An Analysis of the Implications of Squatting on Peri-Urban Protected Environmental Areas in Jamaica: An Assessment of Governance and Squatter Perception

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List of Acronyms

1. CBD	-	Convention on Biological Diversity
2. JaNEAP	-	Jamaica National Environmental Action Plan
3. JNHT	-	Jamaica National Heritage Trust
4. NEGAR	-	National Ecological Gap Assessment Report
5. NEPA	-	National Environment and Planning Agency
6. NRCA	-	Natural Resources Conservation Authority Act
7. PA	-	Protected Areas
8. PAC	-	Protected Areas Committee
9. P-PRPA	-	Palisadoes -Port Royal Protected Area
10. PASMP	-	Protected Areas System Master Plan
11. PSUP	-	Participatory Slum Upgrading Program
12. RAPSJ	-	Rapid Assessment of the Problem of Squatting in Jamaica
13. SOE	-	State of the Environment
14. SEMU	-	Squatter Environment Management Unit
15. STATIN	-	Statistical Institute of Jamaica
16. WRI	-	World Resources Institute

List of Definitions

1. **Attitude** – refers to a set of emotions, beliefs, and behaviours toward the protected area (PA) and consider whether respondents are concerned about the threats to the PA environment as a result of knowledge, experience or upbringing, which may have an influence over their behaviour.
2. **Daily Routine Activities** - are defined as a common part of everyday existence, the day-to-day things done by the squatter in their normal life such as, washing, garbage disposal, use of water, livelihood activities, bathroom use etc. that may directly or indirectly affect the PA.
3. **Governance** – "a set of processes, procedures, resources, institutions and policymakers that determine how decisions are made and implemented" Giessen and Buttoud (2014), it considers the processes of the oversight bodies such as regulations, legislative, norms and actions, how they are sustained and accountability for the PA and squatting in Jamaica.
4. **"Governance" (variable)** – respondent's perception of the implementation of awareness programs that educate the people and allow for continuous monitoring of the implementation of policies that will allow the people to properly coexist with the natural resources.
5. **Informal Housing** - Informal housing in Jamaica are areas where housing does not comply with current planning and/or building regulations (unauthorized housing) but may not be illegal.
6. **Knowledge/Education-** considers awareness or familiarity gained by experience or any information received from the governance bodies of the PA.
7. **Pro-environmental Behaviours** - is conscious actions performed by a person to lessen the negative impact of human activities on the environment or and to enhance the quality of the environment (Jensen 2002, & Kollmus and Agyeman 2002)
8. **Squatting** - Squatting in Jamaica is the illegal occupation of property or "capture land", whether land or buildings.
9. **Squatter Behavior** – This is the general action of the respondents towards the PA in thoughts and deeds (will they engage in PEB's, do they believe it's important to protect the environment, who they perceive as responsible for the environment and are they concerned for the issues that the PA environment faces?).

Chapter 1- INTRODUCTION

It is a widely known fact that the natural environment faces severe anthropogenic threats that result in varying negative conditions such as habitat loss and degradation to include deforestation, climate change, species loss and migration, and various types of pollutions. Consequently, the conservation of the natural environment using strategies like protected areas is critical to the survival of humanity, simply for the benefits associated with nature albeit cultural or spiritual and the valuable ecosystem services they provide, according to scientific and technical research globally. "While protecting ecosystems that are essential for life, they can support human livelihoods and aspirations and offer nature-based solutions for the complex challenges faced by the world today (Sandwith, 2015)."

The instrument referred to as protected areas (PA), is a system that is defined as a key tool for biodiversity conservation, and a strategy that has played a major role in the Convention on Biological Diversity. In this paper, PA refers to the term Protected Areas, defined by IUCN 1994 as, "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, of natural and associated cultural resources and managed through legal or any other effective means" (IUCN 1994).

Since the establishment of PA, there have been several governance issues that have altered the attitude and opinions of those whose lives have been impacted (Pietrzyk-Kaszyńska et al 2012), however this has allowed for discussions not just on protection of our natural heritage but for inclusiveness that considers local community involvement and change of perceptions towards oversight bodies (Chape et al., 2008).

Currently, there are 209,000 PA covering 15.4 per cent of the Earth's terrestrial area (outside Antarctica) and 3.4 per cent of it is marine area (IUCN and UNEP-WCMC 2014), have been designated as PA and are supported by 193 parties (nations) to the Convention on Biological Diversity (CBD) as well as other nations (Worboys 2015). They are established with specificity of conserving nature, yet this tool faces threats of its own that may be contributed to limitations in governance and a severe housing crisis globally.

1.1 Research Question

The PA in Jamaica encounters similar anthropogenic threats; this paper emerged out of an ongoing debate surrounding the matter of squatting in Jamaica, especially the negative press that emanates daily about the conditions of squatter settlements and the solutions that are being

explored and implemented. This ever-increasing problem is persisting whether social statuses have improved over time or not. Further, since the act of squatting is not limited to just idle lands in unfinished housing developments, but have pushed into the boundaries of sensitive ecological areas, and especially because a significant number of the squatter population has been impacting PA negatively both on small and larger scales, it is the belief that a systematic research that delve into how the individuals who utilize this means of housing development perceives the effects of their action, is paramount to determining a policy solution or strategy towards a solution.

The paper was centered on the implications of the act of squatting that is propelled by the global housing crisis with consideration for the reasons they are living in a squatter community, which are varied but common, as they are typical of persons resorting to this style of providing for housing needs. Assessing the impacts of squatting on the environment, the focus of this paper looks deeper into the governance and perception of the residents of these communities.

Dr Tindigarukayo, who has researched the problem of squatting widely in Jamaica, has recommended several means towards a solution that involves a direction that considers the perspective of residents of these low-income communities. The research reveals that many steps to defining a successful resolution to the problem has not placed much consideration on the perception of the squatter and the governance style being implemented and how they are expected to adapt to any change. Considering all other potential risks to PA, the extent or severity of the degradation and risks associated with individuals of a lower economic scale, especially those residing in peri-urban areas that are home to several protected sites in Jamaica, the impacts of squatting on these PA must be further explored.

Consequently, the author sought to use this research to explore the following problem:

To determine the impact (that is, any action that affects the quality of the environment, in either a positive or negative way) of squatting on protected natural environmental areas i.e. marine and terrestrial, from the angle of governance and squatter perception, with a view to provide recommendations for policy direction on protected area conservation and squatter housing policies.

The result of this analysis is expected to assist with determining potential for members of these communities to engage in pro-environmental behaviours (PEB). PEBs are actions that

are defined as conscious activities performed by an individual to lessen the negative impact of human doings on the environment or and to enhance the quality of the environment (Jensen 2002; Kollmus and Agyeman 2002). Also, to determine whether there are correlations with the method of governance and squatter perception, the current living conditions and perception and how these governance strategies are influencing the attitudes and behaviour of the residents. The end goal is to help to fill the gaps in past research and utilize the information to indicate best approach to a Squatter Management Policy direction and thereby recommended solutions for lessening the effects of squatting on PA in Jamaica.

1.2 Rationale for Thesis

The growth in the world's population has had pervasive effects on the natural environment in varied ecosystems, a problem that has been strengthened through technological advancements allowing unencumbered access to locations previously perceived as unreachable (Vitousek et al. 1997), which provided the basis of exploring the background on Jamaica`s settlement and housing crisis and what have been done to address them. Consequently, the protected areas have become one of the best tools implemented that has been providing the protection that is necessary to maintain the populations of species, especially those that are vulnerable and endangered. In the case of Jamaica, this very sensitive ecosystem is facing its fair share of pressures, and one of the triggers is the issue of squatting. The unregulated development of these settlements and the inadequate infrastructure that is associated with them intensifies the problem of environmental degradation. In addition, PA that is not only environmentally sensitive, but is protected because of heritage value is increasingly being affected by squatting. This has now led to the inclusion of the Jamaica National Heritage Trust as a major stakeholder in the governance body designed to address the threats to PA. As a result, the research provided the background to support the need to quantitatively analyse the impact of such pervasive behaviour.

Additionally, there is a continuous proliferation of squatting in Jamaica resulting in emerging terms as "Serial Squatting". The act of "Serial Squatting" refers to the situation where persons who were part of programs to be relocated to better homes, rent those improved housing facilities to other individuals for income and returns to the site of squatting as their residence (Wilson-Harris 2018). This new modus of operandi and the constant and most relevant discussion on how to address the squatter phenomena without treading on the basic human rights of people has merited the need to conduct rigorous research into this problem.

This paper is seeking to explore the viewpoint of the residents of these communities in conjunction with the governance techniques and use that information to create better strategic approaches that will inform policy decisions for minimizing the effects of this activity on the already vulnerable sites.

1.3 Methodology and Thesis Framework

This thesis will present the outcomes of a case study on Jamaica, utilizing a mixed method approach to analysing the problem. This includes a field observation, quantitative statistical analysis of questionnaire data and the qualitative results of semi-structured and structured interviews conducted with two (2) lead governance bodies and done on four (4) Protected Areas in Jamaica, to provide insights on the attitudes, behaviour and perception of Squatters living in or within close proximity to those sites. The research was done in 6 phases:

- Phase 1- Drafting the proposal for the execution of the research and defining the approach to attaining the required results.
- Phase 2- Preparing data collection instruments and getting approval from the Academic Advisor.
- Phase 3- Over 3 separate months utilize data collection instruments to collect the required information.
- Phase 4- Data Analysis and presenting some findings in the form of Journal Papers at both local and international conferences.
- Phase 5- Drafting of the thesis
- Phase 6- Preparing for and presenting the Defence

1.4 Purpose

The purpose of the research seeks to determine the impact (that is, any action that affects the quality of the environment, in either a positive or negative way) of squatting on protected natural environmental areas i.e. marine and terrestrial, from the angle of governance and squatter perception with a view to provide recommendations for policy direction on protected area conservation and squatter housing policies.

1.4.1 Objectives

1. Determine how governance of PA relates to squatting and use this information to inform conservation policy for squatting and the environment.

2. Perform an analysis of Peri-Urban Protected Areas (PA) to determine the impact of Squatter housing sector on the sensitive locations (an area of high environmental importance to wildlife, endangered species and biodiversity) in Jamaica.
3. Utilize results of analysis of squatter perception to determine feasibility for pro-environmental behaviours (PEBs) to aid in informing policy solutions to squatting in PA.

1.4.2 Originality and Limitations

This research explores an area that has not been given much attention, which is the perception of low-income groups (specifically squatters) on the Protected Area systems that they are impacting. The strategy was to assess Governance and Perception to determine whether squatters would engage in pro-environmental behaviours and predict the way they would treat PA, to then inform policy solutions for squatter threats to the environment. Because little research has been done on the Perception of squatters on PA the research is poised to provide insights that would be helpful in developing mitigation strategies and form better plans for resettlement or relocation.

While there may be no distinctively unique differences in the issue being discussed in Jamaica in comparison to other countries, the following maybe be considered:

1) Little to no data on squatting and informal housing as an anthropogenic threat to PA.
2) Unhealthy attachment and reliance on the squatter/slum communities by political parties for power, which presents as a threat to executing some solutions in the PA.
3) A long-standing and ingrained mindset that government is responsible for solving problems and the stubborn behaviour dating back to colonial times that define Jamaica's history with rebellions.
4) Generational habit of squatting dating back to slavery.
5) Repeat offenders that has led to a term adapted referred to as "Serial Squatting".

The completion of this research was not done without certain limitations, such as limited sample size for survey due to limited access to resources, incomplete surveys, surveys not completed properly or not returned. In addition, there was limited information locally and internationally that looked at squatter perception of the PA and the state of the environment. Some communities were unsafe at times and restricted movement or available time to have meaningful interviews. There were literacy issues. Finally, the unease surrounding the lack of

tenure security in some areas limit the cooperation received from residents. Notwithstanding, these constraints have not prevented results of merit and significance.

1.5 Thesis Outline

As previously stated, the aim is to determine the potential impact of squatting on PA and the perception of those living in these areas to provide solutions that will lessen the problem identified. Therefore, in Chapter 1, which is an introduction, provided a synopsis of the current situation with the research and the process for its completion. Chapter 2 of the research provides detailed information on the current housing sector in Jamaica that leads to the act of squatting and the governance structure in place to deal with squatting. Further, provides background on the current state of the environment and the PA systems, governance of these areas. Subsequently, a connection between the two issues is described and a background to the study areas provided. This was done to provide proper understanding of the complexity of both areas and support the approach taken to explore the connection between issues. Chapter 3 is an assessment of literature that examined similar topics and would provide scientific basis for exploring the problem.

Chapter 4 was a detailed description of the methodology chosen for data collection and analysis. This methodology utilized interviews, questionnaires, literature review and focus groups to collect relevant data that would explain the situation. It further demonstrated how the data would be analysed using calculations for impact, correlation tests for relationships, independence tests for associations and an ordinal regression model to determine perception.

Objectives 1 and 2- To fulfil the parameters of both objectives Chapter 5 presented the results of the phenomenological analysis of the governance systems and demonstrated the deficiencies that had implications of impact, by creating the conditions that allowed housing development. In fulfilment of *Objective 3*, Chapter 6 provided the results of squatter perception of squatting and the environment, correlations between the living conditions and the environment, whether the perception of the squatters was influenced by governance and the education systems implemented through same, whether attitude in the form of concern constitutes behaviour and the results of the ordinal regression analysis that presents how to predict squatter perception towards the environment.

Chapter 7 presents a discussion of the findings in the analyses and recommendations that would complete the aim of the paper that is to provide realistic suggestions for solutions

to the problem of squatting, minimizing the impact of squatting on protected areas and policy directions for PA conservation and squatting. Finally, Chapter 8 provides a summary conclusion of what was achieved. The complete flow is provided in the chart below (Figure 1-1).

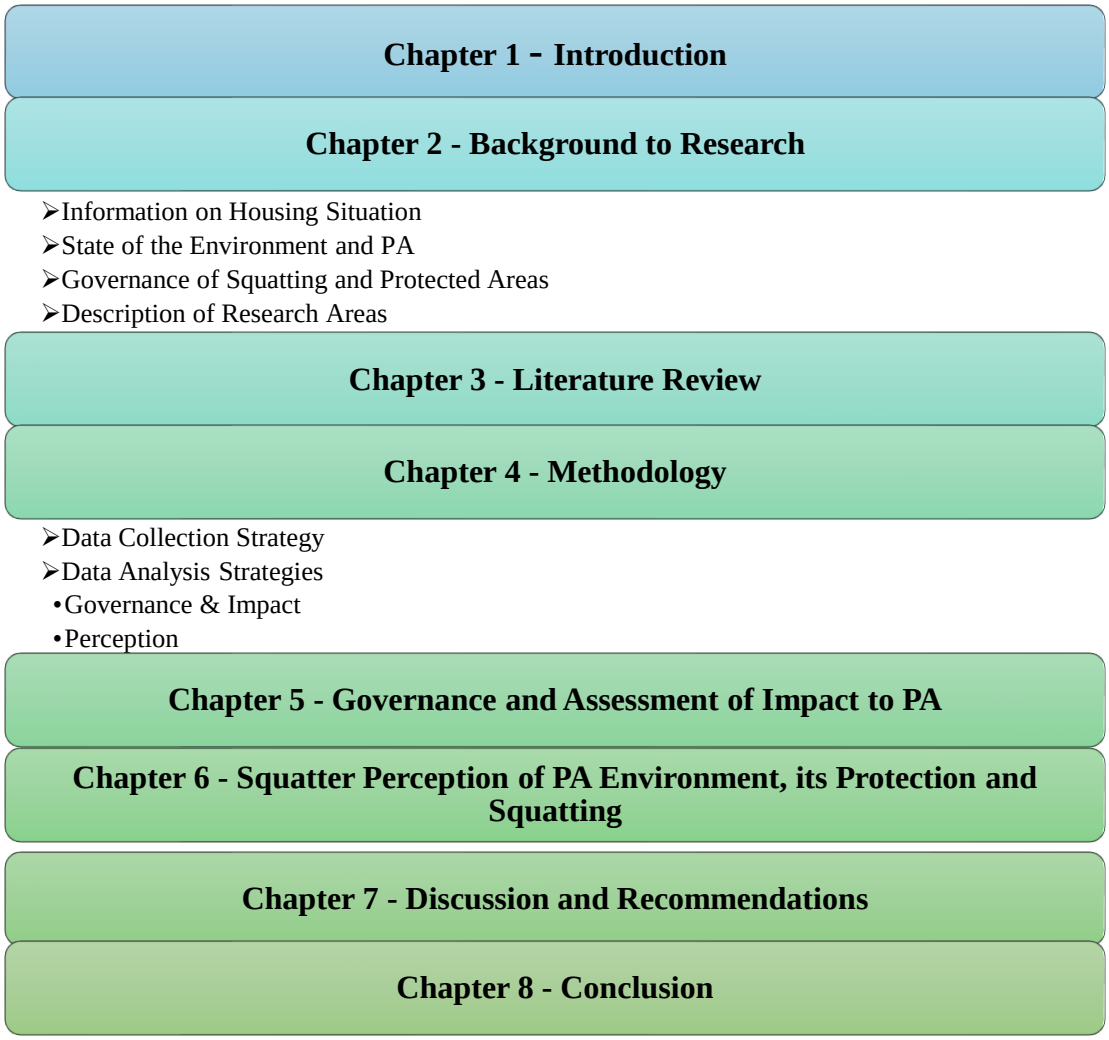

Figure 1-1 Thesis Outline

Chapter 2- BACKGROUND TO RESEARCH

In order to provide policy solutions for governance, the analysis requires an understanding of past attempts to address squatting, governance of squatting and the PA, which has implications for the way we seek to minimize threats to the environment. Therefore, the author sought to provide background on the current situation that would support the need for the research. In addition, this governance may have implications for perception and therefore the information to support the research question provided.

2.1. Background of Jamaica`s Settlement Situation

In analysing the impact and perception of the squatters in the research it is necessary to understand the current situation for settling in Jamaica. Jamaica`s demography, almost comparable to Japan, is going through a transition in the various age groups, this being characterized by children under the age of 15, an increase in the working-class ages below 65 and an extremely fast growing elderly dependent group (PIOJ 2011). In addition, the number of individuals in a household has been declining in Jamaica, from 3.6 people per household in 1997 to 3.3 people in 2007 (PIOJ, 2007) and currently 3.1 in 2018 (ArcGIS 2018; STATIN 2018).

In reviewing Jamaica`s settlement patterns, consideration must be given to the population shift from rural to urban areas, this trend began approximately 57 years ago following the country's independence, and continues even now, having far-reaching implications on economic growth, the environment and social inclusion (McHardy & Donovan 2016). This rural to urban migration has resulted in approximately 54% of the population living in urban areas, having an annual growth of 1.42% (Table 2-1).

Table 2-1 Population by Urban/Rural Distribution for Jamaica: 2001 and 2011 Censuses (Source: STATIN Demographics 2014)

		2011		2001	
Parish		Number	Percentage	Number	Percentage
Jamaica	**Total**	**2,697,983**	**100.0**	**2,607,632**	**100.0**
	Urban	1,453,438	53.9	1,355,334	52.0
	Rural	1,244,545	46.1	1,252,298	48.0

The most predominant location for this domestic migration is in the parishes of Kingston and St. Andrew, referred to locally as Kingston City and categorized nationally as the Kingston Metropolitan Area (KMA), containing a total of 41% of the urban population.

There are four (4) major ways Jamaican`s utilizes to fill their housing demands whether through public or private sector; namely:

1. Residential Housing through the formal sector – Usually done by the Housing Agency of Jamaica (HAJ), Jamaica Mortgage Bank (JAB), National Housing Trust (NHT), collaboration with the NHT and private developers and finally private development in designated areas.
2. Informal Housing Sector- This is by way of mortgages to persons to build on their lands in rural communities, the purchase of housing from private individual developers (persons who owns land and build houses for sale or rental), and construction of temporary or movable housing by individuals who lease lands in private sub-divisions.
3. Squatter Housing- This is by way of "captured lands" by persons in the lower economic classes. This is normally done in both urban and rural areas. Either on idle government lands or private lands unoccupied or unused for extended period.
4. Another housing technique is the Self-help housing initiative using Land Lease practice referred to as Board Schemes. "Board Scheme" is a local name given to Land Leased housing developments consisting of 5 or more houses, constructed purely from Timber on subdivision lots, and is upon the authority of the landowner (Grant and Taniguchi 2018).

As a result of affordability problems, PIOJ 2011, surveys indicated that housing developments should focus on solutions at the lower end of the economic scale. In addition, the NHT, Jamaica`s major housing solution provider, has lowered its interest rates and have tried to be more accessible and flexible, allowing longer mortgage periods to facilitate individuals on the lower economic scale to purchase housing. However, this has not deterred the growth of squatter communities or reduces the damage they have been enacting on at risk environmental areas.

2.2 Affordable Housing Crisis

As described by Turner (1977) in his book *"*Housing By People: Towards Autonomy in Building Environments", an inclusive housing process that allows people of low economic status to guide the design and implementation of their housing process, will prove more logical than to allow persons who are developers or law makers capacity to do so, this he explains will create a better social housing response. As it now stands most solutions for low income housing has not been able to equal the situation of those in that economic level, resulting in the houses still being outside of the grasp of persons below the poverty line. In a paraphrased version of Turner`s proclaimed second law of housing, John Turner (1977) stated, "The important thing about a house is what it does in the life of the dwellers rather than what it physically is." The need for homeownership has been one of the greatest means of satisfying the emotion of belonging and contentment. Along with Turner (1977), Karamujic (2015), in his Chapter, "Why is Housing Important?" supports the critical need for housing when he suggests "being able to access sufficient housing for a long time has expressly been established as a basic human right, which is paramount for the enjoyment of other economic, social and cultural rights of all peoples."

Notwithstanding the vast support for this need, providing an adequate housing supply in urban areas has been a serious challenge for governments and potential homeowners globally, an issue that has been attributed to the rural to urban migration influx. The second United Nations Conference on Human Settlements (Habitat II), which was held in 1996 at Istanbul, Turkey, identified the lack of adequate housing as one of the most pressing challenges facing humanity. The World Health Organizations went further by noting that there is an association between inadequate housing and health, crime and social unrest (WHO 2011). This situation is often referred to as the characterization of Squatter Communities.

A normally overpopulated urban community which is plagued by unemployment, a result of the large percentage of in migration at times impedes the master plans for many developing countries. Rural to urban migration has been the move for income generating solutions for many of the earth's population, especially the poorer classes of people. Squatting in urban areas reflects the growth in population that derives from in-migration, better quality of life (QOL) being the focus (Freidmann 1996; Taher and Ibrahim 2014). The lack of adequate, secure and affordable housing in these urban spaces has been impacting millions worldwide. This inadequacy has been the impetus in the rising number of informal and/or squatter housing developments in urban areas globally. Squatting can be briefly defined as the illegal occupation

of land and or buildings (Srinivas 2015), for commercial, residential and agricultural reasons not limited to public but also privately-owned lands.

According to Jamaica's draft housing policy, the island is facing a similar housing crisis, however there are several strategies being employed to tackle the affordable housing crisis, such as building public housing on public land, or of expropriating private land for social housing, some of which had minor successes. This limited success is a result of most housing needs evolving from the lower economic group. Although, for the past 30 years state agencies have implemented housing sector strategies and policies, only a fraction of the housing requirement has been satisfied (PIOJ 2011), a representation of the scarce resources and an unwillingness for partnerships between the government of Jamaica (GOJ) and private entities. Basically, the private sector with the greater financial resources is unwilling to absorb the risks associated with financing of residential properties for the construction of low- and middle-income housing. This grave underperformance in the housing sector has provided added boost to the informal (provides approximately 27.2% of the housing stock STATIN 2011) and squatter housing sectors in Jamaica, filling a most urgent need, and doing so not without ramifications to national spatial planning and the environment.

While the housing needs are being catered to using permanent homeownership, there is also the rental market that captures a major percentage of the housing need. This rental market is not only limited to the formal sector but is supported by the Informal and squatter housing sectors. As a result of these initiatives the research sought to determine what the current governance situation of squatting is and whether it will have solution-based responses to the problem of squatting in the PA. Also, provide the supporting evidence for calculating the pressures that such growth in the informal housing sector would have on the PA environment.

2.3 Squatting in Jamaica

Jamaica is a small island state in the Caribbean located between the countries of Cuba and Hispaniola (Haiti and Dominican Republic). The island is said to be surrounded by the warm waters of the Caribbean Sea and is located in the Tropics at approximately latitude 18ºN and longitude 77ºW, which is about 4.5 degrees south of the Tropic of Cancer or about midway between the southern tip of Florida and the Panama Canal (Figure 2-1).

It is the largest English-speaking country in the Caribbean and the 3rd largest in the Western Hemisphere, behind the United States and Canada. Jamaica`s climate experiences year-round temperatures of 30 degrees Celsius, which classifies it as a warm humid or tropical

climate. The population is approximately 2,889,187 and has a size of 10,831 Km^2. Jamaica is divided into 14 parishes, 3 counties and has two (2) major cities Kingston in the East and Montego-Bay in the North West. The island has 67% of its population in its mostly coastal urban communities, with 24% in the capital Kingston.

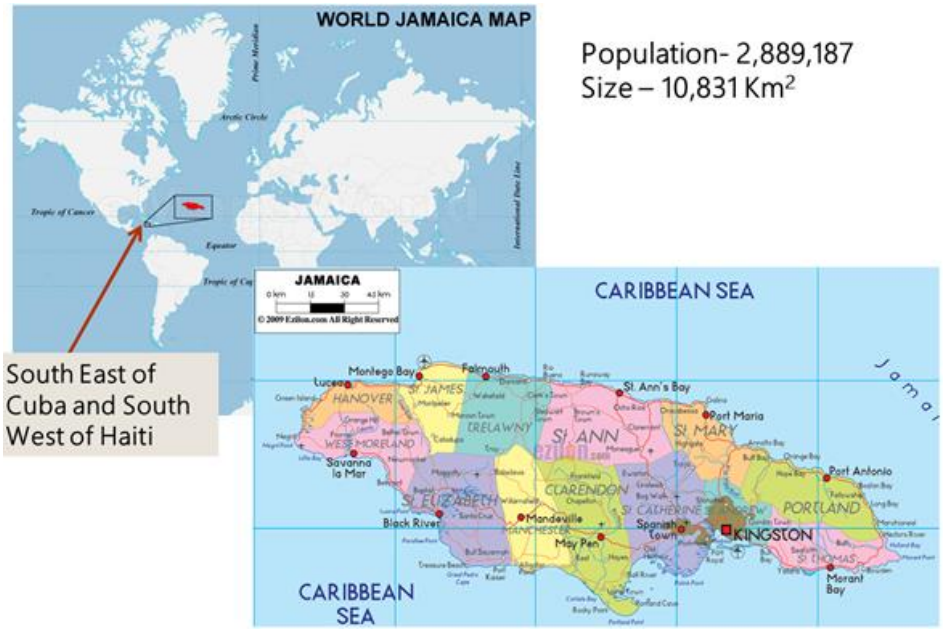

Figure 2-1 Location Map of Jamaica (Source: http://www.emapsworld.com/jamaica-location-map.html)

The Jamaican Housing sector akin many other countries face challenges with providing enough housing for its citizens and tenure security for its even poorer citizens. Jamaica has a significant number of its population living in squatter communities as result of high levels of poverty in rural areas, the impetus for rural/urban migration, leading to rapid urban growth, from 34% in 1960 to 54% in 2011 (STATIN 2011). This rapid unplanned growth resulted in an urban housing shortage (an inability to meet the demands on the supply), also the inability of these urban areas to provide adequate job opportunities, which created high levels of unemployment among these new migrants, resulting in low economic conditions and the ever pressing affordable housing crisis.

According to the Economic Social Survey for Jamaica 2015 (PIOJ 2015), a need exists for a minimum of 15,000 housing units annually, however through national, private and informal efforts only 11,190 units were being produced, suggesting a shortfall of 3810 units, majority of which exceeds the financial potential of the indigent. This situation is cause for greater concern with 19.9% of the population being below the poverty line (World Bank, Global Poverty Working Group 2016). This statistic reiterates the important role that squatting

and other informal housing solutions played in filling the housing needs of the lower economic groups, this modus operandi has been more than a necessity and has been key to solving some of the housing need.

According to Jamaica`s UN Habitat report (2016), "the act of Squatting is one of the major debilitating urban issues identified in Jamaica`s Vision 2030 plan that relates to the major urban areas and providing an understanding that if the current trajectory is allowed to continue may result in an impediment to attaining some of the VISION 2030 goals, which is attributed to the fact that most of the commercial, administrative and financial functions of the country occur in urban parish capitals."

Jamaica's squatter situation can be attributed to the colonial period, where lands were allocated to the minority of the population such as plantation owners or African farmers (Tindigarukayo 2017), and slaves were freed without being given any land holdings. As previously stated, following this trend was the rural to urban migration associated with Jamaica`s independence in 1962, where rapid urban growth took place increasing the urban population from 34% to 54 % in 2011 (STATIN 2011).

Further, the phenomenon was influenced by a political impetus as some of these low income areas have large voting numbers and became attractive to Jamaica`s two (2) major political parties, Jamaica Labour Party (JLP) and People`s National Party (PNP) who may provide political support (Sutherland 1978), also to ensure their survival squatter settlements align themselves to a political party, especially during elections (Tindigarukayo 2002). This alliance assisted in creating a growing urban squatter community, however, so did a growing Tourism Industry.

As previously stated, in recent times, significant increases in the occurrence of squatting in urban areas are as a result of the rural to urban migration phenomena (Friedmann 1996). For Jamaica, this push comes from development in the tourism sector; this development lures people to tourist towns to search for employment, which is sometimes available, however the cost for housing in these locations far exceeds the earning capacity of the individuals and contributes to the act of squatting.

Tourism being Jamaica's largest foreign exchange earner and second largest employer has great influence on the socio- economic status of Jamaicans. According to the National Land Policy of Jamaica (1997), the consistent growth in the tourism industry (Table 2-2), including Negril Area of Westmoreland, Jamaica (one of the study areas), has resulted in insufficient

affordable housing. This growth has also impacted land costs, housing rentals and housing costs, within the tourism spaces, creating increases way above the limits of squatters (Brooks 2016).

Table 2-2 Population by Parish with Major Centres of Tourism Activity; 1982-2011, Jamaica Population Census. (Source: Brooks, S. 2016)

Parish - tourism town	1982	1991	2001	2011	Growth rate (%)
Portland - Port Antonio	73,656	76,067	80,205	81,730	1
St. Ann - Ocho Rios	137,745	149,015	166,762	172,284	14.50
St. James- Montego Bay	135,959	156,152	175,127	183,719	10.22
Westmoreland - Negril	120,622	128,213	138,947	144,075	9.30
St Elizabeth - Santa Cruz	139897	144,118	146,404	150,199	1.86

Internationally and locally there is some level of attractiveness associated with being obligation free from rent and other burdens associated with the formal housing sector, promulgate squatter settlements as ideal locations for housing (Taher and Ibrahim 2014).

Currently, according to the RAPSJ (2008), there are 754 squatter settlements whose population represents an approximate 20% of the total national population residing in urban and rural squatter communities throughout the island. These settlements are mainly located on government lands, representing 76% of the total squatter population. Squatter settlements are of three main types: agricultural, commercial, and residential, with the majority being residential; 82% are in urban areas. The settlements vary in size from 10 units to 1,000 units per site, accommodating more than 100,000 households (RAPSJ, 2008); a reclassification exercise that has been undertaken by the Squatter Environment Management Unit (SEMU) is on the way and preliminary results suggests that the number of settlements that are considered squatting may be reduced or reclassified.

It is evident from the background that the current governance system has implications for the PA with this continued growth.

2.3.1 Housing Quality Description in Jamaica

The emergence of the alarming number of people expected to be dwelling in slum (over 200,000 slums) like conditions by the United Nations, at 3 billion persons by 2050, is of critical concern. These same individuals are living in degrading conditions, lacking quality housing and proper living environmental conditions (UN Habitat 2007). According to Vision 2030 Jamaica, in 2008 the construction sector that has residential construction (housing) being a major sector, represented $41.8 billion in constant dollars, and accounted for 8.3% of total GDP (considers goods and services). In consideration for the building codes in Jamaica, durability of the housing for withstanding the elements of weather and for creating greater security for occupants is paramount. This requires the use of block and reinforced steel construction in majority of housing units, designed to set standards (Figure 2-2).

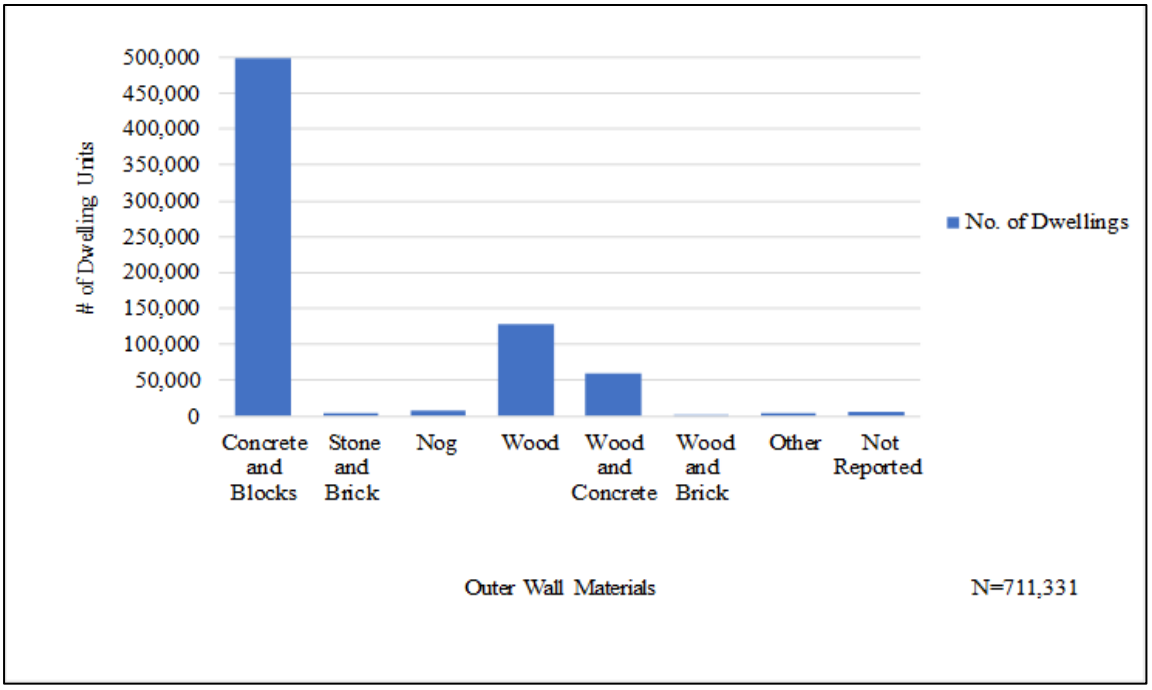

Figure 2-2 Number of Housing Units by Material of Outer Walls in Jamaica. Source: STATIN 2011

Although in the past the right to housing was a catalyst of a growing population country wide and in urban areas, with the rise in homelessness and social exclusion of the accommodation to contribute to better quality of life (Terminski 2011). Jamaica`s housing quality index (HQI) reveals that there are still limitations in providing quality housing, although some increase from 67.2% in 2002 to 70.6% in 2006 for urban areas, and from 55.5% to 60.1% in rural areas, there is still a significant number of persons living in less suitable accommodations, earning less than sufficient income (salaries ranges from $125 USD to $280

USD monthly, averaging $240 USD per month) to make significant changes. Figure 2-3 outlines typically the kind of housing materials that are being utilized by the populations in the squatter income levels locally.

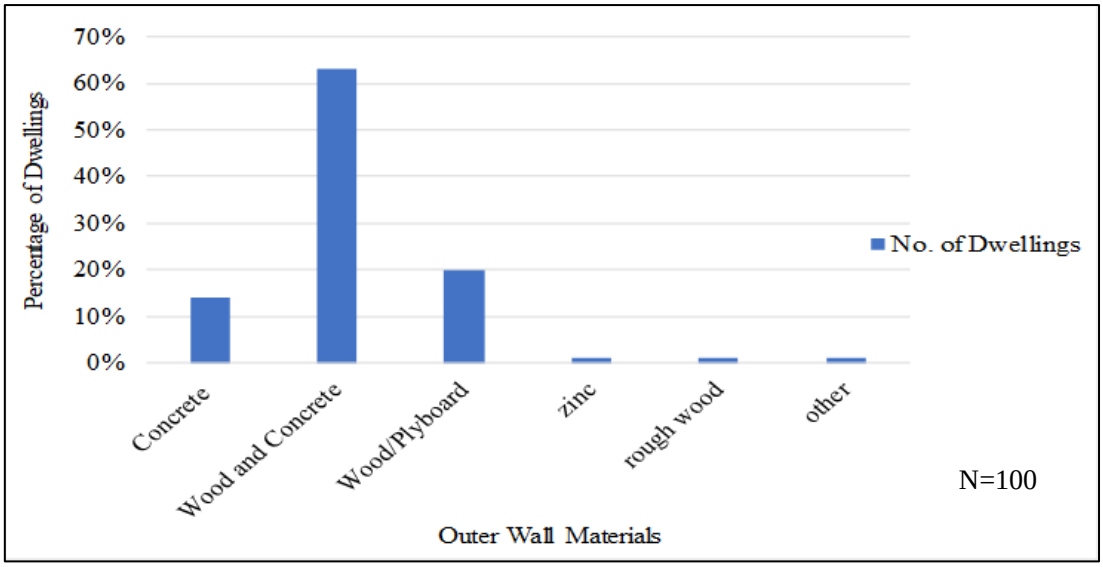

Figure 2-3 Percentage of Housing Units by Materials of Outer Walls Surveyed in Squatter Settlements in Jamaica. Source: RAPSJ 2008

Although Figure 2-3 has the larger percentage of housing using wood and concrete, the majority of Jamaica`s squatter settlements are characterized using timber material in housing construction. The image in Figure 2-4 below is a representation of some the housing design and type in these areas.

Figure 2-4 Typical Timber Houses in a Squatter Settlement or Informal Settlement in Jamaica. Source: Fieldwork 2017

2.3.2 Previous Strategies to Combat Squatting in Jamaica

Although there is a Squatter Environment Management Unit (SEMU) established, there is no legislative policy for the management of squatting, it is administered by way of procedural guidelines and a monitoring system. According to Tindigarukayo (2017), the Jamaican government has employed four main strategies for addressing this problem, which are:

i) Slum Clearance – includes the reconstruction of dilapidated and overpopulated units. This activity after completion requires the occupants to then rent the updated units, placing them into a financial situation that they already have difficulties with, hence a continued cycle.

ii) Reduction of Rural-Urban Migration (Relocation 2000 project) – This method considered providing housing options in the rural areas, however, the issue of poverty persisted, and new housing could not minimize the rural to urban migration influx, resulting in a continued problem.

iii) Assisted Self-Help Housing – This was the major programme directed at reduction of squatter and informal settlements. However, this was marred by corruption, nepotism, property values grew outside the reach of the target group due to infrastructure improvements and funding limitations.

iv) Eviction – This came in the form of demolition of housing units regardless of the demographic, therefore both children and the elderly were met with the same form of treatment.

