The Effects of Climate Change on the Godineau River, Trinidad

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Abstract

The agriculture and food security of the Caribbean islands are being threatened by climate change and sea level rise. Trinidad, the most southern island of this region, is experiencing these effects, particularly in the Godineau River. The Godineau River plays a critical role as a source of fresh water for agriculture in the Godineau Watershed and supports the Godineau Swamp, which is a vital buffer from natural disasters. The river and swamp are an important habitat for numerous flora and fauna species, notably the national bird, the Scarlet Ibis. Additionally, the river creates employment, by supporting fisher folk who catch fish and crab and tour operators. A recent study found that salt water intrusion is affecting the mangroves in the swamp and possibly the surrounding soils (Atwell, Wuddivira and Gobin, 2016). Furthermore, anthropogenic activities such as the ongoing construction of a highway at the mouth of the Godineau River, are exacerbating the effects of climate change and sea level rise. To facilitate the construction of the highway, some mangrove was destroyed at the river's mouth and as a result, severe flooding now occurs in times of heavy rainfall. In light of all of this, this study explores the impacts of climate change and sea level rise in the Godineau River from a qualitative standpoint, in an attempt to improve the country's food security. Possible methods of mitigating against these impacts are suggested.

Keywords: Climate Change, Sea Level Rise, Agriculture, Food Security, Godineau River, Trinidad

1.0 INTRODUCTION

With the year 2016 ranking as the warmest on record (NASA 2017), and the hurricane season of 2017 ranking as the costliest to date (NOAA 2018), the effects of climate change are undeniable. The Small Island Developing States (SIDS), which include the Caribbean Islands, are more vulnerable to these effects due to their fragile environments. Trinidad, the most southern island within this Caribbean chain, is already experiencing many effects of climate change such as salt water intrusion, changes in the weather patterns and increased flooding. These factors are severely threatening the island's food security. This study examines the effects of climate change, focusing on the Godineau River.

1.1 Location of Area

The Godineau River is also known as the South Oropouche River. The river begins in Barrackpore and ends in the Gulf of Paria and drains the South Oropouche Watershed which is 438 km^2 in area and the Godineau Swamp which is 31.7 km^2. Major tributaries such as the Forty Foot Trench, Cipero, St. John's, Trinidad and Blackwater Rivers all merges into the Godineau River and flow into the Gulf of Paria. (Ramsundar 2005). Figure 1 shows the South Oropouche watershed and Figure 2 shows the general outline of the Godineau River highlighted in blue, and the boundaries of the watershed highlighted in red. The tributaries are not shown.

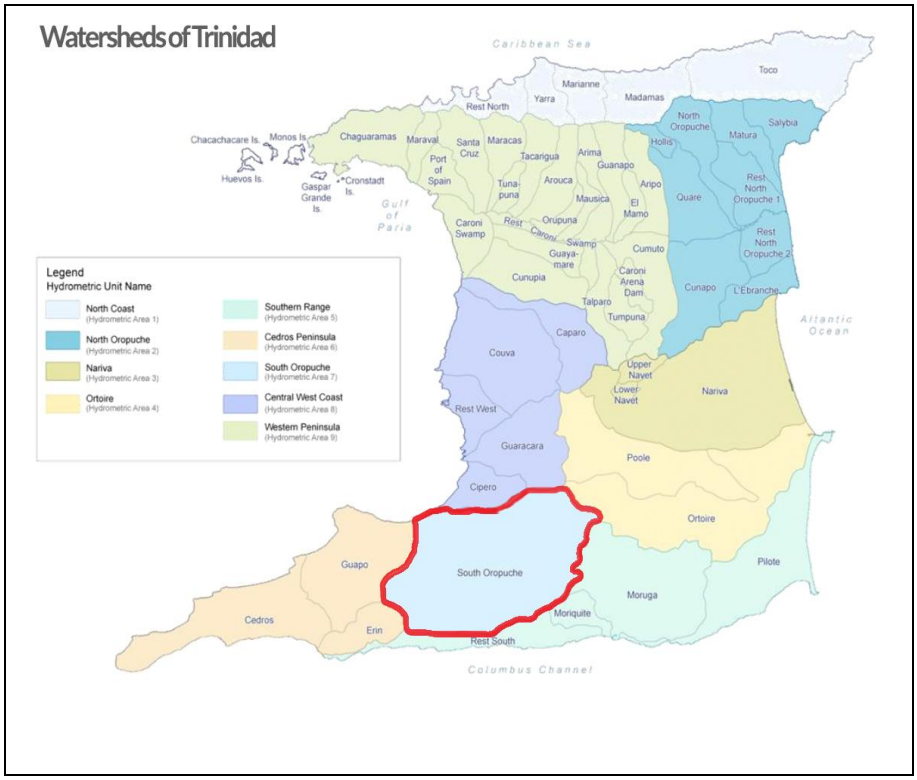

Figure 1 – South Oropouche Watershed – (Adopt a River TT)

