

Climate Change and Natural Disaster Risks in Belize City

2018



JULY 12

Florida State University

Authored by: Belize Research Team 2018

Overview

During the week of June 20-27th, 2018, ten members of Florida State University’s Emergency Management and Homeland Security Department (EMHS) traveled to Belize City, Belize to work with the Belize Association of Planners (BAP). Together these two groups worked to collect data on resident perceptions of climate change and natural disaster risk in two local communities: Jane Usher and Between Canals. This project was initiated to gather baseline data on communities that typically see negative impacts from severe weather events and climate change. Information was collected through surveys, which largely asked residents objectively what they had observed in their own community over the last five years.

Overall, 502 plots were surveyed with more than 300 being responded to by residents. This report contains a debrief of all data collected over the week, detailed out through statistical analysis and visual aids.

The Belize Research Team 2018 was comprised of the following six student researchers under the supervision of Dr. Judith Cuadra and Bobby Duggleby.

- Rachel Bardoul
- Bailey Fohr
- Paige Levanti
- Frank Quintero
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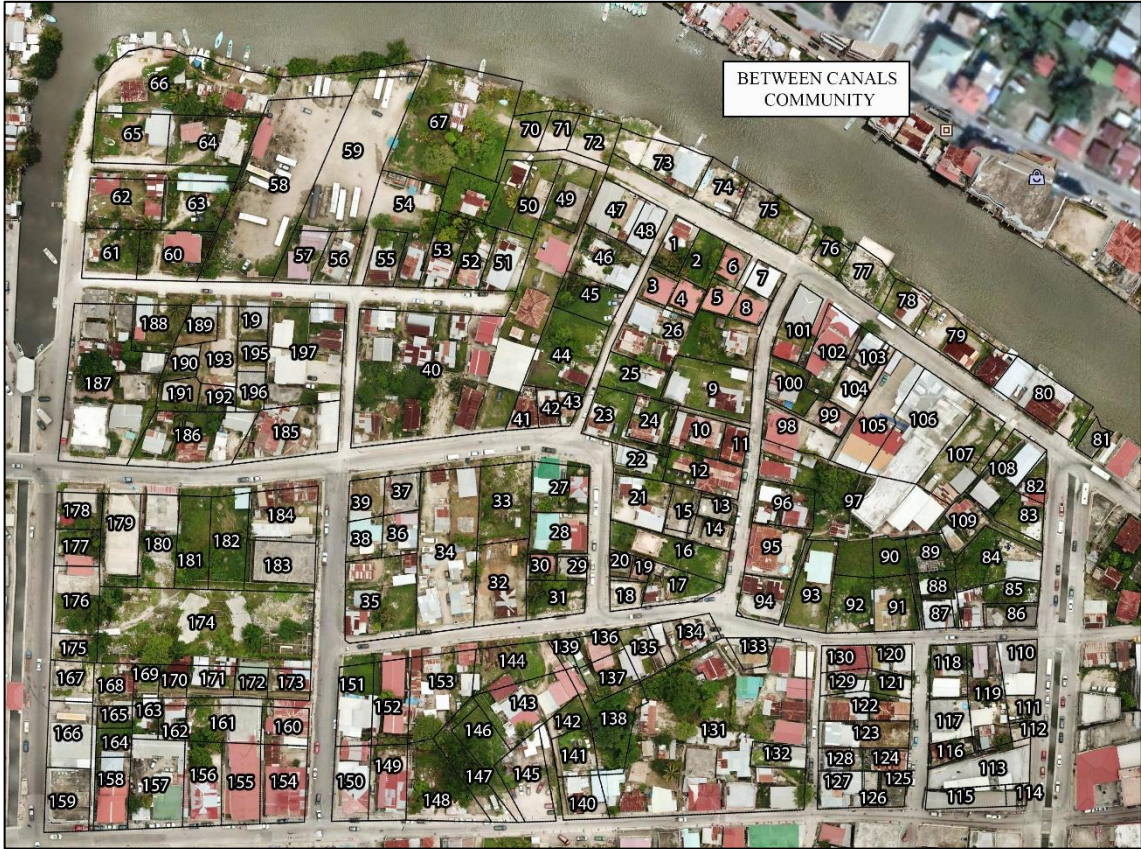
Jarrett Broder and Laura Hart made up the UAS team and provided up-to-date aerial maps and images on five neighborhoods.



**BELIZE ASSOCIATION
OF PLANNERS**
“Making Belize Sustainable”

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Demographic Characteristics

Between Canals Community:

In total, 121 residents responded to the survey in the Between Canals community. Out of those respondents 60, spoke English as their dominant language (49.58%). Following that, 41 spoke Creole (33.88%), 36 spoke Spanish (29.75%), 4 spoke Mandarin (3.30%), and 1 spoke Garifuna (00.82%). Along with these, 28.7% of the respondents declared their household to be multilingual, with English-Creole being the most common pairing. What was noticed was that those who spoke Mandarin were most often store owners in the area as well.

Regarding the adults and the children that lived inside each house, those 18 or older were considered adults and those under 18 were classified as children. 373 adults were accounted for with an average of 3.3 adults per household. 155 children were counted averaging 1.4 children per home (but many homes had zero children, and some with upwards of 6).

Jane Usher Community:

In this community, there were 131 respondents accounted for. Both Creole and English had the most speakers, yet Creole had more dominance with 71 (54.19%); there were 61 English (46.56%). 33 individuals listed Spanish as their most dominant language (25.19%), and there were 7 who listed Garifuna (5.34%). There were approximately 29.7% of homes that declared themselves to be multilingual, and English-Creole was declared as the most common. Compared to Between Canals, this area not only spoke more Creole, but also had far fewer Mandarin speakers living in the area. They did have Chinese-owned stores that most every resident went to, mentioned, or knew about, but the presence of Mandarin speakers in the actual neighborhood was not there.

Again, children here were considered to be younger than 18, and adults were considered to be over 18. This community had 414 adults accounted for within its homes. This averaged out to have 3.3 adults per home. Regarding children, there were 258 accounted for which averaged out to be 2.1 children per home. There were more children in this area, with more places for children to play as there was a park noted in the back of the community. That kind of kid-friendly structure was lacking in Between Canals.

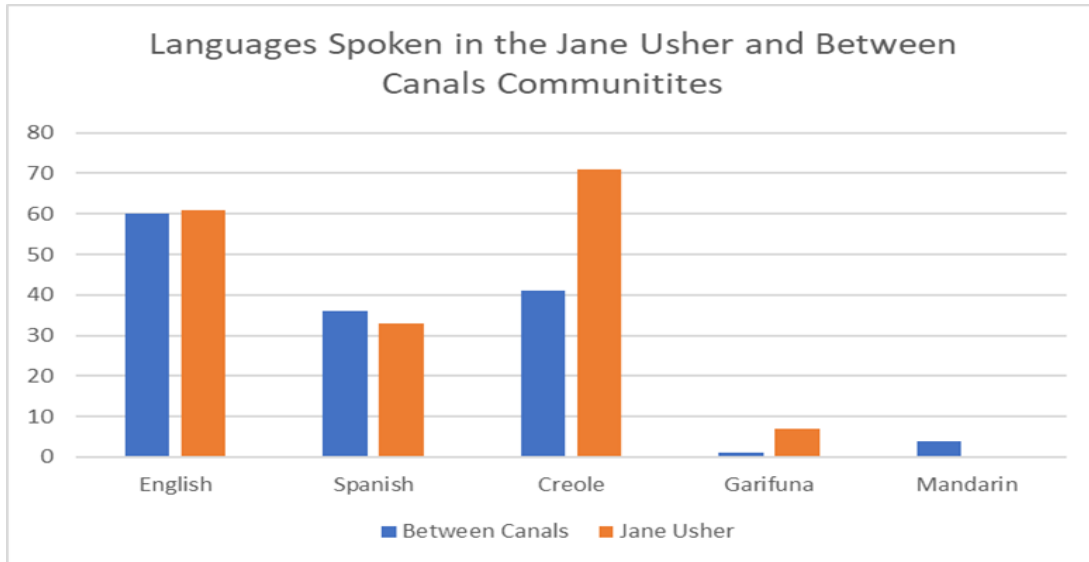
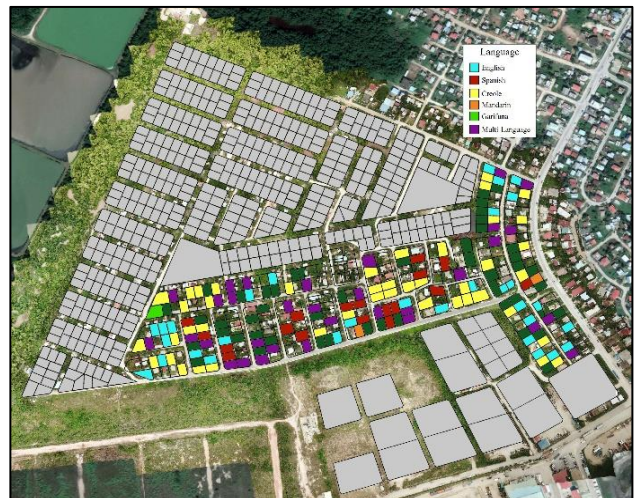


Figure 1: Bar graph of languages spoken in each of the two communities surveyed.

The maps below present a general overview of each community. Lots colored grey were inaccessible to researchers, dark green represents empty lots for which there was no information, and the rest of the lots are coded in the legends found in the images.