In Jamaica, the capturing (local term used for squatting) of land, occurs on privately owned and government owned lands in the form of residential, commercial and agricultural squatting. Although, several approaches to stem the problem of squatting have been implemented (Table 2-3), including the establishment of the previously mentioned SEMU, the issue persists because of a lack of settlement policy and an obviously non-existent squatter management policy. Because of the nature of this activity, squatting has the potential to exist anywhere and in different forms, therefore it is prudent that a policy framework is developed to address this phenomenon.

Table 2-3 Major Urban Renewal Programmes by Government of Jamaica since 1994.
(Source: Mullings et al. 2018)

No.	Programme	Year	Funder	Objectives
1	Programme for Resettlement and Integrated Development Enterprise [Operation PRIDE]	1994	Government of Jamaica	Reduce squatting and improve shelter provisions while empowering persons to relocate legally into organized communities
2	Jamaica Urban Poverty Project	1997–2000	World Habitat, UK	Poverty alleviation through training, infrastructure improvement and maintenance, housing restoration and construction
3	Inner-City Renewal Programme	2000–2005	GOJ	Improvements in physical and social infrastructure; reduction in crime and violence and stimulation of economic and employment opportunities
4	Inner City Basic Services for the Poor Project [ICBSP]	2006–2013	International Bank for Reconstruction and Development [IBRD]/The World Bank/GOJ	Improve quality of life in 12 Jamaican inner-city areas and poor urban informal settlements through improved access to basic urban infrastructure, financial services, land tenure regularization, enhanced community capacity and improvements in public safety
5	United Nations Habitat Participatory Slum Upgrading Programme [PSUP]	2008	European Commission	Improve living conditions of the urban poor; strengthen capacity of local, central and regional institutions and key stakeholders' in settlement and slum improvement
6	Kingston Urban Renewal Programme [KURP]	2009–2010	GOJ/Inter-American Development Bank [IDB]	Infrastructural and social intervention initiative, including income-generating activities
7	Community Renewal Programme [CRP]	2013–2014	GOJ/International Development Partners	Project aimed at improving community empowerment, housing, sanitation and waste disposal, economic opportunity, recreation, dispute resolution and crime
8	Integrated Community Development Project [ICDP]	2014–2020	The World Bank	Provision of basic infrastructure and social services in 18 communities island wide
9	Poverty Reduction Programme [PRP]	2014–2018	European Union/ GOJ	Support the governance, physical transformation, socio-economic development, and youth development components of the CRP
10	Expansion of the downtown Kingston Urban Renewal project	2016	People's Republic of China/GOJ	Expansion of development area, rejuvenation of Downtown Kingston to promote investments in the capital city

In the 2030 Vision there are five (5) key outputs under the PSUP Phase 2 that will be crucial to addressing Squatting in Jamaica, they are:

a) Policy Review for Slum Upgrading and Prevention;
b) Citywide Slum Situation Analysis

c) Citywide Slum Upgrading and Prevention Strategy
d) Resource Mobilisation (and Financing) Strategy
e) Concept Note for a pilot slum upgrading project

2.4 Protected Areas (PA) and State of the Environment

The incorporation of PA as a tool to minimize human activity and to increase the population of specific species of animals and other wildlife, though controversial is not a recent phenomenon, but has been implemented in some countries in very subtle ways throughout history and is considered one of the best tools for the preservation and conservation of the natural environment, as a response to human influences (Possingham et al. 2006).

Jamaica`s need to adapt this method of environmental protection is reinforced by the fact that Jamaica lies in the direct path of Atlantic hurricanes and tropical storms, has areas prone to flooding, earthquake and landslides, in addition as a small island developing state (SIDS), it is particularly susceptible to climate change, and considering the disaster risks from the increasing frequency and intensity of hurricanes and tropical storms this pose grave concerns. According to Dr Winsome Townsend (2017), "Between the years 2001 to 2012, Jamaica experienced 11 storm events (including five major hurricanes) and several floods resulting in loss and damage amounting to about $128.54 billion (Jamaican Dollars)."

According to Jamaica`s NEGAR (2009), "the Island has made a commitment to devising an ecologically representative network of protected areas structured to ensure minimum 10% of the Jamaica's remaining naturally occurring terrestrial, aquatic and marine flora and fauna are conserved." As a result of its inclusion in the classification of biodiversity hotspots areas, Jamaica's PA system plays an integral role in the total global biodiversity. There are some 350 protected areas (Figure 2-5) within the Jamaican territory covering marine, terrestrial and other biodiversity, with terrestrial protected areas having an aggregate total of approximately 200,000 ha or 18% of Jamaica's total land area and the marine protected areas a total 180,000 ha or approximately 15% of the country's archipelagic waters (and 1.1% of Jamaica's total marine area), additionally 75% of marine and national parks have management or zoning plans.

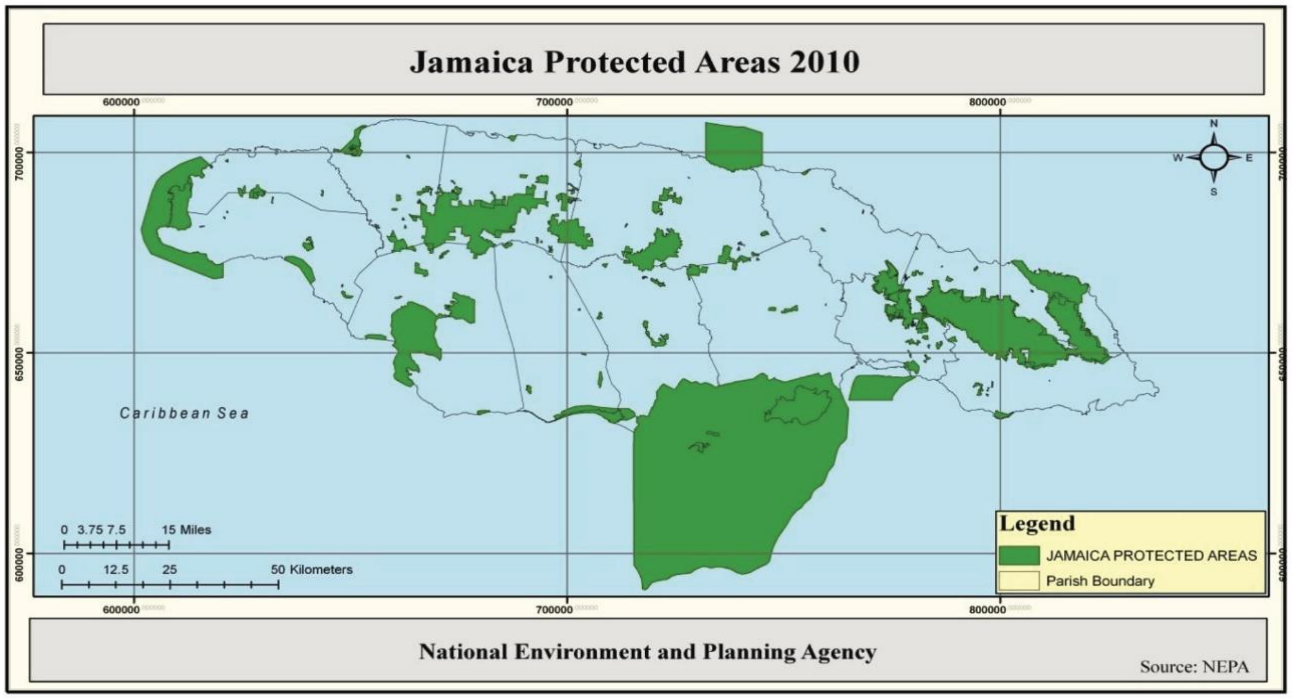

Figure 2-5 Map of Protected Areas (PA) in Jamaica. Source: State of the Environment Report NEPA 2010

Consequent of the severity of threat levels to the local ecosystems; there have been conservation targets considered under the criteria of endemism, threat levels, ecological representativeness and vulnerability. As a result, 13 conservation targets were identified for the marine ecosystem plan identified, 55 for the terrestrial and finally 22 for the freshwater plan. This was also necessitated because of as per the National Environment and Planning Agency in Jamaica (NEPA 2010), there were approximately 206 Biodiversity species threatened or endangered. The anthropogenic threats faced by the PA ranges from pollution, habitat loss and degradation, climate change, lack of law enforcement, invasive alien species among others (Table 2-4), this information necessitates the need to calculate the impact a squatter location has on the PA.

Additionally, the State of the Environment report (SOE) Jamaica (1997) indicated that approximately 104.3 m3 of underground water must be abandoned each year as a result of contamination by human activity. This is disconcerting as most of the country`s water supply, approximately 92% is accumulated from groundwater supplies such as springs and water in wells and this supports all sectors of possible use agriculture, domestic, industrial and tourism.

Table 2-4: Major Threats to Marine, Freshwater and Terrestrial Biodiversity in Jamaica. Source: NEGAR 2009

Marine Threats	Freshwater Threats	Terrestrial Threats
Coastal Development	Nutrient Loading	Mining
Land run-off	Invasive species	Invasive Species
Overfishing	Deforestation and removal of riparian vegetation	Unsustainable use of resources e.g. Deforestation
Solid waste pollution	Unsustainable harvesting of freshwater biodiversity	Poor land use planning

There are four (4) major ways identified that the groundwater resources have been contaminated:

1) Saline Contamination – from poor well designs and coastal aquifers being over utilized below stated safe limits.
2) Caustic Soda Contamination – which is the waste product resulting from the mining process at the bauxite/alumina industry; these are discarded in ponds in limestone terrains that eventually seep into the ground water.
3) Nitrate Contamination – associated with the usage of soil base sewage containment systems, such as absorption and soak-away pits. This system is widely utilized in Jamaica.
4) Organic & Bacteriological Contamination – outside of the other environmental degradation impacts of the sugar industry such as the intensive use of water, chemical use and destruction of wetlands, the organic & bacteriological contamination that occurs through the disposal of the waste product referred to as Dunder in the sugar and rum manufacturing industry by way of karstic water supplies has implications for the underground water supply.

2.4.1 State of Marine PA in Jamaica

According to a study done through the aid of the World Resources Institute for the period 1996-2005, some marine PA has experienced approximately 6 meters of coastal erosion (especially the Negril Area that is the location of the first PA under review), a factor attributed to the reef degradation that now persists due to human activity, including the effects of the squatter settlements in those areas. Issues such as land conversion resulting from fires used for

clearing lands for farming and housing and other domestic activities inclusive of laundry, which uses highly polluting detergents, has had perverse effects on the Marine ecosystems, especially coral reefs. Additionally, other PA experiences threats such as water pollution, loss of mangroves and other vegetation, threats to nursery habitats and solid waste pile up.

Jamaica`s coral reefs have been experiencing severe loss for some time, this impacts beaches and marine wildlife. Most reef systems have evidence of a domination by nutrient indicating algae in the island`s total composition of reefs with coverage ranging between 0% and 62.9% and average of 24.20% (NEPA 2008). The overgrowth of algae on corals due to anthropogenic threats has impacted the fish population (Figure 2-6).

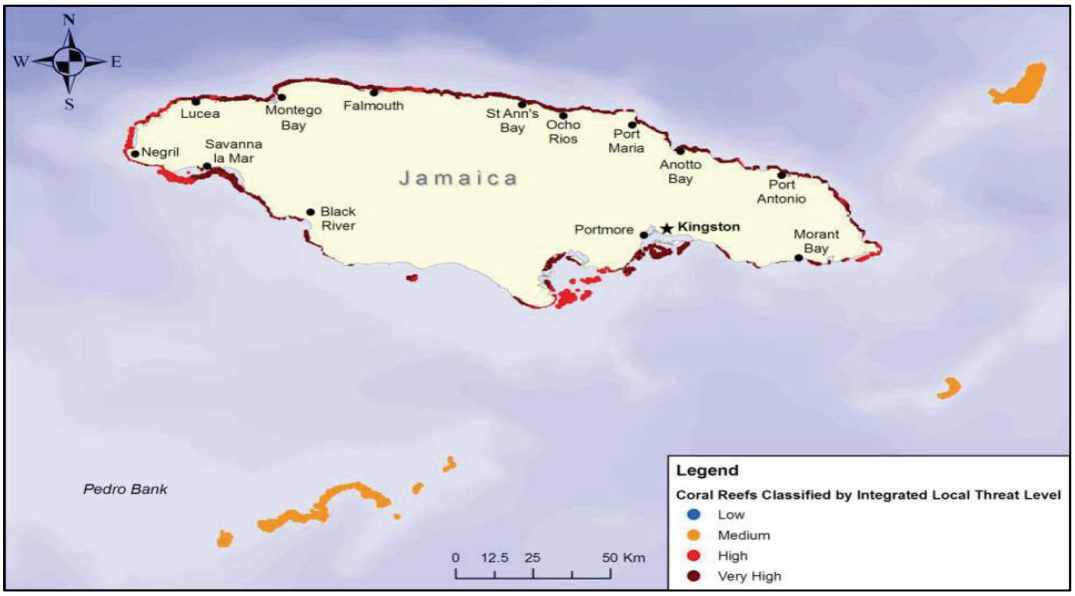

Figure 2-6 Map showing threats to Jamaica`s Reefs. Source: Reefs Revisited World Resources Institute (WRI) Burke et al. 2011

According to NEPA`s report on the state of the environment in 2008, there has been a steady decline in fish population on the country`s reef systems, this can be attributed to inefficient fishing practices (overfishing), destructive fishing methods and natural causes (hurricanes). The implications of these threats mean a total reduction of the national amount of live coral cover to 14.79%, less than that of the entire Caribbean which is 20%.

1.5.1.1 Cost Implications to Marine Ecosystems

Up to 2002, Jamaica`s national accounts did not reflect a monetary value that would indicate the economic losses resulting from environmental degradation to resources such as soil, watershed areas, marine ecosystems and forests. However, such degradation associated to

Marine ecosystems more recently have been studied and suggests there are great economic implications. Further, the heavy reliance of the Tourism sector one of Jamaica`s four (4) major industries, on our natural resources emphasizes the need to tactically realign the country`s resources to manage the environment in order to navigate the risks from the sector and the population growth that accompanies this activity to ensure sustainability as indicated by the Jamaica National Environmental Action Plan [JaNEAP] (1999 – 2002).

There are severe cost implications to a country`s economy that is heavily dependent on its marine habitat, for Jamaica this is especially the case, whose majority of coral reefs are classified as at very high risk of being destroyed (Reefs Revisited WRI, Burke et al. 2011). This marine habitat supports the livelihood of more than 100,000 people and has the potential for US$23 million of income earned from vacationers traditionally drawn to local beaches being reduced. Figure 2-7 below outlines the current coastal risks and the cost implications of those. For the area known as Negril, this represents 1 of the main locations that will be studied in this paper, the threat is more severe.

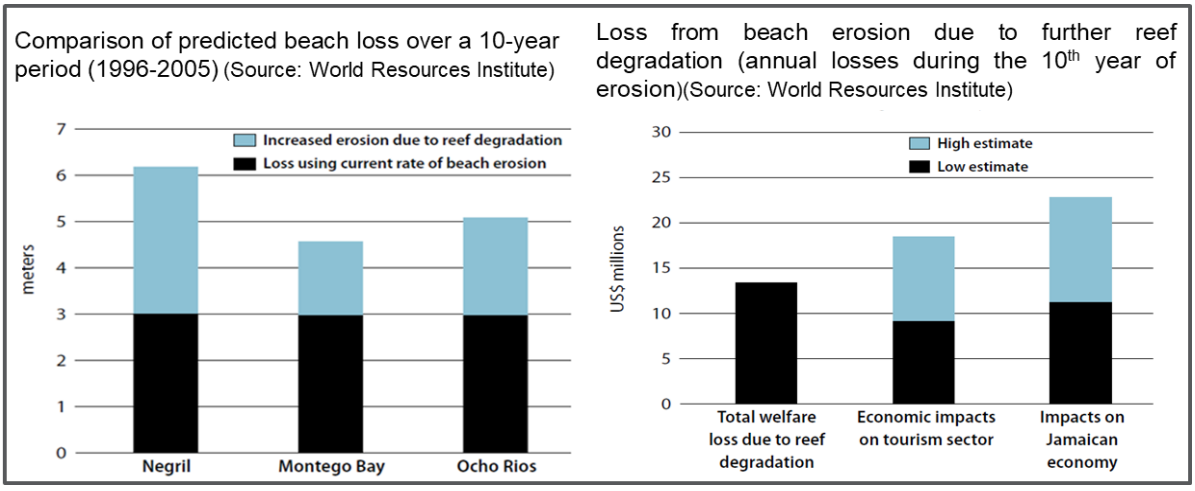

Figure 2-7 Predicted beach loss and economic loss from beach erosion over a 10-year period (Source: Reefs Revisited WRI, Burke et al. 2011)

Additionally, there are implications for the fisheries sector of the Jamaican economy that has reported losses from US$65.8 million in 1995 to US$34.3 million in 2005 (Burke et al. 2011). Further the local fishermen have indicated noticing a significant loss of the fish population over the years. It is being further reiterated that Jamaica's reefs are at risk from overfishing, coastal development, watershed-based pollution, and marine-based pollution. (Reefs Revisited WRI Burke et al. 2011).

2.4.2 State of Terrestrial PA in Jamaica

The island has approximately 32 % of Forest cover, in mostly difficult to access areas with rough terrains such as the now World Heritage Site the Blue and Johncrow Mountains and the Cockpit Country, with dry, hilly uplands of poor soils in the southern, western and north-western parts of Jamaica. Presently, it is comparable to other countries such as Japan, with only a few areas of Primary forests remaining, with mostly compromised secondary forests and woodland growth existing.

One of the major problems associated with Jamaica`s Terrestrial ecosystem is the matter of deforestation that exists in the form of clearing vulnerable and steep slopes for use in agriculture as a form of livelihood and for housing in illegal settlements. Although this practice is evident, not much of the land is accessible due to its difficult forest terrain, as a result, the people focus on easily accessible mangrove forests. The most common uses of the timber from these forests are for fuel, such as charcoal, sticks used for specific agricultural foods and boundary fence, as a result there is considerable damage to the environment, and most importantly the watershed areas.

For some nationally protected terrestrial areas, they experience the greatest rate of deforestation across the island, ranging from -1.16% to -0.02% annually (Forestry Department 2017) to support farming and housing needs. Additionally, the 1997 State of the Environment (SOE) report indicated that an annual rate of 10000 hectares of forests have been degraded as a result of deforestation occurring from poor agricultural practices, concomitantly, the approximately 80 million tons of topsoil that is removed each year by these practices.

Regarding the critical water resources, there are a total of 26 Watershed Management locations that has 17 that are now ranked as critical, as a result of pollution, requiring interventions in the form of remedial work to get these resources back to an adequate state of health (JaNEAP 2002). As critical as water is to preserving life, is the critical importance of preserving such crucial entities to the country`s water supply both for its availability and quality.

2.5 Governance of Squatting and Protected Areas in Jamaica

Although having a long history of self-help housing initiatives, previous research done by Dr Tindigarukayo has identified a significant deficit in the management of squatting in Jamaica, in the form of a lack of an effective squatter policy. Beyond the fact that there is no policy itself for squatting, according to Tindigarukayo (2014), “realizing the cost of having

squatter settlements (economically, health wise, environmentally, etc) it would be wise for the government of Jamaica to establish an effective policy to specifically redress the squatter problem in Jamaica." This research analysis of the current governance system sought to confirm this information as a basis to determine implications of the governance system.

Notwithstanding, a policy direction alone will not solve the issue, if there is not community involvement and proper resettlement instead of relocation plans. This fact is further reiterated by Tindigarukayo (2014), "There needs to be good relations between squatter communities and government agents for any government policy/program to be successful." He further encourages the need for Government agencies to utilize a public-spirited approach to the issues faced by squatters. Further, the fact that there is not a social housing plan in Jamaica provides a breeding ground for squatting, hence the need for government policies for housing and national development to be more inclusive, which will lessen the need for intervention of the magnitude that currently exists.

Several cases locally strengthen the need for community inclusion and proper plans, as they are relocated from their homes without the proper social orientation and proximity to job opportunities, creating added economical burdens, resulting in the squatters returning to their previous homes, albeit located in a vulnerable area, a trend in other such plans prove a futile feat at best. The most recent approach to addressing squatting came in the Governor General of Jamaica, Sir Patrick Allen`s Throne Speech (2019), in which he described a re-energized targeted focus to minimize the effects of squatting in social, environmental and other associated problems. This move will now employ a multi-dimensional look at acquiring relevant squatting data in the country.

2.5.1 Governance Structure for Squatting

In this research Governance can be defined in the PA context as "a set of processes, procedures, resources, institutions and actors that determine how decisions are made and implemented" Giessen and Buttoud (2014). The Ministry of Economic Growth and Job Creation, with its SEMU has the overarching responsibility for Squatting in Jamaica, refer to Figure 2-8 below for the diagram of same.

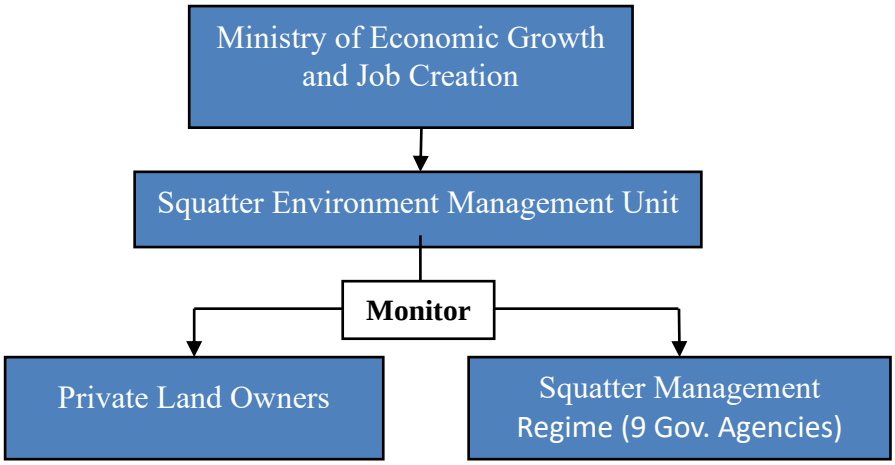

Figure 2-8 Simple Representation of the Governance Structure for Squatting in Jamaica.

Source: Fieldwork 2017

The SEMU is tasked with three (3) main areas of responsibility related to squatting:

- Ongoing assessment of squatting to advise on the relocation, eviction or regularization of squatter settlements.
- Containment of settlements to prevent expansion
- Sourcing of local and international funding to improve the low-income housing stock

Although charged with these responsibilities, the Unit is not empowered in law to serve notices, carry out evictions, demolitions and such enforcement activities. Further, it is a repository of information on squatting locally and is frequently called upon to share information from a wide array of stakeholders including both private and public landowners for advice on squatting related issues. It is the responsibility of the landowner to pursue enforcement activities regarding illegal occupation of their property. Notwithstanding the extensive quandary, the Unit is expected to function on a budget of JMD $25 million annually.

The existing Regulatory Framework for Squatting is predominantly as described below:

- No Squatter Policy
- National Land Policy of 1996 sought to reduce squatting by eviction, relocation, regularization and upgrading where necessary.
- Programmes such as Relocation 2000 & Operation Pride tried to provide subsidized housing.
- Creation of an unpopulated national geo-database on squatting which was designed in 2014.

- Squatter Monitoring Guidelines that outlines an approach to dealing with squatting, which is basically a reporting situation.
- Classification of Squatting into a Three (3) Tiered Model, based on physical features, infrastructure, zoning violations etc. to guide treatment of the locations. The use of Monitoring Officers in some regions of the island.

2.5.2 Governance of Protected Areas

The PA in Jamaica is under several legislative instruments that are headed by the Natural Resources Conservation Authority Act (NRCA), which in 1996 became the main Legislature for PA and Reserves. In addition, there are some 13 policies and action plan that are relevant to PA, further there are another 14 legislative instruments that directly govern protected areas and finally 20 other that concerns protected areas (McCalla, 2004 pp 18-22).The following are the Lead Agencies with oversight responsibility for protecting the environment:

- Forestry Department
- Fisheries Division
- Jamaica National Heritage Trust
- National Environment and Planning Agency

There are several supporting agencies and NGO`s that along with the Lead Agencies forms the Protected Area Committee (PAC) that is currently drafting the Protected Areas System Master Plan (PASMP), which will be responsible for the direction and strategies to ensure the sustainability of the PA, to include:

- Ministry of Finance and Planning, Institute of Jamaica
- Scientific Authority, Convention on International Trade in Endangered
- Species of Wild Fauna and Flora (CITES), Jamaica
- Planning Institute of Jamaica
- National Protected Areas Trust Fund
- The Nature Conservancy, CBD and biodiversity expert
- One NGO responsible for managing a protected area - to be rotated every 2 years, one Local Forest Management Committee (LFMC) - to be rotated every 2 years and one representative of the Special Fisheries Conservation Area Network – to be rotated every 2 years

2.5.3 Protected Areas and Squatting in Jamaica

Since 1950, with the increasing threats to the environment, the National Environment and Planning Agency (NEPA), adapted the use of PA as a tool to combat the issues impacting the natural environment, beginning with the forest reserves of the Blue Mountains (Clydesdale and Hardware Gap) and continued some years later with the establishment of a Marine Park in Montego Bay in 1991. According to the RAPSJ (2008), Jamaica has approximately 37% of the total number of squatter communities being in environmentally sensitive zones such as, forest reserves, protected areas, key biodiversity areas, bauxite reserves and watersheds (Figure 2-9).

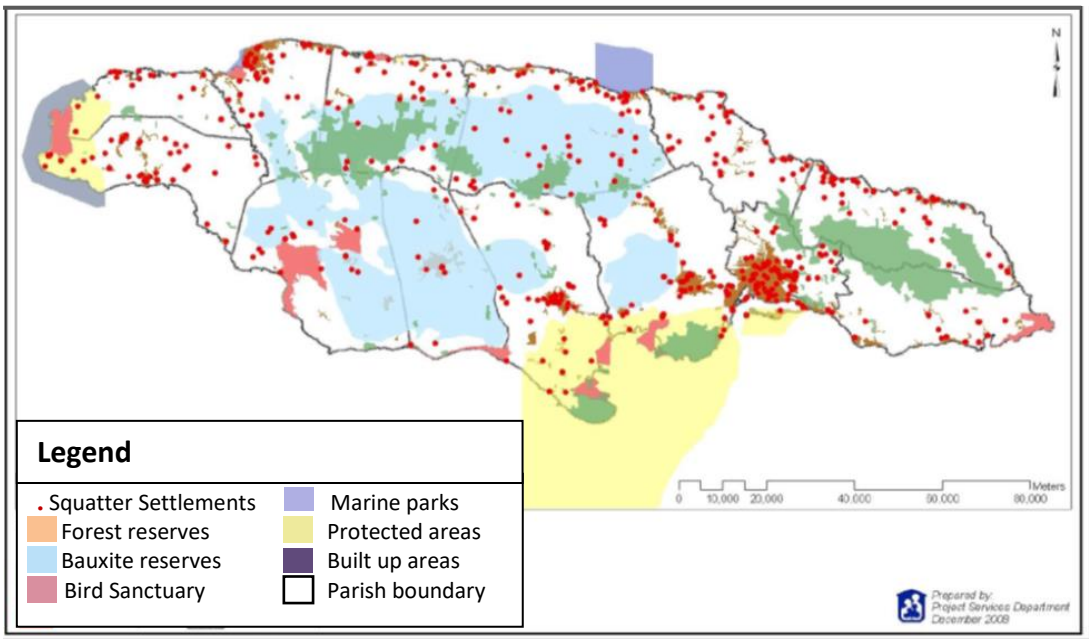

Figure 2-9 Distribution of Squatter Settlements in relation to natural resources and PA. Source: RASPJ 2008

The PA being impacted by squatting is not limited to environmentally sensitive zones, but is also protected natural and manmade cultural heritage, such as the first location in Jamaica visited by Christopher Columbus now a National Heritage site and other physical structures. The fact that squatting has the potential to exist anywhere increases the risks to environmentally sensitive areas, such as protected areas and is exponential. This risk is further complicated by the fact that PA governance policies are not being enforced, resources are limited inhibiting the kind of intervention necessary in some areas, in addition the political affiliations has strong presence (Alsayyad 1993). There is not much application of local community involvement, and resident perception of the need for environmental protection is unimportant when compared to

daily needs. Consequent to the fact that "daily life of informal residents" traverses' uneven development: inadequate roads, water supply, storm drainage, electricity, and sewage infrastructures (Goffe 2017), the ramifications for the sensitive ecological areas are exponential.

According to NEPA, "the Protected Areas System Master Plan (PASMP) being drafted in 2012 represents a set of strategic guidelines for establishing and managing a comprehensive network of protected areas that supports national development by contributing to long-term ecological viability; maintaining ecological processes and systems; and protecting the country's natural and cultural heritage." The four principal government agencies with oversight responsibility are the National Environment and Planning Agency (NEPA), Forestry Department, Jamaica National Heritage Trust and Fisheries Division. These agencies has the authority to delegate authority to local partners, other government entities, NGO's and/or the private sector, hence four (4) types of governance methods adapted (governance by Government, shared governance (by Government and NGO`s), Governance by Private Sector and Governance by Community or Indigenous people), this is the current oversight application that is creating the direction for these areas.

Notwithstanding, the ability to police the PA, which would allow them to fulfil their objective, the growth in squatter settlements and other human influences has limited the impact that is expected in some areas. Additionally, delays in implementation of several key policies and master plans, has created space for activities such as squatting in all its forms.

2.6 Research Area

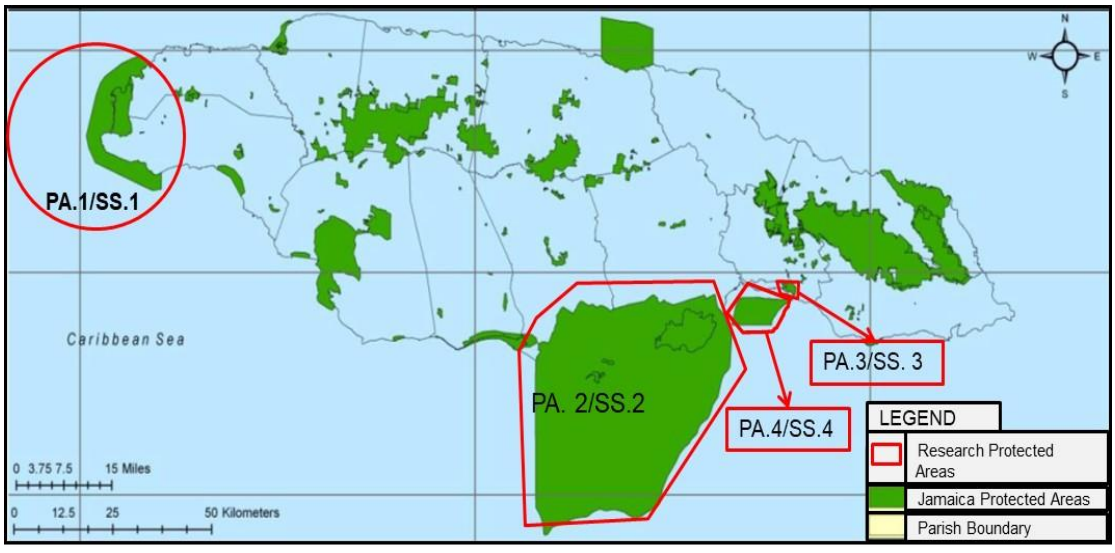

Figure 2-10 Map identifying Jamaica`s PA in relation to study areas. Source: Author & NEPA 2008

The research was conducted in 4 squatter communities located in urban or peri-urban areas within proximity of 4 PA or environmentally sensitive areas (Marine & Terrestrial) in 3 parishes over the Island (Figure 2-10). For the analysis of the data the sites were assessed in the two (2) major environment types marine and terrestrial, also whether they were declared before or after the squatter communities were established. Each PA and squatter settlement were assigned a code using the abbreviations PA and SS (Table 2-3), along with numbers from 1 to 4. PA.1 and PA.4 (referred hence forth as Marine areas) consists of wetlands and coastal habitats, while the PA.2 and PA.3 are Terrestrial habitats and will be classified as such, with PA.2 (dry forest) being one of the perceived homes to the Jamaican Hutia also known as the Jamaican Coney, a mammal that is now placed on the IUCN Red List as vulnerable. Table 2-5 also presents a brief description of the background for each settlement, age and other demographic data, with the settlements ranging from as recent as 10 years ago to as late as 55 years ago. The information also features the fact that the settlements evolved from the major reasons explored initially for the development of squatter settlements to include politics, tourism industry and generational decedents from the early days.

Table 2-5: Summary of Background Information on Study Areas. Source: Research Fieldwork 2017

2.6.1. Infrastructure

PA Zone	Squatter Settlement (SS)	Name	Age (years)	Background to Location & Development Causes
PA 1 Negril Great Morass and Coastal Areas (Negril Marine Park) (**Marine)**	SS. 1	Nonpareil (Westmoreland)	46	Approximate Population: 1320. Impetus is the Tourism industry through employment. Also, jobs are low income, in a, expensive housing market. Difficulty to access formal banking system.
PA 2 Brazilleto Mountains **(Terrestrial**) Part of Portland Bight PA	SS. 2	Hayes Cornpiece (Clarendon)	55	Approximate Population: 1056 Part of SS was houses for Sugar Industry. Formal development too expensive. Section 2 developed on lands that were designated as part of the formal area but left idle.
PA 3 Rockfort Reserve (**Terrestrial**)	SS. 3	Bay Shore/ Harbour Heights (Kingston)	42	Approximate Population: 3276 (1075 households) Politics led to the development. Low income jobs are prevalent in an expensive housing market, also difficulty accessing formal banking system and family.
PA 4 Palisadoes -Port Royal PA(P-PRPA) (**Marin**e)	SS. 4	Port Royal (Kingston)	10	Approximate Population: 141 (50 households) Expansion of family- The general Port Royal area is a historical community, Jamaica`s first city in 1650. Strong generational ties.

Understanding the type of infrastructure present in the settlements is important to measuring impact. For squatters', access to infrastructure is aligned with political allegiance as a survival method. Both major Political Parties, Jamaica Labour Party (JLP) and the Peoples' National Party (PNP), provide support especially during elections (Pickering 1990, Tindigarukayo 2004). However, for the purpose of this research, the most critical infrastructure is those responsible for sewage containment. This is of great concern in squatting, as it impacts health and natural resources.

Due to logistics of sewage disposal (Figure 2-11) majority of communities utilize soil-based absorption methods, such as Absorption Pits (all 4 Communities in the study area) and

Septic tanks, however there is one community that utilizes Water Containment Tanks (only in PA 4/SS. 4), which is just as serious, considering the design allows for the release of polluted water directly into the soil for absorption. As is expected, Marine areas with high water table are at great risk of pollution as a result of these systems.

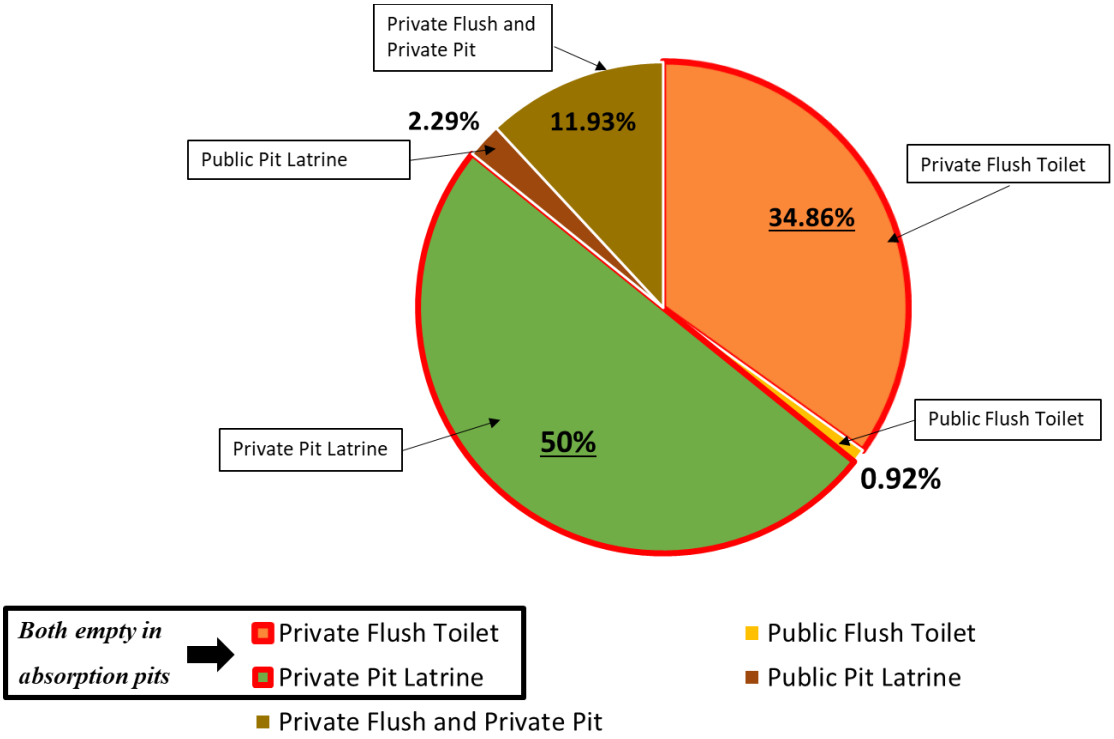

Figure 2-11 Sewage Disposal Systems in Squatter Communities. Source: RAPSJ 2008

It is said that approximately 2.4 billion people worldwide face challenges with proper sanitation, 94% of the squatter community population has achieved the sanitation goals (Grant & Taniguchi 2017). For Jamaica, 50% of total squatter population uses private Pit Latrine (Figure 2-12 shows cross-section of one), 35% flush toilets that empty into absorption pits and 12% public pit la trine (Figure 2-13).

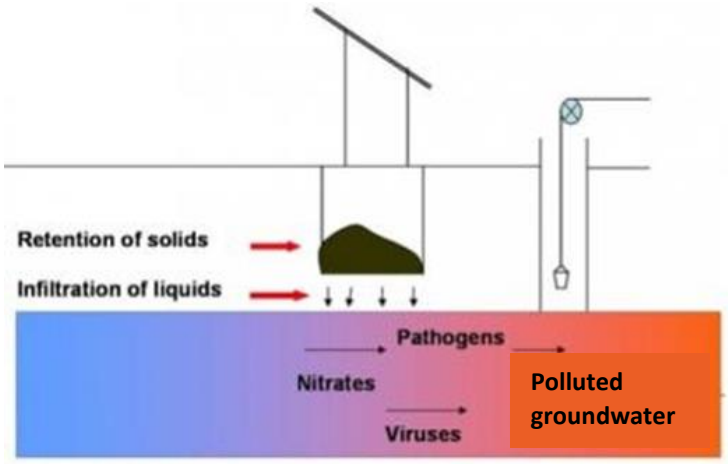

Figure 2-12: Cross-Section through Typical Pit Latrine in Squatter Communities. Source: Tilley et al. 2014

The pathogens, nitrates and virus that are found in the sewage are significant threats to water sources.

