Communities as First Responders: Piñones, Puerto Rico After Disaster

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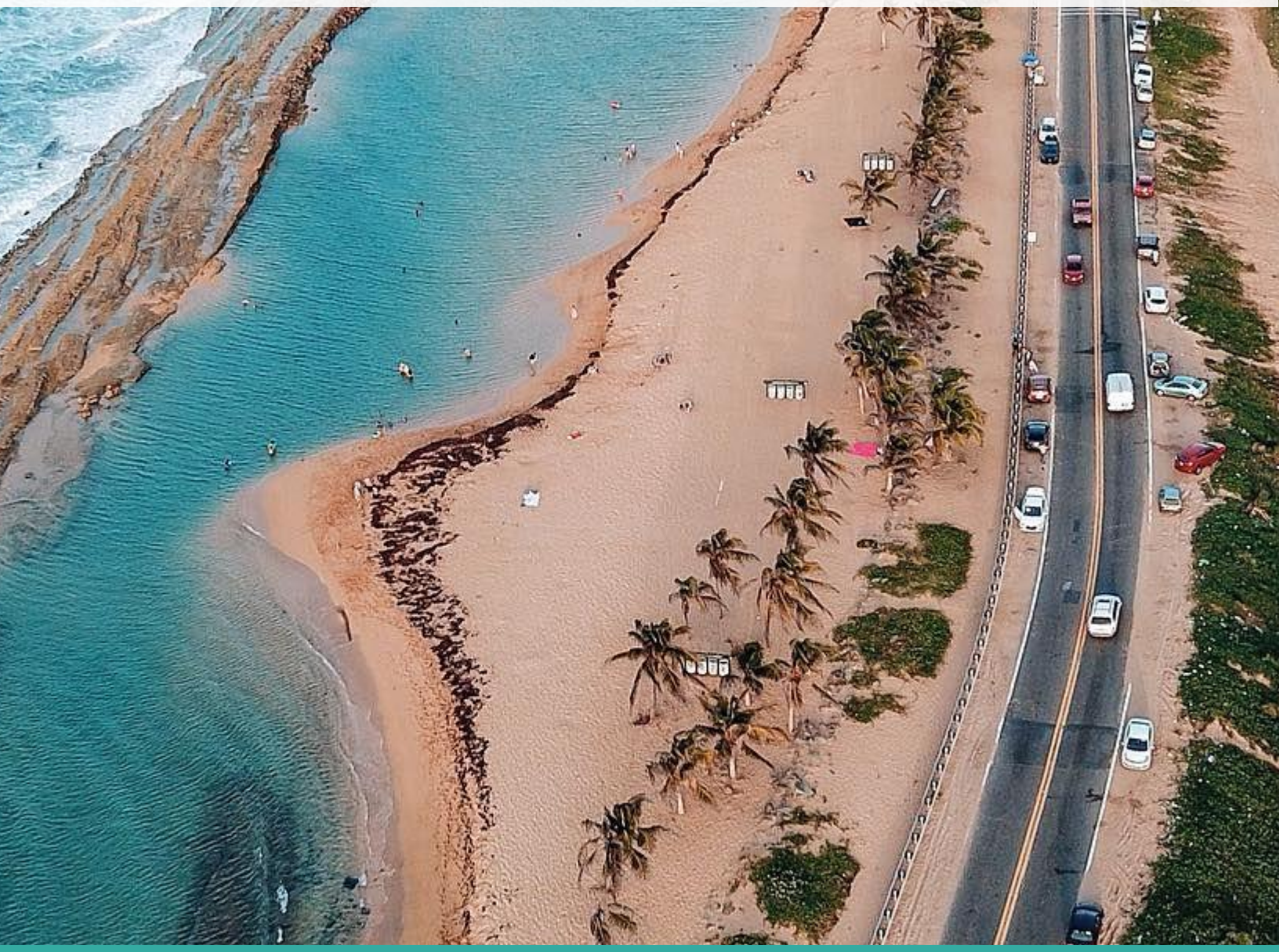

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Abstract

The community of Piñones, Puerto Rico habitually encounters seasonal *marejadas* (tidal waves) and severe hurricanes. Working with La Corporación Piñones Se Integra (COPI), this project focused on exploring past community experiences about natural disasters to initiate organized preparedness and response for the future. We investigated the concept of the community as first responders, analyzing models for Place Attachment, Zero-Order Responders, and adapting the Model for Disaster Resiliency of Place. We gathered stories from community members about natural disasters and created two videos about disaster response across generations, a Spanish-language podcast and large-scale outreach material for the community.

Figure 1. La Pocita, a popular beach in Piñones *(Photo credit: Rachel Swanson)*.

Acknowledgements

Figure 2. The COPI Center *(Photo credit: Rachel Swanson).*

Our project would not have been possible without the help of our sponsor Maricruz Rivera Clemente and her collaborators at COPI. We are grateful for the help of Marcos Peñaloza Pica and Nuria Escalera. Our co-researchers Shawn Escalera, Paola Rolon-Díaz, and Angel Bermúdez-Gagot provided insight and guidance throughout this project, help that included translation, interview coordination and research collaborators. We are especially grateful for their kindness and companionship throughout our time in Piñones.

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Authorship

Chapter/Section	Primary Drafter(s)	Secondary Drafter(s)	Editors
Abstract	Ellis	Ellis	-
Executive Summary	Swanson	Swanson	Earley
Introduction	Ellis, Larson	Ellis, Larson	-
Setting the Narrative	-	-	-
The Piñones Community	Swanson	Swanson	-
Austerity in Puerto Rico	Ellis	Ellis	-
Natural Disasters in Puerto Rico	Ellis	Ellis	-
Community Resilience and First Response	Earley	Earley	Swanson
Importance of Personal Narratives in Disasters	Ellis	Ellis	-
Emergency Preparedness in Puerto Rico	Larson	Larson	-
La Corporación Piñones se Integra	Ellis	Swanson	-
Approaches	-	-	-
Project Goal and Objectives	Ellis	Ellis	ALL
Investigating Dynamics	Ellis	Ellis	ALL
Adapting an Existing Model	Ellis	Ellis	ALL
Beyond the Interviews	Ellis	Ellis	ALL
Findings	-	-	-
Adapting the DROP Model	Earley	Earley	-
The Adapted DROP Model	Earley	Earley	-
Place Attachment Model	Earley	Earley	-
Zero-Order Response Model	Earley	Earley	-
“Piñones Emergency Ready!” / “¡Listo Para Emergencias!”	Ellis	Ellis	-

A Storyworld of Community Perspectives and Reflections	ALL	ALL	Swanson
Conclusions and Recommendations	Swanson	Swanson	-

The chapters which are labeled as “ALL” were a result of collaborative writing in which sections were divided among members and compiled into one chapter. All sections were edited by all team members.

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Executive Summary

Figure 3. Shoreline in Piñones *(Photo credit: Rachel Swanson)*.

Piñones, Puerto Rico is a tight-knit community of Afro-Caribbeans who have lived in this area for more than 400 years. The community is surrounded by three large bodies of water: the Atlantic Ocean to the north and both the Laguna la Torecilla and the Laguna de Piñones to the south. The area is continually affected by seasonal *marejadas*, or tidal waves, and hurricanes and is vulnerable to flooding from the ocean, lagoons, and canals. Most notably, Hurricane María, a Category 5 Hurricane, struck Puerto Rico in 2017 causing catastrophic damage to the community. External assistance and resources were slow to arrive in Piñones and little government assistance was provided in the aftermath of the storm. Instead, the community relied on their own resources for recovery – resources that were essential when power was out for months after the storm, and homes were in need of rebuilding. Piñones was able to overcome these challenges after the devastation of María through self-sufficiency and self-reliance, qualities that reflect the concept of the community as first responders.

La Corporación Piñones Se Integra (COPI)

La Corporación Piñones Se Integra (COPI) is a community-based nonprofit organization comprised of people from in and around the Piñones area. COPI celebrates the culture and history of Piñones, while also supporting the community to be better prepared for future natural disasters. COPI is invested in understanding how the Piñones community tackles emergency preparedness and response, as this is vital knowledge for the survival of the community in the event of a disaster. COPI was interested in better understanding the community's experience of natural disasters and preparedness and recovery strategies. This IQP project focused on collecting personal stories and investigating how the experiences of local residents could be analyzed through various models of community resiliency in the context of disasters.

Goal and Objectives

The goal of this project was to explore experiences of the people of Piñones in light of the concept of the community as first responders. Our team created four objectives to meet this goal.

I. Explore the perspectives of various stakeholders in terms of past and present emergency preparation and response.
II. Compile community experiences of past natural disasters and investigate dynamics of community networks and coping responses.
III. Adapt existing model of community after disasters to organize and analyze the concept of "community as first responders."
IV. Consider and reflect on community member perspectives for future emergency preparedness to stimulate deeper conversations.

Collecting community experiences through interviews

The intricacies, characteristics and dynamics of a community, and the unpredictability of natural disasters, make quantifying a community's resilience less helpful than gauging a community's resilience from members' perspectives of their community and how it operates (Sherrieb et al., 2010). We conducted 17 key informant interviews, including semi-structured and ad hoc interviews, with community leaders, residents, and external stakeholders to gather perspectives on disaster response, preparation, and the lived experience of natural disasters by people in and around Piñones. We sought to understand the role of individuals and networks of community response in the aftermath of Hurricane María, including how supply networks functioned, the role of spiritual support during emergencies, and perceptions of risk. We collected an array of stories and experiences across age, gender, and location.

Adapting a model of community resilience

We adapted the Disaster Resilience of Place (DROP) model by Susan Cutter et al. (2008) to fit the experiences of the community. To highlight the ways in which the Piñones community facilitated its own relief efforts, we coded and analyzed our interviews using this model. We organized our findings to describe what occurred before, during, and after an event such as Hurricane María.

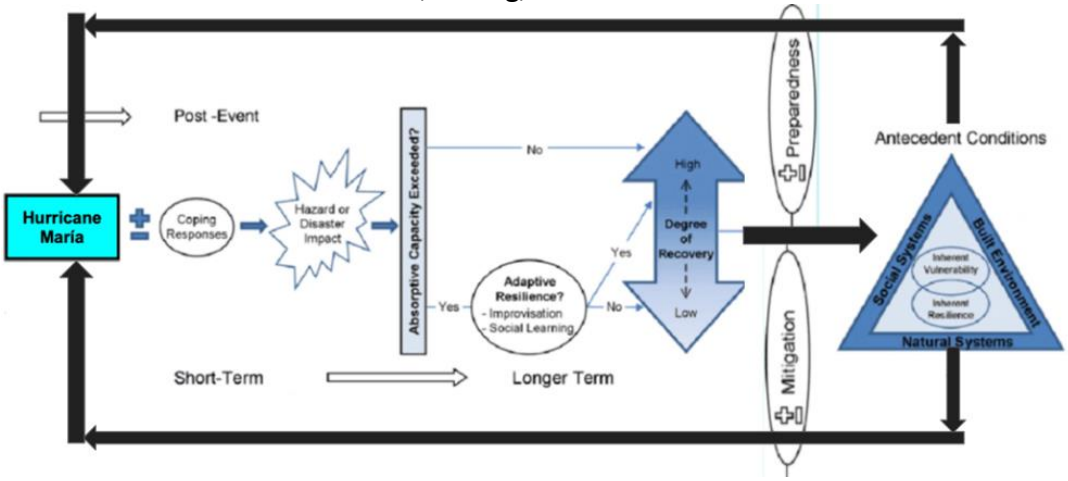


Figure 4. Cutter et al.'s (2008) DROP Model, adapted.

We also related interview content to the Swapan and Sadeque's (2021) theories of place attachment and different classifications of responders, such as Phung et al.'s (2017) Community First Responders, Briones, Vachon, and Glantz's (2019) distinctions between Immediate Responders, Zero-Order Responders (ZORs), and Professional First Responders after disaster.

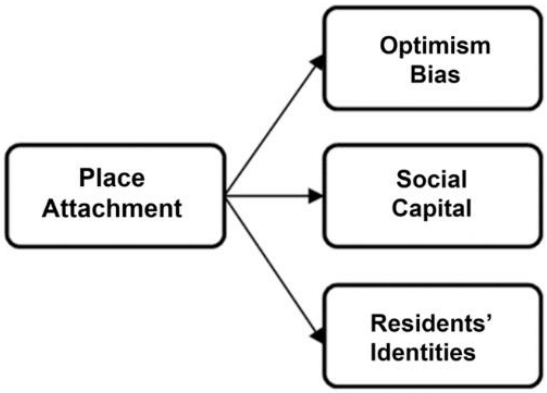


Figure 5. Swapan and Sadeque's (2021) Place Attachment Model.

Community First Responders	Community members with basic medical training
Immediate Responders	Those that respond to disaster due to proximity
First Responders	Trained professionals by formal government structure
Zero-Order Responders	Local resident involvement with immediate relief and recovery

Figure 6. Briones, Vachon, & Glantz (2019) Community Members as Disaster First Responders Model.

In addition, we compared content to the CDC's Crisis and Emergency Risk Communication (CERC) manual and model for community response after disaster (CDC, 2015). We used these models to understand the different dimensions of the Piñones community as first responders. Our project sought to understand the unique relationship that a community has with its coping responses and how a community's resources, networks, and culture influences this concept of community as first responders.

Storytelling through videos, a podcast, and outreach material

We created several storyworld elements to appeal to various audiences, such as community members, visitors to COPI, and an academic audience. We produced a "Community as First Responders" video showcasing community experiences of Hurricane María. This video highlights how, despite lack of government support, and a lack of power and resources, people in Piñones were able to overcome the challenges of Hurricane Maria. The "Memoirs of María" video and "La Última Ficha" / "The Last Piece" podcast featured the three coresearchers who represent millennial voices in the community. The "Memoirs of María" video is an English-language exploration that intertwines coresearchers' memories of Hurricane María and the response of the communities. The co-researchers created one episode of "La Última Ficha" podcast, a Spanish-language podcast on coping mechanisms in the aftermath of Hurricane María. We also designed the "Endurance, Resilience, Perseverance" banner to be displayed at COPI. The largescale (2'x6') public banner

spotlights compelling quotes and portraits from interviews with community members as well as archival photos. The "Endurance, Resilience, Perseverance" banner can be used to highlight the community's strengths, capabilities, social networks, and vulnerabilities. It was designed to support COPI's efforts to better prepare for and respond to natural disasters.

Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!

"Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!" is a household worksheet that includes a checklist for general emergencies, prompts for evacuation procedures, emergency contact information, and reminders of storm preparation procedures. The worksheet served as a way to generate conversations about individual preparation, evacuation strategies, and reflections on actions that residents could take prior to natural disasters.

Figure 7. Angel Bermúdez-Gagot, a co-researcher, filling out the worksheet *(Photo credit: Rachel Swanson).*

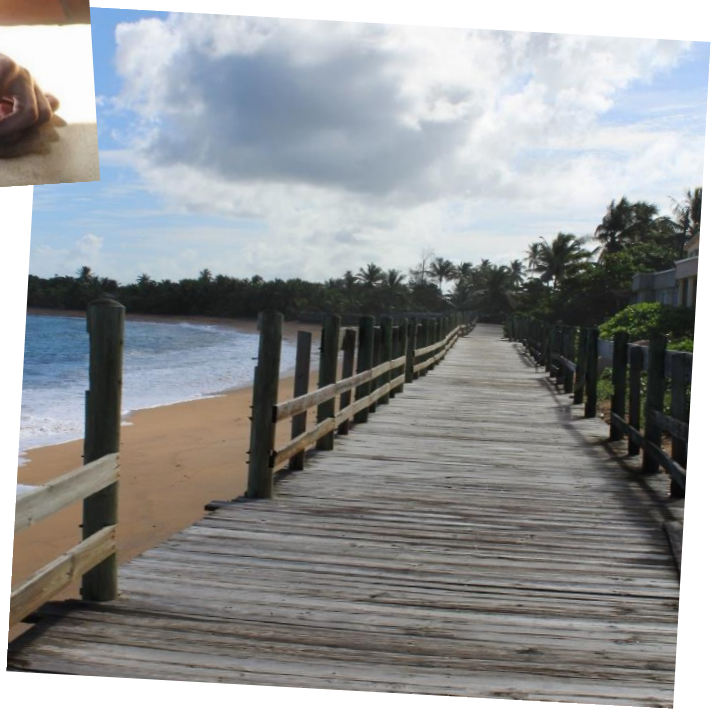
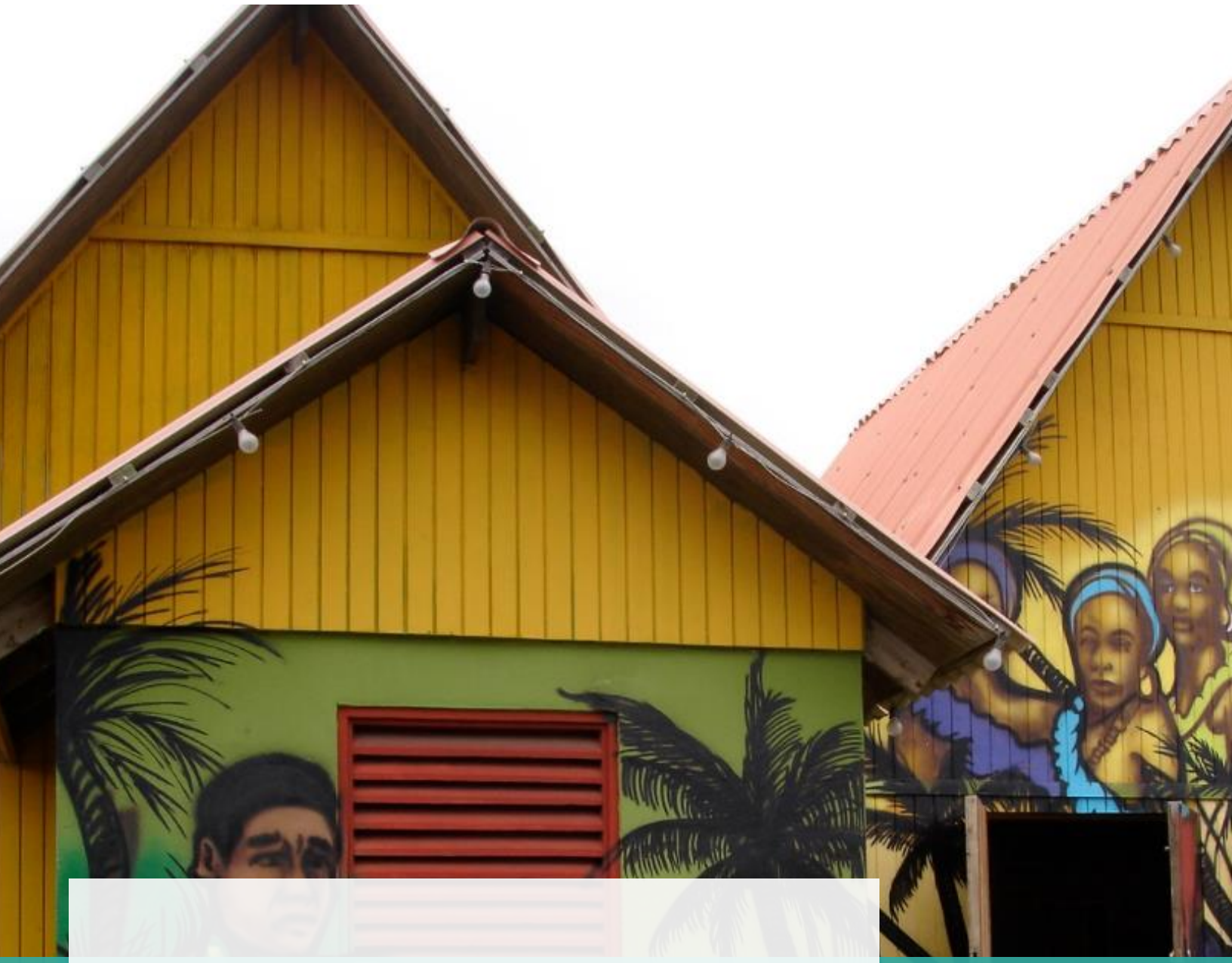


