

## **COMBATING AND COPING WITH CLIMATE CHANGE IN A SMALL ISLAND DEVELOPING STATE: THE CASE OF ALLIGATOR POND, JAMAICA**

S.A. McFarlane-Morris, O.O. Pusey, A. K. Gayle  
Geography Unit, School of Humanities  
Church Teachers' College:  
40 A Manchester Road,  
P.O. Box 41, Mandeville  
Manchester, Jamaica

**ABSTRACT:** *There is a growing volume of research on the adverse effects of climate change on Small Island Developing States (SIDs), one of the globe's most vulnerable places to the phenomenon. The aim of this research was to investigate the aspects of climate change and climate variability that are having the greatest effects on Alligator Pond, a small coastal community in Jamaica, which is heavily dependent on the sea for its livelihood. Its close proximity to the coast increases its vulnerability to sea level rise, coastal erosion and hazards created by more intense hurricanes and storms. The study was also centered on the residents' social and economic capacities to cope with these environmental changes and understanding the resilience strategies being undertaken by the residents and business operators to further protect the community. The study was conducted within a qualitative framework which included semi-structured interviews, photographs, observations and notetaking. The study reveals that sea level rise, more intense storms and hurricanes as well as coastal erosion are creating serious challenges, including damages to structures and loss of property, which have forced some to migrate further inland. These issues are complicated by the reluctance of most residents to totally relocate to safer grounds and the general absence of governmental intervention.*

**Keywords:** *Climate change, resilience, capacity, Jamaica, mitigation.*

### **INTRODUCTION**

Climate change should be considered “an urgent and potentially irreversible threat to human societies” (IPCC, 2018). Climate change speaks to a change of climate that is directly or indirectly linked to human activities, that alters the composition of global atmosphere and that is in addition to natural climate variability over comparable time periods (UNFCCC, 2018). The gradual rise of the earth's average surface temperature is thought to be caused in part by increased concentrations of greenhouse gases (GHGs) in the atmosphere. This is called global warming, a phenomenon which is “having very real consequences on people's lives” (UN, 2019).

This study was conducted against the background that the most vulnerable places to the effects of climate change are coastal areas. With more than 80% of Jamaica's population living in coastal areas (Ministry of Land and Environment, 2011), the island's residents and economic activities in such locations are considered to be the most threatened. One such coastal community is Alligator Pond, located in the southern part of the parish of Manchester (Figure 1). This community of around 3000 people, is highly dependent on the sea for their livelihoods (Figure 2) and as such, have been apprehensive about their future in lieu of the rising sea level, coastal erosion and intense hurricanes. With the use of the Socio-ecological Theory, the rest of this paper discusses the effects that climate change has been having on the community and the social, economic and physical capacities of the local population for mitigation.



Figure 1. Map Showing Location of Alligator Pond, Jamaica.



Figure 2. Alligator Pond- one of the largest fishing villages in Jamaica. All photos by the authors.

## **OBJECTIVES**

The study was guided by two broad objectives:

1. To explore the effects of climate change- particularly sea level rise, intense hurricanes and accelerated coastal erosion- on the coastal environment of Alligator Pond.
2. To analyze the social, economic and physical capacities of the residents of Alligator Pond to combat the effects of climate change.

## **REVIEW OF LITERATURE**

### **Climate Change in Island Communities**

Islands are home to one-tenth of the global population and, together with their exclusive economic zones, cover one-sixth of the earth's surface (Baldacchino, 2010). Islands, especially the coastal parts, are amongst the most vulnerable geographical areas to the effects of climate change which potentially increases pressure on already relatively narrow ranges of natural resources and undiversified economies (Moore, 2010). Owing to global increases in greenhouse gas emissions and land-use changes in response to climate change, the picture of island futures painted by the Intergovernmental Panel on Climate Change is troubling. A case in point is that over the Twentieth Century, temperature increases in the Caribbean oceans exceeded the global mean temperature rise of around 0.6°C and is rising at a rate of 3.4 millimeters per year (UNDP, 2018).