Figure 2-13 Exterior View of a Typical Pit Latrine. Source: RAPSJ 2008

Majority of the squatter communities in the study area used absorption pit, but 48% of PA4/SS.4 utilizes the Polyethylene Water Containment Tank as a Sewage System. Polyethylene Water Containment Tank Sewage System (PWC) (Figure 2-14) is a community led response to sanitation. 65% of total containment system users practice shared usage (2-3 households on one system) (Grant and Taniguchi 2017).

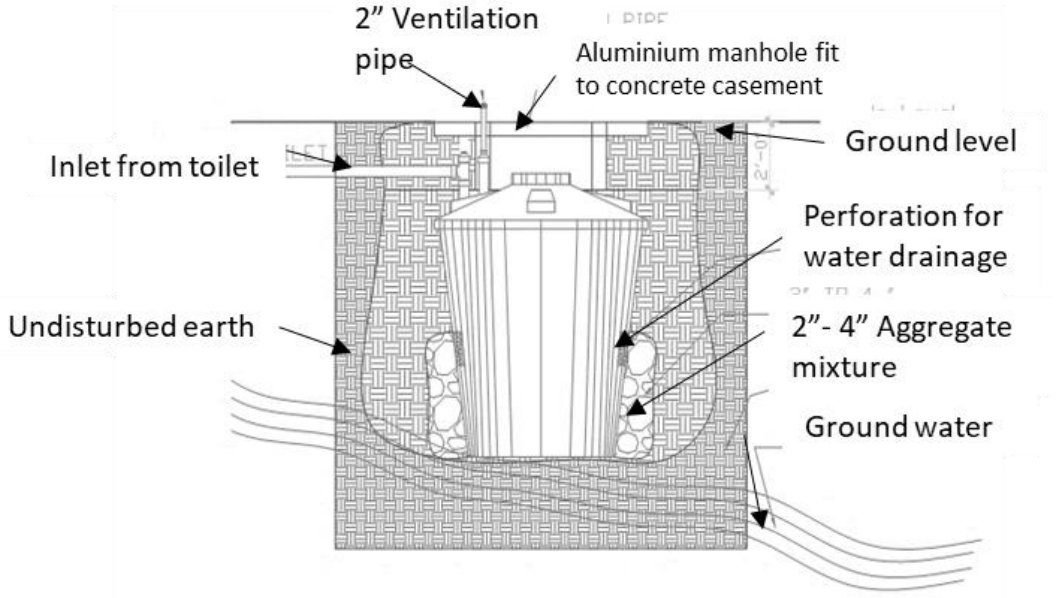

Figure 2-14 Representation of the Polyethylene Water Containment Tank Sewage System in PA4/SS.4. Source: Fieldwork 2017

2.7.2 PA1 and SS1 (Nonpareil, Westmoreland*)*

The Nonpareil community is in the parish of Westmoreland, which is the most westerly parish in the country. The settlement is approximately 81,658 sq. m, according to the community members is over 46 years old and has an approximate population of 1320 as per the population census of 2011 (STATIN 2011). Most of the surveyed population in that area is either unemployed or self-employed, with the 3rd largest percentage working in the tourism industry in various capacities.

This settlement poses great risk to the environment, since it is located on the boundary and is migrating in the Negril Great Morass (one of the countries protected areas). The practice of squatting in this location occurs as both residential and commercial squatting, with most of the building structures fabricated from timber. There is also some level of land reclamation being done to accommodate some of these houses. This informal method of development has resulted in great changes to the natural environment over the years.

For the purpose of this research the Negril Great Morass to include the Royal Palm Reserve and Coastal Areas in the Negril Marine Park is the section of concern, an already vulnerable location due to hoteliers; the act of squatting acts as an increase to the already high pollution load. The Negril Marine Park was officially declared a PA on in 1998 and covers a total area of approximately 160 Km^2 (62 sq. mi). The Great Morass is managed by the Negril

Area Environmental Protection Trust (NEPT) and is approximately 6000 acres (Figure 2-15), together 37,100 ha. The community is 0.3% of the size of the PA.

Figure 2-15: Images of the Negril Great Morass and Coastal Areas and Negril Marine Park, specific to the PA. Source: http://inweh.unu.edu/jamaica-mpa/, https://fiwiroots.com/scuba.html, https://www.pripsjamaica.com/places/3328/go/attractions/royal-palm-reserve

2.4.2.1 Infrastructure Description

For squatters' access to infrastructure is aligned with political allegiance as a survival method. Both political parties, the Jamaica Labour Party (JLP) and the Peoples' National Party (PNP), provide support especially during elections (Pickering 1990, Tindigarukayo 2004). This community has access to several public service infrastructures mainly because of its location. They are outlined below:

1. Roads- Access using Class A arterial Road (highway -7.43m) and Class C Tertiary roads. Other smaller roads classified as tracks, deviates from the arterial road deeper into some communities.

2. Electricity – Inhabitants can access legally and illegally the national power supply provided by the Jamaica Public Service Limited (JPS). Illegal electricity results in greater costs to legal homeowners.
3. Drainage- an open rectangular storm water drain is provided along one side of the Arterial road.
4. Water- Piped water provided by the National Water Commission is accessible to the residents. Although it may not be piped directly to the houses.
5. Building Material- Self-help houses are constructed from Timber/Wood and Concrete block and Steel.
6. Garbage Disposal- Municipal garbage collection system is utilized along with the burning method of waste disposal.
7. Sewage: The method of sewage containment is done utilizing an Absorption Pit (soil-based system that at times has sewage directly piped to it)

2.7.3 PA2 and SS2 (Hayes/Cornpiece, Clarendon)

The section of the PA that this community is in and is impacting is referred to as the Brazilleto Mountains and forms part of the Portland Bight PA. The Portland Bight PA was declared in 1999 under the Natural Resource Conservation Act of 1991; and spans approximately 1,880 Km^2 (Figure 2-16); it has 3 main ecosystem types, namely wetlands, coastal mangroves and coastal dry forests, all of which are important and threatened ecosystems. The location has scientific evidence that suggest it was the home of the indigenous Taino people who occupied Jamaica before the invasion of the Spanish beyond 1494. It is the location of several different ecosystems and known for its significant natural heritage resources, being home to nurseries, fish sanctuaries, and other wildlife sanctuaries such as for the Jamaican iguana.

It is perceived to be one of the homes of the Jamaican Hutia or Jamaican Coney (IUCN categorize as Vulnerable), the only mammal species endemic to Jamaica, the Jamaican Iguana (IUCN critically endangered) and the Jamaican Boa a rare protected species. The perceived threat to the forest area is for housing, farming and as a means of logging. This practice in turn threatens the habitat of the animals, as well as they are exposed and use as a source of food.

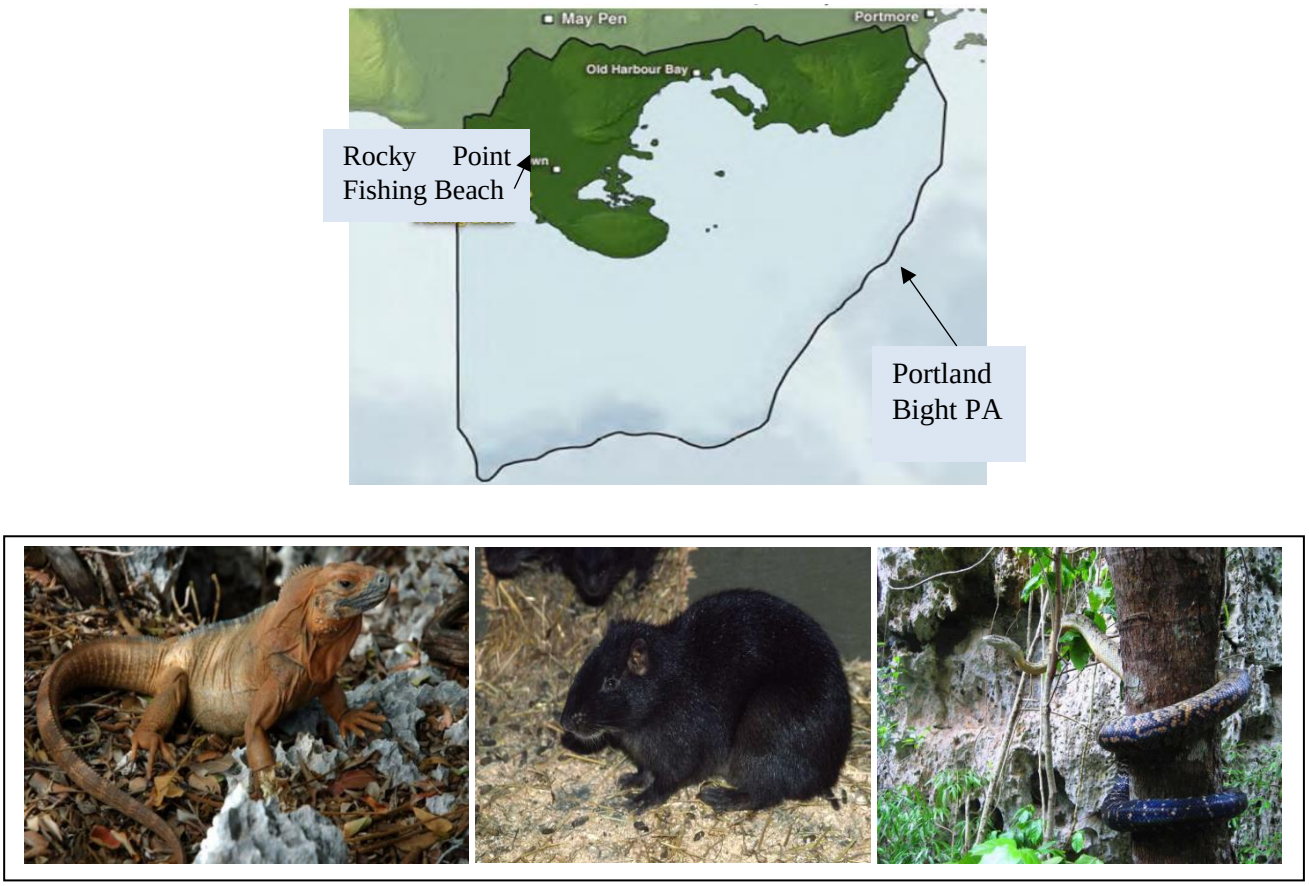

Figure 2-16: Map of the Portland Bight PA and images of the Jamaican Iguana, Jamaican Hutia and Jamaican Boa respectively. Source: http://www.portjam.com/PortJam/documents, https://www.iucn.org/content/20-years-conservation-success-jamaican-iguana, https://jamaicandryforest.wordpress.com/mammals/

This area is the least urban of all the sites chosen but would be much less rural than other sites of similar nature. The community is approximately 55 years old. It has a population of 1056 and was in the past an area that supported sugar cane farming. It is near the Jamalco Bauxite Company.

The main source of income for the residents in this area is farming, construction workers and self-employment. However, some 37% of the individuals living in this community are unemployed.

2.4.3.1 Infrastructure Description

The following are some of the public infrastructure made accessible to the community:

1) Roads- The community has access to Class C Tertiary roads and roads comprise of gravel. The average width of the road is 6.26m. There are tracks that are used to access the upper regions of the community.
2) Electricity- Inhabitants can access legally and illegally the national power supply provided by the Jamaica Public Service Limited (JPS).
3) Garbage Disposal- solid waste is disposed of by burning or dumping.
4) Water- The community has access to the public water supply legally from the National Water Commission (NWC), a part government entity and illegally from an abandon pump house owned by the NWC.
5) Sewage: Absorption pits are used for majority of the inhabitants; others have no toilets and practice open defecation.
6) Building Material: Houses are constructed from Timber and mix of timber and concrete or concrete only.

2.7.4 PA3 and SS3 (Harbour Heights, Kingston)

The Rockfort Reserve is one of Jamaica`s earliest Forest Reserve designations, declared in 1950 (Figure 2-17). It is 6.45 Km^2 and is a terrestrial ecosystem that falls under the IUCN VI category. The community is 182 hectares and approximately 28% of the size the PA.

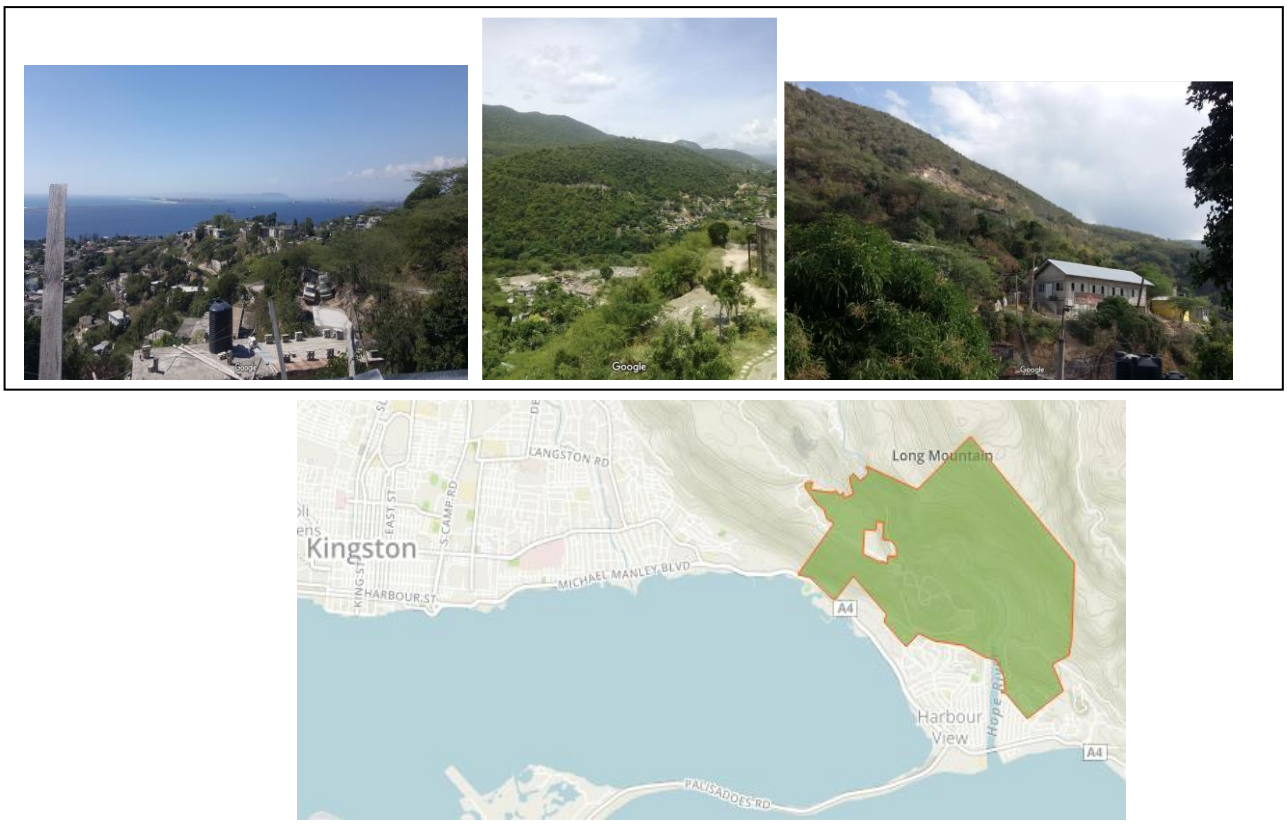

Figure 2-17: Map of Rockfort Reserve and Images of the PA location. Source: https://www/protectedplanet.net/rockfort-forest-reserve, Google maps.

The Harbour Heights community is in the capital Kingston. This community is the largest of the 4 areas studied in this research. It has a population of approximately 3276 persons. The history behind the development of this settlement is rooted in a political background. The topography of the location is one of a vulnerable nature, since it is prone to landslides and flooding.

The main sources of livelihood for these residents are self-employment through small grocery shops, small cook shops and hair salons. There are also construction labourers, Fishermen and small farming, while a noticeable percentage is unemployed.

2.4.4.1 Infrastructure Description

This community although located in the capital Kingston has similar infrastructure amenities as the previously stated communities, as outlined below:

1. Roads- The community has access to Class A Tertiary road. There is a Class C road and several track type roads that run through the community.

2. Electricity- Inhabitants can access legally and illegally the national power supply provided by the Jamaica Public Service Limited (JPS).
3. Drains- storm drain is provided in some parts of the community, through initiatives done by the office of disaster management.
4. Sewage- The residents have in some cases both indoor and outdoor flush toilets, some also use Pit Latrines, however the main mode of containment is the soil-based system, absorption pit.
5. Water- provided to some houses and standpipes by NWC, also taken from hydrants.
6. Garbage Disposal- The main method of garbage removal is burning; however, some sections can utilize the services of the Municipal solid waste collection.
7. Building Materials- houses are constructed mainly from concrete blocks and steel and has some wooden structures.

2.7.5 PA4 and SS4 (Port Royal, Kingston)

The Palisadoes Port Royal Protected Area (P-PRPA) is in Kingston and at the entrance of the Kingston Harbour and at the end of the Palisadoes. The size is approximately 7,523 hectares (75.23 Km^2) and was designated under the Natural Resources Conservation Authority (NRCA) Act in 1998 (Figure 2-18). However, earlier designation of the Port Royal Protected Area was done in 1967 under the Beach Control Act (BCA). It is home to the community of Port Royal, which predates the 1600`s. It is Jamaica's first unofficial capital. The size of the community in comparison to the PA is less than 0.1%, being only approximately 6 hectares.

This community has a rich history and was once classified as one of the wealthiest ports in the Caribbean. It was destroyed in 1692 by an earthquake and Tsunami that sunk most of the city below the sea. Port Royal provides a rich archaeological, ecological and historical source of information and cultural exchange. This PA is perceived to be one of the most sensitive ecosystems on and off the coast of the island. The area is home to fish sanctuaries, nesting grounds for turtles, endemic plants and animal species, with an exceptionally high-water table resulting from being surrounded entirely by water.

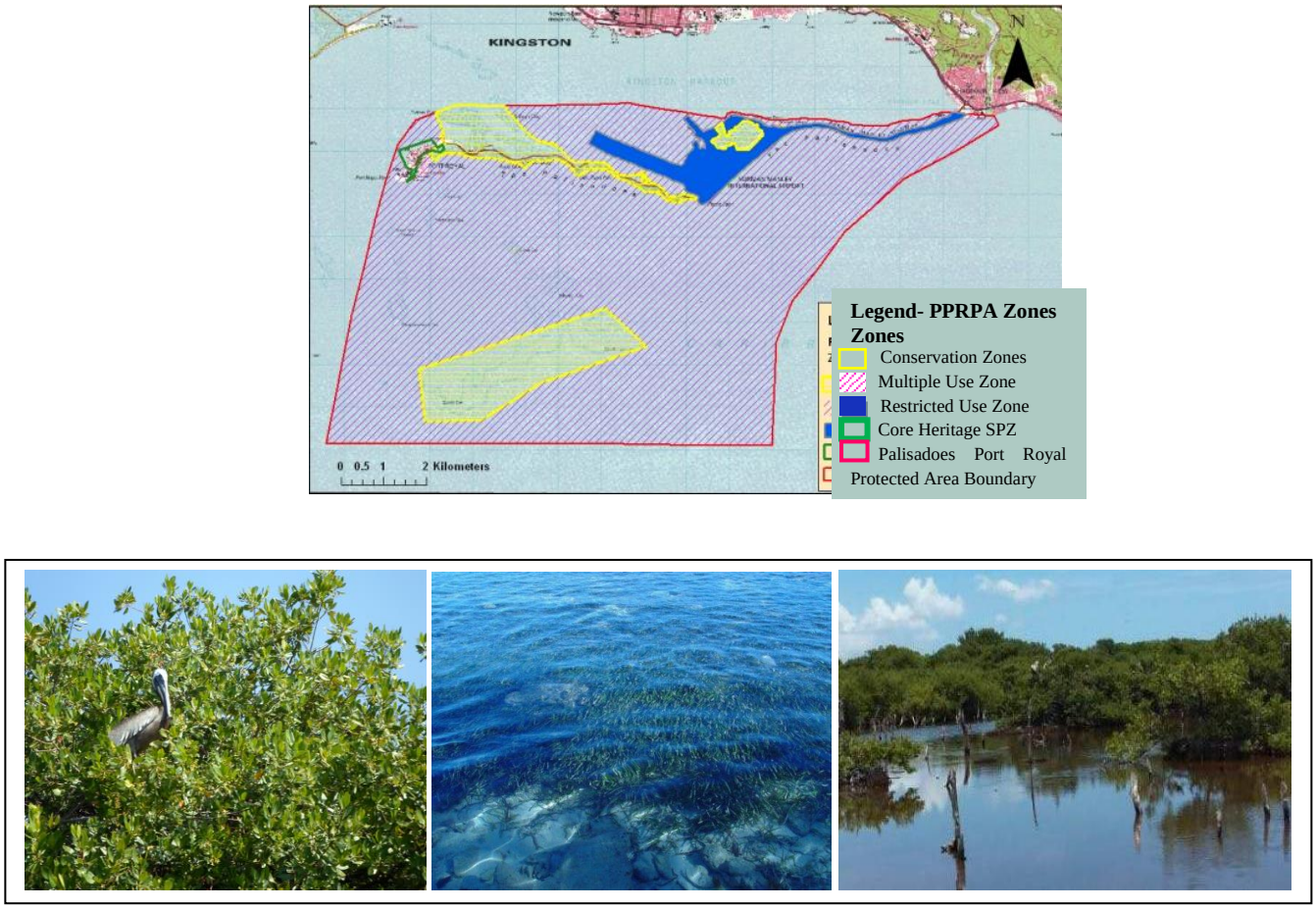

Figure 2-18 Map showing the P-PRPA. Source: PA Branch, NEPA 2013, https://www.ramsar.org/news/jamaicas-palisadoes-port-royal-joins-the-ramsar-list, http://thisvincyperspective.blogspot.com/p/port-royal-treasure-chest-of-history.html, http://www.jamaicaobserver.com/news/refuge-cay-shows-signs-of-regeneration-again_156453?profile=166

The current population is approximately 1252 (STATIN 2011) and has a total of 338 households in the community. Port Royal has two (2) main areas of squatter settlements, firstly the Michelin Avenue settlement and the second on the eastern edge of the small town (images provided later). There is also evidence of scattered squatting within the mangrove areas of this PA. The larger settlements have a total of 47 dwelling units (Fieldwork & SEMU 2016).

The economy of this small town relies on fishing, tourism and self-employment through service enterprises (shops and restaurants).

2.4.5.1 Infrastructure Description

The community is also located in the capital Kingston and has access to most public infrastructure services:

1. Roads- The community is accessed by Class A Tertiary road, within Class C roads are present. There other roads made of gravel in the community.
2. Electricity- Inhabitants can access legally and illegally the national power supply provided by the Jamaica Public Service Limited (JPS).
3. Drains- there were no drains observed. However, the sandy soils allowed quick rainfall to run off.
4. Water- This resource is provided by the national water commission (NWC).
5. Sewage- The community designed a sewage containment system made from a polyethylene material that is sold mainly as a water storage tank, they also utilize absorption pits.
6. Garbage Disposal- mainly done by burning, municipal collection and dumping.
7. Building Materials- Timber, mix of concrete and timber and concrete houses.

Chapter 3- LITERATURE REVIEW

3.1 Squatter Settlements

The inadequacy of low cost housing and the lack of social housing programs in many countries, especially in the urban areas to meet the needs of the indigent, coupled with some government's inability to provide adequate job opportunities has fueled the creation of squatter settlements and/or slums (Tunas and Peresthu 2010; UNCHS Habitat 1987), further squatting is a ploy sometimes used by individuals to improve their housing situation outside of any social movement (Squatting Europe Kollective 2013). The illegal occupation of land or buildings defined as squatting occurs all over the world but mostly in developing countries (Tindigarukayo 2002). The practice characterized by self-help housing, while solves one problem in the eyes of the occupants, in the form of providing homes and access to land for generating income, it creates another for society in terms of risks to health, social issues and problems for the environment (Pugh 2000).

In some cities, especially where housing markets are tight (Jamaica being one), squatter settlements house moderate- and middle-income groups, as well as the poor and the poorest of the poor and forms a significant percentage of the total housing stock (Pugh 2000). This trend is also a result of the fact that the private sector determines what is available in the form of housing; this means that the location and price will be made to target individuals who can afford to purchase. Additionally, as a profit-based venture, the stock will be developed to supply a certain market.

Squatter settlements also vary in sizes having over 100,000 people to smaller groups with 40 households or less. As a result of the settlements fluidity in size and varied characteristics, this increases the potential for them to regenerate, however, the improvement of squatter areas can reduce the risks and improve the urban health transitions among the poor.

3.2 Management of Squatter Settlements & Governance

The poor living conditions experienced by persons of low economic standing in conjunction with the sometimes-crippling fear that comes with tenure insecurity, added to the inaccessibility associated with housing cost, land cost, construction cost and even mortgages, greatly impacts their ability to provide suitable housing in ideal locations. This deficit forces them to occupy some very unfavorable areas, creating risks to life, property and environment;

most times these are disaster prone or environmentally sensitive areas (Payne and Durand-Lasserve 2012).

The inability to provide a sustainable social housing or low-income housing program to meet the demands of the poor has met with several roadblocks globally, especially in those developing countries. This inadequacy provides the thrust to informal or self-help approaches by these groups in providing for their housing needs have proved to be an important part of national housing supply avenues. They also provide a clear definition of the needs of the housing supply and demand market (Nassar and Elsayed 2017). As a result of the ineffective efforts to provide adequate housing solutions especially in urban areas that receives the greater numbers of persons in search of better QOL, policies and strategies for curbing the expansion of squatter and informal housing developments have more or less failed (Nassar and Elsayed 2017; Zhang 2017).

On the contrary, there are policymakers who have decided to move away from the policy directions aimed at stopping the proliferation of squatter settlements or slums, but to accepting them as a means of fulfilling a demand for housing. This they have done through the inclusion, formalization and upgrading of these informal developments and viewing them as solutions rather than a problem (Khalifa 2015; Zhang 2017). Further, there is the contention that the political interests are served by allowing the growth of these informal developments and this would therefore explain the provisions of formal public infrastructure and new settlements in other urban spaces (Zhang 2017; Alsayyad 1993). As a consequence, what emerges is the implications to vulnerable areas not zoned for development and increased burdens to otherwise inadequate public infrastructure. According to Zhu and Simarmata 2014, ineffective governance (a governance that becomes negligible in areas of political interest), environmental amenities such as PA especially in the urban areas that are allowed unrestricted access experiences overutilization, in addition to idle spaces that are now encroached on.

3.3 Protected Areas

The recent trending slogan *`we only have one planet`* has been making the rounds, highlighting the current crisis faced by mankind in the form of overuse of resources, we are consuming our natural resources faster than they can be replenished and in some cases they have been completely depleted (Steinbach and Wellmer 2010; Jowit 2008; Pimentel et al. 1997). It is this phenomenon that in part led to the evolution of PA.

What are Protected Areas? IUCN suggests that "a protected area is a clearly defined and recognized geographical space (land and/or sea), which sole purpose is to achieve long term conservation of nature (biodiversity) with associated ecosystem services and cultural values, through effective legal means." (IUCN Definition 2008) What is the purpose? While this is dependent on the management objective for a specified area, it is said that PA are one method of engaging a conservation strategy and is the cornerstone to conservation (Dudley et al. 2014). They are established for a variety of reasons (restricting access and improving population of species among them), with very different objectives and criteria for success (Geldmann et al 2013; Agardy et al 2003). This tool is aimed at allowing us to transfer resources to our future generations; hence it is the responsibility of all generations to participate in the conservation and preservation of our natural and cultural heritage. In order to achieve this generational transfer of resources, and due to the success recorded with the implementation of PA, the Convention on Biological Diversity's Aichi target 11 calls for strategic ways especially through the use of well-designed PA systems to ensure a minimum of 17% of terrestrial land surface area and 10 % of coastal and marine areas to be protected and effectively and equitably managed by 2020. Although all these targets are achievable, it is no hidden fact that there are factors that aim to challenge how effectively PA will accomplish this (Watson et al. 2014)

3.3.1 Marine Protected Areas

According to the International Union for Conservation Nature (IUCN), Marine Protected Areas (MPA), must fit into the definition given for PA, which is defined as, "geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Day et al. 2012)." These MPA`s like many other types of PA are established for the preservation of species, whether in small or expansive geological waters with a focus on managing anthropogenic activities to minimize the associated pressures on such sensitive environment, such as overfishing, habitat loss and pollution (Simard et al. 2016; Kenchington et al. 2003).

In planning for future generations outlined in the definition of sustainable development, it is critical to protect those environments that are important to the population of key biodiversity, especially with the human population at the rate it currently is, this will ensure good QOL (Sumaila et al. 2000; Kenchington et al. 2003). Moreover, an adherence to the key

roles of MPA that of ecosystem-based management and “no-take” reserves is critical to longevity of species.

Notwithstanding, for an MPA to be effective consideration must be holistically given to the design, size, anthropogenic impacts, characteristics and requirements of the local species, include public participation and local community involvement (Agardy et al., 2003; Claudet 2011; Sumaila et al. 2000; Davies et al 2012; Mangi and Austen 2008), especially since the management of MPAs have experienced tumultuous influences, such as fragmented oversight and inadequate governance by stakeholders (Mangi and Austen 2008). However, this tool when implemented properly can result in the sustainable use of fish stock and a reduction in mortality of specific species (Davies et al 2012). Additionally, it can act as reference in researching marine ecosystems and their services.

3.3.2 Terrestrial (Forest) Protected Areas

The rate of decrease in the world`s forest created the impetus for the implementation of conservation strategies to minimize the effects to the earth’s resources. Governments and other organizations globally sought to minimize the negative effects of this practice, referred to as Deforestation, through the introduction of PA and specifically Terrestrial PA (Apan et al. 2017). Similar to MPA, there is the use of a multidimensional approach to governance and management of these areas to ensure effective conservation, this done through partnerships with indigenous peoples and local community (Davies et al 2012; Lockwood 2010). The cultural importance of Terrestrial PA cannot be overstated as these locations ensure the longevity of tribes and *in situ* practices (Hess 2001).

Recognizing the importance of forests to preservation of culture (including for the use of traditional medicines), land-use strategies for protection of forests have been increasingly being inclusive of local communities in the management and maintenance of PA (Bray et al. 2008; Primack et al. 1998).

Although the inclusion of community for preservation of the tropical forests and biodiversity has increased, there is also the concern of the effect of these populations on the same forests (Nagendra et al. 2009) and whether these are the best practices for tropical forests protection (Shahabuddin and Roa, 2010). Further, the implications of unplanned and planned developments such as road construction, mining activities, dams built, construction of roads and infrastructure activities also pose major threats to the biodiversity and ecological corridors

of the forest (Bhattacharya 2019). Consequently, this may lead to serious hazards such landslides, forest fires, soil erosion, contributes to drought, which then have an incremental effect on the fragility of the ecosystems. Furthermore, activities associated with the lifestyle of the local community such as poaching wild animals, use of land for livestock grazing, overexploitation of forest resources, and pollution pose as major threats to biodiversity and other natural resources (Bhattacharya and Ghosh, 2014).

However, empirical results from several research suggests that the best practice involves inclusion of indigenous groups or local communities, since, forests managed by local or indigenous communities for the livelihood purposes have proven to be equally or potentially more effective than those with solely external governance protection objectives (Nepstad et al. 2006; Bolland et al. 2012).

3.3.3 Threats and Vulnerability of Protected Areas

The fact that PA creates a buffer for ecosystems, which in turn reduces biodiversity loss, makes them a valuable, popular and efficient tool for protecting the natural environment (Campbell et al. 2009; Walden-Schreiner, Leung, and Tateosian 2018). Although such an effective tool, PA faces a cumulative share of threats that limits the ability for it to completely satisfy its goals, specific evidence can be found in the effects of climate change, which proves to be a formidable opponent when we consider the size of the PA and the task they are expected to undertake (Malakoutikhah et al. 2018), also when consideration is given to specific locations, especially in areas that are polar and mountain based that are some of the first and most vulnerable (Parmesan, 2006). An intensification of the climate change threat to PA as Perry (2015) suggests comes in the form of ill-equipped societies handicapped by restrictive political systems and fluid policies.

In addition to the effects of climate change, are the more widespread and direct impacts of human activities in various forms. This is especially dangerous for areas that have sanctioned conditional allowance of human activities, in the form of Tourism, whether ecological or otherwise. There is also the issue of poor PA management or conservation strategies, according (Guidetti et al. 2008) the deficiencies associated with poor management strategies has led to some protected areas failing in their efforts to save rare species and ecosystems.

3.3.4 Managing the Threats and Challenges to PA

As we are well aware PA allow for the transference and sustenance of key ecosystem services, but what is the current management situation of these key areas? In defining management effectiveness of PA, we simply describe it as whether the goals and objectives associated with its implementation is being achieved (Hockings et al. 2000). There are several ways governance of PA has been carried out, such as by government, NGO, combination of government and NGO`s and by private entities such as community groups. Recent research indicates that greater attention is being given to private entities as it demonstrates the need for more inclusion of community in the governance of these areas (Dudley et al. 2014), and that their involvement is fundamental to successful conservation because of their diverse perceptions can be explored and considered (Himes 2007).

Are we utilizing effective management or governance approaches? Currently, there are several challenges to the effectiveness of PA, these come in the form of competence of governors and managers of these areas who need knowledge and skills both to manage and mitigate (whether the technical and other resource capacity exist in the management bodies), all out poor governance, input from relevant stakeholders, governance techniques (site monitoring and adaptation) and intimate knowledge of the areas being listed under the PA umbrella (Geldman et al 2013; Kusumawati and Huang 2015). Some research proposed possible interventions to these challenges by improving the competence of those practitioners, scientists engaging in more experiment approach to the implementation strategies, sharing of information across boundaries, utilizing measurable objectives (Geldman et al 2013; Sandwith 2015; Worboys et al., 2015). Critical to the process as well is evaluating the current management situation, which will help in future decision-making (Camargo et al. 2008).

Worboys et al. went further through the assistance of the IUCN to produce a book aimed at providing guidelines that will assist many to create effective solutions into the management and governance challenges. Since it has become evident that former conservation methods were ineffective (Halpern 2003), if we are to rely on PAs as an adaptive application for the protection of our precious resources we must implement measurable responses that can be tested and allow us to determine their effectiveness as critical tools for conservation science (to address issues such as global climate change, human health and wellbeing, addressing food and water security and managing for disaster risk reduction).

Notwithstanding, for persons in the developing world the challenges are ever prominent and ensuring competent management and governance of protected areas to meet their goals are met with several obstacles, requiring protected area professionals to meet new demands and challenges with limited resources, in turn making their jobs more complex (Sandwith 2015). It is situations like these that has led to management effectiveness receiving the amount of attention it is now getting in conservation literature, with the assistance of international donors such as the IUCN, ICOMOS and nongovernmental organizations (NGOs), developing tools directed at PA managers to assess threats, the local setting, and management effectiveness (Eklund and Cabeza 2017).

3.4 Squatting and Protected Immovable Heritage Sites

There are many spectacular landscapes worldwide that have been protected because of their cultural importance, these include rivers, mountains, forests, caves and other such features that are deemed heritage as a result of rituals and other commemorative practices from ancient times. The Making Space 2018 exhibition in Sheffield UK, highlighted the evolution of squatting and trespassing as seen from the perspective of colonial times, this allowed people to have a tangible view of such historical informal way of solving settlement problems (Burgum 2019). This exhibition set the tone for the potential relationship with squatting and protected heritage sites, idealizing the fact that solutions will be adaptable to the future if an understanding of the past is clear, and consideration ought to be given to the fact that many of these protected heritage sites were significant as a result of the activities from the past, wrestling with housing and agricultural needs of the poor. Burgum (2018) highlighted the fact that when people want to squat in derelict or old huts/houses, this is celebrated as an initiative, however, when the encroachment is on empty luxury properties, this is a fundamental threat to private property. Therefore, enforcing the gap in where importance is placed, showing the lack of the protection of some heritage sites from human activity as a result of the perception of dereliction.

Research in countries in the African continent identifies the issues emerging from squatting and the protected heritage, it furthers emphasizes the necessity of determining collaborative approaches to the protection of these immovable heritage, indicating the need for not just a government governance approach but inclusion of communities and private organizations, through a clear understanding of the invaluable legacies of these heritage (Ndoro et.al. 2008). The argument is not that external influences on these heritages are all antagonistic

in nature, as many were determined necessary to be protected by some very developments in each country, however, to treat in the context of a mutually agreeable way forward.

For countries like Jamaica, outside of the more popularized climatic threats, the conservation of this heritage is not only hindered by the act of squatting in its entirety, but limitations with the monitoring of said heritage, inadequacies in inventory keeping, lack of sustainable funding and deficiencies in public awareness of the value of the heritage.

3.5 Perception of PA by Local People

It is a common notion between conservation researchers that prescribing PA as a conservation tool can prove beneficial to the lives of communities, through forms of better resource governance, various forms of job creations, increasing the stock dependent resources and other cultural and educational gains (Salm et al 2000). Further, for areas that will include variations in zones, especially for no-take zones, it is critical to evaluate or understand local perceptions to best manage stakeholders' competing interests (Mangi and Austen 2008; Suman et al. 1999). Binkley and Duncan (2009) understood the importance of considering the views of the local people, therefore suggested that considerations must be given to the daily pursuits in connection with how the local people treat their ecosystems and more specifically what they think and what they think they know about the particular area.

In our efforts to conserve and preserve our natural and cultural heritage we may intrude on the lives of persons who depend on that resource for food, employment or other needs. As a result, consideration must be given to the perception of these individuals and develop ways to minimize the impact to their daily lives. According to Pietrzyk-Kaszyńska et al (2012), "The attitude of local stakeholders towards protected areas, their perception and approval of designated areas are conditioned by many factors." Also, Jones (2008) indicated that the "attitudes of resource users living adjacent to MPAs are a central issue for the management of protected areas." However, for more specific examples, Mangi and Austen (2008) explains that "MPAs typically affect heterogeneous communities that include stakeholders with diverse perspectives and outlooks on the marine environment", hence the importance of understanding the views of local people and benefits of their knowledge (Danielsen et al. 2018).

In a study done in Thailand, the results indicated that the resistance received on the implementation of a PA was as a result of lack of inclusion of the communities in decision making and the fact that the approach used limited access to the area therefore causing implications for livelihood, in turn negatively impacting social and economic statuses, also the

lack of consideration given to the need for social and cultural interventions created resistance among the populace (Bennett and Dearden 2014; Leung et al. 1998).

