



# Community Profile

## Comerío, Puerto Rico

Erik Fronberg, Samah Safiullah, Emily Seang, Lauren Victor  
CMP 6960 – Spring 2019



## Introduction

Comerio was established in 1799 as a settlement near a plantation known as El Palmar. The settlement officially became a municipality in 1826, under the name of Sabana del Palmar. The municipality's economy was dominated by the tobacco industry in the past, but is now more diverse with tourism, healthcare, and government administration as the largest sectors of employment.

The central barrio (neighborhood), Pueblo, is surrounded by eight outlying barrios Cedrito, Naranjo, Cejas, Vega Redonda, Piñas, Río Hondo, Palomas, and Doña Elena (**Figure 1**). The terrain is mountainous and densely vegetated. The topography makes the area prone to flooding and landslides, natural hazards which proved disastrous during Hurricane Maria from which the community is still struggling to recover.

The community is resilient and proud of a strong heritage of music, social activism, and education. They have a dynamic vision for recovery that emphasizes barrio self-sufficiency, ecotourism, and renewable energy. This profile aims to provide a brief introduction to Comerío that will provide the background essential to understanding Section II: Disaster Risk and Impact and Section III: Recovery Assessment.



**Figure 1.** Municipality of Comerío, Puerto Rico.

## Community Assets

The Community Assets map (**Figure 2**) focuses on the barrio Pueblo because it has the highest concentration of people in Comerío. In this map, schools, hospitals, cemeteries, churches, and the dams, are highlighted to show various services to the people in this area. There is one hospital for the area which is important to note because of the access to healthcare. Their access to schools and churches and cemeteries create a sense of identity for the area. This map is also important because of flooding zones that will be touched upon later in the document. Much of Pueblo is within the flooding zone and this will be elaborated on later.



## Legend



**Figure 2.** Community assets in Pueblo.

## Heritage and Community Identity

The name “Comerío” has two origin stories. The first and most accepted version is that the name is that of the local native Taino chief of the tribe that inhabited the area at the time of Spanish colonization. The second, by most considered folklore, is that a master curious about the community asked his slave to cross the La Plata river, and the slave, upon seeing the river’s depth cried “me come rio,” i.e. that he would be eaten by the river. According to local legend,

the people on the other side were so impressed by the slave's exclamation that his words became the name of their settlement.

The municipality has a strong sense of social activism. During the 1900s, the primary industry in the municipality was tobacco farming. Large plantations, often owned by businessmen from corporations outside the community, dominated. The work environment was often less than ideal, and workers sought to improve conditions. Many Comerians advocated for the rights of tobacco workers, particularly women. Today a museum near Pueblo's central plaza commemorates the legacy of these activists in making the community a better place for all Comerians.

Education is an important part of the municipality's identity. Comerío has claim to the island's only secondary school for baseball, a popular sport in Puerto Rico. The municipality also sponsors an agriculture course and aims to provide a course on apiculture (bee keeping) in the coming years.

Urban design in the central barrio, Pueblo, adheres to the Spanish colonial style. Municipal offices and a cultural hall are located next to a large central plaza that lies in front of a Catholic church. A Methodist chapel now lies at the other end of the plaza. Little formal design exists throughout the rest of the municipality where the organic growth of informal (built without municipal permit) residential and small-business structures prevails.

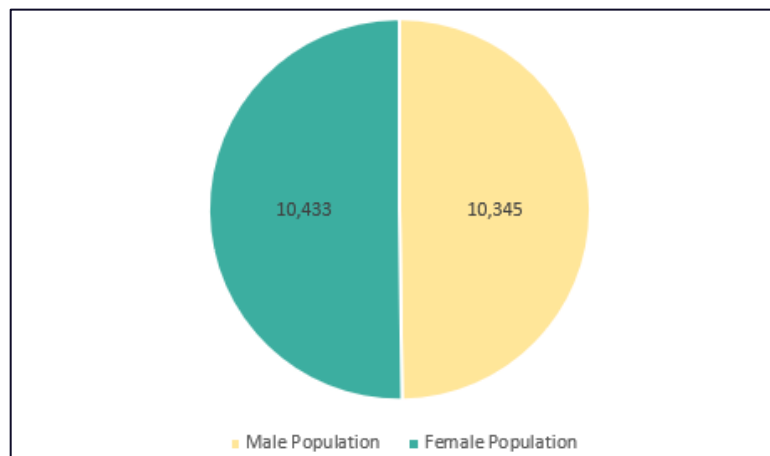
The community takes pride in its tourism industry. The municipality has established a municipality-run hotel, Media Luna, which draws tourists to the center of the island. They hope to create trails leading from Media Luna to other areas in the municipality including the Comerío Dam. Their tourist programs include a tour of the "10 Wonder of Comerío" as well as a local chinchorro (street food) tour which takes visitors to several of the community's most celebrated restaurants and food stands.

Comerío is well-known for its musical heritage particularly of trovadores, musicians who sing and play the guiro, a Caribbean island percussion instrument. Entertainment is a large part of both the local identity and the tourism industry.

## **Demographics**

As of the 2016 U.S. Census, the total population of Comerío is 20,778 people. The majority of the population are Hispanic, with about 20 percent of minorities including Black, Native American, and mixed race. The population consist of equal parts male and female (**Figure 3**). The community faces poverty, with a median income of \$6,242, and a 58.9 percent rate of people who fall within the measurement of poverty. In comparison to the overall median income of Puerto Rico, (which is \$19,343), this is fairly low. 55 percent of all families had incomes in the past 12 months below the poverty level. There is limited information in the Census regarding the specific ethnicities and their earnings within the municipality, however data does show that 50 percent of women participate in the labor market, versus 56.3 percent of men. 64.3 percent of the population has gained a high school degree, while only 11.6 percent have gained a bachelor's

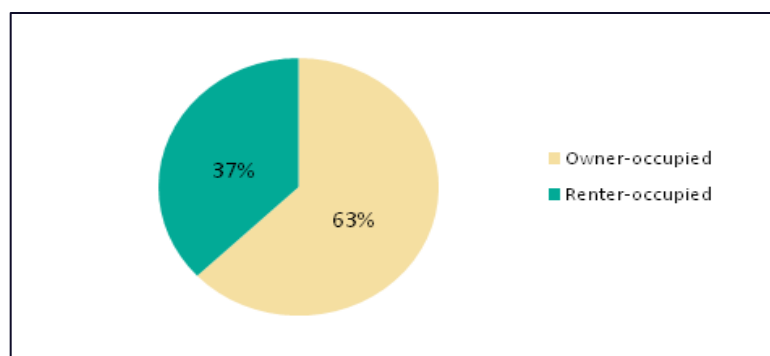
degree or higher. Additionally, 22.5 percent of the population have a disability, while 4.2 percent do not have health insurance (under the age of 65).



**Figure 3.** Population of males and females in Comerío, Puerto Rico

## Housing

As of the 2016 U.S. Census, there are 7,735 housing units and of that total 80.6% of the units are occupied. The majority, about 63%, of the occupied housing units are owner occupied and about 34% is renter occupied (**Figure 4**). However, the vacant houses may have risen, and it is estimated that 2000 homes have been lost since Hurricane Maria. Household occupancy is an important indicator of resilience in that owners have more autonomy than renters to determine their choices for housing and steps to retrofit or rebuild their home after a disaster. In contrast, those who are renting units are subject to changes and uncertainty of redevelopment depending on the landlord, or owner.



**Figure 4.** Comparing owner- and renter- occupied housing percentages in Comerío, Municipality. Source: 2016 U.S. Census data.

About 53% of housing units in the municipality are built before 1980s. Although, every building is different, it can be assumed that homes and building built before this time are of poorer quality. During the 1980s, the International Code Council (ICC) developed and implemented the International Building Code (IBC) and the International Residential Code (IRC) to standardize

structures to meet safety and resilience needs. These codes were slowly enforced throughout the U.S. but are usually for newer built homes and buildings. Unless retrofitted or rebuilt, older homes and buildings may be more vulnerable to damage during a disaster. In Comerío, the majority of barrios have over 50% of their occupied housing units with structures built before the 1980s, as seen in the figure below. This chart shows that the majority of the municipality has older structures and it is not centralized in particular barrios but spread out throughout the municipality. There is limited information on if those housing units were modified or retrofitted prior to the Census. For more information about building codes, see **An Introduction to Building Codes for Property Owners- FEMA Building Science Branch – Building Disaster Resilient Communities** and **FEMA Building Codes Toolkit in References**.