Maps 1 & 2: Coded maps of the Between Canals Community (left) and the Jane Usher Community (right).

Climate Change

In the survey conducted, a number of sections were dedicated to resident perceptions on climatic changes in the past 5 years and their associated responses to such changes. Residents were surveyed on their observations of temperature changes during wet season and dry season, changes in rainfall, and changes in water level in the street. Further, residents were asked for more detailed responses of how they defined climate change, how they heard about climate change, what they do differently daily because of climate change, and whether they had a positive or negative relationship with the mangroves.

Changes in Weather Patterns

There was an overwhelming response that there has been some kind of change in climatic factors in the last 5 years. Overall, there was a response of increased temperatures during the dry season with 94% of Between Canals respondents and 80% of Jane Usher respondents reporting an increase. Responses about temperature changes during the wet season were a little more mixed with people responding across the board that temperature increased, decreased, hasn't really changed, or they couldn't tell. For example, 59% of Between Canals respondents reported an increase, but the other 41% of respondents had a mix of the remaining 3 responses. Likewise, in the Jane Usher community, 38% of respondents said that wet season temperatures have not changed at all, and only 36% said that there was an increase.

Similarly, there were very different responses for rainfall changes. In the Between the Canals community 45% of respondents said rainfall has increased and 46% said it decreased. In the Jane Usher community, only 26% of respondents said rainfall has increased and 54% responded that there has been a decrease. The varying answers could possibly be explained by certain perceptions people have of what it means for rainfall to increase or decrease. For example, when speaking to the locals there seemed to be confusion on how to define what they were seeing. Some residents responded to rainfall as decreasing because rainfall has seemed to come later in the wet season than ever before. Conversely, some people responded by saying that rainfall has increased because while it may start later in the year, the rain is insanely heavy causing more flooding compared to years past.

As for water level in streets and lots, the Between canals community seemed to be a bit more affected by street flooding than Jane Usher. 70% of respondents in Between canals reported an increase in water level in the street when flooding occurs while a lesser 48% in Jane Usher reported an increase in water level in the street. Both communities are obviously affected but there were some mixed feelings on what the causes of the increased water level in the street was. Some respondents said that the water level increase was due solely to poor street construction or incomplete reconstruction, which was a common response specifically in Between Canals, while others attributed it to the increased rainfall. Further, the Between Canals community has probably seen an increase in water level in the street because they are heavily affected by anything that increases the height of the canal water. High tides and storm surges combined with poor drainage have obviously left disastrous results in Between Canals.



Image 1: Bar (on left) bordering the canal in the back. Non-elevated businesses in this area reported intense flooding inside their businesses during times of high-tide.

When it comes to road work and reconstruction, there needs to be local policies that are tailored to specific communities for city infrastructure. Many residents blamed road construction and unfinished work for their poor drainage. Developing stricter urban planning policies on street construction is imperative to mitigating the issues of poor construction or unfinished construction in certain areas.

Perceptions on Climate Change in the Jane Usher Community

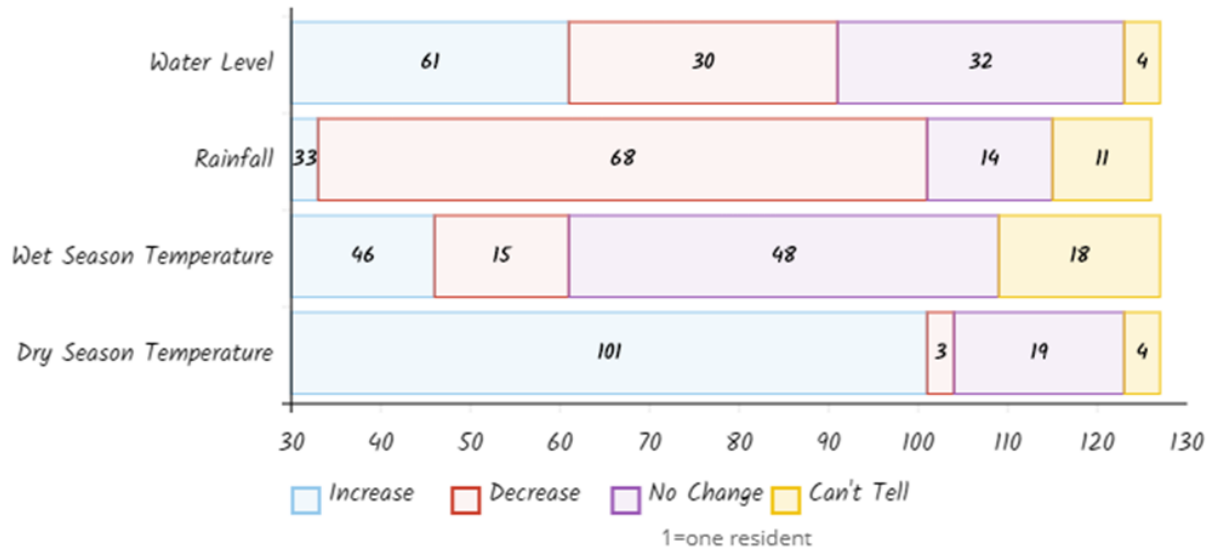


Figure 2: Climate Change Perception Statistics for Jane Usher Community

Perceptions on Climate Change in the Between Canals Community

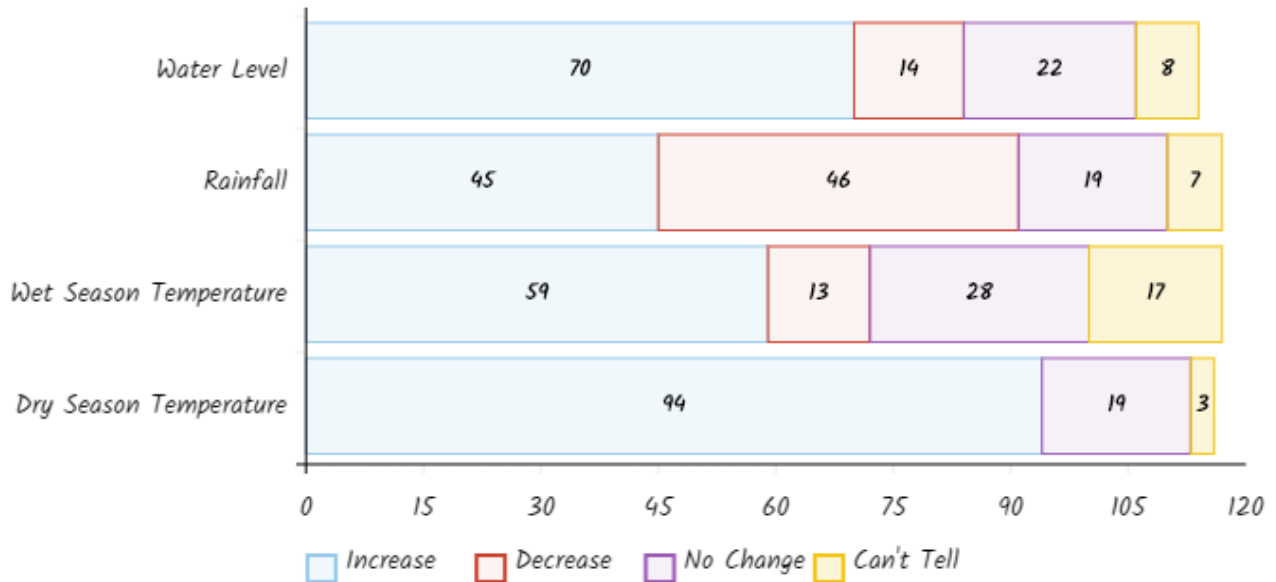


Figure 3: Climate Change Perception Statistics for Between Canals Community

Community Description of Climate Change: “What is climate change in your own words?”

The most common explanation that locals gave when asked to put climate change in their own words was that it meant a loss of usual weather patterns. People are extremely confused by the weather. They don't understand why rain is beginning later in the year, why their wet and dry seasons are stretching longer or becoming shorter or why it's insanely hot during seasons when it should be cooling off. Overall, the response was “things aren't like they used to be.”

Information on Climate Change- “Where did you hear about this [climate change]?”

Most people heard about climate change from the radio, television, and school. Likewise, many respondents spoke about how they learned all the positive impacts mangroves bring from school too. While a good portion of people did know about climate change, some people hadn't ever heard of it before or couldn't put into words what it meant for them even though they had heard the phrase before.

Lifestyle Adjustments Due to Climate Change- “Do you do anything differently in your daily life because of climate change?”

Common answers to this were that people are bathing more, drinking more water, and staying inside close to fans due to heat. Most people are responding to climate change by using even more resources, which will only further the effects of climate change. However, while a lot of people know about climate change, they don't really know how to respond to it or they don't have the means to respond to it. A lot of people said that even though the Earth's weather patterns are changing, they're still comfortable in their own personal patterns so they don't want to change them or simply can't.

Community Opinions on the Mangrove Forests- “What is your relationship with the mangroves? Positive or Negative?”

A large majority of people responded that the mangroves are positive for the communities and that they had a good relationship with them. Many people advocated for them because they protect the communities from strong winds during hurricanes and soil erosion. However, there were a couple responses specifically in areas in the back of Jane Usher Boulevard where people said that they were bad for the community as they harbor criminal activity because it's easy for criminals to hide in them. Additionally, some people consider the mangroves to be breeding grounds for mosquitos that carry illnesses.



