Harmonizing Holistic Health & Disaster Relief in Puerto Rico

WPI

AMA PUERTO RICO
APOYO MUTUO AGRÍCOLA

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Abstract

Solidarity helps Puerto Ricans survive natural disasters as federal neglect and failed government response too often leave them unprepared for emergencies. This credo applies to Apoyo Mutuo Agrícola (AMA), who helps small farmers by focusing on holistic health and emergency preparedness, while uniting rural and urban communities. We partnered with AMA to support this mission by improving disaster relief and strengthening AMA's network. Using archival research, semi-structured interviews, ethnographies, and mapping, we created a community-based emergency plan, an AMA website, and identified funding opportunities. From collaborating with AMA and their allies, we found a need for documenting emergency plans to increase clarity and efficiency in disaster response. Additionally, we witnessed how gentrification and corruption are prevalent and disruptive, yet communities are resilient and not backing down.

For more project information and resources: https://wp.wpi.edu/puertorico/projects/mar-apr-2024/ama/

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Executive Summary

Introduction

Mutual aid is necessary for communities in Puerto Rico to survive natural disasters as federal neglect and government failures have left communities unprepared for emergencies. The archipelago is susceptible to hurricanes, drought, earthquakes, landslides, and tsunamis, all of which will intensify or become more frequent due to climate change (Diaz et al. 2022). The federal government responds to these disasters slower and with fewer resources relative to disasters on the mainland. Government failures in Puerto Rico stem from a history of colonialism. Path-dependent policies have not only left Puerto Rico unprepared for disasters, but also led to industrialization of agriculture and gentrification in urban communities.

Our sponsor, Apoyo Mutuo Agrícola (AMA), is a mutual aid group that helps small farmers and urban communities survive these challenges by focusing on holistic health. AMA defines key aspects of holistic health to be consumption of foods grown with agroecological practices, use of medicinal plants, and participation in auricular acupuncture. AMA also provides emergency relief resources and serves as a link between community organizations. Providing support simultaneously in urban and rural communities is a unique aspect of AMA which allows them to connect a larger number of mutual aid groups. We partnered with AMA to create an emergency plan, with a focus on holistic health and connecting urban and rural areas. Through our collaboration with AMA and their allies, we found a need for documenting emergency plans to increase clarity and efficiency in disaster response.

Figure 1 The WPI team collaborating with Martín Cobian and Jessica Santos, the founders of AMA

Objective and Methods

The mission of our project was to help AMA achieve their goal of supporting small farmers and urban communities by completing the following objectives:

1. Strengthen AMA's network for times of emergency by creating an emergency plan.
2. Organize and represent information for allies and community members by developing a website.
3. Identify methods for AMA to increase inventory of supplies after disasters by developing a funding narrative.

Figure 2 "For Sale" sign on one of the buildings in Río Piedras, contrasting with the astronaut artwork in the background (Photo by Grant Burrier)

The methods used to achieve these objectives were archival research, semi-structured interviews, ethnographies, and mapping. We also participated in brigades hosted by AMA's allies, which allowed us to contribute physically in community efforts and build stronger connections. This multi-method approach

increased our project's robustness, as it allowed us to triangulate our findings from each method.

Findings

We have made several key findings regarding the emergency plan, gentrification, corruption, and community resilience.

Our interviews revealed that gentrification, corruption, and poor government disaster relief are prevalent issues in Puerto Rico, resulting in distrust of the government and forcing communities to rely on one another during times of emergency. Many organizations and farmers communicated that they did not have an existing emergency plan for disasters. All interviewees expressed their interest in a documented emergency plan, knowing that it could strengthen emergency preparedness.

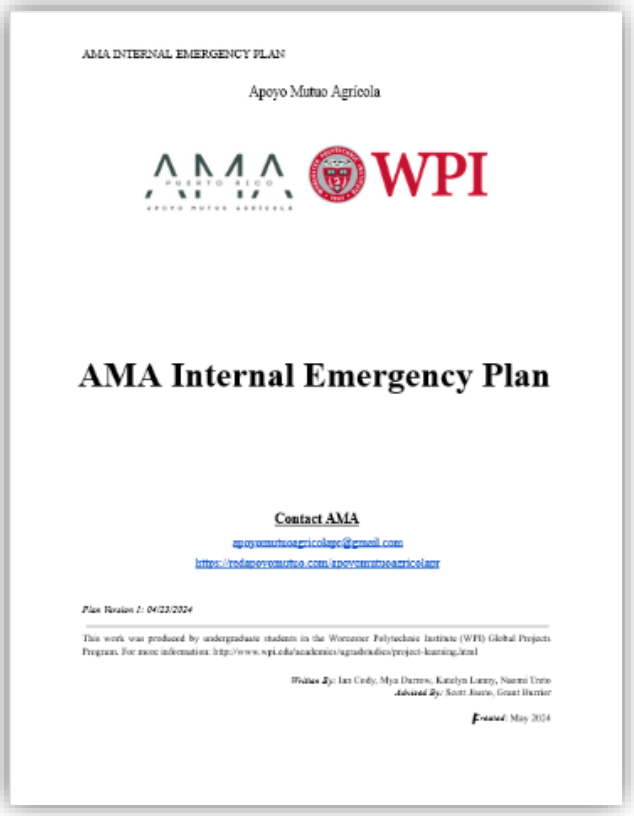
When speaking with various organizations, we heard many issues of insufficient community-focused development. Corruption, gentrification, monoculture, and machismo impact lives and the ability to recover following emergencies. Though such issues remain prevalent and disruptive, AMA and allies illustrated their resilience by fighting back. These community groups stand for their right to a good quality of life by resisting the unfavorable policies working against them.

Figure 3 Mural in Río Piedras paid for by the municipality to distract from the abandoned building it covers

Outcomes

Our team produced three deliverables to reflect the project objectives. The first deliverable was the AMA Emergency Plan as AMA did not have a well-developed, nor documented emergency plan. Three emergency plans were created: AMA Internal Emergency Plan, AMA Rural Emergency Plan, and AMA Urban Emergency Plan. These emergency plans contain the following resources:

- AMA Yearly Emergency Preparedness Plan
- AMA Emergency Preparedness Checklist 2024
- Medicinal Plant Workbook
- Community Census
- Emergency Quick Tips Sheet
- Farmer's Technical Sheet
- Inventory System
- Workshop Planning System
- Mapping System
- Volunteer Management System
- Ally Alert System
- Rapid Response System


AMA INTERNAL EMERGENCY PLAN

Apoyo Mutuo Agrícola

AMA PUERTO RICO APOYO MUTUO AGRÍCOLA

WPI

AMA Internal Emergency Plan

Contact AMA

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Plan Version 1: 04/23/2024

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Created: May 2024

Figure 4 Cover page of AMA Internal Emergency Plan

For AMA's internal plan, we developed a Yearly Emergency Preparedness Plan for AMA's monthly

meetings. As this plan was completed in May, we also developed an AMA Emergency Preparedness Checklist 2024 that is focused on helping AMA start preparations in the next few months, before the height of the hurricane season begins in late summer/early fall. The Medicinal Plant Workbook provides information on plant growing details, benefits, and usages, as incorporating holistic health was a key aspect to the emergency plans.

The Community Census Form was designed for AMA to distribute to community residents to collect information for prioritization of community needs in times of emergency. The Emergency Quick Tips Sheet provides easily accessible information regarding emergency preparedness, directing community members to resources. The Farmer's Technical Sheet outlines information on the calculation of losses, animal preparation, food conservation, drought resources, and compilation of important documents.

The Inventory System was developed for AMA and allies to keep track of ally resources in times of emergency. The Workshop System was created to ensure allies and community members' skills are up to date. The Mapping System was made to identify ally resources and locations quickly. The Ally Alert System and Volunteer Management System were developed to send a mass email to allies and volunteers in case of an emergency. The Rapid Response System was developed to quickly gain information on community members and farmers following an emergency.

We viewed holistic health as the most distinguishing feature of AMA's emergency plan. Other factors included the vulnerabilities of communities and considerations of the unreliable electricity in Puerto Rico into our emergency plan.

The second deliverable we created for AMA was a draft website. The website includes Welcome, Community

Mapping, Allies, News, and Contact pages. The Welcome page offers an introduction to AMA, their members, and their projects. The Community Mapping page includes links to the maps developed with our mapping system for community members to visualize resource distribution in Río Piedras and Lares. The Allies page gives an overview of AMA's allies, their resources, and contact information. The News page provides links to news articles and social media pages relevant to community members. The Contact page utilizes a Google Form to connect website users to AMA members. Together, the five pages organize and represent information about AMA and allies for community members to access.

The third deliverable we created for AMA was a compilation of funding resources that included the following:

- Funding Narrative
- List of Discount and Donation Opportunities
- List of Available Grants

The funding narrative can aid AMA in writing grant applications or donation requests. To complement this narrative, the team compiled a list of relevant companies which donate or discount products for non-profits, and list of agricultural grants available to non-profits in Puerto Rico.

Conclusion and Recommendations

Alongside AMA, the ally organizations are working to strengthen their network to continue the path of resilience. The remnants and presence of colonialism in Puerto Rico has demonstrated the need for these groups to join forces in an emergency plan. Through our time in Puerto Rico, we have only scratched the surface of the struggles Puerto Ricans face every day, but we readily recognize the necessity and importance of community-based organizations.

The limitations our team has faced were limited time, travel restrictions, and the ongoing displacement of Paseo 13, a local ally that supported our work. Our recommendations for future projects with AMA are further collaborations with Paseo 13, integration of plan elements on the AMA website, and development of an ecosystem outside of Puerto Rico. Our recommendations for the Global Experience Office are to reduce barriers regarding travel and to provide housing for WPI students closer to their sponsor's location.

Our team has gained invaluable experiences, research skills, and unique lessons. Puerto Rico is beautiful and resilient, despite it being a modern colony. This project has left us with newfound lessons and reignited passions, and we would love to return to Puerto Rico and are so appreciative of how dedicated our liaisons were in collaborating on the project.

Table of Contents

1.0 Introduction

Walking down the streets of Río Piedras, colorful murals paint the buildings of Paseo de Diego – one can only imagine the once flourishing community. Looking around, it is only us four walking down and staring at the shuttered shops and abundance of for sale signs. The eerie silence contrasts with the massive, vibrant, and thought-provoking art begging the question... where is everyone? Our first view of Río Piedras, and we could already see the impacts of government neglect. Bringing to the forefront of our minds the reason we are here: to support a community-based emergency plan.

Natural disasters heavily impact Puerto Rican's livelihoods as well as their mental, physical, and emotional health. Because of these natural disasters, our community liaison in Puerto Rico, Apoyo Mutuo Agrícola (AMA), is currently developing community disaster relief capabilities for rural and urban areas in Puerto Rico. This is a concern to Apoyo Mutuo Agrícola because of the large negative impact on farmers and all community members in Puerto Rico.

AMA's purpose is to serve the Puerto Rican people with an emphasis on supporting small farmers by providing knowledge of agriculture and healing. Through serving and educating the local farmers, AMA helps communities transition to sustainable agriculture. AMA was formed following the impact of Hurricane Fiona to help small farmers recover from the damage to their land as well as their physical and mental health. To support the farmers, Apoyo Mutuo Agrícola provides alternatives to healthcare and works with "community organizers, educators, [and] healers" to provide farmers with a way to heal and cope (Apoyo Mutuo Agrícola PR, n.d.). Apoyo Mutuo Agrícola is a smaller project within the larger Mutual Support Network of Puerto Rico. The project was intended to help AMA achieve their goal of advancing their

disaster relief efforts and supporting small farmers' business and health by building community connections, a virtual resource hub, and identifying possible spaces for growth. To build our background on issues faced by AMA, we researched the question: “Under what conditions can community-based and trauma-informed disaster responses improve outcomes compared with government-led relief efforts?”.

Our research question is relevant to mutual aid groups, policymakers, and citizens. Mutual aid groups hold an interest in approaches to disaster relief as research on the topic can identify what resources communities currently lack and how to assist communities most effectively in times of emergency. Policymakers hold interest as funding for emergency planning may come from government budgets. More importantly, if done correctly, emergency planning can save and enhance the lives of the citizens represented by the policymakers. Furthermore, trauma-informed disaster relief is of importance to citizens as previous disasters have caused mental and physical trauma in their lives. Many citizens believe that if involved parties are cognizant of this trauma, disaster planning will be more effective.

Following research on disaster relief approaches, this paper explains how we built a relationship with AMA and collaborated to plan and execute the following objectives:

1. Strengthen AMA’s network for times of emergency by creating an emergency plan.
2. Organize and represent information for allies and community members by developing a website.
3. Identify methods for AMA to increase inventory of supplies after disasters by developing a funding narrative.