Further to those concerns are the controversial issues surrounding the spatial specifications of these areas, in terms of size or specific locations that should become a protected area, which may differ for scientific reasons to the professionals and in terms of cultural or livelihood use for local communities (Agardy et al 2003). Additionally, the concerns surrounding implications of the PA being adapted after a space has already been utilized by local people, this may result in the displacement of locals, resulting in a negative perception of the PA strategy (Imran et al 2014; Coad et al 2008). Not to mention the disquiets uttered from community members concerning corruption, in cases where the perception is revenue generated from the implementation of this system should aid in developing the local community, however, is not always done (Bennett and Dearden 2014; Vodouhe et al. 2010).

However, there are examples where the opposite is also true and instances where community inclusion and proper orientation towards the benefit of the PA is done, yields positive perception results towards a greater acceptance of the strategy and the ability for it to generate increased benefits in their lives (Novelli and Scarth 2007; Vodouhe et al 2010). In addition, this inclusion of the local people has resulted in the emergence of the term `people-oriented conservation` that allows for a participatory approach to the protection of key ecological areas (Durand and Lazos 2008) and the Community-based natural resources management (CBNRM) concept which considers the coexistence of people and nature (Del Mar Delgado-Serrano et al. 2015).

On the contrary, perception of PA protection responsibility has been attributed to external party, such as government instead of the local community (Durand and Lazos 2008), while in other instances because of government intervention local people learned to accept responsibility (Durand and Lazos 2008).

3.6 Perception of Squatters towards PEBs

PEBs or pro-environmental behaviours, refers to `behaviour which is generally (or according to knowledge of environmental science) judged in the context of the considered society as a protective way of environmental behavior or a tribute to the healthy environment (Krajhanzl 2010). In the context of implementing strategies based on people-oriented conservation such as, community-based conservation, co-management, and indigenous reserves, it is determined of critical importance is the collection of “multiple perspectives to

encompass the dissimilar ways different groups interpret the task of biodiversity conservation" (Durand and Lazos 2008).

It's an inevitable thing that people will interact with their environment, and even more so, can be heavily dependent on their immediate space, especially those that support their livelihood, as a result it is important that we understand how they perceived this environment (Gray et al. 2010; Allendorf et al 2012). Although there are numerous studies exploring human activity and its impact on natural ecosystems, it is yet to delve into the attitude and behaviour of individuals of low economic status in relation to their natural environment, especially locations that are of an extremely sensitive ecological makeup. According to Ramkissoon et al (2012), this area is poorly understood as relatively little is known about local perceptions of both the benefits and costs of environmental change. Further, "little is known about the ways local people live with and understand deforestation (Toledo 2003)." This limited knowledge on specific information has hampered many efforts to mobilize local resources.

While other research has used environmental psychology to study the relationship between individuals and the natural environments (Turaga et al 2010; Sawitri et al. 2015) and explored the relationship between place attachment and identity in regards to pro-environmental behaviours (PEBs) and attitudes, there is the belief that social capital (Jones 2005, Harpham et al 2002) would be instrumental as a means of determining PEBs. Putnam 1993, p. 36, refers to social capital as "stronger relationships of trust, common rules, shared norms, reciprocity between neighbors, and endorsement of environmental behaviors within a community."

Another critical matter to look at when considering PEBs and low-income groups or squatters, is the factor of responsibility for the preservation of the environment. Durand and Lazos (2008) suggests that the local people perceived themselves as incapable of acting for forest conservation and restoration, with majority believing it's the responsibility of the government. It is for this reason why it is necessary to understand their daily pursuits in relations to how they treat their ecosystems and what they think they know about them since they are inextricably connected.

However, one of the best measures for determining success in effective management and governance of protected areas, aside from inclusiveness (heavy community involvement), is to understand the perceptions and attitudes of the local people and of protected area managers (Hirschnitz-Garbers and Stoll-Kleemann 2010).

Subsequently, Pelletier et al. (1996) indicated the extensive belief that knowledge about environmental conditions along with knowledge of pro-environmental strategies would result in PEBs. In addition, may also result in acceptance of greater responsibility for environment protection (Durand and Lazos 2008).

Chapter 4- METHODOLOGY

4.1 Introduction

The research is a quasi-experimental study using a mixed-method approach to the problem, to collect both qualitative and quantitative information. The research utilized this approach since previous studies done, presented solutions to address the problem of squatting as a two-fold cause, firstly that of a governance issue and a lack of people involvement.

4.1.1 Qualitative Approach

The qualitative approach sought to understand the governance strategies and approaches to ensuring protected areas are meeting their objectives and where they are not due to squatter settlements to locate the deficiency in the system, also, to determine whether the management of squatter settlements and PA are being collectively considered for minimizing the negative effects. Further, to understand the perspectives of those who reside in these squatter communities, by gathering social context of squatting and their approach to the governance system they experience daily. Further, to collect information on threats observed as a result of squatting in the PA.

4.1.2 Quantitative Approach

The quantitative analysis is to provide a measured and scientific understanding of squatter perception and interaction with the PA they are impacting. Therefore, the results will be utilized to provide empirical supporting evidence for solutions that will be a means of informing policy. In addition, to determine intensity threat levels of squatter communities on PA they are impacting. Using this information to guide the categorizing the settlements as in application of solution strategies.

4.1.3 Study Area

The process undertaken to determine study area for conducting this research involved strategic and careful considerations. The four (4) areas of focus and were chosen based on the following variables:

- Must be a squatter community
- Located in or near nationally assigned environmentally protected areas.

- Must pose a threat to either marine or terrestrial.
- Their proximity to towns (urban areas),
- Accessibility to the community.
- Must be on government land

The four (4) communities were grouped into two main ecosystems, Marine and Terrestrial, as follows:

- PA1 and PA 4 are Marine areas that share similar ecosystem characteristics, such as wetlands, coral reefs, mangroves, beaches, fish and turtle sanctuaries and nesting habitats. Experience heavy intervention for protection of the ecosystem.
- PA 2 and PA 3 are Terrestrial areas and are protected because of their importance as forests. They have same ecosystem characteristic of being Open Tall Dry Forests. Both areas have not been given much attention for governance.

4.1.3.1 Infrastructure in Study Area

The community`s alignment to a political party allows for the facilitation of some infrastructural development as represented below in Figure 4-1. It is typical, close to election occasions that the following are gifted:

- Water – Public Sector
- Electricity - Private Sector
- Some drainage – Public Sector
- Access to garbage disposal along main roads- Public Sector
- Installation of public Roads where possible

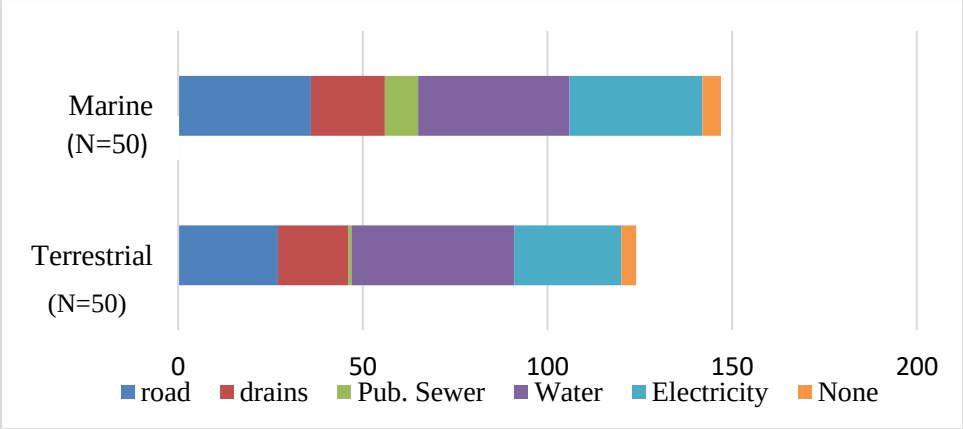

Figure 4-1 Share of Infrastructure accessed by Squatters in the Study Area. Duplicate responses. Source: Fieldwork 2017

4.2 Data Collection Strategy

Initial research design had intentions of utilizing eight (8) communities, however after several checks for feasibility and context to suit the urban impact areas the sites were narrowed down to four (4). Each Squatter Community is a case of itself with its own unique features; however, they were aggregated in terms of the ecosystem they would have been representing since testing revealed significance between ecosystem types and not locations. The four (4) sites were chosen under two categories, Marine and Terrestrial as each ecosystem type has different governance interventions. Each protected or ecological sensitive area had 1 community chosen for review.

4.2.1 Questionnaires

The participants who took part in the survey for the most part were the head of the household, where this was not possible a senior member of the household was interviewed. The aim was to collect 50 samples from each community 1 per household. The initial attempt to collect samples in January 2017, was based every other household, however the fear of tenure insecurity surrounding living in a squatter settlement posed as a challenge to collecting all of the samples, since people were refusing to participate. Therefore, in August 2017, the author settled for collecting the data from those who agreed to participate in the activity, a total of 120 household samples were collected and a final 100 utilized in the analysis of the results, this comprised of 33 for the Nonpareil community, 17 for the Port Royal community, 28 for the Bayshore/Harbour Heights community and 22 for the Hayes/Cornpiece community.

The design of the questionnaire questions considered the stated preferences method, using the choice modelling variation inclusive of a `Willingness to Act` component. This approach was taken as the respondents had competing priorities, that is shelter with livelihood component and environment preservation and the need for stakeholder participation in the development of policy is necessary. The use of questionnaires for collecting data was adapted to aid in providing scientific support to the qualitative data that was collected from the respondents in the interviews. The questionnaires were designed to acquire maximum information into the perception of squatter settlers and the protected areas they are impacting. Survey was conducted by face to face method, it consists of 3 sections, the first which collects short answers demographic and social data. This section considered respondents gender, age, number of persons in the household, number of years they lived in the community, occupation, tenure status (responses were open ended), reasons for living in the community (Likert style list of choices provided and they were asked to rank based on what was there main reason), infrastructure, community population information (Likert question range from slow increase to fast increase) and living standard (Likert question ranked from 1= Very Poor to 5 = Very Good).

The second section was designed to collect data on Perception (this considered how they viewed the importance of the natural resources and biodiversity in their community, also their views on squatting and the environment and who is responsible for protecting the PA) Likert 5 point scale questions (strongly disagree = 1, lowest to strongly agree = 5, highest) and Attitude (this came in the form of whether they were concerned about the environmental problems locally and an overall concern for global threat of climate change or global warming), Likert 5 point Scale (None =1, Lowest and Extremely = 5, Highest) was assigned to the questions.

Finally, the third section questions were open ended questions about their observations on any changes in the environment during their tenure (each observation was classified as yes =1 or no = 0) and possible pro-environmental behaviours (Implied PEBs) they may have engaged in (each PEB had yes =1 or no = 0 values). Also, any relationships between the squatters, formal housing, government entity and private entity that may present as subjective influences were considered in these questions. Further, inquiries on their intention in the form of future tenure status in regard to the community.

The questionnaire was presented to, reviewed and approved by the school before being issued to the participants. All participants were advised that the purpose of the survey was for

research purposes only and was not a tool to determine removal from location. The same questionnaire was issued to all residents in all the protected areas, although two ecosystems were chosen for comparison. For each question we ensured the squatters clearly understood all the terms in the questionnaire to ensure no ambiguity. During the exercise, they were asked, "Do you know what this means? If yes then they are asked to explain, if not the definition was provided. Hence the type of wording for the questions, in addition the local dialect is utilized during the questionnaire interview to provide further clarity for those who are not fluent in Standard English.

4.2.1.1 Demographic Statistics

The number of samples collected was a total of 120 households; however, after cleaning the data 100 samples were useful. As per Figure 4-2 below, there were almost equal amounts of male and female heads of households and of various age groups.

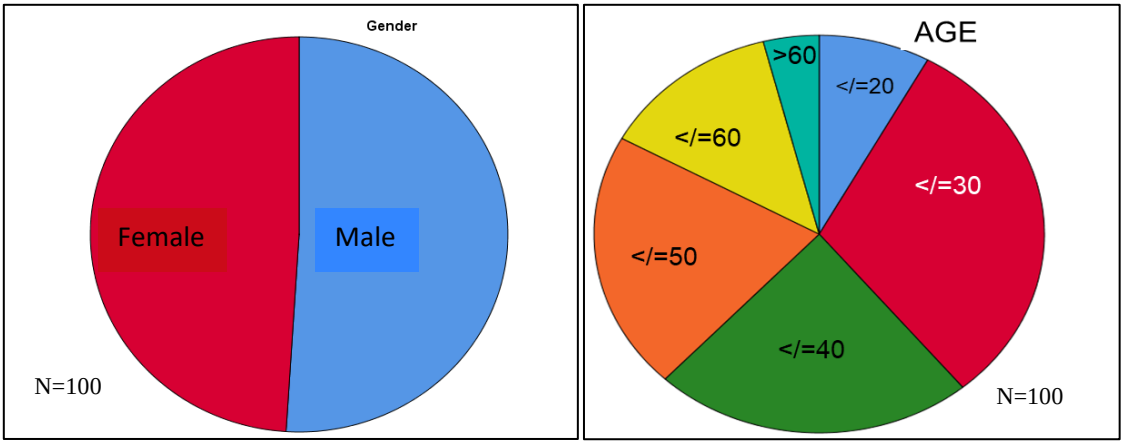

Figure 4-2 Pie chart showing gender (left) and age of household heads respectively (right). Source: Fieldwork 2017.

A key characteristic of the squatter communities is the number of years they have been in existence, during the time of this research, this ranged from 10 years to approximately 55 years. In the Figure 4-3 the diagram provides an indication of the range of years that persons have been residing in these squatter communities.

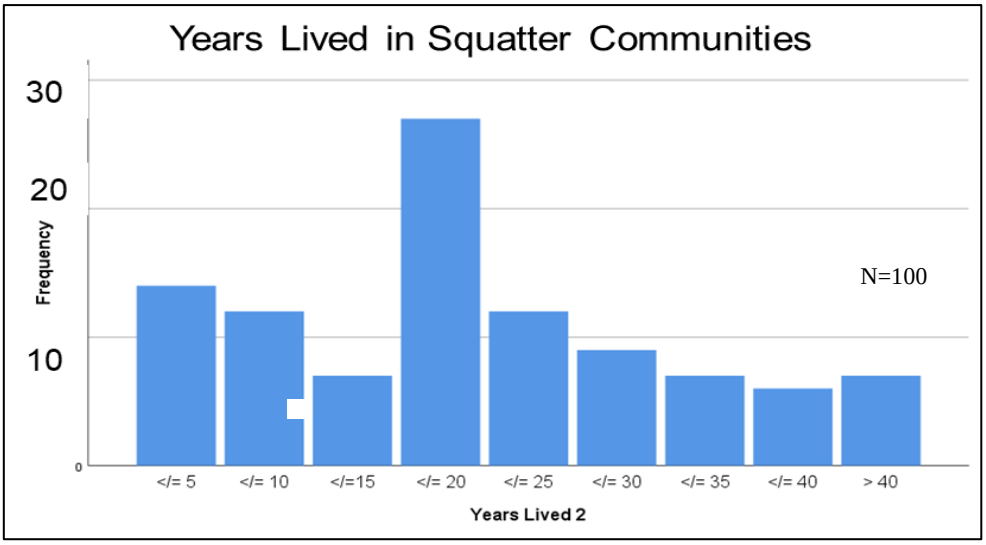

Figure 4-3: Length of time participants have been living in the communities. Source: Fieldwork 2017

4.2.2 Interviews

A set of 15 general and in-depth interview questions designed to track and collect historical and present day information over a period of 30 years on phenomenon related to squatting and the PA was created and administered (the questions considered interactions with daily life, livelihood, origin, potential for co-existence and population data) and the responses were captured by handwritten notes taken. For governance data, for majority lead agencies interviews were conducted in offices and with most senior person with specific area governance, where this was not possible, interview questions were sent by email and responses returned in similar manner. The following are agencies and the contact person:

- Manager for Protected Areas branch and Senior Librarian/Public Education Manager of the lead agency responsible for environmental protection in Jamaica, National Environment & Planning Agency (NEPA) in September 2016 and August 2017.
- Environment Data Manager, Center for Marine Sciences, Jamaica, August 2017
- GIS Mapping Officer, Forestry Department, August 2017
- Manager, Negril Environment Protection Trust, September 2017
- Executive Director, Jamaica National Heritage Trust, May 2018
- Lead Director and Junior Director of the Squatter Environment Management Unit (SEMU) January & October 2017, with follow up in 2019.

This qualitative approach to collecting data was conducted with both members of the squatter communities and governance bodies. The interviews with residents in the squatter

communities were conducted in two (2) small groups (no more than 5 persons) in the larger communities to allow persons to feel comfortable with having the discussion, and two (2) small groups (no more than 4 persons) in smaller communities. Additionally, these persons were selected base on set criteria, to include the amount of years living in the area, willingness to participate in the discussion, understanding of environmental threats, keen knowledge of the area, must be a squatter. The format adapted was of a semi-structured format. The same set of interview questions designed for the governance bodies was used, but only as a guide for conducting the interviews with the residents, this was done to acquire comparative responses and to guide the discourse ensuring relevant information to the problem is being explored. Also, to further probe into historical information on the phenomenon and to create a comfortable atmosphere for the community persons, some flexibility in language use was applied and respondents encouraged to provide their lived experiences on topics covered under the interview questions, this in all instances allowed them to be more relaxed and provided information without much hesitation.

4.2.3 Field Observation

A field observation exercise was conducted in July – August 2017, this was done through transect walks in the community and windshield survey for some instances. The identification of community boundaries was done with the assistance of SEMU (2017).

Field observations were done to see if there were noticeable changes in the environment that would support a potential for a correlation analysis of the environment and the act of squatting and whether or not the noticeable changes would merit such a research.

In addition, this method was adapted to determine if the data provided by the respondents could be considered reliable, having observed intimately what the state of the environment in that location was. The author took notes and photos of obvious anthropogenic threats, taking precautions to avoid capturing specific images of people, and getting permission where possible to capture certain images.

4.2.4 Limitations

There were several limitations to this study, namely:

1. Resistance to the exercise as some of the respondents was extremely fearful because of their tenure situation.

2. Similar to other areas, some locations are characterized by crime and limited the amount of time that could be spent and the time that one could actually go into the community for information.
3. Some respondents were limited by their literacy ability and so a longer time would have had to be spent with them to explain the contents of the questionnaire.
4. Proximity to research location and the institution, also the amount of time available to go into the field for the research was limited so sample sizes were smaller in some areas.
5. The Port Royal community has only 50 households so the sample could not exceed the number of households in this community.
6. The life of one of the persons assisting with the questionnaire sampling was threatened and the survey had to be cut short.

Bias:

Some respondents may project social desirability biases, since the act of squatting associated with the fear of tenure security, is a sensitive and personal situation, resulting in instances of them trying to present themselves in the best possible light.

4.3 Data Analysis Strategies

Previous research on squatting and the environment suggests a two-fold cause to the negative effects resulting from the activity of people in proximity to PA, that is governance and a lack of people involvement in decisions (Tindigarukayo 2014; Ramkissoon et al 2012; Hirschnitz-Garbers and Stoll-Kleemann 2010). However, a gap in the perception of low-income groups who occupy theses spaces was discovered and forms a major part of the research. The results of analysis of the data will be presented in two (2) Chapters, 1) Chapter 5- Governance and Assessment of Impact on PA and 2) Chapter 6- Squatter Perception and PA Environment. Each chapter will be analyzed using best fit techniques and are considered as follows:

4.3.1 Governance and Assessment of Impact on PA

The analysis was done using both qualitative and a quantitative approach:

1. Qualitative: The background information allowed for a phenomenological approach (whether authorities took consideration of the association of squatting in these areas) to understand, in four (4) examples, the following:
    - The governance structure and strategies used in management of squatting & PA

- Determine whether the management of squatter settlements and PA are being collectively considered for minimizing the negative effects
- Potential relationship between squatting and environmental degradation in the locations

2. Quantitative: Background information on the problem helps to determine the consequences of current governance structure in the form of impact on the PA over a period of time:
    - Calculation of the land cover change over a 13-year period.
    - Use of GIS represented land use Data 1989 -1998 to show deforestation.
    - Comparison of standards for pollutants in locations with high water table vs what exist in the PA affected by squatting.
    - Photos were captured by transect walks/walking survey and windshield surveys are distinct areas, the aim was to collect visuals of environmental changes and threats to the environment that may be attributed to the lifestyle of these residents. These results were later compared to information provided by the participants about changes they have noticed for the extent of the period they have been living in these communities.
    - Calculation of location impact on the PA. This was done using the formula below, which aids in providing impact of anthropogenic threats on ecosystems and was adapted using descriptive weighting values (Low 1- High 5) provided by NEPA the lead government agency with responsibility for environment protection.

Formula: $$I_l = \sum_{p=1}^{n} L_p * E_j * \mu_{pj}$$ (Halpern et al. 2008).

I_l = Impact of Location

n = number of pressures

p = pressure (values are 0 for absent and 1 for present and impacting)

L_p = Log- transformed and normalized value of pressure at location

E_j = presence or absence of an ecosystem (1 or 0 respectively)

j = Ecosystem

$\mu_{p,j}$ = impact weight of Anthropogenic pressure (Low 1 to High 5, Table 4-1)[1]

Bryant et al (1998), analyzed impact on coral reefs worldwide, defining the anthropogenic threats and indicating areas of various intensities including Jamaica that has all coral reef system affected by human and natural causes, such as pollution from sewage disposal, agricultural runoff, siltation due to poor land use practices, and other algae grazers, the unchecked algal overgrowth of corals have compounded the problem. Both Bryant and Halpern researched calculating impact intensities base on human influence, with Halpern applying methods used by Bryant. In this study, the method of analysis was adapted from Halpern`s et al (2008) research. In their study, the authors found a significant percentage (41%) of each area was strongly affected by multiple drivers and no area was unaffected by human influence. Similarly, in this paper each PA is impacted by human influence some more than others (where the pressure is absent the value = 0, and 1 the pressure is present and impacting). In addition, Rabalais et al. (2009) analyzed impact of anthropogenic threats in the Gulf of Mexico from multiple stressors, utilized this method to determine intensity on MPA.

Table 4-1 Environment Threat Variables Considered for Location Impact of Settlement as per NEPA. Source Fieldwork 2017

No.	Pressure *(p)*	Weighting
1	Sewage Infrastructure	5
2	Wetlands Species Loss or Migration	4
3	Solid Waste	5
4	Water Pollution	5
5	Economic /Livelihood	3
6	Land Conversion/Land cover change	4
7	Squatting	3

[1] The pressures and weighting are an official government description of threats and weights faced by the PA as defined by the lead agency for environment protection in Jamaica, the National Environment and Planning Agency (NEPA). Threats ranked as 5 are of severe intensity/significance – characterized as those which are seriously degrading values in the protected area; 4 are of high intensity/significance which are degrading the environment; 3 are of medium intensity/significance - those threats having some negative impact; 2 are characterized as of low intensity/significance - those threats which are present but not seriously impacting values; and 1 are characterized as where the threat is not present or not applicable in the protected area.

4.3.2 Squatter Perception and PA Environment

The variables utilized in the analysis for findings presented in Chapter 6, originates from the questionnaire. The questions were designed with the literacy of the respondents in mind and to capture the best information based on the views of the respondents. The questions which comprised of categorical responses were changed into data that would allow for statistical analysis which are aimed at capturing any association among the variables. Depending on the type of question the responses were then converted into variable data based on 3 types, nominal/binary, scale and ordinal data (See Appendix -IV).

Section 1 of the questionnaire consisted of socio-economic, demographic, infrastructure and population information. However, to best comprehend the respondents' attitude and perception towards the PA environment they are impacting, Section 2 of the questionnaire utilized questions that were considered under Attitude (whether they were concerned about the threats to the PA, Likert scale data none =1 being lowest and extremely = 5 being the highest) and Perception (how they viewed the natural resources, squatting in relation to the PA, living conditions, education and the environment) developed using the Likert 5-point Scale, where 1 = strongly disagree, the lowest point of perception and 5 = strongly agree. Section 3

There were three (3) main considerations when assessing the Perception of this lower economic group, they are:

1. Whether there was a significant difference in perception for the predetermined dependent and independent variables, such as, governance, squatting and the environment, responsibility for environment protection, between ecosystem groups (Marine & Terrestrial) and gender.
2. Affect (changes in the PA) and Pro-environmental Behavior to determine if the attitude and the actions they might have taken has any relationships that are to be considered. In order to indicate potential environmental implications of the act of squatting as it currently exists, participants were interviewed on the environmental changes they noticed over time living in these communities and to provide information about ways they have tried to protect their environment.
3. What are the best predictor variables for addressing squatter perception towards PA and which independent variables best explain their actions?

To analyze the first consideration, Anova One-Way and Mann U Whitney Tests was done on nominal, binary and ordinal data to determine if there would be significant differences in perception of persons by the PA location as per ecosystem type (Marine and Terrestrial) or by Gender. This was done to determine the best approach for solutions to guide policies targeting the effects of low-income groups on PA.

Secondly, to determine if Squatter Attitude and Pro-environmental Behaviours (PEBs)[2] have an association, correlation tests were done using Spearman Ranked Correlation for ordinal data, since these are ranked data. However, Chi-Square tests and Pearson tests were conducted on nominal and binary data. Similar tests were done for the importance of education in their attitudes and potential behaviours. The results were subjected to frequency analysis, further nonparametric correlations to determine if squatter perception was influence by the subjective informational norms associated with governing the PA, through public awareness in the form of educational programs. Also, to assess whether there were any significant associations to the observed changes in the communities and any PEBs indicated.

To determine the strength of these associations between variables, the effect size was measured by Cohen's d as 0.2, 0.5 and 0.8 considered small, medium and large effects respectively (Cumming and Calin-Jageman 2017).

Finally, as previously stated a suitable dependent variable was determined using Mann-Whitney U test on median scores of results that considered whether protecting the environment was important, routine activities of squatters and the activity of squatting itself. Regression Modelling in the form of an Ordered Logistic Regression or Ordinal Regression analysis was done to try predicting squatter perception how it may affect the PA environment. The assumptions for the associations between variables are satisfied with p-values significant at either less than 0.05 or 0.01. The Ordinal regression predictive analysis method was chosen as it's the statistical method that would best describe the relationship between the data of one dependent variable with ranked data and two or more independent variables (McCullagh 1980 & Greenland 1994).

The results of the survey were analyzed using Software tools for the quantitative analysis of the perception data that is Excel 2010 and IBM SPSS version 24.

[2] Pro-environmental behavior (PEB) is conscious actions performed by a person to lessen the negative impact of human activities on the environment or and to enhance the quality of the environment (Jensen 2002, & Kollmus and Agyeman 2002)

As previously stated, three (3) predetermined set of dependent variables were considered, they were analyzed using a Mann U Whitney Test done to determine the best predictor of squatter behavior:

1. Squatting is a Threat to the Environment.
2. Daily Routine Affects Environment
3. Important to Protect the Environment

The ordinal regression model considered 18 categories of factors with 46 explanatory variables (Table 4-2), which were chosen based off their socio-economic situations, potential to perform pro-environmental actions, changes to the environment (listed individually such as, water pollution, less trees, less animals, soil erosion), Attitude which refers to concerns for the environment (such as climate change, deforestation, water pollution, threats to species), Perception which refers to how important they perceive the protected resource in the community (Sea is important or Forests are important) and intention (refers to future tenure status) for the location.

The analysis began by testing each of the 46 explanatory variables (See Appendix IV) against the dependent variable, then adding and removing variables to improve the model outcome.

The complete analysis was done under a particular pattern to ensure a logical sequence and practical application of the information collected during the study (Figure 4- 4).

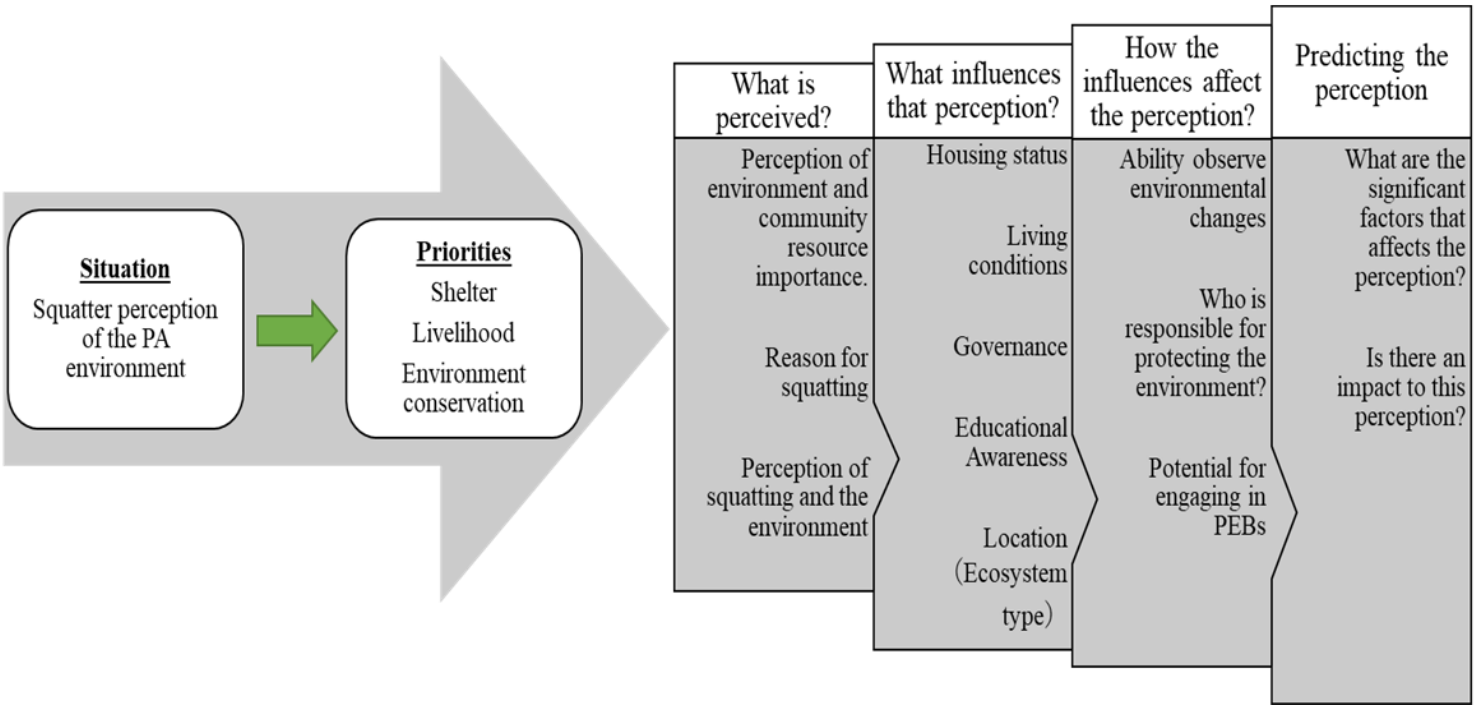

Figure 4-4 Flow of Perception analysis results

There were certain questions that were hypothesized to clarify the perception of the respondents and determine the usefulness of the information. The following were explored:

- Hypothesis 1: Participants will believe that squatting is not a threat to the environment.
- Hypothesis 2: Participants will disagree that their daily routine activities are a threat to the protected area.
- Hypothesis 3: Status in the community (homeowner or tenant) and intention for future status will determine the attitude towards the PA.
- Hypothesis 4: The subjective norms in the form of social informational influences associated with the governance of the PA by government agencies, will allow these individuals to take greater responsibility for environmental protection. Also, for communities in Marine PA that have greater governance will accept greater responsibility and participate more in PEBs over Terrestrial PA squatter communities.
- Hypothesis 5: Educational programs that create awareness about environmental protection and the degree of personal control they have over their surroundings affect their intention and behavior towards the environment, this determine if they would engage more in PEBs and believe in the idea of protecting their environment.

Chapter 5- RESULTS - GOVERNANCE AND ASSESSMENT OF IMPACT TO PA

5.1 Current Governance for PA & Squatting

In researching this topic, analysing the governance situation was considered two-fold, namely governance of the PA and governance of squatting. This was done since both have implications for the other, whether positive of negative.

5.1.1. Protected Area Governance

According to the Ecological Gap Assessment, "Beginning with the Harbours Act of 1874 and the Morant and Pedro Cays Act of 1907, conservation efforts evolved through a number of legislative acts applied in a largely ad hoc fashion and, as a result, protected areas now fall into 19 different named categories under the jurisdiction of four government agencies within 3 ministries." The governance structure for PA is a multi-level collaborative framework encompassing the four (4) lead government agencies having ultimate responsibility, this done in conjunction with other consulting NGOs and agencies.

As stated previously, the four principal government agencies with oversight responsibility are the National Environment and Planning Agency (NEPA), Forestry Department, Jamaica National Heritage Trust and Fisheries Division. These agencies have the power to delegate authority to local partners, other government entities, NGO's and/or the private sector, hence four (4) types of governance methods adapted (governance by Government, shared governance (by Government and NGO`s), Governance by Private Sector and Governance by Community or Indigenous people), the same structure as in Dudley 2008 research. This approach to governance is being used to develop the Protected Areas System Master Plan (PASMP), however it is evident since the document continues to be in the draft stage after 1 year pass the deadline (now 6 years) that there are deficiencies.

The analysis of the current governance strategy highlighted some key limitations to ensuring that the human impact on the PA systems are controlled and within the prescribed limits. These limitations are as follows:

- **Lack of accountability** – This is a major hinderance to protecting the sensitive ecosystems. The diagram in Figure 5-1 demonstrates an example of such a deficiency.

Example 1 – PA.1/SS.1

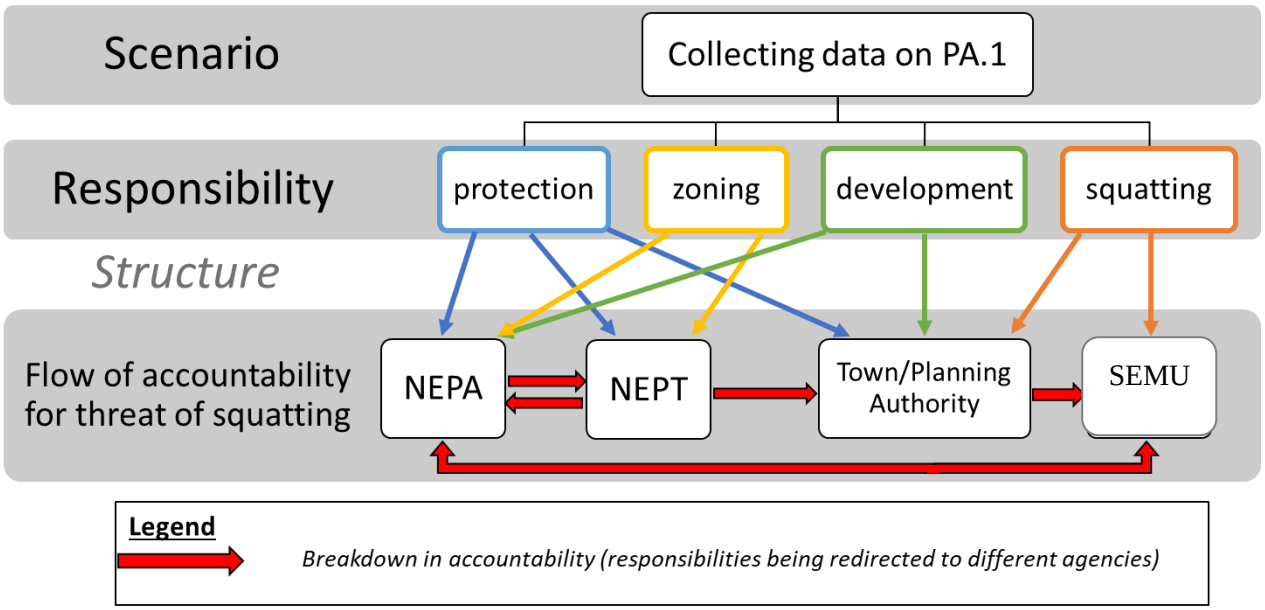

Figure 5-1: Shows lapse in accountability for Governance of PA related to Squatting. Source: Research Fieldwork 2017.

- Fragmented, incomplete and inconsistent governance framework exists in the responsible agencies.
- Legislative frameworks aren't being enacted, and in the environments where enactment exists, there is limited follow through for monitoring and evaluation.
- The lapse in monitoring of these areas, create an easily accessible space for housing development, whether low, medium or otherwise, especially if the house is being developed further away from the main road.
- Resource deficits, whether human or financial resource.
- Inadequate use of licensed software that are capable of monitoring squatter development.
- **Individualistic approach to solving problems of squatting**, as the owner of the land whether public or private sector is tasked with the decision of approach to the act.
- Responsible agencies have been determined to have limited knowledge database on squatting as a threat to these PA as illustrated in Example 2, Table 5-1, which draws a comparison to interview questions responses for both lead agency and the squatters.

Table 5-1: Example 2 - Comparison of Responses to Interview Questions by Lead Agencies and Squatters. Source: Fieldwork 2017

No.	Interview Questions	Responses	Squatter Response
1	What is the extent of deterioration or impact on the natural environment by these communities?	This has not been established	Flooding, Place is hotter, less trees
2	Does the origination of the community determine the severity of the impact?	This is not known.	Do not Know
3	What led to the development of these communities in the specified areas?	This is not known.	Prime Minister, Sugar Plantation, Hotel Work, nowhere to live, job, school
4	How does the livelihood and routine activities of these communities impact the natural environment?	Cannot say definitively how livelihood and routine activities impact the natural environment in these communities.	Improper garbage disposal, wasted water because poor infrastructure, pollute water, less fish
5	Is the current trajectory of the communities tolerable to the natural environment or will it be necessary for them to relocate? If tolerable are the practices applicable to planned communities?	This has not been established.	Community population growing
6	Are the inhabitants aware of the threats they pose? Their views on the threats and who is responsible?	This has not been established as the respondent is not aware of any survey that was conducted to garner this information.	Forests were once protected against cutting of specific species of trees by Forest Rangers, heavy fines were imposed, currently no longer enforced
7	What has been the rate of growth for population over the period?	The respondent is not in possession of data to ascertain the population growth over the period at the various sites.	Community population growing, some fast, some slow

Table 5-1 indicates the lack of information on the part of the Lead Agencies and strengthens the widely established fact that it is important to have stakeholder perspective. This is supported by the fact that they possess vast historical knowledge (Leung et al. 1998), and as indicated in the Table the community members appear to be aware of the changes occurring in

the area and can supply the information. This lack of information could be associated with a lack of accountability and as according to McCall 2003, accountability for good governance can be defined as, `transparency and visibility of government decisions and policies, accountability mechanisms, and responsiveness to lower levels, community involvement being a means to generate accountability and further expressing that it is not the only way to show good governance,` however, in this instance it is crucial to the well-being of PA, since, as previously stated, there are four (4) types of Governance applied to these PA.

Consequently, it is paramount that consideration be given to how well is this type of governance system working for the PA, since lack of accountability is a foremost deficiency among responsible parties with each agency pointing in the direction of the other for answers. It also puts in question what obtains at the time of decision-making and may contribute to the extended durations it takes to enact policy or other legislative frameworks which have implications for these sensitive habitats.