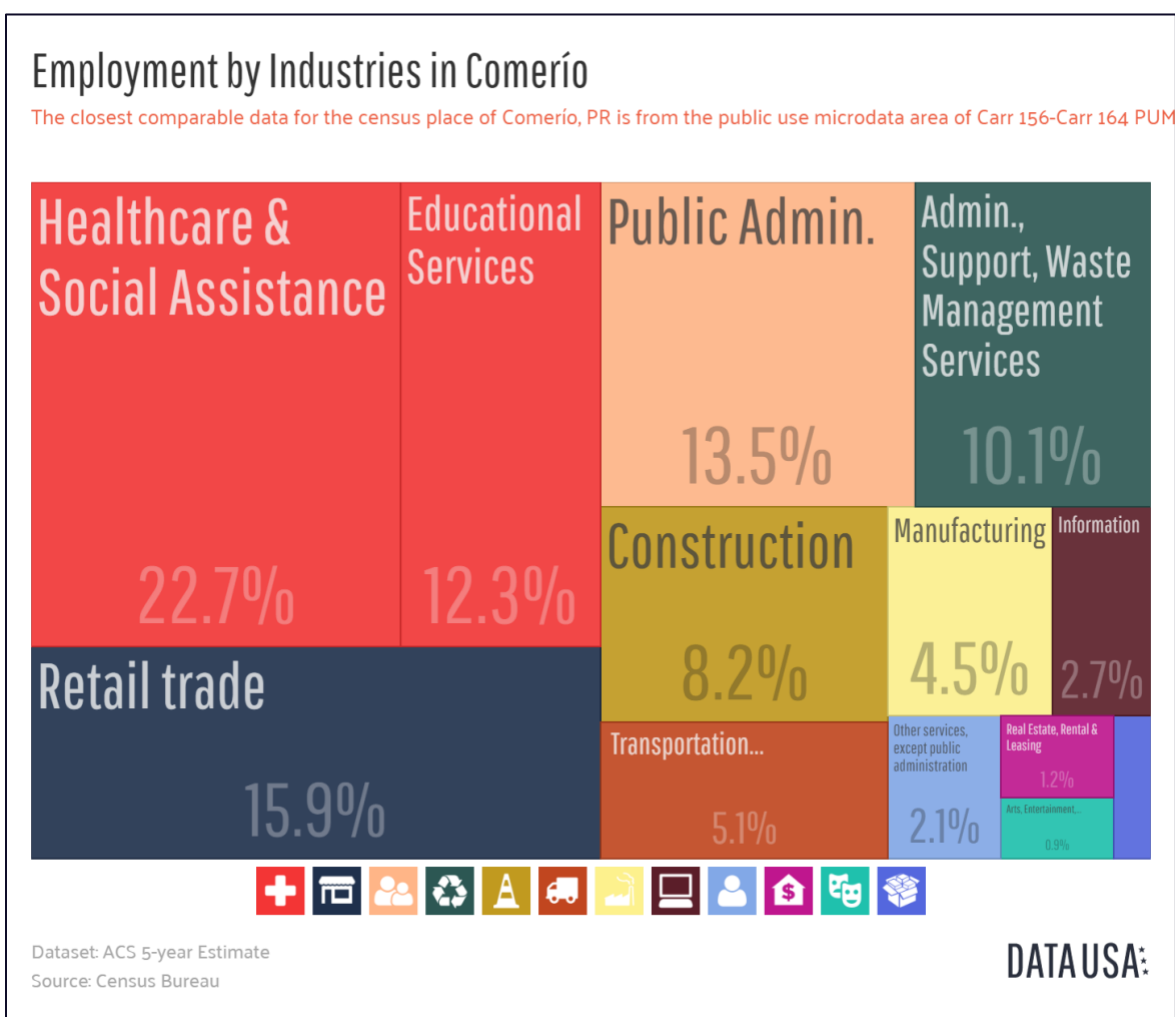
To see how housing in Puerto Rico was impacted after Hurricane Maria, see **The Housing Crisis in Puerto Rico and the Impact of Hurricane Maria by Jennifer Hinojosa and Edwin Meléndez in References**

**Table 1.** Percentage of occupied housing units built before the 1980s for each barrio in Comerío. Pueblo has the most units that were build before 1980, followed by Cedrito and Naranjo.

Barrios in Comerío, PR	Percentage of occupied housing units, built before 1980s
Cedrito barrio	76.6%
Cejas barrio	60.4%
Pueblo barrio	80.5%
Doña Elena barrio	59.7%
Naranjo barrio	76.4%
Palomas barrio	74.1%
Piñas barrio	67.2%
Río Hondo barrio	41.7%
Vega Redonda barrio	58.0%

## Economy

In Comerío, major industries include healthcare services, retail/trade, and public administration. The largest industry is healthcare and social assistance, which employs 22.7% of the municipality's workforce. These occupations include nursing, personal aide care, physical therapy, etc. The next largest industry is retail trade with 15.9% of the workforce, working in occupations regarding retail, sales, trade/exchange, customer service, etc. The third largest industry, public administration employs 13.5% of the workforce and includes work like governmental positions, police officers, administrative assistants, social workers, firefighters, etc.



**Figure 5.** Major industries within the Comerío Municipality by percentage based on the 2016 U.S. Census. Source: DATA USA

Pre- and post- Hurricane Maria, Comerío has taken more interest in a rising tourism, food industry, and other specialized education. Food is a particular focus because 80% of food in Puerto Rico is imported and there was a severe food shortage after Maria. The municipality has an agriculture and apiculture school to promote apiary industries locally and teach sustainable agricultural practices. With Puerto Rico's shift in sustaining their own food supplies,

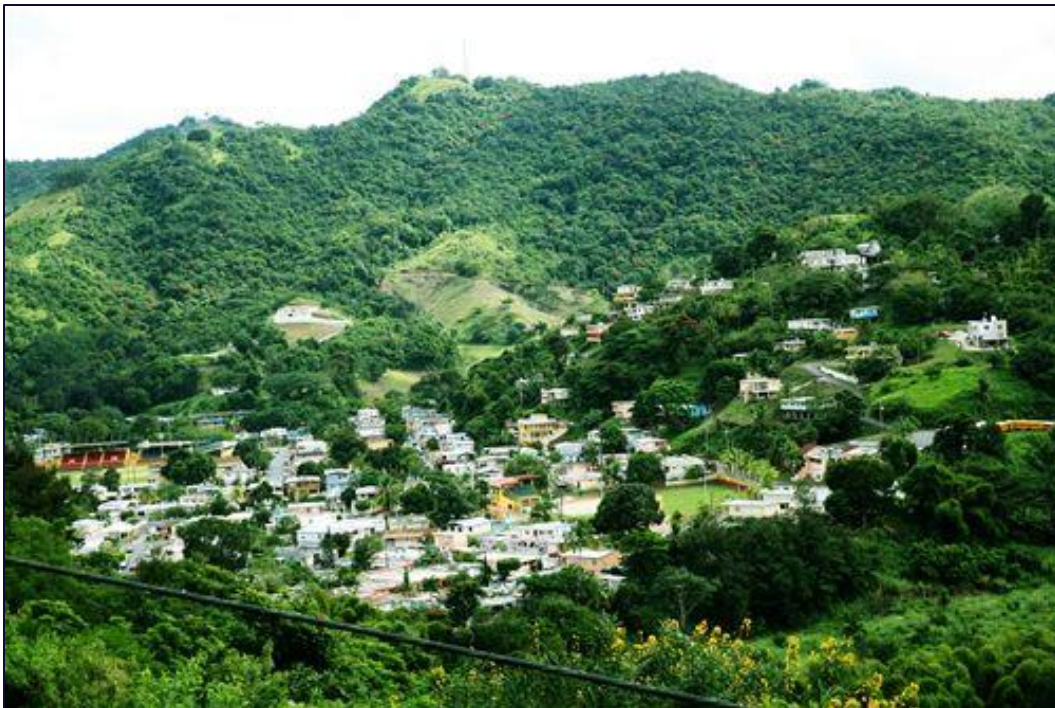


agricultural-based education and tourism has increased. Other types of specialized education includes Puerto Rico's first baseball academy for high school students in collaboration with the University of Puerto – Bayamón. This unique school prepares students for the Major Leagues and could potentially expand Puerto Rico's sports and entertainment industry in the future to accommodate the increasing fans to the sport.

Tourism has been a large aspect of Comerío's economy. The municipality would like to focus on expanding their ecotourism and showcasing their forestry and agricultural services to visitors, not only to show their care for the environment, but to show how their resources are utilized (see Section III: Advisory for more information on eco and agro-tourism). This expansion in tourism can cultivate adjoining industries and businesses within educational services, hospitality industry, entertainment, recreational services, etc. For instance, local food tours like the Ruta Gastronómica de Comerío, Sabor de la Trova help visitors explore the different business and food businesses within Comerío. Overall, there is great potential to expand their existing industries and develop services unique to Comerío.

## Geography

Comerío is located on the central-eastern part of Puerto Rico, and is known for the two main rivers which run through the municipality: Rio de la Plata and Rio Hondo. The town is often known by the nickname of “La Perla de Plata” which literally translates to the Pearl of the Plata, due to the beauty and significance of the former river. Other streams which run through Comerío are Convento, Piña, Quebrada Prieta, Cándida, Tigre, Naranjo, Ollas, and Jagüita brooks. The topography is very hilly, and the elevation includes five mounts at varying elevations: Mount La Tiza, Mount Comerío, Mount Magueyes, Mount Lazo, and Mount Viento Caliente.



**Figure 6.** Comerío, Puerto Rico



The town is known for its dam and electric power plant, which were first built in the first half of the 20th century. The plant was powered by the Comerío falls and the Blanco River. There are two small dams on Rio De Plata, built in 1908 for the supply of power. One of the dams is currently looked to for a main source of eco-tourism in the area, this will be touched on in the Recovery Assessment portion of this report.

According to the notes from the students' recent trip, this dam is a large attraction for tourists as it is the only dam infrastructure in Puerto Rico which can be accessible on the other side by tourists, including an access ramp and ticket office. The town is now interested in reviving and restructuring the hydroelectric plant, which was damaged by Hurricane Maria.

## **Environment and Hazards**

The geography of Comerío makes it particularly susceptible to flooding and landslides during extreme weather events. In September 2017 Hurricane Maria struck the island of Puerto Rico causing widespread damage to homes and infrastructure. The Puerto Rican power grid was damaged, leaving the municipality without power for an extended period. The eye of the hurricane passed through the northern region of Comerío. Heavy rainfall caused flooding along the Rio Platas and, according to community reports, 77 landslides. High winds also took their toll on the community leveling vegetation and tearing off roofs. Temporary blue-tarp roofs built by FEMA are still a common sight in Comerío, particularly in the outlying barrios.

The threat of extreme weather events like Hurricane Maria is only increasing. Climate change trends suggest a future of more frequent and more dramatic hurricanes. Local officials are working to plan for this future. Hazards including flooding, landslides, and high winds have been identified and steps are being made to mitigate disaster. For a more detailed information about natural hazards and disaster risk, including a social vulnerability analysis please see Section II: Disaster Risk and Impact.

During Hurricane Maria flooding made multiple bridges inaccessible and outlying barrios were without the support of the municipality for days. A large part of the municipal mitigation plan is the designation of resilience centers in each barrio. Buildings already suitable for community gathering are to be renovated to provide shelter and serve as bases of operations with basic necessities such as clean water, public restrooms, and food in the case of disaster. Additional information about these resilience centers is included in Section III: Recovery Assessment.

## **Recovery Vision**

Comerío has a major focus on sustainability and resilience for its community. The municipality aims to create resilience centers in each barrio to support residents during the time of a disaster (See Section III: Advisory for more information about community resilience centers).

Restoring the hydroelectric plant at the second dam is another goal. They hope to use as much renewable energy as possible to power the area. The dam in Comerío was first built in the early 1900s. According to local accounts, the dam was built by 700 workers who transported large concrete blocks one-by-one across the steep slope. The dam was built by a private company, but

it is now owned by the municipality. In addition to its energy efficiency, the dam will also work as a site for tourists to learn about the dam. After Hurricane Maria the project was halted, but now restoration is underway. Debris from the damaged dam will be reused and put towards community gardens and asphalt works. This dam is the only one in Puerto Rico where tourists can pass underneath to the other side.