These dynamics firstly indicate significant changes in island environments and economies which are accompanied by calls for changes in the ways in which people are accustomed to residing on them. Secondly, there has been a new area of emphasis in the political discourse on climate change, that of climate justice which speaks to the environmental rights of places and the differentiated responsibilities that accompany such fairness (Schlosberg, 2012). Human safety and food, water, national security, houses, business places and livelihoods in coastal locations are already being affected. The concerns are highest at the lowest altitudes. Low-lying islands and coastal areas such as the Maldives; the Marshall Islands; the Federated States of Micronesia, Kiribati, and Tuvalu; and many Arctic Islands such as Shishmaref may be rendered uninhabitable in the future as sea levels rise and freshwater resources are reduced.

### **Climate Change and Jamaica**

Islands of the Caribbean are, likewise, under threat from global warming and climate change. One such island, Jamaica, is the third largest (James-Williamson, Aratram and Green, 2017) and the largest English-Speaking island in the region. The effects of climate change in Jamaica are becoming more pronounced. These include longer periods of drought; sea level rise of 3.4 millimeters per year; rising mean temperatures rising at a rate of 0.16°C per decade, with projections of 0.49°-0.57°C by the 2020s; 0.65°-0.84°C by the 2030s, 0.85°-1.80°C by the 2050s (Planning Institute of Jamaica, 2015). The island is also projected to be increasingly drier as the mid-2020s will see 0 to 2 % less rainfall in the annual mean and the 2050s up to 10% drier (*Ibid*). There have also been coastal erosion and more intense hurricanes, according to the Jamaica Information Service (2018). The island has responded to climate change at both the global and local levels. At the global level, it has been part of the climate change agreements, including signing to the Paris Agreement, which seeks to limit the rise of the global temperature below 2° Celsius and becoming a party to the United National Framework Convention on Climate Change which aims to regulate Greenhouse Gas Emissions. At the national level, Jamaica has implemented the Climate Change Focal Point Network (CCFPN), a network which is comprised of representatives of nearly all local Ministries and Agencies who are given the responsibility to mobilize resources through the Climate Change Division of the Ministry of Economic Growth and Job Creation. As part of Jamaica's environmental sustainable development goals in the Vision 2030 document, it is the government's aim to give priority to raising the environmental awareness of the general population. To this end, public school curricula, including at the elementary level have in recent times been modified to include climate change components. It is imperative that the overarching framework within which the island responds to the effects of climate change at the local level is integrative of both the social and ecological systems existing within communities.

### **The Socio-Ecological Theory**

Cote and Nightingale (2012) acknowledge that climate change resilience thinking requires a systems approach to duly make the human-environment connection. Social systems, human activities and the natural environment constantly interact with and affect each other over time. The socio-ecological theory (SET) helps us to appreciate and understand the interconnectedness between ecological processes and human systems (Walker et al., 2006). Hence, “a change in the state of the ecological system can also change the social system and vice versa” (Beichler, 2017:52). One of the greatest challenges of environmentalists and planners remains the ability to maintain equilibrium between these two components, that is, the human and the natural. On the one hand, the environmental changes such as coastal flooding and erosion in turn can cause damage to man-made physical structures such as houses. On the other, the response of residents to such environmental changes should entail resilience that helps them to secure the existence of their houses, businesses and communities. Resilience, here, speaks to the ability of a social or ecological system to resist, absorb, accommodate or recover from disturbances in a timely way, while retaining the same basic structure and ways of functioning (UNISDR, 2009). The degree of individual and community resilience invariably depends on not only the capacity of their physical structures to absorb or resist shocks, but also the strength of their social and financial capital. In the context of Alligator Pond, resilience is hanging by a thread of hope as the poor financial capacities and social capital limit their resilience and adaptation efforts.