Figure 8. Boardwalk along the Piñones shoreline *(Photo credit: Rachel Swanson).*



Introduction

Hurricanes and Marejadas

On September 20th, 2017, Hurricane María struck Puerto Rico. As a Category 5 storm with winds that exceeded 155 mph winds, Maria was the strongest hurricane to strike the island in 80 years and was regarded as the worst natural disaster in Puerto Rico's recorded history García-López, 2018). Much of the island's infrastructure was decimated and roadways and the electrical grid were not fully restored for almost a year after the storm. While official data sources report that only 64 deaths resulted directly from the storm, more than 3,000 deaths were attributed to Hurricane María a year in the following years (Keelings, 2019).

Puerto Rico remains vulnerable to natural disasters, with many communities, especially those along the coastline, prone not only to disasters such as hurricanes, but also to more frequent storms and tidal surges.

Figure 9. Shoreline of the edge of La Pocita, a popular beach in Piñones *(Photo credit: Rachel Swanson).*

Marejadas (tidal waves) and storm surges are abnormal rises in sea levels caused by strong winds from a tropical storm or hurricane ("Storm Surge Overview" n.d.). When large waves and additional rainfall combine, these water surges can flood inland. High tides can cause erosion of shoreline features as well as change the location of sand and sediment along a given coast. Not only can these tides deteriorate a shoreline, but they can also flood the surrounding communities, which causes widespread devastation. Tidal waves and storm surges can also generate strong currents, strong enough to make boats incapable of proper transportation throughout the water (Davis, 2021; *Storm surges*, n.d.*)*.

The Piñones Community

Piñones is community, of about 2,000 people, located ten miles to the east of metropolitan San Juan along the northern coast of the island. It is home to generations of Afro-Caribbean families that have occupied the land for more than 400 continuous years. Residents in Piñones have developed a high-level of self-sufficiency in light of government neglect, lack of community schools and medical services, racism, and social and economic marginalization (Maricruz Rivera Clemente, personal communication, October 21, 2021).

Piñones is located between three large bodies of water: the Atlantic Ocean to the north, the Laguna de Torecilla to the south, and the Laguna de Piñones to the southeast. This geographic configuration leads the community to be susceptible to floods and natural disasters, such as hurricanes and seasonal m*arejadas.*

Figure 10. Ariel view of Piñones, showing the Atlantic Ocean (top, right), the Laguna de Torecilla (left) (Girona, n.d.).

It is very difficult to travel through, let alone evacuate from, the Piñones area because there is only one main road (Highway 187) that runs alongside the ocean, with two-lane bridges at the entrance and exit to the community. Highway 187 frequently floods and is regularly jammed with traffic.

La Corporación Piñones Se Integra

Our sponsor, the non-profit community organization, La Corporación Piñones Se Integra (COPI), celebrates the cultural and historical aspects of Piñones. COPI is committed to supporting the community to be better prepared for future natural disasters. Through collaborations with our sponsor and our coresearchers, the goal of our project was to explore experiences from the people of Piñones considering the concept of the community as first responders.

Setting the Narrative

The Piñones Community
Austerity in Puerto Rico
Natural Disasters in Puerto Rico
Community Resilience and First Response
Importance of Personal Narratives in Disasters
Emergency Preparedness in Puerto Rico
La Corporación Piñones Se Integra

The Piñones Community

The community of Piñones is vulnerable to natural hazards due to the lack of protective geography, poor infrastructure as well as a lack of physical, financial, and political resources to prepare for and recover from natural disasters. The community also contends with a history of racism, governmental neglect, and marginalization, which amplify the effects of natural disasters.

Geography and Local Infrastructure

Piñones is a small community located in Loíza, Puerto Rico, on the northeast coast of the island, 19.3 km or 12 miles, east of San Juan (Google, n.d). The Río Grande de Loíza, the second-longest river in Puerto Rico runs between Piñones and the neighboring town, Loíza. There is also a large mangrove forest and a popular beach area in Piñones. In some places, sand dunes along the beach merge with the mangrove forest (DRNA, 2021). Piñones is surrounded by water: the Atlantic Ocean in the north and the Laguna de Torecilla and the Laguna Piñones to the south (Google, n.d.). The maximum elevation in Piñones is approximately 25-30 feet, and some parts of Piñones are below sea level (National Geographic Society, 2013).

The community of Piñones is divided into eight "sectors" based on areas where houses are located. These smaller sectors identify neighborhoods. These include
(Los Cuadrángulos Topográficos, 2002):

- Sector El Terraplén
- Sector Piñones
- Sector La Torre
- Sector La Arena
- Sector Las Pajita
- Sector Los Vizcarrondo
- Sector Monte Grande
- Sector Punta Maldonado

Figure 11. Topographical map of Piñones and the surrounding geographical features (National Geographic Society, 2013).

A lack of paved roads and sidewalks make it difficult for people in Piñones to easily evacuate in times of emergency. (Garcia-Rivera, 2017). Highway 187 is the only main road that runs through Piñones, extending from San Juan to the Municipality of Loíza, connected via two bridges on either end of the highway (Google, n.d.). This highway floods and is often covered in sand in the aftermath of natural disasters.

For example, during Hurricane Hugo (1989), sand covered the entire seafront section of Highway 187. At some places on the road, the sand was estimated to be a meter deep. It is important to note that after Hugo, much of this sand was dumped into empty lots, instead of being returned to the beach to restore the dunes. This put the shoreline at risk of further erosion (Bush, 1991). In addition, coastal sand mining has also reduced the size of the shores which line the border of the community of Piñones (Rodriguez, 2017). Thus, dunes are becoming smaller and are not able to effectively protect against storm surges from hurricanes or tidal waves. As Muñoz Zaibette Maldonado notes, the exploitation of natural resources in in Piñones is increasing vulnerability to natural disasters (Muñoz Zaibette Maldonado, 2001).

Figure 12. Archival photos of Piñones after María. A collapsed building and debris from plants (*Photo credit: Mercia Soto)*.

Hurricanes have also destroyed parts of the mangrove forests. Mangrove forests aid in serving as a natural barrier to flooding due to the roots ability to absorb large quantities of water (Improvements for Shore Protection, 2013). These geographic vulnerabilities demonstrate the risk factors the community faces from a lack of protective barriers over time.

History of Piñones

In 1870, Piñones was one of the major sugarcane producing centrals in Puerto Rico. Its fertile cropland, large mangrove forests, pasture, coconuts, lagoons, and the seashore allowed for easy access to transport goods and ecological diversity that supported agriculture (Giusti-Cordero, 1994).

Figure 13. Historical photograph in Loíza, circa 1889-1899 (Esquilin, n.d.).

Mangrove collection for charcoal occurred in Piñones and Loíza during the late 1800s. Mangroves were called “black wood” (Giusti-Cordero, 2015). Piñoneros would cut down and burn wood which had been buried underground for decades, or even centuries, and sell this charcoal to railways. Railways were built across the area to easily transport sugarcane which had been cultivated (Giusti-Cordero, 2015).

The name Piñones originates from Francisco Piñon, an Afro-Carribean gold miner who owned 11 slaves in the 1530s. He lived with his family in the area which became known as the "land of Piñones" (Badillo, 2007).

Demographics

The Municipality of Loíza has a population of approximately 24,553 (U.S. Census Bureau, 2020). The racial makeup of the community is largely Afro-Puerto Rican (Giusti-Cordero, 1994). The median age of the population is 27 years. The majority (39.3%) of the population is under 19, reflecting a much larger proportion of young people in the Municipality of Loíza than the island-wide average of 17.9% (U.S. Census Bureau, 2020).

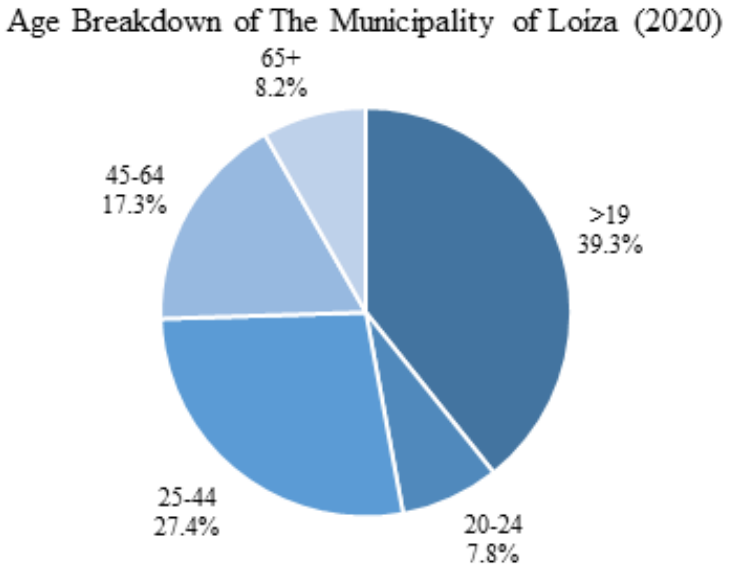


Figure 14. Breakdown by age of the Municipality of Loíza (U.S. Census Bureau, 2020).

In 2019, the median income for a household in Loiza was $8,962, while the median income for a family was $9,911. The percentage of families below the poverty line was 64.7%, again higher than the 43.5% of the island-wide population living below the poverty line (U.S. Census Bureau, 2020).

The Municipality of Loíza also has a significant number of communities categorized as *Comunidades Especiales de Puerto Rico* (Special Communities of Puerto Rico). These are marginalized communities in which residents generally live below the poverty line, lack opportunities, and lack basic infrastructure. These communities are designated by the Puerto Rico Office for Socioeconomic and Community Development (Puerto Rico OMB, 2012). Of the 742 *Comunidades Especiales* (Special Communities) that were on the list in 2013, 14 of these were in the Municipality of Loíza, including Piñones (Quintero, 2014).

Austerity in Puerto Rico

Puerto Rico is a territory of the United States. It plunged into bankruptcy in 2017 burdened by more than $70 billion in debt that had accrued since 2006 (Caraballo-Cueto, 2021). The current debt crisis is being managed by the U.S. judicial systems, specifically the Oversight Board, under the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA). In 2016, The Oversight Board implemented a set of austerity measures to control the public sector debt. Those measures aimed to lower the debt by drastically reducing wages and public spending across Puerto Rico; raising taxes; and privatizing industries such as the Puerto Rican Electric Power Authority (PREPA) (Natural Resources Committee, 2016).

Figure 15. Puerto Rican May Day protestors demand to end austerity The sign reads: "If you are not furious, you are not paying attention" (Democracy Now!, 2019).

The Impact of Austerity

Proponents of PROMESA argued that austerity measures would help control Puerto Rico's debt. Opponents argued that the severe austerity measures were attacks on the already impoverished welfare of the island. Austerity measures, they asserted, created new forms of debt causing Puerto Ricans to be burdened with humanitarian and environmental disasters (Cortes, 2018). According to Yabe, Rao, and Ukkusuri (2020), some of the consequences include a lack of location-specific emergency planning and resources to mitigate natural disasters. The local and federal governments have proven unable to effectively address the island's long-standing adversities. This has inspired many Puerto Ricans to focus on grass root efforts to confront the increasing levels of vulnerability (LeBrón, 2016).

Privatization

Disaster capitalism is defined as the concept where government institutions use catastrophe, in this case damaging natural disasters, to promote and empower a range of private capitalist interests (Schuller & Maldonado, 2016). The previous company that was responsible for Puerto Rico's electricity generation, transmission, and distribution on the entire island was the Puerto Rican Electric Power Authority (PREPA). A few months after Hurricane María, the previous governor, Ricardo Roselló, announced the privatization of PREPA (Naseck, 2018). The PROMESA board and Puerto Rico's federal government secretly signed a 15-year contract with the new electrical company LUMA. LUMA has failed to manage Puerto Rico's grid and has left one million Puerto Ricans without power (Stout, 2021). Piñones didn't receive power after Hurricane Maria hit in September, until December (Maricruz Rivera Clemente, personal communication, November 29, 2021). Due to effects of austerity measures and privatization, there's a lack of adequate resources for communities, like Piñones, when disasters strike. This is indicative of the effects of austerity and privatization, which has left communities like Piñones with inadequate resources for when disasters strike.

Natural Disasters in Puerto Rico

Storm surges and tidal waves

Puerto Rico has a hurricane season that typically runs from June 1 to November 30. During this period the island endures its most severe storm surges and *marejadas*, or tidal waves (”NOAA predicts near-normal, 2019”). Piñones, located amidst three large bodies of water, is susceptible to hurricanes, surges, and seasonal *majerjadas*. A storm surge is the abnormal rise in seawater level, primarily caused by storm winds, such as those of a hurricane, that push water onshore (“Storm Surge Overview” n.d.). The observed seawater level rise during a storm is referred to as a storm tide. Storm tides can be the result of storm surges and astronomical tides, which are caused by the gravitational pull of the sun and moon. The highest storm tides typically occur when the sun, moon, and earth are in alignment; this phenomenon referred to as a tidal wave (NOAA, 2021).

Past Natural Disasters in Puerto Rico

In September of 1989, a Category 4 hurricane, Hurricane Hugo, devastated Puerto Rico (National Academies Press, 1994). Hurricane Irma, a Category 4 hurricane, passed close to Puerto Rico on September 7, 2017, leaving one million people in Puerto Rico without power, which is approximately 70% of all consumers. Additionally, there were water service interruptions for several days (NPR, 2017).

Figure 16. Hurricane Irma destroys power lines (Robin Mejia, 2018).

Soon after, on September 20, 2017, Hurricane María struck Puerto Rico. As a Category 5 storm with greater than 155 mph winds, this was the strongest hurricane the island had seen in eighty years (García-López, 2018). One of the biggest impacts of Hurricane María was that it decimated the electrical grid, which was already fragile even before Irma. People struggled to refrigerate food and store medicine. Hospitals struggled to run dialysis machines and other electrical machines which lives depended on. Generators were in short supply and fuel was expensive (Lloréns, 2018). Communities had to rely on their own resources and networks. According to Klein, “In every case, deep community relationships, as well as strong ties to the Puerto Rican diaspora, successfully delivered lifesaving aid when the government failed and failed again,” due to austerity (Klein, 2018).

Figure 17. A collapsed building located in Aroyllo in the aftermath of Hurricane María (Zorilla, 2018).

Projected Increase in Natural Disaster Events

Scientists have concluded that the increasing temperature of the Earth's oceans and atmosphere contributes to the severity of surge storms (McMichael & Lindgren, 2011). Studies also show an upward trend in the number of natural disasters that take place each year due to climate change (Borgen Project, n.d.). Since 1960, sea level has risen approximately four inches relative to Puerto Rico's shoreline. In the next century, sea level around Puerto Rico is projected to rise one to three feet (Mercado-Irizarry, 2017). With rising sea level and higher tidal waves from surge storms, mangroves will be submerged, and coastal beaches are expected to further erode, both of which act as natural barriers for the island. The rise in sea level and change in climate is also projected to increase inland flooding. Intense rainstorms contribute to overtopping of riverbanks, causing water to accumulate in areas where water drains slowly (EPA, 2016).

Figure 18. Storm surge in San Juan, Puerto Rico (Jorge Rodriguez/Creative Commons, 2013).

Community Resilience and First Response

Community Resilience

Communities must often compensate for missing resources that might normally be expected from enabling agencies, such as the local and national governments. They turn to networks in the community to improve their situation and livelihood. Different networks connect different people, such as: family members and close ones within the community, more distant relationships in a community, and those between organizations and community. These networks serve different purposes, and their utilization can achieve different goals. As such, they can be leveraged as social capital during times of hardship to alleviate the effects of adversity in a community (Aldrich & Myer, 2015).