The dam project is a great asset to the municipality's investment in ecotourism. Visitors can come to learn about the dam and the energy it provides as well as tour the facility and nearby businesses. They have plans for a souvenir shop on the other side of the river and to create a trail network for visitors to walk to and from their hotels. Or, visitors can choose to kayak through the river back to the hotels. For more information on ecotourism please see Section III: Advisory.

## References

1. An Introduction to Building Codes for Property Owners- FEMA Building Science Branch – Building Disaster Resilient Communities. Federal Emergency Management Agency. *U.S. Department of Homeland Security*. Retrieved from [https://www.fema.gov/media-library-data/bc72838e65f84ad5e5025b576679317c/Introduction To Building Codes PPT-New Brand.pdf](https://www.fema.gov/media-library-data/bc72838e65f84ad5e5025b576679317c/Introduction%20To%20Building%20Codes%20PPT-New%20Brand.pdf)
2. EPRL, G. E. (2017). Comerío Municipality. Retrieved from <https://enciclopediapr.org/en/encyclopedia/comerio-municipality>
3. FEMA Building Codes Toolkit: Frequently Asked Questions. Federal Emergency Management Agency. *U.S. Department of Homeland Security*. Retrieved from
4. [https://www.fema.gov/media-library-data/1391095848112-ea8765dee99538f4bb2cc7179cf5c175/Building Codes Toolkit FAQ 508.pdf](https://www.fema.gov/media-library-data/1391095848112-ea8765dee99538f4bb2cc7179cf5c175/Building%20Codes%20Toolkit%20FAQ%20508.pdf)
5. Hinojosa, J. & Meléndez, E. The Housing Crisis in Puerto Rico and the Impact of Hurricane Maria. (2018, June). *Centro: Center for Puerto Rican Studies*. Retrieved from [https://centropr.hunter.cuny.edu/sites/default/files/data\\_briefs/HousingPuertoRico.pdf](https://centropr.hunter.cuny.edu/sites/default/files/data_briefs/HousingPuertoRico.pdf)
6. Ruta Gastronómica de Comerío. (2015). *Municipio Autónomo de Comerío*. Retrieved from <http://www.visitacomerio.com/>
7. US Census Bureau. (2019, March 13). American Community Survey (ACS). Retrieved from <https://www.census.gov/programs-surveys/acs/>





# **Disaster Risk & Impact Report**

## **Comerío, Puerto Rico**

**Aaron Flores & Zixuan Huang**

**CMP 6960 – Spring 2019**

## Introduction

It is estimated that Hurricane Maria resulted in \$90 billion in damages, making Hurricane Maria the third costliest hurricane in the United States (U.S.) history (Pasch, Penny, & Berg, 2017). Hurricane Maria made landfall on the island of Puerto Rico as a Category 4 on 20 September 2017 in the early morning hours. Heavy rains produced by Maria caused flooding in many locations on the island, especially near rivers. Landslides and wind damage were also concerns associated with Maria, causing significant damage across the island. Approximately 80% of the island's power grid was compromised, leaving the entire island without power for months. Official reports by the U.S. government state that Hurricane Maria directly caused 65 deaths, but one study reported that over 4,000 excess deaths were related to the event (Kishore et al., 2018).

This portion of the project is focused on hazards and risks associated with Hurricane Maria, specifically in the municipality of Comerío, Puerto Rico (**Figure 1**). Using data from the U.S. Census Bureau American Community Survey 5-year estimates, we created a Social Vulnerability Index for Comerío, enabling us to identify the most vulnerable communities within the study area. We provide a user-friendly web platform that integrates geographic information systems (GIS) with various data including flood zones, landslide incidents, and demographic characteristics so that members of the public can visualize specific physical and demographic characteristics of Comerío. These data and map products can help residents, local officials, and decision makers identify which communities may be affected the most in future disaster scenarios, potentially improving hazard mitigation.



**Figure 1.** Map of Comerío, Puerto Rico and all barrios located within the municipality.

## Methods

### *Social Vulnerability Index*

To create a Social Vulnerability Index (SVI), we utilize methods proposed by previous research (Flanagan et al., 2011). Data were obtained from the American Community Survey (ACS) 5-year estimates (2013-2017) at the County Subdivision scale for the municipality of Comerío, Puerto Rico (**Table 1**). This scale was preferable because it was comparable across multiple datasets used in this analysis. The data were divided into four groups: (1) Socioeconomic Status; (2) Household Composition/Disability; (3) Minority Status/Language Proficiency; and (4) Housing/Transportation. In the Socioeconomic Status (SES) group, variables include percent persons below poverty, percent civilian unemployed, per capita income (2017) and percent persons with less than high school education. The Household Composition/Disability group includes percent persons 65 years of age or older, percent persons five years of age or younger, percent persons with a disability, and percent single-parent households. The Minority Status/Language group includes percent minority and percent persons who speak English less than “well.” The Housing/Transportation group includes percent multi-unit structures, percent households with more than one person per room, and percent of households with no vehicle available. For each variable included in the SVI, a percentile rank was calculated. Percentile ranks were summed within each group. The resulting sums for each group were also summed together and ranked by percentile to provide a final SVI rank for each County Subdivision within Comerío. These data were joined with geographic information systems (GIS) data obtained from data.pr.gov and mapped using ArcMap 10.6.1.

**Table 1.** Variables included in the Social Vulnerability Index (SVI) analysis by domain.

Domain	Variable	Description
<b>Socioeconomic Status</b>	Percent of persons below poverty	Percent of persons below the federally defined poverty line.
	Percent of civilian unemployed	Percent of the civilian population (16+) unemployed and seeking work.
	Per capita income (2017)	Mean income computed for each County Subdivision.
	Percent of persons with less than a high school education	Percent of persons with less than a 12th-grade education.
<b>Household Composition/Disability</b>	Percent of persons $\geq 65$ years of age	
	Percent of persons $\leq$ five years of age	
	Percent of persons with a disability	Percent of the civilian population (5+) with a disability.
	Percent of single-parent households	Percent of single-parent households with at least one child under 18 years of age.
<b>Minority Status/Language Proficiency</b>	Percent minority	Black + Hispanic + Asian + AI/AN + NH/PI + Some other race + two or more races.
	Percent of persons who speak English less than “well.”	Total persons who speak English “not well” or “not at all.”
<b>Housing/Transportation</b>	Percent of multi-unit structures	Percent of housing units with 10 or more units in the structure.
	Percent of households with $> 1$ person per room	Percent of total occupied housing units with more than one person per room.
	Percent of households with no vehicle available	



### *Flood Zones/Landslides*

Data for flood zones within Comerío were obtained from the Federal Emergency Management Agency's (FEMA) National Flood Hazard Layer (NFHL). This data was integrated into GIS software and mapped, showing the 100-year flood zone and the 500-year flood zone. A 100-year flood has a 1% chance of occurring on an annual basis (FEMA, 2019). A 500-year flood has a 0.2% chance of occurring on an annual basis (FEMA, 2019).

Students involved in this project were provided aerial imagery of Pueblo (the central most barrio in the analysis) while visiting the study area. This imagery was presented to local community members, and they provided information on landslide incidents, which we then mapped with point locations in ArcMap. These data are not validated empirically and are only available for Pueblo and small portions of surrounding barrios (Palomas, Río Hondo, and Piñas). The United State Geological Survey (USGS) provides a landslide susceptibility map for Comerío, which can be cross-referenced with our landslide incidents data. According to USGS data, approximately 60% of Comerío had moderate landslide susceptibility, and 27% has high landslide susceptibility (Larsen & Parks, 1998). Moderate susceptibility is defined as the potential for one to three landslides per square kilometer per decade (Larsen & Parks, 1998). High susceptibility is defined as the potential for more than three landslides per square kilometer per decade (Larsen & Parks, 1998).

### *Web GIS Platform*

In order to provide better data visualization and interactive experience, a *Disaster Risk and Impact Web Map* is created for Comerío, Puerto Rico using web GIS technique. Web GIS is any geographic information service that uses web technology to communicate between components. It is a distributed information system that contains three important elements: web client, network, and web server. Since Web GIS utilizes the internet to access information over the web without worrying about the distance between server and client, it introduces distinct advantages over traditional desktop GIS. The benefits include global reach, higher user volume, better cross-platform capability, low cost, easy to use, and unified update. The web GIS interface in this project is designed for disaster risk analysis and the recovery process of Comerío in that we could provide the information to local researchers for further analysis and planning.

The web map platform is created using ESRI ArcGIS Suite, which includes ArcMap, ArcGIS Pro, and ArcGIS Online. Microsoft Visual Studio is also utilized and is an integrated development environment. The web map currently contains 16 layers, including maps for population, flood zones, community-reported landslide locations, social vulnerability index, as well as an intuitive and interactive 3D environment for better data visualization. Some maps, such as the population map, are made directly in ArcGIS online. Others, like SVI maps and flood zone maps, are made in ArcMap 10.6.1 and then published as hosted feature layers to the ArcGIS Server. Also, the web map includes a few widgets that allow users to change the basemap, search information, and measure distances or areas.