## **METHODOLOGY**

The study was conducted within a qualitative framework involving a combination of observation, semi-structured interviews, and photography. After receiving approval from the Church Teachers' College Administration, an initial visit was made to the study area, where the Primary Investigator and Research Assistants familiarized themselves with the physical layout of the community in June 2018. From that time until March 2019, the researchers made trips to the community to observe and interview residents, while 'immersing' themselves in the local context and gaining a level of trust with the residents who were very skeptic of researchers, noting that they are tired of being 'researched' for many years, without any forthcoming solutions to their challenges.

A total of 20 semi-structured interviews were done with residents- some of whom were fisherfolk or business operators- which were selected using the purposive and convenience sampling techniques (see Table 1). Unlike the quantitative approach, qualitative research has the potential to provide detailed explanation of social phenomenon which quantitative research cannot (Creswell, 1998) and was therefore useful in exploring key themes of the residents' perceptions of the effects of climate change and their capacities of resilience. A total of 13 males and seven females within the age group of 18-65 participated in the study. The size of the sample depended on the amount of data needed for thematic saturation, therefore, the optimal number of interview participants came when data saturation was achieved in the course of research (Sandelowski, 1995).

Individuals were selected from random sections of the community so as to minimize homogeneity of responses. The sampling was convenient because the selection was done on the basis of those who were available and willing to be interviewed; it was also purposive because the researchers were interested in those who were residents in the communities, not visitors. The qualitative approach ensures that more detailed information about personal feelings, perceptions, opinions and ambiguities are garnered. The interviews were mostly conducted at respondents' homes and shops. Questions asked were about their demographic background and their views of climate change. The qualitative data were supplemented by the use of satellite imageries on sea level rise over time. Although, these images do not account for high tide seasons, they nevertheless assisted in gaining understanding of the general sea level changes. One of the drawbacks encountered was that there is limited access to sea level rise data and measurement instruments in Jamaica, therefore there is a general reliance on qualitative data to research climate change impacts, which cannot be generalized from.

## **DISCUSSION OF FINDINGS**

### **Climate Change and the Physical Environment of Alligator Pond**

Alligator Pond has been exposed to hazards and disasters which are connected to climate change, including: sea-level rise, coastal erosion and intense hurricanes. The community's situation on the largest sand dune in the Caribbean and its subsequent ubiquitous sandy soils, increases the vulnerability of the coastline to erosion by the

sea. Residents identified different changes that they have observed in their environment over the past 15 years, the most notable one being a rise in the sea level. There was also a general perception that significant amounts of damage to property have been caused by Hurricanes Ivan in 2004, Dean in 2007 and Gustav 2008 and a series of back-to-back hurricanes between 2016 and 2018, including Hurricanes Matthew and Maria. These hurricanes had led to storm surges, strong winds and floods that not only caused property damage and but adversely affected business in the community through loss and damages to property and by preventing fishing activities for several days. Figure 3 shows a structure that was damaged by Hurricane Ivan which was already a Category 4 as it entered the Caribbean Sea in 2004. The intensity and duration of North Atlantic hurricanes, as well as the frequency of the strongest ones (Category 4 and 5), have all increased since the early 1980s. The Centre for Climate and Energy Solutions (2018) reports that while scientists cannot confirm an increase in the frequency of storms, “models project a 45-87 percent increase in the frequency of categories 4 and 5 hurricanes.”



Figure 3. Structure damaged by Hurricane Ivan.

Another effect of climate change plaguing the community is sea level rise. According to a report by the UNDP (2018), the sea surrounding Jamaica is rising at 3.4 millimeters per year and is projected to rise another 280 millimeters to 340 millimeters by 2100. This is the result of added water that is projected to come from melting land ice and the expansion of seawater as it warms (NASA, 2018). In the next several decades, storm surges and high tides could combine with sea level rise and land subsidence to further increase flooding in Jamaica and the rest of the Caribbean region. Sea level rise is of great concern to community members, particularly those whose livelihoods depend on the sea as well as residents who live closest to the sea. Figure 4 below shows sea level rise between 2001 and 2011.