The capability for endurance and adaptation in times of hardship demonstrates what researchers call "community resilience," a concept that threads through the way that individuals and social systems interact and engage. Dimensions of resilience can be embedded in many aspects of a community, including through emotional support, feelings of belonging, community identity, and shared experience (Aldrich & Myer, 2015).

Models for Communities and Community Resilience After Disasters

Models of community resilience in disaster contexts are helpful ways to identify strengths and vulnerabilities in a community. The intricacies, specific characteristics and dynamics of a community, and the unpredictability of natural disasters make quantifying a community's resilience less helpful than gauging a community's resilience from members' perspectives of their community and how it operates (Sherrieb et al., 2010).

In the Disaster Resiliency of Place (DROP) model (see Figure 17), Cutter and her research team (2008) identify an *inherent resiliency* and *inherent vulnerability* that a community has before a disaster. The model highlights that the *hazard or disaster impact* on a community depends on the characteristics of the disaster, and the community's immediate *coping responses*, which Cutter et al. defines as planned responses that offset the immediate effects of a disaster event.

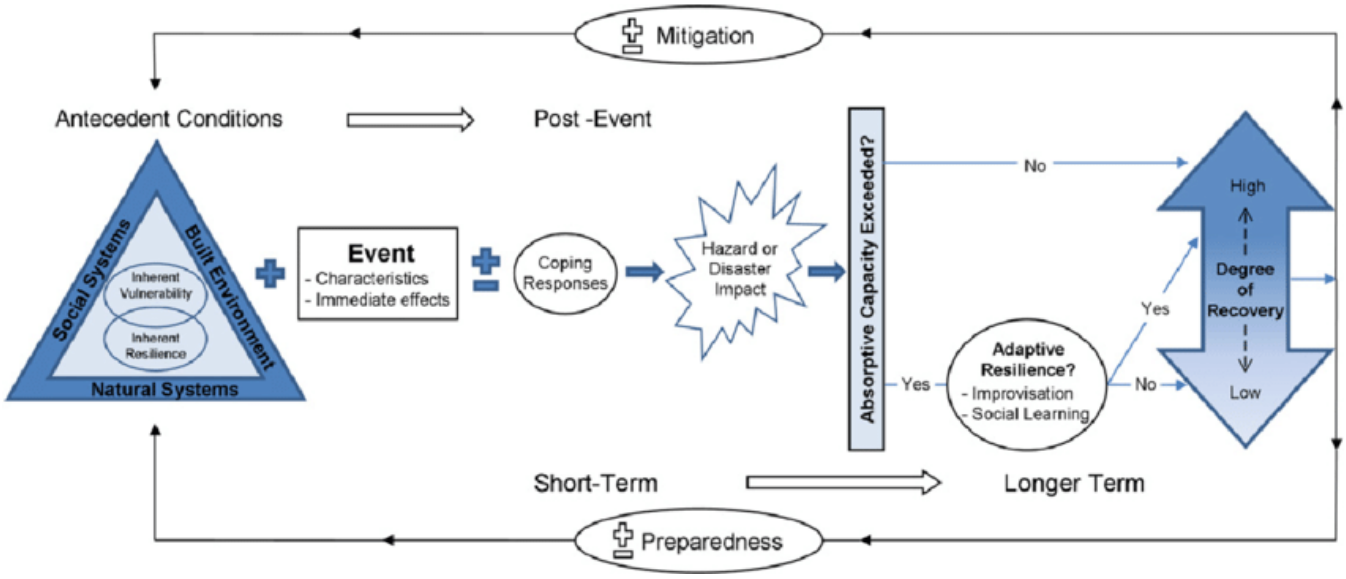


Figure 19. Cutter et al's (2008) Model for Disaster Resiliency of Place

The impact of a disaster can be both alleviated and absorbed by current resources in a community. In the DROP model, absorptive capacity comprises the existing procedures, physical resources, and other predetermined strategies to reduce the impact of disaster (Cutter et al., 2008). If this capacity can absorb the impact, then the degree of recovery is high. If the capacity is exceeded, then the degree of recovery is low (Cutter et al., 2008).

The model then proposes that inadequacies in resources inspire adaptive resiliency. Adaptive resiliency leverages improvisation and social learning to recover from disaster impacts. Cutter et al. (2008) define social learning as the acquisition of knowledge from surrounding people's actions and past experiences. Recovery from disaster impact lies on a spectrum. Depending on the level of absorptive capacity and adaptive resilience. The community debriefing and making recommendations for future preparedness then contribute to the inherent resiliency for the next disaster, emphasizing the cyclic structure of the model.

The DROP model emphasizes the cyclic nature of resilience in a disaster context, i.e., previous events and responses inform future actions of the community. The model also notes that not all coping responses and longer-term preparedness and disaster mitigation efforts benefit the community in light of a future disaster (Cutter et al., 2008).

Other models of vulnerable communities, including the Model of Stress and Resilience over Time by Norris et al. (2007), and International Fund for Agricultural Development's (IFAD) Alternative Sustainable Livelihoods Framework (2008) are not designed for, but can be applied to, communities in a disaster context (Appendix A). The Norris et al.'s (2007) model did not include humanitarian aspects of resilience that are so prevalent in the Piñones community. Instead, it is a procedural model that results in either "function" or "dysfunction." IFAD's model focuses on how individual characteristics and assets influence community actions and outcomes, but the model does not emphasize the influence of community networks. The model does highlight the role of enabling agencies and service providers (i.e., Politics & Policies, Governmental Aid and Agencies, NGOs), that interact with the community via Markets, Politics, Rights, and Culture relationships. These agencies and providers can alleviate community vulnerability. In the Piñones community, enabling agencies and service providers are an important dimension to understanding how the Piñones community responded to Hurricane María.

Place Attachment

Place attachment is a term used in many fields to describe the relationship between people and environments (Scannell & Gifford, 2010). This bond to an area is influenced by emotional, spiritual, cultural, and social factors (Adger et al., 2010). Swapan and Sadeque (2021) reviewed 22 research articles regarding place attachment in hazard-prone areas. Across these articles, they noted the following concepts:

- Place attachment was a reason that residents in hazard-prone areas did not relocate, indicating 'optimism bias.' Optimism bias is the underestimation of negative consequences that would affect someone personally. It does not prompt action to mitigate negative consequences, as they are not regarded as truly threatening.
- Place attachment and high levels of social capital often result in residents staying in their location rather than migrating to safer areas.
- Places of attachment are connected to "social and psychological meaning" (Swapan & Sadeque, 2021). Thus, these areas are embedded into residents' identities: leaving is "akin to

losing one's identity" (Swapan & Sadeque, 2021). Places of attachment are often seen as safer due to the feeling of familiarity (Swapan & Sadeque, 2021).

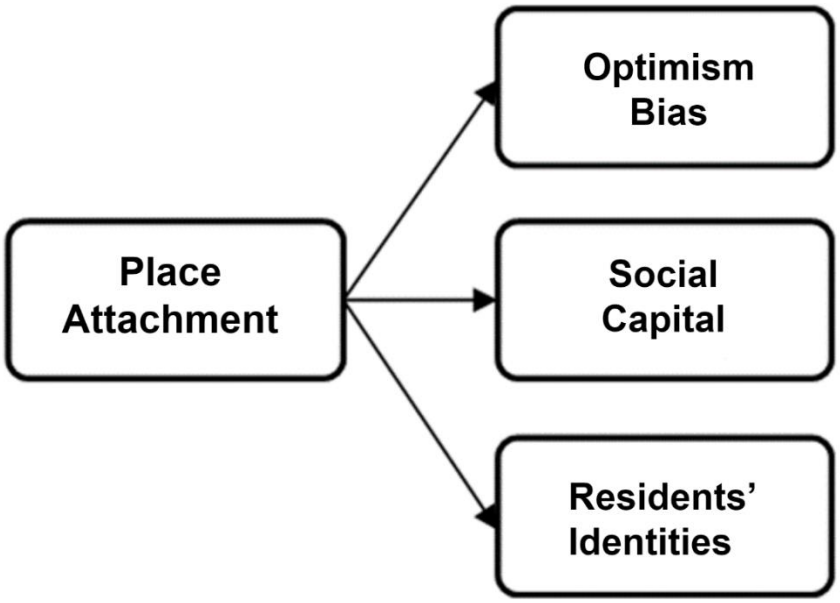


Figure 20. Concepts on place attachment (Swapan & Sedeque, 2021).

Place-based attachment is founded on the qualities of a place, while psychology-based attachment is grounded in "emotional and perception-related" qualities associated with the place of attachment. The analysis proposes that place attachment that is primarily psychology-based will lend itself to staying in a hazard area when there is strong social capital and socio-cultural beliefs at this location (Swapan & Sadeque, 2021).

Community Members as Disaster First Responders

Regardless of whether place attachment influences whether people remain in their communities when disaster strikes, the aftermath of disaster is initially in the hands of those in the disaster location. The U.S. Department of Health and Human Services' Crisis Emergency Risk Communication (CERC) Manual states that a minimum "72-hour delay" for "federal or state help" can be expected after a disaster (CDC, 2015). Relevant government agencies aim to "stabilize the crisis situation" before turning responsibility over to the community (CDC, 2015). The CERC manual acknowledges that family and community members will be the first to respond to a disaster and are the "biggest assets" in emergency preparation and response (CDC, 2015). To improve this first response, the CDC has provided a list of instructions for community members to take inventory of their community's risks, resources, and stockpiling abilities to better prepare for disaster (CDC, 2015).

The concept of 'community first responders' varies across the scholarly literature. According to Phung et al. (2017), community first responders are residents in areas without easy access to hospitals. These first responders provide basic medical management until qualified personnel arrive (Phung et al., 2017). 'Immediate responders' are those who find themselves responding to a disaster due to their proximity to the disaster. Immediate responders often do not have training in disaster response (Joseph et al., 2020). 'First Responders' are trained professionals who are dispatched to areas of disaster by "formal government structures" (Briones,

Vachon, & Glantz, 2019). 'Zero-Order Responders' (ZORs) are a concept that recently emerged from local resident involvement with immediate relief and recovery actions, such as rebuilding homes after a disaster. Briones, Vachon, and Glantz (2019) report that ZORs maximize the function of present resources and act in innovative ways to survive and thrive after disaster. Briones, Vachon, and Glantz (2019) also propose teaching improvisation, as a method of resilience, to other at-risk communities (Briones, Vachon, & Glantz, 2019).

Table 1. Community Members as Zero-Order Responders (Birones, Vachon, & Glantz, 2019)

Community First Responders	Community members with basic medical training
Immediate Responders	Those that respond to disaster due to proximity
First Responders	Trained professionals by formal government structure
Zero-Order Responders	Local resident involvement with immediate relief and recovery

Importance of Personal Narratives in Disasters

Narratives are personal stories that enable expressions of self-identity (Phoenix & Sparkes, 2009). An event can be presented by different people without being any less "true" (Greenhalgh, 1999). According to Ruth and Kenyon (1996), narratives are not just personal accounts of life experiences, they allow insight into how life has been lived, how it is lived now, and how it can be lived in the future. In this sense, recounting past experiences can become a resource for present and future actions.

Disaster studies focus on the decision-making process and emotional response in personal narratives. Listening to people's personal stories is how others learn more about the meaning of disaster and human adaptation to it (Stein, 1999). Jencson noted that, "the greater understanding of ritualized and emotional aspects of disaster response, will contribute practical knowledge of use in the mitigation of disaster consequences in an increasingly imperiled world" (Jencson, 2001).

Emergency Preparedness in Puerto Rico

Emergency preparedness refers to the steps taken to be safe before, during, and after an emergency (Department of Health, 2008). The Federal Emergency Management Agency (FEMA), part of the U.S. Department of Homeland Security, provides information and resources to both plan for and respond to different emergencies. For emergency preparedness, FEMA provides tools such as risk and evacuation maps (Figure 21) and provides local contacts for emergency situations (United States FEMA, 1997).

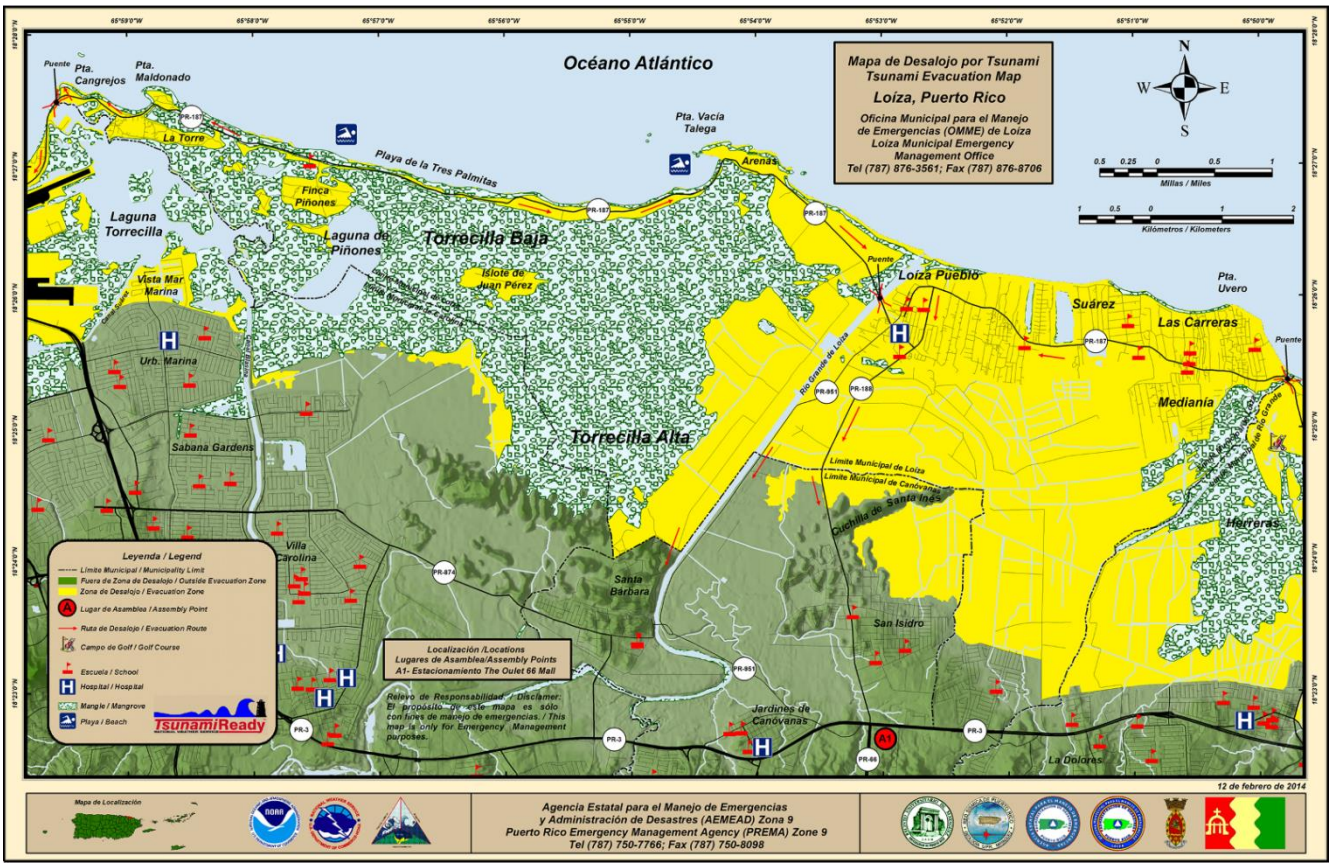


Figure 21. Evacuation map for Loíza as issued by PREMA in 2014, specifically for the case of a tsunami. Red arrows indicate routes of evacuation via roadway or waterway (Puerto Rico Emergency Management Team, 2014).

Puerto Rico is a part of FEMA's Region 2, which also contains New York and New Jersey. FEMA's resources available for Puerto Rico are environmental and disaster risk assessments, mitigation guides, and a list of other available resources around Puerto Rico (United States FEMA, 1997). FEMA also operates offices and warehouses on the island, but they are focused near urban areas, such as San Juan and Caguas, and would be hard to access from rural areas. FEMA has struggled with its emergency response and preparation in the past. During Hurricane Maria, FEMA's Puerto Rico supply warehouses were found to be nearly empty and understaffed (United States FEMA, 2018). A later FEMA report from 2018 found that the planning assessment they used was from 2012, leading to an underestimation of requirements for the hurricane in 2017 (United States FEMA, 2018).

Difference in Disaster Relief

Residents and business owners in Piñones were worse-off than those in the nearby metropolitan area of San Juan when Hurricane María came (Garica-Lopez, 2018). There were a limited number of stores in the surrounding area and roads were often blocked with obstructions such as sand, debris, and water. The wealthier area of Condado in San Juan, by contrast, was one of the first to have electricity restored in addition to being powered by large backup generators regardless (Garcia-Lopez, 2018). Food and clean water were also major concerns for many people across the island, including Piñones. On October 11, 2017, FEMA officials admitted their concern about a food shortage on the island. The agency was supplying two hundred thousand meals a day but estimated that it fell two million meals short of the island's need (The Guardian, 2017). Additionally, one month after María, FEMA had distributed 6.2 million gallons of bottled water, only 9% of the island's drinking water requirement per WHO guidelines (Rozsa, 2017). However, this shortage did not affect those in the Condado area: "In the Condado neighborhood, only three weeks after the hurricane there was live music, people happily drinking and eating, powered by massive generators in my daily visits to a hotel to use my computer" (Garica-Lopez, 2018).