5.1.2 Governance of Squatting

Apart from the National Housing Policy and regulations associated with the Planning Authorities that aims to reduce squatting by eviction, relocation, regularization and upgrading where necessary, no other legislature governs squatting, resulting in several deficiencies:

- Lack of Squatter Policy
- Lack of a Squatter Database that provides critical information that will inform solutions for low income housing problems.
- Confrontational governance – in the form of aggressive removal methods from the locations that is then repelled by squatters.
- Failed Squatter relocation or resettlement strategies and no innovation for new approaches such as temporary Land Lease techniques (Board Scheme) that information collected during the research reveals could address some 50% of the squatter population. The Board Scheme Concept has created informal legitimacy in areas close to PA.1, allowing people to access the formal financial system and provide cost efficient housing in areas less damaging to the PA.
- Political Affiliations that disturb the process of implementing solutions in areas that has strong party support.
- Squatting Solutions are mainly Individualistic (Example 3, Figure 5-2), this can be attributed to the fact that the SEMU is not empowered in law to serve notices, carry out

evictions, demolitions and such enforcement activities. It is the responsibility of the landowner to pursue enforcement activities regarding illegal occupation of their property.

- The Municipal Corporation have statutes on their books to deal with illegal constructions/development but appears to be deficient in carry out these functions.

Example 3 – PA.4/SS.4

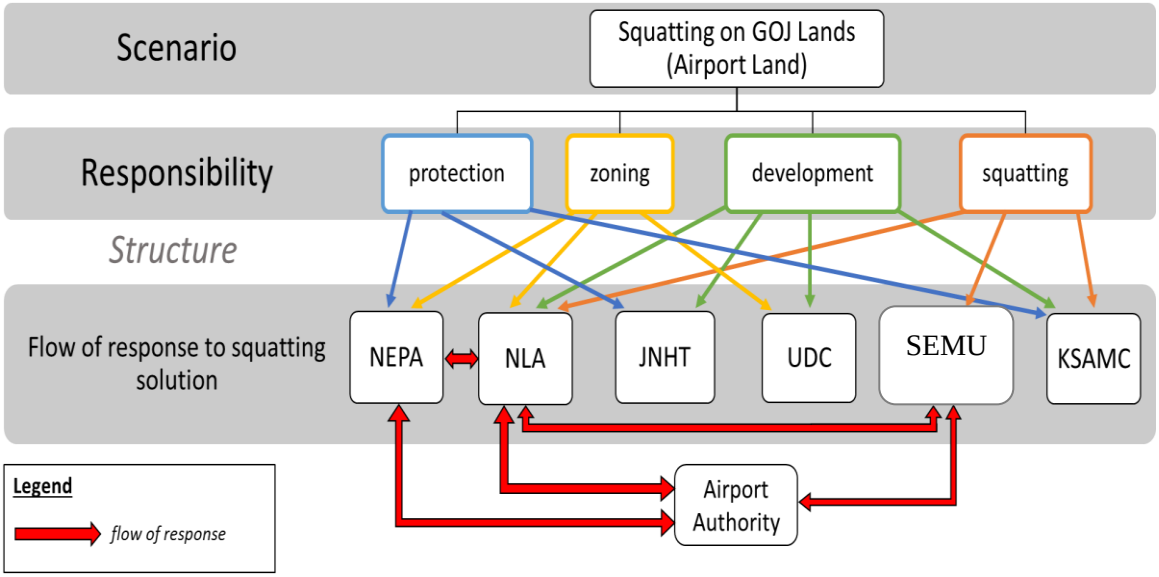

Figure 5-2: Shows an example of how Squatting is addressed on privately run government land. Source: Research Fieldwork 2017.

- Lack of or inadequate involvement of key governance Agencies in steering committees (Example 4). The interviews were conducted with two lead agencies (NEPA and SEMU) and an analysis of the current governance system for the natural environment and the issue of squatting showing the approach to monitoring and other governance techniques such as policy direction can be represented as shown in the diagram Figure 5-3.

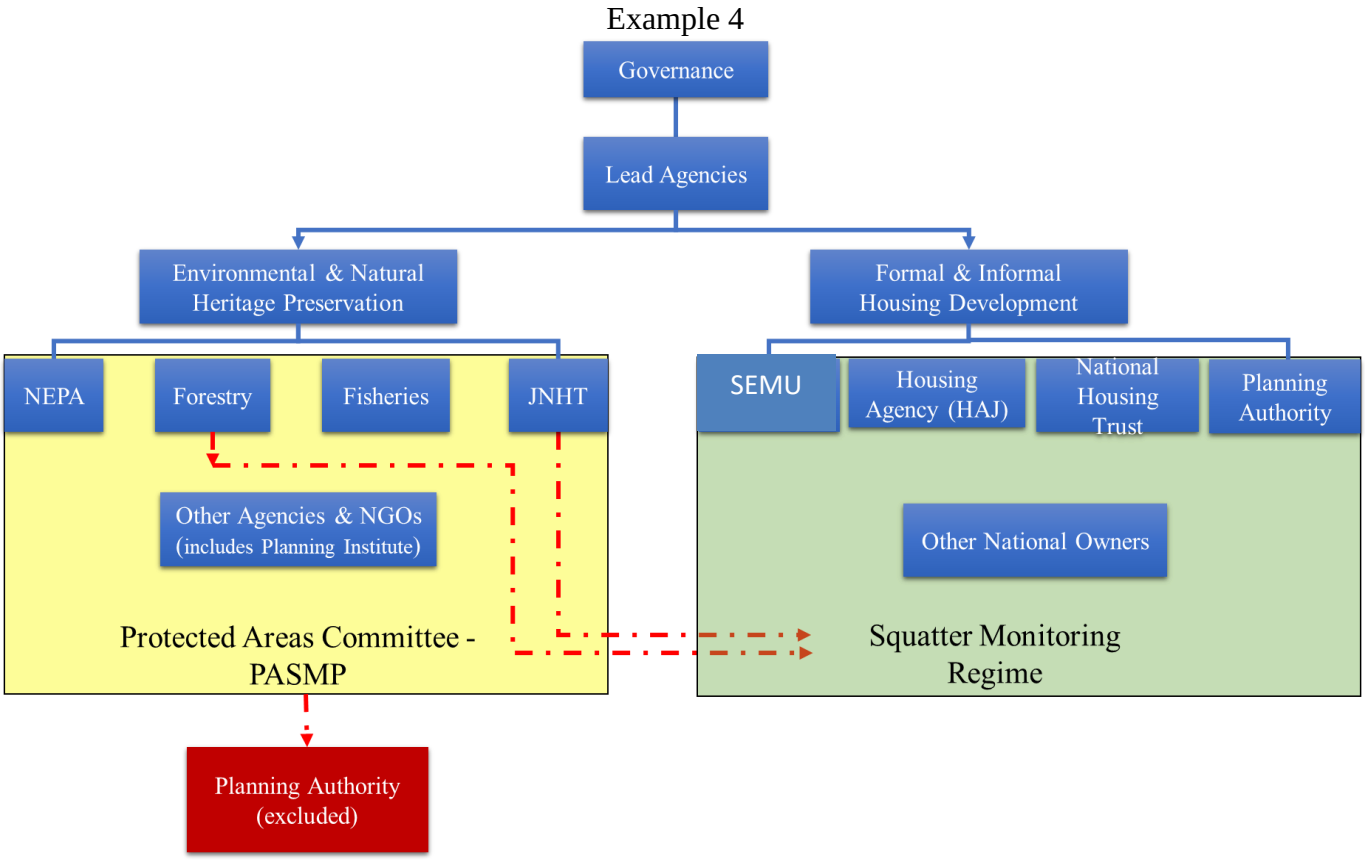

Figure 5-3 Illustration of Steering Committees Governance Structure for PA and Squatting. Source: Fieldwork 2017

The flow of operations in the structure highlighted in Figure 5-3, revealed added shortfalls that may contribute to the deterioration of the PA environment, and are outlined as follows:

- Lack of collective consideration for solution implementation
- The Planning Institute of Jamaica (PIOJ) whose responsibility is to "initiate and co-ordinate planning for the economic, financial, social, cultural and physical development of Jamaica; monitoring the implementation of plans so initiated or co-ordinated; undertaking research; conduct training in planning; undertaking consultant activities for Government Ministries, agencies and statutory bodies; maintaining a national socio-economic reference library; and managing technical corporation agreements and programmes" has a supporting role in the Protected Areas Committee, however, does not form a part of the Squatter Monitoring Regime. In addition, policy for squatting is being developed outside of this body. The PIOJ was contacted in September 2016 about the research problem and was informed, the Institute does not have the community specific data that required for this research.

- Common connection between both structures is the Forestry and Heritage (JNHT) Agencies, key environmental agency does not participate on the Squatter Monitoring committee.
- Planning Authority/ Municipal Corporation, which is the agency that has statutes on their books to deal with illegal constructions/development responsible for development orders in specific areas also ensures preservation and conservation, appears to be excluded from the main strategic planning process for the Protected Areas Committee, however, is included the process for monitoring squatting.
- Marine PA experience greater interventions for preservation than Terrestrial PA, see Table 5-2 for summary description of efforts.

Diagram clearly identifies a disconnect that would play a crucial role in the governance of environmental areas affected by squatting, however, in recent times, as previously stated there is a re-energized targeted focus to minimize the effects of squatting in social, environmental and other associated problems. This move will now employ a multi-dimensional look at acquiring relevant squatting data in the country, instead of the current situation that suggests, it is the responsibility of the landowners to put mechanisms in place to monitor squatting on their land.

The research into the governance of the PA further reveals as common with many countries' deficits in the funding. This among other resource issues has resulted in lapse in monitoring of the areas and a lack of enforcement of the conservation policies that have been implemented. The summary in Table 5-2 shows a failure to reduce the development of housing through the policies as the settlements are still in the location and has a growing population. In addition, although majority of the PA has funding available for conservation, there may be concerns for inadequacy and in one case there appears to be nothing done regardless of a budget. It is important to note that PA 4 has heavy intervention, however a lot of the strategies for conservation are still in draft stage and therefore are not enacted and has legislative polices for over 70 years, but failed to prevent the development of squatter settlements within the PA.

The deficiencies in governance has real consequences for the future population of the country about the incalculable value of biodiversity loss and in one case a monetary value of approximately 23 million USD has been loss from the threats associated with human activity.

Table 5-2 Summary of Governance Situation with all four (4) PA. Source: Fieldwork 2017.

Governance of Protected Areas											
Protected Area				*External Parameters*		*Monitoring Parameters*				*Implications*	
#	**Zone**	**Squatter Settlement**	**Agency**	**Conservation Policy**	**Enforcement Status (Action, No Action)**	**Cost (Approx..)**	**Frequency**	**Age of Policy (yrs.)**	**Age of Area (yrs.)**	**Environmental Threats**	**Potential Impact Costs (Threats)**
P1	Negril Great Morass and Negril Marine Park and Coastal Areas	Nonpareil SS.1	NEPT & NEPA	Natural Resources Conservation (Marine Parks) (Amendment) regulations 2003. Negril Coral Reef Preservation Society	**Action-** Creation of a Zoning plan, Public awareness programs, Monitoring of Coral Reef and fisheries. Petitioning for Bans	NEPT= $5,700,000 JMD per year	Equipment purchased to ensure regular monitoring of coastal areas and wetlands.	14	45	Destruction of mangroves (Land Clearing by fire) for housing and farming. Sewage and domestic waste (Laundry). Solid waste, overfishing,	USD 23,000,000
P2	Portland Bight PA (Braziletto Mountains)	Hayes (Cornpiece) SS.2	Forestry Department	Forest Policy and the Forest Act 1996 updated 2001	**No action**	Not monitored	Not Known	21	55	Deforestation and Land conversion	Unsure
P3	Rockfort Reserve	Bayshore/ Harbour Heights SS.3	Forestry Department	Forest Policy and the Forest Act 1996 updated 2001	**No action**	Part of $122,000,000 JMD	Not Known	21		Deforestation, Soil Erosion and Land conversion	Unsure
P4	Palisades and Port Royal Protected Areas	Port Royal SS.4	NEPA, NRCA, JNHT, NLA & Fisheries Division	SPAW Protocol, Wildlife Protection Act (1945), Beach Control Act 1956, Ramsar Convention 1971, Endangered Species Act 2000, Natural Resources Conservation Authority (NRCA) Act (1991)	**Action-** Draft P-PRPA mgmt. Plan. Draft Zoning Plan. Habitat and Species Conservation Plan. Public Education. Rangers	NEPA= $5,932,650 JMD per year	Proposed quarterly for wetland species and daily monitoring for human activity.	72 46 26	11	Destruction of Mangroves, squatting, Wetlands Species Loss, Land conversion, damage to coral reefs, sewage, water pollution	Biodiversity and Ecosystem Values. Economic Value through Livelihood support

5.2 Consequences of Governance as Impact on PA

For results to analysis that looked at the deficits in governance of these PA, it has demonstrated where not authorized, the ability for proliferation of unsanctioned developments. According to Myers et al 2000, “The number of species threatened with extinction far outstrips available conservation resources, and the situation looks set to become rapidly worse.” The situation as described is linked to the burdens on protected areas as a result of human activity and by individuals living in low income situations. Although there are several problems resulting from these threats, this research noticed major problems in the form of Deforestation and Improper Sewage Disposal as implications of the deficiencies in governance.

The limited annual budget of the SEMU, which is approximately J$25 million which includes about J$10m for policy formulation, along with a lack of regulatory empowerment and deficiencies in the operations of the municipal corporations creates a gateway for threats that may result in negative impact to the PA. Although, the SEMU may be considered the entity with an array of information on squatting locally and are frequently contacted by both private and public landowner for advice on squatting issues, this not allow for action that an empowered entity would be able to take to minimize the influence on these sensitive locations.

5.2.1 Deforestation

According to Chakravarty et al. (2012), the world faces a major crisis in the form of Deforestation, an act that can be defined as the permanent removal of trees to use the space for a purpose other than the intended (Van Kooten and Bulte, 2000). This act is widely frowned upon as it results in major problems such as, loss of food source, destruction of homes to other wildlife, increases in carbon, droughts, destruction of watersheds and other crippling effects.

Jamaica has been facing its fair share of forests loss for many years. St Ann, Hanover, Clarendon and Kingston experienced the greatest rate of deforestation, ranging from -1.16% to -0.02% (Forestry Department 2017). The parishes of Clarendon and Kingston that is home to two (2) locations of focus for this research, namely Hayes

Cornpiece SS.2 in PA 2 and Bayshore SS. 3 in PA 3 respectively. The repercussions of the impact of forests are felt by both locations in the form of droughts and warmer temperatures, changes in the environment noticeable by the inhabitants in each settlement. The following diagram in Figure 5-4 is a partial representation of that factor:

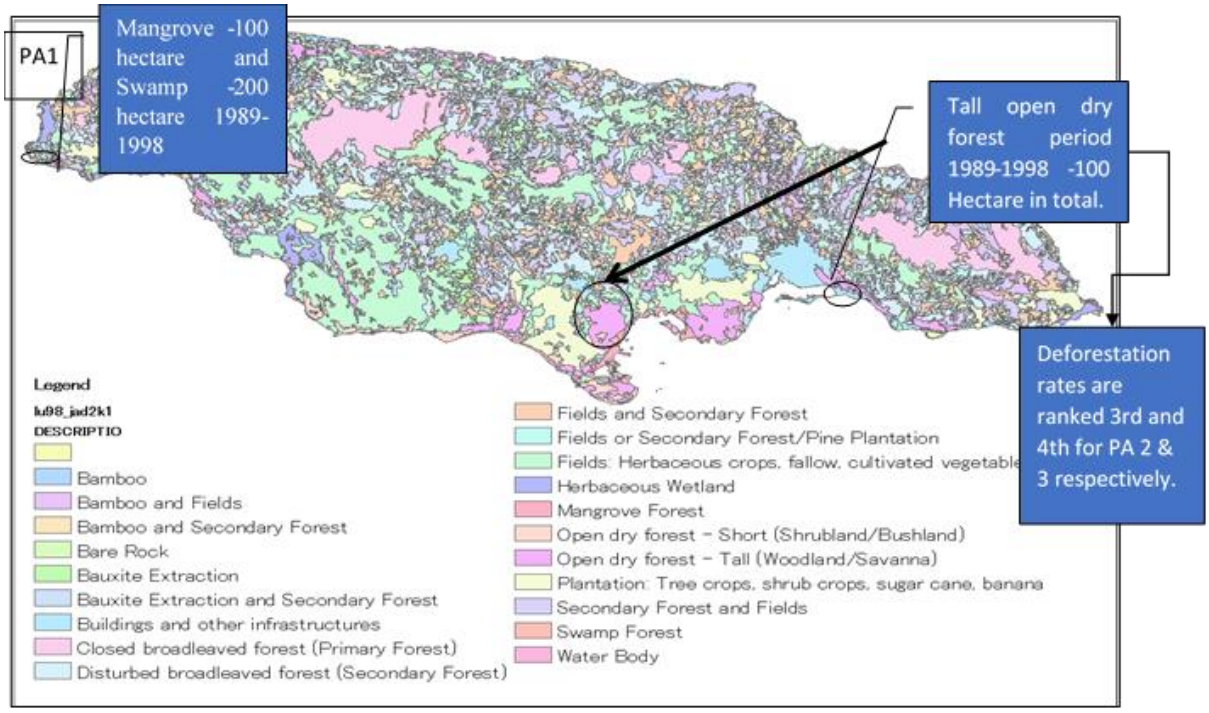

Figure 5-4 Land-use data with forest change in PA1, PA2 and PA3. Period 1989- 1998, 2013 Data was received but when compared with old data was not usable. Source: Research Fieldwork 2017 and Forestry Division, Jamaica 2017

The results in the diagram indicates the forest loss from 1989 to 1998 associated with squatting, showing that there has been deforestation impacting not just one type of forest, but affecting dry forest, swamp and mangrove forests. This as previously stated has unsanctioned Land Cover Change or Land Conversion in the form of land clearing for housing, livelihood activities such as farmlands and other associated activities. This land cover change in the form of Deforestation continued after 1998 removing hectares of Dry Limestone Forests and Mangrove Forests.

Responses form the community respondents indicates that Forests were once protected against cutting of specific species of trees by Forest Rangers, heavy fines were

imposed, however, at the time the study was conducted this practice was no longer being enforced.

Threats of deforestation through land conversion for housing as a result of the growth in these squatter settlements appear to be associated with the fact that they share infrastructure and in some cases are formed on lands that are left over from the formal subdivisions. This is commensurate to a Commensalism relationship. Figure 5-5 below indicates the approximate total land cover change as a result of the conversion for the 13-year period.

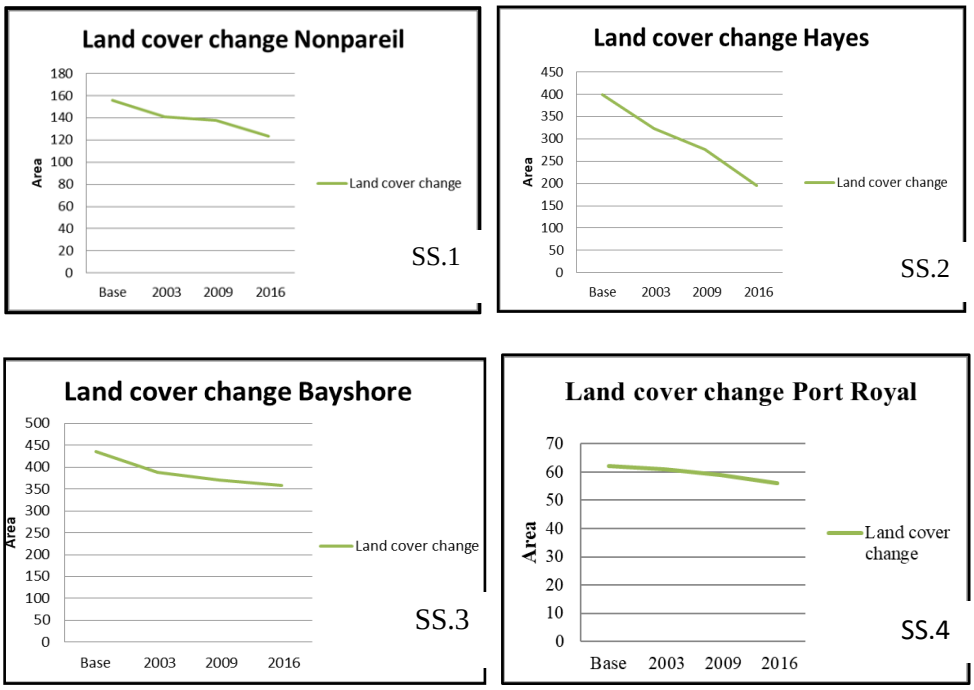

Figure 5-5 Shows total land-cover change for each PA in relation to housing and livelihood. Source: Fieldwork 2017.

The change in Landcover was calculated using S-S1= X1, where S is available base year data using boundary information and oldest Google Earth information on the location, S1 is first year of change measured and X1 is the existing area of the protected site. For the measured areas only sections of direct impact were taken, the results range from approximately 6 hectares in PA.4 that was 10 years old at time of data collection to approximately 200 hectares in PA.2 that was 55 years old.

This change is being noticed not just by the regulatory bodies, but by squatters, who have indicated they have experienced environmental changes in their communities by this activity, such as warmer temperatures, flooding, droughts, less trees and animals. For the locations that are home to the Terrestrial PA, approximately some 2500 Hectares (ha) of forests Table 5-3 has been loss for this a similar period.

Table 5-3 Forest Cover Annual Rate of Forest Loss. Source: Forestry Department 2017

Parish	1998	2013	Difference (ha)	Deforestation Rate	Annual Rate
St. Ann	32,154.49	28,826.03	-3,328.46	-10.35	-0.65
Hanover	14,057.09	13,022.44	-1,034.66	-7.36	-0.46
Clarendon	**35,379.62**	**32,858.66**	**-2,520.96**	**-7.13**	**-0.45**
Kingston	**221.71**	**221.04**	**-0.68**	**-0.3**	**-0.02**

Location in bold is the parish and presents total deforestation value for the area, which is home to PA.2 and PA.3 respectively.

For the more urban locations, such as PA.3, the fast rate of population growth increases the rate of land cover change and increases the removal of habitat, which implies animal species migration and reduction of specific wildlife. There is also the introduction of other nonnative animals such as goats and dogs, in noticeable amounts which further impacts the location.

5.2.2 Improper Sewage Disposal

In addition to the struggle to provide shelter that is normally faced by the individuals who occupy these communities, as result of their socio-economic status, sometimes intensified by the limitations of tenure, is the problem to build sewage containment systems that are according to regulatory standards. Figure 5-6 provides the details of the types of toilet systems, it shows that majority of the households utilize the indoor flush toilet facilities, these are emptied into the most frequently used soil absorption containment system, namely Absorption Pits.

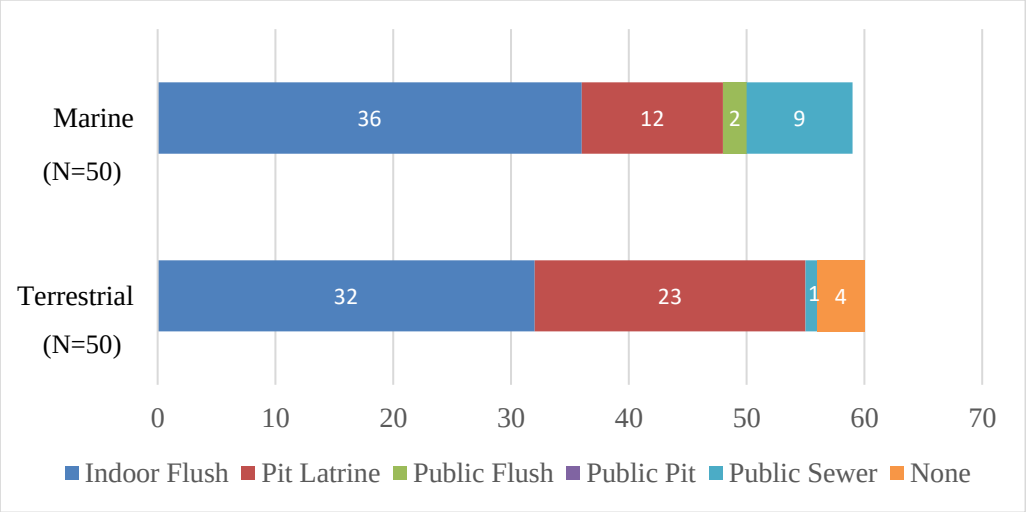

Figure 5-6 Types of Toilet Facilities in the Squatter Settlements by PA. Source: Fieldwork 2017

Notwithstanding, there seems to be several efforts made albeit the implications to the types of ecosystems they impact. There is numerous research that speaks to the vulnerability of Marine and Coastal PA, and even to those located in low lying flood prone areas, like wetlands as a result of informal settlements or squatting. As previously stated, Jamaica is not strange to this situation having approximately 37% of total number of squatter settlements in environmentally sensitive areas, forests reserves, protected and key biodiversity areas and water sheds.

Although the main sewage system utilized in the country has to do with soil absorption mechanisms inclusive of, septic tank, tile fields and absorption pits, these are constructed according to regulations are not suited for high water table areas and soil types which are typical of the locations in PA.1 and PA.4, which is impacted by respective squatter settlements, especially since they are categorized under the conditions of the Protocol Concerning Specially Protected Areas and Wildlife. As per Table 5-4 there are certain limits to the amount of Feacal Coliform that can be released into these areas, therefore, sewage containment systems must be designed to limit the contamination of such critical water sources. However, with the lapse in governance, especially in areas of restrictive developmental guidelines, this crucial legislature is ignored by the residents of these PA.

Table 5-4 The Protocol Concerning Specially Protected Areas and Wildlife (SPAW) to the Convention (Class 1 Waters). Source: UN1999

Parameter	Established Limitations
Faecal Coliform (Parties may meet effluent limitations either for faecal coliform or for E. coli (freshwater) and enterococci (saline water).	• Faecal Coliform: 200 mpn/100 ml; or • E. coli:126 organisms/100ml • benterococci: 35 organisms/100 ml

The ability for unsanctioned developments that ignore zoning and development regulations to be able to build their own sewage infrastructure to their own specifications, regardless of implications, has emerged in this research, mainly the use of soil absorption systems and community led designed sewage containment system. The negative effects of this practice cannot be overstated as they result in coastal erosion and destruction of coral reefs. National statistics indicate that algae on most reef systems across the island (nutrient indicating) ranges between 0% and 62.9% for an island-wide average of 24.20% (NEPA 2008).

Effluent waste that causes increased dissolved inorganic nitrogen (DIN) and Soluble Reactive Phosphorus (SRP) from these systems, in addition to agricultural run-off and Domestic (detergents) results in polluted water going to the South Negril River and then into the sea (part of PA.4) causing macroalgae on coral reefs (Lapointe 2011; Fieldwork at NEPA 2017).

5.2.2.1. The Polyethylene Water Containment Tank (PWT) Sewage System

As is widely known, Squatter of Informal communities' experiences greater limitations to safely contain and treat their sewage waste, sparking improvisation and the use of intuitive measures that will provide good sanitation and lessen the impact on their daily lives (McFarlane et al 2011). Evidence from this research suggests excessive utilization of Sewage containment systems in Marine PA with high water table that are best suited in soil absorption locations, such as the Absorption Pits.

Also, the inclusion of an innovative measure referred to as the Polyethylene Water Containment Tank (PWT) system. The PWT system is made from the regular water storage tanks and is the size of whichever size tank they can afford. However, on occasions larger tanks can be used as a result of residents pooling funds together to match their family sizes. The system is designed to accept only toilet waste and to allow for immediate release of the toilet waste into the containment tank (Grant and Taniguchi 2017). This system is found predominantly in PA.4, is unregulated and neither use as per the manufacturer specifications. Figure 5-7 as previously provided, is an illustration of the system as described by residents. In design and construction, the sides of the tank are perforated to release the liquid and retain solids to minimize frequency of removal of sludge. The dangers of this system exist in the fact that it is used in the Marine (coastal) area and in placed into holes that are dug until water is visible (which is normally not very deep as these areas have high water table), resulting in the black water being released directly in to the underground water systems.

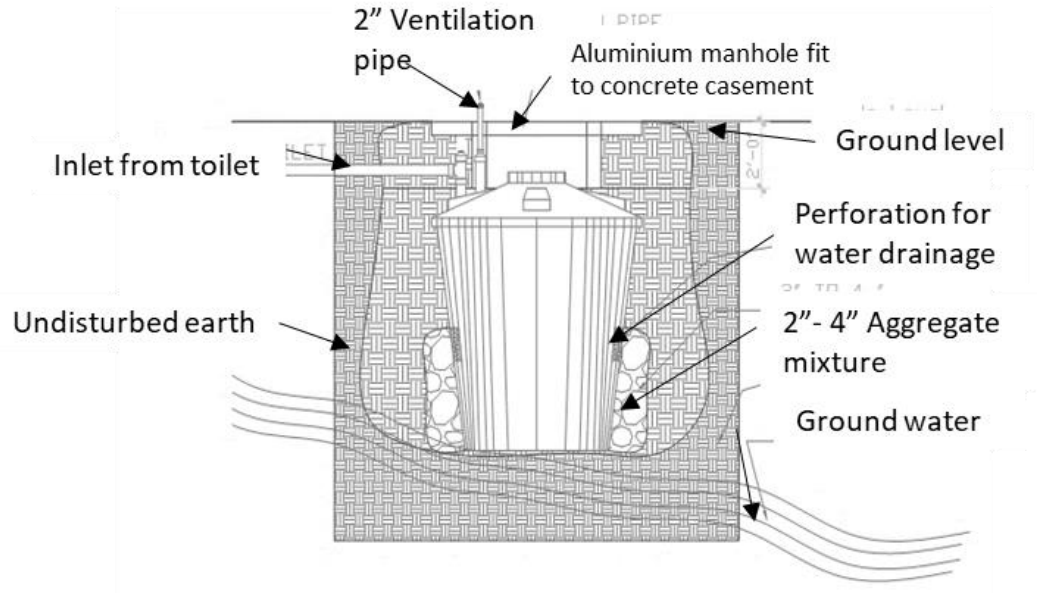

Figure 5-7 An illustration of the Polyethylene Water Containment Tank (PWT) system. Source: Grant and Taniguchi 2017

Considering the Faecal Coliform (FC) National Limit is 200MPN/100 ml the fact that this system only allows minimal treatment and therefore releases approximately 107 -108 MPN/100 ml FC in untreated sewage into the underground systems, this creates increase pollution loads on an already vulnerable ecosystem.

5.2.3 All Observed Changes

There were several threatening activities recorded that are impacting these PA. These threats although severe are only seeing partial intervention and for mainly PA 4. This information came from the interviews conducted with NEPA. The windshield and walking survey done in the field captured several noticeable changes to the areas as shown in Figure 34 that can be attributed to the time span of inhabitation, such as the following:

- Loss of Habitat
- Loss of Species
- Coastal Degradation
- Solid Waste Pile up
- Population growth
- Polluted Marine ecosystems
- Loss Vegetation
- Sewage Discharge in Coastal Waters
- Destruction of Mangrove habitats
- Destruction of Coral Reefs

Figure 5-8 Environmental Threats Identified in each PA associated with Squatting.
Source: Fieldwork 2017

These changes correspond to the changes observed by some of the participants in their responses in the survey and are potentially linked to the deforestation that results in hectares of forest loss over time. The images in Figure 5-8 indicates threats to the PA (from Top left) tree cutting for charcoal PA2, dune vegetation removed from coastal areas for livelihood activities and improper solid waste disposal in PA4 (top middle), polluted river and beach erosion from climate change and other anthropogenic threats partly squatting in PA1, also soil erosion in PA3 that contributes to heavy run-off during rainfall and loss of key plants to prevent or minimize landslides.

During the survey data was collected on changes that the respondents may have observed during their tenure in these communities, the results in Figure 5-9 indicated by the squatters, are similar in nature to threats noticed during the period of data collection and are a possible by-product of the deficiencies in governance.

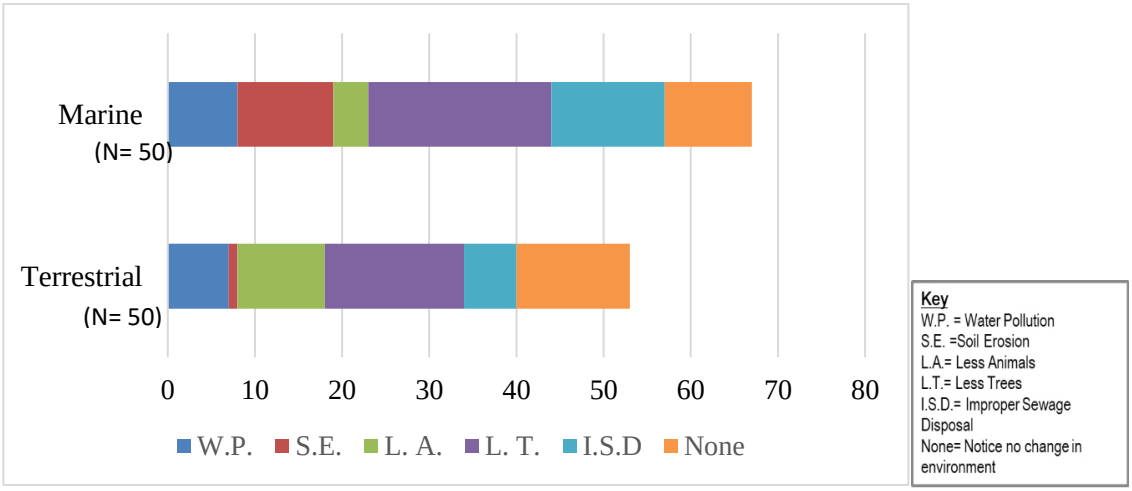

Figure 5-9 Shows environmental changes observed by participants during their tenure. Duplicate responses. Source: Fieldwork 2017.

5.2.4 Impact of Settlement Location on PA

It has been proven that Land-based activities create some amount of pollutants and nutrient loading that absorbs into runoff into water bodies, resulting in the negative impact or destruction of natural habitat. There are even severe situations such as species

altering that occurs as a result of such human activities. To determine the level of impact on the PA under investigation, specific drivers as indicated in Table 5-5 was placed into the formula:

$$I_l = \sum_{p=1}^{n} L_p * E_j * \mu_{pj}$$

Impact weights to test the intensity of the drivers were provided by the Lead Agency for preservation of environment NEPA. According to results from the interview with NEPA, only the PA 4 (P-PRPA) has classifications of threat levels and suggest some levels of monitoring, other PA are not treated in similar manner (regardless of ecosystem value). For the threat of squatting in the PA it is ranked a 3 for medium intensity/significance. For the analysis of all PA a similar ranking of threats were applied and the results of the cumulative impacts of each settlement was presented in Table 5-5 and Figure 5-14 below.

Table 5-5 Results of Calculation of Location Impact on PA

Pressures		**Sewage Infra.**	**Solid Waste**	**Water Pollution**	**Economic /Livelihood**	**Land Conversion /Land cover change**	**Wetlands Species Loss or Migration**	**Squatting**	**E_j**	**I_l**
Rating		***5***	***5***	***5***	***3***	***4***	***4***	***3***		
Marine	SS.1	1	1	1	0	1	1	1	1	**26**
	SS.4	1	1	1	1	1	1	1	1	**29**
Terrestrial	SS.2	0	1	0	1	1	0	1	1	**15**
	SS.3	0	1	0	0	1	0	1	1	**12**

The result in the Table indicates that the Marine PA has the highest predicted cumulative impact scores, while Terrestrial locations have lower impact intensities. However, as these locations are connected to urban locations, consideration for livelihood activities were less for two (2) of the settlements, species migration was non-determinable for lack of location data and water pollution absent as well for Terrestrial settlement because of proximity to the coastal or other water bodies and the fact that the sewage containment systems are potentially low threat.

Using the factors in the Table Community Impact (I_l**)** are ranked low, medium and high, with low being (0-10), medium (11-20) and High (21-30).

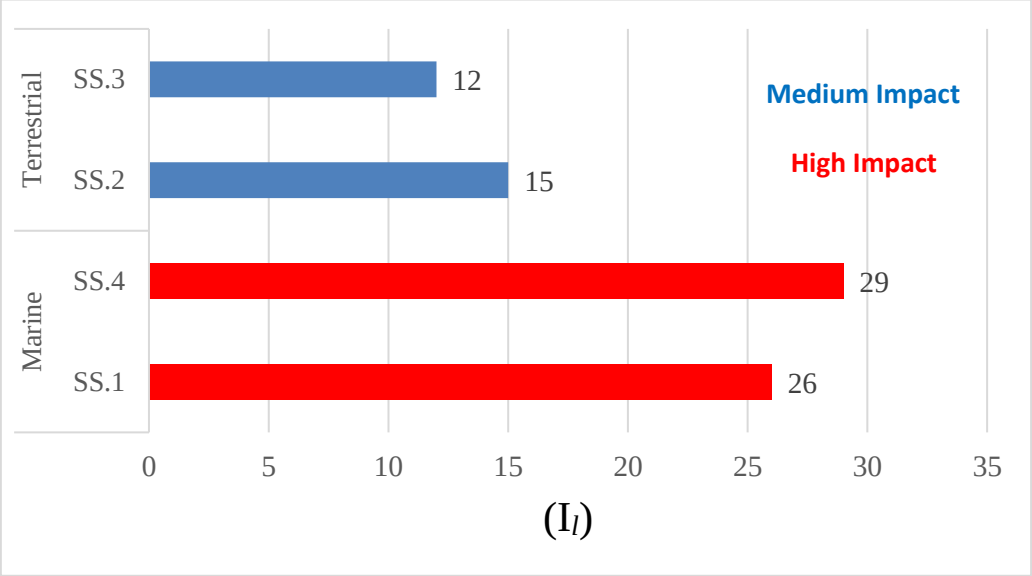

Figure 5-10 Results of the Impact of Pressures of Squatter Settlements PA (I_l**)**. Source: Fieldwork 2017.

The results show that the settlement locations range from a medium to high impact and suggest a variation in intensity of impact on the different ecosystems, with Marine PA faces greater threats, and the settlement impact is higher than Terrestrial locations as the settlements are ranked high on the threat level (Figure 5-10). The Marine PA higher impact scores may be a result of it being a more sensitive ecosystem and having greater number of pressures applied by the community use. The Terrestrial PA lower cumulative impact scores are reflective of a more resilient ecosystem and fewer pressures from the communities.

5.3 Summary

Squatter settlements are characterized by spatial concentrations of poverty and environmental degradation (Crawford and Rahman 2018). Hence, Uncontrolled informal developments add pressures to PA when there is lapse in governance. The following deficiencies were identified, as outlined below, and must be addressed in any approach for improvement, such as:

5.3.1. Multiple Legislature – Implementation deficits

Extensive legislature or multiplicity of responsible agencies does not ensure proper management but presents loopholes for issues with accountability and poor governance. As it relates to the management of Protected Areas in Jamaica, according to the Ecological Working Group (EWG 2009), "inadequate linkages across agencies and ministries and a lack of clarity in definitions of categories of areas for protection have hindered effective management". Hence, as stated by the draft Protected Area System Master Plan, this tool sole purpose is to redefine and create better connectivity between agencies so as to ensure the long-term resilience and maximize the benefits of the country's network of protected areas, while realizing sustainable development goals nationally and internationally.