Image 2: Mangroves in resident's backyard lagoon



Image 3: Resident's backyard lagoon

Conclusion and Recommendations

Ultimately, it is evident that the residents in these communities are aware of the changes taking place in their climate. Whether it is from the radio, television, school, local people, or self-perception, it is clear to residents that there are climatic changes taking place every day. It is clear, as well, that these communities are vulnerable to the immediate and delayed effects of climate change. The effects of climate change and cyclic, as the immediate solutions to the problems residents are facing will only exacerbate the future effects of climate change. For example, residents reported more water and energy use to cope with the rise in dry season temperatures. However, over-using these resources will only make recovering from them harder. Additionally, increase in intensity of rainfall and therefore water level in the street will displace stray trash in the streets and increase pollution. Decreases in rainfall could mess up local food businesses from being able to grow and sell local fresh fruits and vegetables.

While there are a lot of potential problems for these communities, there are also a lot of proactive and implementable solutions. Something very noticeable in these communities was how familiar residents were with each other. Understanding and expanding upon this community relationship could be very beneficial. Involving the community by having community meetings on Saturdays (a day our team found most residents were free) could improve education on how to mitigate human impact on the climate and how to prepare for future disasters. Another solution is to create jobs and businesses from the problems communities are currently facing. Our team found that there was a lot of stray trash in these communities which adds to toxic pollution. By finding a way to offer either jobs, volunteer opportunities with associated benefits, or a combination of both to help remove this trash is an excellent way to bolster involvement.

When it comes to education on climate change and disaster preparedness, it was obvious that schools are huge advocates for educating on this topic. Many people knew of climate change, but there were still a significant number of residents who hadn't heard about it to the extent that they need to know it. The classroom can be utilized significantly by having teachers assign easy at-home projects that help teach children and their families how to conserve resources daily and re-use resources that would have otherwise been thrown away. For example, a simple take home project would be to re-use containers to create compost bins with fruit and vegetable peels which could then be used to start a garden. Likewise, handing out important flyers and notices for anything disaster preparedness related to students to bring home to parents could be a viable way to get important information disbursed to the community.

While a significantly large majority of residents believe in the positive effects the mangroves have in the communities, surveys conducted in the back of Jane Usher started to see opinions change on mangroves. A couple houses mentioned how they are used for criminal activity and added that it is for this reason that they need to be cut down. Highlighting their positive impacts to the community through education may make residents more inclined to see the best of the mangroves. Further, warning the community on the risk of going in mangroves may mitigate their use for criminal purposes.

Disasters

Between Canals Community:

Floods

According to the residents in this area, there was a response of over half (55.17%) that believed that the number of floods had increased over the past five years whereas 34.48% believed there was no increase. Out of those who responded with increased flooding, only 26 out of the 64 believed they received warning prior to the flooding, and out of those 26 only one found the warning difficult to understand. Additionally, 13 of 116 could not tell if there was a change in flooding amount. Overall it can be safe to assume that there is a feeling of increased flooding in this area with less than ideal warnings in place which can cause serious vulnerability in the area.

Hurricanes

In regard to hurricanes, almost half (43.97%) believed there had been an increase in the number of hurricanes whereas 41.38% believed there had been no increase. 80 respondents of the 93 who responded believed there was a warning put into place, and 76 respondents out of 91 could understand that warning. Only 13.79% of individuals could not tell if there had been a change in the number of hurricanes. Overall there is a split in between the community members in regard to hurricanes increasing or not increasing. However, there is a strong response that warnings do occur when hurricanes are present, and they are easy to understand which would be a good thing for such vulnerable areas. In the below map, homes that have received hurricane warnings in the past are highlighted in red.



Map 3: Aerial map depicting reach of hurricane warnings in the Between Canals Community

Fires

There were only 31.90% of respondents that believed the amount of fires had increased with 57.76% saying there was not an increase, and there were only 8.62% that could not tell there was a change. Only 12 of the 86 individuals who responded declared that there was a warning present before fires occurred and out of that, 9 out of 63 believed the warning was easy to understand. This shows that there is not a large perceived increase in the amount of fires over the past five years, and warnings are not typically present with this kind of disaster. Considering the closeness of the buildings and the material being used to build these houses, a decrease in the perception of fires is promising, but if a warning could be created, that would help substantially for the area.

Tsunamis

Almost half (48.70%) of individuals believed there was not an increase in the amount of tsunamis in the area with 45.22% finding a perceived increase, and only 5.22% could not tell if there was a change at all. In regards to warnings, 69 of the 91 individuals who responded found a warning to be in place with 52 out of 90 of those finding it easy to understand. Tsunamis seem to be split in the middle as well regarding the increase or not increase of the disaster's occurrence. There does seem to be a high percentage of warnings being perceived with most also finding them easy to understand. This information is largely coming from a tsunami warning that was issued on January 9/10, 2018. This warning came in the form of a loud siren that sounded across the city. The map below demonstrates where the tsunami warning was received and who of those receiving the warning understood what was being signaled.



Map 4: Aerial map of receipt of tsunami warnings in the Between Canals Community

Earthquakes

Around half of the individuals reported an increase (49.14%) with 41.38% reporting no increase, and 8.62% being unable to tell if there was a change at all. Of those who responded that there was an increase, 11 out of the 102 of those who responded believed there had been a warning, and 11 out of 65 of those individuals believed the warning was easy to understand. Clearly, the warning when perceived is easy to understand, but many individuals did not even know a warning was taking place. Also, similar to both tsunamis and hurricanes, there is almost a split down the middle regarding increase or no increase in earthquakes.

Effects on Daily Life

Only 4 out of 111 respondents had any family injured, 46 out of 114 had their house damaged, 51 out of 113 said the roads were damaged, 54 out of 112 evacuated, 88 out of 114 lost power, and 54 out of 113 lost water. A pattern of evacuation was noticed, seeing as people tended to evacuate in clumps. This meaning that certain areas were more likely to evacuate due to potential familial ties, neighbor to neighbor communication influencing perceived risk, or very vulnerable areas in general. Those who did not evacuate typically did not because they had nowhere to go, thought it pointless to leave, or felt themselves prepared. Overall, most people do not get hurt whereas roads and homes do.



Map 5: Aerial map depicting water loss in the Between Canals Community



Map 6: Aerial map depicting power loss in the Between Canals Community



Map 7: map depicting damaged homes in the Between Canals Community



Map 8: Aerial map depicting water loss in the Between Canals Community

Disaster Assistance

Regarding reconstruction assistance, overall only 25 out of 114 individuals reported that they received any; 3 reported it from NGOs, 6 from the central government, 5 from the local government, 5 from the area rep, 2 from family, 0 from neighbors, 1 from church, and 3 from others. Regarding food assistance, overall only 22 out of 114 individuals reported that they received any; 1 reported it from NGOs, 6 from the central government, 4 from the local government, 2 from the area rep, 4 from family, 3 from neighbors, 2 from church, and 0 from others. Regarding shelter assistance, 46 out of 114 reported that they received any; 5 reported it from NGOs, 4 from the central government, 4 from the local government, 0 from the area rep, 11 from the family, 6 from neighbors, 3 from church, 13 from others. Regarding finance assistance, 7 out of 114 individuals reported that they received any, 0 reported it from NGOs, 2 from the central government, 1 from the local government, 2 from the area rep, 0 from neighbors, family, or church, and 2 from others. The feeling in this area was that assistance was not given and if it was it was not enough.

Jane Usher Community:

Floods

Over half (53.97%) of the residents in this area of Belize City reported an increase in the amount of flooding over the past five years with 40.48% finding no increase, and along with that 5.88% could not tell if there was a change at all. Of those 102 that did report an increase, 29 found that there was a warning with 29 out of 71 of those individuals also finding the warning easy to understand. This shows that there is a split decision regarding whether flooding has increased or not in the area, though warnings here do seem to be easy to understand.

Hurricanes

For this disaster, there were 34.92% of individuals who believed that the amount of hurricanes had increased. With that, over half (57.94%) found no increase, and only 7.14% could not tell a difference. Out of the 88 who responded, 68 found that there is a warning prior to hurricanes, and 62 out of 86 found the warning easy to understand. In this particular area, there seems to be a perception that hurricanes have not increased in the past five years, however they do perceive the fact that warnings do occur and that they are easy to understand.



Map 9: Aerial map depicting the reach of hurricane warnings in the Jane Usher Community

Fires

In the case of fires, 33.87 % believed there to be an increase in the amount of fires in the area whereas 62.4% found no increase in the past five years, and only 3.23% could not tell if there was a change present. Out of the 91 respondents regarding warnings, only 13 found a warning to be present, and 13 of 58 believed the warning to be easy to understand. This area of Belize City mostly

found no increase in the amount of fires, yet warnings seem to not be present in the perception of those who responded.

Tsunamis**

In reference to tsunamis, almost half (45.24%) believed that there was an increase and around half (50.79%) believed there to be no increase in the past five years, with 3.99% finding that they could not tell if there was a change. Regarding warnings, 67 out of 94 believed a warning was present in the case of tsunamis occurring, and 52 of 86 found that the warning is easy to understand. Warnings are perceived in this area to be present in the case of tsunamis with most finding them easy to understand. However, there is a split in the perception of tsunamis increasing or not over the past five years. The below map demonstrates where the tsunami warning was received and who of those receiving the warning understood what was being signaled.