Figure 22. Archival photo of María of heavy flooding in a street in Piñones *(Photo credit: Mercia Soto).*

La Corporación Piñones Se Integra

Our sponsor, La Corporación Piñones Se Integra (COPI), is a community-based nonprofit organization composed of people from in and around the Piñones area who are committed to finding alternative solutions to the existing social problems in Piñones (Corporación Piñones se Integra (COPI), 2015). COPI has a strong focus on empowerment through programs that revolve around history and culture. Additionally, COPI runs a mangrove reforestation program (Marcos A. Peñaloza Pica, personal communication, October 25, 2021).

COPI has been involved in emergency preparedness and response for the Piñones community. During Hurricane María, COPI was a center for emergency relief through the organization and distribution of donations and resources before the government was able to issue supplies to the community. In the aftermath of the disaster, COPI sought to better understand the community's relief and recovery strategies to better support and serve their community in times of disaster. COPI identified an interest in collecting community perspectives on emergency to better understand how the people of Piñones acts as first responders before, during and after disaster events.

Approaches

Project Goal and Objectives
Investigating Dynamics
Adapting an Existing Model
Beyond the Interviews

Project Objectives

I. Explore the perspectives of various stakeholders in terms of past and present emergency preparation and response.
II. Compile community experiences of past natural disasters and investigate dynamics of community networks and coping responses.
III. Adapt existing model of community after disasters to organize and analyze the concept of "community as first responders."
IV. Consider and reflect on community member perspectives for future emergency preparedness to stimulate deeper conversations.

Project Goal and Objectives

The goal of this project was to explore experiences from the people of Piñones in light of the concept of the community as first responders. We collected stories from various stakeholders in Piñones on past natural disasters. We analyzed these stories and produced different forms of media to portray the community's strengths, capabilities, challenges, and vulnerabilities. We also adapted an emergency preparedness worksheet for the community to stimulate more awareness of preparation strategies and to catalyze conversations about preparedness.

Figure 21 is a flowchart that summarizes our objectives and methods.

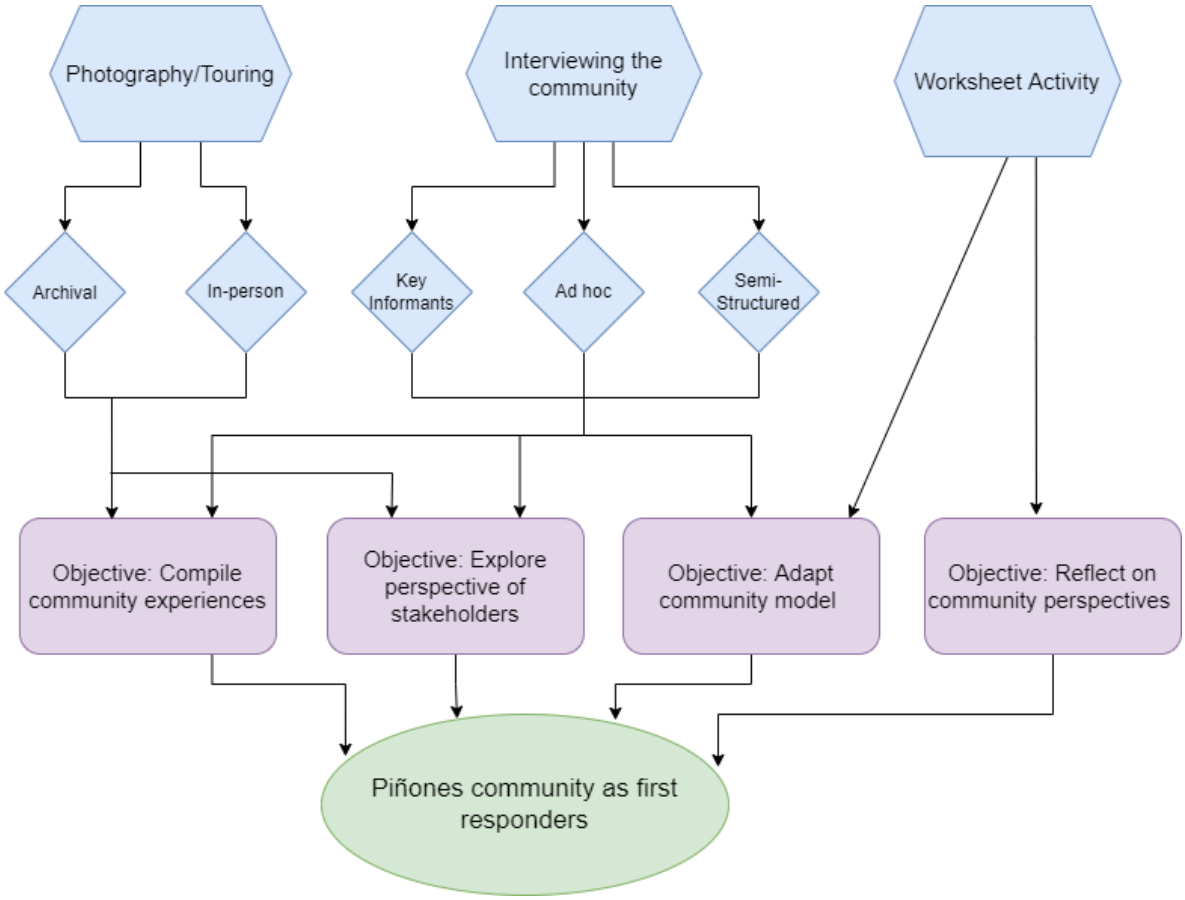


Figure 23. Flowchart of each objective leading to our main methods and ultimately to our project goal.

Investigating Dynamics

An essential part of our project was obtaining the perspectives and experiences of community members who had witnessed natural disasters in Puerto Rico. Local residents were chosen using mixed sampling strategies comprised of convenience, purposive, and snowball sampling. We obtained the perspective of a diverse set of community members, getting information from a variety of ages, genders, locations, and community status.

Co-researchers

Our project work involved collaboration with three co-researchers, Paola Rolon-Díaz, Shawn Escalera, and Angel A. Bermúdez-Gagot. They assisted in facilitating community outreach, interview organizing interviews, translating, and serving as bridges between our team and the community. Shawn Escalera was born and raised in Piñones, Paola Rolon-Díaz is connected to Piñones through Shawn Escalera, and Angel A. Bermúdez-Gagot has family in Piñones and a friendship with both Shawn Escalera and Paola Rolon-Díaz.

Figures 24 & 25. Our co-researchers, Paola Rolon-Díaz (top, left), Shawn Escalera (top, right), and Angel A. Bermúdez-Gagot (below) *(Photo credit: Rachel Swanson)*

Convenience Sampling

We first attempted a convenience sampling strategy. Convenience sampling is a type of nonrandom sampling where research subjects of a target population are easily accessible to the researcher. These samples are sometimes referred to as “accidental samples” because they may happen near to where the researcher is conducting data collection (Etikan, Musa, & Alkassim, 2016). We attempted “door-to-door" strategies and speaking with people as we walked through the community. Due to the time of day, lack of people around, and that we were not affiliated with the community, this sampling strategy was not as effective as other strategies.

Purposive Sampling

We also pursued a purposive sampling strategy. Purposive sampling is when a researcher deliberately chooses a participant due to the qualities of the participant (Etikan, Musa, & Alkassim, 2016). This was useful for our project because we wanted to interview people within the broader community of Piñones who have dealt with natural disasters. With the help of our sponsor and co-researchers, we were recommended specific people to interview such as those in construction, pastors, and young adults.

Snowball Sampling

We also utilized a snowball sampling strategy. Snowball sampling refers to when a few identified members of a population, in this case community leader, Nuria Escalera introduced us to our co-researchers, Shawn Escalera and Paola Rolon-Díaz, who then identified other members of the population to obtain a nonprobability sampling (Handcock & Gile, 2011). This was extremely helpful for our project as our co-researchers helped point us towards people who would be willing to be interviewed.

Mixed Sampling Strategies

Many of our interactions with community members resulted from mixed sampling strategies. These were effective when our co-researchers, Paola Rolon-Díaz and Shawn Escalera, took us into the community at a time when they knew people would be available to interview and brought us to specific neighborhoods where we could find people who likely had experiences relevant to our project. This is akin to snowball sampling. However, the individuals interviewed depended on who was there when we were in the neighborhood, and resembled convenience sampling. Furthermore, the dual nature of co-researchers as both community members and researchers blurred the boundaries of these sampling strategies. Figure 24 illustrates how the mixed sampling method gave us access to more interviewees.

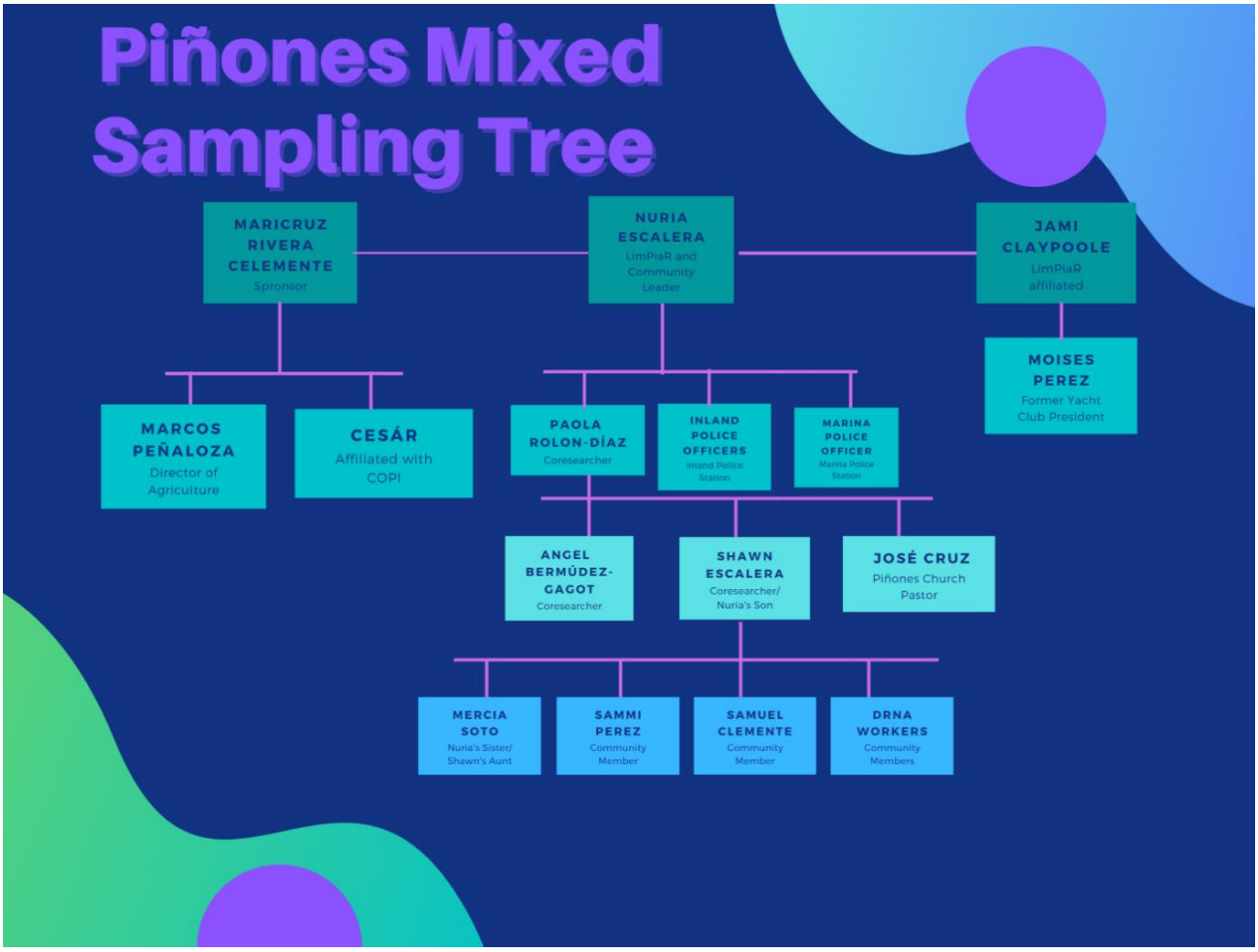


Figure 26. A tree visual for how the mixed sampling method led us to people we interviewed.

Interviews

Interviewees provided direct insight into what is important to understand about the broader area of Piñones and allowed us to gather knowledge related to our project goal. We gathered people's stories on their previous experiences in emergency situations and how they would prepare for a future emergency. This allowed us to learn from what the community has done in the past and get a sense of their current preparedness. We conducted key informant, semi-structed, and ad hoc interviews. Appendix B contains interview questions for community members and leaders. We recorded interviews using audio and video equipment. In some interviews with community members, we only collected audio recordings due to privacy concerns.

Key Informant Interviews

Figure 27. Our team conducting an interview with Marcos Peñaloza *(Photo credit: Rachel Swanson).*

Key informants are knowledgeable people who have an in-depth understanding about a community, such as leaders, residents, or professionals in the area. Conducting interviews with these people was essential to our project as these interviews will provide direct insight into local attitudes and concerns in terms of emergency preparedness. We recorded key informant interviews with Maricruz Rivera Clemente, Nuria Escalera, José Cruz, Moises Perez, Marcos Peñaloza, Paola Rolon-Díaz, Shawn Escalera, and Angel Bermúdez-Gagot. In addition to obtaining the perspectives of residents in Piñones, we also explored the viewpoint of local stakeholders who were not residents. Of the key informant interviews conducted, six were local stakeholders. These stakeholders included three police officers from the inland police station and marina police station, the Cangrejos Yacht Club former president, and two workers from the Departamento de Recursos Naturales y Ambientales (DRNA). The stakeholders were chosen by purposive sampling. The police stations are located in Piñones, the Cangrejos Yacht Club is located directly across La Torrecilla lagoon from COPI, and the DRNA workers were located at a well-known government regulated park within the sector of Piñones. The interviews with the police officers were written only, and interviews with DRNA workers were audio only for privacy reasons. These interviews were conducted in a semi-structured format.

Semi-structured Interviews

Information on how residents reacted to and prepared for past disasters was obtained via interviews. Information such as the types of warnings the community had to inform their preparation and response was information we hoped to gather from the community. This was done mainly through semi-structured interviews, which allowed the flexibility to adapt to naturally changing conversation (Louise Barriball & While, 1994). We conducted semi-structured interviews with all key informants.

Ad hoc Interviews

We conducted ad hoc, or very informal, unplanned interviews at various locations such as local restaurants and around the community. Over the course of seven weeks, we had numerous occasions to have ad hoc conversation with our sponsor, COPI employees, and our co-researchers. Interview questions were formed in a more conversational style around topics such as experiences with Hurricane María and the individual's involvement and perceptions of the community.

Adapting an Existing Model

In order to investigate the utility of various models of resilience to the reality of people's experiences in Piñones, we transcribed and analyzed all of our interviews. English interviews were transcribed from audio using a computer application called Descript. Spanish interviews were translated with the help of our co-researchers. All transcriptions were uploaded to our online shared folder. In cases where we did not record audio, we uploaded our hand-written field notes to our shared folder.

Transcripts and field notes were coded by themes based on major recurring concepts. These themes were based on elements of community's and their potential in influencing response as well as community perspectives and how they shape behavior. Coding is a qualitative form of analysis that assigns a short word or phrase to a longer section of text. Coding not only facilitates interview comprehension and analysis, but it also aids in organizing information across interviews (Saldana, 2008). Figure 28 presents the themes used to analyze our interviews.

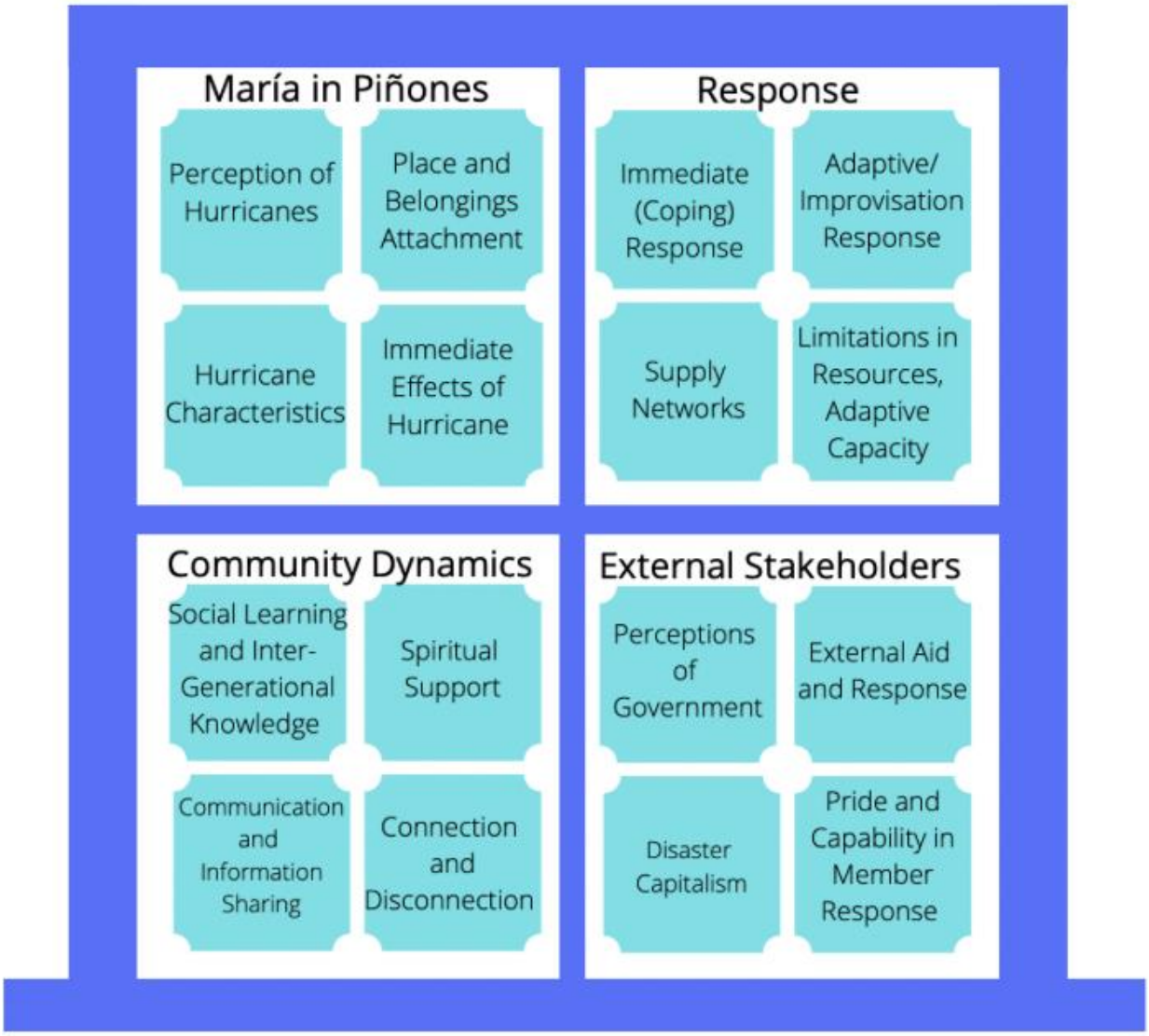


Figure 28. Coding themes used to analyze transcriptions and notes.

