ahu Economic Development Board (OEDB), The Nature Conservancy of Hawai‘i (TNC), University of Hawai‘i Foundation, University of Hawai‘i at Mānoa, Research Corporation of the University of Hawai‘i (RCUH), and Plant Pono.

- **Goal/Mission:**
  - The mission of the Coordinating Group on Alien Pest Species is to coordinate and catalyze action among government and non-government partners to prevent and manage invasive species in Hawai‘i to protect the environment, economy, agriculture, and public health. The goal of CGAPS is also to communicate key issues to the public.
- **Responsibilities:**
  - CGAPS facilitates coordination, planning, and management to close the gaps in terrestrial and aquatic invasive species prevention and response.
  - CGAPS works on community outreach related to invasive species issues.
  - CGAPS holds quarterly meetings where organizations can share updates about invasive species issues and projects.
  - CGAPS gathers together the organizations and individuals involved in invasive species management to make sure they are aware of each other and are communicating.
  - CGAPS supports their partners with invasive species issues.
- **Management Plan(s):**
  - HISC & CGAPS 2025 Strategic Plan: This plan outlines strategies and actions to protect Hawai‘i’s economy, agriculture, environment, and the health and culture of its people from invasive species. It implements ten priority strategies.

- CGAPS Strategic Plans: These plans have a five year timeline and identify priority goals and actions based on regulations and the importance of certain issues.
- 2009 CGAPS Vision and 10 Point Action Plan: This plan outlines the ten most important issues to be resolved to prevent, detect, and manage invasive species.

Table 6: Analysis of the Coordinating Group on Alien Pest Species.

Organization: Coordinating Group on Alien Pest Species				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		CGAPS does not advertise volunteer opportunities. If a student comes to them with a project idea within the scope of their mission they will work on the project with them.
Does the organization actively inform the public about its programs and services?		✓		GCAPS focuses more on teaching the public about invasive species issues than teaching them about the organization.
Does the organization receive community input about its mission and activities?	✓			CGAPS uses surveys to monitor public opinions about their activities. The public is also welcome at all of CGAPS' quarterly meetings. The public voices their opinion when issues come up and amplify concern for issues.
Does the organization have opportunities for future student involvement?	✓			CGAPS willing to work with students in the future, but rely on the students to bring a project topic.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			CGAPS has a coordinated management plan with HISC called the 2025 HISC and CGAPS Strategy. CGAPS has five year strategic plans as well. These plans set goals and activities to help achieve CGAPS' mission.
Does this plan develop timelines for their accomplishments?	✓			Their strategic plans are under a five year timeline and the joint management plan with HISC has a timeline until 2025.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			CGAPS collaborates with the island Invasive Species Committees.

Does the organization collaborate with other organizations of different types?	✓			CGAPS collaborates with non-profit organizations, university groups, and government agencies.
Does the organization want to increase collaboration with other organizations?	✓			CGAPS wants to reach out to people out of their normal area of work to increase collaboration.
Does the organization have interest in working with WPI students?	✓			Yes, but someone would have to identify an area of interest for the project.

Appendix C.5: The Daehler Lab

The following section shows the characterization profile and analysis, shown in Table 7 of the Daehler Lab. All of the information was found through research and an interview with Curtis Daehler (C. Daehler, personal communication, February 23, 2021; Daehler Lab, n.d.).

The Daehler Lab Characterization Profile:

- **Type:** U
- **Location:** Honolulu, HI
- **Contact Information:** Curtis Daehler / Professor of Botany / Email: daehler@hawaii.edu
- **Date Established:** N/A
- **Number of Employees:** The Daehler Lab has two PhD students, two MS students, and a visiting professor.
- **Volunteer Opportunities:** N/A
- **Public Involvement:** The Daehler Lab is currently holding Zoom meetings to meet with land managers. They have also sent surveys to the managers to get information on what their biggest concerns were regarding invasive plants that pose a fire threat. They were able to share this information among the managers to allow them to hear the concerns of the managers they may have not communicated with before.
- **Total Budget/Funding:** N/A
- **Collaboration/Partners:**
    - This is a lab at the University of Hawai‘i at Mānoa.
    - At the international level, The Daehler Lab worked with the Mountain Invasions Research Network (MIREN) to study patterns of invasions in mountain environments.
    - At the national level, the Daehler Lab works with the National Park Service to understand particular problems with invasions within the national park boundaries.
    - At the local level, the Daehler Lab works with the Department of Land and Natural Resources and the Invasive Species Committees to align their research to help address their concerns.

    - List of Partners:
        - Mountain Invasions Research Network (MIREN), National Park Service (NPS), and Hawai‘i Department of Land and Natural Resources (HDLNR)
- **Goal/Mission:**
    - Professor Daehler’s research focuses on the ecology of invasive species and the processes that affect the success and failure of invasions. He focuses on how invasive species interact, often with native species, and their impacts on several areas such as humans, ecosystem services, or broader vegetation-type implications.
- **Responsibilities:**
    - The Daehler Lab conducts research on different invasive species issues.
        - Some examples of this research are patterns, prediction, and trends among invasive plants, predicting invasive plant ranges, population ecology and evolution of invaders, and ecological control of invasive plants.
    - Professor Daehler’sresearch involves the management of invasive species as well as looking at the biology or ecology of invasive species.
    - Professor Daehler also does research in other areas related to population ecology and plant-animal interactions.
- **Management Plan:**
    - N/A

Table 7: Analysis of the Daehler Lab

Organization: The Daehler Lab				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		The Daehler Lab does not have volunteers.
Does the organization actively inform the public about its programs and services?	✓			The Daehler Lab provides research publications of their work.
Does the organization receive community input about its mission and activities?	✓			The Daehler Lab previously received feedback from land managers and helped them through research.
Does the organization have opportunities for future student involvement?	✓			The Daehler Lab accepts students who have an interest in invasive species management issues and research.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?			✓	N/A
Does this plan develop timelines for their accomplishments?			✓	The Daehler Lab does not have a management plan.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			The Daehler Lab is part of the School of Life Sciences at the University of Hawai'i at Mānoa
Does the organization collaborate with other organizations of different types?	✓			The Daehler Lab collaborates with federal and state government groups.
Does the organization want to increase collaboration with other organizations?	✓			The Daehler Lab would like to increase collaboration in new focus areas and has been working on building more in the past year.
Does the organization have interest in working with WPI students?		✓		The Daehler Lab does not currently have the capacity to host a group of students.

Appendix C.6: Department of Land and Natural Resources Hawai'i Division of Aquatic Resources Ānuenue Fisheries Research Center

The following section shows the characterization profile and analysis, shown in Table 8, of the Department of Land and Natural Resources Hawai'i Division of Aquatic Resources Ānuenue Fisheries Research Center. All of the information was found through research and an interview with Kimberley Fuller (K. Fuller, personal communication, February 15, 2021; Aquatic Invasive Species Program, 2019; Division of Aquatic Resources, 2015).

Department of Land and Natural Resources Hawai'i Division of Aquatic Resources Ānuenue Fisheries Research Center (DLNR DAR AFRC) Characterization Profile:

- **Type:** S
- **Location:** 1151 Punchbowl St #330, Honolulu, HI 96813
- **Contact Information:** Kimberley Fuller / Aquatic Invasive Species Biologist / Email: kimberly.h.fuller@hawaii.gov
- **Date Established:** The Aquatic Invasive Species Program (AIS) started in about 2009.
- **Number of Employees:** AFRC has three Aquatic Biologists, six Fishery Technicians, three temporary Fishery Technicians, and a librarian. The AIS Team has six people.
- **Volunteer Opportunities:** AFRC has one volunteer in the AIS program. This volunteer learns how to identify species, and do computer and field work. This volunteer is also the main support for sea urchin outplanting. AFRC tailors volunteer activities to the interests of the volunteers they have at the time.
- **Public Involvement:** The community reports instances of invasive species to AFRC. Additionally, some of the regulations AFRC implements require community comments. AFRC will inform the community about potential regulations and ask for their feedback.
- **Total Budget/Funding:** The State of Hawai'i employs AFRC with general funds. They also have contract funds.
- **Collaboration/Partners:**
    - AFRC works closely with the HDOA's Aquaculture Disease Program and shares staff members who work on both organizations' projects. Collaborative studies are being conducted on moi and opakapaka with the Hawai'i Institute of Marine Biology and the Oceanic Institute. The University of Hawai'i's Sea Grant Extension Program (UHSG), the Center for Tropical and Subtropical Aquaculture (CTSA), Waikiki Aquarium, and the Hawai'i Aquaculture and Aquaponics Association all receive cooperation, support, and infrastructure assistance from AFRC. Representatives from NOAA, Universities, and USFWS are present during strategic planning sessions when revising management plans.
    - List of Partners:

        - HDOA Aquaculture Disease Program, Hawai‘i Institute of Marine Biology (HIMB), Oceanic Institute, University of Hawai‘i’s Sea Grant Extension Program (UHSG), Center for Tropical and Subtropical Aquaculture (CTSA), Waikiki Aquarium, Hawai‘i Aquaculture and Aquaponics Association (HAAA), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS)
- **Goal/Mission:**
    - AFRC has three general programs. Two programs are dedicated to sustainably managing fisheries’ resources, both commercial and recreational, and the third is the environmental program. The Aquatic Invasive Species (AIS) program is within the environmental program. The AIS program is committed to managing AIS threats to Hawai‘i to minimize the ecological, economic, and human health impacts of AIS.
- **Responsibilities:**
    - AFRC is a base yard, hatchery, and culture center for the DAR. AFRC has a biological-chemical laboratory, freshwater fish hatchery, workshop and storage areas for fisheries survey gear/equipment/boats, a thermo-controlled hatchery building, and a quarantine facility to study aquatic animal diseases. AFRC is involved in all DAR’s fisheries and aquaculture programs. Their activities include producing channel catfish and rainbow trout for stocking public fishing areas at Nu‘uanu (O‘ahu) and Koke‘e (Kaua‘i). AFRC also does natural stock enhancement experiments by releasing mullet pua (baby fingerlings) into Hilo Bay and Kona areas on the island of Hawai’i, and moi juveniles (moili‘i) on O‘ahu (in the Waikiki-Diamond Head Fisheries Management Area) and on Maui (in Wailua Bay and Honomanu Bay).
    - AFRC also performs culture experiments on moi, kumu, ulua, aholehole, hybrid rose tilapia, Samoan crab, and ogo.
    - The AIS program prevents and manages AIS invasions, expansions, and dispersals into, within, and from Hawai‘i. The AIS program focuses on invasive algae management and control in Kāne`ohe Bay, O`ahu, managing and operating the sea urchin hatchery, ballast water and hull fouling data gathering and policy development. The AIS Team controls invasions through early detection, rapid response, marine debris clean-up, controlling disease outbreaks, monitoring coral bleaching, and ecosystem monitoring.
    - AIS focuses on outreach, education, and community engagement, AIS policy development, and collaboration with fellow researchers, stakeholder, community groups, and partners.
- **Management Plan:**
    - The AIS Team has a guiding document that is a management plan from 2003. Since then, they have done revisions and added more strategic planning to a draft

management plan from 2019, but they still reference the 2003 management plan when writing grants.

Table 8: Analysis of the Department of Land and Natural Resources Hawai'i Division of Aquatic Resources Ānuenue Fisheries Research Center

Organization: DLNR DAR AFRC AIS Program				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			Volunteers do activities based on what they have an interest in.
Does the organization actively inform the public about its programs and services?	✓			Some regulations require community comments, so AFRC will inform the community and ask for comments.
Does the organization receive community input about its mission and activities?	✓			Community reporting is a priority, citizens report invasions.
Does the organization have opportunities for future student involvement?	✓			AFRC has had Kupu interns before, so they have worked with students.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			The AIS Team has management plans online and team accomplishment reports.
Does this plan develop timelines for their accomplishments?		✓		There are ongoing revisions.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			AFRC collaborates with many state agencies.
Does the organization collaborate with other organizations of different types?	✓			AFRC collaborates with federal government agencies, non-profit organizations, and university groups.
Does the organization want to increase collaboration with other organizations?	✓			AFRC is currently trying to increase their extent of collaboration.
Does the organization have interest in working with WPI students?	✓			AFRC can circulate a project idea to see where it would fit the best.

Appendix C.7: Friends of Hakalau Forest National Wildlife Refuge

The following section shows the characterization profile and analysis, shown in Table 9, of the Friends of Hakalau Forest National Wildlife Refuge. All of the information was found through research and an interview with J. B. Friday (J. Friday, personal communication, February 12, 2021; Friends of Hakalau Forest, 2020a; Friends of Hakalau Forest, 2020b; Friends of Hakalau Forest, 2020c).

Friends of Hakalau Forest National Wildlife Refuge Characterization Profile:

- **Type:** NP
- **Location:** Hilo, HI
- **Contact Information:** J.B Friday / President / Email: jbfriday@hawaii.edu
- **Date Established:** 2006
- **Number of Employees:** The Friends of Hakalau Forest NWR is a non-profit organization with no staff. They only consist of volunteers who support the Hakalau Forest National Wildlife Refuge (HFNWR). They have four board members and eight "members at large."
- **Volunteer Opportunities:** They have around 400 members. The U.S. Fish and Wildlife Service provides support and training for members. Volunteer responsibilities on the Refuge can include planting native plants, working in greenhouses, controlling brush along roads and fence lines, painting, guiding visitors, maintaining the volunteer cabin, and more. They also offer volunteer opportunities outside of the Refuge such as working tables at environmental fairs, creating promotional posters, selling FOHF t-shirts, and managing memberships.
- **Public Involvement:** One of FOHF's biggest roles is educating the public about the Refuge. To do this, they have tabling events, community talks, and have a newsletter that is published and shared on various social media pages. The public is mostly involved with FOHF through membership.
- **Total Budget/Funding:** FOHF's funding comes from memberships of private individuals, donations, and some funding from the sales of t-shirts. They also receive grants occasionally for different projects.
- **Collaboration/Partners:**
    - Currently, FOHF does not work with many other organizations to manage invasive species, but are open to the idea of increasing collaboration with other groups such as the Friends of Hawai'i Volcanoes National Park.
    - FOHF provides fundraising, volunteer and advocacy support to help HFNWR. They have provided volunteer labor to plant native trees and rare plants, conducted weed control efforts, and raised funds for the construction of facilities.

    - List of Partners:
        - Hakalau Forest National Wildlife Refuge (HFNWR) and U.S. Fish and Wildlife Service (USFWS)
- **Goal/Mission:**
    - The mission of FOHF is to support the U.S. Fish and Wildlife service to protect, preserve, and restore the biological diversity at Hakalau and Kona Forest Units.
- **Responsibilities:**
    - Their biggest responsibility is to help the Refuge achieve their mission of conserving and protecting native Hawai‘i forest birds and their native Hawai‘i forest habitats.
    - FOHF educates people about the Hakalau Forest National Wildlife Refuge both statewide and in the local community. This refuge is different from a lot of other refuges, as there are no visitors, so they aim to inform people about what is happening in the Refuge.
    - They provide opportunities for recreational activities such as birdwatching, photography, wildlife education, cultural experiences, and scientific research.
- **Management Plan:**
    - FOHF does not have a management plan as they just support the Hakalau Forest National Wildlife Refuge.

Table 9: Analysis of the Friends of Hakalau Forest National Wildlife Refuge

Organization: Friends of Hakalau Forest National Wildlife Refuge				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			FOHF is a non-profit made up entirely of volunteers.
Does the organization actively inform the public about its programs and services?	✓			One of FOHF's responsibilities is educating the public about the Refuge.
Does the organization receive community input about its mission and activities?		✓		They do not conduct surveys with the public.
Does the organization have opportunities for future student involvement?	✓			FOHF is interested in future student involvement when things return to normal after COVID.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?		✓		FOHF does not have a management plan as they just support the Hakalau Forest National Wildlife Refuge.
Does this plan develop timelines for their accomplishments?		✓		FOHF does not have a management plan.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?		✓		FOHF only collaborates with Hakalau National Wildlife Refuge, and receives training from the U.S. Fish and Wildlife Service, but does not work with any other groups to do their work.
Does the organization collaborate with other organizations of the same type?	✓			FOHF collaborates with Hakalau National Wildlife Refuge, another non-profit.
Does the organization collaborate with other organizations of different types?	✓			FOHF only collaborates with USFWS, a federal government agency.
Does the organization want to increase collaboration with other organizations?	✓			They would like to increase collaboration with groups such as the Friends of Hawai'i Volcanoes National Park.
Does the organization have interest in	✓			They are interested, but think there

working with WPI students?				would be more opportunities with the actual refuge.

Appendix C.8: Hakalau Forest National Wildlife Refuge

The following section shows the characterization profile and analysis, shown in Table 10, of the Hakalau Forest National Wildlife Refuge. All of the information was found through research and an interview with Thomas Cady (T. Cady, personal communication, February 17, 2021; Hakalau Forest National Wildlife Refuge, n.d. a; Hakalau Forest National Wildlife Refuge, n.d. b; Hakalau Forest National Wildlife Refuge, n.d. c).