Map 10: Aerial map depicting the reach of tsunami warnings in the Jane Usher Community

Earthquakes

A little over half (52.38%) of the individuals who responded found that the amount of earthquakes had increased over the past five years whereas 43.2% found no increase and 3.97% could not tell. There were 102 individuals who responded about whether a warning was present, and out of that only 7 found that a warning had occurred, and 5 of the 50 who responded about the warning being easy to understand found that it was easy to understand. In the case of this area, the perception is split regarding earthquakes increasing with a lean toward increasing over not. Warnings are not

perceived to be present for this area, and if they are present they do not seem to be easy to understand.

Effects on Daily Life

There were 8 out of 126 individuals who reported that someone in their family was hurt, 57 out of 125 people had their homes damaged, 59 out of 125 people believed the roads were damaged, 66 out of 125 evacuated, 90 out of 123 lost power, and 69 out of 124 lost water. In this area, regarding loss of water, a lot of individuals turned off their water or had their water turned off prior to a disaster so that they would not lose it once the disaster was over. Power however seemed to be much more likely to go out, though only a small amount reported anyone getting hurt. Similar to Between Canals, homes tended to evacuate in groups, as evidenced by the map below.



Map 11: Aerial map depicting the loss of water in the Jane Usher Community



Map 12: Aerial map depicting the loss of power in the Jane Usher Community



Map 13: Aerial map depicting the evacuation patterns in the Jane Usher Community



Map 14: Aerial map depicting the reach of tsunami warnings in the Jane Usher Community

Disaster Assistance

Regarding reconstruction assistance, overall only 19 out of 126 individuals reported that they received any; 7 reported it from NGOs, 5 from the central government, 5 from the local government, 2 from the area rep, 0 from family, neighbors, church, and others. Regarding food assistance, overall only 41 out of 126 individuals reported that they received any; 11 reported it from NGOs, 8 from the central government, 7 from the local government, 5 from the area rep, 3 from family, 1 from neighbors, 1 from church, and 5 from others. Regarding shelter assistance, 49 out of 126 reported that they received any; 3 reported it from NGOs, 2 from the central government, 6 from the local government, 0 from the area rep, 21 from the family, 3 from neighbors, 2 from church, 12 from others. Regarding finance assistance, 36 out of 126 individuals reported that they received any, 1 reported it from NGOs, 0 from the central government, 1 from the local government, 0 from the area rep, 33 from family, 0 from neighbors or church, and 1 from others. There was a lot of family assistance in this area as well as a lot of anger towards the government or anyone else who could give assistance for not helping with road and home rebuilding.

**DISCLAIMER:

Regarding tsunamis, there has only ever been one recorded tsunami/tsunami warning for Belize City, so a lot of individuals considered that not an increase since there was only one whereas others believed it was an increase since none had occurred before.

Regarding earthquakes, a lot of respondents did not think Belize suffered from earthquakes at all, yet they did believe they received the tremors from places like Guatemala when those countries had earthquakes occur. Therefore the increase in tremors was usually recorded.

Institutions and Services

The surveys used for this research included a section solely dedicated to measuring the residents' access to essential institutions and services thereby measuring the adaptive capacity of both the communities being surveyed. The results show varying degrees of access to certain institutions across the two communities.

Institutions

The Between Canals community is located at a relevant location in Belize city. The community is bordered by an important vehicular road, Orange Street, bringing vehicles from the cemetery road, western highway, and Central American Boulevard. Additionally, in the immediate vicinity of the community, the Swing Bridge connects the community with the northern part of the city. As such, residents have a significant level of access to institutions whether they are located within the boundaries of the community or in the neighboring communities. On the other hand, the residents of the Jane Usher community, located at the most southern part of the city and surrounded mostly by fuel deposits, the port of Belize, and undeveloped lawns, reported a reduced level of accessibility to the same kind of institutions.

Institutions	Between Canals	Jane Usher Blvd
School	90.18%	85.60%
Hospital/ Health Center	89.47%	84.13%
Municipal Market	96.49%	83.20%
Local Food Store	95.61%	88.00%
Police Station	83.93%	75.20%
Belize city council office	73.45%	54.84%

Table 4.1 Access to Institutions

Residents of the Between Canals community reported that they would mostly walk to the institutions mentioned above: 81.65% of the people surveyed would walk to the nearest school; 56.36% of the people surveyed would walk to the nearest health center; 88.39% would walk to the nearest market; 90.09% would walk to the nearest food store; 71.30% would walk to the nearest police station; and 63.81% would walk to the local government office (Belize City Council). Thus, highlighting the proximity of the institutions and the degree of accessibility that the residents of the between canals community have within their reach.

Contrasting the results of the Between Canals Community, the results from the Jane Usher community state that residents have to travel longer distances to reach the institutions: 56.56% would walk to the nearest school; 66.39% would choose to drive (including taking a bus or a taxi) to get to the nearest health center; 73.77% would have to drive to get to the nearest municipal market; 51.69% would have to drive to get to the nearest police station; and 64.04% would have to drive to get the office of the local government (Belize City Council).

It is important to note that this measurement of accessibility to institutions is based on normal conditions. Many residents reported that under extreme weather conditions - such as floods, hurricanes, etc. – the institutions that seem accessible to them in their everyday life turn almost completely inaccessible as transportation through the communities becomes more difficult. Additionally, despite the fact that these institutions might be open to the public, some residents might not perceive them as accessible as they might have limited mobility or a lack of resources to mobilize to the mentioned institutions.

Given the density of the population in both communities, it would be recommended to develop more institutions that the average resident can reach, especially before and in times of disasters. Further, the development of emergency transportation systems capable of mobilizing at-risk populations that would otherwise be unable to transport themselves to an institution when a disaster occurs would tremendously increase residents access to vital institutions and services.

Services

Overall, Residents of the Between Canals community enjoy slightly more accessibility to essential services than Jane Usher’s residents. The major difference reported was the perception of the Jane Usher Community regarding the state of the roads within the community. Table 4.2 states the percent of accessibility to the following services.

Services	Between Canals	Jane Usher Boulevard
Potable Water	96.49%	96.03%
Electricity/ Power	98.25%	93.65%
Paved Roads	95.61%	62.70%
Garbage Collection	98.25%	93.65%

Table 4.2 Services in Between Canals and Jane Usher Blvd

Employment

Employment, or lack thereof, is an important issue for the residents of the communities. Depending on the educational and specialization degree, access to well-paid, long-term employment varies. The perception for some residents is that employment was accessible only to those who had received a formal education; However, some argued that even having an education was not enough to gain employment and described the employment problems as a nationwide issue for the entire Belizean population.

The issue becomes further exacerbated when it comes to access to local employment. Despite being densely populated and residential areas, both communities lack considerable sources of employment. Residents reported that they must mobilize outside of the boundaries of the communities to search for employment. For the average Between Canals resident, employment is more accessible locally than for residents of Jane Usher Boulevard given its centric location within the city. Table 5.1 below

describes the overall perception of the accessibility of employment for residents of both communities and the percent of the residents who have had difficulty finding a job.

	Between Canals Community	Jane Usher Boulevard
Reported access to employment locally	70.80%	49.19%
Reported difficulty finding a job	54.05%	47.15%

Table 4.3 Employment Access

Even though Between Canals residents reported a higher percentage of local employment than Jane Usher’s, they also reported more difficulty finding a job. This might be given that the community is surrounded by highly dense populated areas making the search for employment more competitive than in the Jane Usher community. Furthermore, a great number of residents have compensated the lack of local employment opportunities by developing informal businesses to sustain themselves and their households. There are a remarkable number of houses – especially in the Jane Usher Community – providing business to the community compensating the access to certain institutions described in the previous section. Possibly, the most common was the development of small food stores (See figure 4.1), but there were other services being provided to the community such as mechanics (figure 4.2), sewing, and carpentry services.



Image 4: Informal Food Store (Jane Usher Boulevard)



Image 5: Informal Mechanics Business (Jane Usher Boulevard)

Residents reported differences on the transportation methods to a possible employment:

- Between Canals Community: 39.05% of the residents reported that they would be able to find a job within walking distance, while a 37.50% reported that they would have to drive (including taking a bus or a taxi). 12.38% didn't know how they would get to a possible workplace.
- Jane Usher Boulevard Community: 24.35% of the residents reported that they would be able to walk, while 51.30% reported that they would have to drive to a given employment (including taking a bus or a taxi). 18.10% didn't know how they would get to a possible workplace.