2.0 Literature Review

Puerto Rico's location and geography make the archipelago susceptible to natural disasters such as hurricanes, drought, earthquakes, landslides, and tsunamis, all of which require significant preparation and response to mitigate negative effects. Hurricanes and other climate-driven disasters are predicted to intensify due to human-caused global warming, requiring even more preparation. After outlining how climate change will affect natural disasters and agriculture, we will explore different opinions on how to approach disaster response and preparation. This paper focuses on the three conceptual models commonly discussed by scholars – a centralized government model, a participatory community-led model, and a trauma-informed response. There are strengths and limitations to all the models; however, we argue adding a trauma-informed approach to government-led and community-led approaches contributes to communities being more connected and supported before disasters, which aids during disasters, as communities are more resilient.

2.1 Environmental Considerations

2.1.1 Climate Change

Human-caused carbon emissions have resulted in large-scale changes to the earth's climate, which is greatly affecting Puerto Rico's local climate and environment. In this section, we will discuss rising surface air temperature, changing precipitation patterns, rising sea levels, ocean acidification, and increasing intensity of tropical cyclones, which are directly linked to global climate change (Diaz et al., 2022). The extent to which surface air temperatures have risen in Puerto Rico

depends on the elevation and time of day analyzed, with the maximum increase between 1950 and 2000 being 1.6 [0.9 to 2.2] °C at sea level, measured at nighttime conditions (Diaz et al., 2022). Projections for future surface air temperature change in Puerto Rico range from "4.5°C for a lower emission scenario to 7°C for an extremely high emission scenario" (Diaz et al., 2022).

Though no shifts in annual rainfall are evident between 1925 and 2020 in Puerto Rico, there has been an increased variability in wet season rainfall since 2000. Recent drought has been associated with the wet season variability which raises concern, especially when considering future precipitation in Puerto Rico is predicted to decrease by more than 20% by mid-century due to increasing greenhouse gas emissions (Diaz et al. 2022). As we will discuss below, this increased variability of rainfall and drought conditions can negatively impact agriculture.

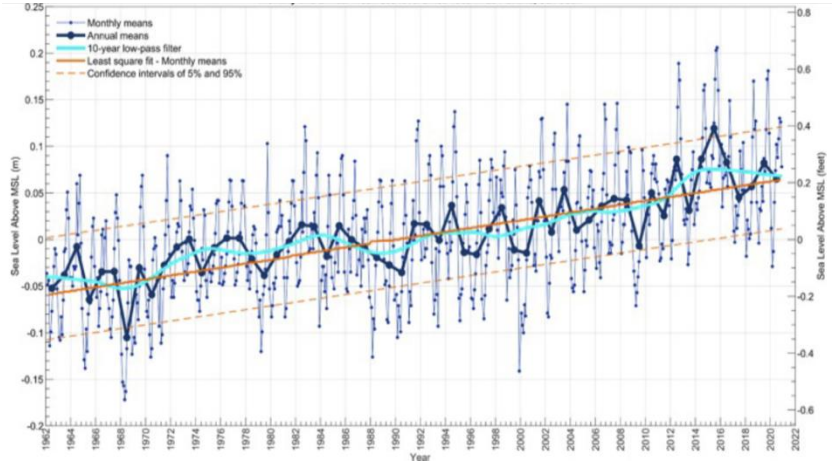

Figure 5 Monthly and annual mean sea level since 1962 in La Puntilla, San Juan (Diaz et al. 2022)

The mean annual sea level has risen 0.4 feet from 1962 to 2022 in San Juan, Puerto Rico, as seen in Figure 5. Sea levels in Puerto Rico are predicted to rise 2.72 feet by 2050 in the most extreme scenarios, posing great threats to Puerto Rico's low-lying and urbanized coasts (Diaz et al. 2022). In Puerto Rico, oceans have absorbed 26-30% of all CO_2 emissions leading to a 0.017 ± 0.0002 units/decade decrease in seawater pH, "moreover, the seawater concentration of calcium carbonate minerals has decreased by about 1.7% in the last decade, making calcification more difficult for marine organisms..." (Diaz et al., 2022). These changing sea conditions have made it harder for sea-life to survive in Puerto Rico's oceans (Diaz et al., 2022).

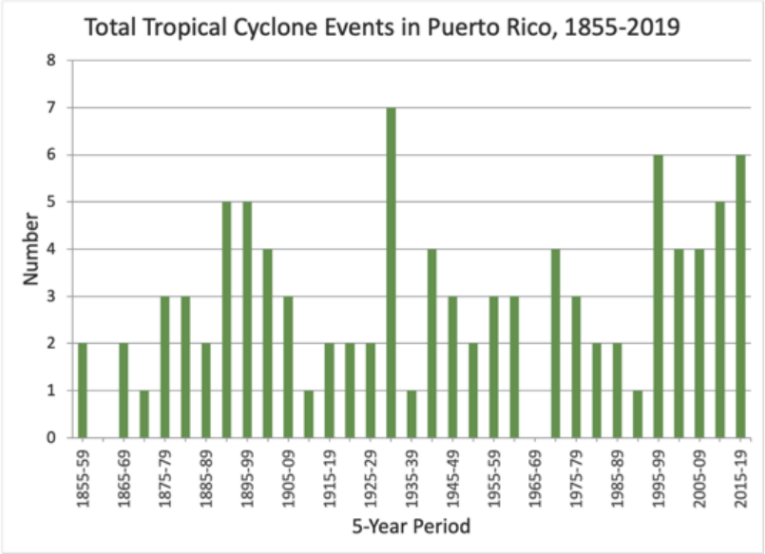

Figure 6 Tropical cyclone events in Puerto Rico, 1855-2019 (Diaz et al., 2019)

Tropical cyclones are rotating, low-pressure systems which developed in tropical or subtropical weathers and can be further classified into, tropical depressions (wind speeds less than 39 mph), tropical storms (wind speeds 39-73 mph)

and hurricanes (wind greater than 74 mph) (Diaz et al., 2022; NOAA, 2023). Figure 6 shows there is not a precise detectable trend in tropical cyclone frequency due to climate change between 1855 and 2019. However, from 1995 to 1999 and 2015 to 2019 there has been a spike in tropical cyclone frequency. Additionally, there is high confidence that the frequency of categories 4 and 5 hurricanes will increase due to global warming (Diaz et al. 2022), causing concern as hurricanes are among the most destructive disasters Puerto Rico faces (U.S. Department of Agriculture). Moreover, hurricanes have long term environmental impacts as they can increase forests' vulnerability to drought (Smith-Martin et al., 2022).

The destruction caused by climate driven natural disasters renders adequate disaster response vital to Puerto Rico. Moreover, diverse community needs must be considered in this response. For example, communities most susceptible to the impacts of rising ocean levels, such as urban centers on the coast, will require flood protection. Meanwhile, communities most susceptible to drought, rural farming centers, will require resources to protect their crops (Diaz et al. 2022). Furthermore, low-income communities in both rural and urban areas will be most susceptible to any disaster as they receive less aid for disaster preparation and generally are less likely to have the savings and the insurance needed to rebuild (Diaz et al. 2022). Considering the aforementioned data, Puerto Rico will face an increased need for disaster response and relief efforts must include mechanisms to protect poor, marginalized communities.

2.1.2 The Importance of Sustainable Agriculture

Since the Great Depression, the U.S. federal government has had a particularly large impact on the characteristics of individual farms through its subsidization and industrialization of agriculture. They aimed to increase the size of farms

and decrease the number of owners. Particularly during the administration of U.S. Secretary of Agriculture Earl Butz (1971 to 1976), this "get big or get out" mantra put pressure on farmers to adhere to mechanization and rationalization of farming, pushing millions of farmers out of work (Lakhani, 2023; Wurtz, 2023). So much so that, in the U.S., the farming population had an average loss of half a million farmers per year for 41 years. This drop led to the U.S. Census Bureau's decision to stop counting the number of Americans living on farms, claiming this population to be statistically insignificant (Berry, Wendell, 2004). According to scholars, these large corporations have managed to grow and evade any form of accountability despite their deliberate harm to communities, consumers, and the environment (Berry, Wendell, n.d.; Wurtz, 2023). With policies and leaders prioritizing profit, in the food industry, "the overriding concerns are not quality and health, but volume and price" (Berry, Wendell, 2004).

Such interests have only served to contribute to health and waste problems, with marginalized communities receiving the brunt of the impact, due to disproportionalities in socioeconomic power (Bullard, n.d.). More specifically, marginalized communities remain at substantial risk for these negative impacts of agribusinesses as one scholar notes that such communities will likely also suffer from unemployment and poverty (Bullard, n.d.). The innovations of these large corporations (bioengineering, patenting, transportation) will only continue the increase in the cost of food with little adjustment to its quality, making it more expensive for the impoverished population to be well nourished (Berry, Wendell, 2004).

While agribusinesses provide the benefit of large production scale, the reallocation of farming to communities allows the opportunity for a more sustainable agriculture system. This concept of sustainable agriculture can be defined as

"[meeting] society's food and textile needs in the present without compromising the ability of future generations to meet their own needs" (Doval, 2018). By shifting consumption of locally grown food, consumers will have a greater influence over production and access to higher quality and purity food. This community-driven agricultural production assists in the reduction of food costs, increased income to local farmers, and a sustainable, dependable supply of food, as outlined by one scholar (Berry, Wendell, n.d.). These local impacts contribute to the overall aim of preserving "ecological diversity and integrity, and the renewal, on sound cultural and ecological principles, of local economies and local communities" (Berry, Wendell, n.d.).

In the case of Puerto Rico, it is important to recognize that the island only produces 10% of its domestic food supply, a remnant from its time as a Spanish colony. During this time, local agriculture was largely focused on the exportation of coffee, tobacco, and sugar to increase profit margins for Spain (Pierce Flores et. Al, 2009). Following its acquisition by the U.S., Puerto Rico suffered economic blows and faced pressures to continue an agricultural model that emphasized the export of cash crops. The devaluation of the Puerto Rican currency, the peso, to sixty cents, allowed American sugar corporations to cheaply purchase of farmland and create large plantations (Zambrana, 2021). These plantations were typically owned by absentee owners, putting many small Puerto Rican farmers out of business. The emphasis on agricultural exports reduced the supply of land used to meet domestic consumption, raising the price of domestically produced agricultural products. Also, increasing prices, the Jones Act in 1920, required foreign ships to dock at a continental U.S. port before docking in Puerto Rico, the cost of production increased due to the higher feed prices, meaning an increase in meat, egg, and milk prices. These economic hardships caused a migration of Puerto Ricans from rural to urban areas in search of work in factories to maintain a livable wage (Bresette et al., 2022).

With a decrease in local farmers as well as the growing American focus on large-scale farming, monocultures, the cultivation of a single crop in a given area, increased as exportation was heavily encouraged and favored (Ayala, n.d.). Monoculture remains a favored agricultural principle because insurance companies require one acre of the same variety of plant to receive farmer insurance, likely due to the difficulty in calculating crop loss for smaller farms. While this model may work for the mainland U.S., where the average farm is 445 acres, this model is unsuitable for Puerto Rico where typical farms range from 0-10 acres (USDA, 2022; Bresette et al., 2022). These policies impact farm recovery following disasters as there is no or little financial assistance available for small-scale farmers. Additionally, it is important to note that even if the farmers own more than one acre, most have a variety of crops planted, which does not adhere to the monoculture requirement for insurance (Bresette et al., 2022).

Agroecological practices work to produce in harmony with the planet and its resources by using what is given by the land and prioritizing the health of the soil. Agroecological practices include contour plowing, crop rotation, minimizing pesticide usage, organic fertilizer, and agroforestry (Holt-Giménez, n.d.). These practices are merely examples of techniques used in agroecology as it is important to understand that the variation of techniques used is dependent on the needs of the lands being used. Agroecology, when using techniques compatible with the land, has been shown to build resilience in the rise of climate change (Carolina et al., 2024). By incorporating agroecological practices, Puerto Rico's agriculture can be more sustainable and resilient in the face of rising natural disasters.

The emergence of agroecological practices in Puerto Rico has been on the rise following Hurricanes Irma and María in 2017 (All About Food, n.d.). These consecutive storms wiped out nearly 80% of Puerto Rico's agricultural industry,

forcing many farmers to either stop production or leave the island altogether (All About Food, n.d.; NowThis Impact, n.d.). Along with its own production coming to a halt, Puerto Rican port closures stopped food imports, causing large food shortages across the island as imports make up 90% of its food supply (NowThis Impact, n.d.). Food insecurity has been a consistent issue in Puerto Rico, as imported food is more expensive, making it especially difficult for marginalized communities to afford the price of eating healthily (All About Food, n.d.). To combat these vulnerabilities, Puerto Ricans feel that if they can feed themselves, they can free themselves, promoting the idea of self-sustaining, local food production on the island (All About Food, n.d.).