Hakalau Forest National Wildlife Refuge Characterization Profile:

- **Type:** S
- **Location:** Two locations: 60 Nowelo St, Hilo, HI 96720 and a location on the Kona side of the Island
- **Contact Information:** Thomas Cady / Refuge Manager / Email: thomas_cady@fws.gov
- **Date Established:** 1985
- **Number of Employees:** The Refuge has ten employees and a police officer and a firefighter that they split with the other offices in Fish and Wildlife.
- **Volunteer Opportunities:** The Refuge usually has hundreds of volunteers that contribute cumulatively thousands of hours of work. They have not had any volunteers during the COVID-19 pandemic.
- **Public Involvement:** The public can provide feedback and knows of HFNWR's plans through the National Protection Environmental Act (NEPA). NEPA requires the agency to voice what they are doing to the environment and it gives the public a chance to voice their concerns.
- **Total Budget/Funding:** USFWS receives money from the Department of the Interior, and a portion then gets passed to HFNWR. They are limited to receiving funding from outside areas because they are a government agency but their partners help with that.
- **Collaboration/Partners:**
    - Through collaboration with The Nature Conservancy, HFNWR was established. TNC donated parcels of lands to the Wildlife Refuge System.
    - HFNWR provides tree seedlings and labor to the Department of Hawaiian Homelands.
    - The FOHF provide HFNWR with volunteers, advocacy, funding, and support.
    - The Mauna Kea Watershed Alliance provides labor and resources to HFNWR.
    - The University of Hawai‘i at Hilo primarily, but also Mānoa, provides research and projects to HFNWR using Hakalau as a base. They also have a facility up on

the HFNWR station where a lot of research historically has been conducted.
    - The U.S. Geological Survey provides HFNWR with research.
    - HFNWR also collaborates with the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) because they are neighbors of Hakalau. However, they do not collaborate very often.
    - HFNWR also works with Three Mountain Alliance and Teaching Change staff to provide a program to high school students.
    - List of Partners:
        - The Nature Conservancy (TNC), Department of Hawaiian Homelands (DHHL), Friends of Hakalau Forest National Wildlife Refuge (FOHF), The Mauna Kea Watershed Alliance (MKWA),The University of Hawai‘i (UH) at Hilo and Mānoa, U.S. Geological Survey (USGS), Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW), Three Mountain Alliance, and Teaching Change
- **Goal/Mission:**
    - To conserve and protect endangered native Hawaiian forest birds and their native forest habitats.
- **Responsibilities:**
    - To manage invasive species, the Refuge has a two part program, a plant and an animal program.
        - One of the biggest pests on the Refuge are pigs which they try to use fences, traps, and hunting methods.
        - Other small predators include feral cats, mongooses, and rats, which they rely on trapping to control.
        - For plants they mainly use herbicides as a management strategy.
    - Another responsibility is to reforest the land back to native forest. As they slowly reforest the land, it becomes harder to navigate.
    - HFNWR focuses their efforts on preventing any more destruction of the native forest, restoring the native forest, and surveying the status of biological resources.
- **Management Plan:**
    - HFNWR has step-down plans and a Comprehensive Conservation Plan (CCP) which they reopen every 15 years when things change.
    - The CCP clarifies the direction of management and includes goals, objectives, and strategies to improve HFNWR.

Table 10: Analysis of the Hakalau Forest National Wildlife Refuge

Organizations: Hakalau Forest National Wildlife Refuge				
	Does	Does Not	Don’t know	Notes

Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			HFNWR typically gets hundreds of volunteers in a year and they are able to reforest large areas of the Refuge.
Does the organization actively inform the public about its programs and services?	✓			HFNWR has to inform the public of its environmental doings through NEPA.
Does the organization receive community input about its mission and activities?	✓			Yes, HFNWR accepts feedback from the public.
Does the organization have opportunities for future student involvement?	✓			Yes, HFNWR is always open to volunteers and accepting interns.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			HFNWR's step-down plans and CCP include goals, objectives, and strategies.
Does this plan develop timelines for their accomplishments?	✓			HFNWR has the CCP which they reopen every 15 years or when things change.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			Yes they work with other state organizations such as DOFAW and USGS.
Does the organization collaborate with other organizations of different types?	✓			Yes, they work with non-profit organizations such as FOHF and TNC.
Does the organization want to increase collaboration with other organizations?	✓			HFNWR is always looking to increase collaboration.
Does the organization have interest in working with WPI students?	✓			HFNWR is always looking for opportunities for anyone who has interest in Hakalau.

Appendix C.9: Hawai'i Ant Lab

The following section shows the characterization profile and analysis, shown in Table 11, of the Hawai'i Ant Lab. All of the information was found through research and an interview with Heather Forester (H. Forester, personal communication, February 11, 2021; Hawaii Ant Lab, 2020a; Hawaii Ant Lab, 2020b; Hawaii Ant Lab, 2020c; Hawaii Ant Lab, 2021).

Hawai'i Ant Lab (HAL) Characterization Profile:

- **Type:** U
- **Location:** Hilo Office - 16 E Lanikaula St, Hilo, HI 96720, Kona Office - 79-7381 Old Mamalahoa Hwy Kealakekua, HI 96750, Oʻahu Office - 1428 South King St. Honolulu, HI 96814
- **Contact Information:** Heather Forester / Hilo Office Extension Specialist / Email: heather.forester@littlefireants.com
    - Hilo Office:
        - Phone: 808-315-5656
        - Main email: info@littlefireants.com
    - Kona Office:
        - Phone: 808-209-9014
        - Main email: kiyoshi.adachi@littlefireants.com
    - Honolulu Office:
        - Phone: 808-824-1366
        - Main email: oahu@littlefireants.com
- **Date Established:** Around 12 years ago, about 2009
- **Number of Employees:** There are seven employees at Hilo Office, one employee at the Kona Office, and two full-time employees, and two part-time employees at the Oʻahu Office.
- **Volunteer Opportunities:** HAL does not have volunteers.
- **Public Involvement:** The role of the public is to control the pests themselves.
- **Total Budget/Funding:** The Hawaiʻi Department of Agriculture funds HAL but HDOA does not receive a lot of the state's budget. HAL also submits to the Hawaiʻi Invasive Species Council and the USDA Farm Bill for grants. They have also received funding from the County of Hawaiʻi and Hawaiʻi Tourism Authority. Other funding partners include USDA, APHIS, USFS, and OMKM.
- **Collaboration/Partners:**
    - HAL was formed out of the Department of Agriculture and is a project of the PCSU.
    - HAL and Maui Invasive Species Committee collaborated to apply bait aerially.
    - HAL also worked with DOA and Kauaʻi Invasive Species Committee to control an infestation of ants on Kauaʻi.
    - Some of the other organizations that collaborate with HAL mentioned in the interview were Big Island Invasive Species Committee and CGAPS.
    - HAL receives funding from Hawaiʻi Department of Agriculture, Hawaiʻi Invasive Species Council, County of Hawaiʻi, USDA, APHIS, U.S. Forest Service, Office of Mauna Kea Management, and Hawaiʻi Tourism Authority.
    - List of Partners:
        - Hawaiʻi Department of Agriculture (HDOA), Maui Invasive Species Committee (MISC), Kauaʻi Invasive Species Committee (KISC), Big

Island Invasive Species Committee (BIISC), Coordinating Group on Alien Pest Species (CGAPS), Hawai‘i Invasive Species Council (HISC), County of Hawai‘i, Animal and Plant Health Inspection Service (APHIS), U.S. Department of Agriculture (USDA), U.S. Forest Service (USFS), Office of Mauna Kea Management (OMKM), and Hawai‘i Tourism Authority (HTA).

- **Goal/Mission:**
    - The Hawai‘i Ant Lab has four main components to their mission. The first component is to protect Hawai‘i from the introduction of invasive ants. The second is to mitigate the spread of the little fire ant (LFA) inter-island and intra-island. The third is to eradicate LFA on the Big Island of Hawai‘i. The fourth is to spread the research they are conducting in the lab and treatment methods to the community, nurserymen, and agriculture communities.
- **Responsibilities:**
    - Overall, HAL does research, education, surveys, and eradication of invasive ants.
    - HAL is currently dealing with the issues of LFA. They are conducting research to test control methods for LFA. One method they are working to develop is a bait to apply to the trees so ants that are living in the trees will be wiped out as well. Most of the research is conducted on baits that are meant for different species of ants, to see how well they work on LFA.
    - HAL shares prevention strategies and treatment methods with stakeholders to help improve their techniques.
    - They help people understand and choose the best treatment option for their situation.
    - HAL educates through training programs, workshops, presentations, and educational articles.
    - HAL also participates in field operations. They survey ports of entry (i.e. airports), green waste facilities, nurseries, and other areas at high risk for invasive ant species.
    - They participate in LFA eradication efforts throughout Hawai‘i. They focus on eradication on the Big Island, but prevention and early detection on the other islands.
- **Management Plan:**
    - HAL does not have a formal plan but they work off of grant funding plans.

Table 11: Analysis of the Hawai‘i Ant Lab

Organization: Hawai‘i Ant Lab				
	Does	Does Not	Don’t know	Notes

Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		HAL does not have volunteers.
Does the organization actively inform the public about its programs and services?	✓			HAL educates the public on different treatment options for LFA.
Does the organization receive community input about its mission and activities?		✓		The public does not impact their mission or activities.
Does the organization have opportunities for future student involvement?	✓			They would be open to working with students but needs to get approval first.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			They have grant funding plans that they follow.
Does this plan develop timelines for their accomplishments?		✓		They do not have a plan with timelines, they work off of grant funding to develop plans.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			HAL is a project of the PCSU.
Does the organization collaborate with other organizations of different types?	✓			HAL works with state agencies, federal government agencies, and partnerships.
Does the organization want to increase collaboration with other organizations?	✓			HAL is always looking to increase collaboration. They would like to increase collaboration with funders.
Does the organization have interest in working with WPI students?	✓			This could entail a long process because HAL is part of the University of Hawai'i, but they are open to it.

Appendix C.10: Hawai'i Invasive Species Council

The following section shows the characterization profile and analysis, shown in Table 12, of the Hawai'i Invasive Species Council. All of the information was found through research and an interview with Randal T. Bartlett (R. Bartlett, personal communication, February 9, 2021; Hawaii Invasive Species Council & Coordinating Group on Alien Pest Species, 2020; Hawaii Invasive Species Council, 2015; Hawaii Invasive Species Council, 2018a; Hawaii Invasive

Species Council, 2018b; Hawaii Invasive Species Council, 2021; Hawaii Invasive Species Council, n.d.).

Hawai‘i Invasive Species Council (HISC) Characterization Profile:

- **Type:** P
- **Location:** 1151 Punchbowl St, Honolulu, HI 96813
- **Contact Information:** Randal T. Bartlett / HISC Interagency Coordinator / Email: randal.t.bartlett@hawaii.gov
- **Date Established:** 2003
- **Number of Employees:** There are five members of the support staff who carry out program duties. There are also six agency chairs on the council, eight legislative participants, and five working groups for various invasive species issues involved in HISC.
- **Volunteer Opportunities:** HISC currently does not have volunteers, but are open to the possibility in the future.
- **Public Involvement:** HISC's meetings are open to the public, so anyone can attend the meetings in public or now via Zoom due to COVID-19. HISC takes the public's comments into consideration. The public can also report a pest through the 643-PEST telephone hotline and 643pest.org website.
- **Total Budget/Funding:** HISC receives approximately $4.5 million per year from the state legislature. For FY21, the legislature approved $5,750,000 for HISC.
- **Collaboration/Partners:**
    - HISC gets input from many organizations in the conservation community and the state for their management plan.
    - HISC itself is made up of five stage agencies and the University of Hawai‘i. The council co-chairs are the DLNR and the HDOA. The other members are the Department of Health, Department of Transportation, DBEDT, and the University of Hawai‘i.
    - HISC works with the Division of Forestry and Wildlife in the DLNR and the Department of Agriculture by providing them funding from their legislature.
    - HISC also relies on non-profit agencies such as the Nature Conservancy and Conservation Council for Hawai‘i.
    - They are also members of CGAPS, where they meet regularly to identify challenges or issues and how to overcome them. They also have a HISC & CGAPS 2025 Joint Strategy.
    - HISC also works closely with the ISCs and provides a lot of their funding.
    - HISC gives funding to ISCs, university researchers, Department of Agriculture researchers, and UH researchers from CTAHR and in return requires project reports. Then HISC will provide feedback on their plans and objectives in return.
    - They also provide the Ko‘olau Mountains Watershed Partnerships with project

funding.
    - The following organizations contributed to the making of HISC's 2015-2020 strategic plan by identifying top priorities for invasive species work in Hawai‘i: CGAPS, DLNR, HDOA, Department of Health, HDOT, DBEDT, UH CTAHR, DAR, USFWS, USFS, U.S. Customs and Border Patrol, NPS, U.S. Army, The Nature Conservancy, PCSU, Hawai‘i Pacific University, The Weed Risk Assessment, Plant Pono, Watershed Partnerships, BIISC, KISC, OISC, MISC, MoMISC, Pacific Islands Climate Change Cooperative, SWCA Environmental Consultants, H.T. Harvey and Associates.
    - HISC provides feedback on Hawai‘i Green Growth's plans and objectives.
    - List of Partners:
        - Council: Hawai‘i Department of Land and Natural Resources (HDLNR) (Division of Forestry and Wildlife), Hawai‘i Department of Agriculture (HDOA) (Plant Quarantine Branch and Plant Pest Control Branch), Hawai‘i Department of Health (HDOH), Hawai‘i Department of Business, Economic Development and Tourism (DBEDT) (Office of Planning and Hawai‘i Tourism Authority), Hawai‘i Department of Transportation (HDOT) (Highways Division and Airports Division), and University of Hawai‘i (CTAHR and College of Natural Sciences).
        - Other Partners: U.S. Fish and Wildlife Service (USFWS), DAR, U.S. Department of Agriculture USDA), Coordinating Group on Alien Pest Species (CGAPS), Island Invasive Species Committees (ISCs), Hawai‘i Green Growth, Department of Defense (DOD), County of Kaua‘i, City and County of Honolulu, County of Maui, County of Hawai‘i, U.S. Department of Interior (DOI), U.S. Forest Service (USFS), U.S. Customs and Border Patrol (CBP), National Park Service (NPS), U.S. Army, The Nature Conservancy (TNC), Pacific Cooperative Studies Unit (PCSU), Hawai‘i Pacific University (HPU), The Weed Risk Assessment (WRA), Plant Pono, Watershed Partnerships (Ko‘olau Mountains Watershed Partnerships), Pacific Island Climate Change Cooperative (PICCC), SWCA Environmental Consultants, H.T. Harvey & Associates, and Māmalu Poepoe.
- **Goal/Mission:**
    - HISC's mission is to provide policy and fiscal direction, coordination, and planning among stakeholders to address invasive species issues. They take science, culture, and social contexts into account when addressing invasive species.
- **Responsibilities:**
    - HISC supports the control and eradication of harmful invasive species and prevents the introduction of other invasive species.

    - They develop an interagency spending plan with the state legislature funds.
    - HISC receives proposals from government agencies and partners.
    - HISC funds projects to fill gaps that current laws or programs do not address and to increase knowledge and tools for invasive species management.
    - The staff is in charge of creating the management plan every five years and revising it.
    - HISC has a number of working groups related to specific areas of invasive species management.
    - HISC implements terrestrial and aquatic invasive species programs to address the gaps not being fulfilled by state agencies.
    - HISC provides policy direction in invasive species management.
    - HISC oversees a number of working groups focused on different areas of invasive species management including prevention, control, aquatic biosecurity, outreach, research and technology, resources, and pacific biocontrol.
- **Management Plan:**
    - HISC Strategic Plans: These plans are on a five year timeline.
    - HISC & CGAPS 2025 Joint Strategy: Outlines strategies and actions to protect Hawai‘i’s economy, agriculture, environment, and the health and culture of it’s people from invasive species. Implements ten priority strategies.
    - Hawai‘i Interagency Biosecurity Plan: Plan adopted by Hawai‘i to protect the economy, environment, agriculture and health by addressing three areas in biosecurity. There are action items assigned to different stakeholders in the plan. HISC tracks how the plan is being implemented and reports progress twice per year.
    - Māmalu Poepoe Strategic Biosecurity for Hawai‘i: Project to improve monitoring on airport facilities in Hawai‘i.
    - Strategic Plan for the Control and Management of Albizia: Provides objectives and a framework to decrease the impacts of Albizia in Hawai‘i.
    - HISC also supports specific species management plans.

Table 12: Analysis of the Hawai‘i Invasive Species Council

Organization: Hawai‘i Invasive Species Council				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		HISC does not currently have any volunteer opportunities.

Does the organization actively inform the public about its programs and services?	✓			The public is welcome at HISC's meetings, which presents activities, plans, and other topics related to the organization.
Does the organization receive community input about its mission and activities?	✓			The public is welcome at all meetings and HISC will take comments into consideration.
Does the organization have opportunities for future student involvement?	✓			HISC has considered having interns in the future.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			HISC focuses a lot of its goals and activities around the Hawai'i Interagency Biosecurity Plan and their own strategic plans.
Does this plan develop timelines for their accomplishments?	✓			HISC has long range management plans that have a five year timeline. They also have a 2025 joint strategy with CGAPS. There is also HISC's 2017-2027 Interagency Biosecurity Plan.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			HISC collaborates with other state agencies, such as the Hawai'i Department of Agriculture.
Does the organization collaborate with other organizations of different types?	✓			HISC collaborates with university researchers, non-profit organizations, and federal agencies.
Does the organization want to increase collaboration with other organizations?	✓			HISC is open to collaborating with anyone who wants to work with them, as long as they are focused on conservation issues.
Does the organization have interest in working with WPI students?	✓			HISC would love to get new perspectives from people thinking outside of the box.