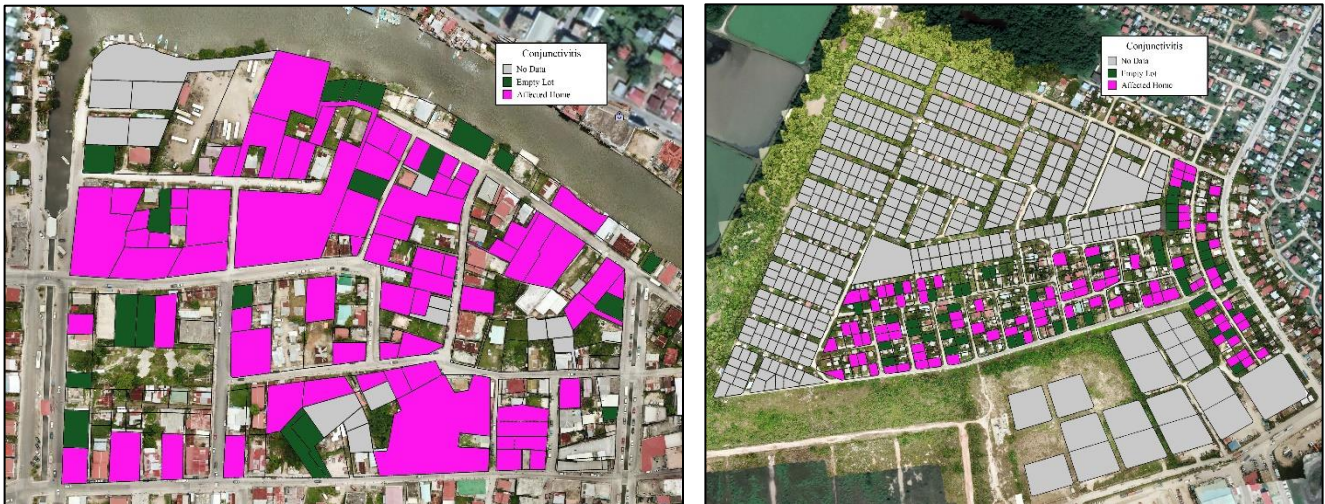
It would be beneficial to develop new sources of employment within the communities or within its vicinity to promote the hiring of their residents. Also, improving transportation systems would make distant employment attainable for residents to apply to and reach on a daily basis, especially Jane Usher residents, while also building a system capable to evacuate people in a disastrous event. Additionally, the development of programs to help employ people with high-demanded skills needed in the Belizean economy and communities.

Effects on Human Health (Sensitivity)

Bacterial and Viral Pathogens

Conjunctivitis

Commonly known as pink eye, conjunctivitis is an infection of the eyes caused by environmental irritants such as dust, bacteria, and viruses. Conjunctivitis is highly contagious, but it is not deadly. Symptoms include itchiness, discharge or gritty feeling, and redness of the eye. Conjunctivitis may go away on its own after one or two weeks, but infectious bacteria can easily spread to others and can cause damage to the eye if left untreated. Because conjunctivitis is not life-threatening, infected individuals may not seek medical care. This survey did not ask whether the affected individuals obtained medical treatment. Information about treatment could be important to understanding the epidemiology of conjunctivitis in Belize City. 84 households in the Between Canals community reported a recent infection with conjunctivitis. 88 out of 126 households in the Jane Usher Boulevard community reported a recent infection with conjunctivitis. Conjunctivitis was the second most reported illness in this local survey. Both children and adults were affected.



Maps 15 & 16: The maps above show homes that were affected by conjunctivitis. Between Canals on the right, Jane Usher on the left.

Common Cold and Fever

These symptoms were reported by 99 households in the Between Canals community and 107 out of 126 households in the Jane Usher Boulevard community. Symptoms of many vector-borne diseases including Malaria and Zika virus share symptoms of the common cold including fever. Survey statistics from both communities found that children and adults were both affected by common cold/fever, which were the highest-reported illnesses in both communities surveyed.

Respiratory Illness and Asthma

These conditions can be caused by allergies, pollution, or exposure to infectious bacteria or viruses. In the Between Canals community, 38 households reported family members affected by asthma or respiratory illness such as coughing. The Jane Usher community reported 46 out of 126 households with family members affected by respiratory illness or asthma. A few households responded that children were affected by asthma specifically. Asthma is an inflammatory illness causing constriction of airways. Respiratory illness/asthma was the third most reported illness in both the Between Canals and Jane Usher communities.

Extreme weather events such as heat waves and fires can worsen respiratory illness when dust and soot particles pollute the air. Flooding increases the risk of mold and fungus irritants in the air which can irritate those with lung conditions. Some residents reported smoking cannabis to soothe asthma, but this was not recorded in the survey materials. Like with common cold symptoms, medical history would be beneficial to further understand the epidemiology of respiratory illness as the climate in Belize City grows hotter during the dry season.

Cholera

Cholera is an enteric bacterial infection spread through ingestion of infected bodily fluids. Symptoms of cholera include diarrhea, vomiting, dehydration, and seizures. Cholera spreads in infected waterways and in areas of poor water filtration. Without medical diagnosis, cholera can be confused with other less dangerous bacterial diarrhea infections. Cholera was reported in three properties in the Between Canals community and reported one time in the Jane Usher community. The established sewage and septic systems in these communities likely control the spread of cholera.

The Jane Usher community mostly uses septic waste removal. 94.53% of properties surveyed (n=128) reported a waste removal system on Jane Usher boulevard. 7 properties in Jane Usher reported no waste removal systems present on the property, and 5 properties on Jane Usher boulevard use an outhouse for human waste removal. Lack of waste removal for human waste is a risk factor for viral and bacterial diseases such as cholera and typhoid fever. The Between Canals community uses a sewage “main line” waste removal system to control human waste. This system was created to stop human waste from flowing directly into the canals and the ocean around Belize City. Currently, 95.24% of properties in Between Canals reported having a sewage waste removal system present, and six out of 177 properties reported no waste removal system present there. All reported waste removal from Between Canals was in the form of the sewage main line, which has largely mitigated human waste in Belize City and most likely contributed to the low reports of cholera from this local survey.

Mosquito-borne Illnesses

Vector-borne, or mosquito-borne diseases only reportedly affected adults in the studied communities. Malaria and Dengue were the only vector-borne diseases. Local reporting on vector-borne illnesses such as Malaria, Dengue, Chikungunya, and Zika Virus could be biased due to lack of diagnostic information on the diseases. Residents could report common cold/flu symptoms but have contracted one of these illnesses without proper diagnosis. Due to frequent exposure to mosquito-borne pathogens, the body may react less severely than would be expected. A lack of sufficient medical data limits this survey's capabilities on concluding the incidence of these mosquito-borne illnesses.

Malaria

Malaria is spread through a parasite carried by the anopheles mosquito. Symptoms include fever, chills, sweats, headaches, nausea and vomiting, and body aches. Malaria is not eradicated in Belize, but it is seldom seen in Belize City. The between canals community reported 11 cases of family members with malaria and Jane Usher community reported 5 cases.

Dengue

Dengue is an endemic vector-borne disease in Belize City. Symptoms of dengue include high fever, rash, muscles and joint pain, headache, vomiting, and pain behind eyes. Diagnostic test results are needed to confirm Dengue infection. 15 cases of dengue were reported in the Between Canals community. 19 cases of dengue were reported in the Jane Usher Boulevard community.

Chikungunya

Chikungunya is a vector-borne illness that was not reported in this survey of Belize City. Symptoms of chikungunya include fever, joint pain, headache, and rash. Symptoms occur 3-7 days after contact with an infected mosquito. The between canals community reported 0 cases of chikungunya, and the Jane Usher community reported 1 case.

Zika

Zika virus is a mosquito-borne illness with symptoms similar to the common cold. If contracted during pregnancy, Zika virus can cause birth defects. Zika virus was not reported by any households in either the Between Canals or Jane Usher communities.

Risk Factors

Because mosquitoes lay their eggs in still bodies of water, vector borne diseases are of increased danger when standing water pools after storms and floods. To mitigate mosquito-borne illness, public awareness is crucial. During the rainy season, it is important that residents remove standing water from their land and keep drainage ditches clear of standing water.