Figure 4. Rising Sea Levels over Time. Sources: Authors.



Of those interviewed, sea level rise was cited by the majority (75%) as the most outstanding environmental change they have seen (see Table 1). Hotter times, more powerful waves and coastal erosion are the other changes cited by the respondents. It was quite evident that the rising sea level in the study area has caused considerable damage to the coastline and it is projected to continue in the coming years. Notwithstanding the damages that have already occurred and the projected increase in sea level rise, residents and business operators are reluctant to relocate from their current locations because their livelihoods are largely dependent on the sea. As reflected in Table 1, none of the respondents are willing to relocate from Alligator Pond in the future.

This increases the likelihood of climate change-induced migration and possibly inundation. The phenomenon has already commenced as one lifelong resident recalled, “my daughter and her baby had to move out from their home because the sea water is coming in on them. They had to move in with me.” Residents recounted having significantly more beach spaces to play football before 15 years ago. In the words of another lifelong resident, “the beach is being taken away more and more by the waves. It used to be bigger than this, right now it’s narrow.” One of the fishermen, also a resident recalled, “there were coconut trees here and we, as boys used to climb and pick them and look for sea grapes. Now it’s covered by almost 5-6 feet of water!” Likewise, a business operator maintained, “we have lost 40 feet of beach over a 12 year period” which has made the beach unattractive and also possibly part of the reason for gradual reduction in visits from tourists to the locality.

### **Physical Capacity**

Resilience has been summed up as: maintaining stability, recovery (bouncing back) and transformation (Australian Government Bureau of Rural Sciences, 2008). Physical resilience deals with the ability of structures in the community to withstand and cope with the effects of climate change. Many of the buildings constructed in the community are made from board and zinc which make them particularly vulnerable to strong winds, rough seas and salt water intrusion which weakens the structure and foundation of the buildings. Oswald's Sea Food and Little Ochi Sea Food Restaurant, the two largest sources of employment for residents, are largely constructed from board and as such have suffered significant damages. As mentioned earlier, exacerbating this challenge is the fact that the community sits on the largest sand dune in the Caribbean and one of the largest sand dunes in the western hemisphere (Office of Disaster Preparedness and Emergency Management and Canadian International Development Agency, 2011). Sandy soils are amongst the most vulnerable to water erosion and have been partly blamed by residents for the collapse of a fish-cleaning and vending structure in 2017 (Figure 5). There were no casualties or injuries, but paints a grim picture of what can recur in the future if the same materials and engineering are employed. As part of the resilience and adaptation strategy of the people, some have constructed ‘portable homes’ which are wooden structures without concrete foundations that can be easily pulled down and transported to higher grounds before hurricanes. The burden of mitigation efforts for the community as a whole, however, has fallen on the few business operators whose strategies range from the use of old tires and boulders to form makeshift breakwaters along the coastline to the regular refurbishing buildings that house their businesses (Figure 6). During field observation, it was noted that the breakwaters are without any formal engineering, thereby resulting in their poor durability.



Figure 5. Collapsed fish-cleaning structure.

Table 1. Respondent socio-demographic characteristics.