Appendix C.11: Island Conservation

The following section shows the characterization profile and analysis, shown in Table 13, of the Island Conservation. All of the information was found through research and an interview with Patty Baiao (P. Baiao, personal communication, February 19, 2021; Island Conservation, 2020; Island Conservation, 2021a; Island Conservation, 2021b; Island Conservation, 2021c; Packard, 2017).

Island Conservation (IC) Characterization Profile:

- **Type:** NP
- **Location:** Honolulu, HI Honolulu office: 300 Ala Moana Blvd Rm 5-231, Honolulu, HI 96850
- **Contact Information:** Patty Baiao / U.S. Head of Operations / Email: patty.baiao@islandconservation.org
- **Date Established:** 1994, Hawai‘i office opened in 2012
- **Number of Employees:** Island Conservation has about 50 employees.
- **Volunteer Opportunities:** IC works with volunteers at the headquarters office, and ground operations typically have volunteers as well. IC also hires temporarily for projects. Their volunteer opportunities change depending on the projects they are working on, so they accept volunteers on a case-by-case basis. There are both student volunteer opportunities and professional volunteer opportunities.
- **Public Involvement:** All of IC’s projects must go through the National Protection Environmental Act (NEPA) process, which requires public engagement. Many projects go through public meetings and public outreach and communications. They also incorporate members from local communities into the steering committees for different projects.
- **Total Budget/Funding:** IC has mixed funding from federal agencies, and donations from foundations, private partners, and the public. They also have government based funding that is bilateral and multilateral funding from international funding organizations such as the World Bank.
- **Collaboration/Partners:**
    - IC is nested within the larger community of island restoration practitioners and works closely with their staff on projects.
    - There was a partnership of Hawai‘i Department of Land and Natural Resources (DLNR), U.S. Fish and Wildlife Service, National Tropical Botanical Gardens, and Island Conservation to remove invasive rabbits from Lehua Island in 2006.
    - IC worked with the Hawai‘i Department of Land and Natural Resources, U.S. Fish and Wildlife Service, U.S. Department of Agriculture, U.S. Coast Guard, the Kaua‘i Endangered Seabird Recovery Project, the National Tropical Botanical Garden, and Pacific Rim Conservation to remove invasive rats from Lehua Island.
    - The people of Ni‘ihau, the island just adjacent to Lehua, were included in the steering committee for the Lehua Island project.
    - IC worked with the Kaho‘olawe Island Reserve Commission (KIRC) to advance the restoration of Kaho‘olawe Island by removing invasive rodents and feral cats.
    - Partnerships for IC projects are typically public private, and are as broad as possible to include a wide range of partners into the planning, such as local stakeholders, cultural practitioners, representatives from tribal communities or tribal leadership.

    - IC has Memorandums of Understanding (MoU) and Memorandums of Agreement (MoA) with government agencies.
    - With local communities, IC tries to use MoUs that are specific to projects in order to bind the groups working towards a shared mission.
    - List of Partners:
        - HDLNR, U.S. Fish and Wildlife Service, National Tropical Botanical Garden, USDA, State of Hawai‘i, Kaho’olawe Island Reserve Commission, U.S. Territory of Guam, U.S. Coast Guard, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Palau, the Kaua‘i Endangered Seabird Recovery Project (KESRP), Kaho‘olawe Island Reserve Commission (KIRC), Pacific Rim Conservation, and a host of non-government partners such as The Nature Conservancy.
- **Goal/Mission:**
    - Island Conservation’s mission is to remove invasive species from islands to prevent extinctions.
- **Responsibilities:**
    - IC works with local communities, government agencies, and conservation organizations on islands to prevent extinctions of globally threatened species.
    - IC develops comprehensive and humane plans of invasive species removal, implements invasive species removal, and conducts research to better understand how invasive species removal changes and benefits island ecosystems.
    - IC focuses more on eradications rather than control work. They determine the places where eradication is possible and feasible. They have also been exploring innovations in the future of eradications to achieve bigger and better eradication projects.
    - They are currently working towards increasing the pace and output of projects, and also contributing to the innovation and cultural outreach and social engagements that would allow different methods to be used.
    - IC has projects on Lehua Island and Kaho‘olawe Island in Hawai‘i.
- **Management Plan:**
    - IC has a five year strategic plan, and are currently about half way through their current strategic plan. Their current plan is focused on increasing the scale, scope, and pace of eradications by increasing the output of projects that they do per year.

Table 13: Analysis of Island Conservation

Organization: Island Conservation				
	Does	Does Not	Don’t know	Notes

Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			IC doesn't have a formal volunteer process, but they accept volunteer applications and accept on a case-by-case basis depending on what projects IC is working on at the time.
Does the organization actively inform the public about its programs and services?	✓			All of IC's eradication projects must go through the NEPA process and require public engagement.
Does the organization receive community input about its mission and activities?	✓			Many projects go through public meetings, whether it be one-on-one, small groups, or a big public meeting.
Does the organization have opportunities for future student involvement?	✓			IC has a student internship program.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			IC has a five-year strategic plan related to their eradication efforts.
Does this plan develop timelines for their accomplishments?	✓			IC's strategic plan is on a five year timeline.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			IC works with many of non-profit organizations, such as the Nature Conservancy
Does the organization collaborate with other organizations of different types?	✓			IC works with government agencies, local stakeholders, cultural practitioners, land managers, and rights holders.
Does the organization want to increase collaboration with other organizations?	✓			There is always room for new partners to contribute to IC's projects.
Does the organization have interest in working with WPI students?	✓			While IC does not have a formal volunteer program, they would be open to having information about the WPI program if the need arises for their support.

Appendix C.12: Kōkeʻe Resource Conservation Program

The following section shows the characterization profile and analysis, shown in Table 14, of the Kōkeʻe Resource Conservation Program. All of the information was found through research and an interview with Katie Cassel (K. Cassel, personal communication, February 16, 2021; Kōkeʻe Resource Conservation Program, 2021a; Kōkeʻe Resource Conservation Program, 2021b; Kōkeʻe Resource Conservation Program, 2021c).

Kōkeʻe Resource Conservation Program (KRCP) Characterization Profile:

- **Type:** NP
- **Location:** PO. Box 1108, Waimea, HI 96796
- **Contact Information:** Katie Cassel / Founder / Email: KokeeResource@gmail.com
- **Date Established:** 1998
- **Number of Employees:** They have four full-time staff, three field staff, and an administrative assistant.
- **Volunteer Opportunities:** KRCP worked with 669 volunteers (14 groups) in 2019. KRCP usually sets up a day for a group to come, and first gives a safety talk about the dress code and herbicide use. They give anyone who comes the choice of whether or not to use herbicides. If the person or group does not want to use herbicides, they can do hand pulling. They then take them into the forest and teach them the difference between the native plants and the weeds.
- **Public Involvement:** KRCP does not actively seek community input because they receive unsolicited input through their volunteer opportunities.
- **Total Budget/Funding:** $150,000-$200,000. The Hawaiʻi Community Foundation has funded KRCP for years, and provided KRCP with the grant writing workshop that started the program. KISC has given KRCP some of their budget for Kōkeʻe incipient weeds. They also receive funding from HCF Serendipity Fund, Atheron, Patagonia, DOFAW, Kagimoto Fund, Cloudwater Tea Farm, Ellen & Clarence Peterson Foundation, HTA, Nihoku, Upper Manoa Valley, and book sales.
- **Collaboration/Partners:**
    - KRCP has contracts with DOFAW, NARS, and DLNR to weed inside their fences and with TNC for weeding and fence checking in the remote Alakai.
    - They also have a USDA NRCS RCPP contract ongoing.
    - KRCP helps out the state forests by managing weeds there.
    - TNC chooses areas they want to manage and they pay KRCP to weed the areas.
    - KRCP and the KISC have planned a volunteer work day to remove invasive weeds from Kōkeʻeʻs native forest. KRCP and KISC also work together to pick the primary targets of the incipient weeds.
    - List of Partners:

        - HDLNR State Parks, Hawai‘i Community Foundation, Hawai‘i Tourism Authority (HTA), U.S. Department of Agriculture National Resources Conservation Services Regional Conservation Partnership Program (USDA NRCS RCPP), U.S. Fish and Wildlife Service (USFWS), Division of Forestry and Wildlife (DOFAW), Natural Area Reserves Systems (NARS), The Nature Conservancy (TNC), Kaua‘i Invasive Species Committee (KISC), Garden Island Resource Conservation and Development (GIRC&D) and Kaua`i Watershed Alliance (KWA).
        - Other sources of funding from 2019: Atheron Family Foundation, Patagonia, Kagimoto Fund, Cloudwater Tea Farm, Ellen & Clarence Peterson Foundation, HTA, Nihoku and Upper Manoa Valley.
- **Goal/Mission:**
    - The mission of KRCP is to preserve and protect the native forest in the Kōke‘e region, by primarily removing the invasive species in the forest there and any other threats that might arise.
- **Responsibilities:**
    - KRCP tries to focus on “special ecological areas” that have endangered and rare plants, but are still fairly native.
    - KRCP does trail maintenance for visitors.
    - In terms of managing and removing the weeds, they mostly use herbicides to kill the weeds.
    - KRCP has had some attempts and a little success with introducing biocontrol. They had distributed a fungus that attacks the Lantana, and saw effects on the leaves.
    - KRCP does hand pulling with smaller weeds.
    - Invasive trees are notched and herbicide is applied.
    - The main species KRCP focuses on are kahili ginger, strawberry guava, firetree, privet, and firethorn.
- **Management Plan:**
    - KRCP runs plans and strategies by their partners. Weed management is an ongoing process, so they don’t have a set timeline for the work.

Table 14: Analysis of the Kōke‘e Resource Conservation Program

Organization: Kōke‘e Resource Conservation Program				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have	✓			KRCP has a set volunteer program with training before the

within the organization?				volunteers do field work.
Does the organization actively inform the public about its programs and services?	✓			KRCP sends out a monthly calendar, showing where they're working and when, to the community including their partners and volunteers.
Does the organization receive community input about its mission and activities?		✓		KRCP does not actively seek community input because they receive unsolicited input through their volunteer opportunities.
Does the organization have opportunities for future student involvement?	✓			KRCP works with college groups, and has interns.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			KRCP runs plans and strategies by their partners.
Does this plan develop timelines for their accomplishments?			✓	N/A
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			KRCP works with other non-profit organizations, such as the Hawai'i Community Foundation.
Does the organization collaborate with other organizations of different types?	✓			KRCP works with government organizations, such as USFWS
Does the organization want to increase collaboration with other organizations?	✓			After COVID-19 they would be open to it.
Does the organization have interest in working with WPI students?	✓			KRCP expressed interest in working with WPI students.

Appendix C.13: Laukahi

The following section shows the characterization profile and analysis, shown in Table 15, of the Laukahi. All of the information was found through research and an interview with Emily Grave (E. Grave, personal communication, February 18, 2021; Laukahi, n.d.).

Laukahi Characterization Profile:

- **Type:** NP
- **Location:** Honolulu, HI
- **Contact Information:** Emily Grave / Network Coordinator / Email: coordinator@laukahi.org
- **Date Established:** Officially established in 2015
- **Number of Employees:** One staff and a voluntary eight member advisory council
- **Volunteer Opportunities:** A lot of the volunteer work they have is on database entry and media. They usually need help with IT work.
- **Public Involvement:** The public lets Laukahi know which plants are important and why; they can provide feedback into which native plants are the most important to the culture. Laukahi is also in the process of launching a front facing dashboard that will help the public understand the conservation tactics in Hawai‘i. They invite comments but get more feedback on their management plans from their partners than the public.
- **Total Budget/Funding:** Laukahi is privately funded but has also received contracted work from the Institute of Museum and Library Services and the Hawai‘i Tourism Authority.
- **Collaboration/Partners:**
    - Laukahi’s advisory council is made up of eight volunteers: Lauren Weisenberger (U.S. Fish and Wildlife Service), Matthew Keir (DLNR-DOFAW), Tamara Sherrill (Maui Nui Botanical Gardens), Susan Cordell (U.S. Forest Service), Don Drake (UH Mānoa), Randy Kennedy (Hawai‘i Conservation Alliance Foundation), Hank Oppenheimer (Plant Extinction Prevention Program) and Rakan (Zak) Zahawi (Lyon Arboretum - Chair).
    - Laukahi works with IUCN species survival Commission Hawai‘i plant specialist group to access species status on the red list.
    - The Hawai‘i Conservation Alliance is their fiscal sponsor.
    - Right now they are working to advocate for CGAPS at the ledge, provide testimony and other support for CGAPS.
    - Laukahi works with Professor Curt Daehler, the Watershed Partnerships, University of Hawai‘i, U.S. Fish and Wildlife Services, DOFAW (Division of Forestry and Wildlife), and Kelsey Brock at UH. Emily also mentioned that Laukahi has or had contracts with the Institute of Museum, Library Services, and the Hawai‘i Tourism Authority.
    - List of Partners:
        - Lyon Arboretum (University of Hawai‘i), Plant Extinction Prevention Program (PEPP), U.S. Fish and Wildlife Service (USFS), National Tropical Botanical Garden (NTBG), Hawai‘i Island Seed Bank, Waimea Valley (HI‘IPAKA LLC), Fleming Arboretum, Maui Nui Botanical Gardens (MNBG), Plant Conservation Alliance (PCA), Hawai‘i Plant

Specialist Group, Hawai‘i Conservation Alliance, U.S. Department of Agriculture (USDA), U.S. Forest Service (USFS), Pu‘u Kukui Watershed Preserve, Ohia Love, IUCN Red List, City and County of Honolulu, NPCC, Molokai‘i Land Trust, Center for Plant Conservation, KUPU, Waikoloa Dry Forest Initiative, Pacific Cooperative Studies Unit (PCSU), University of Hawai‘i, Hawai‘i Association of Watershed Partnership (HAWP), O‘ahu Army Natural Resource Program, Coordinating Group on Alien Pest Species (CGAPS), and Millennium Seed Bank KEW.

- **Goal/Mission:**
  - Laukahi is a statewide initiative working to strengthen ongoing programs, establish conservation goals for the state, measure progress, and create a formal partnership for plant species collection.
  - Laukahi is a voluntary alliance of organizations and individuals working to protect Hawai‘i’s rare plant species through coordinated conservation efforts.
  - Laukahi’s goal is to prevent extinction of native plants and their habitats through coordinated efforts.
- **Responsibilities:**
  - Laukahi works to achieve their goals by implementing the Hawai‘i Strategy for Plant Conservation.
  - Laukahi conducts a lot of collaboration. They conducted research with 90 conservation practitioners to determine which topics they needed researched and then compiled a list to give to principal investigators at University of Hawai‘i.
  - Laukahi also works on advocating for their partners and their needs.
  - Laukahi works to build a conservation network and establish a data sharing platform.
  - Laukahi works to increase the collection of wild plants and keep them safe by increasing facilities and knowledge.
- **Management Plan:**
  - Laukahi has a management or action plan. It is a five year plan that emphasizes growth and expansion.
  - Laukahi is working to implement the Hawai‘i Strategy for Plant Conservation.

Table 15: Analysis of Laukahi

Organization: Laukahi				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have	✓			Laukahi’s volunteers usually help with data entry.

within the organization?				
Does the organization actively inform the public about its programs and services?	✓			Laukahi is going to launch a public facing dashboard.
Does the organization receive community input about its mission and activities?	✓			The public helps Laukahi understand the importance of certain native plants in Hawaiian culture.
Does the organization have opportunities for future student involvement?	✓			Student involvement could include help with database entry or media production.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			Laukahi has a management plan that emphasizes growth and expansion.
Does this plan develop timelines for their accomplishments?	✓			Laukahi's management plan is on a five year timeline.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			Laukahi collaborates with other non-profit organizations such as NTBG.
Does the organization collaborate with other organizations of different types?	✓			Laukahi collaborates with partnerships, university groups, state agencies, and federal agencies.
Does the organization want to increase collaboration with other organizations?	✓			Laukahi sees themselves increasing collaboration.
Does the organization have interest in working with WPI students?	✓			Laukahi is always open to student involvement.

Appendix C.14: Maui Invasive Species Committee

The following section shows the characterization profile and analysis, shown in Table 16, of the Maui Invasive Species Committee. All of the information was found through research and an interview with Adam Radford (A. Radford, personal communication, February 8, 2021; Hawaii Invasive Species Council, 2019; Maui Invasive Species Committee, 2014; Maui Invasive Species Committee, 2020a; Maui Invasive Species Committee, 2020b; Maui Invasive Species Committee, 2021).