Figures and Examples of Health Characteristics

Occurrence of Illnesses in the Jane Usher Community

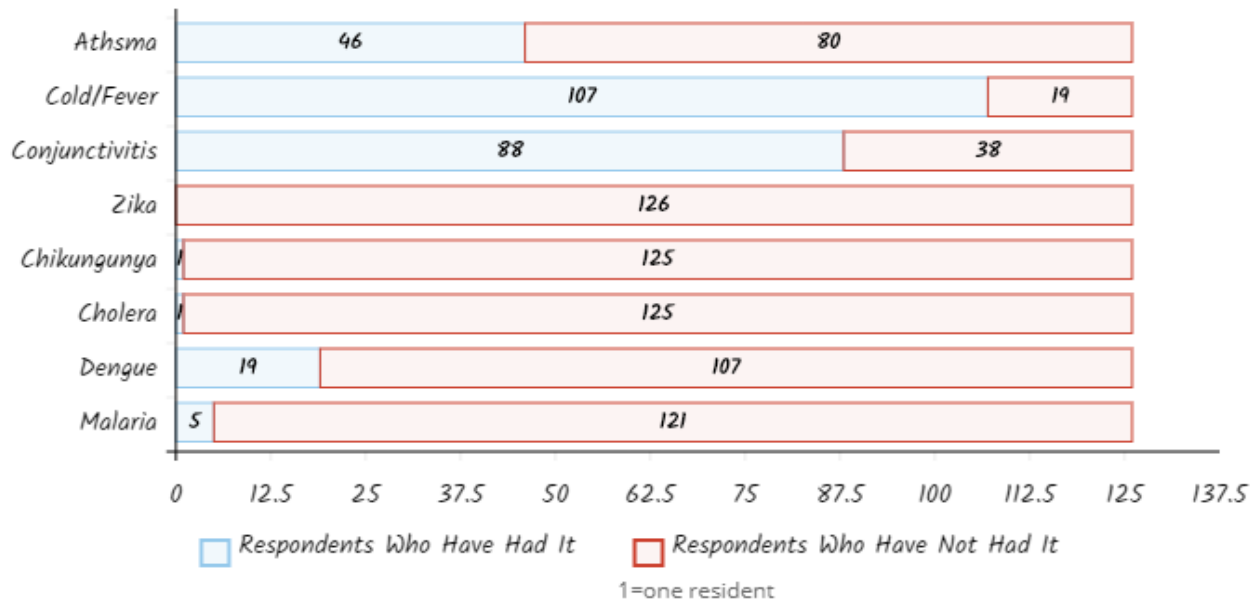


Figure 4: Occurrence of Illnesses in the Jane Usher Community

Occurrence of Illnesses in the Between Canals Community

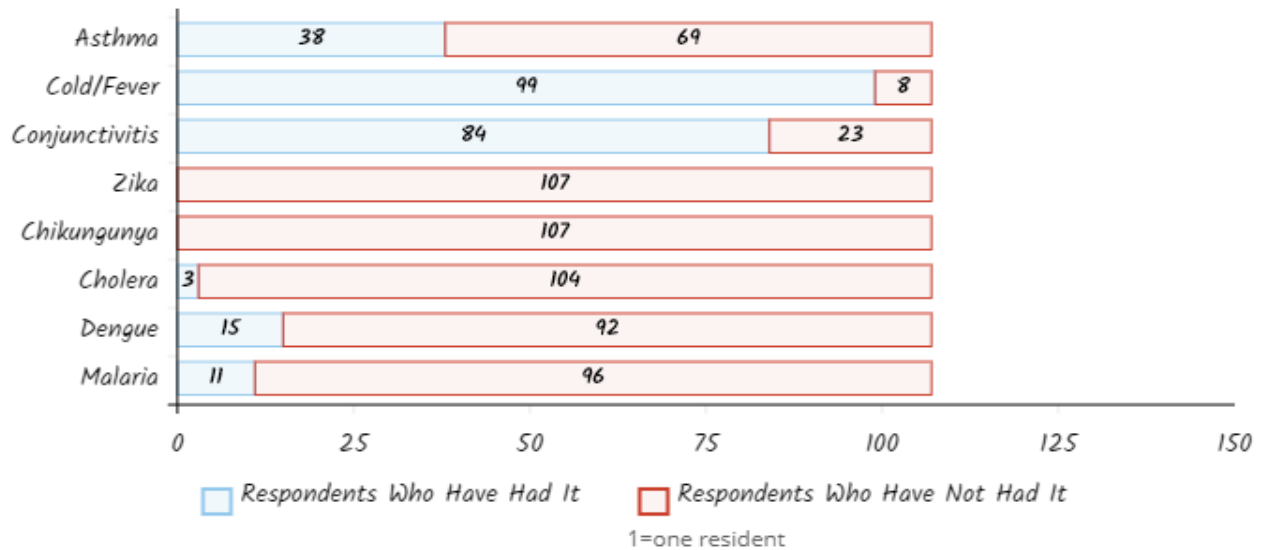


Figure 5: Occurrence of Illnesses in the Between Canals Community



Image 6: (N 17.49710 W 088.19930) An open drain near Between Canals plot 1 is a possible breeding site for mosquitoes.



Image 7: (N 17.48462, W 088.20471) A drain on plot 131 on Jane Usher Boulevard harbors standing water due to inefficient drain construction, leaving a breeding ground for mosquitoes.



Image 8: Tall grass in empty lot (208) on Jane Usher Boulevard is a possible site of standing water and can also be a habitat for snakes and rats.

Rats are also vectors for disease that are present in both the Jane Usher and Between Canals communities. Diseases carried by rats were not included in the survey, but are important to consider when surveying these communities in the future. Rats live in areas where human waste and garbage is available, and can carry fleas and other parasites.



Image 9: This rat carcass near Between Canals plot 75 (an empty lot), illustrates the detriments of open refuse piles and unkept land.

Observations of Physical Structures

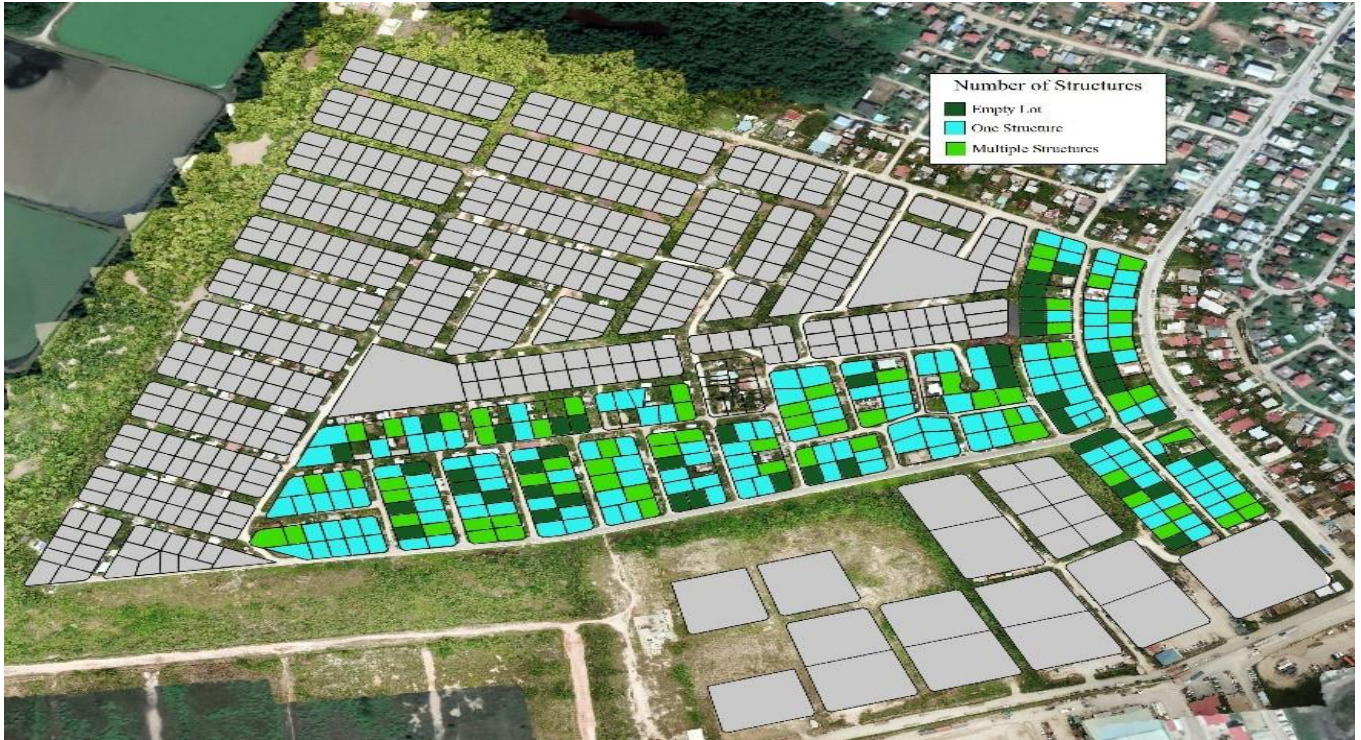


Map 17: Aerial map depicting the types of structures found in the Between Canals Community

Structural observations concluded that many plots contained one structure that was a single-family home. In the Between Canals community, 138 out of 177 plots contained one structure. Twenty-six out of 177 plots had two structures. Eight of 177 plots had three structures, and two out of 177 plots had 4 structures present on the property. Observations of structures indicated that eighty out of 177 plots are single-family homes, while 77 are duplex structures. Twenty-two structures are sheds, 2 are animal shelters, 5 are apartments, 7 were multiple-family homes, and 16 fell into the category of “other.”

In the Jane Usher Community, structural observations concluded that many plots contained one structure that was a single-family home. 146 out of 212 plots contained one structure, while forty-one out of 212 plots had two structures. Eighteen of 212 plots had three structures, three out of 212 plots had 4 structures, one property had 5 structures, and one property had 6 structures present. Observations of structures showed that out of 212 structures in the Jane Usher community, 190 were single family homes, 29 were duplex homes, 36 were sheds, 9 were animal shelters, 6 were apartments, and 12 were owned by multiple families. 7 structures fell into the category of “other”.

Compared to Between Canals, Jane Usher properties were slightly more likely to have more properties on the plot. This could be due to overcrowding, or residents using land as shop space, or spaces for sheds and apartments. The properties surveyed in the Between Canals community are made of masonry, wood, metal, plycem, or improvised materials. Homes were observed from the outside only with resident’s permission.



Map 18: Aerial map depicting the types of structures found in the Jane Usher Community

The properties surveyed in the Between Canals community are made of masonry, wood, metal, plycem, or improvised materials. Wooden homes are somewhat common in Belize city. Forty out of 177 homes in Between Canals have wooden walls only. Eight out of 177 homes have walls made of wood and metal. Five out of 177 homes have walls made of wood and masonry.

Improvised structures are less structurally sound than masonry or wood houses and are susceptible to damage during hurricanes and floods. Four out of 177 structures in the between canals community had improvised roof structures. Seven out of 177 structures in the Jane Usher community had improvised wall structures.



Image 9: Between Canals 187B is an example of an improvised structure. Wood, plywood, and metal make this structure.

Masonry is a common structure material in both the between canals and Jane Usher communities. Masonry is considered the strongest structure and can withstand hurricane winds and flooding without risk of rotting or rusting away. Houses with walls made of masonry can absorb heat better than wooden or metal structures, making them cooler during times of extreme heat.