Beyond the Interviews

Objective number four focused on community perspectives beyond interviews. We engaged in photo elicitation, community tours, photography, video, and audio recordings.

Photo Elicitation

We used the photo elicitation method where to collect photos of flooding in Piñones and around, sand blocking Highway 187, and other damage-related photos from natural disasters. We requested photographs from multiple community members and their consent to use them as part of our project. Photographs, especially from disasters, such as Hurricane María and seasonal *marejadas*, provided context and visual representation of storm damage and storm response.

Community Tours

We went on many walking tours of the community, with our co-researchers and community leader Nuria Escalera, all of whom have extensive knowledge about the community and its dynamics. We also toured the community via car, bike, and kayak to get a better understanding of the geography of the community and its waterways which could be used for evacuation.

Photography

On all community tours we took our own photographs. We also requested consent to take and utilize portraits of community members we interviewed. These photographs were used within our deliverables and throughout our written report.

Audio & Video Recordings

Video for all interviews was recorded using a HERO 7 Go Pro and a Canon T5 Rebel. Additionally, the HERO 7 was also used to record a community tour and several b-roll footages used within our deliverables. Audio for all interviews was recorded using a Zoom H5 Recorder. On one occasion, during a community tour audio was recorded using an iPhone. We used audio recording in our deliverables.

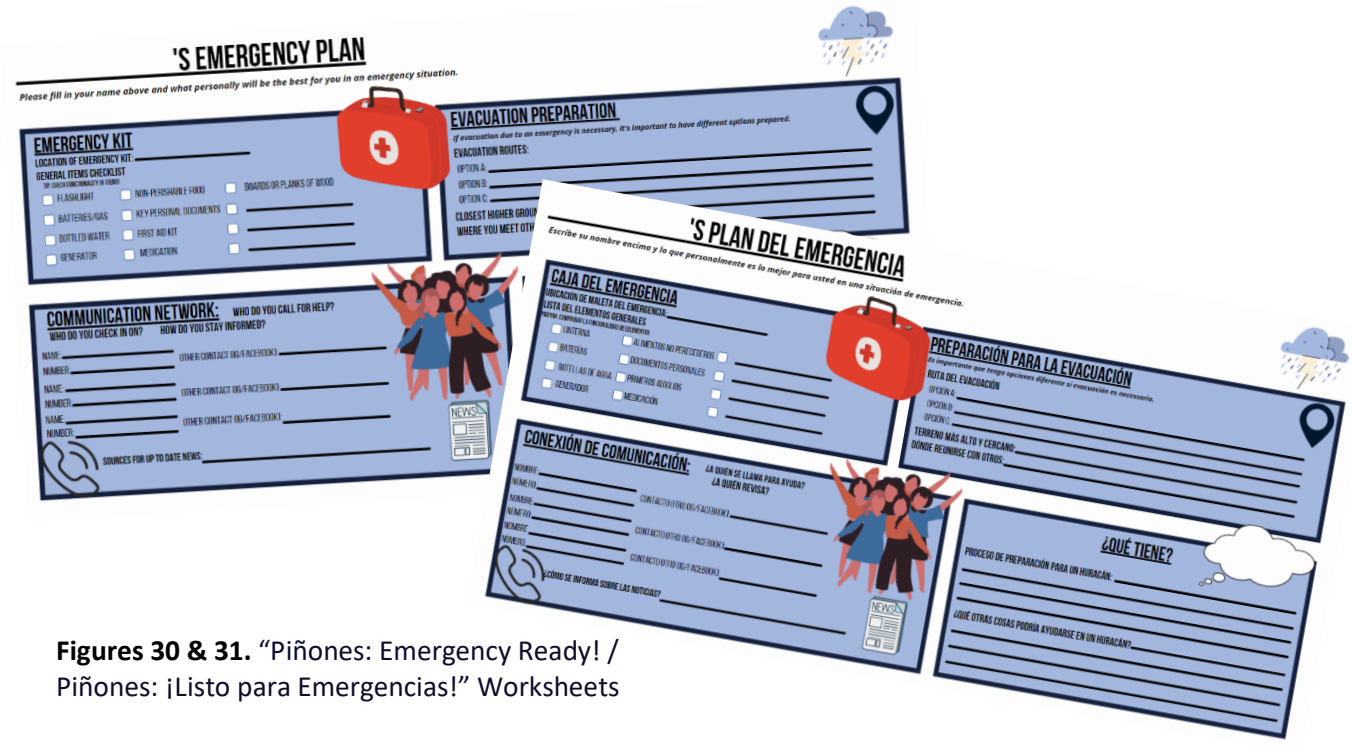
"Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!"

We adapted a worksheet from the Reducing Flood Risk in Shkodër Through Community Engagement IQP (Dickinson, Dione, St. Pierre, & Weiss, 2017). The worksheet included a general emergency checklist, prompts of possible evacuation procedures, emergency contact information, and reflections of storm preparation procedures. The purpose of this worksheet was to bring awareness to personal hurricane/disaster preparation and stimulate conversation. The worksheet was created in both English and Spanish.

Focus Group

The worksheet was created to be tested in a focus group of five people. A focus group is a group of people assembled to participate in a discussion about certain material (Stewart & Shamdasani, 2014). While the group of Piñones residents aged 18-29 was completing the worksheet, our team observed how participants reacted, how long it took to complete, and asked what suggestions participants have for possible future iterations. We used the responses to create an updated version of the worksheet.

Figure 29. Our co-researcher, Paola-Rolon Díaz, filling out the worksheet (*Photo credit: Rachel Swanson)*.



Figures 30 & 31. "Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!" Worksheets

Findings

Adapting the DROP Model

The Adapted DROP Model

Place Attachment Model

Zero-Order Response Model

“Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!”
A Storyworld of Community Perspectives and Reflections

Our project sought to understand the unique relationship that a community has with its coping responses: how do a community's resources, networks, and culture influence its coping and adaptive responses, after disaster and inform future emergency preparedness. The capability for endurance and adaptation in times of hardship demonstrates what researchers call "community resilience" (Sherrieb et al., 2010). Personal narratives shared during interviews helped gauge the community's resilience efforts and information that was not captured in qualitative measures of Hurricane Maria's impact. As Jencson said, "The greater understanding of ritualized and emotional aspects of disaster response, will contribute practical knowledge of use in the mitigation of disaster consequences in an increasingly imperiled world (Jencson, 2001)." With the information gathered by our methods, our team has analyzed the concept of the community as first responders through a reimagined community framework originally proposed by Susan Cutter et al (2008).

Figure 32. Abandoned home along the shoreline (*Photo credit: Rachel Swanson)*.

Table 2. Key Informants

Name	Title	Storytelling
Maricruz Rivera Clemente	Founder of COPI	Video and Audio
Nuria Escalera	Community Leader of Piñones	Written notes, Video and Audio
José Cruz García	Church Pastor of Iglesia Universal de Jesucristo	Video and Audio
Marina Police officer *(name withheld)*	Chief Commander of the Marina Police Station	Written notes only
Inland Police officers *(names withheld)*	Inland Police Station Officers	Written Notes only
Marcos Peñaloza Pica	Director of Agriculture at COPI	Video and Audio
Moises Perez	Former President of Cangrejos Yacht Club	Video and Audio
Juan Boria and Eniel Bolón	DRNA workers at the Bosque Estatal de Piñones	Audio only
Paola Paola Rolon-Díaz	Co-researcher	Video and Audio, Written Notes
Shawn Escalera	Co-researcher	Video and Audio, Written Notes
Angel Bermúdez-Gagot	Co-researcher	Video and Audio
Mercia Soto	Resident of Piñones	Video and Audio
Sammi Perez	Resident of Piñones	Audio Only
Samuel Clemente	Resident of Piñones	Audio Only

Adapting the DROP Model

This DROP Model was rearranged to better suit the information and perspectives gathered throughout our project.

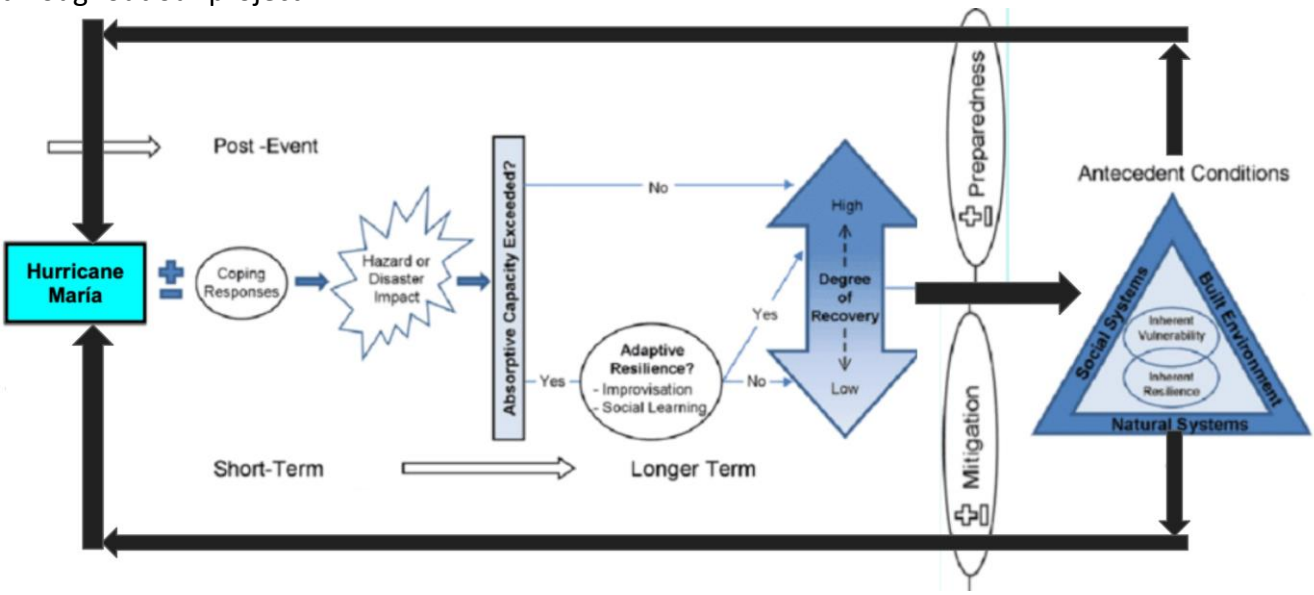


Figure 33. Our revised DROP model.

First, we shifted the *antecedent conditions* icon to the end of the model sequence. The content of our interviews did not explore details of what the community was like specifically before María struck Piñones. Instead, our findings regarded the current qualities of the Piñones community and how those dynamics contribute to the community's inherent vulnerability and resilience for future disaster events. As the model is cyclic, this does not change the sequence of the model but changes the logical starting point to our findings.

We also restructured the *preparedness* and *mitigation* icons so that the arrows from *degree of recovery* to *antecedent conditions* and *antecedent conditions* to *disaster event* flow through those icons. We feel this allows the analysis of long-term and short-term preparedness efforts for disasters.

The Adapted DROP Model

Disaster Event

Disaster events are an element in the Adapted DROP model. Cutter et al. (2008) emphasize the *characteristics* of the disaster event and the *immediate effects* of the disaster. These two elements of the *disaster event* contribute to the *impacts of disaster* (see Disaster Impact in this chapter). Cutter et al. (2008) provide examples of *disaster event characteristics* such as classification and categorization of the event itself. In our interviews, descriptions of Hurricane María's *characteristics* were less prevalent than the *immediate effects* of the disaster on the community. These *immediate effects* were both physical changes and emotional reactions in the Piñones community that resulted from the hurricane itself.

Immediate Effects of Hurricane María in Piñones

Hurricane María was the most recent, destructive hurricane that community members experienced. Marcos Peñaloza described how roofs were ripped off like can openers, and Nuria Escalera explained how "the doors were bending inside like someone was actually pushing the door." Co-researcher, Shawn Escalera, conveyed that:

"All preparations went completely to waste, as soon as María hit. It was like Irma kind of washed through our defenses and left us completely exposed. And then María came."

José Cruz talked about the danger posed by projectiles, such as an iron pole which was stuck about a foot into the tree.

Interviewees shared their immediate emotional reaction to storm. Nuria Escalera described how emotionally she felt unprepared for the storm: "I went to bed comfortably, not worrying about anything." She also explained her experience as an army veteran and the anxiety she struggles with due to her years of service. She spoke of the effects of Hurricane María provoking this emotional response:

"Being in the dark was so hard for me because that caused depression and anxiety. Horrible"
Nuria Escalera, community leader

Figure 34. Nuria Escalera, community leader (*Photo credit: Rachel Swanson*).

The immediate impact of the storm resulted in new trauma for many people and a re-traumatization for many others. Physical and emotional aftereffects engrained in the collective memory of the Piñones community.

"You see your own roof about a mile down the road in a huge pile. Those sorts of images stay with you."
Marcos Peñaloza, Director of Agriculture at COPI

Figure 35. Marcos Peñaloza, Director of Agriculture at COPI (*Photo credit: Rachel Swanson*).

Coping Response

Coping response in our Adapted DROP model uses Cutter et al.'s (2008) definition: *coping response* identifies the actions taken in response to the *immediate effects* of the disaster.

Community Influencing Coping Response after Disaster

Interviewees described utilizing networks and social capital in Piñones during the *immediate response* of Hurricane María. These strategies were seen in the *coping responses* of community members interviewed.

Residents who stayed in place during Hurricanes Irma and María sustained the community, social, and spiritual networks of Piñones. Those networks provided the community with resources such as skills, manpower, and knowledge that can be used in a coping response. Thus, there is an interactive relationship between community networks and *coping response*.

Family networks also influenced response after María. Paola Rolon-Díaz and Angel Bermúdez-Gagot described the Piñones community as a clan, given the amount of extended families. Multiple interviewees including Nuria Escalera, Maricruz Rivera Clemente, and Samuel Perez noted that they all live near family in the community the Torre and the Piñones sectors. During the immediate aftermath, people recruited their family members for response efforts following the disaster.

Disaster Impact

Disaster impact refers to the sum of antecedent conditions, immediate effects of the disaster, and the positive or negative coping responses that result according to the Cutter et al. (2008) model.

Through their accounts of immediate effects of Hurricane María and coping responses to those effects, interviewees conveyed that Piñones was isolated from many outside influences. This was displayed in the physical damage to infrastructure and reduced connection to greater networks during the aftermath of Hurricane María.

Figure 36. Portrait of our Sponsor, Maricruz Rivera Clemente (*Photo credit: Rachel Swanson*).

Physical Impact

Hurricane María changed the resources available to the community. Nuria Escalera shared that the community went months "without electricity, without potable water, without supermarkets, without access to money. There wasn't anything."

Nuria Escalera and Maricruz Rivera Clemete described how people were unable to access their savings funds because the banks were not open.

Travel was limited by significant flooding and sand obstruction. Highway 187, the only way to drive in and out of the community, was inaccessible to cars during most of the aftermath of the disaster. The majority of Paola Rolon-Díaz's journey to Piñones after the storm was by car, but she had to walk once she got close to the Piñones sector due to the sand blocking the road. Mercia Soto spoke of the walk through the sand-filled roads to get to the open supermarket in Isla Verde.

Structural damage was also an impact of Hurricane María. Beachfront restaurants crumbled and the local school suffered foundational damage. Samuel (Sammi) Perez, 61 years old, described his previous home and how Hurricane María "picked that shack up like a tissue and threw it into the palm trees."

Damage to homes was prevalent in interviewee responses about the impact of Hurricane María, some highlighted in the Disaster Event section. Cutter et al.'s (2008) model shows that immediate effects of disaster, if not successfully overcome by coping response, factor into disaster impact.

Impact on Greater Networks

Maricruz Rivera Clemente explained that, even with emergency resources, "a generator does not solve all your problems." Preparedness efforts and stockpiled resources by community members improved aspects of Hurricane María, but community members still struggled accessing funds and physically getting to stores to improve resources. In addition, Mercia Soto described how the high demand of gas and food in Puerto Rico caused hours-long wait times to even enter grocery stores, let alone acquire needed resources.