Maui Invasive Species Committee (MISC) Characterization Profile:

- **Type:** P
- **Location:** 820 Piiholo Road, Makawao, Hawai‘i (main location).
- **Contact Information:** Adam Radford / General Manager / Email: miscmgr@hawaii.edu
- **Date Established:** MISC was established in 1999 and hired their first staff in 2001.
- **Number of Employees:** MISC has 45 employees.
- **Volunteer Opportunities:** MISC accepts volunteers and usually has ten interns at a time. They do not have a formal volunteer program and instead usually talk with the interested volunteers to see what area of work would be a good fit. Volunteers and interns are assigned a leader or mentor who work with them on tasks in their interest area.
- **Public Involvement:** The public are MISCs eyes and ears. About 85% of the invasive species that they took action on came from public reports. Along with identifying invasive species, the public also helps with controlling invasive species. Also, MISC's quarterly meetings are open to the public.
- **Total Budget/Funding:** MISC operates like a non-profit in that they apply for funding and are soft-funded. They receive funding from a variety of sources at the local, county, state, and federal level, as well as from private organizations and individuals. MISC received $801,453 from HISC for control projects and $132,640 from HISC for outreach projects in the 2020 fiscal year.
- **Collaboration/Partners:**
    - MISC is a project under the Pacific Cooperative Studies Unit at the University of Hawai‘i Mānoa.
    - Since MISC was the first ISC, they have been able to participate with lots of great scientists from the start, such as with NPS and USFWS.
    - The Hawai‘i Department of Land and Natural Resources is not only a contributor financially by completing grants with MISC, but they also send staff to work with MISC.
    - MISC also works with the Hawai‘i Department of Agriculture and complementary projects in different areas.
    - List of Partners:
        - The County of Maui, Hawai‘i Department of Transportation (HDOT), Hawai‘i Invasive Species Council (HISC), The Nature Conservancy (TNC), Research Corporation of the University of Hawai‘i (RCUH), U.S. Forest Service (USFS), Moloka‘i/Maui Invasive Species Committee (MoMISC), Pacific Cooperative Studies Unit (PCSU), University of Hawai‘i at Mānoa, National Park Service (NPS), U.S. Fish and Wildlife Services (USFWS), Hawai‘i Department of Land and Natural Resources (HDLNR), and the Hawai‘i Department of Agriculture (HDOA).
- **Goal/Mission:**

    - MISC's mission is to protect Maui Nui from harmful invasive species that cause issues in quality of life, human health, animal health, agriculture, the environment and the economy.
- **Responsibilities:**
    - MISC also has an outreach and education team. This team conducts an outreach program that educates teachers and tour guides about invasive species and the local environment. They also educate the public about invasive species.
    - MISC has four crews who do field work focused on specific target species. They look to target invasive species that are feasible to take on and will really make a difference. They prioritize target species for control operations and provide expertise on effective survey and control techniques and reporting.
    - MISC has administrative staff who oversee projects, funding, and progress.
    - MISC holds quarterly meetings to discuss their programs and future initiatives.
- **Management Plans:**
    - MISC has a strategic plan that was last updated in 2013 and outlines six goals to improve their program's impact, quality, collaboration, and outreach as well as increase financial stability and number of employees.

Table 16: Analysis of the Maui Invasive Species Committee.

Organization: Maui Invasive Species Committee				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		MISC does not have a formal volunteer program. They let volunteers identify work or project areas of interest as long as it lines up with what MISC needs.
Does the organization actively inform the public about its programs and services?	✓			MISC has many education programs and allows the public at their quarterly meetings where they discuss their programs.
Does the organization receive community input about its mission and activities?	✓			MISC closely follows reports of invasive species from the public to take action on.
Does the organization have opportunities for future student involvement?	✓			The internships at MISC usually depend on what the student is interested in.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			MISC a strategic plan that outlines six main goals for improving their programs.
Does this plan develop timelines for their accomplishments?		✓		MISC's strategic plan from 2013 does not outline a timeline for certain goals to be achieved.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			MISC works with other partnerships, such as MoMISC.
Does the organization collaborate with other organizations of different types?	✓			MISC works with state agencies, university groups, non-profit organizations, and federal agencies.
Does the organization want to increase collaboration with other organizations?	✓			Their strategic plan indicates their intentions of increasing collaboration.
Does the organization have interest in working with WPI students?	✓			MISC expressed great interest.

Appendix C.15: The Nature Conservancy Hawai‘i

The following section shows the characterization profile and analysis, shown in Table 17, of the Hakalau Forest National Wildlife Refuge. All of the information was found through research and an interview with Samuel M. ‘Ohukani‘ōhi‘a Gon (S. Gon, personal communication, February 17, 2021; The Nature Conservancy, n.d. a; The Nature Conservancy, n.d. b).

The Nature Conservancy Hawai‘i (TNC) Characterization Profile:

- **Type:** NP
- **Location:** 923 Nuuanu Avenue, Honolulu, HI 96817
- **Contact Information:** Samuel M. ‘Ohukani‘ōhi‘a Gon / Senior Scientist and Cultural Advisor / Email: sgon@TNC.org
- **Date Established:** TNC was established in 1950. It was formed by a small group of ecologists who were concerned about unchecked and unregulated development in the habitats of rare species. They decided to purchase land that was designated for development and establish nature preserves instead. The first acquisition in Hawai‘i was in the late 60s. The Hawai‘i Chapter of TNC was established in 1980. The marine program was established in 2000.
- **Number of Employees:** The number of employees varies based on funding. At one time, TNC had as many as 70 people working across Hawai‘i in the preserves. Currently they have 30 people working in the main office and an additional five-ten people on each of the five islands TNC is located on.
- **Volunteer Opportunities:** In the marine program, where access to the ocean is easy, they rely on community involvement. Volunteers help monitor, define the management program, and implement the plans. On the terrestrial side, wherever it is safe, volunteers will help with weed control, monitoring for ungulates, and even helping with ungulate control. TNC will take hunting groups to specific areas to hunt certain animals, such as feral pigs or goats. They usually have people reach out to them to volunteer if they already have an interest or skill set to complete the work, but sometimes they have school groups so they tailor the volunteer work based on the skillset of the volunteers.
- **Public Involvement:** When dealing with biodiversity in urban or suburban settings, the public is vital for the work TNC does. TNC will not work in a particular area unless the community invites them to do so. They look to inform the public the importance of taking care of nature and biodiversity because if people do not care about nature, any work to protect it will be short-lived. If there is ever a choice between the wellbeing of humans and the wellbeing of nature, if people do not have a deep understanding and care for nature, then humans will take precedence everytime. TNC hopes to encourage

community support and involvement in conservation because when there is a community in which all members recognize the importance of biological diversity and take a role in protecting it, then in the long run conservation organizations will no longer be needed. A large part of TNC outreach is place-based education, in which they do not use a one size fits all approach to teaching about ecology, biology, and the need for conservation protection. When working with communities that already value their local resources, TNC works to enhance those understandings about biodiversity, the threats to that biodiversity, and the role they can play in minimizing those threats.

- **Total Budget/Funding:** TNC receives roughly one-third from government grant programs, one-third from private individuals who are devoted to conservation, and roughly one-third from foundations. They raised over $1.055 billion in total revenue and support in 2019. They used $725 million on conservation programs, land purchases, and conservation easements. A budget breakdown shows they received $1,055,554 in total support and revenue.
- **Collaboration/Partners:**
    - TNC was formed from the Ecological Society of America.
    - Many of TNC's preserves are within Watershed Partnerships. These Watershed Partnerships have management plans that TNC follows.
    - TNC is an important partner of the ISCs and they share staff.
    - TNC is also part of the steering committee for the HCA. As a member of the Steering Committee for the Hawai‘i Conservation Alliance, they can communicate with many other conservation partners. They developed the Effective Conservation program with the Hawai‘i Conservation Alliance, TNC, and other key members. There are 27 members, and it is a great way to take an idea and communicate/collaborate with the entire body.
    - For their partnerships with NPS or USFWS, since federal governments cannot lobby on Capitol Hill for much needed funds for projects, TNC, being a non-profit organization, will be in touch with them and find out what their high-priority needs are. Then they will go to Washington DC to lobby their delegation and others for the funds needed.
    - In order to have effective ungulate control programs, TNC has become a leading organization in the larger landscapes in which they reside. They work with landowners to put up fences where they are most effective, not only where their property boundaries are, through these collaborative efforts with the Watershed Partnerships.
    - For their marine program, TNC collaborates with the government and communities near the shores where they work because no one person can own part of the ocean and be responsible for its management.
    - For the marine management program at TNC, effective conservation occurs when you have identification of an important area for biodiversity, official recognition

of a protective status (TNC preserve), management effort within that area, and long-term community involvement.
    - TNC collaborates with agencies in Florida that are dealing with the same pests they are by reading their publications.
    - List of Partners:
        - Hawai‘i Department of Land and Natural Resources (HDLNR), U.S. Fish and Wildlife Service (USFWS), The National Park Service (NPS), Watershed Partnerships (HAWP), Invasive Species Councils (ISCs), and Hawai‘i Conservation Alliance (HCA).
- **Goal/Mission:**
    - The general mission of TNC is to protect the life-giving lands and waters, lands being any terrestrial ecosystem and waters being both fresh or marine.
    - Since its establishment, TNC has turned into a global organization dedicated to protecting native biodiversity in any setting because protecting biological diversity, especially native biological diversity, is vital for keeping our biosphere intact, and thereby supporting humans and all other living things on the planet.
    - The mission statement has also evolved to include paying attention to the dynamics between human actions and the impacts on natural systems.
- **Responsibilities:**
    - TNC sets policies to help identify invasive species that have the greatest negative impact on native biodiversity.
    - The Watershed Partnerships management plans that TNC follows include enforcing the Zero Tolerance policy, in which identified areas across the Islands are identified as areas with zero tolerance for ungulates. Enforcing this policy involves building fences, monitoring and using methods, such as hunting, to get the ungulate population in that area as close to zero as possible.
    - For terrestrial matters, TNC will often identify areas that need protection, work to establish either a TNC preserve or state established natural area reserve, and, depending on the distinction, will devote staff to the management of the area.
    - TNC uses the idea of bio-cultural conservation, in which they respect and understand the culture of a place and build it into a conservation program. Many of the community members they collaborate with really value the native plants; therefore, they are able to sustainably harvest some of the native plants while removing competing weeds, building fences to keep out ungulates, and respecting the resource they are interacting with.
    - TNC was the first to use aerial drones to monitor the effects of ungulates and detect non-native plants in very remote locations. They also use high resolution satellite imagery to identify from the canopy spectra where invasive populations are spreading.
    - TNC protects close to 200,000 acres of natural lands in Hawai‘i.

- **Management Plan:**
    - There are management plans for every TNC preserve and landscape they work in. These plans first identify prioritized invasive species based on how habitat-modifying they are, and then outline protocols for prevention and rapid response to incipient invasions. The Watershed Partnerships that some TNC preserves are located within also have management plans that focus on threat mitigation. The Watershed Partnerships' management plans outline ungulate and priority weed control by using an integrated pest management system that uses as many tools, such as manual and chemical control, and even biological control, as possible to try maintaining low populations of invasives so as to allow native ecosystems to continue normal processes.

Table 17: Analysis of The Nature Conservancy Hawai'i

Organization: TNC				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			TNC defines roles for volunteers working in different areas. Marine volunteers work on monitor and management plan implementation. Terrestrial volunteers help with field work, such as weed pulling.
Does the organization actively inform the public about its programs and services?	✓			TNC tries to do outreach to educate the community about biodiversity and help create a society in which nature is cared for.
Does the organization receive community input about its mission and activities?	✓			The community must invite TNC to work in a particular area.
Does the organization have opportunities for future student involvement?	✓			TNC has volunteer opportunities for students.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			TNC has management plans for each of their preserves and landscapes they work in.
Does this plan develop timelines for their accomplishments?			✓	It is unclear if these management plans have clear timelines to accomplish them.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.

Does the organization collaborate with other organizations of the same type?			✓	There are other non-profit organizations in the Hawai‘i Conservation Alliance, but we do not know which ones TNC interacts with.
Does the organization collaborate with other organizations of different types?	✓			TNC collaborates with partnerships, state agencies, and federal agencies.
Does the organization want to increase collaboration with other organizations?	✓			Yes, TNC really values the collaboration.
Does the organization have interest in working with WPI students?	✓			Reach out to TNC marine program.

Appendix C.16: O‘ahu Invasive Species Committee

The following section shows the characterization profile and analysis, shown in Table 18, of the O‘ahu Invasive Species Committee. All of the information was found through research and an interview with Erin Bishop (E. Bishop, personal communication, February 9, 2021; Hawaii Invasive Species Council, 2019; Oahu Invasive Species Committee, 2015; Oahu Invasive Species Committee, 2017; Oahu Invasive Species Committee, 2018a; Oahu Invasive Species Committee, 2018b; Oahu Invasive Species Committee, 2018c; Oahu Invasive Species Committee, 2020).

O‘ahu Invasive Species Committee (OISC) Characterization Profile:

- **Type:** P
- **Location:** 743 Ulukahiki Street Kailua, HI 96734
- **Contact Information:** Erin Bishop / Outreach Coordinator / Email: oisc@hawaii.edu
- **Date Established:** In 2001 the first staff was hired but before that they had volunteers doing the work of OISC.
- **Number of Employees:** OISC has 15 staff.
- **Volunteer Opportunities:** OISC usually takes on one intern per year and in a ten month internship. OISC has a volunteer page on their website and prior to COVID 19 they had two volunteer trips. Through these trips volunteers surveyed the land and trails after a safety briefing. Since COVID-19 began, they have started community-driven trail surveys that people can do on their own using a smartphone application.
- **Public Involvement:** OISC educates the general public about invasive species to get them involved in early detection/rapid response. OISC hopes to increase their outreach to community organizations in the next five years. They also hope the public will become

more involved in local legislation related to invasive species. OISC holds public meetings as well.

- **Total Budget/Funding:** OISC is not state-mandated and therefore does not receive any dedicated funding. Instead, they apply for grants through the federal government and sometimes get donations from private individuals or institutions. Most of their funding comes from HISC. In the 2020 fiscal year, OISC received $675,759 for control projects and $107,279 for outreach projects from HISC.
- **Collaboration/Partners:**
    - In order to revise their strategic plan, OISC's new plan is presented to their committee. The OISC committee is made up of natural resource managers from different departments and stakeholders. Some of the organizations on the committee are the Hawaiian electric company, the Department of Land and Natural Resources, and the Board of Water Supply.
    - OISC has been doing virtual outreach with the Gardening Club Farm Association.
    - Before COVID-19, OISC did volunteer trips with Lyon Arboretum.
    - OISC also does work with the Oʻahu Army Natural Resource Program on Devil Weed. Together they camp and look for this plant once a month and OISC surveys the private properties that devil weed has spread to.
    - OISC also works with the Māmalu Poepoe Project to early detect Africanized honey bees at airports and harbors by doing trap checks.
    - With the Hawaiʻi Department of Agriculture, OISC checks traps for the Coconut Rhinoceros Beetle.
    - Often CGAPS will coordinate a meeting for agencies to express their invasive species issues and receive help, and OISC participates in those meetings.
    - OISC supports some organizations by educating the public on their specific invasive species, such as the Coconut Rhinoceros Beetle Response Team.
    - OISC also collaborates with the Hawaiʻi Department of Agriculture by asking them to write a letter on behalf of OISC to property owners so that OISC can manage invasive species on private property.
    - OISC also collaborates with the Hawaiʻi Association of Watershed Partnerships, which focuses on high priority native ecosystem watersheds.
    - List of Partners:
        - Hawaiian Electric Company, Department of Land and Natural Resources (DLNR), Board of Water Supply, Gardening Club Farm Association, Lyon Arboretum, Oʻahu Army Natural Resource Program, Māmalu Poepoe Project, Hawaiʻi Department of Agriculture (HDOA), CGAPS, Coconut Rhinoceros Beetle Response Team (CRB Response), Hawaiʻi Association of Watershed Partnerships (HAWP).
- **Goal/Mission:**

    - OISC has three parts to their mission. The first part is to detect and contain invasive species to prevent their spread and eradicate them from the island. The second part is to educate the general public so they contribute to early detection/rapid response. The third part is to protect O‘ahu’s ecosystems, agriculture industry, and quality of life.
- **Responsibilities:**
    - OISC protects native ecosystems and watersheds.
    - To eradicate invasive species, OISC does ground and aerial surveys and treats the species. OISC surveys private and public properties.
    - OISC also participates in educating the general public on invasive species issues. OISC uses presentations, volunteer activities, and educational materials for their education.
    - OISC holds public meetings to update partners and other stakeholders about their activities.
- **Management Plan:**
    - OISC has a strategic plan that outlines the invasive species they are targeting and their prevention, control, and eradication plans. To target these species they use an adaptive management plan so if they notice that something is not working, they can look back and see if there is a new way to manage the invasive species or if there is new research related to the management of the species. The last strategic plan documented on their website is from 2006.
    - OISC previously posted monthly reports, as well as some annual reports, up until 2018. These reports outline their recent field work, target species, outreach strategies. Some reports also describe the staffing and financial situation of OISC.