### *Service Types & Functionalities*

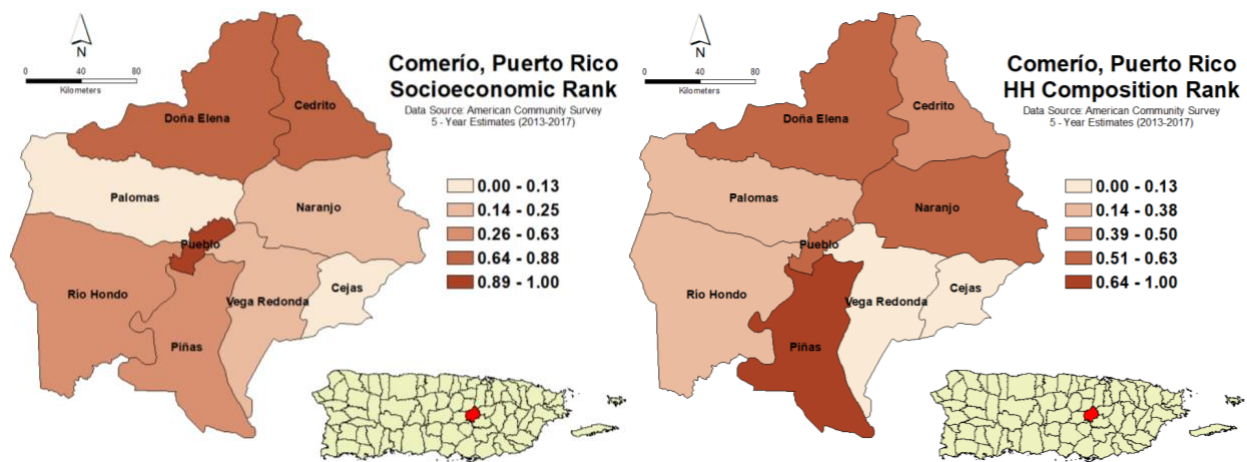
The web map provides three services. The first one is data visualization and access, which is the very basic function of a web map. The map currently provides 16 map layers and their associated information pop-up for the user to easily view. Map service and scene service are the two web

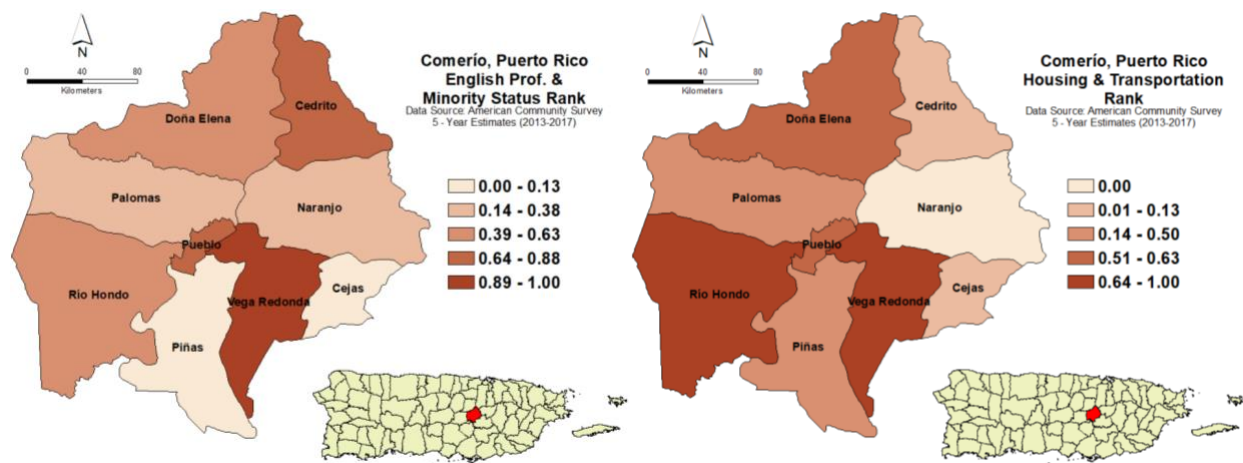
services used in this project. Map service provides a two-dimensional visualization by offering access to the contents of a map hosted on a server. Scene service, on the other hand, provides a three-dimensional (3-D) visualization by giving access to 3-D content originally created in ArcGIS Pro. The web map can be easily updated if necessary, and we can add additional functions and analysis tools into the map if required.

## Results

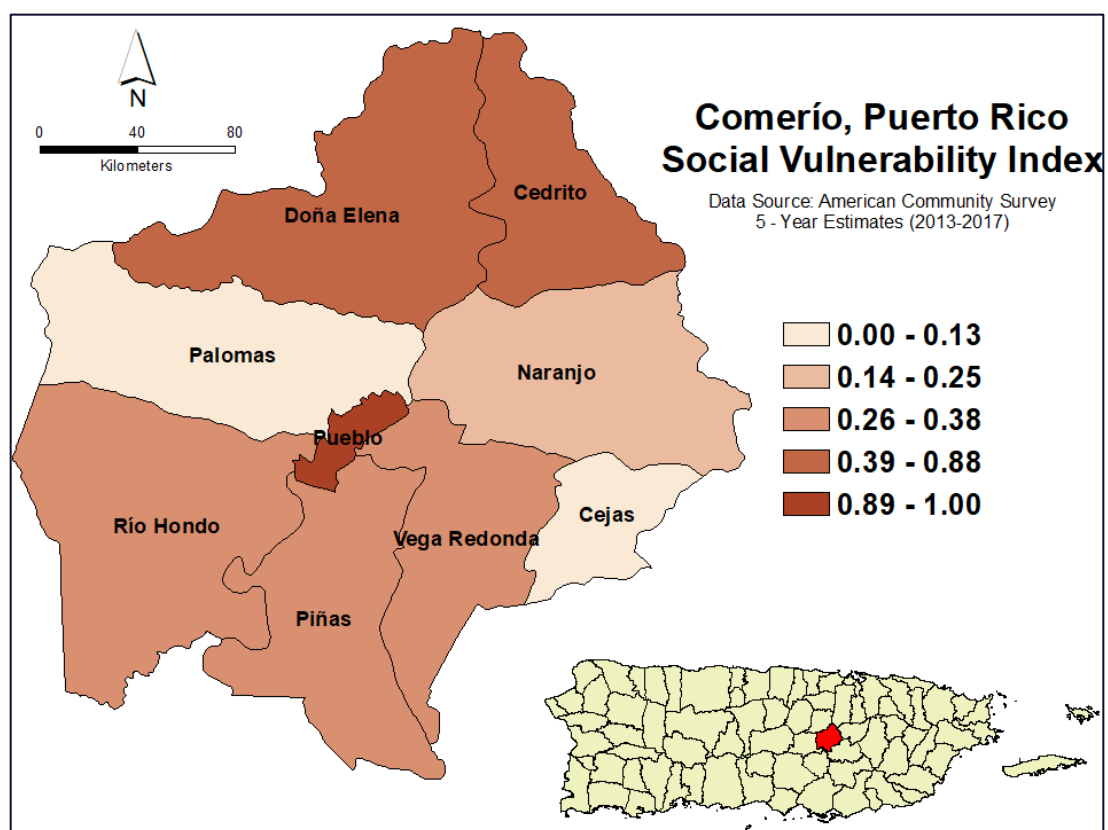
### *Social Vulnerability Index*

**Figure 2** includes maps for each domain included in the SVI analysis. In the Socioeconomic Status domain, Pueblo ranks in the highest percentile, meaning it has the lowest socioeconomic status of all barrios located in the study area. Cedrito has the highest percentage of residents with less than high school education, but Pueblo has the highest poverty percentage, highest unemployed percentage, and the lowest per capita income among all barrios in Comerío. In the Household Composition domain, Piñas ranks in the highest percentile. Piñas has the highest percentage of residents 65 years of age and older and the highest percentage of residents with a disability. In the Minority Status/English Proficiency domain, Vega Redonda ranks in the highest percentile, where 93% of the population speaks English less than well. Vega Redonda also contains the highest percentage of minorities among all barrios. In Puerto Rico, minority status and language proficiency will usually not contribute to social vulnerability, but in the contexts of a disaster like Hurricane Maria, residents would receive aid and assistance in the recovery process are required to work with United States federal agencies, such as FEMA. In the Housing/Transportation domain, Vega Redonda is in the highest percentile. Vega Redonda has the highest percentage of residents living in multi-unit structures, which could result in evacuation problems if several residents are trying to escape through a few exits. The final SVI map indicates that Pueblo has the highest social vulnerability among all barrios in Comerío. Palomas has the lowest social vulnerability among all barrios and was not in the highest percentile for any of the domains. Interestingly, the SVI map is very similar to the socioeconomic status map.