Many interviewees spoke of the challenges of communication during the aftermath of Hurricane María. Cell service was very unreliable, and it was difficult to recharge cell phones because

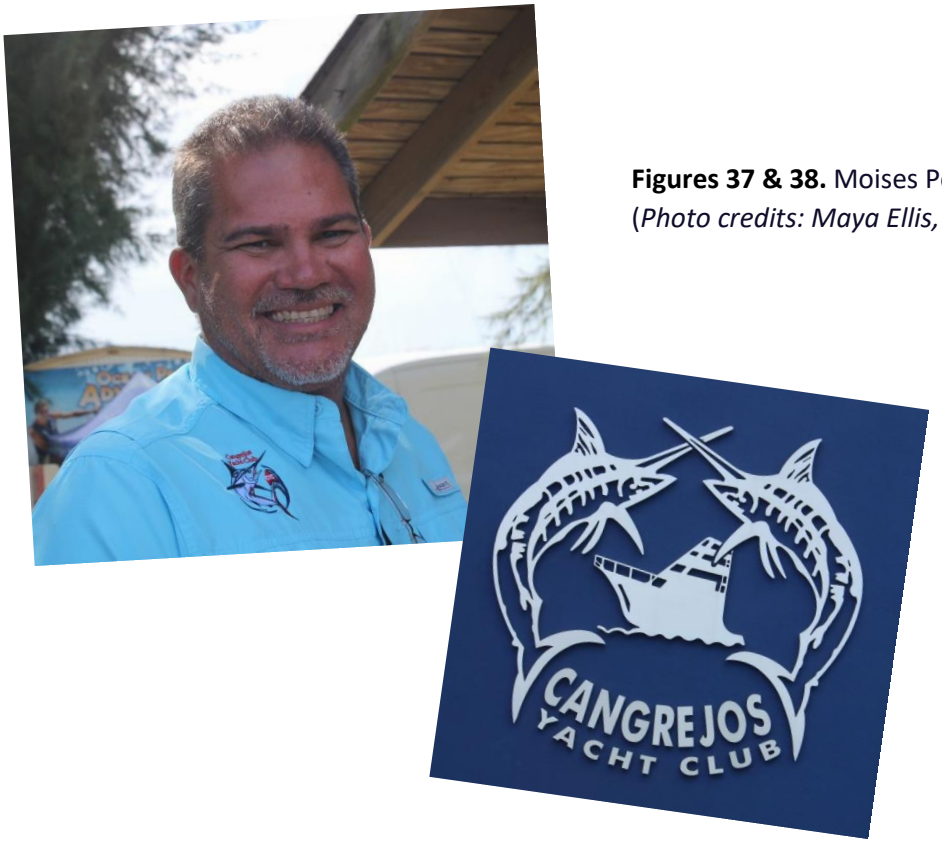
of the widespread power outages. Some interviews identified the main doorway in COPI and the entrance to the airport as more reliable areas of cell service compared to other parts of Piñones. As such, networks of communication were more localized.

Disparities in Disaster Impact

Included in the *antecedent conditions* of the DROP model, Cutter et al. (2008) also identify that the built environment, such as infrastructure, of a community influences the impact of a disaster. In Piñones, this is supported by Garica-Lopez (2018) compared livelihoods in Piñones to a neighboring town, Carolina, which has access to more resources.

The characteristics which make Piñones vulnerable to disasters, such as its demographics and lack of government support, left the community to face the immediate impacts of the disaster with existing resources and the preparedness efforts of community members (Garcia-Lopez, 2018).

This disparity in disaster impact is highlighted by the different experience that the Yacht Club had. The Cangrejos Yacht Club is located across the Laguna de Torrecilla, which is visible from COPI. Moises Perez, the former president of Cangrejos Yacht Club, explained that during María, boats were not damaged but about 40% of their infrastructure buildings were damaged. The impact, of the yacht club's damage on the community was less than that of Piñones because of the difference in antecedent conditions: the residential community of Piñones influences community members differently than the social community of the Yacht Club. Moises Perez explained how, in the event of a severe storm, all club members and staff are sent home well before the expected onset of the disaster.



Figures 37 & 38. Moises Perez and Cangrejos logo (*Photo credits: Maya Ellis, Rachel Swanson*).

Absorptive Capacity

Cutter et al. (2008) describes absorptive capacity as the planned responses to the impacts of a disaster. Whereas coping responses are planned response to immediate effects, absorptive capacity is the ability, through resources and planned coordination of action, to reduce the lasting impacts of disaster.

Absorptive capacity after Hurricane María

The Piñones community's ability to absorb the impact of Hurricane María was already reduced due to the recency of Category 4 Hurricane Irma two weeks prior. The absorptive capacity of Piñones was already limited due to the effects of austerity, racism, and ongoing marginalization.

Limitations of the DROP Model

One of the limitations to Cutter et al.'s (2008) model was the binary of absorptive capacity. While some resources of the community were exceeded or approached capacity following Hurricane María, many aspects of the Piñones community were robust in their alleviation of the disaster's impacts.

Supply Networks in Absorptive Capacity

Supply networks through social networks connected people to available resources, increasing absorptive capacity. Supplies and physical aid were enabled by a combination of community organizations and individual member efforts. These efforts also supported supply distribution from external aid. For example, COPI played a pivotal role in distributing supplies after María. In November, a few weeks after the storm hit, FEMA gave generators and non-perishable foods (i.e. meals ready to eat, or MREs) and workers at COPI distributed those supplies to the community.

Figure 39. José Cruz, Church pastor (*Photo credit: Maya Ellis*).

An example of absorptive capacity was Mercia Soto's food service for the community. She accessed the nearest grocery store in Isla Verde on foot, waited in long grocery store lines, and cooked meals for the community as part of her food service. She expected to provide this service after María to pay off the generator she bought. This service improved access to meals in the community.

Spiritual networks were important before, during, and after Hurricanes Irma and Maria. Pastor José Cruz and Mercia Soto helped sustain the spiritual network in Piñones whole also providing tangible resources in troubled times.

José Cruz mentioned how The Iglesia Universal de Jesucristo Church was able to raise $5,000 in donations from his own networks to buy food, bread and cheese to distribute it to the community. In addition, Pastor José Cruz' church provided books and uniforms for children and paid for medical bills later in disaster aftermath. Mercia Soto is considered a leader in her church. People often give her items such as clothes to redistribute to others:

"They are always bringing me clothes, and I always look to see who needs them."
Mercia Soto, Piñones resident

Skills and Skill-building in Absorptive Capacity

Skill networks also influenced the community's absorptive capacity. Community members who could fish, hunt for crabs, and grow their own food, notably plantains, lemons, and other tropical fruits increased accessible food resources. Furthermore, the ability to produce charcoal and cook meals outside helped when conventional stoves were not functional. This shows that resources can be skillfully acquired, not just redistributed, even when supply is limited.

Absorptive capacity is also increased in Piñones through intergenerational knowledge and skills taught in between disaster cycles. Members expressed that knowledge about how to deal with hurricanes and natural disasters is passed down through generations. Pastor José Cruz also holds workshops after services about ways to combat food insecurity and identified that food insecurity was a challenge after Hurricane
María. His workshops teach canning techniques to make food last longer. Marcos Peñaloza holds nature workshops to teach children about the importance of mangroves and how to care for them. Paola Rolon-Díaz learned how to ward off mosquitos, keep food without the need for a refrigerator, and start fires.

"Those kinds of things really will help you survive long-term in a disaster scenario. I think it's probably most important. It's a good foundation to build off. You're going to be okay."
Paola Rolon-Díaz, co-researcher

Preparation and Absorptive Capacity

Nearly every interviewee mentioned that they made preparations prior to Hurricanes Irma and María, such as stockpiling food and hygiene supplies, reinforcing homes, and readying flashlights. Preparation efforts in Piñones focused on what Mercia Soto describes as "sustainability" rather than prevention. In the DROP Model, these "sustainability" efforts would include actions that soften the impacts of disaster, such as stockpiled food softening the impact of widespread food insecurity.

Most preparedness efforts in Piñones aim to sustain function and survival, while others directly reduce the effects of the disaster. Preparedness efforts such as stockpiling resources tended to increase absorptive capacity in the DROP Model, while actions like boarding up houses are better categorized as coping strategies. Many Piñones community members consider these short-term preparedness efforts to be ways to sustain survival.

Gauging effectiveness of the community's ability to absorb the impact of disaster (absorptive capacity)

The efforts by those who aided in community response alleviated the impact for many. Paola Rolon-Díaz, one of our co-researchers, expressed how if it was not for the efforts of Mercia Soto cooking and entertaining through the storm, it would have been difficult for her and Shawn Escalera to make it through the aftermath.

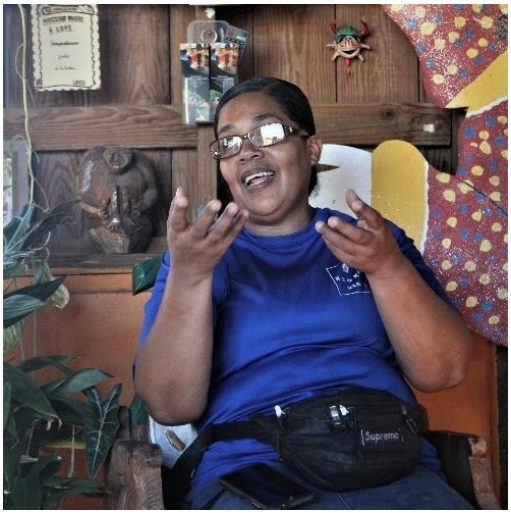


Figure 40. Mercia Soto, Piñones resident (*Photo credit: Rachel Swanson*).

"She rescues people. She rescued us."
Paola Rolon-Díaz, co-researcher

Mercia Soto, expressed that, she felt overwhelmed with responsibility in the aftermath of María. In addition to processing the trauma of disaster, she juggled caretaking for her children, animals, and bedridden mother with the onset of running a food service which took up her days and evenings. She, however, relied on her faith and spiritual network to support her, saying that "God gave her the strength." These accounts indicate that these responses and networks leveraged by the community in the DROP Model may provide both physical and emotional support in times of disaster.

Adaptive Resilience

The DROP Model proposes that, when absorptive capacity is exceeded, adaptive resilience through improvisation and social learning can lead to higher degrees of community recovery (Cutter et al., 2008).

Networks, improvisation, social learning, and adaptive resilience

For example, Sammi Perez had previously worked with the government before retiring. After his house was swept up by the storm, leaving only a doorframe behind, Sammi contacted FEMA for aid to rebuild his house. FEMA made the process complicated for him, told him he did not have the right paperwork, and left him homeless.

Sammi Perez eventually stopped trying to work with FEMA and went to the Ricky Martin Foundation, a non-profit, non-governmental institution. The Foundation sent him doors, clothes, a stove, a refrigerator, and other supplies. This was the only help received and with the effort of connected family members, he rebuilt the house that he lives in currently.

Preparedness and Mitigation

There were indications of capacity being increased from previous disaster events. Both Sammi Perez and Marcos Peñaloza spoke of the advantages of concrete homes instead of wooden houses. Marcos Peñaloza spoke of the history of houses in the area, and how both government codes and the strength of concrete homes against hurricanes led to a shift from wood to concrete homes. This affirms Cutter's explanation of a community's antecedent conditions being improved through both policy (mitigation in the model) and long-term preparation efforts by community members during the recovery phase of a disaster.

Antecedent Conditions

Disaster response highlights communication and information sharing as a key component of community resilience. Communication methods and networks in a disaster are founded in the communication strategies that occur outside of disaster. Communicating information was a frequent component of the stories we collected.

Social-media Based Communication

Numerous interviewees identified Facebook as a "primary" social media platform in Puerto Rico. Younger adults regarded Facebook as a platform for informal communication, while older interviewees, especially community leaders, used Facebook to share event information.

Telephone Communication

Mobile phones play an important role in connecting community members. Maricruz Rivera Clemente, Mercia Soto, Paola Rolon-Díaz, and Shawn Escalera described that, when people cannot directly contact the person they need, they often call someone who knows that person, who knows that person, et cetera. Telephones also have a role to play in connecting connect spiritual networks. Paster José Cruz spoke of the sermons the Iglesia Universal de Jesucristo holds over the phone, to connect to those unable to visit the church services.

Sense of Place

The built environment of Piñones, with its sectors and organization of families residing in the community, also influences community networks and contributes to inherent resilience.

Considering the lack of governmental aid, variation of storms, and pride in their adaptive abilities as a community, community leaders feel that community members do not emphasize emergency planning. For example, Nuria Escalera, a community leader, explained how people do not worry enough about planning for disasters. This can be contributed to the concept of place attachment described by Swapan and Sadeque (2021), specifically optimism bias, or underestimating negative consequences due to a belief that the event will not affect an individual.

"I think people have more of an attitude of like, take it as it comes here. You just got to be ready to adapt. I think that's a strength that Puerto Ricans have is that we have good adaptability in those moments."
Angel Bermúdez-Gagot, co-researcher

While some emphasize this adaptivity with pride, such as Angel Bermúdez Gagot, some members feel this pride may overshadow the need for emergency planning efforts. Samuel Clemente, a 76-year-old Piñones resident spoke about his connection to community leaders. He said that the community leaders of his generation have either died or retired, leaving him less connected to present community leaders, and the following generation. When asked how to improve the connection between himself and the present leaders, he said that face-to-face introduction to share information could be useful. According to Cutter et al. (2008), this reflection on the community dynamics is important to contribute to the community's inherent resiliency. This idea that the community is using previous experience to recover demonstrates a cyclical idea to improve antecedent conditions for the next disaster event.

Vulnerability Due to Damaged Natural and Geographic Systems

The geography of Piñones is an important aspect of the community's natural systems that have areas of resilience as well as vulnerability. Because the community is at or below sea level and is surrounded by both the ocean and lagoons, flooding is a common. However, the lagoon is a potential food source of fish and crabs and is a potential evacuation route. Bosque Estatal de Piñones is a protected area, founded in 1918 by the Departamento de Recursos Naturales, that focuses on preservation of natural systems. In Piñones, mangroves act as a natural shelter by protecting the land from erosion, mitigating flooding and reducing wind strength in the community. However, damage to the mangrove forests by natural disaster and developers make the community more vulnerable. Members of the community have recognized how geography influences the impacts of disaster and have taken long-term preparedness efforts to increase resilience, such as reforestation of the mangroves. Marcos Peñaloza stated: "by focusing on the reforestation of the mangrove and the cleaning up of the canals, it kind of rejuvenates revitalizes the area and allows it to fight for itself and fend for itself."

Figure 41. Two workers at the DRNA, Juan Boria (left) and Eniel Bolón (right) (*Photo credit: Rachel Swanson*).

Place Attachment Model

Place Attachment Influenced by Community Factors

The stories we gathered about Hurricane María highlight the ties people have to Piñones. For example, family ties that were a notable social factor influencing place attachment, similar to Adger et al.'s (2010) observations that people bond to areas through emotional, spiritual, cultural, and social factors (Adger et al., 2010).

Mercia Soto's mother was bedridden and could not be moved. Prior to Hurricane María, she had purchased a generator to care for her mother in case of power outages and planned a way to offset the costs of the generator before Hurricane María occurred.

"This all started with my mother. My mother is one of the bedridden people... I had to make a kind of sale [the food service] in my house to be able to buy gasoline, to have the generator on to keep my mom alive."
Mercia Soto, Piñones resident

Paola Rolon-Díaz describes the reason she "loves" this community is because, community members are like "honorary family members." She came into the community as Shawn Escalera's partner and was accepted by his extended family.

Optimism Bias and Place Attachment

Comments of many community members interviewed were consistent with Swapan and Sadeque's (2021) findings about 'optimism bias.' Some interviews shared how their expectations of Hurricane María differed from the actual storm. These expectations came with indica tions of place attachment. Nuria Esclera's explaination for this optimism bias was her ties to the area and experience of hurricanes in Piñones:

> *"We were not really prepared for this. I was not prepared for this. I thought that I live here, I am from Piñones. My family is all here... I never thought the hurricane was going to be as strong as Maria was."*
> *Nuria Escalera, Community Leader*

Marcos Peñaloza had a similar perspective, noting that: "People [in Piñones] don't think that they are going to die. They say they will die here." These perspectives could indicate that the power of place attachment could be harmful to people when the desire to stay, and unknowingness of disaster impacts, exceeds the ability of a person to stay safe in that area.

On the other hand, there were some accounts that indicated a dawning understanding of Hurricane María's threat. This identifies inconsistencies with Swapan and Sadeque (2021)'s proposal of optimism bias. Shawn Escalera shared that "Irma, was when we realized it was going to be more complex [than other hurricanes they had faced]". The expectations of the hurricane were alerted well in advance. Nearly all interviewees spoke of the alerts and information shared about María as comprehensive. Instead, Nuria Escalera shared that it was the lasting impact of Hurricane María, "Eight months without electricity, potable water, no services" that she was not prepared for.

Social Capital and Place Attachment on the Decision to Stay During Disaster

Swapan and Sadeque (2021) propose that high social capital, when paired with place attachment, often cause residents to stay, rather than evacuate (Swapan & Sadeque, 2021). In our interviews, social capital, defined as the social networks that enable action, was a significant topic during response to Hurricane María (Bhandari & Yasonobu, 2009). Social capital in Piñones is explored in the Adapted DROP Model's sections on *coping response* and *absorptive capacity* later in this chapter. We found that most people interviewed have a perception that Piñones residents stay during disaster. Merica Soto speaks of how the community has adjusted to staying in the community during hurricanes:

> *"Everyone stays. Nobody leaves because we are already used to it. Nobody moves. Whatever happens, nobody leaves the area."*
> *Mercia Soto, Piñones resident*

Place Attachment and Returning to the Area to Contribute to Social Capital

Five key informants were not present in Piñones during Hurricane María but came back to the area in the aftermath and contributed to the social networks and response of the community. Of those interviewed, Pastor José Cruz, Maricruz Rivera Clemente, Shawn Escalera, Paola Rolon-Díaz, and Angel Bermúdez-Gagot were not in Piñones for the hurricane itself but returned shortly afterwards. They all were involved in various degrees in the social networks and capital of the community.