Table 18: Analysis of the O'ahu Invasive Species Committee

Organization: O'ahu Invasive Species Committee				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			While they do not currently have volunteers, OISC has had volunteer trips where volunteers surveyed trails.
Does the organization actively inform the public about its programs and services?	✓			OISC holds public meetings to provide updates about its activities. They educate the public in the hopes of gaining their support legislatively.
Does the organization receive community input about its mission and activities?	✓			The public reports pests to OISC.
Does the organization have opportunities for future student involvement?	✓			OISC previously had interns and is open to future student involvement.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?		✓		OISC has a strategic plan which lists which species they are targeting and their plans for prevention, control, and eradication.
Does this plan develop timelines for their accomplishments?	✓			OISC has a timeline for eradication but does not always have timelines. They mostly have adaptive management strategies.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			OISC collaborates with other partnerships such as MISC, KISC, and MoMISC
Does the organization collaborate with other organizations of different types?	✓			OISC collaborates with state agencies, such as HISC, and other corporations.
Does the organization want to increase collaboration with other organizations?	✓			If funding allows, OISC would increase collaboration.
Does the organization have interest in working with WPI students?	✓			Yes, OISC has projects they would do if they had the time that could become a project for students.

Appendix C.17: O‘ahu Master Gardeners Program

The following section shows the characterization profile and analysis, shown in Table 19, of the O‘ahu Master Gardeners Program. All of the information was found through research and an interview with Kalani Matsumura (K. Matsumura, personal communication, February 8, 2021; University of Hawai‘i at Mānoa, n.d.).

O‘ahu Master Gardeners Program (OMGP) Characterization Profile:

- **Type:** U
- **Location:** 955 Kamehameha Hwy. Pearl City, HI 96782-2501 (O‘ahu Urban Garden Center)
- **Contact Information:** Kalani Matsumura / Junior Extension Agent in Urban Horticulture / Email: kalanitm@hawaii.edu
- **Date Established:** 1972 in Washington, 1982 on O‘ahu
- **Number of Employees:** The Master Gardeners Program has five Program Coordinators across Hawai‘i.
- **Volunteer Opportunities:** OMGP has 130 active volunteers on O‘ahu. They have a volunteer program to become a Master Gardener. Volunteers are trained at a yearly training class that consists of 40 or more hours of training. Part of this training includes learning to identify invasive species. After five years as a Master Gardener volunteer, they can become a lifetime Master Gardener. The volunteers they recruit also help staff booths at outreach events, answer calls or emails, and talk to people at OMGP facilities.
- **Public Involvement:** They provide educational opportunities to the public, such as workshops, large events/fairs, farmers’ market booths, publications, and a lot of personal communication. They are constantly responding to public inquiries.
- **Total Budget/Funding:** OMGP receives funding through the USDA Hatch Act, Smith-Lever Act, Research, NIFA and IFA through the USDA, and partnerships with organizations with grants.
- **Collaboration/Partners:**
    - They partner with other organizations to do outreach and education, but they also send volunteers to help other organizations with ground work.
    - OMGP receives funding from the Hawai‘i Department of Agriculture and they work directly with each other to do educational activities and host large events.
    - OMGP receives funding from the USDA.
    - OMGP and OISC work directly with each other to do educational activities and host large events.
    - OMGP and Mālama Learning Center work directly with each other to do educational activities and host large events.

    - The Honolulu Board of Water Supply has an extensive educational department with an annual plant sale that is pretty highly attended and OMGP participates with that.
    - List of Partners:
        - Hawai‘i Department of Agriculture (HDOA), U.S. Department of Agriculture (USDA), O‘ahu Invasive Species Committee (OISC), Mālama Learning Center, and Honolulu Board of Water Supply.
- **Goal/Mission:**
    - The mission of the University of Hawai‘i Master Gardener Program is to provide research based information and sustainable management practices in tropical gardening to the public. These management practices are appropriate for home gardens, the community, and more.
- **Responsibilities:**
    - OMGP works to get people engaged in workshops and education programs to learn and exchange ideas.
    - OMGP responds to any environmental issues that come up that affect the local neighborhood.
    - OMGP publishes blogs, hosts workshops, and organizes plant sales to address the top issues facing local neighborhoods.
    - OMGP has protocols for the proper handling of organic materials, mulch, and compost.
    - OMGP tries to work with landowners to do what they can with invasive species on their own properties.
    - OMGP provides educational opportunities to the public, such as workshops, large events/fairs, farmer’s market booths, publications, and a lot of personal communication.
- **Management Plan:**
    - Each Master Gardener program has its own charters and bylaws; however, there is no set management plan. They evolve to what is happening with invasive species at that time.

Table 19: Analysis of the O'ahu Master Gardeners Program

Organization: O'ahu Master Gardeners Program				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			OMGP has a volunteer program that teaches their volunteers about invasive species and gardening in general to then become ambassadors in the community.
Does the organization actively inform the public about its programs and services?	✓			OMGP provides educational opportunities to the public through workshops, larger events (prior to COVID-19), fairs, farmers' market booths, publications, and lots of conversations (email, in-person, etc.).
Does the organization receive community input about its mission and activities?	✓			OMGP has a helpline where people can call and ask them questions. They can also email or visit in-person (prior to COVID-19). The subject matter taught by OMGP is guided by these questions and what is going on in the local neighborhoods.
Does the organization have opportunities for future student involvement?	✓			OMGP has welcomed student involvement on many different projects over the years.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?		✓		OMGP does not have a set management plan.
Does this plan develop timelines for their accomplishments?		✓		OMGP responds to current environmental issues; therefore, there is no set timeline for dealing with specific issues. They will continue to help the public.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?			✓	Since OMGP is part of the CTAHR, they likely collaborate with other groups within the college, but we have no clear evidence to make that claim.
Does the organization collaborate with other organizations of different types?	✓			OMGP collaborates with state government and non-profit organizations.
Does the organization want to increase collaboration with other organizations?	✓			OMGP volunteers and coordinators are always out at public events, the State Farm Fair, other farm

				fairs across the island to network and gain connections with other organizations to increase collaboration.
Does the organization have interest in working with WPI students?	✓			OMGP has limited staffing and said they could benefit from working with some people who are enthusiastic and talented.

Appendix C.18: O‘ahu Plant Extinction Prevention Program

The following section shows the characterization profile and analysis, shown in Table 20, of the Plant Extinction Prevention Program. All of the information was found through research and an interview with Kobey Togikawa (K. Togikawa, personal communication, February 11, 2021; Plant Extinction Prevention Program, n.d. a; Plant Extinction Prevention Program, n.d. b; Plant Extinction Prevention Program, n.d. c).

O‘ahu Plant Extinction Prevention Program (PEPP) Characterization Profile:

- **Type:** NP
- **Location:** Honolulu, HI
    - We talked to the only full-time employee on O‘ahu
- **Contact Information:** Kobey Togikawa / O‘ahu Plant Technician / Email: kobeyt@hawaii.edu
- **Date Established:** 1990
- **Number of Employees:** O‘ahu PEPP has ten employees and six are full-time.
- **Volunteer Opportunities:** There are around 20 dedicated volunteers that will work regularly throughout the year. They have a small group of retired senior citizens who have either worked in conservation before or have gotten degrees in environmental science or natural resource management. Prior to COVID-19, PEPP would also partner with a couple volunteer groups once in a while. Volunteers from the general public will help with planting, weeding, watering, and giving them data about the status of the plants. Limited volunteers with enough experience work in labs to help process seeds for germination trials.
- **Public Involvement:** The main role of the public is to give support to PEPP. PEPP also educates the public about their species and their mission so that the public will spread the information and be more conscious when going hiking on their own. They receive feedback from the public when people go hiking and come across a PEPP species. The public can also help PEPP through volunteering and donating.
- **Total Budget/Funding:** PEPP’s funding is split between the Hawai‘i Department of Land and Natural Resources and the U.S. Fish and Wildlife Service. They also apply for

private grants and other outside funding sources such as donations from public and private institutions.

- **Collaboration/Partners:**
    - PEPP is a project of the Pacific Cooperative Studies Unit (PCSU) of the University of Hawai‘i at Mānoa. PEPP staff help the unit when they need help with projects.
    - PEPP utilizes the Lyon Arboretum Seed Conservation Facility and several greenhouses on O‘ahu for seed storage and to hold long-term plants in the greenhouses before planting them back out into the wild.
    - PEPP is a subset of the Department of Land and Natural Resources, the Division of Forestry and Wildlife (DOFAW) and works closely with the Native Ecosystems Protection & Management program because they are housed in the same office.
    - Since each Hawaiian Island only has about two PEPP staff, PEPP typically partners with other agencies who can do more widespread, landscape level restoration while PEPP staff help with weed control, planting, and monitoring.
    - PEPP also partners with the Watershed Partnerships in Hawai‘i. For example, PEPP staff will sometimes help with a helicopter operation.
    - PEPP also works with the Board of Water Supply on O‘ahu. The Board of Water Supply owns the land where there are PEPP species, so PEPP staff and Board of Water Supply colleagues will hike through the area together.
    - PEPP also works with private landowners by attaining a Right of Entry (ROE) to access the lands and do work with them.
    - PEPP has permits with the U.S. Fish and Wildlife Service to do collections and work with endangered species.
    - List of Partners:
        - O‘ahu Partners: City and County of Honolulu, Honolulu Board of Water Supply, Ko‘olau Mountains Watershed Partnership (KMWP), Kualoa Ranch, Leeward Community College Nursery, O’ahu Army Natural Resource Program (OANRP), UH Mānoa Harold L. Lyon Arboretum Hawaiian Rare Plant Program, Wai‘anae Mountains Watershed Partnership (WMWP), Pacific Cooperative Studies Unit (PCSU), Hawai‘i Department of Land and Natural Resources (HDLNR), Division of Forestry and Wildlife (DOFAW), Board of Water Supply, and U.S. Fish and Wildlife Service (USFWS)
        - Other partners for locations not on O‘ahu can be found here.
- **Goal/Mission:**
    - The mission of PEPP is to protect Hawai‘i’s rare plants through teamwork. PEPP originally focused on species with fewer than 50 plants remaining in the wild, but has expanded to include those that could potentially turn into PEPP species.

PEPP's mission involves invasive species management and predator control.

- **Responsibilities:**
    - There are currently about 240-250 PEPP species on their list.
    - PEPP collects fruit, seeds and clippings for propagation.
    - PEPP protects wild plants. For example, they built a fence protecting 64 PEPP species.
    - PEPP surveys for wild plants and new species.
    - PEPP creates new populations of rare species in new locations.
    - PEPP monitors populations of both wild and reintroduced plants.
    - PEPP builds fences, sets up rat traps, and controls ungulates.
    - After fencing and protecting the plants, PEPP focuses on collecting fruit or vegatative material for seed storage and plant propagation. They will then plant them back in the wild to create new populations.
    - PEPP also surveys to look for new populations of known plants, new populations of extirpated species, and new sites for outplanting and restoration.
- **Management Plan:**
    - PEPP's work is more ongoing rather than having a set timeline. They have a PEPP management approach with five main activities, and supporting management activities.
    - The PEPP Approach
        - 1) Manage threats to protect the remaining wild plants.
        - 2) Monitor the remaining wild plants and those new populations of plants that were planted in a safe location.
        - 3) Collect fruit, seeds, spores, clippings, and more for use in propagation.
        - 4) Reintroduce PEPP species and increase existing species populations through planting these species in a protected location.
        - 5) Survey for new remaining wild plants.

Table 20: Analysis of the Plant Extinction Prevention Program

Organization: O‘ahu Plant Extinction Prevention Program				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			PEPP has volunteer opportunities for both volunteers who have a background in invasive species management and the general public.
Does the organization actively inform the public about its programs and services?	✓			PEPP educates the public through public outreach and volunteer opportunities.
Does the organization receive community input about its mission and activities?		✓		The public does not have a say in their management strategies, but they do provide input regarding PEPP species they come across.
Does the organization have opportunities for future student involvement?	✓			PEPP could benefit from future student involvement.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization’s activities around a focused mission?	✓			PEPP has a mission statement and a list of 240 PEPP species that they focus their work around. They also have an approach with five main activities to support their management activities.
Does this plan develop timelines for their accomplishments?		✓		PEPP’s work is more ongoing rather than having a set timeline.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?			✓	The O‘ahu PEPP may collaborate with other non-profit organizations, but we cannot say this with certainty based on the interviews and research.
Does the organization collaborate with other organizations of different types?	✓			PEPP collaborates with university groups, state organizations, and federal organizations.
Does the organization want to increase collaboration with other organizations?	✓			PEPP is interested in increasing collaboration based on what their focus is and where they are working.
Does the organization have interest in working with WPI students?	✓			PEPP has future project areas, such as streamlining their monitoring, or gathering and compiling data for large populations of outplants that WPI students could get involved in.

Appendix C.19: Office of Maunakea Management

The following section shows the characterization profile and analysis, shown in Table 21, of the Office of Maunakea Management. All of the information was found through research and an interview with Jessica Kirkpatrick (J. Kirkpatrick, personal communication, February 9, 2021; Office of Maunakea Management, n.d. a; Office of Maunakea Management, n.d. b; Office of Maunakea Management, n.d. c; Office of Maunakea Management, n.d. D; Vanderwoulde et al., 2015).

Office of Maunakea Management (OMKM) Characterization Profile:

- **Type:** U
- **Location:** 640 N. Aohoku Place, Rm. 203, Hilo, HI 96720
- **Contact Information:** Jessica Kirkpatrick / Natural Resource Specialist / Email: jakirkpa@hawaii.edu
- **Date Established:** OMKM was established in 2000 as part of the Master Plan, mentioned in the Management Plan section. They were established as a management entity because astronomers were concerned about the resources.
- **Number of Employees:** OMKM has about fibe staff members, and two temporary staff.
- **Volunteer Opportunities:** They have had hundreds of volunteers over the past few years. OMKM organizes volunteer days in which volunteers clear weeds to then plant native plants in those areas. They would normally publish a newspaper article saying that they are going to have a volunteer weed pull on a given day with contact information. Before COVID-19, they had a van that would take volunteers up the mountain, where there would then be an orientation and safety talk. They would be given lunch, a presentation about the research being conducted on the mountain, and training about what kinds of weeds to pull. OMKM staff monitors activities to make sure the correct weeds are being pulled and disposed of properly.
- **Public Involvement:** OMKM must get their management plans approved by the Culture Advisory Group (Kahu Kumauna) and the Environmental Committee which are both made up of people from the public. OMKM tried to get the word out about their activities by doing outreach events with students and the community, providing brochures about checking equipment, and including the public in surveys with their permission. The public is also welcome at OMKM board meetings.
- **Total Budget/Funding:** Receive funding from the University of Hawai‘i
- **Collaboration/Partners:**
    - OMKM collaborates with the Hawai‘i Ant Lab to receive recommendations about how to deal with specific invasive species that may establish themselves on the

Maunakea. They give them valuable recommendations about treating pests that may not be common to the public.
    - OMKM works with the Big Island Invasive Species Committee to get feedback on their management.
    - List of Partners:
        - Hawai‘i Ant Lab (HAL) and Big Island Invasive Species Committee (BIISC)
- **Goal/Mission:**
    - The mission of the Office of Maunakea Management is to organize the sustainable management of the University of Hawai‘i managed lands on Maunakea Mountain through community involvement and activities to protect, preserve, and enhance the resources of the mountain. Their mission also includes providing a learning environment for researchers and astronomers, all while providing safe access for visitors.
- **Responsibilities:**
    - OMKM is responsible for the management of the Maunakea Mountain and the University of Hawai‘i managed lands. This land includes the Maunakea Science Reserve, Onizuka Center (mid-level facilities for astronomers), and the RoadRoad Corridor. This land makes up about 11,000 acres on the mountain.
    - For prevention, OMKM has a Department of Land and Natural Resources approved biologist inspect vehicles and equipment for observers (any vehicle with more than two axles) that go up the mountain because they do not have the authority to inspect all public vehicles. In the future, they would like a kiosk or shuttle at the bottom of the mountain to inspect vehicles before they go up. If they have plant or animal products, they are rejected.
    - For early detection, OMKM performs perimeter searches around parking lots, sets up traps inside the facilities, pulls weeds around the property, and does monitoring for native and invasive species.
    - For control, OMKM has volunteers pull weeds in areas with a lot of people.
    - They also have rapid response in which an issue becomes the main priority and surveys are performed, an emergency response committee is contacted, areas are blocked off, and then plans of control are determined.
    - After invasive species are controlled, OMKM continues to do follow-up surveys until they are confident that the mountain is free of that species.
    - OMKM focuses on cultural management on Mauna Kea and addresses cultural practices and the historical context of the mountain.
- **Management Plan:**
    - OMKM has a Master Plan that was created in 2000 and is currently being updated. This Master Plan and all standard operating procedures are adaptive plans. Within this Master Plan there are specific management plans such as the

invasive species management plan. Their invasive species management plan is one of the best in the state and it was used as a reference to create the Hawai‘i Interagency Biosecurity Plan.

- The Maunakea Invasive Species Management Plan outlines the objectives, policies and procedures of OMKM for preventing, detecting, and managing invasive species on Mauna Kea.
- The OMKM website also has documented a Comprehensive Management Plan from 2009. This Comprehensive Management Plan addresses the cultural resources of Mauna Kea, provides a guide for existing and future management initiatives, discusses the community engagement process, and outlines human impacts.