**Figure 2.** Social Vulnerability Index domain ranks for each barrio within Comerío, Puerto Rico.

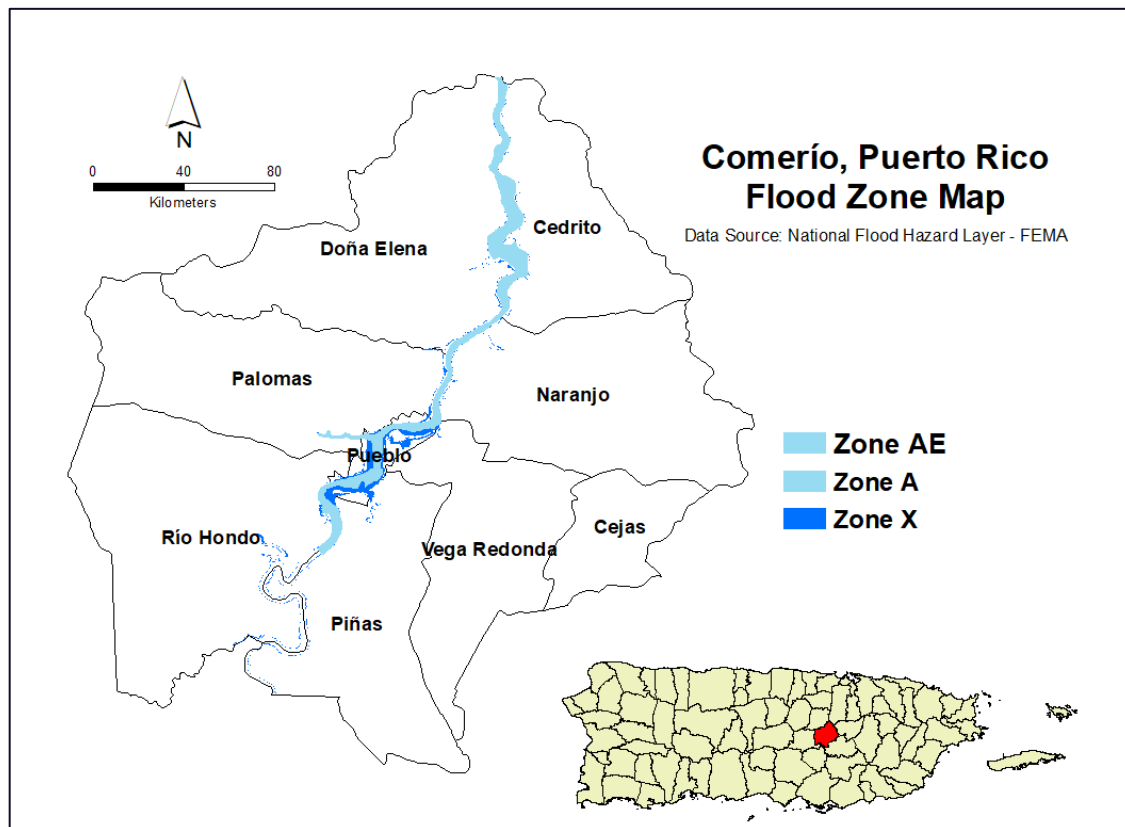


**Figure 3.** Social Vulnerability Index ranks for each barrio within Comerío, Puerto Rico.



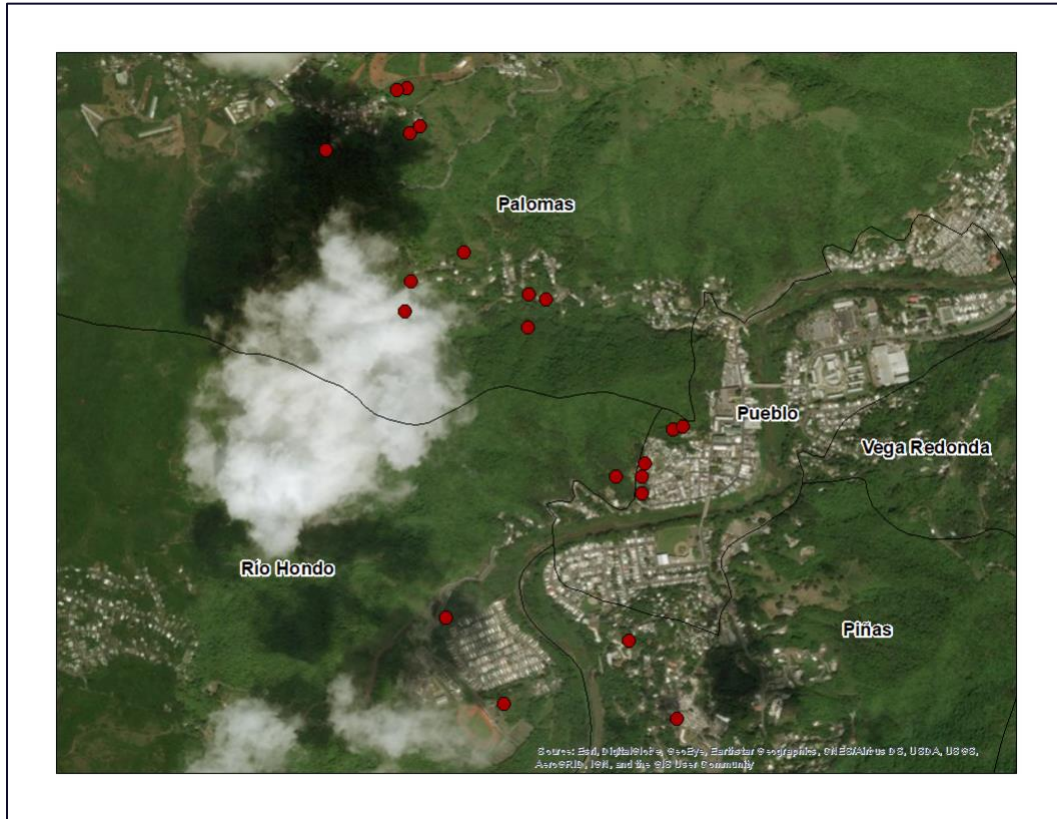
### *Flood Zones/Landslides*

The flood zone map (**Figure 4**) depicts the 100- (Zone AE, A) and 500-year (Zone X) floodplains within Comerío. A portion of the Río de la Plata runs through all of the barrios except Cejas. Pueblo has the most area covered in the 100- and 500-year floodplains. The light blue color indicates areas that would be inundated by a 100-year flood event. The dark blue color indicates areas that would be inundated by a 500-year flood event. If physical characteristics such as the area within the floodplain were incorporated into a vulnerability index, Pueblo would likely remain the most vulnerable.

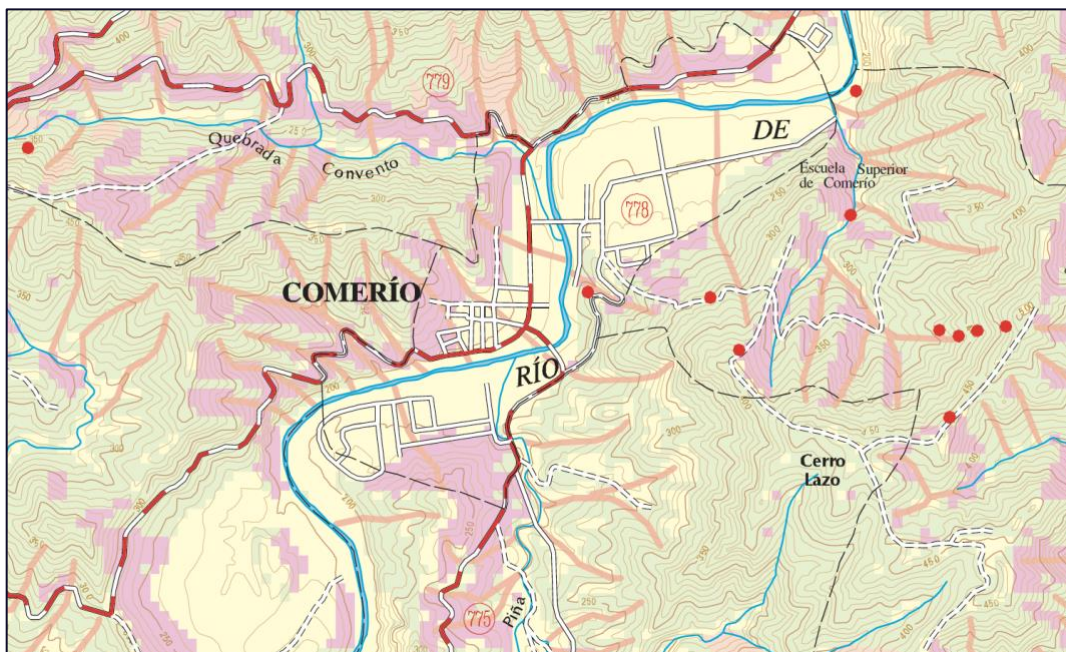


**Figure 4.** Flood zone map for Comerío, Puerto Rico.

Community reported landslide incidents can be seen in **Figure 5**. There were a total of 21 reported landslide incidents and the majority of them in Palomas. Pueblo had five reported landslide incidents. From the imagery, it can be observed that the landslide incidents reported in Pueblo are very close to infrastructure. The USGS provides a landslide susceptibility map for the entire municipality of Comerío (**Figure 6**). Areas in pink are considered areas of high susceptibility to landsliding. Areas in green are considered areas of moderate susceptibility to landsliding. Areas in yellow are areas of low susceptibility to landsliding. When comparing the community reported landslide incidents and the USGS landslide susceptibility map, it can be observed that reported landslide incidents occurred primarily in areas of moderate to high susceptibility of landsliding.



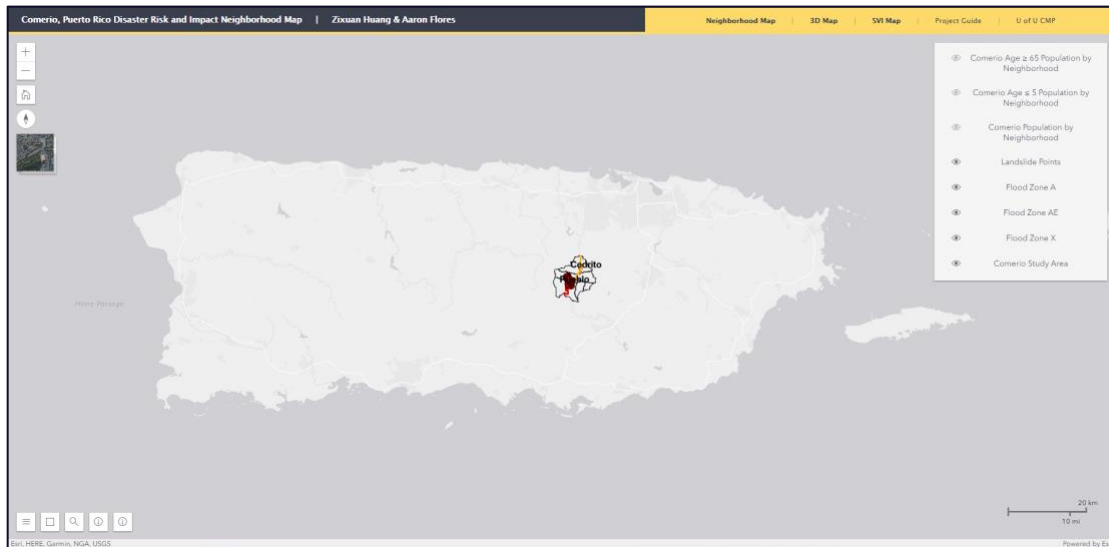
**Figure 5.** Community reported landslide incidents for areas surrounding Pueblo.



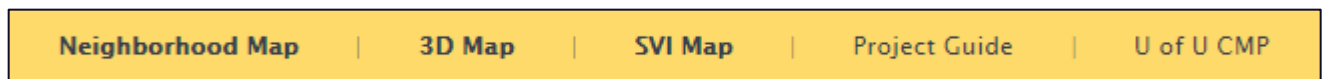
**Figure 6.** Landslide susceptibility for areas surrounding Pueblo (Larsen & Parks, 1998).

### Web Application Demonstration & Explanation

While using the web map, the user will first be presented with the neighborhood map (**Figure 7**), the homepage of this project. In this web map, we provide two-dimensional data visualization at the neighborhood (barrio) level. Located in the top right corner is the navigation bar (**Figure 8**), which provides links to other map layers, the project guide, and the homepage for the Department of City and Metropolitan Planning at the University of Utah. In the top left corner, there are four widgets. The first allows the user to zoom in and out, adjusting the scale of the map. The home widget allows the user to go back to the initial map scale. The compass widget allows users to rotate the map. The basemap toggle widget allows users to switch from a colored basemap to a satellite imagery basemap. There are five additional widgets located in the bottom left corner of the web map. The first one allows the user to expand the legend. The next allows the user to find a location by inputting latitude and longitude coordinates. Another widget allows the user to search for information in the layer being used. Lastly, two widgets are available to the user allowing for the measurement of distances and areas.