Although determined to be a crucial response to the current situation with the country's natural environment, the Master Plan remains in a draft state some 6 years later, has not been implemented and potentially will require additional time for completion. Therefore, a limitation to implementing well needed solutions and set back to progress, resulting in greater pressures from human activities to include squatting.

5.3.2. Institutional Capacity (Human, Administrative, and Financial Resource) & Poor Collaborative Efforts

The management of squatter settlements and PA are showing inefficiencies with collective consideration for minimizing the negative effects of squatting and results in poor governance and an excuse for proliferation of Squatter Settlements. As is common in many developing countries the institutional capacity required to successfully develop and transition critical goals for good governance are hindered by the poorly funded responsible agencies and or the ineptitude in administration, and not the least inadequate human and financial capital.

There were a few key strategically important systems that were not been fully realized that would inhibit the effectiveness of the governance framework:

1. Deficient squatter monitoring system- the research identified lack of human resource, not enough input from responsible agencies (untimely reports or no reports, passing

the buck approach to issues) and no measurable performance indicators or mechanisms

2. Urgency and importance of the governance mechanisms and tools are understated and under-supported at the national level, requires more attention to push the implementation of key strategic objectives.
3. In relation to minimizing the threats that are associated with squatting in PA, the governance structure must include all agencies that have a stake in the successfully protecting and monitoring the issues under consideration. As indicated in the Figure 5-3, the environmental agency with oversight responsibility is not included in the monitoring of squatter settlements and would not have direct access to the policy direction. From the interview conducted with the Lead Agencies (NEPA and SEMU) there was a lack of information or data to support environmental risks mitigation strategies especially as it relates to the squatter communities in these areas. Interview responses mainly produced a lack of information on basic data; most responses stated the information is not yet established, unknown or had no definitive information on the issues (Appendix I- Interview Questions).
4. Lapse in accountability measures - Responsible development authorities are not a part of the governance committees
5. In addition to the lapse in regulatory framework, are the limitations with not having a proper database and inadequate governance structure for said database, contributed to by the resource issues of the SEMU. Another challenge faced by this unit is a lack of cooperation from other governance bodies with timely reporting of occurrences of squatting (Interview with management of the SEMU 2018)

5.3.3 Poorly executed relocation and resettlement plans

In considering both terminologies, Relocation and Resettlement has very different connotations and represents very different ways of comfortably re-housing individuals affected by one situation or the other. Relocation is viewed as simply moving one thing from one place to another, while resettlement is a more detailed and time-consuming process. The practice of Relocation to address squatting in Jamaica is a most frequent approach. This however, results into other or even more difficult social issues for the affected. As outlined earlier, several communities that underwent relocation plans have

had members returned to their old community, citing instances of not belonging, lack of adequate job opportunities and distance from current jobs and schools, therefore increasing the economic strains. This reflects the lack of or limitations in inclusiveness that occurs in the planning for these relocation exercises, a practice that goes contrary to the Covenants of Civil and Political Rights of an individual.

On the other hand, if proper resettlement plans are considered where potential jobs are identified, schools that would have capacity to accept students are available and other infrastructure are present that would make life more comfortable is pursued, the benefits to the environment would increase and the lives of the people will be enhanced. Currently, this is not the practice and so the environment experiences greater pressure and the country experiences great economic loss for expending resources that are not fully utilized.

5.3.4 Environmental Implications of the Governance (Squatting and Environment)

Marine PA ecosystems are more vulnerable and are at greater risks for anthropogenic threats and so the squatter settlements have greater impacts. In the analysis, squatter communities came after the designation of these sites as PA and as such should have been alleviated, however, possibly because of the issues affecting the governance such as limitations with resources and political affiliations these communities were able to be created and in the case of SS.3 flourish.

Chapter 6- RESULTS - SQUATTER PERCEPTION OF PA ENVIRONMENT, ITS PROTECTION AND SQUATTING

6.1 Squatter Perception of the PA and Squatting on PA

What is perceived? This section tries to understand the factors that led to the inhabitation of the PA in the initial phase; also, it considers how the PA environment is viewed by the local community, its importance and the importance of the resources they provide. Additionally, the views of squatters regarding the act of squatting and their day to day activities on this environment (the Means and Standard Deviation values are in Appendix IV). The assumptions in Hypothesis 1 about squatting and the PA are presented in this section as well.

Many low-income families seek refuge in these locations because of varying factors, with most being associated with the socio-economic factors. Therefore, it is critical to understand the potential effects of the social status on their perception of squatting and the importance of protecting the environment. The results in Figure 6-1 demonstrates the greater total cumulative number of people chose to live in that area consequent of low-income jobs (42), housing costs (35), land cost (34), lack of collateral (26) and lack of savings (28). The Terrestrial group had the greatest number of persons who declined to respond (14).

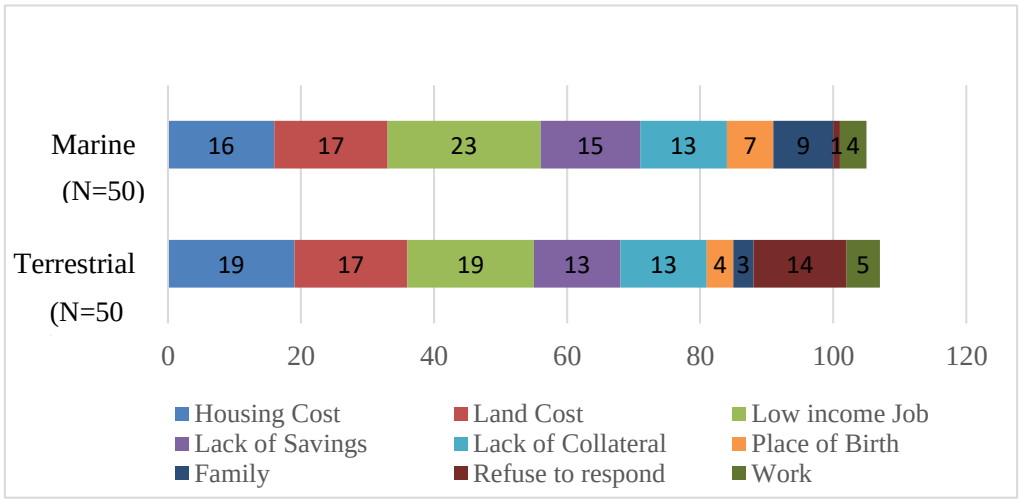

Figure 6-1 Results for reason for living in squatter settlements. Duplicate Responses. Source: Research Fieldwork 2017.

Descriptive data were analysed for their perception for the variable “Important to Protect the Environment”, the results in Figure 6-2 provides the results as per the PA group.

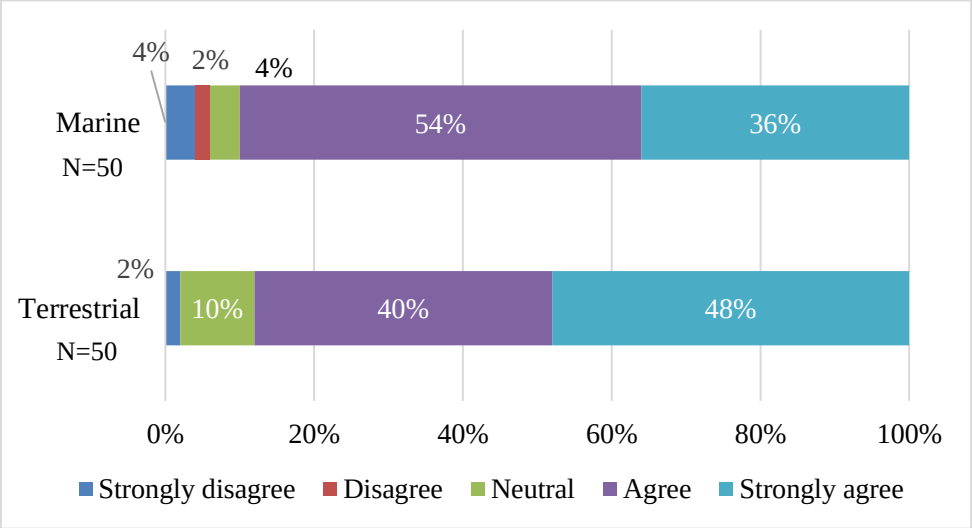

Figure 6-2 Results of Residents` Perception of Important to Protect the Environment. Source: Research Fieldwork 2017

The results indicate that for Terrestrial PA respondent’s a total cumulative percentage of 88% agrees (some more strongly) that it is “Important to Protect Environment”, while for Marine PA respondents a total cumulative percentage of 90% agrees (some more strongly) that it is “Important to Protect Environment”. For the Terrestrial group there is a greater percentage that is neutral at 10%.

As the PA comprised of specific resources that required them to be protected both nationally and internationally, there were four (4) specific resources considered that would be impacted in some way by the residents, they include the sea, forests, rivers and wetlands (including swamps and mangrove areas) and endangered species. The respondents were asked would they agree that the natural resources of the sea were important to the community (Figure 6-3), for Terrestrial groups a total cumulative percentage of 56 % agreed that it is important. However, for the Marine groups a larger total cumulative percentage of 96% agreed with the importance of the resources of the sea to the community.

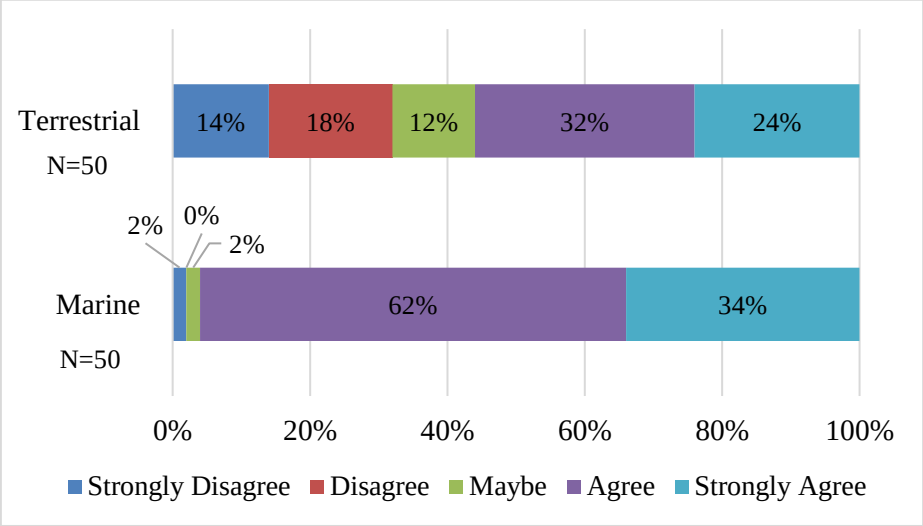

Figure 6-3 Results of residents' perception of the importance of the Sea to the community. Source: Research Fieldwork 2017

In addition, the respondents were asked about their perception of the importance of the rivers and swamp (wetland areas) to their community. Figure 6-4 indicates that for Terrestrial groups a total cumulative percentage of 60% disagree the river and wetland areas are important to the community, in contrast to the Marine groups that had a total cumulative percentage of 74% agree that the resources are indeed important to their community.

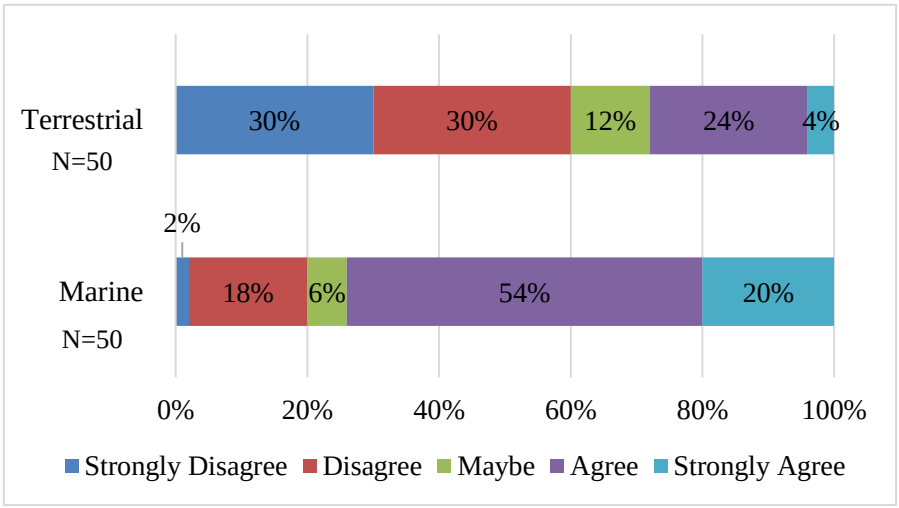

Figure 6-4 Results of residents` perception of the importance of the River and Swamp (Wetlands) to the community. Source: Research Fieldwork 2017

The respondents were asked to indicate their perception of the importance of the forests to their community, the results of the frequency analysis suggest that for Terrestrial groups a total cumulative percentage of 92% agrees that the forests are important to the community, while for Marine groups a total cumulative percentage of 78% agrees the forests are important to the community (Figure 6-5).

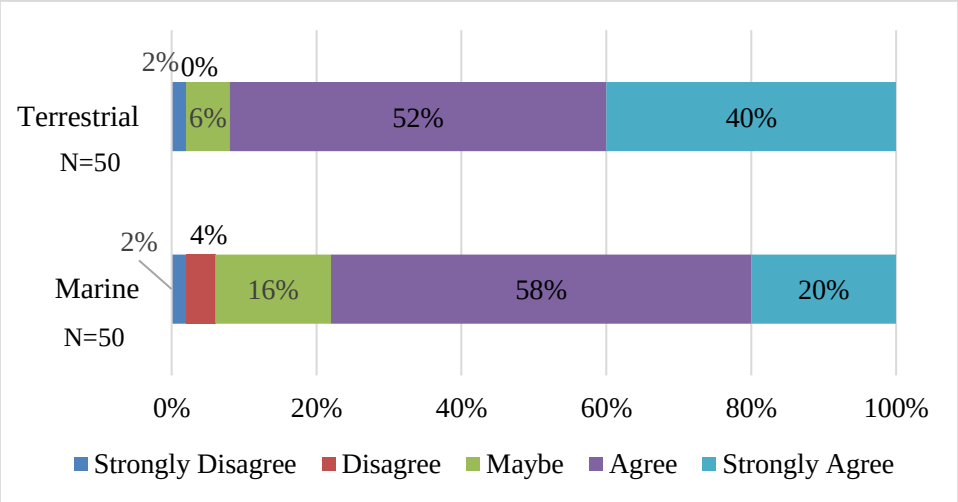

Figure 6-5 Results of residents' perception of the importance of the Forests to the community. Source: Research Fieldwork 2017

Finally, the respondents were asked about the endangered species in the community and whether they agreed these animals are important to the community. Figure 6-6 indicates that for Terrestrial groups total cumulative percentage of 72% agrees that the protected animals are important to their community, while for Marine groups a total cumulative percentage of 66% agrees. There is a 16 % of Terrestrial groups and 20% of Marine groups that indicated the protected animals maybe important to their community.

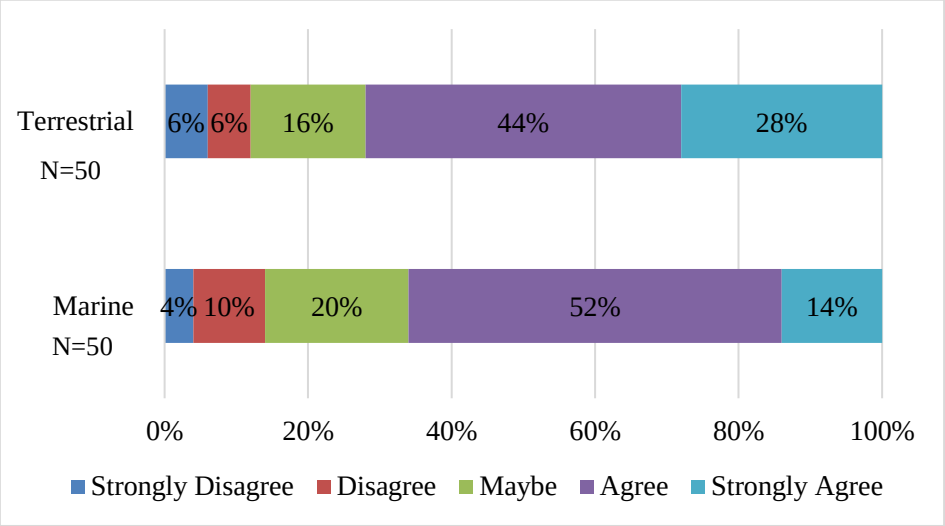

Figure 6-6 Results of resident`s perception of the importance of the Protected Animals to the Community. Source: Research Fieldwork 2017

The previous results have presented the views of the local community on the PA and demonstrated that majority of the residents agrees with the importance of the environment and the resources that are beneficial to their communities. However, the next step is to determine whether this agreement is reflected in their perception of the fact they are squatting and the potential effects of squatting. Hypothesis 1 & 2 presents the assumption in that regard.

- ✓ Hypothesis 1: Participants will believe that squatting is not a threat to the environment.
- ✓ Hypothesis 2: Participants will disagree that their daily routine activities are a threat to the protected area.

The location of Squatter Settlements in most countries is areas of less appeal and locations that expose their vulnerabilities. In addition, because of the nature of the activity, meaning categorized as an illegal activity, one can assume that there will be social desirability biases when questioned about the action and whether there are implications for the environment. Hence, the results in the figure suggests for Marine (including coastal areas and wetlands) the total cumulative percentage of 60% of respondents for the variable "Squatting is a Threat to the Environment" (Figure 6-7), does not agree in comparison to Terrestrial community that had a total cumulative percentage of 50% that

does not agree. Further, both have equal 32% total cumulative percentage that agrees that squatting is a threat to the environment, however a greater percentage of Terrestrial respondents opted to be neutral 18% in comparison to 8%.

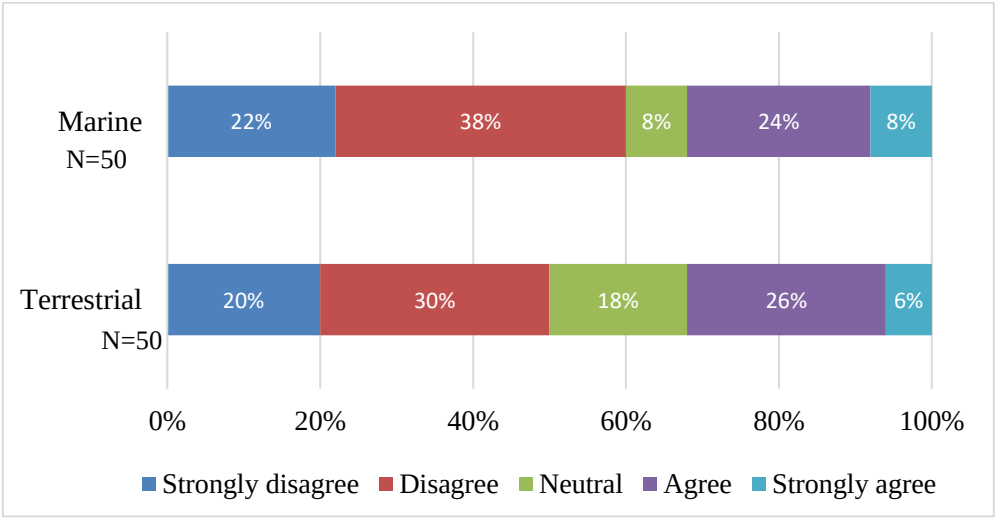

Figure 6-7 Results of Residents` Perception of Squatting is a Threat to Environment (PA) for four (4) Settlements. Source: Fieldwork 2017

Devi et al (2017) suggested that the opinions of the squatters may favour the fact that they utilize fewer resources and as such would have a lesser impact. This may be a contributory factor to their being a difference in results when they responded to whether the variable "Daily Routine Affects Environment" (Figure 6-8).

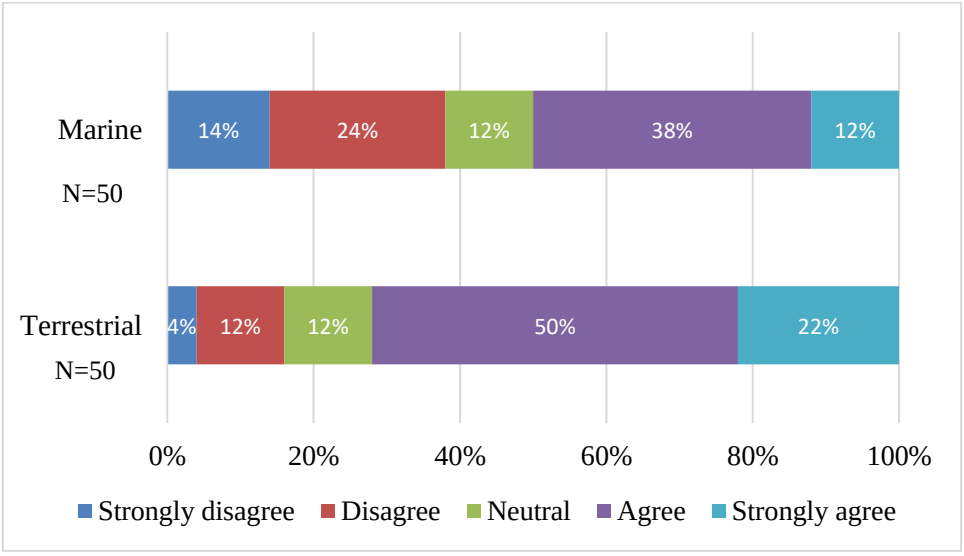

Figure 6-8 Results of Residents` Perception of Daily Routine Affects Environment in PA, response of all four (4) settlements. Source: Research Fieldwork 2017.

The results in Figure 6-8 suggest a different perspective from the graph in Figure 6-7, with the respondents indicating opposite views for Terrestrial with a total cumulative percentage of 72% agrees that their daily routine activities affects the environment and for Marine respondents a total of 50% agree that what they do in day to day life such as washing (clothes and utensils), use of bathroom, some livelihood activities, garbage disposal and water usage affects the environment. We noted the fact that a larger cumulative percentage in of Marine respondents, some 38% disagrees that the routine activities affect the environment, in comparison to Terrestrial that recorded a 16% total cumulative score.

Hence, consideration for the act of squatting and the by-product of squatting must be considered in any interaction with squatters towards governance solutions. In addition, the contrast in responses in terms of the total cumulative percentage values suggests consideration for difference in perception of the respondents based on their location.

Consequently, Table 6-1 provide the descriptive values for the potential pre-dependent variable, which were subjected to several tests to remove any biases to understanding the perception of the squatters towards the environment and potential to participate in PEBs. The value of the mean scores and standard deviations suggest that the variable "Important to Protect Environment" is more significant to their perception than "Daily Routine Affects Environment" and "Squatting is a Threat Environment".

Table 6-1 Descriptive of Predetermined Dependent Variables describing Squatter Perception of Squatting and Environment. Source: Fieldwork 2017

	Squatting is a Threat Environment	Important to Protect Environment	Daily Routine Affects Environment
Mean	2.63	4.24	3.42
Std. Deviation	1.26	0.87	1.22

Further, the results in Table 6-2 would indicate that we should reject the assumption that respondents will believe squatting is a threat and believe their routine

activities are also threats, this corresponds to a lack of correlation between the variables "Squatting is a Threat Environment" and "Daily Routine Affects Environment". In addition, in further analysis of the idea purported in Hypothesis 1 and 2, correlation tests were on done on the predetermined potential dependent variables, the previous results for rejecting the assumption is further supported by the correlation results of each factor in Table 6-2, where "Daily Routine Affects Environment" shows an association with "Important to Protect Environment" with value 0.302, being significant at p-value < 0.05.

Table 6-2 Spearman`s rho Correlation among variables of Squatter Perception of Squatting and PA. Source: Fieldwork 2017

	Variables	1	2	3
1	Squatting is a Threat Environment			
2	Important to Protect Environment	0.08		
3	Daily Routine Affects Environment	0.00	**.302****	

Note: N=100, p < 0.05 **.

Bold is significant

The need for this analysis originates from the necessity of determining how to approach the problem of squatting in the PA from the perspectives of the squatters, although the Cohen`s d effect suggests a small (low) effect size between groups for the dependent variable "Daily Routine Affects Environment" in relation to "Important to Protect Environment", it is the only significant association that merits attention when considering the perception of the squatters.

6.2 How are their perception influenced?

As was established socio-economic factors associated with the formal housing sector is primary factor for people choosing to live in the squatter community, followed by family and place of birth, which contributes to an inability to fund suitable spaces to live for these individuals. Consequently, a correlation analysis was done to examine the relationship between respondents' perception and factors such as age, location, living conditions and tenure status. Also, there are subjective influences in the form of governance, through environment education (awareness) programs that are considered.

6.2.1 Is Age and Gender a consideration for squatter perception?

In the study is was determined that there were ranges of age between 18-75 for household heads and almost equal number of both genders. The research considered whether those factors influences how the perceive the importance of protecting the PA environment. The result of the analysis revealed no significant relationship with Age and Important to Protect the Environment. However, there was a significant ($p < 0.05$) relationship between Gender and Important to Protect Environment (Table 6-3).

Table 6-3 Results of Chi-Square test of Association for Gender and Important to Protect Environment. Source: Research Fieldwork 2017

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Kendall's tau-b	-0.346	0.084	-4.023	p<0.01
	Gamma	-0.603	0.125	-4.023	p<0.01
N of Valid Cases		100			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The results in the table indicate that both are significant at p-value< 0.01. This means that for Kendall`s tau-b 34% (moderate association) and for Gamma 60% of the error (good association) would be reduce if we have information on the association between the two (2). The negative values suggest that male respondents are more likely to agree it is important for to protect the environment.

6.2.2 Does their current tenure status and living condition affect perception?

The tenure status of the squatters was considered under four (4) categories Owner, Rent, Family House and Other. The frequency analysis indicates that 49% of respondents own the house, 15% are renters, 31% are living in family houses and 5% has some other living situation. A correlation analysis was done to determine if the tenure status has an association with their perception of whether it is important to protect the environment. The results revealed no significant correlation.

- ✓ Hypothesis 3: Status in the community (homeowner or tenant) and intention for future status will determine the attitude towards the PA.

Considering the fear associated with tenure security in these locations, it is important to know if this situation affects the perception of people towards the PA environment. Consideration for the current housing status of the respondents was tested using Chi-square test of independence in relation to Environment Protection Responsibility. The test was ran using all current housing factors, that is Owner, Rent and Family House, however only Family House produced a significant result. The results in Table 6-4 suggests that responses re housing status Family House is not independent of Environment Protection Responsibility. The result of the Pearson Chi-Square value X (6) = 17.056, p-value = 0.009 suggest there is a statistically significant association between the two (2) variables, indicating Family House is not independent of the group perception about Environment Protection Responsibility. No relationship with owners or renters. But living in family house, could suggest an association with their intention for living status in the PA.

Table 6-4 Results of Chi-Square Test of Family House Status and Environment Protection Responsibility. Source: Fieldwork 2017

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.056	6	.009
Likelihood Ratio	17.891	6	.007
Linear-by-Linear Association	6.208	1	.013
N of Valid Cases	100		

a. 8 cells (57.1%) have expected count less than 5. The minimum expected count is .31.

For the Symmetric Measures test, Phi and Cramer's V are both tests of the strength of association. The values of both tests are the same, 0.413, p-value = 0.009, this significant value suggests there is a good association between both variables (Table 6-5). Therefore, it means 41% of the behavior can be attributed to the housing status of Family

House. This confirms that when proposing solutions towards environment protection the tenure of status of the residents is significant.

Table 6-5 Symmetric Measures Results of Environment Protection Responsibility Family Housing Status. Source: Research Fieldwork 2017

			Value	Approximate Significance
Nominal	**by**	Phi	.413	.009
Nominal		Cramer's V	.413	.009
N of Valid Cases			100	

To establish the quality of life experienced by these residents, they were asked about their living standards. The residents indicated that they experience conditions from Very Poor to Very Good. A total of 17% out of a total of 100 respondents indicated that their living condition is poor (very difficult to provide meals daily), 59% said that it is average (able to provide meals once employed/do not eat every day) and 16% saying it is good (able to provide food daily), 4% said it was very poor and 4% indicated it was very good.

A Spearman correlation analysis was done on the variables of "Living Standards" and "Important to Protect Environment", to determine if there is an association between the factors regarding their perception. The results indicated no significant correlation between the two (2). However, the respondents were asked if improvements in their lifestyle and living conditions would make a difference to the environment. 93% of the respondents believe this can help to protect the environment.

A Spearman correlation analysis was done on the results for "Important to Protect Environment" and "Improve Living Standards can reduce Environmental Threats", results are provided in Table 6-6.

Table 6-6 Results of Spearman Ranked Correlation between the two (2) factors Important to Protect and Improve Living Standards. Source: Research Fieldwork 2017.

No.	Variable	1	2
1	Important to Protect Environment		
2	Improve Living Standards can reduce Environmental Threats	**0.26****	

Note: N=100, p < 0.05 **.

Bold is significant

The value 0.26 although low on Cohen`s d effect measure, it is significant to guiding approach to squatters in relation to their environment. In addition, these correlations are important because of the current situation with infrastructure in the communities, especially sewage disposal, solid waste (garbage) disposal and grey water (shower, washing, kitchen activities) disposal issues. Devi et al (2017) also suggested that improving basic infrastructure such as potable water, storm water drainage and sewerage has implications for many of the problems of local (in situ) environmental degradation and pollution and can be alleviated.

The correlation analysis (Table 6-7) between "Important to Protect Environment" and "Lifestyle Change can Improve the Environment" found a significant correlation of 0.31 (p-value< 0.01).

Table 6-7 Results of Spearman Ranked Correlation between the two (2) factors Important to Protect Environment and Lifestyle Change can Improve the Environment. Source: Research Fieldwork 2017

No.	Variable	1	2
1	Important to Protect Environment		
2	Lifestyle Change can Improve the Environment	**0.31****	

Note: N=100, p < 0.05 **.
Bold is significant

Further results from the Spearman Ranked Correlation tests suggest that there is a significant association between the responses of respondents for the current situation with the environment when considering the factors “Improve Living Standards can Reduce Environmental Threats” and “Lifestyle Change can Improve the Environment”, with significant correlation results of 0.51 at a p-value of less than 0.01. This information suggests that consideration must be given to the living situation of the individuals before proposing solutions especially with competing priorities.

In regard to Hypothesis 2, the activities that are done during their daily lives and the living conditions they live in may suggest the difference in perception for the act of squatting and daily routine activities however, there was no significant correlation between either of the predetermined dependent variables and the living conditions except on whether it is important to protect the environment.

6.2.3 Governance or Ecosystem Location an Influencer Squatter Perception

- ✓ Hypothesis 4: The social informational influences associated with the governance of the PA by government agencies, will allow these individuals to take greater responsibility for environmental protection. Also, for communities in Marine PA that have greater governance will accept greater responsibility and may participate more in PEBs over Terrestrial PA squatter communities.

The descriptive analysis for “Governance” of the PA show the total cumulative percentage as 79% of the respondents has identified some form of environmental governance action in their community. An Anova One-Way test was done that below showed results indicating that there were significant differences in perception between groups with F values at 35.483 and significant at $p<0.01$ (Table 6-8). This result contributed to a determination of treating the solutions each PA in its own context and rule out a one size fits all approach to the recommended responses for impacts occurring because of squatter activity.

Table 6-8 Anova One-Way Test on Governance and PA. Source: Research Fieldwork 2017

Governance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.410	1	4.410	**35.483**	**p<0.01**
Within Groups	12.180	98	0.124		
Total	16.590	99			

N= 100, p-value < 0.05. Bold is Significant.

Levene's Test for Equality of Variances is a test that determines if the two conditions have about the same or different amounts of variability between scores. The results indicate that there is potential association to governance practices in the locations. The variances are not equal, and the variable is significant ***t*** = -5.957, Marine and Terrestrial N = 50 each and the p-value is < 0.01 (Table 6-9), it means that the variability in the two conditions is significantly different. Results of the t- test suggests that governance systems, does have impact of the perception of the squatters, the negative value of ***t*** corresponds with possibility of the squatters in Terrestrial area perception being opposite in reaction to Marine who experience more governance systems.

Table 6-9 Levene`s Independent Samples Test of Governance of PA Groups. Source: Research Fieldwork 2017

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	**Sig.**	**T**	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Governance (Action/ Action)	Equal variances No not assumed	1865.063	**p<0.01**	**-5.957**	49.000	0.000	-0.420	0.071	-0.562	-0.278

Bold is significant

Furthermore, according to Ugoni and Walker (1995), the Chi-Square test is a statistical test of association between two (2) categorical variables. a Chi-square test of independence was done to explore whether this negative significance can be confirmed to not be a random phenomenon but would better able to determine the perception of squatters towards the environment. Governance approach to dealing with the problem is

important to determine the reaction of the respondents to policy solutions, therefore, a Chi-Square Test was done to verify whether PA groups and governance as categorical variables were independent of each other or if we could reliably estimate that the "PA" and "Governance" of the location has an effect on the perception of the squatters.

Table 6-10 Results of Chi Square Test for Association of PA and Governance. Source: Research Fieldwork 2017

	Value	df	Asymptotic Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	26.582[a]	1	p<0.01		
Continuity Correction[b]	24.111	1	p<0.01		
Likelihood Ratio	34.762	1	p<0.01		
Fisher`s Exact Test				p<0.01	p<0.01
Linear-by-Linear Association	26.316	1	p<0.01		
N of Valid Cases	100				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.50
b. Computed only for a 2x2 table.
c. Bold is significant

The result in Table 6-10 of the Pearson Chi-Square value X (1) = 26.582, p-value <0.01 suggest there is a statistically significant association between the two (2) variables, indicating governance is not independent of the group perception in each PA based on the PA location or ecosystem type. The results were subjected to Symmetric Measures Test. In the Symmetric Measures test, Phi and Cramer's V are both tests of the strength of association (Table 6-11).

Table 6-11 Results of Chi-Square Symmetric Measure of Independence. Source: Fieldwork 2017

		Value	**Approximate Significance**
Nominal by Nominal	Phi	0.516	**p<0.01**
	Cramer`s V	0.516	**p<0.01**
N of Valid Cases		100	

Bold is significant

The values of both tests are the same, 0.516, p-value <0.01, this significant value suggests there is a good association between both variables, as per the results in Table 6-9. Therefore, it means 52% of the perception can be attributed to the governance structure. The results suggest that governance system in a particular PA does have an effect on the perception of those that are impacted by this system and provides insight for any approach towards a solution, it therefore means an approach of one size fits all may not be effective.

6.2.4 Education programs as an influencer of perception

Assessment of *In Situ* Educational Programs and Squatter Perception

The research considered whether the programs implemented would influence squatter perception. Therefore, a Chi-Square test was conducted on the variables "Education Programs" and "Important to Protect Environment", this analysis revealed no significant association between the two (2) variables.

Further Chi-square test for ordinal data with Kendall`s tau-b and Gamma was conducted on squatter perception of variables "Education Programs Important for Environment Protection" and "Important to Protect Environment" (Table 6-12).

Table 6-12 Results of Chi-Square test of Association for Education Programs Important for Environment Protection and Important to Protect Environment. Source: Research Fieldwork 2017

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Kendall's tau-b	0.398	0.097	4.045	**p<0.01**
	Gamma	0.609	0.130	4.045	**p<0.01**
N of Valid Cases		100			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The results in the table indicate that both are significant at p-value = 0.000. This means that for Kendall`s tau-b 35% (moderate association) and for Gamma 60% of the error (good association) would be reduce if we have information on the association between the two (2). The results of the crosstabulation suggest that when respondents

strongly agree that education programs are important for environment protection, then they will also agree it is important to protect the environment.

6.3 The effects of external influences on Squatter Perception

Pelletier et al (1996) indicated that knowledge of environmental threats will influence people to participate in actions that are positive towards environment protection. Therefore, this section analyzed whether the subjective influences that can shape the squatter's perception did so and would motivate them towards behaviours that positively affects the PA environment.

6.3.1 Effects of Educational Programs Influenced on Squatter Perception

A Spearman and Pearson correlation analysis was done on the numerical variables for "Environment Protection Responsibility" and "Education Programs" (programs that exist to inform squatters about the necessity of protecting the environment) contrary to information surrounding subjective influences, what is described by the respondents' in their responses for what happens in their communities, the result of the test showed no significant association between the two. Further tests were done on whether they believe that educational programs were necessary for the improvement of the environmental conditions. The variable for the response for "Education Programs Important for Environment Protection" results suggests that there was no significant association between the two responses.

Hypothesis 4 suggests that the social informational influences associated with the governance of the PA by government agencies, will allow these individuals to take greater responsibility for environmental protection. Also, for communities in Marine PA that have greater governance will accept greater responsibility and may participate more in PEBs over Terrestrial PA squatter communities. In addition, research suggests knowledge of environmental conditions, perceptions, attitudes will affect Squatters intent to engage in PEBs (Sirivongs & Tsuchiya, 2012; Pelletier et al. 1996). However the results thus far are in contradiction with this theory and therefore further assessment was done using information gathered from the respondents about the environmental changes they have observed during their tenure at the location and the actions they indicated they have taken

as pro-environmental measures towards limiting any negative influence of their community.

- ✓ Hypothesis 5: Educational programs that create awareness about environmental protection and the degree of personal control they have over their surroundings affect their intention and behaviour towards the environment, this determine if they would engage more in PEBs and believe in the idea of protecting their environment.

The assumptions in Hypothesis 5 are tested in the correlation done on factors associated with changes respondents cited they observed and things they claimed they have done to protect the immediate environment. The method used in designing the questionnaire played a role in this correlation test as there were five (5) potential pro-environment actions and five (5) changes to the environment that were stated by the respondents and included in the test. The willingness to act variation of the model for testing may play a role in the results of the test. The model also included governance, educational programs (exist or not) and whether educational programs are important variables.

The frequency analysis of the factors for any changes observed throughout their tenure in the community revealed that respondents can identify changes in the environment, which can be a result of awareness programs. The results indicate that all except those who observed “Less Trees” had a lower cumulative value of 63% saying none observed and 37% saying they have observed a reduction in trees, while all other four (4) factors had between 81% and 88% saying none. The cumulative value of 88% was for “Soil Erosion”, while 86% was “Less Animals” and 85% for “Water Pollution” and finally 81% for “Improper Sewage Disposal”.

For potential pro-environmental actions in their communities the descriptive analysis revealed the largest cumulative response was for the factor “Disposing Garbage Properly” at 65%, then for Save Water at 55% and finally for the factor of “Plant Trees”

at 45%. The factor with the least cumulative percentage response was for “Animal Protection” at 13%. Finally, respondents who participated in “Recycle” totalled 18%.