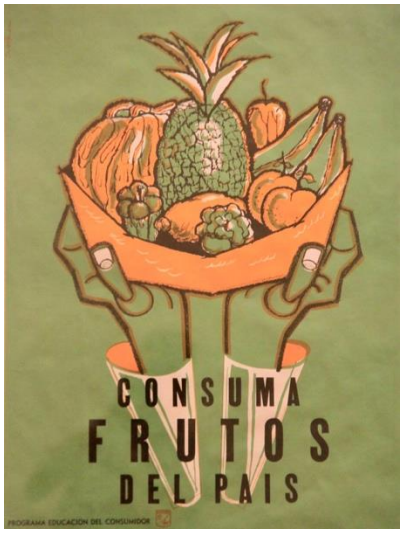

Figure 7 Artwork titled "Consuma Frutos del País (1956)" by Santos René Irizarry, located in Museo de Arte de Puerto Rico. This artwork title translates to "consume fruits from your country" (Photo by Grant Burrier)

This shift back to local agricultural production would also assist the economy, as it would decrease food costs and support local farmers, resulting in an increase in employment and government tax revenue (All About Food, n.d.). However,

with the current climate crisis, landslides and hurricanes will become more frequent as well as increased variability in rainfall, holding the potential for destruction of agriculture, a factor of importance when selecting agricultural practices (Diaz et al., 2022). As seen with Hurricane Mitch, Nicaraguan farms that "protected soil and implemented agroecological practices recovered much quicker following the storm" (NowThis Impact, n.d.). One study examined the impact of sustainable land management systems (agroecological practices) on agroecological resistance, by analyzing indicators such as topsoil, vegetation, landslides, and erosion. It was found that these practices have more topsoil, less erosion, more vegetation, and lower economic losses as compared to conventional farming practices. Agroecological farms were also effective at building and conserving soil, water, and vegetation over time (Holt-Giménez, n.d.).

2.2 Approaches to Disaster Relief

In this section, we discuss the strengths and weaknesses of three common approaches to disaster relief. These disaster relief approaches include government-led, community-led, and trauma-informed.

2.2.1 Government-Led Disaster Response

The U.S. federal government can represent an effective mobilizing disaster relief force due to the vast resources and networks at its disposal. The main source of U.S. federal financial assistance after disasters comes from the Disaster Relief Fund (DRF) which is managed by the Federal Emergency Management Agency (FEMA) (Sperl, 2022; Painter, 2024). The total budget allocated to the DRF between the years of 1992 and 2021 was $381 billion, 44% of which was used for hurricanes (Sperl, 2022). In 2005 alone, the DRF was budgeted $68 billion in response to hurricanes Katrina, Rita, and Wilma (Sperl, 2022). Additionally, FEMA receives budgeting from other appropriations (Painter, 2024).

FEMA can use their budget in many ways, such as repairing infrastructure, clearing debris, providing critical services, covering property costs, and mitigating future disasters (Sperl, 2022). Aside from FEMA's monetary resources, they possess eight distribution centers to rapidly distribute food and water during natural disasters (FEMA, 2023). Furthermore, FEMA employs more than 20,000 people who possess logistical knowledge and experience (FEMA, 2023). FEMA coordinates their response to natural disasters through the Logistics Systems and Logistics Operations divisions of the agency (FEMA, 2023). Despite these logistical resources, bureaucratic delays can delay the emergency response (Office, 2023; Santana, 2024). Additionally, though led by FEMA, the federal response to disaster is split across 30 entities (Office, 2022). This divided

response leads to challenges, especially when federal, state, and municipal governments collaborate, "state and local officials ... said that they experienced challenges navigating multiple federal recovery programs, including their differing requirements and time frames; multiple federal authorities; and limited data sharing" (Office, 2022).

Positive examples of the FEMA allocating their expansive resources in at-risk communities have allowed some government officials and journalists to favorably assess current disaster preparation from the U.S. federal government (Office, 2022; Manuele & Haggerty, 2022). A recent FEMA program known as the Building Resilient Infrastructure and Communities (BRIC) is aimed to build resilience in communities that will be most affected by climate-driven disasters. Unfortunately, wealthy at-risk communities receive the most funding from programs like BRIC, which discourages equity and inclusion (Manuele & Haggerty, 2022; Hersher & Kellman, 2021). Furthermore, wealthier communities possess better life and property insurance (Gropper & Kuhnen, 2021), which renders federal assistance more important in poor communities. Despite the U.S. federal government's expansive resources, inequitable funding is only one of many instances in which poor and marginalized communities receive unfair treatment.

The U.S. government does not distribute knowledge or resources fairly when it comes to disaster preparedness or response as seen in the aftermath of Hurricane Katrina (Eisenman et al., 2007). In New Orleans, a long history of segregation and racial inequality perpetuated racialized and unequal public policy (D. Bullard, R., 2009). A study was conducted to interview people who had evacuated to Houston, Texas and were majority Black and from low-income communities (Eisenman et al., 2007). This study concluded that poorer communities in the U.S. are more at risk of not being prepared before a natural disaster due to the government's lower education and infrastructure investment in poorer communities.

The federal government did not make the disaster outcomes clear to the poorer community in the case of Hurricane Katrina and caused many people to not evacuate when they needed (Eisenman et al., 2007). Out of 400,000 New Orleans residents, 112,000 did not have access to a car and could not evacuate to a safe distance (Brinkley, 2007). During Hurricane Katrina, toxic chemicals and over 7 million gallons of oil were spilled, largely affecting black communities along a river corridor between Baton Rouge and New Orleans (D. Bullard, R., 2009).

Years after Hurricane Katrina, the Environmental Protection Agency has since "failed to implement even the basic requirements of Clinton's executive order on environmental justice," (D. Bullard, R., 2009). As described by the Department of Energy, "Environmental Justice is the fair treatment and meaningful involvement of all people... with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies," (DOE, n.d.). The government's failures in disaster planning and response have disproportionately affected communities of color due to histories of racial inequity and colonization which ultimately pushes people to seek more community-focused aid.

Puerto Rico has faced a lot of the same challenges with the federal government's response to hurricanes. The adverse effects of emergency response and planning is a result of the United States' neglect and Puerto Rico's history being a Spanish colony. Currently, Puerto Rico is not a U.S. state, but a territory (Weiss 2019). Puerto Ricans are U.S. citizens eligible for the draft, but only have one non-voting representative. The Spanish did not develop Puerto Rico and did not give independent power to Puerto Ricans, as the island was a colony: a way for the Spanish to make money and have control in the Caribbean (Flores, 2009). Currently, the U.S. federal government has been slow to incorporate community-led organizations and has pushed for the privatization of government services, limiting the government's ability to respond in times of crisis. The

federal response to disasters in Puerto Rico is failing its citizens by not providing them with proper resources. Instead of stepping up themselves, the government passed the Public-Private Partnership Act (Act 29-2009) that allows private companies to "optimize" government services (Home, n.d.). This act has only worsened the hardships that hurricanes have on Puerto Ricans, specifically in the energy sector.

In 2017, Hurricane Maria hit and left the entire island without power for two weeks due to the central electric power system being down (Laughland, 2018). The failed grid left many Puerto Ricans without power for over 10 months (Laughland, 2018). Puerto Rico Electric Power Authority (PREPA) was in control of the power system of Puerto Rico, and it was in disarray before and after Hurricane Maria hit (Campbell, R. J., 2017). PREPA attempted to create a plan for long-term recovery; but, in 2018, Governor Ricardo Rosselló announced PREPA's privatization plans (Antonetty, A. D. R., 2023). LUMA, a private company, took over the power distribution for Puerto Rico; yet, power issues persisted due to damage, poor conditions of infrastructure, and a continued reliance on oil for energy production (Antonetty, A. D. R., 2023). Some Puerto Ricans have decided to live off the energy grid to avoid the constant outages (Antonetty, A. D. R., 2023).

Puerto Ricans have experienced poor American emergency response since the beginning. In 1899, Hurricane San Ciriaco hit Puerto Rico within a year of the control changing from Spain to the United States (Schwartz, 1992). The towns and cities in Puerto Rico did not have the supplies to support communities, nor did the island have the resources to support Puerto Ricans. Puerto Rico then reached out to the United States for help. Instead of deciding to provide immediate relief, the United States made Puerto Rico change their municipality administrations and hold elections as well as divide the island into 12 districts (Schwartz, 1992). Obviously, these administrative efforts did little to address the immediate emergency

needs. This poor emergency response performance demonstrates elements of path dependency that are still prevalent in the modern day. The United States often does not provide resources unless all other resources in Puerto Rico have been exhausted (Painter, 2024). To access resources like FEMA, a place hit by disaster must prove that the resources of the town or city have reached their limits, then prove the resources of the state have reached their limits, only then are federal resources available (Painter, 2024). This process takes time, but also shows that local resources also have their limits.

The Puerto Ricans that need the most help during disasters are predominantly Black and Brown people that live in poor communities. It is clear the United States disaster response on the mainland shows a lack of proper inclusion for minoritized groups and it is no different in Puerto Rico (Eisenman et al., 2007). While ignoring the needs of vulnerable populations, the government has showered more attention on wealthy, white mainlanders, creating a "tax haven" for people seeking to move to Puerto Rico (Sampas, J., 2015). The government incentives for the wealthy further exacerbates the inequities of wealth and disaster relief, as people moving from the mainland generally have more money yet receive a disproportionate share of disaster relief (Bianca Graulau, 2021).

On one side, there are federal resources accessible in large quantities but not well distributed – demonstrating the government's top-down approach. On the other, there are local resources which can be distributed to the community but are generally in smaller quantities, fragmented, and in a bottom-up approach. There is a lot of distrust in federal disaster response, resulting in some Puerto Ricans turning to community-based approaches.

2.2.2 Community-Based Response

Community-based responses primarily focus on how communities can provide relief for their own disasters. Scholars of this school of thought generally agree that the existing context of communities is the driving force for community-based solutions, meaning that a community's response can only be as strong as the community itself (Li et al., 2022; Santiago Ortiz et al., 2022; Stier & Goodman, 2007). More specifically, these scholars fixate on how inadequacies in government responses have illustrated the dire need for the community to ultimately step in to address problems. In the case of Puerto Rico, which has been experiencing an economic depression since 2006, the relentless occurrence of disasters only exacerbates these prevalent issues, such as their poor fiscal and infrastructure situations. The United States' failure to rebuild Puerto Rico's infrastructure quickly became recognized as a major issue as the wake of Hurricane María left, on average, homes without electricity for an average of 84 days and water for 68 days; though, in marginalized communities, many remained without access to electricity for up to a year following María (Contreras & Niles, 2022; Santiago Ortiz et al., 2022).

This unfortunate commonality among communities struck with disaster is that socioeconomic inequalities affect the response treatment received, a point one scholar highlights in "diversity in access and privilege exists even in wealthy communities" (Li et al., 2022). These existing inequalities are especially vital when working within a community. This understanding is natural for community-based aid initiatives as they have vast experience with such complex contexts (Contreras & Niles, 2022). While technically defined as the sharing of supplies such as personnel and equipment, mutual aid revolves around solidarity. These scholars highlight the necessity of such aid, saying that it is "solidarity, not charity" and for community members, it is a matter of survival (Li et al., 2022; Santiago Ortiz et al., 2022). This approach ensures

collaborative efforts to maintain long-term change, which promotes equality as it accounts for all community members' voices and focuses on a bottom-up approach. One scholar takes note of how this allows for the prioritization of diverse perspectives and the community's needs (Li et al., 2022).

These community-led efforts can increase community resilience and social capital. These scholars define community resilience as "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaption in constituent populations after a disturbance" and social capital as "a set of social networks that include trust, reciprocity, common rules, norms, and public engagement." The incorporation of social capital provides the overall outcome of resilience as it bridges access to information and resources, or more generally it allows for reallocation of existing resources (Delilah Roque et al., 2020; Petrun Sayers et al., 2023). The usage of mutual aid in disaster response is vital to ensuring the needs of the community when the existing system has let them slip through the cracks, while actively promoting sustainable changes. Such changes include the development of community resilience as seen in the growth of friendship between community members. Specifically, community members tend to view each other more positively after helping each other through a particularly difficult moment like a natural disaster.

While community-based mutual aid has clear positive results, it is important to discuss its shortcomings. As this approach is deeply rooted in being community-led, some scholars express concerns about unclear community definitions. These murky definitions often lead to "incorrect community assumptions" as well as an overall result of invalid findings of these community-driven initiatives, a likely cause of the minimal exploration of how community-based activities are made and employed (Contreras & Niles, 2022).

In addition to a lack of organizational management and personnel, community-based mutual aid groups are faced with the issue of sourcing physical resources such as equipment and supplies (Contreras & Niles, 2022). This feat can especially cause concern in the case of Puerto Rico as the Jones Act strains time and cost efficiencies for supply sourcing, as it increases the time and cost of importing products (Dietrich et. al, n.d.). It is evident that community-based organizations require strong planning and prioritization of available resources to achieve similar results as larger organizations. The EMAC is an agreement between the continental U.S., U.S. Virgin Islands, and Puerto Rico, which facilitated the movement of an unprecedented amount of mutual aid to disaster areas. Though EMAC's resources outgrow the possibility for community-based groups, EMAC lacks the personal touch to always fulfill community needs (Stier & Goodman, 2007).