Image 10: Jane Usher plot 175 (N 17.48487 W 088.20587) is a homemade of masonry, which is the most resistant to flooding and hurricane damage.



Image 11: This house, plot 26 on Jane Usher Boulevard (N 17.48504 W 088.20222), has the common roof built of wood and metal. Metal roof materials are more resistant to hurricanes than wooden materials, but less resistant than masonry. In the Jane Usher Community, 183/212 structures had a roof made out of metal with wooden support. Roof shingles made of corrugated metal are resistant to fire.

Elevation

In the Jane Usher community, 60.29% of structures were elevated. Elevated homes are less likely to flood inside when heavy rains occur. Property damage can be avoided by moving valuables into the elevated structure during storms. In the Between Canals community, 39.88% of structures were elevated. Both communities are vulnerable to high water levels during storms due to close proximity to bodies of water. Homes were elevated with either concrete or wooden support beams. Concrete support beams are more resistant to flood currents and hurricane-force winds. Elevation also poses a risk for disabled residents who may reside upstairs, unable to descend the stairs in case of emergency.

Recommendations

There could be more public health information made available to facilitate community health resilience. Health data could survey local vaccination records to understand community resistance to diseases. Mosquito-borne illnesses should be reported upon physician's diagnosis-only basis, and not grouped with other cold and fever symptoms. To further identify causes of respiratory illness, resident's exposure to airborne smoke and ash could be explored by asking about cooking stoves, perception of outdoor dust levels, and exposure to tobacco products.

Structural observations could be done with the resident to decrease confusion about the type of building structures. Instead of observations, building structures can be reported by the resident in question in order to get a more accurate portrayal of how inhabitants view their infrastructure. Observations could be made instead about the level of trash present on the plot, since excess trash can clog drains and lead to flooding and standing water. Monitoring trash levels in the street would help to monitor community health through this survey.



Image 12: The picture above was taken in Jane Usher at lot 212 (N 17.48510, W 088.20692).

When talking to some residents, some suggestions were made to create community gardens using space that is already unoccupied. In Jane Usher, lot 58/69 (N 17.48456, W 088.20167) was originally green space that a house was later built on (see picture). The resident in lot 69 seemed very interested in the possibility of returning lot 58 to a community green space. Residents are interested in community-led efforts to help reduce the impacts of climate change, but do not have access to the resources to do it alone.



Image 13: Lot with potential to be repurposed as a community green space in the Jane Usher community.

Partners:

Belize Association of Planners (BAP): Under the direction of Carolyn Trench-Sandiford, BAP is a professional planning organization “committed to assuring social justice and promoting sustainability in the natural and built environment.” BAP designed this project to specifically focus on gathering baseline climate change and disaster/risk perception data so as to create future disaster plans and community programs that best serve the community. This work would not have been possible without the support of Keisha Rodriguez and Carren Williams.

NEMO (National Emergency Management Organization): NEMO is a government agency that works to preserve life and property in the event of an emergency in Belize as well as mitigate the impact of potential hazards. Education and community awareness of resources are a large part of NEMO’s current work and the FSU team was joined by Reanna Kingston and Roddimyr Moguel who provided invaluable support and educational resources. Part of this project also focused on training community partners on how to conduct surveys so as to continue the work after the initial data has been gathered. Both NEMO representatives were trained and participated in the data gathering process.

CEMO (City Emergency Management Organization): Representative Burnel Jones worked with surveying crews to distribute information on nearby shelters and storm preparation tips.

Community Partners: This project would not have been possible without the support and guidance of neighborhood partners who volunteered their time to walk around the neighborhoods with FSU students and staff. These crucial partners helped make introductions and build community support for the project. FSU EMHS would like to give a special thank you to Alize Flowers, Shadheed Haulze, Sophia Perez, and Ms. Rita for providing invaluable services to the team.

Raw Numbers & Statistical Data

Survey Sample

Date:	Lot Number/Community:
Group:	Coordinates:

1. Demographic information

- What is the primary language spoken in this household?
English _____ Spanish _____ Creole _____ Other _____
- How many adults live here (18 years or older)? _____
- How many children live here (under 18 years)? _____

2. Perceptions on climate change and disaster risk (EXPOSURE)

Observation of changes in the following climatic factors in the past 5 years

Climatic factor	Changed		Has not Changed	Can't tell	Location**
	Increase	Decrease			
Temperature in the dry season					N/A
Temperature in the wet season					N/A
Rainfall					N/A
Water level in the street/lot					

b. Observation of increment in disaster events in the past 5 years

Event	Increased?			Did you receive warnings before the disaster events?		Was the warning easy to understand?	
	Yes	No	Can't Tell	Yes	No	Yes	No
#1 Floods							
#2 Hurricanes							
#3 Fire							
#4 Tsunami							
#5 Earthquake							

3. Effects on daily life (SENSITIVITY)

Event #	Effects	Yes	No	Notes
All that apply				

	Was anyone hurt in your family?			
	Was your house damaged?			
	Were the roads damaged?			
	Did you evacuate?			Where? How did you get there? If not, why?
	Did you lose power?			
	Did you lose water?			

4. Wealth, technology, information and services (ADAPTIVE CAPACITY)

a. Assistance during emergencies

Select all that apply	NGO Red Cross	Central Government	Local Government	Area Rep.	Family	Neighbors	Church	Other
Reconstruction materials								
Food assistance								
Shelter								
Financial								

b. Access to institutions and services

Institutions and services	YES	NO	Waking Distance	Bus or taxi	Don't know
Nearest school					
Nearest hospital/health center					
Municipal Market					
Local food store					
Police station					
Local government office					
Access to job locally					
Access to potable water			N/A	N/A	
Access to electricity			N/A	N/A	
Access to paved roads			N/A	N/A	
Access to garbage collection			N/A	N/A	

c. Have you or anyone in your family had problems finding a job? Yes _____ No _____

d. In your own words: what is climate change?

- e. Where did you hear about this? TV, RADIO, NEWSPAPER, LOCAL PEOPLE, NGO, GOVERNMENT, SOCIAL MEDIA, INTERNET
- f. Is there anything you do in daily life different because of climate change?
- g. What is your relationship with the mangroves? *Would you say positive or negative?*

5. Effects on human health (SENSITIVITY)

Has anyone in your family been sick from	Yes	No	Notes Who? Children or adults?
Malaria			
Dengue			
Cholera			
Chikungunya			
Zika virus			
Conjunctivitis			
Common Cold/Fever			
Respiratory Illness / Asthma			

6. Physical information (OBSERVATIONS ONLY)

- a. How many structures are on the plot? _____
- b. Structure Type (*Indicate which type with check mark*):

Select all that apply	Single Family	Duplex (vertical)	Shed	Animal Shelter	Apartment	Other

c. Frame/Construction Type (Indicate which type with check mark):

Source	Wood	Masonry	Metal	Plywood	Plycem	Improvised	Number of stories	Elevated? YES or NO	Elevation type: cement, wood, etc.
Walls									
Roof									

(The “improvised” designation indicates possibly rough materials used to assemble a dwelling including an uncovered domicile or more tent-like structures)

d. Sewer

Is waste removal system present?		Outhouse(s) on lot?		Description of system (chem toilet, organic, etc)
YES	NO	YES	NO	

BETWEEN CANALS DATA	RAW NUMBERS (positive answers/total answers)	PERCENTAGE
DRY SEASON BETWEEN CANALS		
Dry increase	94/116	81.03%
Dry decrease	0/116	0%
Dry unchanged	19/116	16.38%
Dry can't tell	3/116	2.59%
WET SEASON BETWEEN CANALS		
Wet increase	59/116	50.86%
Wet decrease	13/116	11.21%
Wet unchanged	28/116	24.14%
Wet can't tell	17/116	14.66%
RAINFALL BETWEEN CANALS		
Rainfall increase	45/116	38.79%
Rainfall decrease	46/116	39.66%
Rainfall unchanged	19/116	16.38%
Rainfall can't tell	7/116	6.03%
WATER LEVEL BETWEEN CANALS		
WL increase	70/115	60.87%
WL decrease	14/115	12.17%
WL unchanged	22/115	19.13%
WL can't tell	8/115	6.96%
FLOODING BETWEEN CANALS		
Flood increase	64/116	55.17%
Flood no increase	40/116	34.48%
Flood can't tell	13/116	11.21%
Flood warnings	26/116	22.41%
Flood warning understanding	25/116	21.55%
HURRICANES BETWEEN CANALS		
Hurricanes increase	51/116	43.97%
Hurricanes no increase	48/116	41.38%
Hurricanes can't tell	16/116	13.79%
Hurricane warnings	80/93	86.02%
Hurricane warning understanding	76/91	83.52%
FIRES BETWEEN CANALS		
Fires increase	37/116	31.90%
Fires no increase	67/116	57.76%
Fires can't tell	10/116	8.62%
Fire warning	12/86	13.95%