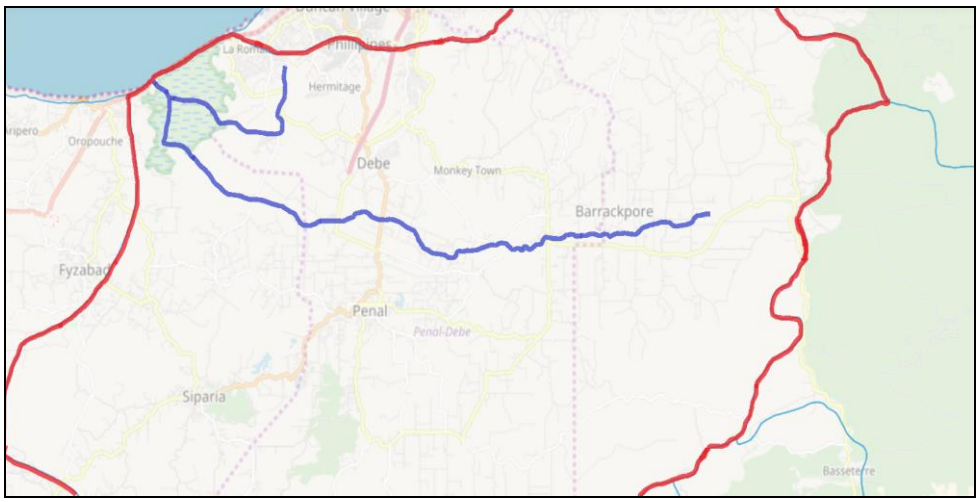

Figure 2 – General path of Godineau River- (Adopt a River TT)

1.2 Background

Historically the river was once an important highway to the sea for inland sugar estates and later for cocoa plantations (Bissessarsingh 2011). Back then, these crops were cultivated for export to European markets. A bridge built across to river's

mouth in 1851, facilitated internal trade of plantains, red rice and ground provisions between Oropouche and San Fernando (Bissessarsingh 2011). Additionally the river was also used to transport oilfield equipment, before the equipment could be loaded onto trucks for delivery (Bissessarsingh 2011). Furthermore, the river also supported hundreds of people who lived for generations on crabs, shellfish, fishing and hunting (Bissessarsingh 2011).

1.3 Present Day Importance of Area

Today agriculture accounts for approximately 0.5% of the country's Gross Domestic Product (GDP), thus the food grown is mainly for domestic use. Crops such as bananas, peppers and corn are cultivated within the South Oropouche watershed and sold at local markets such as the Namdevco market at Debe. The river still serves as the main source of freshwater for this agricultural belt. However the characteristics of this region has changed considerably and the South Oropouche area has become highly residential. A new highway has been built within the area and some agricultural lands have been lost. Also oil pollution, silting, destruction and the removal of the mangrove for road expansion (Bissessarsingh 2011) have decreased the numbers of fishermen and hunters. While the river still plays a critical role, its significance has changed as it is now utilised for recreation, tourism and religious rituals as demonstrated by the boats and flags shown in Figure 3.

Figure 3 – Boats and Religious Flags at Woodland, Godineau River

2.0 METHODOLOGY

This study consisted of a desktop study and field observations, supported by anecdotal information. Existing studies on this river and area are limited. It should be noted that this study is a preliminary one and the list of impacts of climate change considered is not exhaustive.

3.0 EFFECTS OF CLIMATE CHANGE

3.1 Salt Water Intrusion and Mangrove Distribution

Signs of salt water intrusion are already being exhibited in the Godineau River. A recent study examined the surface water quality of two channels of the Godineau river (2 km and 6 km long). Spatially exhaustive river/estuarine salinity data was collected and results showed that salinity values were higher in the dry season than in the wet season (Atwell, Wuddivira and Gobin, 2016). Additionally, salinity values

were detected in the river up to 6 km inland and there was a high potential of saline water intrusion into the soils during the dry season (Atwell, Wuddivira and Gobin, 2016). Changes in the distribution of mangroves within the river/estuarine environment are already being detected (Atwell, Wuddivira and Gobin, 2016). It was found that of the three species, Red mangrove (Rhizophora mangle), black mangrove (Aviciennia germinians) and white mangrove (Laguncularia racemose), the red mangrove was found to tolerate low oxygen, high salinity and high acidity, thus found mostly on the seaward side of the river (Atwell, Wuddivira and Gobin, 2016). Also, evidence provided by locals report that this species was moving further inland and hence dominating the black and white mangroves (Atwell, Wuddivira and Gobin, 2016).