Maricruz Rivera Clemente was in Philadelphia, Pennsylvania during the disaster because there was no cell service in Piñones in the immediate aftermath of Hurricane María. This was a strategic

action as she expected the community would be without cell service. She was able to coordinate donations, aid, and communication between Piñones, the surrounding area, and the greater Puerto Rican diaspora.

"I wasn't physically here, but I was."
Maricruz Rivera Clemente, COPI Founder

Those with ties to the community, socially and psychologically, did come back to Piñones, as argued in the literature. Pastor of Piñones The Iglesia Universal de Jesucristo and contractor, José Cruz, mentioned that even though he lives in Carolina, across the lagoon, he came back to Piñones to help the community after the storm.

Figure 42. Maricruz Rivera Clemente, Founder of COPI (*Photo credit: Rachel Swanson*).

Identifying with the Community

Many interviewees spoke of the power of the identity of Piñones. Speaking about why he thinks community members stay in Piñones during disaster, Marcos Peñaloza said that, "people don't like being taken out of where they are."

Samuel (Sammi) Perez, 61 years old, said of Piñones, "I was born here, I'm going to die here. I've spent my entire life planting trees and growing my own food. I have no dreams of going anywhere else." These responses affirm Swapan and Sadque's (2021) finding of places of attachment holding psychological value (Swapan & Sadeque, 2021).

Zero-Order Responders Model

Many of the interview responses shared in our interviews reflect the Zero-Order Responders (ZORs) model (Briones, Vachon, & Glantz (2019). Most community actions that our interviewees described were unofficial actions to combat immediate obstacles after the hurricanes.

In the Zero-Order Responders (ZORs) Model, those caught in a disaster often act as their own responders until official aid arrives. Documentation from the CDC CERC Manual stated that it's a minimum of 72-hour delay for federal and local help after a disaster (CDC, 2015). Additionally, the CERC manual acknowledged that family and community members would be the first to respond to a disaster (CDC, 2015).

For Piñones, the lack of aid for an extended period of time caused connections and intergenerational knowledge to prevail over government recommendations. Through the social networks described above, many people in Piñones confirmed the ZOR method of utilizing their skills to improve their post disaster environment. Through the social networks described above, the people of Piñones increased access to resources, and confirmed the ZOR method of leveraging skills to improve aspects of their post-disaster environment. This confirms Klein's (2018) analysis of Puerto Rican community response due to government inadequacies (Klein 2018). Through José Cruz's excavation of Highway 187, Maricruz Rivera Clemente's efforts connecting the community to the outside world, and Mercia Soto's service to feed her community, the people we interviewed acted as Immediate and Zero-Order Responders to the Piñones community after Hurricane María.

Contextual Information about Local Professional First Responders

Figure 43. Centro de Operaciones Maritimas (*Photo credit: Rachel Swanson*).

The Marina Police

The Marina Police, or the "Centro de Operaciones Maritimas", is comprised of people who do not live in the Piñones area. Staff and officers work for the Municipality of Loíza and are responsible for maintaining and regulating traffic on the lagoons and waterways. In Piñones, they have two boats, one of which does not work and a few cars. The Marina Police station is largely understaffed, with only six officers who oversee 13 sectors that are in a one-hour radius from the station. Employees are expected to provide 24-hour coverage, meaning they regularly have 12–16-hour shifts. The Chief Commander at this station is a 16-year veteran, who said it was almost impossible to do the job and remain vigilant.

Interviewing the Marina Police showed the pressure that some government systems are under. The staffing issue in the 13 municipalities shows that although stations may have the intention of doing their work the way they are supposed to, they are unable because of the resources they have on hand.

The State Police in Piñones

The inland police station is comprised of staff and officers who do not live in the Piñones area. Previously, the children in the surrounding area used to take care of the police horses, although the station has since gotten rid of them. In terms of preparation, they have different binders for certain situations that may arise. In one binder, they had what they would do for different scenarios for evacuation. Inside, detailed plans for terrorism, natural disasters, jail situations, and dangerous substances were documented. When asked about and shown the natural disasters section, it was completely empty. The officers said when a warning comes through, they abandon the area. Although, the station does have a two-way radio station with the municipality in case of emergency and they are needed.

From interviewing the inland police, we discovered a previous sense of relationship and community engagement. We also discovered a lack of preparation and resources for the community when a natural disaster strikes. Since the police abandon the area, the community is virtually on its own in terms of disaster preparation and response.

FEMA and External Aid Response in the CDC Crisis Emergency Risk Communication (CERC), Adapted DROP, Zero-Order Responder and First Responder Models

FEMA being slow to deliver external aid to Piñones. The community did not receive external aid until two months after Hurricane María had hit, far later than the 72-hours that the CDC CERC indicate as a plausible response time for aid delivery (CDC, 2015). According to Maricruz Rivera Clemente and Nuria Escalera, FEMA did not drop boxes of Meals, Ready to Eat (MREs), generators, and bottled water off at COPI until November.

Although the lack of aid caused hardship in Piñones, respondents mentioned that the lack of external FEMA relief led to greater connections in the community and increased social capital. Shawn Escalera said:

> *"The tremendous community effort that everyone put forward...those first few days where there was no communication. The only thing we had, was everyone."*
> *Shawn Escalera, co-researcher*

Analyzing this through our Adapted DROP Model, the inaction of FEMA could be categorized as a *negative coping response*. This is consistent with Cutter et al's (2008) understanding that negative coping responses worsen, or do not improve, the immediate effects of disaster. As FEMA's delay of aid left the Piñones community with inadequate resources and no real means to acquire resources, worsening the impact of Hurricane María on Piñones.

However, the increase in community's response as a product of FEMA's delay is a positive coping response under the Adapted DROP Model. Many interviewees expressed that, knowing that people could only rely on themselves, coordination and support took place to create a better situation for their community. In Cutter et al's (2008) model, there is distinction between positive and

negative coping responses: in Piñones, the negative coping response of FEMA initiated a positive response in the community members to make up for that negative response.

Community action in response to external aid delay also organizes response in Piñones into the Zero-Order Responders model (Briones, Vachon, and Glantz, 2019). Community efforts that immediately followed Hurricanes Irma and María fall into the model for ZORs, as they provide immediate relief by leveraging existing resources to lessen the impact of disaster (Briones, Vachon, and Glantz, 2019).

Analyzing the community through different models allows for connections between models and deeper analysis. Understanding the aftermath of Hurricane María through our Adapted DROP Model proposes that the Piñones community were responding as Zero-Order responders in the Adapted DROP model's *coping response*. In addition, community members acted to mitigate the impact of lack of external aid and local first response through their *aborptive capacity* and utilized *adaptive resilience* techniques when their capacity was exceeded. Though unofficial, the short and long-term responses of the Piñones community after Hurricane María can be understood as first response after disaster.

"Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!"

The main goal of "Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!"was to start a conversation and bring awareness about emergency preparedness in the community. The worksheet, adapted from the Reducing Flood Risk in Shkodër Through Community Engagement IQP (Dickinson, Dione, St. Pierre, & Weiss, 2017), focuses on creating a personal or family plan in case of emergency or evacuation. Additionally, there is a checklist of common emergency kit items as well as space to fill in other items a person might think of needing in the kit. From interviews, the idea of an "emergency bag" is common in older residents, and this contains items such as a flashlight, batteries, canned food, radio, clothes, rope, and plastic bags. However, very few community members have a kit with these general items.

A focus group of five people aged between 18-29 completed the worksheet and provided feedback. Although the group filled out their emergency guide separately, two mentioned that they would evacuate to the Outlet 66 Mall in Canóvanas. This mall is typically driven to and is 10 miles southeast from Piñones. Interviewees regarded the Outlets as an area of relatively high elevation.

When asked what she needed to prepare for a disaster, Paola Rolon-Díaz exclaimed, "Books!" Since there was no electricity and a lack of internet access, books were a vital form of entertainment for her after María. Another person said that they would leave Puerto Rico. The question then becomes, "What would you do if you couldn't leave Puerto Rico?" Due to this response, the worksheet would be best used when there is a facilitator nearby to clarify sections and ensure the worksheet is being filled out correctly and completely.

A Storyworld of Community Perspectives and Reflections

"Community as First Responders" Video

The "Community as First Responders" video features the community as first. Footage was gathered from around the community and video and audio soundbites were gathered from our interviews. The video features Hurricane María experiences, the aftermath and recovery, and how the community was able to come together despite a lack of government assistance and resources. We also featured news clips and archival videos from María which we received from community

members. This video would appeal to both the community as well as an academic audience. The autobiographical nature of the stories demonstrates the appeal to the community as well as presents the substantial rebuilding and recovery efforts of the community. This video also has English subtitles and could appeal to an academic audience investigating the idea of community first response.

Voices of María Experiences

The perspectives of millennials are an important dimension of a community. To emphasize these stories and the way disaster and community influence individuals we created:

- The “Memoirs of María” video features clips from English-language interview footage of our coresearchers, Paola Rolon-Diaz, Shawn Escalera, and Angel Bermúdez-Gagot. The focus of this video is on Hurricane María’s impact. This video will resonate with English-speakers who have endured similar experiences, but also provides perspectives for those who have not endured a hurricane.
- A Spanish Podcast episode “La Última Ficha” / “The Last Piece” produced by coresearchers Shawn Escalera, Paola Rolon-Díaz, and Angel Bermúdez-Gagot addresses coping responses after Hurricane María. The name originates is a reference to the metaphor that they all fell like dominoes in the aftermath of María. This podcast aims to reach community members in a language they identify with, made by members of their own community. It also gives our researchers the opportunity to control their own narrative and continue these efforts outside of our project.

Community Vinyl Banner

We also created and printed a 2’x6’ vinyl banner portraying the community as first responders. The "Endurance, Resilience, Perseverance” banner will be displayed on COPI’s boardwalk and will be an opportunity for visitors to COPI to gain a perspective on what the community had endured and how they overcame Hurricane María. The banner is a photo montage of our pictures as well as archival photos given to us from community members via photo elicitation. It also spotlights powerful quotes and portraits from our interviews with community members.

Figure 44. Our team holding the community vinyl banner.

Conclusions and Recommendations

Figure 45. An abandoned structure in Piñones (*Photo credit: Rachel Swanson*).

An Island within an Island

The geographical elements that make Piñones an "island within an island" were exacerbated by Hurricane María. Severe flooding, inaccessible highways, and damaged infrastructure isolated the community combined with generations of marginalization and racism. These structural impacts of Hurricane María impacted the resources and methods of response in the disaster's aftermath. The Adapted DROP Model, Zero-Order Responders Model, and Models for Place Attachment allowed our team to organize experiences gathered during interviews withing the boundaries set by each model. Once experiences were organized, our findings showed connections between models that supported the concept of the community not only acting as Immediate Responders, but also as Zero-Order Responders in the aftermath of Hurricane María. In many cases, community members relied on intergenerational knowledge to handle the aftermath of hurricanes, particularly in light of lack of trust in and inadequate aid from government agencies. Furthermore, the relationship of the DROP and ZOR models to the Place Attachment model highlight the resounding influence of the meaning of community and how it influences the response of community members surrounding disaster.

Limitations

Most of our connections came from our sponsor and our co-researchers. Hence, many of those we interviewed already had some sort of relationship with these community members. Given that most of our interviews originated from connections with members who lived in the Piñones

sector, we recognize that the perspectives shared with us do not represent a full range of opinions and experiences. Because we recorded many of our interviews, some interviewees refrained from discussing some sensitive topics. The language barrier was a significant constraint on our fieldwork and on our understanding of the community as first responders. Many of our interviewees were more comfortable speaking in Spanish, so we had to rely on interpretation and translation from our skilled co-researchers.

Our team also had no previous connection to Piñones. In some cases, our outsider status limited the willingness of community members to engage with us.

Adapted Model Limitations

Models are not designed to capture every aspect of a community, particularly in complex situations such as disasters. we identified some limitations to adapting the Cutter et al. (2008) model to the Piñones community. Depending on the lens through which a story or response was analyzed, it could fall under separate categories. Also, in our adapted model, there was no distinction between external aid response versus community response. In our model, the focus on community action meant that it made more sense to keep external aid under the term coping response. This allowed us to demonstrate the interaction between delays in external FEMA aid and increased coping response in the community.

Labelling the degree of recovery as a spectrum of recovery promotes reflection and deeper analysis. However, recovery is difficult, if not impossible, to quantify. First, there is no standard for recovery. Second, in communities that are prone to frequent natural disasters, recovery phases are often long and overlapping. In Piñones, the community is struck by hurricanes, but also combats seasonal tidal waves, or *marejadas*. Furthermore, the recovery process is long, especially with limited external aid and austerity-impacted infrastructure. Thus, cycles in the DROP model may be better portrayed as spirals.

Ethics and Final Thoughts

Our project focused on engaging with the community to understand their experiences. This engagement brought up ethical considerations. While walking around the neighborhoods, conversing with community members, and interviewing people, we had to be careful not to give the impression that we could provide aid or assistance to the community.

Our team was also cognizant that other researchers had preceded us in the field. Community members noted that in the past, researchers would come through, interview the community, and "take the information and leave." We did not want our story-gathering to be an extractive process where we "took" stories of the community. In this regard, our co-researchers served as a vital bridge between us and the community.

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Appendix A

Other models of community resilience

Common themes in these models allow for comparison across 80 different articles, as seen in Patel, S. S., Rogers, M. B., Amlôt, R., & Rubin, G. J. (2017). Their analysis identified 9 main components of community resilience: Local knowledge, Community networks and relationships, Communication, Health, Governance and leadership, Resources, Economic investment, Preparedness, and Mental Outlook. Through these main components, 19 sub-components were linked to resilience in a community (Patel et al., 2017).

One example of a community model was created by the International Fund for Agricultural Development (IFAD). It was developed to better understand the lives of those living in rural, agricultural communities. It highlights that communities are impacted by forces that continuously influence each other as well as the community (Hamilton-Peach & Townsley, 2015).

At the center of the IFAD's Alternative Sustainable Livelihoods Framework is "The Poor". This represents the people, who may have deficient "livelihood assets" in any of the following categories: Human, Natural, Financial, Physical, and Social Capital. These categories of capital are represented by the degree of each category's components, as described in Figure 45 (IFAD, 2008).

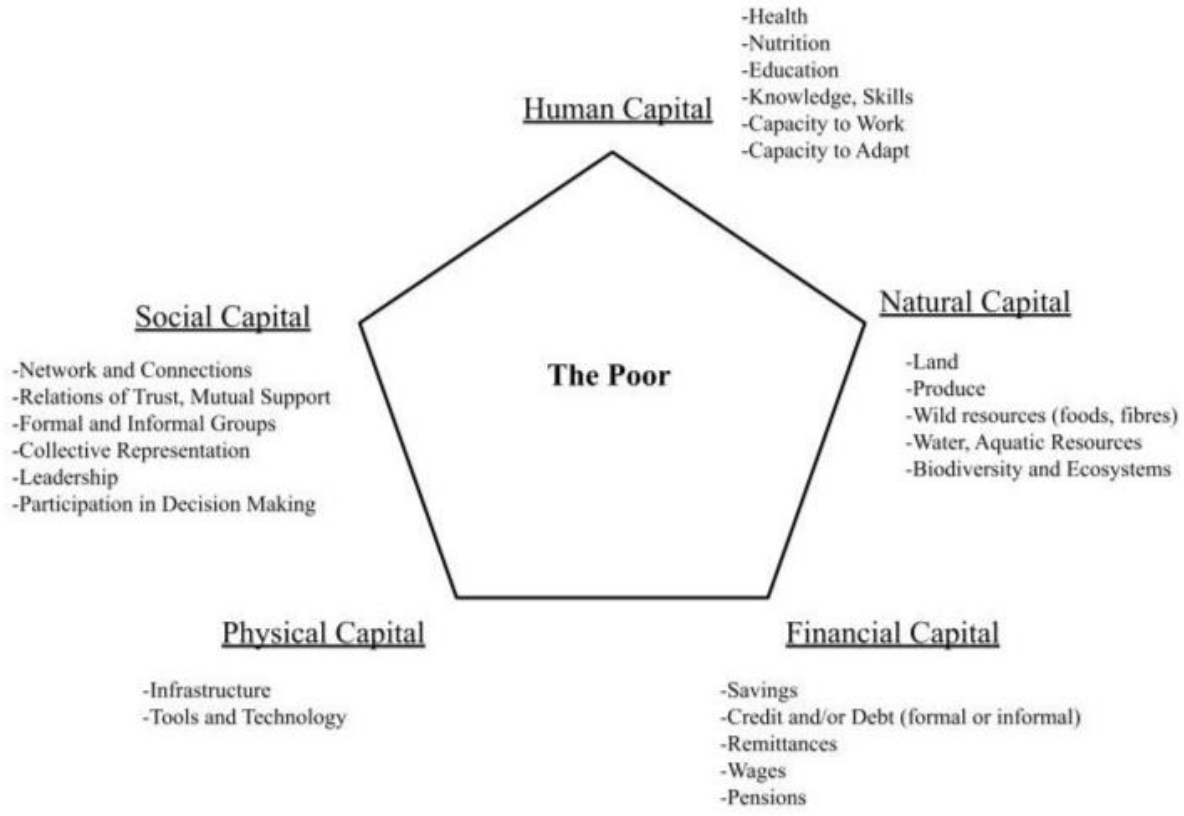


Figure 46. Compiled IFAD categories of livelihood assets (IFAD, 2008).

The model then expands outward to better represent the lens of community members through their individuality in gender, age, class, ethnicity, and ability. Throughout this, the personal perspective, comprising experiences, spirituality, and other emotional aspects also influence the community lens. The people, and all they are made of and represent, then have aspirations and opportunities that inspire action and then outcomes. These outcomes then influence the community in a cycle.