Fire warning understanding	9/63	14.29%
TSUNAMIS BETWEEN CANALS		
Tsunami Increase	52/115	45.22%
Tsunami No increase	56/115	48.70%
Tsunami can't tell	6/115	5.22%
Tsunami Warnings	69/91	75.82%
Tsunami Warnings Understanding	52/90	57.77%
EARTHQUAKES BETWEEN CANALS		
Earthquakes increase	57/116	49.14%
Earthquakes no increase	48/116	41.38%
Earthquakes can't tell	10/116	8.62%
Earthquakes warnings	11/102	10.78%
Earthquakes warnings understanding	11/65	16.92%
EFFECTS ON DAILY LIFE		
Family hurt	4/111	3.60%
House damaged	46/114	40.35%
Roads damaged	51/113	45.13%
Evacuation	54/112	48.21%
Lost power	88/114	77.19%
Lost water	54/113	47.79%
DISASTER ASSISTANCE		
Reconstruction NGO	3/114	2.63%
Reconstruction central government	6/113	5.31%
Reconstruction local government	5/114	4.39%
Reconstruction area rep.	5/114	4.39%
Reconstruction family	2/113	1.77%
Reconstruction neighbors	0/113	0%
Reconstruction church	1/114	0.88%
Reconstruction others	3/114	2.63%
Reconstruction Total	25/114	21.93%
Food NGO	1/114	0.88%
Food central government	6/113	5.31%
Food local government	4/114	3.51%
Food area rep.	2/114	1.75%
Food family	4/114	3.51%
Food neighbors	3/114	2.63%
Food church	2/114	1.75%
Food others	0/110	0%
Food Total	22/114	19.30%
Shelter NGO	5/114	4.39%
Shelter central government	4/114	3.51%

Shelter local government	4/114	3.51%
Shelter area rep.	0/114	0%
Shelter family	11/113	9.73%
Shelter neighbors	6/114	5.26%
Shelter church	3/114	2.63%
Shelter others	13/114	11.40%
Shelter total	46/114	40.35%
Finance NGO	0/114	0%
Finance central government	2/114	1.75%
Finance local government	1/113	0.88%
Finance area rep.	2/114	1.75%
Finance family	0/114	0%
Finance neighbors	0/114	0%
Finance church	0/114	0%
Finance others	2/114	1.75%
Finance total	7/114	6.14%
ACCESS TO INSTITUTIONS AND SERVICES		
School access	101/112	90.18%
School walk	89/109	81.65%
School drive	19/109	17.43%
School unknown	1/109	0.92%
Health Center access	102/114	89.47%
Health Center walk	62/110	56.36%
Health center drive	46/110	41.82%
Health center unknown	2/110	1.82%
Market access	110/114	96.49%
Market walk	99/112	88.39%
Market drive	10/112	8.93%
Market unknown	10/112	8.93%
Local food access	109/114	95.61%
Local food walk	100/111	90.09%
Local food drive	7/111	6.31%
Local food unknown	0/111	0%
Police access	94/112	83.93%
Police walk	77/108	71.30%
Police drive	19/108	17.59%
Police unknown	9/108	8.33%
Local government access	83/113	73.45%
Local government walk	67/105	63.81%
Local government drive	18/107	16.82%

Local government unknown	16/106	15.09%
Local job access	80/113	70.80%
Local job walk	41/105	39.05%
Local job drive	39/104	37.5%
Local job unknown	13/105	12.38%
Potable water access	110/114	96.49%
Electricity access	112/114	98.25%
Paved roads access	109/114	95.61%
Garbage collection	112/114	98.25%
Difficulty finding a job	60/111	54.05%
ILLNESSES		
Malaria	11/107	10.28%
Dengue	15/107	14.02%
Cholera	3/107	2.80%
Chikungunya	0/107	0%
Zika	0/107	0%
Conjunctivitis/Pink eye	84/107	78.50%
Common cold/fever	99/107	92.52%
Respiratory illness/asthma	38/107	35.51%
STRUCTURES		
Single family	80/177	45.20%
Duplex	77/177	71.96%
Shed	22/177	20.56%
Animal Shelter	2/177	1.87%
Apartment	5/177	4.67%
Multiple Families	7/177	6.54%
Other	16/177	14.95%
Elevated	69/173	39.88%
Waste removal	120/126	95.24%
Outhouses	0/125	0%

JANE USHER DATA	RAW NUMBERS (positive answers/total answers)	PERCENTAGE
DRY SEASON		
Dry increase	101/126	80.16%
Dry decrease	3/126	2.38%
Dry unchanged	19/126	15.08%
Dry can't tell	4/126	3.17%
WET SEASON		
Wet increase	46/126	36.51%
Wet decrease	15/126	11.90%
Wet unchanged	48/126	38.10%
Wet can't tell	18/126	14.29%
RAINFALL		
Rainfall increase	33/126	26.19%
Rainfall decrease	68/126	53.97%
Rainfall unchanged	14/126	11.11%
Rainfall can't tell	11/126	8.73%
WATER LEVEL		
WL increase	61/126	48.41%
WL decrease	30/127	23.62%
WL unchanged	32/126	25.40%
WL can't tell	4/127	3.15%
FLOODING		
Flood increase	68/126	53.97%
Flood no increase	51/126	40.48%
Flood can't tell	6/102	5.88%
Flood warnings	29/102	28.43%
Flood warning understanding	29/71	40.85%
HURRICANES		
Hurricanes increase	44/126	34.92%
Hurricanes no increase	73/126	57.94%
Hurricanes can't tell	9/126	7.14%
Hurricane warnings	68/88	77.27%
Hurricane warning understanding	62/86	72.09%
FIRES		
Fires increase	42/124	33.87%
Fires decrease	78/125	62.4%
Fires can't tell	4/124	3.23%
Fire warning	13/91	14.29%

Fire warning understanding	13/58	22.41%
TSUNAMIS		
Tsunami Increase	57/126	45.24%
Tsunami Decrease	64/126	50.79%
Tsunami can't tell	5/126	3.99%
Tsunami Warnings	67/94	71.28%
Tsunami Warnings Understanding	52/86	60.47%
EARTHQUAKES		
Earthquakes increase	66/126	52.38%
Earthquakes decrease	54/125	43.2%
Earthquakes can't tell	5/126	3.97%
Earthquakes warnings	7/102	6.86%
Earthquakes warnings understanding	5/50	10%
EFFECTS ON DAILY LIFE		
Family hurt	9/126	7.14%
House damaged	57/125	45.6%
Roads damaged	59/125	47.20%
Evacuation	66/125	52.80%
Lost power	90/123	73.17%
Lost water	69/124	55.65%
DISASTER ASSISTANCE		
Reconstruction NGO	7/126	5.55%
Reconstruction central government	5/125	4%
Reconstruction local government	5/126	3.97%
Reconstruction area rep.	2/124	1.61%
Reconstruction family	0/123	0%
Reconstruction neighbors	0/126	0%
Reconstruction church	0/126	0%
Reconstruction others	0/126	0%
Reconstruction total	19/126	15.08%
Food NGO	11/125	8.80%
Food central government	8/125	6.4%
Food local government	7/125	5.60%
Food area rep.	5/125	4%
Food family	3/125	2.4%
Food neighbors	1/126	0.79%
Food church	1/126	0.79%
Food others	5/126	3.97%
Food total	41/126	32.54%
Shelter NGO	3/126	2.38%
Shelter central government	2/126	1.59%

Shelter local government	6/126	4.76%
Shelter area rep.	0/125	0%
Shelter family	21/126	16.66%
Shelter neighbors	3/125	2.4%
Shelter church	2/125	1.6%
Shelter others	12/125	9.6%
Shelter total	49/126	38.88%
Finance NGO	1/126	0.79%
Finance central government	0/126	0%
Finance local government	1/126	0.79%
Finance area rep.	0/126	0%
Finance family	33/126	26.19%
Finance neighbors	0/125	0%
Finance church	0/126	0%
Finance others	1/126	0.79%
Finance total	36/126	28.57%
ACCESS TO INSTITUTIONS AND SERVICES		
School access	107/125	85.6%
School walk	69/122	56.56%
School drive	52/122	42.62%
School unknown	1/121	0.83%
Health Center access	106/126	84.13%
Health Center walk	40/122	32.79%
Health center drive	81/122	66.39%
Health center unknown	1/122	0.82%
Market access	104/125	83.2%
Market walk	31/122	25.41%
Market drive	90/122	73.77%
Market unknown	2/122	1.64%
Local food access	110/125	88%
Local food walk	82/122	67.21%
Local food drive	42/122	34.43%
Local food unknown	0/122	0%
Police access	94/125	75.2%
Police walk	39/118	33.05%
Police drive	61/118	51.69%
Police unknown	14/119	11.76%
Local government access	68/124	54.84%
Local government walk	5/114	4.39%
Local government drive	73/114	64.04%

Local government unknown	25/115	21.74%
Local job access	61/124	49.19%
Local job walk	28/115	24.35%
Local job drive	59/115	51.30%
Local job unknown	21/116	18.10%
Potable water access	121/126	96.03%
Electricity access	118/126	93.65%
Paved roads access	79/126	62.70%
Garbage collection	118/126	93.65%
Difficulty finding a job	58/123	47.15%
ILLNESSES		
Malaria	5/126	3.97%
Dengue	19/126	15.08%
Cholera	1/126	0.79%
Chikungunya	1/126	0.79%
Zika	0/126	0%
Conjunctivitis/Pink eye	88/126	69.84%
Common cold/fever	107/126	84.92%
Respiratory illness/asthma	46/126	36.51%
STRUCTURES		
Single family	190/212	89.62%
Duplex	29/211	13.74%
Shed	36/212	16.98%
Animal Shelter	9/212	4.25%
Apartment	6/212	2.83%
Multiple Families	12/212	5.66%
Other	7/209	3.35%
Elevated	126/209	60.29%
Waste removal	121/128	94.53%
Outhouses	5/128	3.91%