Aside from supplies, community groups also struggle with the difficulty in personnel, specifically the hardships of sourcing community volunteers while the community suffers from horrific disasters. These volunteers, trained or not, carry the burden of the community's needs in addition to their personal experience of the disaster they are struck with (Contreras & Niles, 2022). If untrained, these volunteers are at a greater risk of experiencing impairment to concentration and an inability to work due a lack of preparedness to deal with the high levels of stress and trauma (Rosenberg et al., 2022)

Following the disaster of Hurricane Maria in 2017, the delay and lack of organization in disaster relief by the U.S. government was evident and felt by many across the island. Upon this realization of FEMA's inadequate response, namely the failure to properly distribute food and water as well as to purchase a sufficient supply of tarps (FRONTLINE, n.d.), Puerto Rican citizens took matters into their own hands to bridge this gap. These community-based mutual aid groups quickly became known as Centros de Apoyo Mutuo, CAMs, translating to Centers of Mutual Aid. Scholars agree that these

community-centered relief efforts are natural and almost instinctive, as such forms of solidarity are not new to Puerto Rico given its history of unjust and unequal treatment (Mutual Aid and Disaster Justice, 2022; Dietrich et. Al, n.d.; Vélez-Vélez & Villarrubia-Mendoza, 2021). Although, some disaster response experts found this concept of neighbors helping neighbors to be a ground-breaking idea, showing just how out-of-touch disaster relief programs can truly be (Dietrich et. al, n.d.). CAMs have assisted their communities by "organizing and conducting debris-cleaning operations, opening pathways in hard-to-reach communities, distributing food supplies and water; and allocating and installing blue tarps in people's homes" (Vélez-Vélez & Villarrubia-Mendoza, 2018). While these emergency responses have been pivotal in closing the gap to post-disaster recovery, many CAMs also aim to self-sustaining communities through their work in agriculture, holistic health, and energy sourcing. The overall hope is to address the cause of the existing socioeconomic issues that are often exacerbated by government treatment and the frequency of natural disasters, shifting away from the assistentialistic nature of the U.S. government (Vélez-Vélez & Villarrubia-Mendoza, 2018).

Figure 8 A mural from Paseo de Diego with more murals in the background (Photo by Grant Burrier)

2.2.3 Trauma-Informed Approach

Additionally, some scholars advocate for a trauma-informed approach to disaster response, such as Heather Rosenberg et al. (2022) and Quinn et al (2022). This trauma-informed approach can be incorporated by both government-led and community-led models.

After natural disasters, community members often experience trauma after seeing the destruction from disasters and carrying the burden of the community's needs, as stated earlier. Trauma is the emotional response after a terrible incident

occurs, such as a natural disaster (Babbel, 2010). Natural disasters often traumatize large populations, resulting in symptoms of survivor guilt and Post Traumatic Stress Disorder (PTSD). Typically, community members will feel shock, which can lead to feelings of numbness or denial. The American Psychological Association lists the common symptoms of trauma: intense, unpredictable feelings, such as mood swings, anxiety, and depression; flashbacks; confusion; sleep/eating issues; fear of another natural disaster occurring; challenge in interpersonal skills; and physical symptoms, such as headaches (PTSD: The Reality of Post-Disaster Trauma, 2019). People who have experienced a natural disaster may have just lost their home, their belongings, their family and friends. The many different situations of those affected by a natural disaster all can potentially lead to PTSD. Trauma is noticeable only by its symptoms, making it very important to provide enough resources for communities to heal and enough mental health providers to identify community members who may be struggling.

Some scholars have conducted studies to discuss the mental health crisis and ways to approach it. For example, a study analyzed the recovery of communities in California from the 2018 and 2019 wildfire seasons (Heather Rosenberg et al., 2022). They discovered that many community members experienced challenges of wanting to return to normal and being frustrated by the lack of progress in disaster recovery planning and overall feeling unheard from the government. The systemic resilience communities have formed after being forced to respond to emergencies as governments fail to adequately help (Quinn et al., 2022). Additionally, Rosenberg interviewed many planners from local communities and stated that outside groups would often enter these communities following disasters and position themselves as experts or “saviors”. However, these external groups would often create a level of disconnect with understanding the community members’ needs to share their experiences and understanding how local knowledge should be incorporated into their

disaster recovery plan. Rosenberg states that this dynamic of expert versus community member can "perpetuate histories of marginalization, victimization, and disempowerment," resulting in a growing level of distrust from the community to the government. (Rosenberg et al., 2022). Community members may also cope with their trauma by adopting avoidance behavior which may result in not discussing the disaster or participating in community gatherings. Trauma can also develop further into anger and frustration. Natural disasters can have many physical, emotional, and mental effects on community members, including trauma. Because of the emotional effects of natural disasters, it is important to recognize the trauma-informed or healing approach.

A trauma-informed approach includes understanding the widespread impact of trauma, the numerous paths to recovery, signs and symptoms of trauma, and attempting to prevent re-traumatization (Rosenberg et al., 2022). A trauma-informed approach relies on the community to use trust and collaboration to help with disaster recovery. Building trust and collaboration can be difficult. Scholar Rojansathira, a writer for the International City/County Management Association (ICMA), suggests that organizations ideally should build a relationship before a natural disaster occurs. Since natural disasters are often unpredictable, Rojansathira's suggestions should be continuously implemented throughout the year, so members are always building relationships between each other and are better prepared for disasters. Building trust and collaboration can be done by first analyzing what could go wrong during a natural disaster, then by refining emergency planning, response, and communication protocols. After analysis and refining, Rojansathira suggests training regularly with response teams, and identifying and connecting with partner agencies and local community organizations. Finally, after all the organizations are established, he recommends training every organization involved (Rojansathira, 2023).

Following this method will help build relationships both within the community and with external organizations, resulting in a higher level of preparation, trust, and collaboration when a disaster may hit.

Another scholar, Shmueli et al., gives recommendations on how to build trust and collaboration during disasters. First, they mention the importance of the government and the community building trust by the government having a "participatory, transparent, accountable, equitable, and efficient" relationship with the community (Shmueli et al., 2021). Trust is easier to build on the local level because community members help one another and see each other frequently as they discuss emergency management decisions together. Building trust and collaboration is essential to have an effective healing approach to disaster relief.

Rosenberg et al. discusses six guiding principles: cultural, historical and gender issues, safety, transparency and trustworthiness, peer support, empowerment and choice, and collaboration and mutuality (Rosenberg et al., 2022). Regarding cultural, historical, and gender issues, it is important to understand the historical context by being cognizant of the community's history with traumatic events, the relationship with the government, and overall history of the community. It is also important to ensure there is access for all groups to any services provided. Regarding safety, it is important to review the physical site to ensure physical safety, and to acknowledge trauma and provide space for sharing to ensure psychological safety. To provide trustworthiness and transparency, Rosenberg recommends actively listening, supporting community partners to facilitate communication, and to be honest about the mental health resource's role. Some examples of peer support include supporting peer-to-peer interactions and promoting local resources. Empowerment and choice can

be seen through supporting active leadership by the local community and providing meaningful alternatives to increase community participation.

The last guiding principle, collaboration and mutuality, can be conducted by supporting community decision-making and visioning for long-term recovery by consistently communicating to the community. It is also important to value community experience by allowing for member's stories and input. Lastly, it is important to share that the practitioner does not have all the answers. Following Rosenberg's recommendations can help improve the mental health of the community and recognize the emotional state that the community members may be in. These recommendations aim to help the community members know they are not alone and there are resources for them in times of high stress.

Quinn et al.'s paper mainly centers around Indigenous healing, with key elements including using holistic approaches to wellbeing, social processes, identifying and treating the roots of trauma, community-led processes, creating safe spaces, and finally, Indigenous notions of responsibility, justice, and forgiveness (Quinn et al., 2022). Although all Puerto Ricans may not be indigenous to Puerto Rico, there is still the historical aspect of colonialism to recognize when taking a trauma-informed approach to natural disasters. A point Quinn et al. effectively describes is the importance of being cognizant of the historical context, particularly in understanding colonialist history. Both scholars converge in their principles in the importance of community and creating a safe, trusting space that centers around the wellbeing of community members.

As mentioned earlier, Rosenberg et al. stated how there was often a dynamic of savior and victim between the experts and the community members. A trauma-informed or healing approach is helpful in recognizing the importance of history

and having a holistic understanding. Quinn et al. particularly emphasizes the importance of treating the roots of trauma, including understanding how community contexts (such as inequities, and a history of colonization) intersect with disaster recovery (Quinn et al., 2022). Additionally, Rosenberg et al. and Quinn et al. both discuss the failures of the government towards disaster relief, and Quinn et al. argues that the government must accept responsibilities for failures before or after disasters if they want to truly commit to supporting community recovery. A trauma-informed approach keeps in mind the history of the communities and stays cognizant of the emotions of all community members, including those who may feel burdened from having to step up during a time of disaster. Overall, a trauma-informed approach helps community members recover from the emotional effects that come with a natural disaster.

After creating recommendations for a trauma-based approach, it is important to then implement these ideas. Rosenberg et al. suggests that federal agencies, such as FEMA and the Substance Abuse and Mental Health Services Administration (SAMHSA) should help to advance these efforts (Rosenberg et al., 2022). However, as stated prior in this paper, the government often fails in providing proper resources after disasters; and thus, often neglects a trauma-based approach when assisting in disaster relief. On the other hand, Quinn et al. emphasizes that many government disaster responses are implemented the same way to numerous communities and do not consider the diversity in the different communities. Thus, Quinn et al. argue that a healing approach should come from a community, rather than an outside force (Quinn et al., 2022).

However, a community's disaster relief plan is often volunteer-based and has limited funding, making it challenging to implement this approach. Although providing mental health resources is essential, it does not have a tangible result and

may not be as evident as a priority to both the government and to the communities. A trauma-informed approach to disaster relief strengthens a community and makes the community more resilient. A trauma-based approach should be prioritized as it can help heal those affected in Puerto Rico by natural disasters.

As mentioned earlier, scholars often advocate for a trauma-informed approach to disaster relief. A trauma informed approach recognizes the overall declining mental health, exposure to trauma, and daily stressors that may come after experiencing a major natural disaster. Citizens of Puerto Rico experience intense uproots to their daily lives when natural disasters hit their island, resulting in their emotions to become heightened.

For example, Hurricane Maria left many Puerto Ricans without access to their basic needs for numerous months, resulting in many community members to feel a high level of uncertainty and anxiety. Many Puerto Ricans felt immense emotional effects, where a survey of Puerto Rican youth revealed a widespread exposure to trauma, and another survey revealed that 6 months following Hurricane Maria, residents still reported daily stressors from the disaster (Alto et al., 2021). Another scholar, López-Cepero et al., conducted a study that revealed that exposure to hurricanes had a greater likelihood of depression symptoms, post-traumatic stress disorder (PTSD), and generalized anxiety disorder (GAD) (López-Cepero et al., 2022).

A different scholar, Powell et al., discusses the importance of recognizing the wellbeing of healthcare and social services providers by studying the wellbeing of providers in both Puerto Rico and Texas after Hurricane Harvey and Maria. They concluded that Puerto Rico experienced higher levels of anxiety, PTSD, and compassion satisfaction, whereas Texas experienced higher levels of burnout and resilience (Powell et al., 2019). Powell et al. concluded that the proportion of

providers experiencing emotional distress is high in both locations; however, emphasizes that "Texas, part of the mainland United States and a state, was able to receive assistance by land, sea, and air immediately following the disaster, whereas Puerto Rico, an island in the middle of the Caribbean and a U.S. territory, experienced both geographic and political limitations to receiving immediate support" (Powell et al., 2019). Evidently, beyond natural disasters greatly physically affecting Puerto Rico, they also have greatly affected the mental and emotional health of all community members involved, as seen through examples of youth, adults, healthcare, and social services providers.

Lugo-Hernández, an Associate Professor of Psychology at the University of Puerto Rico, articulated well in an interview: "The climate crisis is here to stay—and we need to change with the times," in reference to mental health services provided as the natural disasters in Puerto Rico continue to increase (Abrams, 2022). Both government and community-based approaches are key methods to aid community members in Puerto Rico through trauma and times of high stress after natural disasters. After Hurricane Maria, FEMA provided $22 million in May 2019 to support the Mental Health and Anti-Drug Services Administration, where the funds would be used to conduct mental health outreach (FEMA, 2019). In May 2023, FEMA provided Puerto Rico with $80 million towards addressing mental health, with $76 million going to recover damaged facilities from Hurricane Maria and approximately $4 million to help community members recover the southern part of the island affected by earthquakes in 2020 (FEMA, 2023). These funds will help restore recovery centers, drug courts, mental health centers, and prevention centers.