Respondent	Gender	Age Group	Level of Education	Occupation	Distance of home from foreshore	Main environmental changes seen	Where do you see yourself in the next 10-15 years
1	Male	20-29	High School	Fish Vendor	½ Mile	No Changes	Alligator Pond
2	Male	30-39	High School	Fisherman	½ Mile	Sea Level Rise	Alligator Pond
3	Male	40-49	High School	Business Operator	½ Mile	Sea Level Rise	Alligator Pond
4	Male	30-39	Primary School	Chef	1 Mile	More Powerful Waves	Alligator Pond
5	Male	50-59	High School	Fisherman	1 Mile	Sea Level Rise	Alligator Pond
6	Female	40-49	High School	Business Operator	2 Miles	No changes	Alligator Pond
7	Female	60-69	Primary School	Vendor	Beside the Beach	Times are getting hotter/ Sea level Rise	Alligator Pond
8	Female	30-39	High School	Vendor	Beside the Beach	Sea Level Rise	Alligator Pond
9	Female	40-49	Vocational School	Caregiver	½ Mile	Sea Level Rise	Alligator Pond
10	Male	30-39	High School	Business Operator	½ Mile	Sea Level Rise	Alligator Pond
11	Female	40-49	High School	Farmer	Beside the Beach	Sea Level Rise	Alligator Pond
12	Male	40-49	High School	Fisherman	Beside the Beach	Sea Level Rise	Alligator Pond
13	Male	30-39	Primary School	Mechanic	Beside the Foreshore	Sea Level Rise	Alligator Pond
14	Male	50-59	Primary School	Fisherman	Beside the Beach	Times are getting hotter	Alligator Pond
15	Male	40-49	High School	Fisherman	Beside the Beach	Sea Level Rise	Alligator Pond
16	Female	50-59	Primary School	Vendor	½ Mile	Sea Level Rise	Alligator Pond
17	Male	60-69	High School	Welder	1 Mile	Sea Level Rise	Alligator Pond
18	Male	60-69	Primary School	Fisherman	½ Mile	Sea Level Rise; Coastal Erosion; Destruction by hurricanes	Alligator Pond
19	Female	60-69	Primary School	Fish Vendor	¼ Mile	Sea Level Rise Coastal Erosion	Alligator Pond
20	Male	40-49	High School	Business Operator	¼ Mile	Sea Level Rise; Coastal Erosion; Rougher waves; Destruction from hurricanes.	Alligator Pond

### Social Capacity

Social resilience takes into consideration the social capital of the residents living in the area to combat or cope with change and disturbances (Yohe and Tol, 2002). In the community of Alligator Pond most of the residents are from low income backgrounds with elementary of up to grade 9 education. Of the respondents, 60% had up to High School education, while 35%, Primary and 5% Vocational (see Table 1). They also cited disunity amongst themselves as one of the limiting factors to community development. In the words of one of respondents, “we don’t trust each other...which is why other communities will receive assistance from outsiders, but not Alligator Pond! There is no unity.” The homogeneity of economic activities such as fishing and fish cleaning in the areas increases the likelihood of competition amongst themselves for business. The disunity in the community is reflected in the absence of a Fishermen’s Association which is popular in the other fishing villages in the island.



Figure 6. Artificial sea wall at business establishment.

### **Economic Capacity**

Efforts of maintaining stability and recovery can be a very expensive venture, especially for the economically marginalized. Economic capacity deals with the financial ability of the community members to fund the mitigation efforts being employed to tackle the issues of climate change. Since the members of the community are generally from low income backgrounds, they are not economically stable enough to fund sustainable projects, including the construction of seawalls to withstand the effects of coastal erosion. This is largely why costlier initiatives have been taken on by the two largest business establishments there. A business operator mentioned that he has spent over J\$3M in one go to secure his property from erosion and sea level rise, noting that without the retaining walls he constructed, the sea would have already destroyed his establishment. He argued that little or no help is received from governmental agencies or donors, citing that “everybody is about climate change...but it’s more talk than anything else. I believe they should lobby for methods that can slow the erosion, rather than telling people they would have to move. There was once someone who works with NEPA [National Environment and Planning Agency] ...who said that the only option is to move [from the coastline].”

Residents of Alligator Pond have endured many kinds of loss due to the effects of flooding and high winds during hurricanes. But those living closest to the sea have reported instances of corrosion and cracks in their buildings as a result of the waves’ pressure. One respondent explained that it has cost him “lots of money... as we make the money we have to spend it again; you have to be strong to survive in this place.” He further mentioned the importance of resilience: “It’s the best place to build a seafood restaurant, persons like to come and dine, hang out and overlook the sea, I believe it’s very nice, so we need to do more to save it.” He also opined that if his business closes down, too many community members would become unemployed.