In terms of the descriptive analysis for the factors related to the subjective influences in the form of “Educational Programs” existing in the communities and their perception of whether education about the environment and the threats it faces were important to reducing the effects to the environment the responses suggest that 69% of total cumulative number of respondents indicated that no “Educational Program” exist related to the importance of protecting the environment and teaching them how to do so. While, 95% total cumulative percentage of respondents agree and strongly agreeing that educational programs are important for minimizing the threats to the environment. Finally, 71% of Marine and 16% of Terrestrial respondents indicated that there has been some form of environmental governance action that has been instituted in their communities.

The results in the correlation identifies “Age” having a significant positive association with change observed “Less Animals” at value .216 and implied PEB “Plant Trees” at .199. This implies the older you are the more inclined to see less animals and plant trees. Also, “Living Standard” and “Governance” had negative significant correlation at values -.205 and -.267 respectively. This implies younger people would not notice governance actions and have poorer living conditions. “Gender” had negative significant correlation with “Plant Trees” and “Animal Protection” at values -.243 and -.200 respectively. This means males were not likely to engage in those pro-environmental actions. However, “Gender”, women are inclined to agree that it is “Important to Protect Environment” with positive significant correlation at value .362.

In the correlation, results displayed in Table 6-13 suggest that “Education is Important for Environmental Protection” has a significant correlation with the change observed, “Soil Erosion”, with the greatest positive effect size of .347 in the PA.

Table 6-13 Results of Spearman rho and Pearson Correlation between Implied PEB, Environmental Changes Observed, Governance and Educational Programs. Source: Fieldwork 2017

No	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Age																				
2	Gender	0.01																			
3	Environment Protection Responsibility	0.13	0.03																		
4	Water Pollution	-0.14	-0.02	0.14																	
5	Soil Erosion	0.03	-0.18	0.07	0.02																
6	Less Animals	**.216***	**-.223***	-0.05	-0.01	**.206***															
7	Less Trees	0.17	-0.01	0.14	**-.206***	0.04	-0.07														
8	Improper Sewage Disposal	0.07	0.09	**.245***	0.01	-0.02	-0.20	**-.213***													
9	Recycle	0.12	-0.15	0.01	0.10	0.07	0.04	0.02	-0.03												
10	Plant Trees	**.199***	**-.243***	0.11	-0.10	0.10	**.330****	-0.07	0.18	0.10											
11	Animal Protection	0.06	**-.200***	0.05	0.09	0.13	0.19	-0.05	0.04	**.206***	**.308****										
12	Dispose Garbage Properly	0.09	-0.16	0.04	-0.16	0.08	0.18	0.13	**-.232***	0.02	0.03	-0.03									
13	Save Water	-0.07	0.04	0.10	-0.01	0.15	-0.10	0.07	0.18	-0.10	0.17	0.11	-0.12								
14	Education Programs	0.08	-0.14	-0.09	0.14	0.09	0.17	0.16	-0.10	-0.03	0.09	0.06	0.08	0.17							
15	Important to Protect Environment	**.205***	**-.362****	0.12	0.00	**.200***	0.11	0.17	-0.18	0.02	0.10	-0.01	0.11	0.06	**.201***						
16	Living Standard	**-.205***	-0.07	-0.05	-0.01	0.04	-0.12	0.00	0.01	0.00	-0.01	-0.14	0.00	**.233***	0.19	-0.08					
17	Governance	**-.267****	-0.08	**-.252***	0.08	0.04	**.208***	-0.06	**-.314****	0.05	-0.13	-0.02	**.239***	-0.12	0.19	0.13	-0.10				
18	Lifestyle Change can Improve Environment	0.01	-0.16	0.12	0.16	0.10	0.06	0.08	0.08	0.08	0.06	0.05	0.09	0.11	0.00	**.306****	-0.04	**.249***			
19	Improved Living Standards Can Reduce Environmental Threats	0.01	-0.08	0.14	0.05	0.17	0.03	0.17	0.04	-0.03	-0.01	0.02	0.10	0.12	0.05	**.261****	0.11	0.08	**.506****		
20	Education is Important for Environmental Protection	0.14	-0.07	0.13	0.05	**.347****	0.05	0.11	-0.04	-0.04	0.10	-0.02	0.07	-0.01	-0.06	**.414****	0.03	0.00	**.396****	**.380****	

Note N= 100, * p < 0.05 (2-tailed); ** p < 0.01 (2-tailed)
Bold are variables considered this section

Subsequently, we considered the second largest correlation and that is between changes observed and implied pro-environmental behaviours. The observation of “Less Animals” has positive significant correlation with “Plant Trees” for p-values < 0.01 at .330, suggesting more they observe less animals the more inclined to plant trees. However, there was significant negative correlation between “Improper Sewage Disposal” and “Dispose Garbage Properly” for p-value < 0.05 at -.232, this negative association suggests issues with sanitation.

In addition, “Governance has a greater negative significant correlation with observing improper sewage disposal for p-value < 0.01 at -.314, this can be considered as possible interventions with sanitation by the governance structure that exists. Also, a lower significant positive correlation with observing less animals for p-value < 0.05 at .208, suggesting governance intervention can result in identifying changes in the environment. Further, there was significant positive correlation between “Governance” and “Dispose Garbage Properly” for p-value < 0.005 at .239, suggesting possible positive reactions to education programs for treating waste and provision of systems for waste containment.

Notwithstanding, we explore any relationships with the factor of whether “Education Programs” exist or not to teach the squatters about protecting their environment, we note there were no significant correlations with the responses provided and any changes observed or implied pro-environmental actions. In addition, with the implied pro-environmental action of “Save Water” we note there was no significant correlation identified as well, although we note the response that 55% “Save Water” and “Water is Polluted through Improper Sanitation”. Regarding Hypothesis 4, the results suggest that the act of engaging in PEBs is not automatic, however, the result of subjective influences associated with educational programs or governance, suggest although some squatters are exposed to significant external influences, they do not demonstration a compulsion to exude behaviours that are either negative or positive towards the PA.

6.3.2 Does Governance and PA Location/Ecosystem type Influence Squatter Perception?

The importance of PA in the longevity of species creates the basis for understanding whether governance impacts the perception of Squatters towards environment protection responsibility. The fact that these settlements are sometimes located within the PA that sole purpose is the well-being of society further strengthens the need to understanding the perception of these groups. According to Figure 6-9, the perception of who is responsible differs according to PA group. For Terrestrial PA the indication of the results suggests a greater percentage value for "Community" accepting greater responsibility for its protection at 50%, while Marine PA mainly contributes the responsibility to the "Government" at approximately 48%. In addition, Terrestrial PA communities place a greater percentage value on a collective responsibility at 22 %.

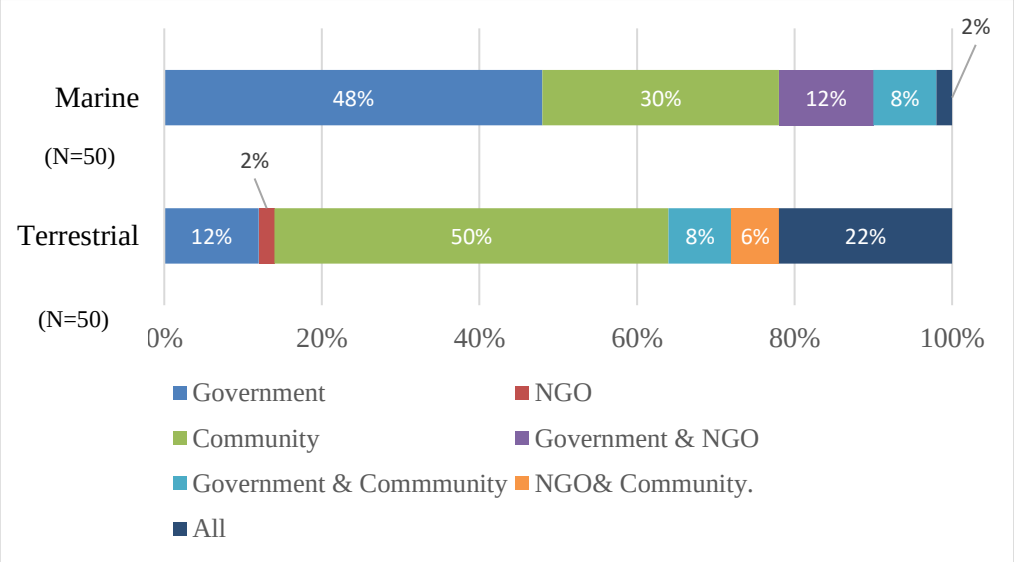

Figure 6-9 Results for Squatter Perception of Environment Protection Responsibility. Source: Fieldwork 2017

The mean scores for persons in Terrestrial communities M = 2.96 are higher than Marine communities at M = 1.40, environmental responsibility variable is greater acceptance of responsibility. The values in Table 6-14 suggests that variances are not equal, and the conditions are statistically different between groups and are significant with t -values = 4.358, N= 50 for Terrestrial and N=50 for Marine, with a significant p-value of 0.019. The Sig. (2-Tailed) value in the test is 0.000. This value is less than 0.05. Because of this, we can conclude

that there is a statistically significant difference between the mean of Marine and Terrestrial PA response to “Environment Protection Responsibility”.

The PA type does have a positive association with “Environment Protection Responsibility” and can mean that Terrestrial PA groups may accept more responsibility and there is objectivity to the responses.

Table 6-14 Levene`s Independent Samples Test of Environment Protection Responsibility of PA Groups. Source: Fieldwork 2017

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	**Sig.**	**t**	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Environment Protection Responsibility	Equal variances not assumed	**5.679**	**0.019**	**4.358**	91.752	0.000	1.560	0.358	0.849	2.271

Bold is significant

An Anova One-Way tests was done to measure if the differences in responses between groups were significant, the results in the Table 6-15 indicates that the perception of the squatters in each ecosystem type is different with F value 18.993 with significant p-value at < 0.01 and so there not occurring by chance but must tailor solutions when addressing each location.

Table 6-15 Anova One-Way Test of Environmental Protection Responsibility between Ecosystem Groups/Types. Source: Fieldwork 2017

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	Location	60.840	1	60.840	**18.993**	**p<0.01**
Within Groups		313.920	98	3.203		
Total		374.760	99			

Note: N=100, p < 0 .05.**
Bold is significant

The Chi-Square Test was used to further compare the categorical variables to confirm whether they were independent of each other or if we could reliably estimate that the PA and who the squatters believe are responsible for protecting the environment are related. According to Ugoni and Walker (1995), the Chi-Square test is a statistical test of association between two

(2) categorical variables. For this test it was detected that the observed cell counts are significantly different from the expected cell counts.

In Table 6-16, the standard expected count for both Terrestrial and Marine PA for who was most likely responsible for environment protection was of 30% of the total, however it was noted that a total cumulative score of 12% was determined for Terrestrial respondents who perceived the "Government" is responsible for protecting the environment, however, Marine had the greater cumulative percentage at 48%. In addition, a greater number of respondents in Terrestrial locations accepted the responsibility as a "Community" with 50% of the total, while Marine respondents were 30%. Further, Terrestrial respondents had a greater percentage contributing it to "All" at 22%, with Marine respondents indicating only 2% in total cumulative score. Finally, Marine also had to the greater percentage with shared type governance with a 12% in response to "Government and NGO", attributing the greater responsibility to an external party once again. The results of the crosstabulation confirms the contrasts in perception between groups previously experienced in the other results during this analysis and further outlines the rational for creating location specific solutions and not utilize blanket solutions.

Table 6-16 Crosstabulation Results of Chi-Square Test for PA and Environment Protection Responsibility. Source: Research Fieldwork 2017

			Environment Protection Responsibility							
			Government	NGO	Community	Government & NGO	Government & Community	NGO & Community	All	Total
Protected Area	Terrestrial	Count	**6**	1	**25**	0	4	3	**11**	50
		Expected Count	**15.0**	0.5	**20.0**	3.0	4.0	1.5	**6.0**	50.0
		% within Protected Area	**12.0%**	2.0%	**50.0%**	0.0%	8.0%	6.0%	**22.0%**	100.0%
		% within Environment Protection Responsibility	**20.0%**	100.0%	**62.5%**	0.0%	50.0%	100.0%	**91.7%**	50.0%
		% of Total	6.0%	1.0%	25.0%	0.0%	4.0%	3.0%	11.0%	50.0%
	Marine	Count	**24**	0	**15**	**6**	4	0	1	50
		Expected Count	**15.0**	0.5	**20.0**	**3.0**	4.0	1.5	6.0	50.0
		% within Protected Area	**48.0%**	0.0%	**30.0%**	**12.0%**	8.0%	0.0%	2.0%	100.0%
		% within Environment Protection Responsibility	**80.0%**	0.0%	**37.5%**	**100.0%**	50.0%	0.0%	8.3%	50.0%
		% of Total	24.0%	0.0%	15.0%	6.0%	4.0%	0.0%	1.0%	50.0%
Total		Count	30	1	40	6	8	3	12	100
		Expected Count	30.0	1.0	40.0	6.0	8.0	3.0	12.0	100.0
		% within Protected Area	30.0%	1.0%	40.0%	6.0%	8.0%	3.0%	12.0%	100.0%
		% within Environment Protection Responsibility	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0 %	100.0%
		% of Total	30.0%	1.0%	40.0%	6.0%	8.0%	3.0%	12.0%	100.0%

In running the test using a 95% confidence, the Asymptotic Significance (2-sided) value or in this case the p-value of the Chi-Square statistic, the p-value was set to be significant at less than 0.05. The difference in observed and expected counts were concluded that the variables are not independent of each other with p-value 0.000 in Table 6-17 and that there is a statistically significant relationship between the categorical variables. Further, it is noted that Marine PA appears to contribute the environment protection responsibility more on external parties than Terrestrial PA who accepts more responsibility. The result of the Pearson Chi-Square value X (6) = 31.633, p-value < 0.01suggest there is a statistically significant association between the two (2) variables, indicating "Environment Protection Responsibility" is not independent of the group perception in each PA.

Table 6-17 Results of Chi-Square Test of Significance of PA and Environment Protection Relationship. Source: Fieldwork 2017

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	31.633[a]	6	**p<0.01**
Likelihood Ratio	37.706	6	**p<0.01**
Linear-by-Linear Association	16.072	1	**p<0.01**
N of Valid Cases	100		

a. 8 cells (57.1%) have expected count less than 5. The minimum expected count is .50.

Bold is significant

This information is important when addressing solutions to squatting in PA as it is evident from the results in our Symmetric Measures for Cramer`s V and Phi the equal values of 0.562 suggest that knowing the type of PA the settlement is in, reduces the error in our prediction of "Environmental Protection Responsibility" by 56% (Table 6-18). The effect of this result may not solely be because of the subjective influences of the governance system through the multiple intervention programs such as public awareness campaigns that are occasionally promoted in the Marine PA, however, potentially a willingness to act on behalf of the surrounding environment as in the case of Terrestrial

PA communities who states that they do not have that level of intervention by their governance system or at all for one community.

Table 6-18 Results of Symmetric Measures Predictability between PA and Environment Protection Responsibility Variables. Source: Fieldwork 2017

		Value	Approximate Significance
Nominal by Nominal	Phi	0.562	**p<0.01**
	Cramer's V	0.562	**p<0.01**
N of Valid Cases		100	

Bold is significant

From the results it suggests the necessity to consider the education that the respondents might have received from the governance authorities in place.

6.3.3 Squatter Attitude and Perception the Implications for PEB

As it regards Squatter Attitude and Perception, we explored how they view global and local environmental threat situations in response to their immediate environment, such as climate change, water pollution, endangered species and deforestation. Then a Spearman Ranked correlation was done on responses received for their perception of the PA that are close to their communities, their Attitude towards environmental threats, changes they have observed and the implied PEBs. The frequency analysis of the factors for the correlation presented as follows:

When asked about their attitude towards the environment in the context of if they were concern for particular environmental threats that would impact their immediate environment the responses ranged from None to Extremely Concern varied according to the problem, the largest cumulative percentage value N =100 for each response, was for “Concern for Endangered Species ” which had 61% saying there was no concern with Median = 1, M = 1.96 and SD = 1.38, followed by “Concern for Deforestation” at 54% saying no concern with Median = 1, M = 2.16 and SD = 1.49, then “Concern for Improper Solid Waste Disposal” at 37% no concern with Median = 2, M = 2.51 and SD = 1.49, then “Concern for Water Pollution” 35% no concern with Median = 2, M = 2.44 and SD

= 1.40, and finally for “Concern for Climate Change” with its lowest cumulative value at 30% no concern with Median = 3, M = 2.69 and SD = 1.45. Alternatively, climate change had the greater percentage of respondents being extremely concern at 16% with would correspond to the mean value being closest ranked towards agree of in 5-point Likert scale, followed by “Concern for Improper Solid Waste Disposal” at 14% and “Deforestation” at 12%, “Water Pollution” and “Concern for Endangered Species” were the factors of least concern.

The Friedman test was run to determine whether there was an overall statistically significant difference between the mean ranks of the related groups in the attitude towards the environment. The Mean Ranks for each variable in the Friedman tests were “Concern for Climate Change” M = 3.28, “Concern for Water Pollution” M = 3.20, “Concern for Deforestation” M = 2.70, “Concern for Endangered Species” M = 2.58, and finally “Concern for Improper Solid Waste Disposal” M = 3.25. The result of the test statistic is that $\chi 2(4) = 27.074$, p-value <0.01.

The statistically significant results of the Friedman Test led to further investigations using the Wilcoxon signed-rank test. This test is the nonparametric test used for testing data that may not be tested using the regular t-tests and does not assume normality in the data, it was chosen for its ability to compare two sets of scores that come from the same participants.

100 respondents in the squatter communities were asked about their concern for specific problems occurring in their immediate environment placed on a scale of 1 for no concern (none) to 5 for extremely concern. The results of the Wilcoxon Signed Ranked Tests for Squatter Attitude towards the environment had notable differences that were significant considerations. The first pair with significance was that of “Concern for Deforestation” and “Concern for Climate Change”, which revealed that there was a statistically significant difference in attitude for with Z = -2.683, p = 0.007, difference in Mean 32.47 negative rank and Mean 31.00 for positive ranks, significant results are based on positive ranks, therefore attitude of “Concern for Deforestation” is > “Concern for Climate Change”. Also, the test result suggest that “Concern for Endangered Species” would contribute to a statistically significant difference in attitude for respondents who

have “Concern for Climate Change” with Z = -4.011, p<0.01, difference in Mean 33.81 negative rank and Mean 22.12 for positive ranks, significant results are based on positive ranks, therefore attitude of “Concern for Endangered Species” is > “Concern for Climate Change”. Further, test results revealed “Concern for Endangered Species” would contribute to a statistically significant difference in attitude for respondents who are “Concerned with Water Pollution” at Z = -2.853, p = 0.004, difference in Mean 29.00 negative rank and Mean 30.81 for positive ranks, significant results are based on positive ranks, therefore attitude of “Concern for Endangered Species” is > “Concern for Water Pollution”. In addition, “Concern for Improper Solid Waste Disposal” had a statistically significant difference in attitude from respondents with “Concern for Deforestation”, Z = -2.120, p = 0.034, difference in Mean 30.07 negative rank and Mean 23.72 for positive ranks, significant results are based on negative ranks, therefore attitude of “Concern for Improper Solid Waste Disposal” is < “Concern for Deforestation”. The final paired variables with significance were “Concern for Improper Solid Waste Disposal” and “Concern for Endangered Species” with showed a statistically significant difference in attitude with Z = -3.970, p<0.01, difference in Mean 18.65 negative rank and Mean 24.85 for positive ranks, significant results are based on negative ranks, therefore attitude of “Concern for Improper Solid Waste” is < “Concern for Endangered Species”.

When asked about their Perception of the immediate PA environment around them as to whether they are important the results of the responses which ranged from Strongly Disagree to Strongly Agree on Likert 5 point scale presented are “Forests are Important to the Community” with percentage values 56% for Agree and 29% for Strongly Agree, then “Sea is Important to the Community” at percentage values 47% for Agree and 28% for Strongly Agree, then the response for “Improper sanitation leads to Health Risks” 31% Agree and Strongly 41%, the factor “Protected Animals are Important to the Community” had 48% Agree and 20% Strongly Agree. There was a total cumulative percentage of 61% in agreement for “Water is Polluted by Improper Sanitation” and 44% for “Swamp and River are Important to the Community”.

The Friedman test was run to determine whether there was an overall statistically significant difference between the mean ranks of the related groups in their Perception of

the PA environment in which they dwell, p-value < 0.05. The Mean Ranks for each variable in the Friedman tests were, for "Water Polluted by Improper Sanitation" M = 3.21, "Improper sanitation leads to Health Risks" M = 3.96, "Sea is Important to the Community" M = 3.71, "Swamp and River Important to the Community" M = 2.64, "Forests are Important to the Community" M = 4.04 and "Protected Animals are Important to the Community" M = 3.46. The result of the test statistic is that $\chi 2(5) = 59.058$, p-value <0.01.

Subsequently, a Wilcoxon Signed-Rank test was done on the variables paired to determine if there was statistically significant difference in Perception for the respondent's responses to the PA environment. 100 people (N = 100) in the squatter communities were asked about their concern for specific problems occurring in their immediate environment placed on a scale of 1 for Strongly Disagree to 5 for Strongly Agree.

The results of the Wilcoxon Signed-Rank test suggested that there were statistically significant differences in the Perception of the Groups towards their environment, p-value < 0.05. The first paired result with significant difference is "Improper Sanitation Leads to Health Risks" would contribute to a statistically significant difference of perception of the PA environment in relation to "Water Polluted by Improper Sanitation", Z = -3.068, p = 0.002, difference in Mean 29.85 negative rank and Mean 30.76 for positive ranks, significant results are based on negative ranks, therefore, perception of "Improper Sanitation Leads to Health Risks" is < Water Polluted by Improper Sanitation". The results for "Sea is Important to the Community" has a statistically significant perception difference in relation to "Water Polluted by Improper Sanitation", Z = - 2.188, p = 0.029, difference in Mean 29.70 negative rank and Mean 35.06 for positive ranks, significant results are based on negative ranks, therefore perception of "Sea is Important to the Community" < "Water Polluted by Improper Sanitation". The results for "Swamp and River Important to the Community" has a statistically significant perception difference in relation to "Water Polluted by Improper Sanitation", Z = - 2.407, p = 0.016, difference in Mean 37.48 negative rank and Mean 32.15 for positive ranks, significant results are based on positive ranks, therefore,

perception of “Swamp and River Important to the Community” > “Water Polluted by Improper Sanitation”. The results for “Forests are Important to the Community” has a statistically significant perception difference in relation to “Water Polluted by Improper Sanitation”, Z = - 4.515, p<0.01, difference in Mean 15.95 negative ranks and Mean 28.19 for positive ranks, significant results are based on negative ranks, therefore, perception of “Forests are Important to the community” < “Water Polluted by Improper Sanitation”. The results for “Protected Animals are Important to the Community” has a statistically significant perception difference in relation to “Water Polluted by Improper Sanitation”, Z = - 2.128, p = 0.033, difference in Mean 21.70 negative rank and Mean 31.81 for positive ranks, significant results are based on negative ranks, therefore, perception of “Protected Animals are Important to the Community” < “Water Polluted by Improper Sanitation”.

Further, the results for “Swamp and river important to the Community” has a statistically significant perception difference in relation to “Improper Sanitation Leads to Health Risks”, Z = - 4.584, p<0.01, difference in Mean 35.66 negative rank and Mean 37.50 for positive ranks, significant results are based on positive ranks, therefore, perception of “Swamp and river important to the Community” > “Improper Sanitation Leads to Health Risks”. The results for “Swamp and River Important to the Community” has a statistically significant perception difference in relation to “Sea is important to the Community”, Z = - 5.348, p<0.01, difference in Mean 23.44 negative rank and Mean 16.83 for positive ranks, significant results are based on positive ranks, therefore, perception of “Swamp and river important to the Community” > “Sea is important to the Community”. The results for “Forests are Important to the Community” has a statistically significant perception difference in relation to “Sea is important to the Community”, Z = - 2.231, p = 0.026, difference in Mean 15.50 negative rank and Mean 22.81 for positive ranks, significant results are based on negative ranks, therefore, perception of “Forests are Important to the Community” < “Sea is important to the Community”. The results for “Forests are Important to the Community” has a statistically significant perception difference in relation to “Swamp and river important to the Community”, Z = - 5.971, p<0.01, difference in Mean 13.50 negative rank and Mean 31.70 for positive ranks, significant results are based on negative ranks, therefore, perception of “Forests are

Important to the Community" < "Swamp and River Important to the Community". The results for "Protected Animals are Important to the Community" has a statistically significant perception difference in relation to "Swamp and River Important to the Community", Z = - 4.638, p<0.01, difference in Mean 17.97 negative rank and Mean 37.03 for positive ranks, significant results are based on negative ranks, therefore, perception of "Protected Animals are Important to the Community" < "Swamp and river important to the Community". Final significant result, was results for "Protected Animals are Important to the Community" has a statistically significant perception difference in relation to "Forests are Important to the Community", Z = - 3.710, p<0.01, difference in Mean 16.93 negative rank and Mean 14.20 for positive ranks, significant results are based on positive ranks, therefore, perception of "Protected Animals are Important to the Community" > "Forests are Important to the Community".

Table 6-19 Correlations among variables of Squatter Attitude, Perception of the Local Environment and PEBs. Source: Fieldwork 2017

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Potential PEBs	1	Recycle																					
	2	Plant Trees	0.017																				
	3	Animal Protection	-0.008	.206*																			
	4	Dispose Garbage Properly	**-.206***	0.036	-0.070																		
	5	Save Water	0.011	-0.022	-0.195	-.213*																	
Observed Changes	6	Water Pollution	0.095	0.067	0.036	0.018	-0.028																
	7	Soil Erosion	-0.099	0.099	.330**	-0.069	0.177	0.099															
	8	Less Animals	0.087	0.132	0.187	-0.050	0.040	.206*	.308**														
	9	Less Trees	-0.161	0.077	0.175	0.128	-.232*	0.016	0.032	-0.028													
	10	Improper Sewage Disposal	-0.014	0.148	-0.098	0.069	0.182	-0.099	0.172	0.111	-0.116												
Attitude	11	Concern for Climate Change	0.049	-0.071	0.176	**.274****	**-.229***	0.057	-0.092	**-.211***	0.072	**-.228***											
	12	Concern for Water Pollution	**.202***	-0.020	-0.074	-0.179	0.063	0.007	-0.104	-0.019	0.051	**-.209***	**.300****										
	13	Concern for Deforestation	0.138	0.094	0.060	0.009	0.008	-0.057	-0.077	-0.010	0.025	-0.193	0.169	**.299****									
	14	Concern for endangered species	0.187	0.094	0.129	-0.067	-0.126	-0.015	**-.211***	-0.032	0.024	-0.121	**.290****	**.294****	**.557****								
	15	Concern for improper solid waste disposal	0.146	0.156	**.203***	-0.124	0.095	0.019	0.031	0.193	0.066	-0.018	0.053	**.211***	**.405****	**.517****							
Perception of the PA in Community	16	Water Polluted by Improper Sanitation	-0.081	-0.021	0.015	**.226***	-0.070	0.110	-0.039	0.021	0.099	0.014	0.017	-0.057	0.088	-0.081	**.234***						
	17	Improper sanitation leads to health risks	-0.104	-0.084	-0.043	-0.144	0.171	0.112	0.038	0.050	0.118	0.026	**-.343****	-0.083	-0.077	-0.138	0.182	**.380****					
	18	Sea is important to the community	0.068	-0.080	0.110	-0.131	0.123	0.067	0.060	-0.039	0.138	0.092	-0.074	0.046	-0.194	-0.104	0.065	-0.001	**.413****				
	19	Swamp and river important to the community	0.002	-0.174	0.107	-0.064	-0.073	-0.100	-0.018	-0.027	-0.085	-0.037	-0.022	-0.013	-0.153	-0.005	0.009	-0.001	0.177	**.461****			
	20	Forests are important to the community	0.071	-0.038	0.044	0.141	0.182	0.131	0.116	0.005	0.089	0.189	0.017	-0.058	-0.133	-0.181	0.073	**.268****	**.285****	**.336****	0.035		
	21	Protected Animals are important to the Community	0.067	0.106	0.078	0.111	-0.060	0.193	0.002	0.074	0.120	0.127	0.101	-0.001	-0.140	0.073	0.160	**.214***	**.208***	**.223***	0.107	**.493****	

Note N= 100, * p < 0.05 (2-tailed); ** p < 0.01 (2-tailed)

Bold are variables considered this section.

The results of the correlation indicate that respondents' attitude regarding their "Concern for Climate Change" although only 18% indicated extreme concern had the most association with environmental changes observed and implied PEBs. Table 6-19 shows "Concern for Climate Change" has a significant positive correlation with implied PEB of "Dispose Garbage Properly" at value of .274 with p-value less than 0.05, this implied PEB was done a majority of 65% of respondents as previously stated. This positive association between the two (2) variables suggest the more concern they are the potential for proper solid waste containment although the relationship has a low effect size. There was also a significant negative correlation between "Concern for Climate Change" and the implied PEB "Save Water" with a value of -.229 being significant at a p-value < 0.05, the implications of this result can be interpreted in two (2) ways, either the greater the concern the less they engage in saving water or the more they save water the less concerned they are, which could be interpreted as misguided knowledge or pose challenges to possibility of respondents willingly engaging in PEB.

In addition, respondents who expressed a "Concern for Water Pollution" demonstrates a significant positive correlation with the results for "Recycle" at a value of .202 with p-value significant at < 0.05. Although "Recycle" had a negative significant correlation with "Dispose Garbage Properly" when tested against each other value being -.206 significant at p-value 0.05, there was no significant relationship between the variable "Dispose Garbage Properly" and "Concern for Water Pollution". Subsequently, results for respondents' attitude in the form of Concern for "Improper Solid Waste Disposal" showed a positive significant correlation with the implied PEB for "Animal Protection" at a value of .203 being significant at a p-value < 0.05. However, a concern for "Improper Solid Waste Disposal" did not reveal any other correlation with any implied PEBs suggesting concerns for the potential of Squatters performing PEBs willingly.

The results of the correlation between attitude and PEBs revealed that "Concern for Climate Change", "Water Pollution" and "Improper Solid Waste Disposal" all had significant positive associations with PEBs.

Finally, the model results showed associations with observed changes identified by the Squatters in their community throughout their tenure for "Concern for Climate

Change" that had significant negative correlations with "Less Animals" and "Improper Proper Sewage" with values of -.211 and -.228 respectively being significant at p-value < 0.05. Also, "Concern for Endangered Species" had a negative significant correlation with "Soil Erosion" at value -.211 being significant at p-value < 0.05.

The cumulative results for the Squatter Attitude towards the environment suggesting a lack of concern is displayed in the results, however, for the largest total percentage of extreme concern being "Concern for Climate Change" at 16% also had the most correlations with areas that would assist in determine the potential of Squatters engaging in PEBs.

The model provides results for correlation between the concerns the respondents expressed, and it suggests that all concerns are correlated, however greater effect size was recorded between "Concern for Deforestation" and "Concern for Endangered Species" with a value of .557 significant at p-value < 0.01 and suggesting a medium effect size, "Concern for Deforestation" and "Concern for Improper Solid Waste Disposal" with value .405 at p-value < 0.01 and "Concern for Endangered Species" and "Concern for Improper Solid Waste Disposal" with value .517 and significant at p-value less than 0.01 also suggesting at medium effect size.

Further tests in the model considered the Perception of the Squatters about the PA in their respective communities and how it relates to observed changes and implied PEBs. The results suggest that there was a significant positive correlation between "Water Polluted by Improper Sanitation" and "Dispose Garbage Properly" with a value of .226 being significant at p-value < 0.05. This factor was the only factor that correlated with a PEB although there was such strong indication in the descriptive frequency value that the respondent's perception had values greater than 60% saying the ecosystems and biodiversity in their communities were important to the community.

In addition, we note from the model that all values for perception had positive significant correlations ranging in value from .214 to .493, being significant at p-value < 0.05 suggesting a low to a medium effect size in the correlation between the perceptions of the importance of the ecosystems and biodiversity, although no correlation with PEBs.

6.4 Predicting Squatter Perception

6.4.1 Squatter Housing Status Intention towards PA

Squatter Intention towards the community is important to determine how to apply solutions. Knowledge of this fact may be significant to their intent to live and own the space.

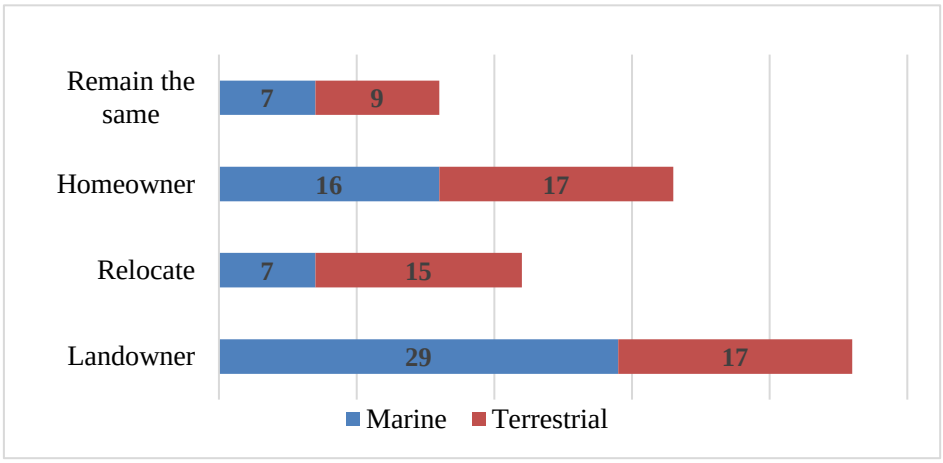

Figure 6-10 Results of Squatter intention for Community by PA group. Source: Research Fieldwork 2017.

The results of Figure 6-10 are that greater proportion of the squatters would rather to own the land and house they occupy in these communities. However, in terms of owning the land Marine PA community have greater desire to own, but Terrestrial respondents had larger number wanting to remain the same, total of 9 for Terrestrial in comparison to 7 for Marine. Further, for projecting intent to proposing resettlement solutions, Terrestrial has a greater proportion with the desire to "Relocate".

A Pearson correlation of the factors was done to provide an objective analysis of the responses related to tenure in relations to implied PEBs and their observations of the environment during their tenure in the communities.

Table 6-20 Correlations among Housing Status, Squatter Intentions, Behaviour and Changes Observed. Source: Research Fieldwork 2017

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Squatter Intention Toward Community	1	Landowner																	
	2	Homeowner	-0.14																
	3	Relocate	**-.30****	**-.27****															
	4	Remain the same	**-.29****	**-.31****	**-.23***														
Current Housing Status	5	Owner	0.10	-0.09	-0.09	0.12													
	6	Rent	0.04	-0.02	-0.03	0.03	**-.43****												
	7	Family House	-0.18	0.13	0.17	-0.12	**-.66****	**-.23***											
Threats Observed	8	Water Pollution	-0.05	0.00	-0.02	-0.11	**-.36****	0.05	**.32****										
	9	Soil Erosion	-0.07	0.09	0.12	-0.15	-0.15	-0.07	**.25***	0.03									
	10	Less Animals	**.26****	0.02	0.06	-0.18	0.07	-0.02	-0.15	-0.01	.23*								
	11	Less Trees	-0.10	0.02	-0.12	0.05	0.10	0.00	-0.03	-.21*	0.05	-0.08							
	12	Improper Sewage Disposal	-0.14	**.20***	0.11	-0.14	-0.12	0.00	0.12	0.01	-0.01	-0.20	-.22*						
Implied PEBs	13	Recycle	0.06	0.08	-0.05	-0.12	-0.02	-0.05	-0.02	0.11	0.01	0.05	0.03	-0.02					
	14	P. Tre	0.19	0.06	0.06	-0.11	-0.10	-0.06	0.10	-0.09	0.07	.34**	-0.07	0.19	0.08				
	15	Ani. Pro	0.03	0.00	0.18	-0.16	0.01	-0.08	0.09	0.10	0.07	.21*	-0.04	0.06	0.16	.29**			
	16	Dispose Garbage Properly	0.15	-0.05	**-.21***	0.04	0.03	0.10	-0.17	-0.15	0.06	0.18	0.12	-.22*	0.01	0.04	-0.04		
	17	Save Water	-0.09	0.16	0.09	0.07	-0.12	-0.10	**.30****	-0.01	0.13	-0.10	0.09	0.18	-0.13	0.15	0.09	-0.13	

Note: N= 100, * p < 0.05 (2-tailed); ** p < 0.01 (2-tailed). Analysis done using Pearson Correlation. Bold is significant.

The results of the correlation in Table 6-20 suggest that tenure status in the form of “Family House” has positive significant correlation with changes observed in the environment for “Water Pollution” with value .32 at p-value < 0.05 and “Soil Erosion” with value .25 at p-value < 0.05. In addition, “Family House” had significant positive correlation results with implied PEB “Save Water with value .30 significant at p-value < 0.05. Although, effects are low they support a better conclusion for imposing solutions. Further, results suggest that tenure status “Owner” had a negative significant correlation with changes observed during the tenure for Water Pollution” with value -.36 significant at p-value < 0.05. Respondents who “Owner” and “Rent” their houses had no significant correlation with the implied PEBs they indicated to have done.

Results of the Pearson Correlation did not produce much significant result for Squatter Intention in relation to changes in the environment and implied PEBs. For persons who want to “Relocate” from the squatter community had a negative significant correlation to being inclined to “Dispose Garbage Properly” with value -.21significant at p-value < 0.05, which may be interpreted as if they want to relocate then no motivation to properly treat with their garbage.

In addition, the results suggest that respondents who wants to own the land Landowner” they live had a significant positive correlation with the change of “Less Animals” in the PA with value .26 significant at p-value < 0.05. Also, for respondents who wants to own the house they live in “Homeowner” had a positive significant correlation with changes observed “Improper Sewage Disposal” with value .20 significant at p-value < 0.05.

The results of the correlation in conjunction with the intention of the respondents may suggest that intention for tenure status does not automatically result in PEBs nor enable the respondents to observed environmental changes in the PA environment. However, the correlations between the relevant intentions expressed by the respondents produced negative significant correlations, which would correspond to the responses provided in the data collection exercise.

6.4.2 Predicting Squatter Perception Towards Environment using Daily Routine Activities

The research aimed to identify the best factors to determining the main variable to assist with predicting squatter perception towards the environment and therefore the best approach for solutions to squatting. Thus far, several variables have shown association with Squatter Attitude and Perception, however, we had preselected dependent variables, three (3) variables we considered captured the idea of the relationship between squatting and environment and now want to find out if there is a significant difference between the groups as it relates to the activities and the act itself.

In assessing whether there was an association with the predetermined dependent variables and categorical explanatory variables Squatter Attitude towards and their Perception of the PA environment a Spearman ranked correlation was done. The results suggest that there were correlations between categories Attitude in the form of concern, "Daily Routine Affects Environment" and "Squatting is a Threat Environment". "Daily Routine Affects Environment" had a positive significant correlation with "Concern for Climate Change" with value .236 at p-value < 0.05, also "Squatting is a Threat Environment" had significant correlations with "Concern for Climate Change" and "Concern for Endangered Species" at values -.206 and .273 respectively, at p-value < 0.05. Also, "Daily Routine Affects Environment" variable had correlation only with changes observed (variable "Less Trees" had positive significant correlation with value .227 at $p < 0.05$ and negative significant correlation with "Improper Sewage Disposal" with value -.466 at $p < 0.05$). There was no correlation with the pro-environmental activities.