Although FEMA has provided funds towards mental health, some scholars question whether that is enough. Patricia Landers, Associate Professor of School Psychology at the Pontifical Catholic University of Puerto Rico, stated that "we

[mental health providers] have been giving that first response, but we haven't received any aid or relief from the government," (Abrams, 2022) resulting in many providers having feelings of burnout and hopelessness. Another scholar, Baiz, states that although the government provided aid to support people throughout Puerto Rico, "it is impossible to deny that the government failed to carry out actions that were important to the country's well-being" (Laboy Baiz, 2022), noting a key problem of accessibility. Mental health services were limited due to lack of resources and accessibility. A psychologist in Baiz's study stated the government's providing mental health services were essential but often provided too late. Many community members in Puerto Rico have differing opinions on the government's involvement in providing adequate mental health resources; but overall, with the rising cases of PTSD and anxiety after natural disasters, more work must be done to help Puerto Ricans through these mental and emotion hardships.

Baiz quotes that "'the structures and enduring legacies of colonialism set the stage for Maria's impact and its aftermath'" (Laboy Baiz, 2022). Baiz describes how the social and political context between the mainland and island have forced community members in Puerto Rico to recognize the inadequate help from the federal government and the necessity of community members to act for their communities to be resilient. Zara Abrams discusses the mental health response from mental health providers in Puerto Rico after Hurricane Fiona hit in 2022. Mental health responses can be seen through the increase of community-based organizations formed to train first responders.

An example of these responders is through the Puerto Rican Center for Intervention and Training in Trauma. This center created tools, such as a short video and a tip sheet to guide trainees with disaster response protocols. Additionally, graduate and faculty members in the psychology department at UCA-Mayagüez in Puerto Rico provided mental health

services following Hurricane Maria (Alto et al., 2021). UCA-Mayagüez members also received Psychological First Aid training and a manual to help community members (Alto et al., 2021). A community-based approach towards mental health is more cognizant of the true emotions that community members feel as they struggle to have their basic needs met.

There are both advantages and disadvantages to a government and community-led model incorporating trauma-informed disaster relief. A community-based approach to trauma requires community members to help other community members. This approach is great in building resilience and strength within a community. However, it often results in mental health providers feeling the same, if not worse, emotions as the members they are helping. Many providers feel hopeless due to the limited government response and economic position of Puerto Rico, where there are overall not enough mental health providers in proportion to mental health services needed. Additionally, many of the members helping may not be adequately trained in providing these services and may feel unprepared assisting in mental health services following natural disasters. In Puerto Rico, there have been numerous examples of both government and community-based responses to trauma and mental health. It is important that a combination of both approaches continues, such as through funding from the government and resilience within the community.

2.3 An Integrated Approach to Emergency Response

The ideal response to a natural disaster would involve combining government, community-based, and trauma-informed practices, as limitations in one approach can often be reduced by the strengths of another. Ideally, governments would provide emergency supplies, monetary resources, and technically trained specialists equitably to marginalized communities. Emergency supplies and monetary resources would help communities that lack tangible resources, while personnel would help communities that lack logistical and leadership resources. Unfortunately, atrocities committed by the U.S. government in Puerto Rico, such as neglect after natural disaster, the forced sterilization of Puerto Rican women[1] and the bombing of Vieques[2], among many other problematic examples, have created distrust of U.S. government personnel among Puerto Rican communities. Trauma-informed practices aimed at acknowledging these historical atrocities, prior lack of neglect from the government, and contemporary traumas, could aid in forming new, more trustworthy relationships

[1] In 1937 the unemployment rate in Puerto Rico was 37%. Blanton Winship, the American governor of Puerto Rico at the time, approved a law legalizing sterilization. Winship approved this law based on the principles of eugenics, as he believed there were too many poor people on tothe island. Following this law, many women were sterilized unknowingly or without knowledge of the negative effects. By 1965, 34% of Puerto Rican women ages 20-49 were sterilized (Coqui Report, 2023).

[2] Throughout the second half of the 20th century, the U.S. navy bombed Vieques, a Puerto Rican Island, for training purposes. To this day parts of the island are still too hazardous to travel on or inhabit, as there are live and toxic munitions. Studies show residents on the island have higher rates of cancer and toxic metal exposure (AJ+, 2019).

between government personnel and Puerto Rican communities. In this ideal response, community-based groups would spend less time procuring and distributing resources, and more time building resiliency in their communities through practices such as sustainable farming. Though ideal, a combined government, community-based, and trauma-informed response is not realistic in Puerto Rico, as it would involve the U.S. government aiding marginalized communities in a way which it never has.

2.4 Apoyo Mutuo Agrícola

From these schools of thought, community-based mutual aid and trauma-informed approaches show the most promise for disaster relief in the case of Puerto Rico. This validates the work our liaison, AMA, is pushing for and our research can help identify improvements to their existing practices; however, we acknowledge the possible bias towards community-based and trauma-informed mutual aid organizations. Community-based approaches bridge the gap of inequalities in government disaster relief. Time and time again, Puerto Ricans have experienced the U.S.'s often out-of-touch response to natural disasters. Despite access to numerous resources, the government's failure to properly allocate them has resulted in community needs being unmet. This is not just felt by one community but communities across the island of Puerto Rico. These communities have started to band together, and create organizations that take action, and make a positive impact on people. While these initiatives have great intentions, their lack of access to resources equates to a

reliance on volunteers, many of whom are also suffering the effects of the disasters simultaneously. This hardship placed on these volunteers can be reduced by incorporating the trauma-informed approach.

AMA is an example of one of these volunteer-led organizations which is also a part of a larger network of community-based groups called Centros de Apoyo Mutuo. Listed on their website, there are currently 15 projects under the Centros de Apoyo Mutuo collective all with the same mission of "providing community health brigades, attending to bedridden people, carrying out educational and entertainment activities, supporting single mothers, and solidarity in cases of need and housing improvements" (Red de Apoyo Mutuo, n.d.).

AMA was founded by Jessica Santos and Martín Cobian in 2022 after Hurricane Fiona, with the purpose of helping small and medium-sized farmers in collective healing and agricultural development. By serving and educating the local farmers, farmers can most effectively do the work of feeding society. The trauma of Fiona affected the land and farmers' physical and mental health. Apoyo Mutuo Agrícola provides alternatives to healthcare and works with "community organizers, educators, [and] healers" in supporting small farmers (Red de Apoyo Mutuo, n.d.). AMA holds workshops on biofertilization, providing resources to lower production costs, organizing agro-markets, and promoting agroecological practices and chemical-free food. They also work towards establishing long-term collaborative relationships with farmers in the technical work of fertilizer production, and the human work for maintaining and cultivating spaces for health and well-being.

Outside of AMA, Jessica Santos is an anthropology professor at CUNY Brooklyn College and SUNY Binghamton University. Martín Cobian is also a professor and teaches in the Latin American and Latino Studies department at Lehman

College, CUNY, and the University of Puerto Rico. Both Jessica and Martín received their PhD in Anthropology, and both have extensive knowledge on topics regarding agriculture, specifically in Puerto Rico, Latin America, and the Caribbean. Additionally, both Jessica and Martín advocate for agroecology reforms and equitable agrarian policies in Puerto Rico. Their combined knowledge and passion resulted in the creation of Apoyo Mutuo Agrícola, where they can use their skills to continue to help farmers in the rural regions in Puerto Rico.

AMA has allies in both Lares, a rural town in the mountainous region of Puerto Rico, and Río Piedras, an urban district within San Juan. AMA is composed of eight members – Jessica, Martín, Diana, Irenia, Jose, Augusto, Carlos, and Zacha – that volunteer to help local farmers and work to connect and support these rural and urban communities.

In the urban district of Río Piedras, AMA works to strengthen relationships with other organizations, especially Paseo 13. Paseo 13 is an art collective consisting of 6 members – Mayte, Efrain, Paula, Millo, Rocío, and Pablo – that volunteer to preserve and restore the #13 Paseo de Diego building and create a community through art and workshops. Paseo 13 acts as a pivotal community center that emerged during Hurricane Maria to serve as a community resource hub, receiving and distributing resources to Río Piedras community members. Paseo 13 offers many services such as welding, construction, carpentry, rubble collection, scraping and painting, pressure washing, and sewing and repairing clothes. Paseo 13 also holds other programs, such as art festivals, bike renting, and compost donations.

Paseo 13 and AMA are working very closely together to help connect the rural and urban communities and improve their emergency preparedness plans. Paseo 13 provides hope for the archipelago's future, especially as the island is experiencing a migration of the younger population to the mainland U.S.

It is indisputable that the effect of natural disasters in Puerto Rico are large and destructive to the lives of many Puerto Ricans, affecting many community member's livelihoods as well as their mental, physical, and emotional health. Because of these natural disasters, Apoyo Mutuo Agrícola is currently developing community disaster relief capabilities for rural and urban areas in Puerto Rico. These natural disasters are a concern to Apoyo Mutuo Agrícola due to the large negative impact that they have on farmers and all community members in Puerto Rico. The WPI team investigated further into a community-based and trauma-informed approach to disaster relief to help AMA continue to provide holistic health services for community members and to be better prepared for natural disasters.

3.0 Methodology

3.1 Outline

The methods we used in this project were archival research, semi-structured interviews, ethnographies, and mapping. This multi-method approach increased the project's robustness, as it allowed us to triangulate our findings from each method. In this section, we evaluate the strengths and weaknesses of these methods and describe how we used them to answer our research question.

Archival research provided our team with depth and a foundation of knowledge, allowing us to approach all our objectives from an informed perspective. The sources for this research were found using the digital Gordon Library at WPI and analyzed to produce a literature review.

Semi-structured interviews provided insights from experts or knowledgeable subjects in agriculture, disaster preparedness, holistic health, and trauma-informed disaster relief. Additionally, semi-structured interviews helped build foundational relationships due to their relatively open-ended format. Data from these interviews was collected through written notes and audio recordings, then analyzed by indexing an annotated transcript.

Ethnographies allowed each team member to observe our surroundings and experiences in Puerto Rico. More specifically, the ethnographies document our accounts of the areas AMA works with, Río Piedras and Lares. These observations were the best way to document our experience and provided authentic knowledge that was critical in forming a prosperous connection with our liaison. They offered an opportunity to achieve a deeper understanding of the project's

implications and contextualize the environment in which the project was completed. We collected this information through fieldnotes which were transferred and organized on Microsoft Word.

Mapping provided a visualization of resources that contributed to our goal of emergency planning by allowing AMA to have a visualization of their allies, as well as allow community members identify spaces in situations of high stress to either get resources or decompress. By using mapping, we were able to increase communication and clarity between organizations and increase awareness of spaces for the community to utilize them at will.

3.2 Methods

3.2.1 Archival Research to Build Knowledge Base

Archival research is an unobtrusive research method which provides us with a background of knowledge relating to our objectives. Archival research promotes a depth in knowledge due to the expansive nature of archives. Furthermore, archival research allows researchers to build this depth of knowledge without being in the field, meaning there are no travel limitations. The main categories of archives are commercial media accounts, actuarial records, official documentary records, and autobiographies (Berg & Lune, 149). We mainly used commercial media records and official documentary records to understand broad historical, social, political, and economic dynamics in Puerto Rico. Individual accounts are important to consider and can be obtained from actuarial records and autobiographies; however, more current personal accounts were obtained from semi-structured interviews and ethnographies. A form of archival research specific to our project is the study

of past projects at PRPC. We focused on projects which involve mapping to inform our mapping methodology. We also implemented mapping guidebooks created by past teams to propose the use of mapping with AMA.

3.2.2 Open-Ended Conversations with Semi-Structured Interviews

Semi-structured interviews allow for the interviewer to gain depth in knowledge on a predetermined subject. This form of interview is planned by creating a general layout of questions; however, the semi-structured format allows the interviewer to ask clarifying questions or inquire about subjects beyond the outline. Additionally, the interviewee can carry the conversation outside the lines of the original questioning, providing knowledge unforeseen by the interviewer. In contrast, highly structured interviews prompt answers that may lack important information. "This [a semi-structured interview] resulted in a much more textured set of accounts from participants than would have resulted had only scheduled questions been asked" (Berg & Lune, 70).

We conducted semi-structured interviews with experts and knowledgeable subjects in agriculture, disaster preparedness, holistic health, and gentrification. Interview subjects were found through our connections at AMA because they are part of a large network of Puerto Rican mutual aid groups and farms. To obtain a variety of perspectives on agriculture, holistic health, and disaster challenges specific to farmers, we interviewed a variety of farmers including Bruje Fuego, Miguel Santiago, Lester McGrath, Grisa, and Millie. To obtain a variety of perspective on gentrification and disaster challenges specific to urban communities, we interviewed a variety of urban community groups including Fideicomiso, an organization which acquires abandoned land and donates it to the community; Centro Paz Para Ti, an organization which

fights gender-based violence; and CAUCE, a University of Puerto Rico program which strengthens community relationships.

Because we conducted numerous interviews, it was essential to develop interview questions for both urban organizations and rural farmers. For the urban organizations, we asked questions about the organization, workshops they host, and their funding strategies. We then asked questions about the organization's experience with disaster relief to better understand the strengths of the organization and the areas that they would like to improve upon regarding emergency preparedness. Lastly, we asked who their point of contact would be in times of emergency and if they would be interested in being a part of AMA's emergency plan. For farmers, we asked questions about holistic health practices, important skills or resources during times of emergency, understanding crop losses, and how to recuperate after disasters. Notes were taken for each interview using Google Docs that were then organized into a shared Google Drive with the WPI team and AMA.