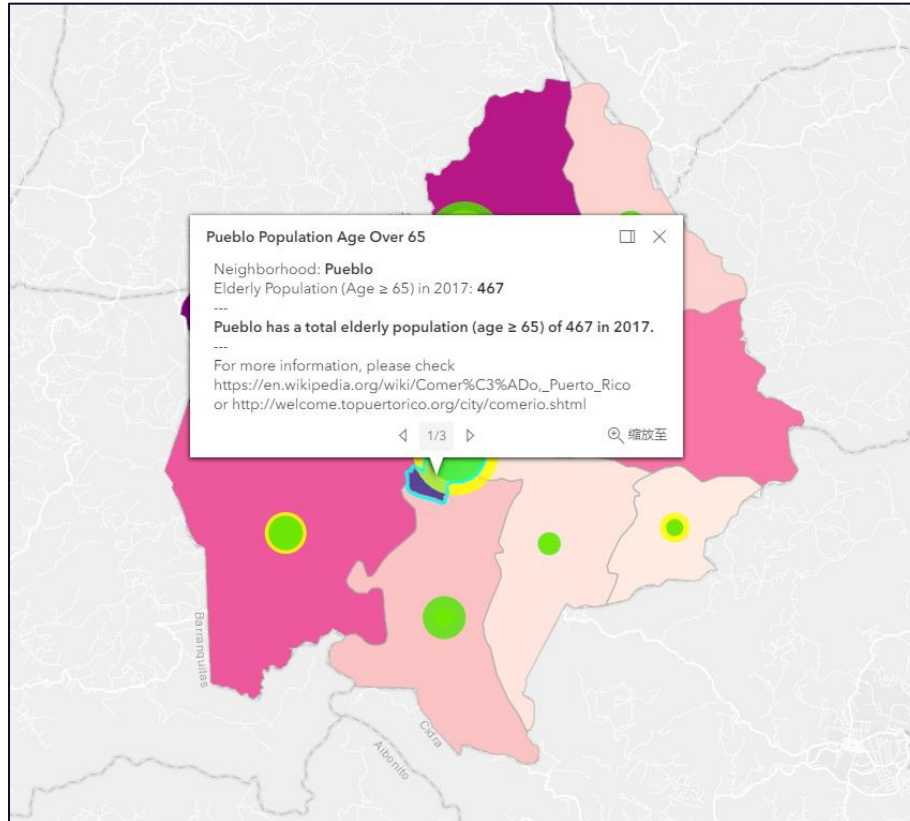


**Figure 7.** Web map interface for Comerío, Puerto Rico.



**Figure 8.** Navigation bar.

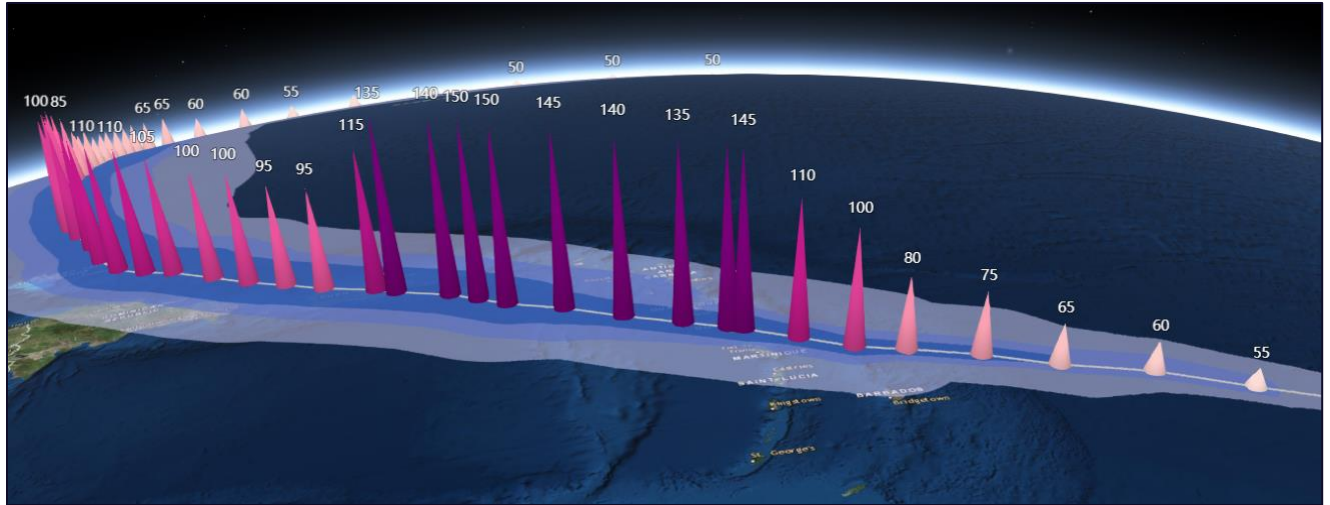
The neighborhood map provides eight layers, which are shown in the layerlist on the top right side. The layerlist allows users to turn various layers on or off. Three population layers are associated with the information pop-up (**Figure 9**). Users can click on each layer to see the population information in each municipality. As we can see from the map, Palomas and Pueblo are the most populous barrios in Comerío. However, the two barrios have differing age structures. Pueblo has a higher population of children five years of age or younger (yellow circle) whereas Palomas has a higher population of elderly, 65 years of age or older (green circle).



**Figure 9.** Population layers and associated information pop-up.

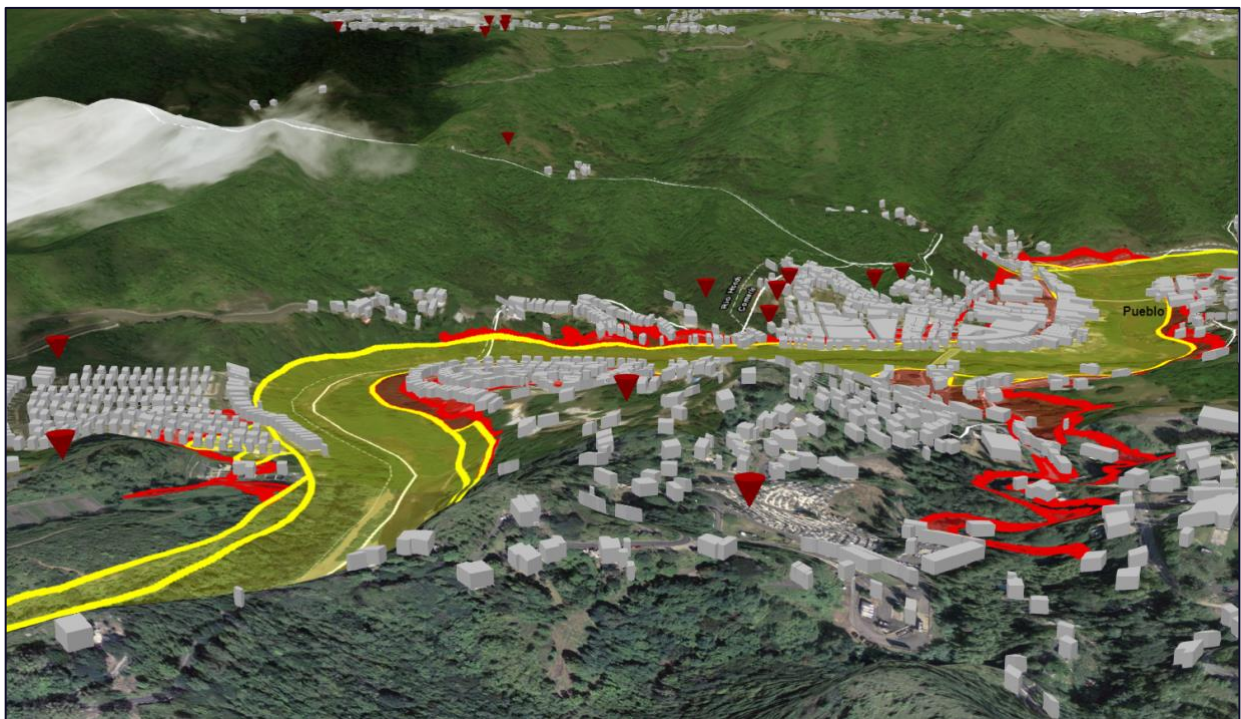
We also provide a 3-D representation of Hurricane Maria's path (**Figure 10**). Hurricane Maria's path data are provided by the National Oceanic and Atmospheric Administration's (NOAA) National Hurricane Center (NHC). The data show that Hurricane Maria started to increase its intensity after passing Martinique, an overseas region controlled by France. The intensity was 115 when it reached Comerío region. The blue shades beneath the path cones are the wind swath. It represents 64, 50 and 34 knots of wind speed from dark blue to light blue. As can be seen from the map, the entire island of Puerto Rico was covered in at least 64 knots of wind speed.





**Figure 10.** Hurricane Maria's path and wind swath.

When zoomed in to the Comerío area, landslide locations, building footprints, and flood zones can be seen. One of the advantages of 3-D representations is that users can see the slope and actual environment for the study area. **Figure 11** shows that community reported landslides mostly occurred in areas with deep slope. Adding building footprints allows users to see how many buildings are located within the 100- and 500-year flood zones. This information can significantly improve local government plans and policies for residents and businesses located within the flood zones.



**Figure 11.** Three-dimensional environment of landslide locations, building footprint, and flood zones.

A short project guide is provided in the web map, including a project description and goals, data sources, and contact information. Reading the project guide will allow users to further understand the project and the web map. The web map is currently accessible through this link: <http://content.csbs.utah.edu/~u1201537/CMP6960/CMPFinalProjectHuang.html>. This link is provided by the College of Social and Behavioral Science (CSBS) at the University of Utah.

## **Conclusion**

The results of our analysis indicate that Pueblo is the most socially vulnerable barrio in the municipality of Comerío, Puerto Rico. These results have important implications in the contexts of disaster scenarios such as Hurricane Maria. Decision makers, local health officials, and community members can utilize this information so that resources can be allocated more effectively and efficiently to the most vulnerable barrios. Additionally, the creation of a web GIS platform will allow these parties to have all of the information provided in this report, in one easily accessible location. The information provided in this report can be used in all stages of a disaster. For instance, flood zone and landslide incidence maps may inform planners of the most vulnerable areas within Comerío, so that infrastructure decisions can be made accordingly (e.g., avoid building in floodplains and landslide risk areas). This analysis has two major limitations. First, our landslide incidence data are reported by members of the community and is not empirically derived. Despite this, the community reported results compare favorably to the landslide susceptibility map provided by the USGS. Additionally, our SVI results should be tested using statistical analyses, such as principal components analysis or regression analysis, so that we can confirm the statistical significance of social vulnerability.