Table 21: Analysis of the Office of Maunakea Management

Organization: Office of Maunakea Management				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			OMKM organizes volunteer days in which volunteers clear weeds to then plant native plants in those areas.
Does the organization actively inform the public about its programs and services?	✓			OMKM has outreach events with students and the community, provides brochures about checking equipment, and includes the public in surveys with their permission.
Does the organization receive community input about its mission and activities?	✓			OMKM must get their management plans approved by the Culture Advisory Group (Kahu Kumauna) and the Environmental Committee which are both made up of people from the public.
Does the organization have opportunities for future student involvement?	✓			There have been lots of management changes and they are working to maintain funding and expand their staffing. They could use an outreach coordinator and someone to manage the data they receive, possibly automating the data management.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization’s activities around a focused mission?	✓			OMKM has a Master Plan that was created in 2000 and is currently being updated. This Master Plan and all standard operating procedures are adaptive plans. They also have an Invasive Species Management Plan and a Comprehensive Management Plan.

Does this plan develop timelines for their accomplishments?		✓		There is no set timeline because the plan is adaptive. As new issues arise, the plan is updated. They also actively remove invasive species that are no longer a high priority from the management plan.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			OMKM collaborates with Hawai‘i Ant Lab, a university organization.
Does the organization collaborate with other organizations of different types?	✓			OMKM collaborates with BIISC, a partnership.
Does the organization want to increase collaboration with other organizations?	✓			They would like to increase collaboration because collaboration is necessary when you have limited resources.
Does the organization have interest in working with WPI students?		✓		Potentially. There are a lot of little projects students could do, but the resources right now are very limited.

Appendix C.20: Pacific Rim Conservation

The following section shows the characterization profile and analysis, shown in Table 22 of the Pacific Rim Conservation. All of the information was found through research and an interview with Lindsay Young (L. Young, personal communication, February 23, 2021; Pacific Rim Conservation, 2018; Pacific Rim Conservation, 2019a; Pacific Rim Conservation, 2019b; Pacific Rim Conservation, 2019c; Pacific Rim Conservation, 2019d).

Pacific Rim Conservation (PRC) Characterization Profile:

- **Type:** NP
- **Location:** Honolulu, HI
- **Contact Information:** Lindsay Young / Executive Director/ Email: lindsay@pacificrimconservation.org
- **Date Established:** 2008
- **Number of Employees:** PRC has 20 staff. They have a six person board of directors.
- **Volunteer Opportunities:** PRC has six to seven interns and no volunteers at the moment due to COVID-19. Volunteers usually help on their sea group translocation project.
- **Public Involvement:** The public is not involved with PRC.

- **Total Budget/Funding:** Direct Revenue: $1,139,118, About 20% of their funding budget is from contracts. They have had contracts with U.S. Fish and Wildlife and currently have one with the U.S. Navy.
- **Collaboration/Partners:**
    - PRC manages lands for U.S. Fish and Wildlife Services, specifically their Wildlife Refuge System.
    - PRC also works with the Division of Land and Natural Resources to manage their lands and work with their staff.
    - List of Partners:
        - Papahānaumokuākea Marine National Monument (PNMN), National Fish and Wildlife Foundation, The David Lucile & Packard Foundation, Island Conservation (IC), Kauaʻi Endangered Seabird Recovery Project (KESRP), National Tropical Botanical Garden (NTBG), EarthJustice, Oikonos, American Bird Conservancy, Maui Nui Seabird Recovery Project (MNSRP), U.S. Geological Survey (USGS), Wildlife Conservation Society, Hawaiian Electric Industries (HEI), Hawaiian Airlines, Pacific Cooperative Studies Unit (PCSU) at the University of Hawaiʻi at Mānoa, Pono Pacific, Conservation Metrics, Harold K.L. Castle Foundation, Atherton Family Foundation, National Park Service, U.S. Navy, U.S. Fish and Wildlife Services (USFWS), Department of Land and Natural Resources (DLNR), and Kauaʻi Forest Bird Recovery Project.
- **Goal/Mission:**
    - PRC's mission is to protect and restore native bird populations, ecosystems, and diversity across Hawaiʻi and the Pacifc.
- **Responsibilities:**
    - PRC creates areas of land where predators were removed or controlled to restore habitats and bring back bird species.
    - PRC conducts research related to avian biology, the impact of predators and invasive species, and ecosystem changes to help in future conservation initiatives.
    - PRC also conducts research on the effects of predation on native birds.
    - In the area of conservation, PRC conducts biological surveys and bird translocations. They also construct predator proof fencing. In addition, they restore habitats and control predators.
    - PRC researchers have scientific publications and technical reports.
    - PRC created a Seabird Restoration database that details past, current, and present seabird restoration initiatives around the world.
    - PRC worked on a monitoring assessment of pacific seabirds.
    - PRC determined identified sites where birds were present and prioritized the sites to protect.

- **Management Plan:**
    - PRC adopted a management plan in 2016. PRC has a strategic plan that is reviewed every three years and rewritten every five years.
    - PRC worked on a plan to draw attention to the decrease of Hawaiian birds and their needs.
    - PRC also worked on a plan for the release of the Hawaiian Crow.

Table 22: Analysis of Pacific Rim Conservation

Organization: Pacific Rim Conservation				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			Volunteers usually work on PRC's sea group translocation projects.
Does the organization actively inform the public about its programs and services?		✓		PRC does not work with the public.
Does the organization receive community input about its mission and activities?		✓		The public are not involved in PRC.
Does the organization have opportunities for future student involvement?	✓			PRC has interns and is open to collaborating with students.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			PRC adopted a management plan in 2016 and they have a strategic plan.
Does this plan develop timelines for their accomplishments?			✓	Their strategic plan is reviewed every three years and rewritten every five years but they didn't mention a timeline.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			PRC collaborates with other non-profit organizations, such as the American Bird Conservancy.
Does the organization collaborate with other organizations of different types?	✓			PRC collaborates with state, university and federal organizations.

Does the organization want to increase collaboration with other organizations?			✓	N/A
Does the organization have interest in working with WPI students?	✓			PRC currently works with students from UC-Santa Barbra and would be open to the opportunity with WPI students.

Appendix C.21: U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine

The following section shows the characterization profile and analysis, shown in Table 23, of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine. All of the information was found through research and an interview with Dorothy Alotonga (D. Alotonga, personal communication, February 18, 2021; Animal and Plant Health Inspection Service, 2020; Animal and Plant Health Inspection Service, 2021a; Animal and Plant Health Inspection Service, 2021b; Clark, 2015; El-Lissy, 2015).

U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA APHIS PPQ) Characterization Profile:

- **Type:** F
- **Location:** 3375 Koapaka Street, Suite H-420, Honolulu, HI 96819-1895
- **Contact Information:** Dorothy Alotonga / State Operations Coordinator in the State Plant Health Director's Office
- **Date Established:** In 1975, the North American Plant Protection Organization, APHIS plant health officials, their corresponding officials in Canada and Mexico, and industrial partners began to develop protocols for plant protection and quarantine for safe plant and produce trading.
- **Number of Employees:** USDA APHIS PPQ has a little less than 500 employees.
- **Volunteer Opportunities:** USDA APHIS PPQ has internship and student opportunities, but no general volunteer opportunities.
- **Public Involvement:** There is an email chain that people can sign up to be on. When APHIS is thinking of creating a new regulation, the public will receive an email about it. The public can respond to the email about a possible new regulation. There could be more opportunities for APHIS to engage farmers and growers to understand how they trade. The Hawaiian farmers sometimes have excess products and they would like to sell it, but there are protocols for getting products to the mainland to reduce the risk of spreading pests.

- **Total Budget/Funding:** USDA APHIS PPQ receives funding from the U. S. Treasury.
- **Collaboration/Partners:**
    - In 2003 the USDA APHIS PPQ surveillance program integrated with CBP. Now they would closely together to intercept pests entering or exiting Hawai‘i. They work in the same building and ask each other to look for specific products.
    - The National Plant Board is a group of individual State Plant Regulatory Officials of each state’s Department of Agriculture who get together to discuss their work and goals.
    - The U.S. Forest Service, Hawai‘i Department of Land and Natural Resources, and the HDOA all have intersecting projects with USDA APHIS PPQ.
    - The U.S. Agricultural Research Service, the U.S. Forest Service, the Hawai‘i Department of Agriculture (HDOA), and the University of Hawai’i all provide research to the USDA APHIS PPQ.
    - USDA APHIS PPQ is also invited to speak at annual meetings for the Growers’ Association.
    - The USDA APHIS PPQ is also part of the Coordinating Group on Alien Pest Species. The interactions at CGAPS are mainly information sharing for APHIS.
    - USDA APHIS PPQ has meetings with other groups in regulation positions. The attending groups are from all over the U.S. and they are risk assessment committees.
    - List of Partners:
        - Hawai‘i Department of Transportation- Airports Division (HDOT), U.S. Department of Defense, U.S. Fish and Wildlife Service (USFWS), Customs and Border Protection (CBP), National Plant Board, U.S. Forest Service (USFS), Hawai‘i Department of Land and Natural Resources (HDLNR), U.S. Agricultural Research Service (USDA ARS), Hawai‘i Department of Agriculture (HDOA), University of Hawai‘i (UH), Fruit Grower Associations, and Coordinating Group on Alien Pest Species (CGAPS)
- **Goal/Mission:**
    - The mission of USDA APHIS PPQ is to help citizens, organizations, industries, and government agencies resolve wildlife conflicts and protect agriculture, other natural resources, as well as to safeguard human health and safety. The mission involves trade negotiations, statistical analysis of program success, addressing new outbreaks, developing and implementing new approaches to limit chemical use, and coordinating with other groups to address common issues. Additionally, the mission involves work on animal and plant research in laboratories, literature research, enforcement of USDA APHIS regulations, and participation in the international agreements regarding regulations along with alliances with trading partners.

- **Responsibilities:**
    - USDA APHIS PPQ Wildlife Services works to implement effective strategies that value wildlife, the environment and the resources being protected. They also manage wildlife damages.
    - USDA APHIS PPQ works on specific projects, such as managing wildlife hazards to aviation, protecting corn seed research crops, protecting endangered plants, protecting endangered species and native seabirds, conducting surveillance for wildlife diseases, and controlling invasive species
    - Even though the CBP took over a lot of the surveillance of foreign imports, USDA APHIS PPQ still has plans for planting because produce still comes in from foreign countries, as do seeds and other products for planting.
    - A large part of USDA APHIS PPQ's responsibility is pre-departure plant quarantine. Hawai‘i has pests, such as an abundance of fruit flies that are not on the mainland US, so some fruits are banned and they must enforce these quarantine regulations.
    - USDA APHIS PPQ impacts the market because they can make regulation on foreign products being shipped into Hawai‘i.
    - USDA APHIS PPQ usually works in the field with other people, but COVID-19 is making that difficult.
    - The community outreach USDA APHIS PPQ does is very important because oftentimes if people break the law around plant quarantine, they simply were unaware of the regulation.
- **Management Plan:**
    - USDA APHIS PPQ has a strategic plan for five-year periods. The plan documents the mission, vision, and values of the organization, as well as plans for collaboration and tactics for achieving set goals.

Table 23: Analysis of U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine

Organization: USDA APHIS PPQ				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?		✓		USDA APHIS PPQ does not have volunteer opportunities.
Does the organization actively inform the public about its programs and services?	✓			There is an email chain that people can sign up to be on. When USDA APHIS PPQ is considering a new regulation, the public will receive an email all about it.
Does the organization receive community input about its mission and activities?	✓			The public can respond to the email about a possible new regulation with input.
Does the organization have opportunities for future student involvement?	✓			USDA APHIS PPQ offers internships for students to work in agriculture, science, technology, math, environmental, management, business, and other fields.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			They have a five-year plan.
Does this plan develop timelines for their accomplishments?	✓			Their management plan is on a five-year timeline.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			USDA APHIS PPQ works with other federal organizations such as CBP.
Does the organization collaborate with other organizations of different types?	✓			USDA APHIS PPQ also works with state agencies, university groups, and non-profit organizations.
Does the organization want to increase collaboration with other organizations?	✓			USDA APHIS PPQ is always talking to other organizations.
Does the organization have interest in working with WPI students?	✓			USDA APHIS PPQ is open to it.

Appendix C.22: U.S. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry

The following section shows the characterization profile and analysis, shown in Table 24, of the U.S. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry. All of the information was found through research and an interview with Susan Cordell (S. Cordell, personal communication, February 18, 2021; U.S. Forest Service, n.d. a; U.S. Forest Service, n.d. b).

U.S. Forest Service Institute of Pacific Islands Forestry, Pacific Southwest Research Station (USFS PSW IPIF) Characterization Profile:

- **Type:** F
- **Location:** Hilo, HI
- **Contact Information:** Susan Cordell / Director and Research Ecologist / Email: susan.cordell@usda.gov
- **Date Established:** 1956
- **Number of Employees:** There are currently around 20 official Forest Service employees, but if you include the partners, collaborators, volunteers, and interns that work out of their facility, it would be close to 100.
- **Volunteer Opportunities:** They have both volunteer and professional internship opportunities. They mostly focus on internships. Volunteers can perform tasks such as weeding experiment plots, taking measurements on plots, looking at species growth, creating web pages, and organizing webinars.
- **Public Involvement:** USFS PSW IPIF is starting to do more community-based work. While they are more of a research organization, they are working with communities to do "bi-directional learning" or co-creation of projects. They would like to be more active in terms of citizen science.
- **Total Budget/Funding:** USFS PSW IPIF receives about $10,000 from the Forest Service for their own research, so they try to receive a lot of outside funding from partners and grants.
- **Collaboration/Partners:**
    - The U.S. Forest Service helps with the management of federal lands in and around the Lake Tahoe Basin, and research conducted by USFS PSW IPIF helps to guide Forest Service management practices in these lands.
    - USFS PSW IPIF works with researchers from the California Academy of Sciences to investigate a forested Northern California watershed to determine how controlled fires may help to promote healthier forest ecosystems and reduce the risk of intense wildfires.

    - USFS PSW IPIF's partners or "customers" are mostly land managers within Hawai'i, and the State of Hawai'i Department of Forestry and Wildlife is their biggest client.
    - They currently have a partnership with Arizona State University to study scientific topics from the tops of mountains to coral reefs and integrate the components together.
    - USFS PSW IPIF receives funding from the National Science Foundation, Department of Defense, and USDA.
    - USFS PSW IPIF works with Kupu and ORISE for professional development and interns.
    - USFS PSW IPIF also is a part of the Hawai'i Conservation Alliance.
    - USFS PSW IPIF is next door to the USDA Agricultural Research Service, and they work together on forest pathology and invasive species issues.
    - List of Partners:
        - California Academy of Sciences, Tahoe Science Consortium, Division of Forestry and Wildlife (DOFAW), Arizona State University, National Science Foundation, Department of Defense (DOD), U.S. Department of Agriculture (USDA), U.S. Department of Agriculture- Agricultural Research Service (USDA ARS), Kupu, Oak Ridge Institute for Science and Education (ORISE), University of Hawai'i Hilo, University of Hawai'i at Mānoa, Watershed Partnerships, Laukahi, Hawai'i Conservation Alliance (HCA).
- **Goal/Mission:**
    - USFS PSW IPIF's mission is to Develop the science necessary to support forest ecosystems and communicate the benefit of forest ecosystems to society.
    - The goal of the invasive species research that USFS PSW IPIF conducts is to identify the organisms whose introductions threaten California and Pacific island ecosystems.
- **Responsibilities:**
    - Some examples of research topics USFS PSW IPIF works on are air quality, biological control, climate change, ecosystem processes, fire science, forest genetics, forest management, invasive species, recreation, restoration, urban forestry, tree mortality, water and watersheds, and wildlife and fish.
    - They look at landscapes and decide what strategic investments would go into protecting the high-value conservation areas first. This mostly involves hand pulling weeds and using herbicides.
    - USFS PSW IPIF have also used more creative approaches such as using herbicides from drones.

    - In terms of invasive species management, their research focuses on tools for detection and identification, early response and management if the invasive species becomes established.
    - USFS PSW IPIF focuses mainly on plants and forest pathogens, but also addresses vertebrates and invertebrates.
- **Management Plan:**
    - USFS PSW IPIF does not currently have a management plan. There currently is no USFS national forest in Hawai‘i, so they only serve land managers. Their guiding document, referred to as a “research portfolio” is focused on disturbance mechanisms and how they are changing with climate change, land conversion, and any disturbances that are impacting the forest and forest resources.

Table 24: Analysis of U.S. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry

Organization: U.S. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry				
	Does	Does Not	Don’t know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			USFS PSW IPIF has volunteer opportunities in different areas of work.
Does the organization actively inform the public about its programs and services?		✓		USFS PSW IPIF is more of a research-based organization rather than on-the-ground management and has not started involving the community until recently.
Does the organization receive community input about its mission and activities?		✓		USFS PSW IPIF would like to become more involved with citizen science.
Does the organization have opportunities for future student involvement?	✓			USFS PSW IPIF has had interns in the past.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization’s activities around a focused mission?		✓		USFS PSW IPIF’s guiding document, referred to as a “research portfolio” is focused on disturbance mechanisms and how they are changing with climate change, land conversion, and any disturbances that are impacting the forest and forest resources.