3.2.3 Experimental Observations

Ethnographies can generally be described as a "study of culture," though more intently defined as "a process that attempts to describe and interpret social expressions between people and groups", which further distinguishes them from other methods in which culture is involved (Berg & Lune, 108). This method requires that researchers watch, listen, and learn in the location determined by the essential aim of the study. As noted by Berg & Lune, this form of observation can be broken down into four main aspects for success: taking in the physical setting; developing relationships with inhabitants; tracking, observing, eavesdropping, and asking questions; and locating subgroups and central characters (Berg & Lune,

118). By incorporating these key elements in our fieldwork, our team aimed to capture the reality of the Puerto Rican communities that we collaborated with, mainly Río Piedras and Lares.

During these seven weeks in Puerto Rico, each team member kept a notebook filled with observations, journal entries, and meeting notes. These notebooks encouraged team members to be observant of our surroundings, providing a comprehensive image of the areas and communities we engaged with. We immersed ourselves in the communities by participating in community activities like meetings, farmer's markets, and brigades. These experiences allowed us to interact directly with community members. By having direct connection with communities, the authenticity of these notebooks provided a new perspective and helped develop a deeper understanding of the cultural context and implications of our work in the communities. These ethnographic accounts filled gaps in our archival research and formed meaningful connections with our liaisons and their communities.

3.2.4 Mapping to Connect Puerto Rican Communities in Times of Stress

Mapping is a research method aimed at producing a visualization of data and is commonly paired with other research methods for data collection but can be conducted if data is provided as well. This method aims to help community members comprehend assets in an easy-to-digest, visual map. Mapping is most effective when the provided data is specific to the assets to be mapped. Addresses or coordinates are also necessary in this method, as everything that is mapped should be placed in the correct, specific place (Fallon et al., 2023). This method allows for maps that can be accessed online, printed, and distributed to communities. We used mapping to help identify spaces for promoting holistic health, organizing supplies,

hosting events for small farmers, and aid AMA in visualizing their network. We used archival research, semi-structured interviews, and Google Forms to gather data, then inserted that data into a mapping tool to compile a visualization of available resources. This allowed us to aid the community in identifying strong assets and risk factors in different locations.

Mapping was a vital component to our project as we created many Google Forms for AMA to collect information on allies, community members, and farmers. Our liaisons found this technology extremely useful for their goal of identifying allies' strengths and weaknesses. Mapping allowed us to visualize data from google forms and highlight the most important information such as location and available resources from each ally. Mapping allows AMA the opportunity to eventually make their network easily accessible. The emergency plan interface was created with a focus on Google Forms, as any data input into a form could be mapped if it contained an address. The use of the Google Site also made it possible for any resource in the emergency plan to be easily hosted and interacted with by community members and allies alike.

3.3 Ethical Considerations and Limitations

We identified and understood the potential ethical issues that could have arisen when employing our methodologies. In the case of archival research, we limited selection bias by triangulating our sources and predominantly relied on peer-reviewed sources. This further informed us of the poor relationship that the United States has with Puerto Ricans.

There is a history of unethical and nonconsensual studies conducted by the United States government on Puerto Ricans. Due to the history, we needed to gain the trust of the community, so people were more likely to volunteer and take

part in any interviews we conduct. We also asked for verbal consent rather than written, as it is a culturally more appropriate way to secure the consent of research subjects. In our interviews, we ensured that interviewees were properly informed of the information we gathered, the purpose of gathering it, and how the information will be utilized.

We also provided our interviewees and team members with the option of staying anonymous in their responses in interviews and ethnographies. Any data we collected was only accessible to us in the group unless otherwise stated. We also recognized the potential harm in our process during interviews when bringing up sensitive and/or traumatic subjects. In these cases, we had specific questions to ask that are optional and targeted to not dive deeply into possibly traumatic events to not cause subjects' further harm. We have also completed research specific to Puerto Ricans in disaster response to stay informed and understand possible traumas of Puerto Ricans. Specific to mapping, we ensured data stays private and is only accessible to AMA.

3.3.1 Archival Research to Build Knowledge Base

There are two significant limitations to archival research, selection bias and its potential to be outdated. First, selection bias can be described as "occurring when the non-random selection of cases results in inferences, based on the resulting sample, that are not statistically representative of the population" (Lustick,1997). This non-random selection of cases can come from us, the readers, or the authors themselves. To mitigate the effects of selection bias, we used triangulation to analyze multiple sources on the same topic, and critically assessed the authors and publishers of our sources. Secondly, sources obtained through archival research can be outdated because they may not have been written in the

context of current social, political, and economic atmospheres. We used present-day context provided by the other outlined methods to mitigate the negative effects of archival research being outdated.

3.3.2 Open-Ended Conversations with Semi-Structured Interviews

Selection bias is an inherent limitation of semi-structured interviews. To mitigate selection bias in semi-structured interviews we were cognizant of why we chose a subject to interview, and ensured it was not because their beliefs align with ours. Additionally, we interviewed multiple subjects within the same fields to triangulate the data we obtained from semi-structured interviews. The decision to find interviewees from our connections at AMA is a form of selection bias. However, due to our project's nature, our team was unable to conduct interviews with people who were not allies of AMA or WPI PRPC.

3.3.3 Experiential Observations

As ethnographic research required immersion in communities, it was subject to the unpredictable nature of life. These uncontrollable aspects can alter the study's circumstances or lead to a lack of desired data. In the case of alterations to the circumstances, the research may end prematurely as it “throws your question into a new and unintended light” giving the question a new meaning (Berg & Lune, 135). The failure to collect desired data is typically a consequence of not being in the right place at the right time, where the researchers miss the intended situations. Another important consideration was the possible impact of the Hawthorne effect. This occurs when a researcher’s presence on the routine

affects the behavior of the research participants, which thus alters the study results. Such inaccuracies in data can also arise from observer bias, a particularly pertinent issue to our project. Our team recognizes that as outsiders to Puerto Rico, we may have had unintentional biases due to our backgrounds and experiences that hold the potential to skew our accounts of local communities.

3.3.4 Mapping to Connect Puerto Rican Communities in Times of Stress

Effective mapping is limited to the skill set of those completing the mapping, and of the data provided from either the teams liaison or methods used. Therefore, mapping can have the limitations of the method used in gathering the provided data. If the data provided is missing sections of the community, the maps will lack assets. If the data does not have the necessary assets, any maps generated cannot be used to their full extent. Another limitation to mapping is that it is a technical method. Mapping software must be learned and used effectively through practice of using the software, which we only had a few weeks to master. When done correctly, the maps should be a positive contribution to how the community prepares in times of disaster. Especially in times of disaster, internet access is little to none across Puerto Rico, and online resources are useless. To combat this, any mapping we did was available offline or had an effective offline alternative. Mapping also requires collaboration between those providing the maps and those that will use the maps. To create a usable map, both parties must be on the same page of what the needed outcomes are. We avoided these issues by staying in frequent contact with our liaison to ensure the assets we plan to map are what they require. By examining where the data

comes from, we could clearly identify a lack or bias in how data was collected. Additionally, we ensured that, unless necessary, personal data can be made private, and that the maps are distributed keeping privacy in mind.

3.3.5 Overall Limitations

There were also other limitations we had to be cognizant of during our time in Puerto Rico. First, it is important to recognize the skill set of the team as we are not experienced researchers. We learned about the history, politics, economics, and social culture in Puerto Rico the eight weeks prior to traveling; however, we recognize we are not experts in the field, and this was the first time we engaged with AMA and the community in Puerto Rico. Additionally, we recognize the time constraint to complete this project as we only had eight weeks in Puerto Rico to collect and analyze data. There was a language barrier in Puerto Rico as only two of our group members are conversational in Spanish. They helped translate for the other members who could not speak Spanish. Lastly, we understand our observer bias as we traveled to Puerto Rico. We recognize that as we participated with the community, we were still outsiders who may have brought their own observer bias. To help reduce this innate observer bias, we tried to immerse ourselves into the community by engaging with and having open conversations with community members through brigades and interviews. During these conversations and our time in Puerto Rico, we ensured that we were not being judgmental, listening rather than dictating, and viewing community members as partners rather than just research subjects.

4.0 Findings

4.1 Field Research

Our project's field research was conducted in various locations to incorporate perspectives from urban centers and rural sectors. Our team valued these diverse perspectives as this was the first time a WPI Puerto Rico Project Center team had the opportunity to conduct research outside of the San Juan municipal area. Our urban research was conducted in Río Piedras, a district of San Juan, and was centered around meetings in Paseo 13. Every Monday, the team would meet at Paseo 13 to plan and participate in brigades. The interior of Paseo 13 is vibrant with life which outshines the damage from a long period of abandonment before Paseo 13 restored the space. The building is filled with art, with most rooms dedicated to a specific medium. The background of Figure 9 offers a glimpse into Paseo 13's textiles space.

Figure 9 The WPI team in a weekly meeting at Paseo 13 with four members of the collective

Following weekly meetings and brigades at Paseo 13, the team conducted interviews with AMA's urban allied organizations. When possible, the team conducted these interviews at the organization's headquarters; however, Paraíso Teatro, a local theater, served as an alternative meeting place that provided a quieter space.

Our rural research did not follow a consistent pattern as shortsighted travel policies from the WPI Global Experience Office made frequent trips outside of San Juan too expensive. Fortunately, the team made a trip to Lares, a mountainous town located in the island's center. While in Lares, the team participated in a brigade at Casa Taller, AMA's new headquarters, and spoke to farmers at Finca El Timón. Casa Taller is currently an empty house, seen in Figure 10, which will be transformed into a medicinal community garden and resiliency hub. Finca El Timón is a farm, rich with animal life, which cascades over the side of a mountain.

Figure 10 The WPI team participating in a brigade to clean the interior of Casa Taller

Additionally, the team was able to travel twice to Somos Espejos, a farm in Trujillo Alto. Though Trujillo Alto is part of the San Juan metropolitan area, Somos Espejos is situated in a sparsely populated section of the municipality. The farm has a scenic landscape made of steep hills covered in diverse flora which has been nurtured by agroecological practices. Switching between research in urban and rural areas allowed the team to identify differences in demographics. Most notably, urban areas had significantly larger youth populations than rural sectors.

4.2 Outcomes and Deliverables

4.2.1 Emergency Plan

The first deliverable developed for AMA was an emergency plan. Three variations of the plan were created: AMA Internal Emergency Plan, AMA Rural Emergency Plan, and AMA Urban Emergency Plan. Each of these plans had a storyboard which divided our plan into five sections based on the timeline of the emergency. To reflect the unique strengths of AMA, holistic health aspects were integrated such as medicinal plant overviews and holistic health workshops. The emergency plan has allowed for the collective knowledge of rural and urban communities to be spread to a wider audience and will increase community's disaster resiliency.

Each variation of the emergency plan has a focus on the Preparation section as our findings determined this was missing from current disaster relief, outlined later in this section. For AMA's internal plan, we developed a Yearly Emergency Preparedness Plan for AMA's monthly meetings. This plan outlines monthly meeting topics, which were

determined around the hurricane season, monthly meeting agendas, and monthly action items that incorporate the systems our team developed. As this plan was completed in May, we also developed an AMA Emergency Preparedness Checklist 2024 that is an action item focused preparation checklist for the remainder of the 2024 calendar year. The AMA Internal Emergency Plan also includes the Medicinal Plant Workbook, which provides information on plant growing details, benefits, and usages as incorporating holistic health was a key aspect to the emergency plans.

For the AMA Urban Emergency Plan and AMA Rural Emergency Plan, the Preparation section includes a Community Census Form, an Emergency Quick Tips Sheet, and a Farmer's Technical Sheet. The Community Census Form was designed for AMA to distribute to the communities it impacts to collect information regarding potential risks or resources of community members. This information will allow AMA to prioritize community needs in times of emergency. The Emergency Quick Tips Sheet provides easily accessible information regarding emergency preparedness, directing community members to resources about communication, medical assistance, distribution centers, and hotlines. The Farmer's Technical Sheet outlines information on the calculation of losses, animal preparation, food conservation, drought resources, and compilation of important documents.

Within our emergency plan, there are six main systems which are implemented. These systems include Inventory, Workshop, Mapping, Ally Alert, Volunteer Management, and Rapid Response Systems. The Inventory System was developed for AMA and allies to keep track of ally resources in times of emergency. The Workshop System was created to ensure allies and community members' skills are up to date. The Mapping System was made to identify ally resources and locations quickly. The Ally Alert system and Volunteer Management System were developed to send a mass email to allies

and volunteers in case of an emergency. The Rapid Response System was developed to quickly gain information on community members and farmers following an emergency.