## References

1. FEMA. (2019). Flood Zone. Retrieved April 28, 2019, from <https://www.fema.gov/flood-zones>
2. Flanagan, B. E., Gregory, E. W., Hallisey, E. J., Heitgerd, J. L., & Lewis, B. (2011). A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 8(1).
3. Kishore, N., Marqués, D., Mahmud, A., Kiang, M. V, Rodriguez, I., Fuller, A., ... Buckee, C. O. (2018). Mortality in Puerto Rico after Hurricane Maria. *The New England Journal of Medicine*, 379(2), 162–170.
4. Larsen, B. M. C., & Parks, J. E. (1998). *Landslide Susceptibility in the Comerío Municipality, Puerto Rico*.
5. Pasch, R. J., Penny, A. B., & Berg, R. (2017). *Tropical Cyclone Report - Hurricane Maria*. National Hurricane Center.





# Comerío Recovery Assessment & Ecotourism and Resilience Centers

Brikelle Peers, Gabby Knudson, & Michaela Choppin

CMP 6960 – Spring 2019



# Comerio Recovery Assessment

## Introduction

Ecotourism is a way to show respect to nature, help with environmental conservation, and improve the quality of life for local people. It does not contribute with degradation and many communities that do not participate in industrial means can really benefit from this type of tourism. In addition, sustainable tourism helps protect natural habitats and allows communities to create a better economy without harming the environment. According to TIES (The International Ecotourism Society), ecotourism is defined as,

*“...responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education. Education is meant to be inclusive of both staff and guests.”*

The main idea of ecotourism is to grow the economy and at the same time create a sustainable environment and protect natural resources. The town of Comerio was significantly affected by Hurricane Maria and is exploring new ways to recover and improve the economy in sustainable ways, such as through ecotourism. As a result, the main focus of this report is ecotourism, which also includes agrotourism.

## Background

Comerio was founded on July 12, 1826 and is located in the center-eastern region of Puerto Rico. It is also known as “La Perla de Plata” (the pearl of the Plata) because the La Plata River runs through the center of town and has been very important to the development of Comerio. Due to the flow of the river, there are two dams called Represa 1 and Represa 2. The town had an economy based on coffee, tobacco, and produce for many years--with 3 local cigar factories established by natives of Comerio. Cobian y Compania, La Comeriana and El Privilegio are the prominent cigar companies in the area.

Today the town is moving towards tourism as a strategy for economic development and recovery after the devastation caused by Hurricane Maria. At the same time, the town is also committed to the idea of sustainable development evidenced by its participation in Puerto Rico’s Recycling Program, Coliseo of Puerto Rico, and promotion of its local agricultural and apiculture schools. Officials of the town have expressed an interest in ecotourism as a way to combine these economic and sustainability goals. Even prior to Hurricane Maria, the municipality had invested into purchasing Hotel Media Luna and is working to restore its second dam, Represa 2, as a way to attract more tourists to the city. We believe that it is in the municipality’s best interest to follow this model and use ecotourism and sustainability to become a stronger and more resilient community.

## Comerio Existing Actions Towards Ecotourism

Comerio created a plan in 2008 to restore the dams, Represa 1 and Represa 2, and create trails around the La Plata River. The town owns Represa 2 and some of the land and the lake around it. According to local officials, to make the area more desirable for tourism they have invested

money to create better infrastructure around the dam including an access ramp, a ticket office and a souvenir shop. With the addition of the Hotel Media Luna, the municipality has even more definitive plans to restore the dam with committed investors.

## **Best Practices in Ecotourism**

The following section reviews multiple communities that have successfully pursued and implemented ecotourism as an economic development strategy. These case studies can inform the path forward for the municipality as it moves towards sustainable economic growth.

### **Costa Rica**

Costa Rica is a small country of just 19,730 sq. miles (51,100 sq. km), but it has a lot to see and do; rainforests, wildlife and beautiful beaches can be found throughout the nation. The country has developed a successful environmental plan, where conservation and economic growth go side by side. Costa Rica has also been able to achieve sustainable development and preserve the environment from the risks of agricultural practices. Common ecotourism ventures in Costa Rica include hiking, biking, and scuba diving.

In 2015, researchers created a study to test the effectiveness of ecotourism on the Osa Peninsula. First, they found that local residents employed by the tourism industry almost twice as much as those not employed in the tourism industry. Additionally, researchers also found that ecotourism provided significant economic benefits to existing parks and protected areas in Costa Rica through reforestation projects and promote nature conservation. Overall, the study found that ecotourism provides great benefits for the community and for conservation (Hunt, 352).

Investing in ecotourism has been quite profitable for the people living in Costa Rica. Comerío has the potential to also profit from the industry and improve the quality of life for the people that live in the municipality.

Costa Rica also has a National Initiative, which is a Certification for Sustainable Tourism (CST), created to comply with a sustainable model of natural, cultural, and social resource management. In addition, the reason Costa Rica's ecotourism is so successful is because of the participation and funding from private sectors, government and non-profits organizations. By adopting ecotourism instead traditional methods of tourism, Costa Rica was able to minimize the negative effects on the environment. Additionally, Costa Rica is almost entirely powered from sustainable energies, as that has been a priority for the nation--to invest in their own well-being.

### **Puerto Rico**

Ecotourism in Puerto Rico is becoming more popular in places like Vieques, Fajardo, and Ceiba, where they are offering unique opportunities for extreme fun in nature. Scuba diving, snorkeling, kayaking, SUP (stand up paddle board) and biking adventures are on the list for the fun activities offered in the Island.

For example, the Toro Verde Nature Adventure Park gives tourists the opportunity to experience a bird's eye view of Puerto Rico. Tours include multiple ziplines, ropes courses, rappelling, rock climbing, hiking, and much more. This ecotourism operation is perfect for those who want to get outside and experience the lush greenery of central Puerto Rico. Tens of thousands of people have experienced Toro Verde, allowing for the adventure park to expand its operations. Toro Verde has been so successful that they hope to soon become a fully-functioning adventure resort

and hotel in Northeastern Puerto Rico. In fact, they have even been able to expand to other locations, like Dubai, because of how successful they have been in Puerto Rico.

## **Resources and Recommendations**

Based on the community profile and social vulnerability assessment created by our peers, we recommend a variety of actions for the municipality of Comerío to pursue. First, we recommend that the Comerío expands its network of hiking and biking trails. The terrain of the municipality is mountainous and perfect for those outdoor activities, making it a profitable investment in ecotourism. Second, we encourage further investment in infrastructure around Represa 2 to invest in more ecotourism opportunities. Once more paths are constructed around the dam and the gift shop is finished, it will be a great attraction to tourists that visit the area. Third, we believe that in renovating the dam, the municipality should also invest in revitalizing the hydroelectric plant so that they can grow their use of sustainable energies.

Fourth, Comerío should create more specific green spaces and botanical/community gardens. The designation of more green spaces will not only create beautiful gardens for tourists to enjoy, but also improve the lives of Comerío's residents. We additionally recommend that the municipality reach out to companies like Toro Verde Adventure Park and investigate the possibility of bringing them to their region. Toro Verde has proven to be quite profitable for the areas in which it is located, making it a great opportunity to find private investment to grow Comerío's economy.

## **Federal Programs for Financing**

There are many ways in which Comerío can receive funding for these numerous ventures. The most flexible of all the options, the Community Development Block Grant - Disaster Recovery (CDBG-DR) Program is an excellent source of funding for governments that need to tackle serious challenges. This funding could be used to address the restoration of Represa 2 as a hydroelectric plant, as well as a center of ecotourism. The Building Blocks for Sustainable Communities is a grant from the Environmental Protection Agency (EPA) that gives communities a boost in the pursuit of sustainability. This funding could also be used towards the hydroelectric plant restoration for Comerío to further strive towards sustainable energy sourcing in their community. After using this grant, Comerío would be better equipped to make sustainable energy much more attainable in larger quantities. The National Parks Service offers a trail planning grant that nearby communities including Luquillo, Farjardo, and Rio Grande have also utilized. The National Parks Service works with local communities and universities to create new trails and improve neglected networks rather than only functioning as an outside force. They utilize local organizations and resources to make the project more personal to the community that it is benefiting. This would give local people the opportunity to contribute to the beautification and utilization of the mountainous terrain that is everywhere around them.

While it may seem intimidating to address all of these recommendations, there are plenty of ways in which Comerío can get the funding it needs to invest in itself. Pursuing ecotourism as a catalyst to economic growth is attainable through many different federal programs that are offered for development purposes and disaster recovery purposes. As the municipality seeks resiliency in the face of Hurricane Maria, they will find that there are many options for growth. In addition to the federal programs we have mentioned, there are also many opportunities in the private sector. Finding companies, like Toro Verde Adventure Park, to invest in the municipality would give the community a well-needed boost in its path towards ecotourism and sustainability.

# Resilience Centers in Comerío

## Background

The result of the devastating disaster, Hurricane Maria, not only affected the coastline but the entire island. Comerío, a city located in the eastern middle part of the island, is separated into seven areas spread widely apart. These small towns experienced major impacts from the hurricane, and were stranded for several days without proper emergency resources. This was due to severe limitation of transportation among the towns, making it nearly impossible to access a nearby place for basic supplies as well as safe living quarters. As post-recovery activism, Comerío is looking to increase their resilience plan by creating more centers for emergencies, community awareness, and find federal program funding to ensure the effort can become reality. Resilience updates can require time and money, however, Comerío already obtains useful resources that would allow a beneficial plan to come into place. In this paper I will introduce examples of other islands and towns with successful resilience plans, explain what community awareness would contain along with beneficial value for it, and ways the community can apply for federal funding to assist with covering the fees in producing a well maintained resilience plan.

One of Comerío's first initiatives was to start the construction for a community resilience center in La Juncia. This will be the first resilience center in the area. An investment of nearly \$150,000 was split by the Puerto Rican Agenda of Chicago and the Municipality of Comerío. The center will serve as a first response building before any natural disaster or emergency. It will maintain necessities such as a 15k electric generator, 2,500-gallon water tank, industrial kitchen, washing machines, food storage, and other basic needs for the community. The resilience center is still in the early phases of construction, and will hopefully be the leader of other resilience centers to be created on the island.