Does this plan develop timelines for their accomplishments?		✓		USFS PSW IPIF does not currently have a management plan.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			USFS PSW IPIF collaborates with other federal organizations such as the USDA.
Does the organization collaborate with other organizations of different types?	✓			USFS PSW IPIF collaborates with state agencies, non-profit organizations, and university groups.
Does the organization want to increase collaboration with other organizations?	✓			USFS PSW IPIF would like to increase collaboration with national programs.
Does the organization have interest in working with WPI students?	✓			USFS PSW IPIF would like to increase collaboration and would be willing to work with WPI students.

Appendix C.23: U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office

The following section shows the characterization profile and analysis, shown in Table 25, of the U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office. All of the information was found through research and an interview with Benton Kealii Pang (B. Pang, personal communication, February 22, 2021; Pacific Islands Fish and Wildlife Office, 2021a; Pacific Islands Fish and Wildlife Office, 2021b; Pacific Islands Fish and Wildlife Office, 2021c; Pacific Islands Fish and Wildlife Office, 2021d; Pacific Islands Fish and Wildlife Office, 2021e).

U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office (USFWS PIFWO) Characterization Profile:

- **Type:** F
- **Location:** Honolulu office: 300 Ala Moana Blvd Rm 3-122, Honolulu, HI 96850
- **Contact Information:** Benton Kealii Pang / Invasive Species Team Manager / Email: Benton_Pang@fws.gov
- **Date Established:** PIFWO was established in the early 1970s. The PIFWO Invasive Species Program was officially established in 2002.
- **Number of Employees:** PIFWO has 70 staff.

- **Volunteer Opportunities:** Currently, PIFWO Ecological Services Branch has no volunteers due to COVID-19. The Refuges Branch has a large number of volunteers to work on projects such as counting seabird populations at Midway.
- **Public Involvement:** The public is important in policy development. PIFWO undergoes public hearings when they list an endangered species or establish a critical habitat. PIFWO programs also undergo a public process under the National Environmental Policy Act (NEPA). The public provides feedback to PIFWO to inform them of any impacts that they may not have considered in their activities and programs.
- **Total Budget/Funding:** PIFWO receives funding to protect and recover native species. They also receive funding to remove invasive plants while restoring native habitats in Hawai‘i and the Pacific. They receive federal and state funding for a variety of invasive species, including the Brown Tree snake, Coconut Rhinoceros Beetle, and Rapid ‘Ōhi‘a Death.
- **Collaboration/Partners:**
    - The invasive species program receives funding from the Office of Insular Affairs in the Department of Interior for their Brown Tree Snake coordinators in Hawai‘i and Saipan to prevent the spread of snakes from Guam.
    - PIFWO receives Aquatic Nuisance Species funding from the U.S. Fish and Wildlife Service for efforts against biofouling and hull fouling.
    - The U.S. Department of Agriculture, Department Of Defense, and Hawai‘i Department Of Agriculture provide funding to manage the Coconut Rhinoceros Beetle.
    - The Department of Defense also provides funding and acts as land managers with the brown tree snake on Guam.
    - PIFWO partners with USGS to send out a rapid response team searching for snakes in Guam.
    - PIFWO partners with the State of Hawai‘i, USGS, and the National Park Service to find the right tool to reduce mosquitos and recover native and endangered forest birds.
    - PIFWO works with BIISC, KISC and OISC as local partners. They work with the Invasive Species Committees and the Hawai‘i Department of Agriculture to deploy teams on the landscape to manage existing problems.
    - They also work with the state to reduce rodents at Kaena Point on O‘ahu.
    - PIFWO is an organization on the Coordinating Group for Alien Pest Species Steering Committee.
    - PIFWO collaborates through sharing or supporting elements of management plans.
    - Benton also mentioned collaborating with the Watershed Partnerships through PIFWO providing funding.
    - To collaborate, PIFWO uses strategic plans, interagency meetings like CGAPS,

and informal meetings.
    - The Office of Insular Affairs holds an interagency meeting with PIFWO, National Wildlife Service, and USGS to talk about getting brown tree snakes off of Cocos Island in Guam.
    - PIFWO works with the American Bird Conservancy, USGS, Hawai‘i DOFAW-Mauna Kea Forest Restoration Project, and San Diego Zoo- Hawai‘i Endangered Bird Conservation Program to protect and recover the palila, an endangered bird in Hawai‘i.
    - PIFWO partially funds the Snail Extinction Prevention Program and the Hawai‘i Invertebrate Program.
    - PIFWO also takes part in the DOI National Irrigation Water Quality Program.
    - List of Partners:
        - Department of Interior (DOI) (Office of Insular Affairs), U.S. Department of Agriculture (USDA), Department of Defense (DOD), Hawai‘i Department of Agriculture (HDOA), U.S. Geological Survey (USGS), State of Hawai‘i, National Park Service (NPS), Big Island Invasive Species Committee (BIISC), O‘ahu Invasive Species Committee (OISC), Kaua‘i Invasive Species Committee (KISC), Coordinating Group for Alien Pest Species (CGPAS), Watershed Partnerships, National Wildlife Services, Hawai‘i Division of Forestry and Wildlife (DOFAW) (Mauna Kea Forest Restoration Project), San Diego Zoo (Hawai‘i Endangered Bird Conservation Program), American Bird Conservancy, Snail Extinction Prevention Program (SEPP), and Hawai‘i Invertebrate Program (HIP)
- **Goal/Mission:**
    - The mission of USFWS is to work with others to conserve, preserve, and strengthen the fish, wildlife, and plants and their habitats to benefit the American people.
    - PIFWO preserves native biodiversity, resources, and the Pacific Islands’ ecological integrity to benefit future generations.
    - The PIFWO Invasive Species Program works to prevent the establishment of introduced invasive species that negatively impact USFWS resources and habitats in the Pacifc.
    - The office mission statement changes every five years, but the national mission statement has stayed the same for 15-20 years.
- **Responsibilities:**
    - PIFWO Ecological Services is primarily focused on endangered species.
    - The Refuges division oversees the land management of refuges in Hawai‘i and the Pacific.
    - The division of Law Enforcement helps Customs and Border Protection inspect

baggage.
    - The division of Wildlife and Sports Fisheries Restoration division gives a lot of funding to states and territories.
    - PIFWO has jurisdiction in the Hawaiian Islands, the northwestern Hawaiian Islands, Guam, Samoa, the Northern Mariana Islands, the Republic of Marshall Islands, the Republic of Palau, and the Federated States of Micronesia, where they do their best to prevent invasive species. However, their main focus is the Hawaiian Islands.
    - PIFWO manages invasive species through early detection and rapid response (EDRR). A rapid response team is established, they survey and monitor the extent of the problem, then they attack the problem.
    - PIFWO does work searching for brown tree snakes in Guam, fencing out ungulates and are looking at developing biotechnology tools to reduce mosquito populations in their sub-alpine areas. They also help reduce rodents at Kaena Point on O‘ahu.
    - PIFWO does outreach when possible and partners with private landowners to restore habitats.
    - PIFWO identifies species on the verge of extinction and helps try to bring them back.
    - PIFWO protects and restores coastal resources.
- **Management Plan:**
    - PIFWO has a strategic plan that is updated every five years. The plan includes focal areas and objectives for staff, such as increased training and hiring diversity. Climate change is also a big component of the plan.
    - PIFWO also helps the State of Hawai‘i develop an aquatic nuisance program and plan.
    - PIFWO looks at other groups’ plans such as the Hawai‘i Interagency Biosecurity Plan and the CGAPS Strategic Plan to help inform the invasive species team plan.
    - PIFWO has habitat conservation plans documented on their website.

Table 25: Analysis of U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office

Organization: USFWS Pacific Islands Fish and Wildlife Office				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?			✓	Currently, the Ecological Services branch of the Pacific Islands Fish and Wildlife Office has no volunteers due to COVID-19. The PIFWO Refuges branch uses volunteers for counting endangered animal populations.
Does the organization actively inform the public about its programs and services?	✓			PIFWO has to inform the public when they list a new endangered species or establish a critical habitat.
Does the organization receive community input about its mission and activities?	✓			The public is important in policy development. The public also provides feedback on PIFWO activities. Also, PIFWO undergoes public hearings to receive feedback when establishing a critical habitat or adding a new endangered species to their list.
Does the organization have opportunities for future student involvement?	✓			PIFWO has a program called the Directorate Fellows Program (DFP), which is an internship program for graduate students nearing graduation.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			PIFWO has a management plan to help them prevent new invasive species from being introduced in the Pacific and to protect endangered species. The strategic plan changes every five years to represent the changing focal areas, projects, and objectives for staff. They often look at other strategic plans, such as the CGAPS Strategic Plan, to inform their own.
Does this plan develop timelines for their accomplishments?	✓			The management plan is normally updated every five years. They have Habitat Conservation Plans documented on their website.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			PIFWO collaborates with other federal government agencies, such as USGS.

Does the organization collaborate with other organizations of different types?	✓			PIFWO collaborates at the local and state level with non-profit organizations, state agencies, and university groups.
Does the organization want to increase collaboration with other organizations?	✓			If organizations share their management plan with PIFWO, they can support either all or parts of their plan and form new collaborative relationships.
Does the organization have interest in working with WPI students?		✓		Benton recommended starting at the local level for project opportunities.

Appendix C.24: U.S. Geological Survey Pacific Island Ecosystems Research Center

The following section shows the characterization profile and analysis, shown in Table 26, of the USGS PIERC. All of the information was found through research and an interview with Gordon Tribble, Ph. D. (G. Tribble, personal communication, February 9, 2021; Pacific Island Ecosystems Research Center, n.d. a; Pacific Island Ecosystems Research Center, n.d. b; Pacific Island Ecosystems Research Center, n.d. C; Pacific Island Ecosystems Research Center, n.d. d).

U.S. Geological Survey Pacific Island Ecosystems Research Center (USGS PIERC) Characterization Profile:

- **Type:** F
- **Location:** 677 Ala Moana Blvd. Suite 615 Honolulu, HI 96813
- **Contact Information:** Gordon Tribble, Ph. D. / Director - USGS Pacific Island Ecosystems Research Center / Email: gtribble@usgs.gov
- **Date Established:** 1879
- **Number of Employees:** USGS PIERC currently has 51 employees: 26 are federal and of those, half are permanent and half are non-permanent. The other 25 are hired by the University of Hawai‘i through the Hawai‘i Cooperative Studies Unit. These employees work for the university, but only on PIERC projects.
- **Volunteer Opportunities:** Due to COVID-19, USGS PIERC currently has six volunteers. USGS PIERC rents two houses inside of Hawai‘i Volcanoes National Park.
- **Public Involvement:** USGS PIERC conducts outreach events every year with local schools, universities, and organizations
- **Total Budget/Funding:** USGS PIERC receives about5.5 million dollars per year. Two-thirds of this funding comes from funding with the Congress appropriations through USGS, which is used to pay the salaries of permanent employees and pay rent. The remaining third comes from other agencies such as the U.S. Fish and Wildlife Service,

Department of Defense, National Park Service, State of Hawai‘i, and Division of Forestry and Wildlife.

- **Collaboration/Partners:**
    - USGS PIERC has cooperative research agreements with the University of Hawai‘i at Hilo. There are people who work for the university but only on PIERC projects.
    - USGS PIERC worked with the U.S. Fish and Wildlife Service, the National Park Service, the State of Hawai‘i, the Division of Forestry and Wildlife, and various groups that do on-the-ground management such as the Watershed Partnerships and Invasive Species Committees to develop a science plan.
    - USGS PIERC also supports on-the-ground management organizations with their knowledge.
    - USGS PIERC periodically has meetings where they get together with the U.S. Fish and Wildlife Service or the National Park Service.
    - USGS PIERC is doing work under an agreement through the Endangered Species Recovery Committee of the State on the native Hawaiian bat.
    - List of Partners:
        - American Bird Conservancy, American Samoa Community College, American Samoa Department of Marine and Wildlife Resources, Auwahi Wind Energy, Bat Conservation International, Bernice Pauahi Bishop Museum, Big Island Invasive Species Committee (BIISC), Cardno, Commonwealth of the Northern Mariana Islands - Department of Fish and Wildlife (DFW), East Moloka‘i Watershed Partnership (EMoWP), Guam Division of Aquatic and Wildlife Resources, Hawai‘i Department of Hawaiian Home Lands (HDHH), Hawai‘i Association of Watershed Partnerships (HAWP), Hawai‘i Conservation Alliance (HCA), Hawai‘i Cooperative Studies Unit (HCSU), Hawai‘i Department of Land and Natural Resources (HDLNR), Hawai‘i Division of Forestry and Wildlife (HDOFAW), Hawai‘i Wildlife Center, Hawai‘i-Pacific Islands Cooperative Ecosystem Studies Unit, Kamehameha Schools, Maui Forest Bird Recovery Project (MFBRP), Mauna Kea Watershed Alliance (MKWA), National Oceanic and Atmospheric Administration (NOAA), National Park Service (NPS), Natural Area Reserve System (NARS), Northern Arizona University, Oregon State University (OSU), Pacific Islands Climate Change Cooperative (PICCC), Pacific Rim Conservation (PRC), Papahānaumokuākea Marine National Monument (PNMN), Pono Pacific, San Diego Zoo Institute for Conservation Research, Smithsonian Institution (SI), National Zoo - Conservation Biology Institute, State Fish and Wildlife Agencies, SunEdison, The Nature Conservancy (TNC), Three Mountain Alliance, U.S. Army, U.S. Army National Guard, U.S.

Coast Guard, U.S. Forest Service (USFS), U.S. Marine Corps, U.S. Navy, University of Hawai‘i Hilo, University of Hawai‘i Mānoa, U.S. Department of Agriculture (USDA) - Agricultural Research Service (ARS), U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)

- **Goal/Mission:**
    - USGS Pacific Island Ecosystems Research Center provides scientific leadership to support national, regional, and local needs to understand, conserve, and manage biological resources in Hawai‘i and other Pacific islands.
    - The goal of Pacific Island Ecosystems Research Center (PIERC) is to provide the scientific understanding and technologies needed to address invasive disturbances and threats affecting species and habitats, and the most effective invasive species management methods.
- **Responsibilities:**
    - USGS PIERC focuses on the protection and recovery of endangered species, as well as understanding and management of invasive species. They also focus on wildlife diseases and landscape management.
    - USGS PIERC does not have any regulatory role within invasive species management. They primarily focus on providing information that land managers can use. They have very strict standards for peer review and scientific integrity.
    - Examples of research conducted by USGS PIERC include the vulnerability of areas to certain invasive species, the dynamics, the ecology, the spread of those invasive species whether they’re plants or animals, and strategies for invasive species management.
- **Management Plan:**
    - USGS PIERC does not have a management plan, as they do not do on-the-ground management.
    - USGS PIERC has a science plan to guide research from 2015 through 2020. This plan addresses the following areas:the ecology of imperiled species, predicting the impacts of invasive species, measuring ecosystem functions and services, modeling changes in ecosystems, developing tools to restore natural resources, and legacy research.

Table 26: Analysis of the USGS PIERC

Organization: USGS PIERC				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			Due to COVID-19, USGS PIERC currently has six volunteers. They rent two houses inside of Hawai'i Volcanoes National Park.
Does the organization actively inform the public about its programs and services?	✓			Through community outreach, USGS PIERC informs the community about their research. They also document publications on their website.
Does the organization receive community input about its mission and activities?	✓			USGS PIERC conducts outreach events in different settings.
Does the organization have opportunities for future student involvement?	✓			USGS PIERC has put aside money to try and set up a one year internship program. They worked with WPI students in 2020 on a project about tracking Coqui Frogs.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			USGS have a science plan (which is now a year out of date) and a finance plan
Does this plan develop timelines for their accomplishments?			✓	We did not obtain this information.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			USGS PIERC collaborates with other federal agencies, such as USFWS.
Does the organization collaborate with other organizations of different types?	✓			USGS PIERC collaborates with university groups, state agencies, and partnerships.
Does the organization want to increase collaboration with other organizations?			✓	USGS PIERC has plans of starting an internship program, but it was unclear if they plan to increase collaboration.
Does the organization have interest in working with WPI students?	✓			Someone would have to identify an area of interest for the project. Kupu and The Pacific Internship Programs for Exploring Science (PIPES) Program at the University of Hawai'i at Hilo were also mentioned as potential collaborators.

Appendix C.25: U.S. National Park Service Region 12- Pacific Islands

The following section shows the characterization profile and analysis, shown in Table 27, of the National Park Service Region 12- Pacific Islands. All of the information was found through research and an interview with Jadelyn J. Moniz Nakamura (J. Nakamura, personal communication, February 12, 2021; National Park Service, n.d. a; National Park Service, n.d. b).