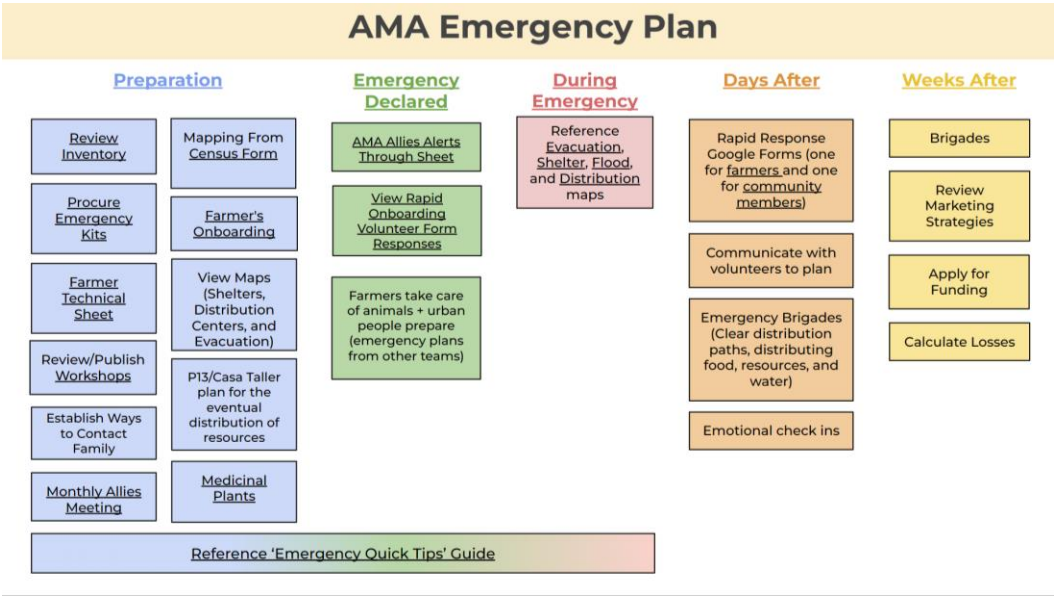

Figure 11 Storyboard outlining AMA's internal emergency plan in chronological order.

The Inventory System was designed for AMA and allies to keep track of the resources. In this system, AMA and allies fill out the Google Form that auto-populates into a Google Sheet, where the resources can be sorted according to available filters. This will allow AMA and Allies to check resources available in times of emergency.

Figure 12 Google Sheet used to organize stock of resources in our inventory system

We also created a system for allies to enter upcoming workshops and events, the Workshop System. This process works similarly to the Inventory System, where allies can fill out a Google Form about the details of upcoming workshops or events that auto-populates to a Google Sheet. AMA will then be responsible for communicating upcoming workshops based on the Google Form responses, such as through utilizing the AMA website.

The third system is used to map important resources and vulnerabilities, the Mapping System. This system once again utilizes Google Sheets which are auto-populated with Google Forms responses. Uniquely, the third step in this system auto-populates a Google My Maps page with the spreadsheet. We utilized this system to create one map of AMA's allied organizations and their strengths; however, any Google Sheet can be used to auto-populate a map if there is a location

column in the spreadsheet. Though these maps are automatically populated, they are not automatically updated, this must be done manually.

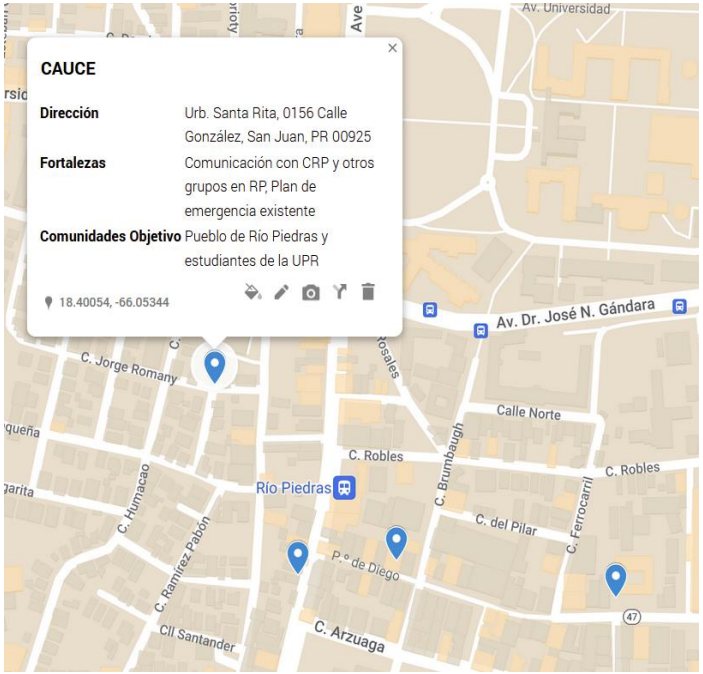

Figure 13 Map created with our mapping system to show AMA's allies and their strengths

Two separate systems were created to alert certain individuals, the Volunteer Management and Ally Alert Systems. The Volunteer Management System was created to alert volunteers by community members filling out a rapid volunteering Google Form and the Ally Alert System was created to alert allies by organizations filling out a different form. Both systems work similarly by connecting Google Sheets to the Google Forms. These Google Sheets contain an alert system where AMA can draft an email and send it to all respective recipients by pressing a button on the Google Sheet.

The Rapid Response System was designed for AMA and allies to keep track of strengths and needs following emergencies. In this system, community members and farmers fill out the Google Form that auto populates into a Google Sheet, where the strengths and needs can be sorted according to available filters. This will allow AMA and allies to prioritize emergent risks and distribute volunteers following times of emergency. Together, these five systems automate processes which were originally completed without software, enhancing the functionality of our emergency plan.

4.2.2 Website Resources

The second deliverable we created for AMA was a draft website. The website includes Welcome, Community Mapping, Allies, News, and Contact pages. The Welcome page offers an introduction to AMA, their members, and their projects. The Community Mapping page includes links to the maps developed with our mapping system for community members to visualize resource distribution in Río Piedras and Lares. The Allies page gives an overview of AMA's allies, their resources, and contact information. The News page provides links to news articles and social media pages relevant to community members. The Contact page utilizes a Google Form to connect website users to AMA members. Together, the five pages organize and represent information about AMA and allies for community members to access.

Figure 14 Homepage of AMA draft website

4.2.3 Funding Resources

The third deliverable developed for AMA was a compilation of funding resources. The first piece to the compilation is a narrative which outlines resources needed by AMA and provides reasoning for why they are essential to AMA's work. This narrative can aid AMA in future applications or donation requests. To complement this narrative, the team compiled a list of relevant companies which donate or discount products for 501 (c) (3) non-profits.

4.3 Documenting Emergency Plans Increases Clarity During Emergency Events

Many organizations and farmers communicated that they did not have an existing emergency plan for disasters. Through semi-structured interviews, we learned about how farmers and urban organizations responded to Hurricane Maria and Fiona by working as a community to rehabilitate the land, but without a documented community emergency plan. All interviewees expressed their interest in a documented emergency plan, knowing that it could strengthen emergency preparedness.

Apoyo Mutuo Agrícola is unique because of their emphasis on holistic health. AMA currently offers holistic health opportunities to farmers, which is a key component of our emergency plan. The WPI team attended AMA's farmers' market in Río Piedras, where AMA offered a community meal, acupuncture, and massages to farmers and everyone who visited the market. AMA's focus on holistic health is due to the current lack of mental and emotional resources from the government. Many existing emergency plans do not incorporate holistic health. The government's failure to respond to disasters has resulted in individuals relying on one another to rebuild after disasters. This reality creates a resilient community, but it also takes a large mental toll on community members. Natural disasters have a large mental, physical, and emotional effect on communities. An emphasis on holistic health can help community members cope with the substantial effects from potentially life-altering disasters.

Numerous interviewees expressed that spending time with other community members, such as playing board games, or rebuilding land together, helped them keep their body and mind strong during times of disaster. One farmer, Lester, also expressed that normalizing preparedness by having a basic plan, materials, and resources helps mentally and physically during times of disaster. Lester also expressed how the "Achilles' heel" during Hurricane Maria was the lack of communication, due to cell phone towers being down. He described how during Maria he would see people by the highway holding their phone up trying to get a cell phone signal. The lack of reliable external communication during disasters makes it crucial to emphasize holistic health practices during times of disaster. Holistic health practices were incorporated into the WPI team's emergency plan to help remind community members to prioritize their mental health during emergencies.

There were also numerous other considerations that we factored into our emergency plan, such as understanding the population demographics, lack of government assistance, and lack of resources. In Puerto Rico, there is a larger older population so there are additional considerations when creating the emergency plan. It is essential to have a risk assessment to better understand the community´s needs and capabilities. For example, the community members near Casa Taller tend to be older, so having a documented list of their medications is essential to emergency preparedness. Our team created a rapid risk assessment form for community members to help respond appropriately to community needs.

The government often neglects understanding community needs during times of disaster. Our community liaison, Martín Cobian, further explained that because the government did not know the community's needs, they would provide an abundance of unnecessary resources and a lack of resources that communities did need. Martín provided an example that the government sent an abundance of diapers during Hurricane Maria, when communities really needed ways to clean

themselves as clean, running water was not available. Martín and other community members built multiple temporary showers for community members due to the lack of government assistance to emergencies. An emergency plan should understand the demographics and needs of the community to be effective.

Additionally, it is important to understand that Puerto Rico has unreliable electricity. Especially during times of disaster, communities can go an extended amount of time without power. One of the biggest results of having no power is the limited use of electronic devices. Unreliable electricity can compound with the preexisting communication challenges and was an important consideration when developing our emergency plan. We created numerous Google Forms and online informational sheets, along with paper versions that would be accessible during times of emergency. We also included in our emergency plan that community members should consolidate both paper and digital versions of important documents for emergencies. Since power is very unreliable, important information must be available both digitally and on paper.

Lastly, it was important to consider how remote the rural locations are. Rural areas, such as Lares, face more infrastructure challenges, as roads are windier and steeper due to the mountainous region. This can make roads more difficult to drive on, making receiving supplies more challenging. During times after a hurricane or heavy rains, landslides can make the roads even more difficult to use. Because of this challenge, it was imperative to create volunteer onboarding forms, so community members know who has certain resources and can transport them to one another.

All the organizations and farmers that were interviewed expressed interest in being a part of AMA's emergency plan. This emergency plan will help strengthen disaster preparedness for both rural and urban allies and communities. This plan will seek to understand community assets and needs and encourage holistic health practices during times of disasters. By

providing more documentation through this emergency plan, the intent is to provide clarity to community members during disasters and strengthen preparedness.

4.4 Gentrification and Corruption are Prevalent and Disruptive

Through interviews, our team found that gentrification is prevalent in Puerto Rico's urban and rural areas and has not stopped due to government inaction. In Río Piedras, there are many shuttered and closed store fronts covered with beautiful street art. While it may look like the city is thriving, these art pieces cover an ugly truth - most buildings are abandoned. These abandoned buildings are mostly owned by investors that live in the mainland and refuse to rent out their buildings, waiting only to sell at unreasonably high prices. While the city has the power to create legislation to impose a fine or tax against landowners that sit on abandoned buildings, they instead purchased the materials required for murals to cover the buildings.

Figure 15 Shuttered store front in Río Piedras (Photo by Grant Burrier)

A similar experience exists in rural areas over land deeds and ownership rights. When interviewing farmers, we found that an investor attempted to buy the previous owner's farmland to turn it into a zipline or to Airbnb's. Investors will try to exploit times after disaster or loss, when people living in rural areas may not have all the required documentation proving ownership of land. An example of this is Ramona Cruz Sanabria, a woman whose family has been living on the same land for over 140 years. After Hurricane Maria, her family home was destroyed, not by the storm, but by an excavator. Ramona was given an eviction notice as her family's verbal deal of living on the land was not recognized by the owner's

descendants. Ramona is still fighting to keep her and her family's home. The investors want to turn Ramona's home into an area for tourist, taking away land from Puerto Ricans. While Ramona's home is near a beach, this experience can be shared in rural, mountainous regions with fertile land. Less farmland available to be cultivated translates to more food imports, and an increased reliance on United States ports.

As our team interviewed groups around Río Piedras, there were patterns of city neglect and poor city planning. Outside of the Teatro Paraíso, none of the streetlights shine brightly, making it unappealing and unsafe to spend time in the neighborhood after dark. Río Piedras is also home to the University of Puerto Rico, and one could imagine the bustling college life that could extend to its surroundings. In our team's experience, we did not see many college students besides a few in nearby cafe chain called Café Comunión. This may be in part due to the two different train stations located 700 meters (or 0.435 miles) apart. With one stop called Universidad – located closer to the university – and another called Río Piedras, it is easy to see how this disconnects students from the locale where they are studying.

Gentrification is linked back to corruption and government failures. After Hurricane María, Puerto Rico was given the Community Development Block Grant Disaster Recover (CDBG-DR) from the U.S. Department of Housing and Urban Development. The grant was to be used to help those who may have been displaced or if their homes were damaged due to the hurricane. These funds were instead used to convert an old mall into single family homes (notiseis360pr, 2023). Residents of Río Piedras have also expressed discontent with city re-development, such as the redeveloped park with fountains that have not worked since the first week it was installed, and trees cut down in Paseo de Diego only to be

replaced with metal grates to simulate “shade”. As with all things, there must be a reason for development that residents do not seek, and most of it is for politicians to gain funding from construction developers.