It is critical to develop hazard resilient communities to prepare for these disasters and enhance their ability to absorb impacts and bounce back. This will reduce the number of lives lost in disasters as well as it will reduce the damage caused to property. It will also secure the economic stability of the communities and support the health of coastal ecosystems including wetlands which are essential for reducing the impact of storms on our coastal communities. The question was asked of the residents, “what can be done to lessen the impact of rapid coastal erosion and climate change?” Most respondents believed that government support is necessary as well as proper management and engineering of the coastal area. Others called for public education on climate change, which is identified in the Jamaica Vision 2030 as an area of development priority (Planning Institute, 2009). It has been published in the Jamaica Observer in 2017 that local government has been developing plans to help combat the issues in Alligator Pond, noting that a pledge of \$5 million has been made by the Environmental Foundation of Jamaica to start the projects. To date, however, residents and business operators are despondent that government intervention has not yet been realized.



## CONCLUSIONS

In conclusion, climate change is a real phenomenon, affecting the lives of many. Accelerated coastal erosion, more powerful storms and sea level rise in Alligator Pond are posing greatest concerns to both residents and business owners, who have been losing beach space, property and their livelihoods. This paper calls for urgent intervention from donor agencies and the government of Jamaica in the fight against climate change. This is particularly against the background that without serious interventions, the projected cost for damage through storms to tourism and infrastructure alone is US\$4, 991 Million by 2100 (Bueno, Stanton and Ackerman, 2008). For starters, an artificial reef system could be installed, which would serve to reduce the power of the waves before they reach the communities' coastline. Back to where we started in this paper and as the socio-ecological theory puts forward, practitioners, scholars, policy-makers, non-governmental organizations and the residents themselves all have critical roles to play in the integrated approach to resilience. The residents need the financial input, training, educational and technical assistance from external sources such as NGOs, governmental stakeholders, as well as the planners and policy-makers need to heed the perceptions, attitudes and the needs of local residents and business operators in their planning and decision-making process. Without this balance, there will be diminished attainability of the sustainable development goals of the government.

## REFERENCES

- Australian Government Bureau of Rural Sciences. 2008. Assessing a community's capacity to manage change: A resilience approach to social assessment. [https://www.tba.co.nz/Resilience\\_approach\\_to\\_social\\_assessment.com](https://www.tba.co.nz/Resilience_approach_to_social_assessment.com). (Accessed April 24, 2019).
- Baldacchino, G. 2010. *Island Enclaves: Offshoring Strategies, Creative Governance, and Subnational Island Jurisdictions*. McGill-Queen's University Press. <http://www.jstor.org/stable/j.ctt7zq30>. (Accessed April 20, 2018).
- Beichler, S.A. 2017. Understanding Social Ecological Systems under Climate Change. <https://www.PDFdoc.sub.uni-hamburg.de/volltexte.pdf>. (Accessed April 22, 2019).
- Bueno, R.; Stanton, E.A.; Ackerman, F. 2008. The Caribbean and Climate Change- the costs of inaction. <https://www.sei.org/publications/caribbean-climate-change-costs-inaction>. (Accessed April 21, 2019).
- Center for Climate and Energy Solutions. September 26, 2018. Hurricanes and Climate Change. <https://www.c2es.org/content/hurricanes-and-climate-change>. (Accessed April 20, 2018).
- Cote, M and Nightingale, J. 2012. Resilience thinking meets social theory: Situating social change in socio-ecological systems. <https://journals.sagepub.com/doi/abs/10.1177/0309132511425708>. (Accessed April 20, 2019).
- Creswell, J. W. (1998). *Qualitative inquiry and research design: choosing among five traditions*. Thousand Oaks, CA: Sage.
- IPCC. 2018. The Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/>. (Accessed April 20, 2019).
- Jamaica Observer. 2017. Manchester PDC moves to save Alligator Pond from beach erosion. [http://www.jamaicaobserver.com/news/Rescue-Plan\\_86663?profile=1432](http://www.jamaicaobserver.com/news/Rescue-Plan_86663?profile=1432). (Accessed August 25, 2018).
- Jamaica Information Service. 2018. Get the Facts - Climate Change and its Effect on Jamaica. <https://jis.gov.jm/information/get-the-facts/get-the-facts-climate-change-and-its-effect-on-jamaica/>. (Accessed April 20, 2019).
- James-Williamson, S.A., Aratram, M. & Green, P.E. Protecting Geoheritage in the Caribbean – Insights from Jamaica. 2017. 9: 195. <https://doi.org/10.1007/s12371-016-0195-y>. (Accessed April 20, 2019).