However, the community is not an isolated system: events such as shocks, seasons, and repeating events both can lead to vulnerability in a community and influence the outcomes of actions. Acting as a buffer, enabling agencies and service providers (represented as Politics & Policies, Governmental Aid and Agencies, NGOs) interact and converse with the community in Markets, Politics, Rights, and Culture relationships. These agencies and providers can alleviate the impact between the community members and what makes a community vulnerable (Hamilton-Peach & Townsley, 2015).

Figure 47. IFAD's Alternative Sustainable Livelihoods Framework (Hamilton-Peach & Townsley, 2015).

This model is a tool that is centered around the humanity in a community, the different perspectives and assets that make up a community, and the engagement and feedback of different stakeholders and their actions. Referencing this framework, researchers can hypothesize what may occur when different aspects of this model are lacking or do not interact with other components as expected. While this model is applicable for understanding communities, it is not specialized specifically to a disaster scenario.

Models of Community resilience in disaster contexts are helpful ways to identify strengths and vulnerabilities in a community. The intricacies, specific characteristics and dynamics of a community, and the unpredictability of natural disasters make quantifying a community's resilience less helpful than gauging a community's resilience from members' perspectives of their community and how it operates (Sherrieb et al., 2010).

Different theorists propose different models for community resilience in the context of disasters. These are just two examples in this field of study:

Norris, Stevens, Wyche, and Pfefferbaum, (2007) proposed four areas of a society that influence the "capabilities" of a community to recover after a "stressor" event. They are: the extent of economic and physical resources distributed among community members, the ability to communicate information both within and between communities, the extent to which a community can organize and make decisions, and the social networks they have. These capabilities affect a community's ability to function after an acute crisis (such as a natural disaster).

As shown in Figure 4, Norris et al. models a community after a crisis. In this model, the nature of a stressor's "severity, duration, and surprise" affects the resources a community has and its ability to mobilize those resources. It is the relationship between resources and stressors that lead to a community's crisis. When a community's resources do not directly offset the effects of a crisis (a situation Norris et al. terms "resistance"), the community experiences transient dysfunction. Depending on the community's resilience and aforementioned capabilities, it will either adapt to a new level of function or continue to dysfunction. Norris notes that it is the persisting inadequacy of resources (termed "vulnerability") that lead to persistent dysfunction (Norris et al., 2007).

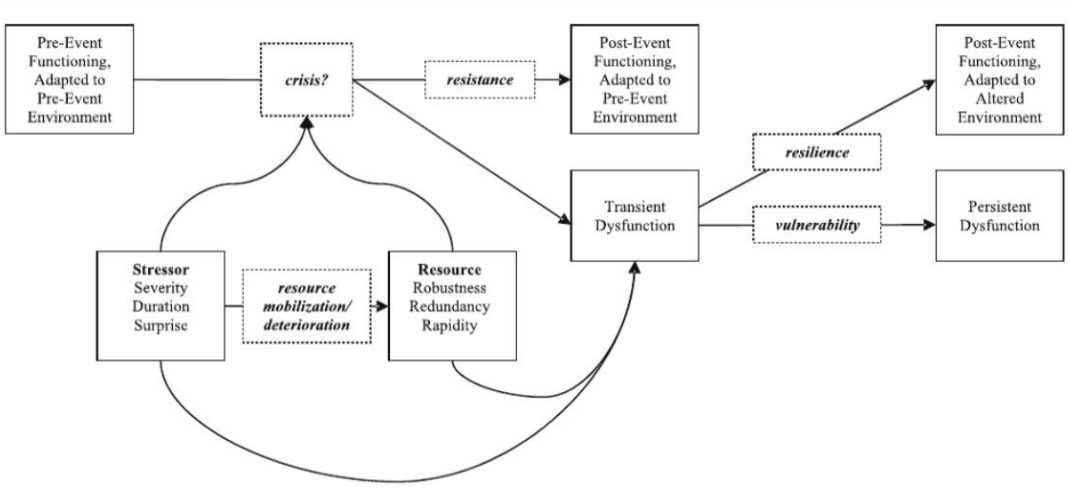


Figure 48. Norris et al. (2007) Model for Community Resilience after Disasters

Appendix B

Consent script and potential interview questions

Consent Script

Hello _____. We are university students from Worcester Polytechnic Institute which is located in Massachusetts. We are conducting a research project on the state of emergency preparedness in Piñones in regard to medical emergencies, marejadas, and hurricanes. We are working with COPI, an organization concerned with increasing the quality of life in Piñones. We would like to interview you on _____. Would it be okay for us to record this interview to make sure we have a record of your responses? If not, that is okay, all information you share with us will remain confidential and will only be used in the scope of this project with your permission. You can also choose to remain anonymous, and your personal information will not be recorded. If you choose to be anonymous, none of your personal information will be identified in our project unless you would like to be quoted.

Our final report will encompass the current procedures in the community to prepare and react to the event of an emergency and perhaps collaborate with community members to improve reactions to these emergencies. This report will be posted online, and we can even email it to you if you would like once we have completed it. If we ask a question which you do not want to answer, let us know and we can move on from that question. If we ask a question which you do not understand, let us know and we can try to rephrase. Before we start, do you have any questions for us?

Interview schedule and questions

This is a breakdown of major questions we asked during our interviews. These are starting points for questions and some questions were extrapolated from information gathered during the interview. These questions are ordered loosely based on when interviews were conducted in and around the community.

1. Key Informant: Founder of COPI, Maricruz Rivera Clemente

- Were you on the island during Hurricane María? If not, how did you organize certain relief efforts?
- Can you explain how the community came together during Hurricane María?
- How were supplies distributed through COPI during Hurricane María? How did FEMA contact you?
- Can you explain how generation differences impact emergency preparedness?
- Do you have any suggestions or comments to improve emergency preparedness in the community?

2. Key Informant: Nuria Escalera

- How did the community prepare for Hurricane María?
- What assistance was provided by local emergency management to Piñones during Hurricane María? What do you think was effective and what could have been improved?

- How did the community come together after Hurricane María?
  - Where do people tend to congregate in the community?

3. Key Informant: Church leader, José Cruz

- Could you introduce yourself for us?
- What is the name of the Church? Denomination? Where is it located? When are services? How many people attend services? What jobs do people hold at the church, such as a singer, etc. cetera?
- Can you describe your involvement with the church? How did you get involved with the church?
- What do you focus on during church services?
- How are you involved in the community outside of the church?
- How did the church assist community members before and after Hurricane María?

4. Key Informant: COPI worker, Marcos Peñaloza Pica

- How did you get involved at COPI?
- Were you here during María? What was your experience like?
- What would you have done differently? Do you have any suggestions for future hurricanes?
- Can you describe the community's perception on preparedness? What do you think people should be more aware of?
- How do you think COPI and other community leaders should go about teaching and helping the community be more prepared?
- How did you learn so much about mangroves and get involved with this reforestation effort?

5. Community members

General experience

- Can you explain what an average day is like for you in Piñones?
- How long have you lived in Piñones?
- Are there any stores in the Piñones "island"? Besides restaurants?
- Who do you know who might have medical and emergency supplies?
- What has been the most meaningful experience in the community so far?
- How do you feel connected to members of this community?

Emergency planning and response

- Were you in Piñones during Hurricane María?
  - If not, where were you and why?
- If so, would you be willing to describe what this experience was like?
- What was Piñones like before and after Hurricane María?
- How do you typically prepare for the flooding around this time of month?
- Can you explain how generational knowledge was useful after the storm? What coping strategies did you have in the aftermath?
- How have you prepared yourself for any disasters that might occur?
  - Prepared a family emergency plan?
  - Prepared a neighborhood emergency plan?

- Prepared emergency/survival kits?
- Trained community members?

- Do you have suggestions on how to improve emergency preparedness in the community?

6. External Stakeholder: Police stations

- How long have you been working here?
  - Were you able to observe the aftermath of Hurricane María? Did the police station play a role in the recovery effort?
- Are you from Puerto Rico? Piñones?
- How many people are typically on staff?
- What areas/communities do you oversee?
- What emergencies does this police station typically respond to? Are there a lot related to natural disasters?
  - Can you tell us a bit about the police strike going on right now?
- What resources does this station have?
- Does the station have a plan for evacuation if needed?
- Do you handle medical emergencies?
- Can you easily reach someone at the nearest hospital in San Juan?
- Do you have any suggestions or comments to reduce health risks and improve emergency preparedness?
- What is the relationship between police officers and the people of the community like?

7. External Stakeholder: Cangrejos Yacht Club, Moises Perez

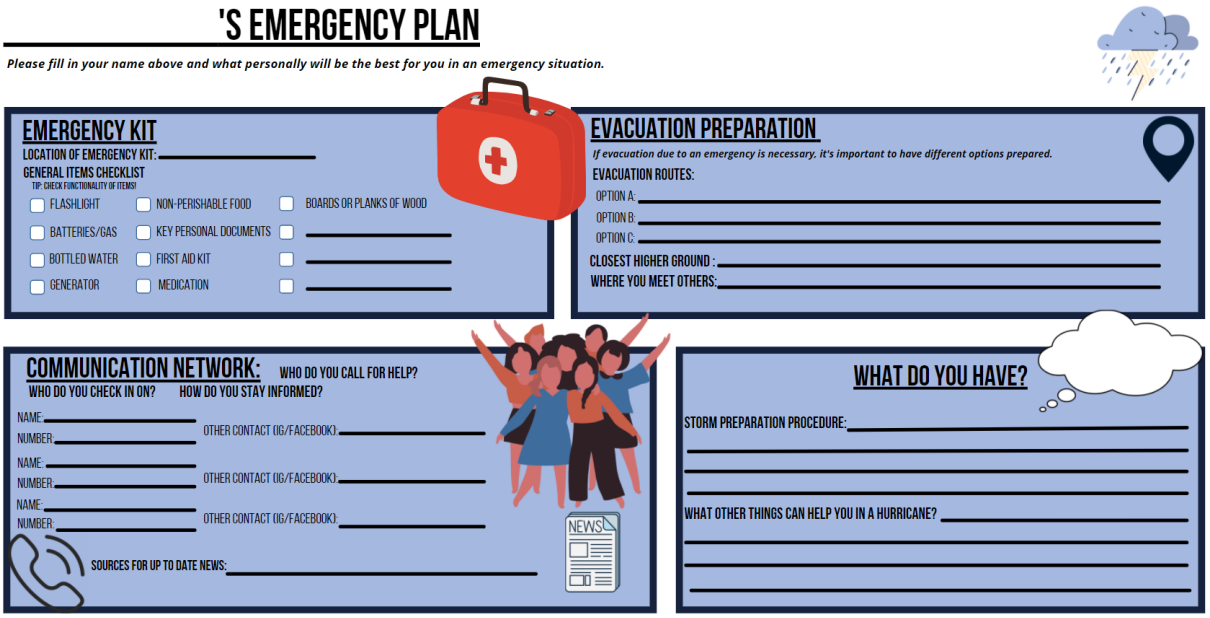
- How long have you been working here?
  - Were you able to observe the aftermath of Hurricane María?
- Are you from Puerto Rico? Piñones?
- What is the main composition of the club members? Where are they from? Are they seasonal?
  - How many tourists are part of the club? How about community members?
- Where are people allowed to take their boats?
- Could these boats we used across the lagoon to help if there was major flooding? In times of emergency?
  - Would the Yacht Club be willing to work with COPI to help with evacuation during natural disasters or emergencies?
- How do you interact with the Piñones community?
- Do you meet with Piñones community leaders?

8. External Stakeholder: DRNA workers

- How long have you been working here?
  - Were you able to observe the aftermath of Hurricane María? What did this park look like?
- Are you from Puerto Rico? Piñones?
- Can you walk me through what a typical day looks like?
- Do you get a lot of tourists who come to this park? Do community members?
- Do a lot of boats come through this lagoon?

Appendix C

“Piñones: Emergency Ready! / Piñones: ¡Listo para Emergencias!”



'S EMERGENCY PLAN

Please fill in your name above and what personally will be the best for you in an emergency situation.

EMERGENCY KIT

LOCATION OF EMERGENCY KIT: _____

GENERAL ITEMS CHECKLIST

TIP: CHECK FUNCTIONALITY OF ITEMS!

- ☐ FLASHLIGHT
- ☐ BATTERIES/GAS
- ☐ BOTTLED WATER
- ☐ GENERATOR
- ☐ NON-PERISHABLE FOOD
- ☐ KEY PERSONAL DOCUMENTS
- ☐ FIRST AID KIT
- ☐ MEDICATION
- ☐ BOARDS OR PLANKS OF WOOD
- ☐ _____
- ☐ _____
- ☐ _____

EVACUATION PREPARATION

If evacuation due to an emergency is necessary, it's important to have different options prepared.

EVACUATION ROUTES:

OPTION A: _____

OPTION B: _____

OPTION C: _____

CLOSEST HIGHER GROUND : _____

WHERE YOU MEET OTHERS: _____

COMMUNICATION NETWORK: WHO DO YOU CALL FOR HELP?

WHO DO YOU CHECK IN ON? HOW DO YOU STAY INFORMED?

NAME: _____ NUMBER: _____ OTHER CONTACT (IG/FACEBOOK): _____

NAME: _____ NUMBER: _____ OTHER CONTACT (IG/FACEBOOK): _____

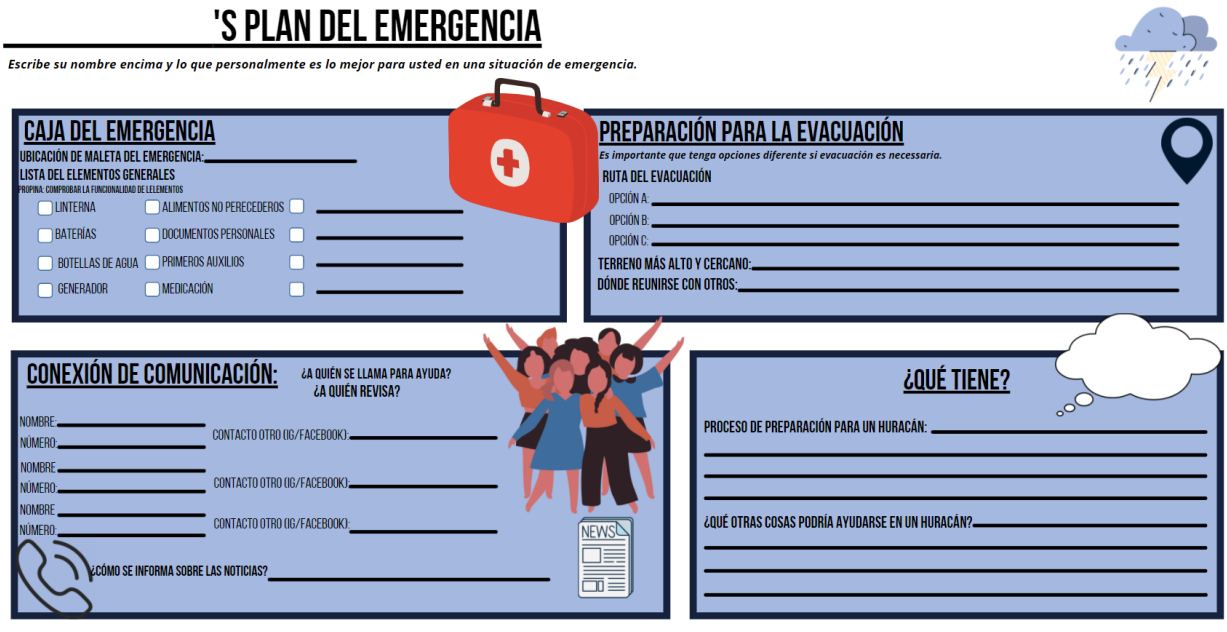
NAME: _____ NUMBER: _____ OTHER CONTACT (IG/FACEBOOK): _____

SOURCES FOR UP TO DATE NEWS: _____

WHAT DO YOU HAVE?

STORM PREPARATION PROCEDURE: _____

WHAT OTHER THINGS CAN HELP YOU IN A HURRICANE? _____



'S PLAN DEL EMERGENCIA

Escribe su nombre encima y lo que personalmente es lo mejor para usted en una situación de emergencia.

CAJA DEL EMERGENCIA

UBICACIÓN DE MALETA DEL EMERGENCIA: _____

LISTA DEL ELEMENTOS GENERALES

PROPINA: COMPROBAR LA FUNCIONALIDAD DE LELEMENTOS

- ☐ LINTERNA
- ☐ BATERÍAS
- ☐ BOTELLAS DE AGUA
- ☐ GENERADOR
- ☐ ALIMENTOS NO PERECEDEROS
- ☐ DOCUMENTOS PERSONALES
- ☐ PRIMEROS AUXILIOS
- ☐ MEDICACIÓN
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

PREPARACIÓN PARA LA EVACUACIÓN

Es importante que tenga opciones diferente si evacuación es necessaria.

RUTA DEL EVACUACIÓN

OPCIÓN A: _____

OPCIÓN B: _____

OPCIÓN C: _____

TERRENO MÁS ALTO Y CERCANO: _____

DÓNDE REUNIRSE CON OTROS: _____

CONEXIÓN DE COMUNICACIÓN: ¿A QUIÉN SE LLAMA PARA AYUDA? ¿A QUIÉN REVISA?

NOMBRE: _____ NÚMERO: _____ CONTACTO OTRO (IG/FACEBOOK): _____

NOMBRE: _____ NÚMERO: _____ CONTACTO OTRO (IG/FACEBOOK): _____

NOMBRE: _____ NÚMERO: _____ CONTACTO OTRO (IG/FACEBOOK): _____

¿CÓMO SE INFORMA SOBRE LAS NOTICIAS? _____

¿QUÉ TIENE?

PROCESO DE PREPARACIÓN PARA UN HURACÁN: _____

¿QUÉ OTRAS COSAS PODRÍA AYUDARSE EN UN HURACÁN? _____

Appendix D

"Endurance, Resilience, Perseverance" Community Vinyl Banner