We also found that in rural areas, much like the rest of Puerto Rico, there is a higher number of older people. Not many young people participate in agriculture, and this means that the number of people working in agriculture is declining. The older people that do work in agriculture may sometimes take shortcuts such as pesticide usage or rely more on machinery to take care of their crops. These decisions affect agriculture health and can make it more difficult for older farmers to recover after times of disaster if they rely on machinery that uses gasoline or oil.

In rural areas, after a disaster it can be hard to gain FEMA relief if houses are destroyed or damaged. We interviewed a couple whose roof was cracked during Hurricane María, and had moved nine times in seven years, and only in 2023 were they finally able to find a home and they are in the process of purchasing it. According to one of our liaisons, the government’s failures to provide after disaster has left the Puerto Rican diaspora with more distrust in donating to government relief projects, and they are instead turning to donate to community-based organizations.

4.5 Communities are Determined and Not Resigning

From our semi-structured interviews, our team found that communities are determined and not resigning. While on the ground, our team spent time speaking with various community groups, from rural areas to urban areas, to strengthen AMA's network of support during emergencies. Through these conversations, our team heard first-hand accounts of how issues like gentrification and corruption are affecting communities that are impacted by the increase of natural disasters.

Through semi-structured interviews, our team saw that Puerto Rican communities have seen a severe lack of development. The corruption in areas such as Río Piedras has led to the construction of community areas that do not benefit community needs. To counteract such developments, community-based organizations like CAUCE and Fideicomiso have emerged in an attempt to fight for the improvement of quality of life in Río Piedras created from Law 75, the "Special Law for the Rehabilitation of Río Piedras". This law created different organizations with the goal of residents having a say in city planning through the creation of different urban community-based organizations. CAUCE is a program that aims to strengthen the bond between the University of Puerto Rico with the people of Río Piedras to promote the development of the community and its members. Fideicomiso is a non-profit organization that is currently purchasing abandoned buildings in Río Piedras to transform them into community spaces. One project of Fideicomiso is to develop low-income housing for Río Piedras, as gentrification is particularly prevalent in this area.

Figure 16 An entrance to Paseo de Diego (Photo by Grant Burrier)

Our team has seen gentrification's impact on communities as one of AMA's allies, Paseo 13, is currently fighting being displaced from an abandoned building. Prior to Paseo 13's occupation of this building, the structure was left unkept by its absentee owner from California. Paseo 13 is a notable example of this. Paseo 13's biggest goal is to obtain their building

for long-term usage. It was previously abandoned. However, due to the gentrification of the area, the building owner – who lives in California – now wants to sell the property to developers. The resulting development is usually "luxury" apartments and condos that are unaffordable for the local community. This forces more Puerto Ricans into homelessness and breaks up communities, as residents are forced to find affordable housing outside the community.

As noted previously, the Puerto Rican agricultural community has a lack of development because of its colonial experiences, which have emphasized monocultures and the production of cash crops through legislation. This priority placed on monocultures is unhealthy for soil health and crop production as it is unnatural and less resilient. In the current climate crisis, it is important to implement practices, such as agroecology, to promote crop resilience and soil health. One organization that we spoke with, Sierra Club, is working to achieve changes that advance environmental and climate justice. Sierra Club runs a program that focuses on immersing Puerto Rican youth into nature to reconnect their relationship with the Earth. Additionally, many farmers we spoke with noted the difficulty in acquiring land plots as the pricing is expensive and land has been lost because of new owners wanting to redevelop the land. This means that many Puerto Rican natives who may want to acquire farming land are unable to due to land acquisition hardships. The increase in difficulty in land acquisition has caused a disconnection between Puerto Ricans and their ancestral roots. To combat this disconnection, Somos Espejos acts as a space for collective healing and community building through their various workshops. More specifically, Somos Espejos is working to revive the connection between Puerto Ricans and nature. The group at Somos Espejos immerses themselves into their native culture by rejecting the culture enforced by Spanish colonialism, Catholicism, and embracing the spiritual practices of the original inhabitants of Puerto Rico, the Taíno. Such practices include healing from the Earth's elements and understanding the symbolism behind tools commonly used in agriculture. These groups

stand at the forefront of resiliency in the agricultural sector by resisting agricultural and spiritual practices forced upon them by Puerto Rican colonial roots.

The impact of Spanish colonialism and culture is also seen in the presence of machismo in Puerto Rico. This concept, defined as strong or aggressive masculine pride, is particularly evident in areas that are typically thought of as masculine, such as agriculture. Through our team's connections with various organizations that work to bridge this gap of inequality. Centro Paz Para Ti acts as community advocates for gender-based violence and prevention in Adjuntas. Their projects focus on food sovereignty and security, economic development, and a resilience center in addition to their medicinal garden. This group serves to support women so that they can safely leave abusive relationships.

While each of these community groups offer something different, they all share resilience to the issues that affect them. These issues, such as lack of community development and corruption, are remnants of Puerto Rico's history as a colony. Alongside our sponsor, AMA, these groups plan to continue their fight against unjust treatment and neglect.

4.6 Limitations

The WPI team recognizes that this project has many limitations. The main limitation was time, as we only have seven weeks of preparation, and seven weeks of time in Puerto Rico. This impediment caused us to restrict the amount of effort we were able to spend on each deliverable and decrease the number of deliverables. We also had a limited number of opportunities to travel to rural areas. We were only able to travel to Lares once, which decreased the amount of information we had to build our rural emergency plan from. Another limitation was the amount of aid we could provide to Paseo 13 during the initial news of possible displacement which happened halfway through our time in Puerto Rico. We were unable to make as much of an impact on Paseo 13 as originally planned and could not use Paseo 13 as a meeting space. Our project was limited by the connections AMA has with the community, as we were unable to interview organizations that were not allied with AMA.

Although there are many limitations, the WPI team overcame challenges utilizing organizational and teamwork skills. Working through these challenges, we were able to collaborate with a new liaison to the WPI Puerto Rico Project Center, building a lasting relationship. Overall, this project can inform agricultural and urban communities impacted by government inequity, and hopefully be a resource for the betterment of communities. We encourage other organizations to take inspiration from our emergency plan and adapt it according to their community's needs.

5.0 Conclusion

Alongside AMA, the ally organizations are working to strengthen their network to continue the path of resilience. The remnants and presence of colonialism in Puerto Rico has demonstrated the need for these groups to join forces in an emergency plan. Through our time in Puerto Rico, we have scratched the surface of struggles that Puerto Ricans face every day, and we recognize the need for and importance of community-based organizations.

5.1 Recommendations

One of the main limitations evident in this project was the time constraint, as there were only seven weeks dedicated to preparation and seven weeks in Puerto Rico. As such, there were many things the team would have loved to work on with AMA had time allowed. The recommendations for future collaborations include projects involving Paseo 13, website continuation, and expanding an ecosystem of support outside of the island. To accomplish such projects, the team is also recommending a change in project center housing.

A main ally in AMA's network of support is Paseo 13, an artist collective located in Río Piedras. The team spent several meetings with the collective discussing projects they hope to accomplish in the future. Three project topics were discussed in depth as they relate to Paseo 13's work as a resilience hub in times of emergency. These plans include expanding the collective's medicinal garden, water filtration system, and solar power system. These project

recommendations are in the best interest of the WPI PRPC because Paseo 13 stands at the forefront of the younger Puerto Rican generation fighting to make a lasting impact on the archipelago.

Though the five systems created as part of our emergency plan automate emergency procedures to a degree, the systems still require management by AMA on the backend. It is our recommendation that future work with AMA involves the full automation of these systems. For the rapid response and alert systems, automation would involve merging the two into a proposed distribution system. First, a distribution system would take in community needs and alert volunteers to participate in brigades based on these needs. Secondly, the distribution system would alert AMA to the amount and location of resources needed, allowing AMA to effectively distribute resources from their resilience hubs. For the inventory, workshop, and mapping systems, full automation would mean the information gathered from these systems is automatically placed on AMA's website. Automatic transfer of information to AMA's website would mean that there are no steps for AMA to take between the systems' respective forms being completed and public visibility of the compiled information. With less steps required by AMA on the backend of these systems, community needs could be met quicker.

Our recommendations for the Global Experience Office (GEO) are to reduce barriers regarding travel and to provide housing for WPI students closer to their sponsor's location. As stated previously in our limitations, we only had one visit to Lares, and two to Trujillo Alto in San Juan. This was due to the transportation restrictions from the Global Experience Office. This can also increase the quality of work for students as they will be fully immersed in the community's culture and gain a more complete view. This can also be financially beneficial as housing outside of Condado may be less expensive. Condado is one of the main tourist areas in Puerto Rico which can cause some critiques between community members and

students, making it hard to gain community members' trust without sponsor's aid. Students would also save money and help promote local business with local grocery stores being closer, and local restaurants being more accessible.

We recommend establishing an ecosystem of support between the mainland and Puerto Rico. By connecting organizations like AMA to other organizations or universities like Worcester, MA, it can provide more information and create a larger support network. These allies can be essential for understanding other existing emergency plans, collaborating between one another, and could potentially help in serving as a network system for Puerto Rico and the mainland in times of emergency.

We also recommend discovering a way to expand the ecosystem beyond the mainland, by connecting communities with organizations that have similar challenges in their environment. For example, it would be beneficial to connect AMA with organizations that experience hurricanes and lack of government response to collaborate on their emergency response plans. The Global Experience Office should develop a system for these tools to be more easily accessed between different project locations to encourage collaboration across project centers.

5.2 Final Reflections

The past seven weeks our team spent in Puerto Rico has been an invaluable part of our undergraduate experience largely because of the passion, dedication, and connections of our liaison, Apoyo Mutuo Agrícola. Jessica and Martín welcomed us into the existing network of support, allowing our team to collaborate directly with community members. While time spent with community members was focused on completing interviews, we also had the chance to connect with these interviewees on a personal level. These experiences were particularly eye opening because of the stark contrast between the effects of colonization on Puerto Rico and our reality as university students in Massachusetts. Our team is incredibly grateful for the opportunities that the IQP allowed us to experience and the hard work of our liaisons, Jessica and Martín.

Through this project, we learned information about Puerto Rico that would not have been possible to learn within our normal coursework. By participating in brigades, we were able to see the importance of communities working together and helping one another when doing hands-on work. Our brigades at Somos Espejos displayed prevalent agricultural challenges and how imperative it is to develop solutions as challenges arise. This project was also eye-opening as it connected our prior archival research to reality, particularly when observing the resilience of communities, such as Paseo 13, AMA, and Somos Espejos. From our interviews, we learned how the effects of colonization in Puerto Rico have never truly disappeared.

Furthermore, our project taught us specific software and research skills as well as how to incorporate holistic health into our daily lives. By simultaneously using a variety of tools within the Google Workspace, we learned the benefits of

intercommunication between Google applications. Using auto-populate features in Google Sheets and Google My Maps allowed us to boost the productivity of tools developed for AMA. Our research skills were developed through revising interview questions after interviews to improve the flow of conversation. This iterative process allowed us to conduct interviews which provided a structured wealth of information. Learning holistic health tools occurred naturally in the presence of our sponsors, as it is the essence of their work. Typically, in our conversations, they provided insights into medicinal plants and ways to boost mental health.

All of us were positively impacted through our collaboration with AMA. Some of us have learned a greater appreciation of global events and their interconnectedness, and others have reignited their passion for community work. We recognize that our efforts were productive in great part due to our liaisons, Jessica and Martín, and the effort they put into collaborating on the emergency plan. Their hard work and dedication are contagious as all members on the WPI team immediately felt their passion and excitement. We will greatly miss them and wish them the best in their future works. Our team also has appreciation for Puerto Rico's beauty, and given the chance, we would love to come back to aid in additional efforts that support Puerto Ricans and community-led development of Puerto Rico.

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Annex

Appendix A. Verbal Statement of Consent

Investigators: Ian Cody, Mya Darrow, Katelyn Lunny, Naomi Treto

Contact Information: gr- **PR24D-AMA@wpi.edu**

Hello and thank you for participating in this interview. Would you prefer if this interview was conducted in English or Spanish? [Participant answers].

We are students working with Apoyo Mutuo Agricola and are interested in learning more about [XYZ] with the goal of better informing our research. Before we begin, I'd like to ask, do you consent to participating in this interview? Your participation is entirely voluntary, and you are free to ask any clarifying questions or withdraw at any time without any consequences. If you have any additional questions, you may email us at gr-PR24-AMA@wpi.edu. Any identifying data that we collect will be anonymized. [Participant answers]. Is it okay if we take notes during our conversation?

Appendix B. Bulleted Version of Statement of Consent

- Thank the participant.
- Say a little bit about us and our work with AMA.
- State the goal/interest in conversation/interview.
- Ask for consent to ask questions/take notes.
- Remind voluntary participation and personal data will be anonymized.