- Ministry of Land and Environment. 2011. Climate Change Policy Framework and Action Plan. <https://www.japarliament.gov.jm>attachments>. (Accessed April 20, 2019).
- Moore, A. 2010. Climate Changing Small Islands: Considering Social Science and the Production of Island Vulnerability and Opportunity Environment and Society: Advances in Research 1 (2010): 116-131.
- NASA. 2018. New study finds sea level rise accelerating – Climate Change: Vital Signs of the Planet. <https://climate.nasa.gov/news/2680/new-study-finds-sea-level-rise-accelerating/>. (Accessed April 12, 2019).
- Office of Disaster Preparedness and Emergency Management and Canadian International development Agency 2011. Community disaster risk management plan for Alligator Pond, Manchester. <http://www.odpem.org.jm/Portals/0/Alligator%20Pond%20Final.pdf>. (Accessed September 25, 2018).
- Planning Institute of Jamaica. 2015. The state of the Jamaican Climate. [https://www.pioj.gov.jm/Portals/0/Sustainable\\_Development/WEB\\_FULL%20DOCUMENT\\_The%20State%20of%20the%20Jamaican%20Climate%202015.pdf](https://www.pioj.gov.jm/Portals/0/Sustainable_Development/WEB_FULL%20DOCUMENT_The%20State%20of%20the%20Jamaican%20Climate%202015.pdf). (Accessed April 20, 2019).
- Planning institute of Jamaica. 2009. Vision 2030 Jamaica National Development Plan. Retrieved on April 20, 2019. [http://www.vision2030.gov.jm/Portals/0/NDP/Vision%202030%20Jamaica%20NDP%20Full%20No%20Cover%20\(web\).pdf](http://www.vision2030.gov.jm/Portals/0/NDP/Vision%202030%20Jamaica%20NDP%20Full%20No%20Cover%20(web).pdf). (Accessed April 20, 2019).
- Sandelowski, 1995. How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. <http://fmj.sagepub.com/>. (Accessed April 20, 2019).
- Schlosberg, D. 2012. Climate Justice and Capabilities: A Framework for Adaptation Policy. <https://pdfs.semanticscholar.org>. (Accessed April 21, 2019).
- UN. 2019. United Nations Climate Action Summit 2019. <https://www.un.org/en/climatechange/un-climate-summit-2019.shtml>. (Accessed April 23, 2019).
- UNDP. 2018. Caribbean. [https://www.adaptation-undp.org/explore/caribbean.\(accessed](https://www.adaptation-undp.org/explore/caribbean.(accessed) April 20, 2019).
- UNFCCC. 2018. United Nations Framework Convention on Climate Change. <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/united-nations-framework-convention-on-climate-change>. (Accessed April 12, 2019).
- UNISDR. 2009. Disaster Risk Reduction. <https://www.unisdr.org>. (Accessed April 22, 2019).
- Walker, B., Anderies, J. Kinzig, A., Ryan, P. 2006. Exploring resilience in social-ecological systems through comparative studies and theory development: Introduction to the special issues. *Ecology and Society* 11: Article 12.
- Yohe and Tol. 2002. Indicators for Social and Economic Coping Capacity Moving Toward a Working Definition of Adaptive Capacity. <https://www.start.org.gv/yoheindicators.doc.pdf>. (Accessed April 22, 2019).