Sea level rise is just one of the contributing factors to saltwater intrusion occurring in this area. One study suggests that faulty drainage is also an issue (Ramsundar 2005). In the past sluice gates and levees were installed and between 2002 and 2003 several of these have been upgraded (Ramsundar 2005). To date, no studies have been found to prove whether they still are in proper working condition.

3.2 Impacts on Fish and Fishing

If left uncontrolled, the salt water intrusion will change the entire river and swamp ecosystem. Just like the mangrove, the fauna will also be affected. The Godineau Swamp supports 29 species of fish which are very sensitive to changes in salinity and can migrate out of the area when levels are high (Ramsundar 2005). This will have a ripple effect on the commercial, subsistence and recreational fisher folk who are supported by the region. A conservative estimate of the income earned by commercial fisher folk in this area is USD $43,300 per annum (Ramsundar 2005).

While fishing provides employment for a small sector, it is very critical for these persons since they have limited options for viable livelihoods (Ramsundar 2005).

3.3 Climate Changes and Food Security

Changes in precipitation and temperature influence the growth of crops, mortality rates and quality of produce. The southern part of the island receives approximately 1800 mm of rainfall per annum and temperatures average 25°C (Atwell, Wuddivira and Gobin, 2016). Whilst no data was obtained for analysis for the Godineau River, studies on Trinidad were explored. A report produced for The Ministry of Food Production, Land and Marine Affairs, analysed forty years of rainfall and temperature data (1971-2010) for Piarco to show the impact on the farming population. The results of this study showed that there was a small decline in rainfall and number of rainy days in the four decades, and temperature has shown a steady increase, alluding to some degree of climate change (Hyacinth-Ash, 2011). These variables influence planting dates and crop success and Figure 4 shows some types planted in the region. As mentioned earlier, the crops planted in this region are strictly for a domestic market so climate changes impact both the local food security as well as the livelihoods of the locals.

Figure 4 -Subsistence Agriculture within Watershed - Bananas, Peppers and Corn

3.4 Increased Storm Intensities and Flooding

Changes in the climate also cause an increase in the intensity of the storms which leads to increased flooding. In 2017, the banks of the Godineau River broke approximately three times and caused flooding in several communities such as Woodland, Penal and Upper Barrackpore (Sookraj 2017). Since Trinidad lies just outside the Hurricane Belt, hurricanes and tropical storms are not a norm, however most of the flooding that year occurred from tropical storms or the effects of tropical storms. Tropical Storm Bret was once such storm that caused abnormal flooding that year. Additionally the increase in development in this region such as construction of residential areas and a new highway has increased the surface run off into the Godineau River, thus exacerbating the effects of climate change.

3.5 Damage to Infrastructure and Loss of Productivity

When abnormal flooding occurs such as the flooding occurring in 2017 due to the Godineau breaking its banks, many persons had to evacuate their homes. Those who did not evacuate were left marooned in their homes for days. There was a loss of productivity, whilst the floodwaters caused damage to infrastructure. Residents lost personal belongings, appliances and furniture. Farmers lost crops as well as animals.

3.6 Outbreak of Diseases

In the communities surrounding the Godineau River, sewage and wastewater are dealt with via cesspits and soakaway systems. As a result the floodwaters of this region often carry raw sewage and bacteria which contaminates both food and water supplies. This leads to outbreaks in diseases such Gastroenteritis which cause

inflamed stomachs and intestines. In 2017, there was an outbreak in leptospirosis which resulted in fifteen cases with two fatalities (Sookraj 2017).

4.0 MITIGATION MEASURES

While the effects of climate change are numerous and cannot be reversed, mitigation measures can be taken to alleviate some of the impacts and make a more resilient environment. The following are some measures which can be taken:

- Restore old sluice gates and install new ones to limit salt water intrusion which affects flora, fauna and therefore fishermen
- Replant red mangroves to restore areas and protect from floods and storms
- Choose new strains of crops which can withstand the salt water intrusion into the soil
- Provision of Public Education Programmes
- Provision of incentives for healthy and green practices

5.0 CONCLUSION

In conclusion, the effects of climate change on the Godineau River are numerous. Some impacts are irreversible but by practicing mitigation measures, the effects can be lessened. It is recommended that further and more detailed research be conducted in this Godineau river region, in order to preserve it for future generations.

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