U.S. National Park Service (NPS) Region 12- Pacific Islands Characterization Profile:

- **Type:** F
- **Location:**
    - Headquarters: Main Interior Building 1849 C Street NW, Washington, D.C. 20240
    - O‘ahu: Honouliuli National Historic Site (1845 Wasp Boulevard, Building #176, Honolulu, HI 96818), Pearl Harbor National Memorial (1845 Wasp Blvd. Bldg. 176, Honolulu, HI 96818)
    - Moloka‘i: Kalaupapa National Historic Park (HI 96742)
    - Maui: Haleakalā National Park (Makawao, HI 96768)
    - Hawai‘i: Ala Kahakai National Historic Trail (73-4786 Kanalani Street, #14 Kailua-Kona, HI 96740), Pu‘ukoholā Heiau National Historic Trail (62-3601 Kawaihae Road, Kawaihae, HI 96743), Kaloko-Honokōhau National Historic Park (73-4786 Kanalani St. #14, Kailua-Kona, HI 96740), Pu‘uhonua O Hōnaunau National Historic Park (Hōnaunau, HI 96726), Hawai‘i Volcanoes National Park (HI 96718)
- **Contact Information:** Jadelyn J. Moniz Nakamura / Research Coordinator and Science Advisor / Email: jadelyn_moniz-nakamura@nps.gov
- **Date Established:** 1916
- **Number of Employees:** There are approximately 100 people in the regional office.
- **Volunteer Opportunities:** There are volunteer coordinators in each park who can be contacted if someone wants to volunteer. The person would then identify the area they want to work in. Some divisions, such as the Interpretive and Natural Resources divisions, are easier to volunteer in. Volunteers then receive training about different protocols and are paired up with an employee to get acquainted with the park. After this, the volunteers can be on their own, especially people who come back year after year. Volunteers are as much of the face of the park as the employees. Volunteers will lead groups, talk to visitors, do site visits, help with outplanting, invasive species removal, work in the museum program, help with archives, and learn to do inventory, surveying, and excavation from the archaeology crew, among other activities.

- **Public Involvement:** NPS generally has a good perceived reputation in the public because when the government is shut down, the public is usually upset that the parks are closed. The NPS is focused on reaching out to the millennial and younger generations in the public to get them out to the parks to enjoy nature. The high turnover of people retiring makes providing information in a way that younger generations can connect with even more important. For cultural resources, natural resources, and interpretation projects, NPS consults with community groups and receives feedback from the groups. If a project is at the EA or EAS level, then NPS seeks comments from the broader public and public scoping.
- **Total Budget/Funding:** The NPS receives funding from Congress in various ways. NPS receives base funding for staff salaries, project funding that each park competes for, and funding from allocated gate fees.
- **Collaboration/Partners:**
    - The NPS used to have an easier time hiring staff and had a lot of people ready to do rapid response in case of an emergency, but hiring is currently difficult. Therefore, they have had to be creative with contracting and cooperative agreements with staff outside of the parks to get work done.
    - The NPS works with agencies such as the USGS, USFWS, and USFS. They will also partner with other agencies if there are overlapping issues being addressed. These partnerships often come from CGAPS quarterly meetings.
    - NPS has been trying to increase connections with more non-profit organizations in the community, especially bringing the native Hawaiian groups back into the parks so that they can have more of a voice and a say.
    - List of Partners:
        - Congress, Coordinating Group on Alien Pest Species (CGAPS), U.S. Forest Service, (USFS), U.S. Fish and Wildlife Services (USFWS), and U.S. Geological Survey (USGS).
- **Goal/Mission:**
    - The NPS has a dual mission. The NPS works to preserve and protect resources and perpetuity by keeping the places that have been protected by congress and the United States as they are for future generations. The other part of the mission is to allow the public proper enjoyment and education of the Parks Service lands.
- **Responsibilities:**
    - When funding is available, they will implement specific projects.
    - The NPS cooperative ecosystem study unit involves federal agencies, universities, and non-profit organizations. They pair NPS parks and projects with outside agencies and students. They also do mentoring and internships through this study unit.
    - There are invasive species teams in each park that will help each other and compete for funding.

    - Through the Natural Resources Project, there is a service-wide comprehensive call in which teams present project proposals in hopes of receiving the funding to carry out their project.
    - NPS Region 12 protects nine parks, historic trails and sites, and memorials.
- **Management Plan:**
    - The NPS has general 10-20 year management plans that guide activities. These plans are very broad and cover activities such as where new roads or paths can be constructed and how to maintain them.

Table 27: Analysis of the National Park Service Region 12- Pacific Islands

Organization: National Park Service				
	Does	Does Not	Don't know	Notes
Does the organization have a clearly defined purpose for the role that volunteers have within the organization?	✓			Volunteers will lead groups, talk to visitors, do site visits, help with out-planting, invasive species removal, work in the museum program, help with archives, and learn to do inventory/surveying/excavation from the archaeology crew, among other activities.
Does the organization actively inform the public about its programs and services?	✓			The high turnover of people retiring makes providing information in a way that younger generations can connect with even more important
Does the organization receive community input about its mission and activities?	✓			Depending on the project, community groups may be consulted or the broader public can comment and be scoped.
Does the organization have opportunities for future student involvement?	✓			NPS Region 12 also does student mentoring and internships through this study unit.
Does the organization develop and adopt a written strategic plan to achieve its mission that integrates all of the organization's activities around a focused mission?	✓			The NPS Region 12 has general 10-20 year management plans that guide activities.
Does this plan develop timelines for their accomplishments?	✓			Their plan is on a 10-20 year timeline.
Does the agency network and/or collaborate with other organizations to produce the most comprehensive and effective services?	✓			See the characterization profile for the list of collaborating partners.
Does the organization collaborate with other organizations of the same type?	✓			NPS works with federal government organizations, such as USGS.

Does the organization collaborate with other organizations of different types?	✓			NPS works with partnerships, such as CGAPS.
Does the organization want to increase collaboration with other organizations?	✓			NPS has been trying to make more connections with more non-profit organizations in the community
Does the organization have interest in working with WPI students?	✓			The NPS Region 12 is interested in learning more about the program and working with future WPI students.

Appendix D: Social Network Analysis

Each line represents an interaction on the SNA. The line color-coding corresponds to the degree of collaboration described in Section 3.2. The nodes, or shapes, represent each organization of a specific type: federal government agencies, state government agencies, non-profit organizations, university groups, partnerships, and "other." The blue nodes indicate the organizations we interviewed. The SNA shows a vast network of interacting organizations.

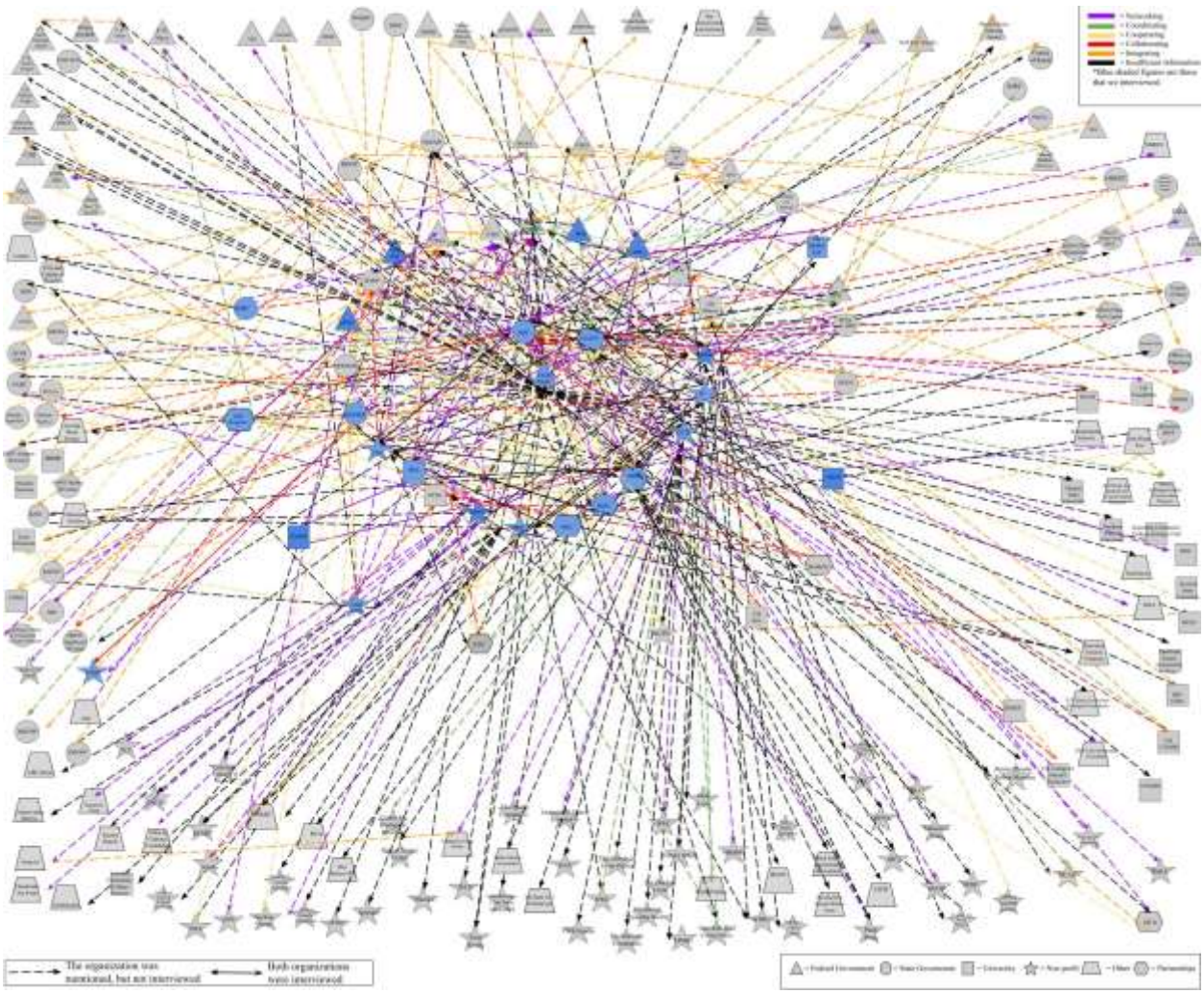

Figure 8: Social network analysis visualizes the degrees of collaboration among the invasive species management organizations included. This SNA is not comprehensive of all the invasive species management organizations in Hawai'i. The organizations with the many known connections are positioned in the center, while organizations with fewer known connections are located on the periphery. To view this SNA in closer detail, click here.

Appendix E: Organization Abbreviations

Table 28: Abbreviations of organizations used in the Social Network Analysis.

Abbreviation	Organization
AG	Hawai‘i Department of the Attorney General
AI	Animal Industry (Division)
AFRC	Department of Land and Natural Resources Hawai‘i, Division of Aquatic Resources, Ānuenue Fisheries Research Station
APHIS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
ASDMWR	American Samoa Department of Marine and Wildlife Resources
BIAN	Big Island Association of Nurserymen
BIISC	Big Island Invasive Species Committee
CBI	Conservation Biology Institute
CBP	U.S. Customs and Border Protection
CCH	Conservation Council for Hawai‘i
CGAPS	Coordinating Group on Alien Pest Species
CNMI DFW	Commonwealth of the Northern Mariana Islands, Division of Fish and Wildlife
CPC	Center for Plant Conservation
CRB Response	Coconut Rhinoceros Beetle Response Team
CTAHR	College of Tropical Agriculture and Human Resources
CTSA	Center for Tropical and Subtropical Aquaculture
DBEDT	Hawai‘i Department of Business, Economic Development, and Tourism
DHHL	Department of Hawaiian Homelands
DHS	U.S. Department of Homeland Security
DOD	U.S. Department of Defense
DOE	Department of Education

DOI	Department of Interior
DOW	Defenders of Wildlife
EMoWP	East Moloka‘i Watershed Partnership
EPA	U.S. Environmental Protection Agency
ESA	Ecological Society of America
ESRC	Endangered Species Recovery Committee
FAS	Foreign Agricultural Service
FOMA NWR	Friends of Midway Atoll National Wildlife Refuge
FDA	U.S. Food and Drug Administration
FOHF	Friends of Hakalau Forest National Wildlife Refuge
GIRC&D	Garden Island Resource Conservation and Development, Inc.
Guam DAWR	Guam Division of Aquatic and Wildlife Resources
HAAA	Hawai‘i Aquaculture and Aquaponics Association
HAL	Hawai‘i Ant Lab
HAS	Hawai‘i Audubon Society
HAWP	Hawai‘i Association of Watershed Partnerships
HCA	Hawai‘i Conservation Alliance
HCAF	Hawai‘i Conservation Alliance Foundation
HCF	Hawai‘i Community Foundation
HCIA	Hawai‘i Crop Improvement Association
HDLNR	Hawai‘i Department of Land and Natural Resources
HDLNR DAR	Hawai‘i Department of Land and Natural Resources, Division of Aquatic Resources
HCSU	Hawai‘i Cooperative Studies Unit
HDOA	Hawai‘i Department of Agriculture
HDOA Plant	Hawai‘i Department of Agriculture, Plant Quarantine

Quarantine	
HDOA Aquaculture Disease Program	Hawai‘i Department of Agriculture, Aquaculture Disease Program
HDOA Plant Pest Control	Hawai‘i Department of Agriculture, Plant Pest Control
HDOH	Hawai‘i Department of Health
HDOFAW	Hawai‘i Division of Forestry and Wildlife
HDOT	Hawai‘i Department of Transportation
HDOT Harbors Division	Hawai‘i Department of Transportation, Harbors Division
HDOT Airports Division	Hawai‘i Department of Transportation, Airports Division
HDOT Highways Division	Hawai‘i Department of Transportation, Highways Division
HENA	Hawai‘i Export Nursery Association
HFBF	Hawai‘i Farm Bureau Federation
HFNWR	Hakalau Forest National Wildlife Refuge
HGG	Hawai‘i Green Growth
HI-EMA	Hawai‘i Emergency Management Agency
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
HILA	Hawai‘i Island Landscape Association
HIMB	Hawai‘i Institute of Marine Biology
HIP	Hawai‘i Invertebrate Program
HISC	Hawai‘i Invasive Species Council

HMGP	Hawai‘i Master Gardener Program
HMLF	Hau‘oli Mau Loa Foundation
HMSPO	Hawaiian Monk Seals Preservation Oahana
Honolulu BWS	Honolulu Board and Water Supply
HPI-CESU	Hawai‘i-Pacific Islands Cooperative Ecosystem Studies Unit
HPU	Hawai‘i Pacific University
HTA	Hawai‘i Tourism Authority
HWC	Hawai‘i Wildlife Center
IC	Island Conservation
IMLS	Institute of Museum and Library Services
IUCN Red List	International Union for Conservation of Nature
ISC	Invasive Species Council
IPIF	Institute of Pacific Islands Forestry
KESRP	Kaua‘i Endangered Seabird Recovery Project
KIRC	Kaho‘olawe Island Reserve Commission
KISC	Kaua‘i Invasive Species Committee
KMWP	Ko‘olau Mountains Watershed Partnership
KRCP	Kōke‘e Resource Conservation Program
KWA	Kaua`i Watershed Alliance
LICH	Landscape Industry Council of Hawai‘i
MCI	Military Customs Inspection Program
MFBRP	Maui Forest Bird Recovery Project
MISC	Maui Invasive Species Committee
MIREN	Mountain Invasions Research Network

MKFRP	Mauna Kea Forest Restoration Project
MKWA	Mauna Kea Watershed Alliance
MNSRP	Maui Nui Seabird Recovery Project
MNBG	Maui Nui Botanical Gardens
MoMISC	Molokaʻi/Maui Invasive Species Committee
NARS	Hawaiʻi Division of Forestry and Wildlife, Natural Area Reserves System
NAVFAC Pacific	Naval Facilities Engineering Systems Command Pacific
NISC	National Invasive Species Council
NOAA	National Oceanic and Atmospheric Administration
NPS	U.S. National Park Service
NSF	National Science Foundation
NTBG	National Tropical Botanical Garden
NWF	National Wildlife Federation
OANRP	Oʻahu Army Natural Resources Program
OEDB	Oʻahu Economic Development Board
OEQC	Office of Environmental Quality Control
OIA	Office of Insular Affairs
OIE	The World Organization for Animal Health
OISC	Oʻahu Invasive Species Committee
OMGP	Oʻahu Master Gardeners Program
OMKM	Office of Maunakea Management
ORISE	Oak Ridge Institute for Science and Education
PBARC	Pacific Basin Agricultural Research Center
PCA	Plant Conservation Alliance
PCSU	Pacific Cooperative Studies Unit

PEPP	Plant Extinction Prevention Program
PICCC	Pacific Islands Climate Change Cooperative
PIFWO	U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office
PNMN	Papahānaumokuākea Marine National Monument
PPQ	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine
PRC	Pacific Rim Conservation
RCUH	Research Corporation of the University of Hawai‘i
SEPP	Snail Extinction Prevention Program
TMA	Three Mountain Alliance
TNC	The Nature Conservancy Hawai‘i
TSC	Tahoe Science Consortium
TWS Hawai‘i	The Wildlife Society Hawai‘i
UH	University of Hawai‘i
UH CTAHR	University of Hawai‘i, College of Tropic Agriculture and Human Resources
UH ERO	University of Hawai‘i, Economic Research Organization
UHSG	University of Hawai‘i’s Sea Grant Extension Program
USDA	U.S. Department of Agriculture
USDA APHIS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
USDA ARS	U.S. Department of Agriculture, Agricultural Research Service
USDA NRCS	U.S. Department of Agriculture, National Resources Conservation Services
USDA NRCS RCPP	U.S. Department of Agriculture, National Resources Conservation Services, Regional Conservation Partnership Program
USFS	U.S. Forest Service
USFS PSW IPIF	U.S. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry,

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USGS PIERC	U.S. Geological Survey, Pacific Island Ecosystems Research Center
WCS	Wildlife Conservation Society
WMWP	Wai‘anae Mountains Watershed Partnership
WRA	The Weed Risk Assessment