## Case Studies

### *Japan*

Due to their increased likelihood for any kind of disaster to strike, Japan is well equipped for post disaster preparedness. Schools have been made as a wise community resilience center because they are strong and large infrastructures that can withstand harsh conditions in order to keep individuals inside safe. Schools have the ability to operate as a school full time, but can obtain several storage spaces to hold emergency supplies. Several areas around the world use schools as an emergency resilience center and have found their need when disasters occur to be needed. Building individual centers is expensive and expected to be unneeded majority of the year. Structures such as schools are a public building that can operate in several scenarios.

### *Greensburg*

A small town called Greensburg, Kansas experienced a deadly tornado that destroyed 90% of the town in 2007. Their disaster recovery plan obtained great potential in rebuilding with sustainable principles. Although such damages take years to repair, the community took it as an opportunity to grow and improve their environment for present and future residents. Greensburg's recovery process concluded to be a major success, in both budgeting and resilience that was able to tie into sustainability. Instead of every community having to "reinvent the wheel", Greensburg created a



recovery handbook, aiding these communities with their experiences. The handbook included sections such as: sustainability and the disaster recovery initiative, post disaster clean-up, the healing process, financing, rebuilding a community and more. The handbook also provides an efficient timeline on the phases a community will go to once a disaster strikes. Comerio would be considered under the reconstruction phase, where the town is beginning to rebuild capital stock and social and economic activities return.

## **Resources and Recommendations**

### *University Design Build Programs*

The University of Utah contains a Design Build BLUFF Program in their Architecture department. The purpose of the program is for graduate students to experience and be immersed in planning for different cultural communities that are in need of architectural designs and recommendations. The program ensures they will create ways to impact a sustainable future both physically and economically. Several universities have programs such as BLUFF. Design build programs are an excellent tool to utilize because it is low cost for communities in need of assistance. This benefits both sides, where the students participating in this project are obtaining impactful learning experiences in the field, and for the community in which the buildings are being placed in are needed and at low cost.

Locally, the University of Puerto Rico also maintains a school of architecture. This would be another inexpensive option, and would promote the local university in assisting with the project of creating economic and sustainable resilience centers. The University of Puerto Rico has already started giving back to the community post hurricane Maria. On March 22 2019, the university held a round table calling it the “Project for the Future”. They invited other colleges as well and the public to assist in gathering data and prioritize learning objectives. “Projects were formulated for addressing the new economic drivers, the planning of the river basins, the coastal plains and coastal erosion, the relocation of floodable neighborhoods, transportation innovation and the eco-transformation of the existing neighborhoods,” (Kohen,2019). This was a major learning curve for the University of Puerto Rico and other key members living on the island. Results have not yet been posted, but will provide a clear perspective from working professionals in this field of study.

## **Buildings to use for Resilience Centers**

Japan provided a valid example of turning schools into resilience centers during times of need. Their schools function normally on a regular basis but have the necessary resources for nearby residents to stay during a natural disaster. Comerio obtains several schools that remain empty year round. If the structure is already built and can withstand dangerous conditions, then following Japan’s path would be an efficient and inexpensive way to create resilience centers for the community. Schools are large enough to house several people at once, and also obtain the ability to supply water, energy, and gas at a larger scale. La Juncia maintains a resilience center that is costing a large amount of money to build. However, schools that are already built would be able to be reused for purposes like this. Project planners for La Juncia’s resilient center could provide a list of material and resources they will add into their building so other centers in Comerio can imitate what is needed.

## **Sustainable Infrastructure**

Greensburg found ways to reuse material from structures that had been damaged. Material such as brick, wood, concrete, metals, and furniture had the ability to be salvaged and used in opposition of placing it in the landfill. This was a cheap alternative, and make it so not as much material ends up into the landfill. The report also provided several low cost tips. This would be especially critical to Comerio due to a smaller budget to fulfill a massive rebuild. Low cost tips included but were not limited to: orienting home to face south, reducing square footage, maximize air circulation, programmable thermostats, and investing in LED lights.

## **Supporting Actions**

### *Awareness Day*

In 1989, the International Day for Disaster Reduction came about by the United Nations General Assembly. Held every October 13, the purpose of this day is to promote awareness of disaster planning and risk reduction. This allows several countries to take part in identifying the importance of planning for disasters, and easy steps for any community, no matter their economic value may participate and implement for future needs. Each year the assembly focuses on a particular theme, but does not limit the day to that. For example, 2018's framework focused on creating actions to reduce mortality around the world. This day would not limit Comerio, but allow the entire island to take part and learn about different methods in mitigating natural hazards. Having an annual occurrence for communities to come together, learn, and take away with vital information in risk reduction would help several people once a disaster strikes.

### *Signage*

Indoor and outdoor signage is an important safety feature all regions should have. Whether it is evacuation routes for stairs or roadways, or notifications on transportation services that it is hurricane season. Signage is a small and inexpensive action that may go a long way. Once a disaster happens, people need to know where to go and what to do in order to stay safe. Signage is the most affordable and efficient way to notify individuals what to do. Signs can be helpful for several situations once a disaster happens, and is considered to be a strong safety value for communities to obtain. Signage would also decrease the risk of death and severe obstruction by making people in the area aware of their surroundings.

## **Federal Programs for Financing**

### *Hazard Mitigation Grant Program*

The Hazard Mitigation Grant Program (HMGP) is available for communities to apply for after a disaster occurred. The amount granted to the area is based off a percentage the total disaster assistance package is given, meaning it is based off of the calculation of damage loss estimates. This is considered to be a great program to apply for due to the severity Hurricane Maria was. Comerio suffered from severe damage. This grant is based off of the amount of damage a community experienced after the disaster occurred. However, the DMA 2000 release decided that communities can only receive certain types of HMGP funding as long as they already had a mitigation plan in place. Funding may still be received if there is not a mitigation plan, but it will be limited. Activities for HMGP include but are not limited to: construction efforts for hazard reduction, retrofitting needed structures, voluntary relocation, elevation of flood-prone areas, development of mitigation regulations, development of a comprehensive mitigation program,

building code enforcement, and public awareness. All of these activities are difficult for a community to provide on their own. HMGP would be a great resource to help make Comerio a resilient area that is prepared for any future disaster that may come its way.

#### *Flood Mitigation Assistance Program*

The Flood Mitigation Assistance Program (FMAP) is an ongoing annual grant that reduces or eliminates the long term risk of flood damage to the environment and infrastructures. This grant is a pre-disaster plan that works to create a resilient community in future disasters. Although Hurricane Maria already happened, it is important for Comerio to plan in case another storm were to strike in the future. Not only does the community need to rebuild from the disaster that already happened, but to also ensure they are prepared in case a hurricane were to occur again. The FMAP grant has three different parts: planning, project, and technical assistance. Not only does it plan for relocation of flood-prone infrastructure, it also ensures the community maintains a FEMA approved flood plan and assistance in planning/project documents.

#### *Community Development Block Grant Disaster Program*

We understand the town already has plans to apply for the CDBG-DR program. However, this is the best option for Comerio to apply for because its ultimate purpose is for communities that are in need of funding. This would greatly benefit Comerio because of the grant's ability to aid in several programs and activities around the area. The grant is not limited to one use, but is to ensure the community can gain strength now and in the future. CDBG-DR recovery activities involve assisting with rebuilding houses, restoring infrastructure, and economic development. Majority of Comerio's damage was caused by Hurricane Maria, allowing the community to fully use and benefit with this grant.

## **Next Steps**

In conclusion, there are several tools and programs Comerio would be eligible to take part in at this time. The most important steps for the community is to become stable and prepare for any future disasters to possibly strike. As a recommendation, the importance of creating resilience centers is vital during times of emergency. There are several schools in Comerio that are not in use, or are big enough to maintain a storage area filled with emergency preparedness supplies. Schools would be the best infrastructure to use because of its structural stability and access for public use. We also recommend utilizing design build programs from other universities. Several universities contain a school of architecture which specializes in creating projects for communities in need. Universities would be able to create a design plan and build the infrastructure needed from their resources and funding. Simple and easy solutions to incorporate into the community would be creating an Awareness Day where the community may practice drills that should be taken during a disaster as well as learning how to be prepared for future hurricanes. Lastly, it is very important for the community to apply for federal funding because of their ability to access this funding and vulnerability to not be able to rebuild the community on their own. Federal funding would ensure the community can be rebuilt as needed, and is disaster prepared.

## References

1. Carter A. Hunt, William H. Durham, Laura Driscoll & Martha Honey (2015) Can ecotourism deliver real economic, social, and environmental benefits? A study of the Osa Peninsula, Costa Rica, *Journal of Sustainable Tourism*, 23:3, 339-357, DOI: 10.1080/09669582.2014.965176.
2. Chandrasekhar, Divya. "Hazard Mitigation and Disaster Recovery Policy in the United States". CMP 4960-005. Planning for Disasters and Environmental Change. Presentation.
3. "What Is Ecotourism? Principles, Importance and Benefits of Ecotourism." Conserve Energy Future, 23 Dec. 2017, [www.conserve-energy-future.com/principles-importance-benefits-ecotourism.php](http://www.conserve-energy-future.com/principles-importance-benefits-ecotourism.php).
4. "Disaster Reduction, Disaster, Humanitarian, Tsunami, Earthquake, Flood, Typhoon, Preparation." United Nations, United Nations, [www.un.org/en/events/disasterreductionday/](http://www.un.org/en/events/disasterreductionday/).
5. "Back to Help Puerto Rico." UF College of Design, Construction and Planning, [dcp.ufl.edu/news/back-to-help-puerto-rico/](http://dcp.ufl.edu/news/back-to-help-puerto-rico/).
6. "HITN and Puerto Rican Agenda of Chicago Continue Solidarity towards Municipality of Comerio." HITN, 11 Sept. 2018, [www.hitn.org/hitn-and-puerto-rican-agenda-of-chicago-continue-solidarity-towards-municipality-of-comerio/](http://www.hitn.org/hitn-and-puerto-rican-agenda-of-chicago-continue-solidarity-towards-municipality-of-comerio/).
7. "Ecotourism in Costa Rica." Go Visit Costa Rica, [www.govisitcostarica.com/travelInfo/ecotourism.asp](http://www.govisitcostarica.com/travelInfo/ecotourism.asp).
8. U.S. Department of Housing and Urban Development Community Planning and Development. June 2018. "Community Development Block Grant Disaster Recovery, CDBG-DR Overview". Presentation.
9. <https://files.hudexchange.info/resources/documents/CDBG-Disaster-Recovery-Overview.pdf>