Regarding category of Perception of their PA environment the results of the correlation test suggest that "Daily Routine Affects Environment" had a positive significant correlation to "Swamp and River is Important to the Community" at value .226, with p-value < 0.05. In addition, for predetermined dependent variable "Important to Protect Environment", perception had statistically significant correlations with "Sea is Important to the Community" at value .210, "Swamp and River is Important to the Community" at value .232 and "Forests are Important to the Community" at value .311,

values were significant at p-value < 0.05. The predetermined dependent variable "Squatting is a Threat to Environment" had no significant relationship to how squatters perceived the resource in the PA and community.

Table 6-21 Mann-Whitney U Test for Difference in Sample Median for Dependent Predictor Variables. Source: Fieldwork 2017

x	Protected Area	Mean Rank	Mann-Whitney U	p
Squatting is a Threat Environment	Terrestrial	49.21	1185.5	0.645
	Marine	51.79		
Important to Protect Environment	Terrestrial	48	1125	0.342
	Marine	53		
Daily Routine Affects Environment	Terrestrial	43.57	**903.5**	**0.012**
	Marine	57.43		

Note: Terrestrial PA, N = 50, Marine PA, N =50, Total N= 100, Bold is Significant at p < 0.05.

Table 6-21 presents the results of the Mann-Whitney U test for differences in medians for each paired combination of ecosystem type. As it relates to the respondent's responses for the predetermined dependent variables, we note only the variable "Daily Routine Affects Environment" had a statistically significant difference in median values, with the Mann-Whitney U value being 903.5 and a p-value of 0.012 that is significant at p-value < 0.05. This result would suggest that "Daily Routine Affects Environment" is the best variable from the questionnaire results to be used as a predictor for squatter perception. This result corresponds to the fact that "Daily Routine Affects Environment" is the only predetermined dependent variable that is constant with correlations to Squatter Attitude and Perceptions.

An ordinal regression model was developed to determine what would have led to the determination by squatters that their daily routine activities impacted the environment and forecast effects or impacts of changes that the independent variables have on a dependent variable.

Consequently, model testing for explanatory variable “Environment Protection Responsibility” presents as a strong predictor variable with good model fitting, data fitting model well and a Pseudo R^2 Nagelkerke of 19%. The variable “Swamp & River Important to the Community” demonstrated good model fitting, goodness of fit having good data and Pseudo R^2 Nagelkerke of 15%. For variable “Protected Animals are Important to Community” with all data fitting and model fitness had a Pseudo R^2 Nagelkerke of 13%, also for variable “Sea is Important to Community” the model fitness had a Pseudo R^2 Nagelkerke 11%. All other categories of explanatory variables such as reason for living in a squatter community, concern for the environment, living standards and housing status that were included in the final regression model when tested range from Pseudo R^2 Nagelkerke of 7% - 8%.

The first assumption that is presented in the Model Fitting Information table suggests the model predictions for Squatter perceptions towards PA with “Daily Routine Affects Environment” being the response variable suggests significance of p-value < 0.05. The model being significant gives better predictions confirming the results of the Mann-Whitney U Test. There was significant improvement of fit from the -2 Log Likelihood Chi-Square test of the Intercept Only compared to the Final model, according to Table 6-22, $X^2(46) = 126.179$, $p < 0.01$, therefore the model gives better predictions in this matter.

Table 6-22 Results for Model Fit of O.R.M. Analysis on Dependent and Explanatory Variables. Source: Fieldwork 2017

Model	**-2 Log Likelihood**	**Chi-Square**	**df**	**Sig.**
Intercept Only	288.455			
Final	177.276	111.179	44	**p<0.01**

Link function: Logit.

Table 6-23 which is the Goodness of Fit table contains Pearson's chi-square and Deviance statistic for the model, which assumptions dictates if the p-value is less than 0.05 we reject the null hypothesis and therefore the data would not fit the model well. This statistical test provides insights into whether the observed data are consistent with the regression model being designed. In the test the resultant p-value is greater than 0.05,

p-value = 0.756, therefore we conclude from the null hypothesis that the data fit is good and that the data and the model predictions are similar resulting in this regression model being a good model to test the predictability of Squatter perception using the "Daily Routine Affects Environment". This is critical to determining the perception of low-income groups towards the environment, the Pearson Chi-Square Test results $X^2(352) = 333.232$, $p = 0.756$ and Deviance Test $X^2(352) = 177.276$, $p = 1$.

Table 6-233: Results for Goodness-of-Fit O.R.M Analysis Daily Routine Affects Environment and Explanatory Variables. Source: Fieldwork 2017

	Chi-Square	df	Sig.
Pearson	333.232	352	**0.756**
Deviance	177.276	352	**1**

Link function: Logit.

The Pseudo R^2 values indicates whether the independent variable would explain any variation in the responses of the Squatters. The Pseudo R^2 Nagelkerke was chosen as it's the most accurate similarity to R^2. The results in Table 6-24 indicates R^2 (Nagelkerke) at 71% explains a relatively large proportion of the variation in the outcome of Squatter responses towards their daily routine activities can be explained by the explanatory variables in the model. This means that age, PA, environment protection responsibility, governance, housing status, attitude, perception of community ecosystems and biodiversity contributes to predicting response in the form of perception of squatters. Although, this is may be a good predictor of the outcome it results does not exclude considerations for other established variables in previous research such as people involvement in decision making and governance of the PA their communities may be impacting.

Table 6-24: Results for Pseudo R-Square O.R.M. Analysis of Dependent and Explanatory Variables. Source: Fieldwork 2017

Cox and Snell	0.671
Nagelkerke	**0.711**
McFadden	0.385

Link function: Logit.

In this model it is established that “Daily Routine Affects Environment” represents the dependent variable considered best predictor of outcome for squatter perception towards the environment, model Pseudo R^2 value 71%, we therefore explore the predicted change in log odds of being higher or lower for the explanatory variables in the model.

In the ordinal regression analysis, the Parameter estimates table is the core of the output, telling us specifically about the relationship between our explanatory variables and the outcome. For the results if the value is significant at a negative it therefore means lower cumulative scores are likely than the reference or if they value is positive significant the cumulative scores are likely higher than the reference.

As presented in Table 6-25, there were a total of eleven (11) categories and 15 independent variables that were in the final model, which improved the outcome predictability. We want to analyse how the fifteen (15) explanatory variables will predict the outcome response of the Squatters in relation to their daily routine activities. In interpreting the results, negative values for a coefficient means lower cumulative scores are likely that then reference coefficient, while positive values means higher cumulative scores are likely than the reference.

Table 6-25: Parameter Estimates of O. R. M. for Predicting Squatter Perception.

Source: Research Fieldwork 2017

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Threshold	[Daily Routine Affects Environment = 1]	-13.342	2.880	21.461	1	0.000	-18.987	-7.697
	[Daily Routine Affects Environment = 2]	-10.801	2.791	14.974	1	0.000	-16.272	-5.330
	[Daily Routine Affects Environment = 3]	-9.673	2.756	12.317	1	0.000	-15.074	-4.271
	[Daily Routine Affects Environment = 4]	-5.331	2.572	4.297	1	0.038	-10.371	-0.291
Location	**Age**	**-0.831**	**0.266**	**9.726**	**1**	**0.002**	-1.353	-0.309
	[Protected Area=0]	0.871	0.923	0.890	1	0.346	-0.939	2.680
	[Environment Protection Responsibility=0]	**4.195**	**1.177**	**12.695**	**1**	**0.000**	1.887	6.502
	[Environment Protection Responsibility=1]	**17.932**	**2.704**	**43.967**	**1**	**0.000**	12.632	23.233
	[Environment Protection Responsibility=2]	**2.172**	**0.948**	**5.243**	**1**	**0.022**	0.313	4.030
	[Environment Protection Responsibility=3]	**7.022**	**2.254**	**9.704**	**1**	**0.002**	2.604	11.440
	[Environment Protection Responsibility=4]	2.106	1.445	2.122	1	0.145	-0.727	4.938
	[Environment Protection Responsibility=5]	2.406	1.979	1.479	1	0.224	-1.472	6.285
	[Work=0]	-0.380	0.576	0.436	1	0.509	-1.508	0.748
	[Concern for Climate Change=1]	**-3.742**	**1.206**	**9.636**	**1**	**0.002**	-6.105	-1.379
	[Concern for Climate Change=2]	**-2.757**	**1.105**	**6.228**	**1**	**0.013**	-4.921	-0.592
	[Concern for Climate Change=3]	**-3.048**	**1.230**	**6.139**	**1**	**0.013**	-5.459	-0.637
	[Concern for Climate Change=4]	**-3.290**	**1.437**	**5.243**	**1**	**0.022**	-6.107	-0.474
	[Family House=0]	0.670	0.686	0.954	1	0.329	-0.675	2.015
	[Sea Important to Community =1]	-1.092	1.547	0.498	1	0.480	-4.125	1.941
	[Sea Important to Community =2]	-0.298	1.335	0.050	1	0.823	-2.914	2.317
	[Sea Important to Community =3]	1.074	1.157	0.861	1	0.354	-1.195	3.342
	Sea Important to Community =4]	1.395	1.033	1.824	1	0.177	-0.629	3.419
	[Swamp/River Important to Community=1]	-1.578	1.422	1.231	1	0.267	-4.366	1.210
	[Swamp/River Important to Community =2]	-0.594	1.192	0.248	1	0.619	-2.930	1.743
	[Swamp/River Important to Community =3]	**-2.597**	**1.271**	**4.176**	**1**	**0.041**	-5.087	-0.106
	[Swamp/River Important to Community=4]	0.536	1.198	0.200	1	0.655	-1.812	2.883
	[Forests are Important to Community=1]	-20.156	0.000		1		-20.156	-20.156
	[Forests are Important to Community=2]	1.433	2.092	0.469	1	0.493	-2.668	5.534
	[Forests are Important to Community=3]	-0.090	1.257	0.005	1	0.943	-2.554	2.375
	[Forests are Important to Community=4]	1.777	1.115	2.538	1	0.111	-0.409	3.962
	[Protected Animals Important to Community=1]	-3.420	2.416	2.003	1	0.157	-8.156	1.316
	[Protected Animals Important to Community=2]	-2.741	1.379	3.950	1	**0.047**	-5.444	-0.038
	[Protected Animals Important to Community=3]	-1.305	1.218	1.148	1	0.284	-3.692	1.082
	[Protected Animals Important to Community=4]	-0.688	1.184	0.337	1	0.561	-3.008	1.633
	[Governance Action/No Action=0]	1.740	0.898	3.750	1	0.053	-0.021	3.501
	[Concern for Deforestation=1]	**-2.992**	**1.102**	**7.368**	**1**	**0.007**	-5.151	-0.832
	[Concern for Deforestation=2]	-1.243	1.259	0.975	1	0.324	-3.710	1.224
	[Concern for Deforestation=3]	**-3.687**	**1.489**	**6.134**	**1**	**0.013**	-6.605	-0.769
	[Concern for Deforestation=4]	-2.306	1.284	3.226	1	0.072	-4.822	0.210
	[Important to Protect Environment=1]	-4.080	2.198	3.445	1	0.063	-8.389	0.229
	[Important to Protect Environment=2]	0.612	3.009	0.041	1	0.839	-5.285	6.509
	[Important to Protect Environment=3]	-1.597	1.132	1.989	1	0.158	-3.815	0.622
	[Important to Protect Environment=4]	**-2.338**	**0.801**	**8.520**	**1**	**0.004**	-3.908	-0.768
	[Living Standard=1]	-2.946	2.317	1.616	1	0.204	-7.487	1.596
	[Living Standard=2]	-1.962	1.713	1.312	1	0.252	-5.320	1.396
	[Living Standard=3]	-2.842	1.642	2.994	1	0.084	-6.061	0.377
	[Living Standard=4]	-2.486	1.776	1.960	1	0.162	-5.966	0.994
	[Less Trees=0]	**-1.569**	**0.651**	**5.809**	**1**	**0.016**	-2.844	-0.293

Link function: Logit. **Bold is significant.**

In Table 6-25, we have the regression coefficients and significance tests for each of the final explanatory variables in the model. The results are expressed as follows:

1) In the model, the first variable with a significant coefficient is age. Age is a significant negative predictor of perception in relation to "Daily Routine Affects Environment". Therefore, results indicate a decrease in age (expressed in years) by 1 year was associated with a decrease in the odds -0.831 of strongly agree, with a p-value = 0.002. This means older people are more likely to associate daily routine as a threat to the environment.
2) "Environment Protection Responsibility" is a significant positive predictor of perception in relation to "Daily Routine Affects Environment". Therefore, results indicate for 1 unit of increase in response for environment protection responsibility the likelihood the higher the response for strongly agree towards the dependent variable. As a categorical variable the odds were different for each although all positive. For 1 unit increase there is a predicted coefficient increase of 4.195 for "Government" p-value 0.000, 17.932 for NGO p-value 0.000, 2.172 for "Community" p-value 0.022 and 7.022 for "Government and NGO" p-value 0.002. In addition, the odds of the responses would be higher between all significant groups and the reference; therefore, the respondents irrespective of who they believe is responsible would strongly agree daily routines affected the PA environment.
3) "Concern for Climate Change" is a significant negative predictor of perception in relation to "Daily Routine Affects Environment". As a unit increase on the independent variable score that is negative it suggests a predicted decrease in the likelihood for respondents' perception towards higher score (agree). For the categories, there is a predicted coefficient decrease of -3.742 for "Concern for Climate Change" strongly disagree with p-value 0.002, -2.757 for "Concern for Climate Change" disagree with p-value 0.013, -3.048 for "Concern for Climate Change" neutral with p-value 0.013 and -3.290 for "Concern for Climate Change" agree with p-value 0.022. While the odds are per 1 unit are different in comparison to the reference, the results suggest the same effect on the dependent variable.

4) “Swamp and River is Important to Community” is a significant negative predictor of perception in relation to “Daily Routine Affects Environment”. As a unit increase on the independent variable score that is negative it suggests a predicted decrease in the likelihood for respondents’ perception towards higher score (agree). There is a predicted coefficient decrease of -2.597 “Swamp and River is Important to Community” response of neutral, p-value of 0.041.
5) “Protected Animals Important to Community” is a significant negative predictor of perception in relation to “Daily Routine Affects Environment”. As a unit increase on the independent variable score that is negative it suggests a predicted decrease in the likelihood for respondents’ perception towards higher score (agree). There is a predicted coefficient decrease of -2.741 of log odds being in a higher level of the dependent variable, significant at p-value = 0.047 for “Protected Animals Important to Community” response Disagree.
6) “Concern for Deforestation” is a significant negative predictor of perception” in relation to “Daily Routine Affects Environment”. As a unit increase on the independent variable score that is negative it suggests a predicted decrease in the likelihood for respondents’ perception towards higher score (agree). There is a predicted coefficient decrease of -2.992 of log odds being in a higher level of the dependent variable, significant at p-value = 0.007 for “Concern for Deforestation” response strongly disagree and there is a predicted coefficient decrease of -3.687 of log odds being in a higher level of the dependent variable, significant at p-value = 0.013 for “Concern for Deforestation” response neutral.
7) “Important to Protect Environment” is a significant negative predictor of perception in relation to “Daily Routine Affects Environment”. As a unit increase on the independent variable score that is negative it suggests a predicted decrease in the likelihood for respondents’ perception towards higher score (agree). There is a predicted coefficient decrease of -2.338 of log odds being in a higher level of the dependent variable, significant at p-value = 0.004 for “Important to Protect Environment” response of Agree. This is the only variable that was significant in relation to the reference.
8) “Less Trees” (observed change in environment) is a significant negative predictor of perception in relation to “Daily Routine Affects Environment.” As

a unit increase on the independent variable score that is negative it suggests a predicted decrease in the likelihood for respondents' perception towards higher score (agree). There is a predicted coefficient decrease of -1.569 of log odds being in a higher level of the dependent variable, significant at p-value = 0.016 "Less Trees" response of not observed.

The other coefficients such as governance, housing status, living standards, reason for living in a squatter community, perception of the forests and sea in the communities that were included in the model are recognized as not significant predictors towards the respondent's perception. Although not significant the values still contribute to understanding squatter perception towards the environment.

Table 6-26: Results for Test of Parallel Lines of Ordinal Regression Model. Source: Research Fieldwork 2017

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Null Hypothesis	177.276			
General	44.197[b]	133.079[c]	132	**0.457**

a. Link function: Logit.

b. The log-likelihood value cannot be further increased after maximum number of step-halving.

c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.

The proportional odds (PO) assumption is evaluated through the test of parallel lines. In this test, there is a comparison of the ordinal regression model with consideration for its set of coefficients for all thresholds according to the Null Hypothesis and to a model with a separate set of coefficients for each threshold referred to as General in the Table. The results suggest that if the general model has p-value < 0.05 being significantly better fit to the data than the ordinal (proportional odds) model in the Null Hypothesis then we reject the assumption, however Table 6-26 results suggest that it is not significant p-value = 0.457, therefore we accept the Null Hypothesis and the odds are consistent whether we increase or decrease.

The model was also subjected to a Generalized Linear Model since the model data was ordinal and not Linear. The Generalized Linear Models procedure expands the

general linear model so that the dependent variable is linearly related to the factors and covariates via a specified link function. The Test of Model effects and Omnibus Test results were included in the summary of the research results to produce Odds Ratio in the form of Likelihood Ratio Chi-Square.

Table 6-27: Results for Generalized Linear Model Omnibus Test for Likelihood Ratio Chi- Square. Source: Research Fieldwork 2017

Likelihood Ratio Chi-Square	df	Sig.
111.179	44	**p<0.01**

The Omnibus Test is a likelihood-ratio chi-square test of the current model versus the null (in this case, intercept) model. The Omnibus Test compares the fitted model against the thresholds-only model. The significance value of less than 0.05 indicates that the current model outperforms the null model. The results in Table 6-27 are that the model is significant at p-value 0.000 and so outperforms the intercept similar confirming the information in the Ordinal Regression Model.

The Test of Model Effects for Likelihood Ratio Chi- Square in Table 6-28 shows that there is significant association between the coefficients "Environment Protection Responsibility", "Less Trees", "Important to Protect Environment", "Concern for Climate Change", "Concern for Deforestation", "Swamp and River Important to the Community", "Age" and "Governance. " Note, "Governance" had a positive relationship with "Daily Routine Affects Environment", as for 1 unit increase there is a predicted coefficient increase of 1.740 for the dependent variable, although the p-value in the regression model was slightly above p-value < 0.05, with a score of p-value = 0.053 we still consider this factor as significant in both models.

Table 6-28: Results for Generalized Linear Model Test of Model effects for Likelihood Ratio Chi- Square. Source: Research Fieldwork 2017

Source	Type III Likelihood Ratio Chi-Square	df	Sig.
Protected Area	0.870	1	0.351
Environment Protection Responsibility	15.475	6	**0.017**
Less Trees	5.470	1	**0.019**
Work	0.406	1	0.524
Important to Protect Environment	10.272	4	**0.036**
Living Standard	3.892	4	0.421
Governance (Action/ No Action)	3.723	1	**0.054**
Concern for Climate Change	10.707	4	**0.030**
Concern for Deforestation	10.702	4	**0.030**
Family House	0.898	1	0.343
Sea is important to the community	6.229	4	0.183
Swamp and river important to the community	10.221	4	**0.037**
Forests are important to the community	5.429	4	0.246
Protected Animals are important to the Community	6.626	4	0.157
Age	9.846	1	**0.002**

6.5 Summary

1. The results as it relates to squatting and the environment indicates that we should reject the assumption that respondents will believe squatting is a threat and believe their routine activities are also threats but treat both individually in terms of the respondents view of the importance of protecting the environment.
2. The results suggest that there is a significant association with living conditions and the importance of protecting the environment. Therefore, consideration must be given to the living situation of the individuals in squatter communities before proposing solutions especially with competing priorities. Regarding

perception the activities that are done during their daily lives and the living conditions they live in may suggest the difference in perception for the act of squatting and daily routine activities.

3. The results suggest that governance system in a PA does influence the perception of those that are impacted by this system and that the two factors of governance and PA ecosystem are not independent of each other but possess a significant association for providing effective solutions.
4. Governance is significantly associated with environment protection responsibility, however, is not the complete factor when we consider the results for Terrestrial PA that has little influences from Governance. Therefore, consideration must be given to a willingness to act on behalf of the surrounding environment as in the case of Terrestrial PA.
5. Environmental knowledge or concern for PA although significant per se, is not an automatic engagement in pro-environmental behaviour. Also, educational programs existing in the community is not significant to environmental changes observed or with PEBs.
6. Squatter Attitude (concern for environment) and Perception of the PA in their communities are significant and contributes to the ease or difficulty of performing PEB and observing changes in the environment.
7. Squatter housing status and intention for tenure has association with the environmental threats observed but does not mean automatic engagement into performing PEBs.
8. Squatter perception of their “Daily Routine Affects Environment” represents the dependent variable considered best predictor of outcome for squatter perception towards the environment in relations to the independent variables that were tested, explaining approximately 71% of the interaction.

Chapter 7- DISCUSSION & RECOMMENDATIONS

7.1 Thematic Review of the Implications of Governance on PA

The background information on the housing situation in Jamaica presents squatting as a key part of meeting the housing demands for people of low socio-economic status. As a result, it is important to determine how to create a balance between affording people the opportunity to live as is their right and also to protect the environment that will enable them to have a healthy and sustainable future through the proper management of the natural resources. It is from this background we analyse the importance of governance of the PA and Squatting, displaying the necessity of understanding the current governance systems and perception of the people to present best response to ensure there is somewhat of a balance.

In alignment with the definition for Governance, the evidence suggests there are no shortage of legislatures, policies, guidelines, organizations and offices with the mandate of PA conservation and environmental protection in Jamaica. As indicated by other researchers, the problem originates not with the abundance of strategies but with the execution and as Perry (2015) suggests, it comes in the form of ill-equipped societies handicapped by restrictive political systems. Although Lockwood (2010) explains that "Good governance is a prerequisite for effective management and is fundamental to ensuring political and community support and the survival of the global protected area system," the results are discussed under four (4) key policy areas that are deficient lending to the encroachment onto the PA:

1. Policy Issues:

The construction industry that forms a significant part of the Jamaican GDP and is also part of a global industry is detrimental to the environment. As previously stated, the research identified a plethora of legislature and policies designed to protect the PA (both national and international) that is applicable. However, the results of the analysis present a disparity between the intent of these tools and the outcome in response to the problem of squatting.

Issues such as:

- Lack of adequate resources to properly address the problem was evident.
- Continuous growth of the communities regardless of the policy tools implemented.
- Increasing threats and negative impact of those threats due to the number of pressures in being experienced in especially Marine PA.

A bombardment of policy response and awareness programs in the Marine PA in response to the threats that repels responsibility instead of encouraging greater acceptance are all outcomes of the current trajectory.

Consideration for governance of protected areas has earned the status of being scientifically important in the last decade or so (Castro and Urios 2016), there is the question of competence of managers of these areas who are supposed to have knowledge and skills both to manage and mitigate against these risks and as the results suggest a lack of input from relevant stakeholders and lapse in governance techniques such as site monitoring and adaptation.

The management of Squatter Settlements and PA are showing inefficiencies with collective consideration for minimizing the negative effects of squatting and results in poor governance and an excuse for proliferation of Squatter Settlements. As is common in many developing countries the institutional capacity required to successfully develop and transition critical goals for good governance are hindered by the poorly funded responsible agencies and or the ineptitude in administration, and not the least inadequate human and financial capital. According to the results, the intimate knowledge of the areas being impacted by squatting that is required to reduce the threats and the effects of these threats being listed under the PA umbrella is totally inadequate or non-existent and creates a handicap (Geldman et al 2013, Kusumawatia and Huang 2015).

In some research it is argued that sharing of power and responsibilities for the protection of these ecologically sensitive locations can increase trust among actors, foster social learning and adaptability (Berkes 2009). However, while that may be characteristic of some areas, this research found situations of lack of accountability in the form of not accepting responsibility for the squatter problems affecting the PA, especially in

PA.1/SS.1 (the PA that practice shared governance between Government and NGO), as the author was caught in a hither and thither situation during data collection exercise between responsible authorities.

Hudson et al (2019) postulates the importance of developing policies for the benefit of expressing intent that will ensure action, through instruments with clear goals and having policies for implementation. In this research, the absence of a Squatter policy that addresses such serious threat to the effectiveness of PA appears to be persistent for over 50 years. Consequently, allowing a proliferation of squatting, even though squatting forms an integral part of supporting the housing stock, especially in low-income groups. Although, there is an allowance made in the Town and Country Planning Act for Jamaica that empowers the Planning Authority to treat with this illegal act, the lack of a policy that would adequately guide the decision and provide measurable instruments for success in treating with the problem by the SEMU, presents as a serious handicap to this entity.

2. Planning Issues

Poor or inadequate or ineffective governance will not allow for environmentally sound or sustainable development that will allow existing low-income communities to exist in harmony with the adjacent protected areas or even add further protection. This was represented in the results as a lapse in collective management with the exclusion or insufficient inclusion of key authorities and a lack of collaborative efforts. Consequently, confirming the results of other researchers that highlight the importance of conservation strategies that integrate public, private, and community-managed areas into solutions to environmental threats (Bray et al., 2008). Additionally, Lockwood (2010) highlighted the significant importance of "participation and equitable representation of all stakeholders and also pointed to the need for coordination of interactions between agents both within and between levels," a situation necessary to define strategies employed to PA conservation as good governance, however the current mode of operation was clearly void of this medium, evidenced by the exclusion of the Planning Authority in the Protected Area Committee who has regulatory responsibility for minimizing development or regulating the kind of developments in PA in Jamaica.

There are negative implications to inadequate enforcement of planning polices and regulations in these areas. This breakdown in enforcement is represented by the implementation of unsuitable sewage containment infrastructure in Marine PA (especially in PA4). In addition, the threat of land conversion in the PA continues to expand through housing development as a result of lapse in the execution of the responsibilities of the Planning Authority.

Further, planning issues are evident in the attempts that have been made to relocate squatters from ecological sensitive and PA. Findings suggest many of these resettlement or relocation exercises have failed for various reasons, such as the fact that the amenities that these locations may provide such as a "combination of infrastructure, employment, and necessary goods and services that propels population growth and acts as human settlements" (Joppa et al. 2009), may not be easily accessible at the new locations for persons of their socio-economic status, especially considering the new sites tend to be further away from the urban centres increasing financial burdens. Further Abbott 2001, states that "relocation may be financially unachievable and there is also a growing recognition that these settlements are social and economic entities"; therefore, a need exists to understand the perception of the individuals residing in these areas towards finding synchronized solutions.

3. Environmental Education Issues

Although there are existing policies for education, training and awareness, the implementation of such policies in Jamaica is severely hampered by resource issues, even though it is critical to the effectiveness of the PA. The research identifies the limitation in resources and an absence of execution of this policy in the Terrestrial areas and inefficiencies in the Marine areas in the form of lack of location specific data and programs.

According to Hudson (2001), the collection and utilization of relevant and updated knowledge and techniques that is adaptable to landscapes, is integral to ensuring that education received is relevant and compliments the needs and interests of the community. Therefore, to firmly transfer information that will motivate and allow

community members to participate in conservation practices requires location specific data that is relatable to the local community. Providing general information to the local community that does not properly communicate the importance based on the needs can get lost in translation. As the study shows, there is a paucity of research on the problem and a failure by the governance agencies to thoroughly research, collect and record relevant information that can both strengthen the existing policies and limit the threat of squatting. This lack of critical information may negatively impact the educational awareness programs being presented to the squatter communities.

Consequently, the Marine squatters, this inadequacy could have potentially skewed the knowledge received by squatters and alter their perception towards environment protection responsibility. The results from the analysis strengthens this position as total of 62% of respondents in Marine communities, with greater intervention from the governance agencies, indicates that external bodies are responsible for environment protection. On the contrary, the absence of this education in Terrestrial community, who accepted greater responsibility as a community for protecting the environment, may have highlighted the willingness to act and potential normative beliefs that may work in favor of the environment. There is evidence of social learning and adaptability, which indicates the Terrestrial squatter settlements that had little or no current educational programs and was able to identify changes in the environment and identify the positive impacts of discontinued conservation programs.

Further, as presented in the results of Table 5-1, the governance bodies in developing environmental education policies, ought to maximize the use of local squatter community knowledge of the areas and so would be able to provide practical and important information towards conservation data. This is supported by researchers Shahabuddin and Roa (2010) that indicated the belief exists that people occupying areas near forests possess intimate knowledge of local ecology and would minimize the effects on the habitats. Hudson (2001) encourages that proper planning and implementation of public education on the environment has great benefits for future quality of life. This is a critical fact that needs to be considered as evidence in Marine squatter communities that

displayed higher impact intensities although the education programs exist, which means deficiencies in delivery.

4. Environment Conservation Issues

According to Mukul and Rashid (2017), “There is also considerable debate on the extent to which PAs deliver conservation outcomes in terms of habitat loss and species conservation”, this statement presents as true in the research findings, since there was a lack of substantive data on the effects of squatting on the PA and the ease at which these areas are accessible to housing development.

Rabalais et al. 2009, consider the intensity of anthropogenic threats in the Gulf of Mexico, the researchers identified multiple stressors that caused nutrient loading, and so highlighted the need to measure such impact to prevent water quality degradation. Likewise, the results of the impact intensity score on the Marine PA suggest that governance bodies of this PA have greater number of threats to contend with and could explain greater attention received in these areas. Consequently, it is understandable why the governance of protected areas has earned the status of being scientifically important in the last decade or so (Castro and Urios 2016), however, there is the question of competence of managers of these areas who are supposed to have knowledge and skills both to manage and mitigate against these risks and as the results suggest a lack of input from relevant stakeholders and lapse in governance techniques such as site monitoring and adaptation.

The management of Squatter Settlements and PA are showing inefficiencies with collective consideration for minimizing the negative effects of squatting and results in poor governance and an excuse for proliferation of Squatter Settlements. As is common in many developing countries the institutional capacity required to successfully develop and transition critical goals for good governance are hindered by the poorly funded responsible agencies and or the ineptitude in administration, and not the least inadequate human and financial capital. According to the results, the intimate knowledge of the areas being impacted by squatting that is required to reduce the threats and the effects of these

threats being listed under the PA umbrella is totally inadequate or non-existent and creates a handicap (Geldman et al 2013, Kusumawatia and Huang 2015).

Poor governance gives way to increased and continuous threats and provides the ideal environment of severe impact of communities on the PA. Although according to Nagendra (2008), the implementation of protected areas had significantly lower rates of land clearing in comparison to other areas without such protection, however, the results of this research determined that some Squatter communities were developed after the designation of these sites as PA and as such proper governance and management should have alleviated such effect. However, possibly because of the issues affecting the governance such as limitations with resources and political affiliations, these communities were able to be created and in the case of SS.3 flourish, this result is also in keeping with what has been said globally "legal designation does not necessarily guarantee the protection of biodiversity values," Liu et al (2001).

7.1.1 Strategic Approach to Address Governance in the Areas

The policy implementation can be described as a complex process from the beginning of designing the policy to implementation. The four (4) thematic issues identified in the research, has clearly indicated a breakdown in governance of PA and squatting. Evidently, there is a lapse between implementation and the outputs or outcomes necessary for the protection of PA and the control of squatting. The implications of this breakdown are apparent in the impact to the PA by the squatter communities. Correcting this problem means fixing the problems at the top of the hierarchy and allowing this to filter down to the lower levels, specifically the Squatters. It is obvious that policy for the protected areas in some cases stopped at the development stages and lacked implementation, more troubling is the fact that there is no policy for squatting.

Past research has presented the importance of maintaining a relationship between the local community and the PA to ensure sustainable development for both (Du et al. 2015), however, imposing solutions for creating that balance with deficiencies in the systems, especially in the areas of outcome will result in failure. Therefore, a Top-Down approach to the problem in the research, is necessary in addressing squatting in PA.

Government bodies that expects the people that interact with the location to assimilate to the policies, ought to ensure that the tools are in place and are implemented before expecting meaningful cooperation. Further, fixing the issues at the top of the hierarchy may be a motivator for the community to participate and help to minimize the pressures on the PA.

Table 7-1 summarizes the main inadequacies in policy for both the PA and Squatting as per the description for good governance that would need to be addressed at the top and properly implement changes and solutions. Du et al. (2015) summaries that area-oriented and process-oriented approaches are key strategies to smoothly integrate the both the PA and the local community. This further postulate the need for deliberately collecting information on the area affected by squatting and understanding the intricacies of the location, to ensure that the process designed in the policies can be implemented successfully and has the buy in of the community.

Table 7-1 Characteristics of Good Governance In relation to Assessment of PA Governance in Jamaica

Good governance*	Measurement	Limitations to Governance
Democracy	Management capacity	Lack of involvement of key governance Agencies in steering committees Failed Squatter relocation or resettlement strategies and no innovation for new approaches. Resource limitations, resulting in poor governance by responsible steering agencies
Participation	Monitoring and enforcement	Lack of PA resource database resulting in lack of basic knowledge on Anthropogenic threats to PA by steering agencies
Responsiveness	Conflict management	Confrontational governance that is repelled by squatters
Compliance/ Rule of Law	Regulation and rule breaking	In complete critical tools for protection of protected areas, especially Protected Area System Master Plan (PASMP), 1 ½ years behind. Lack of Squatter Policy Non ratified international treaties, example, Convention on Biological Diversity.
Transparency	Participation in management	Minimal to no community involvement in decision-making
Accountability Direction		Inadequate accountability Lack of a Squatter Database

∗ Adapted from Lockwood (2010) and UNDP, 1997 criteria for good governance.

7.1.2 Deciphering Impact of Current PA and Squatting Governance Situation

In the results of impact associated with Governance, landcover change in the form of land conversion seems to be associated with some livelihood activities, however mostly because of housing needs. It also, outlines the inefficiencies with proper management of development plans and adherence to same and lack of research or data that will aid in the management of these locations. According to Bolland et al (2012), globally research has focused on assessing the underlying cause of deforestation, however, has failed to distinguish how various management strategies may contribute to reducing deforestation. This analysis has confirmed the lapse in effectiveness in forest management and other PA by the authorities and some level of identification of the necessity and usefulness of certain aspects of the management strategies used in the past by Squatters

in the Terrestrial PA who believe a reintroduction may result in a reduction of deforestation.

Further, Nellemann et al. (2007) found that designation as a PA did not eliminate illegal logging in protected areas of Indonesia, with majority of the forest PA experiencing this action; hence, the same can be said for the Terrestrial Areas, especially SS.2 that has logging for charcoal and other farm practices as a degradation contributor. Notwithstanding, these same respondents were able to identify the negative implications of a practice continued and a link between the effects now, in comparison to previous times where a robust monitoring system existed in the Forest PA.

Furthermore, Marine and Coastal PA (MPA) is an important instrument for protecting habitats, ecosystem structure, species diversity and richness in these locations and has resulted in the increase use of this tool globally to reduce the anthropogenic threats they face. The results of this research strengthen the need for the implementation of this instrument as Figure 5-10 indicates that they are the most vulnerable and that the squatter settlements in the locations have greater threat intensity. Bennett and Dearden (2014) affirm this when they reiterated the fact that the ecological health of MPA are threatened by anthropogenic effects such as over exploitation of fish stocks, degradation and loss of habitats and pollution.

McFarlane (2011) highlighted the fact that there are struggles experienced by low income individuals to provide adequate sanitation facilities as confirmed by the types of sewage containment systems utilized in the areas. This however, pokes further holes in the governance system that allows the development of unregulated containment systems through the absence of the enforcement of the development regulations by the Town and Country Planning Authority.

One of the main threats identified to this area was of improper sewage disposal, through lack of toilet facilities, poorly constructed or the wrong system for the specific soil type and also design flaws that leads to the direct pollution of the underground waterways and or sources to the Marine Parks. This problem was particularly evident in both MPA that were studied, identifying in other studies (Lapointe et al. 2011) the issue

of nutrient loading potentially creating damages to coral reefs and fisheries. Consequently, affirming the position by Halpern 2014 that some MPA are potentially paper parks, with limited regulations and limited enforcement of the ones implemented.

7.2 Implications of Squatter Perception on the PA Environment

In the research the observations and the numerical analysis points to a correlation (association) between squatter activities and environmental degradation. There is not a clear-cut causal relationship; however, this evidenced based association points to theories of "willingness to act", normative beliefs, subjective influences because of the governance situation (educational awareness programs, lack of monitoring and enforcement), fear of tenure insecurity and socio-economic issues.

Tindigarukayo (2017), who researched squatting widely in Jamaica recommends that there should be a revision of squatter perspective in solutions, as mere inclusiveness and authority governance are not adequate, to provide solutions. Further, Bennett and Dearden (2014) pointed to the need to have positive local perceptions as a catalyst for the success of MPAs based on the socio-economic and ecological outcome factors in these areas. The results from initial assessment of the perceptions of squatters in Figure 6 (2-8), shows that the perceptions will vary in how they view the situation of squatting, which is a portrayal of their socio-economic situation, on the local protected environment.

Moreover, considering the living standards of many that may result in competing priorities between somewhere to live and protecting the environment, the perceptions of this group is paramount. The correlation results provided significant positive correlation in their perception of the importance of environment protection and the living standards and potential lifestyle change. This they agreed is important to minimizing the effects to the environment as confirmed by Devi et al (2017), which noted that without improving the infrastructure in these areas, degradation and pollution cannot be alleviated.

7.2.1 Governance of PA – What it means to Low-Income Squatter Community?

Governance approach to dealing with the problem is important to determine the reaction of the respondents to policy solutions, the results show there is a statistically significant association between governance and PA, suggesting they are not independent

of each other when trying to implement solutions and must be based on relationship of governance in the PA location or ecosystem type. Macura et al. (2015) confirms the importance of understanding the relationship between governance and conservation outcomes, since it has been determined that there may be a strong causal relationship between the two that are hard to isolate.

Governance, according to Durand and Lazos (2008), may have implications for perception of the local community in regard to environment protection responsibility, suggesting government is responsible instead of the local community. The results of the frequency and Chi-Square analysis (Figure 6-9 and Table 6-12) for environment protection responsibility coincides with this notion, as 60% of the Marine group indicated that the Government (including NGO) has greater acceptance of responsibility for protecting the PA environment. This perception by majority of residents in the Marine PAs (PA.1 and PA.4) that were exposed to continuous subjective influences from the government and private sector organizations finding themselves less responsible for the protection of their environment agrees with the findings of Gifford et al. (2011). On the contrary for respondents in the Terrestrial PA they attributed most of the responsibility to the community. This may be associated with greater livelihood dependency, which is strengthened by the results of other researchers that suggest if the ecosystem resources are of benefit, they become more inclined to support conservation objectives in comparison to a situation of restricted access (Western 1994).

Moreover, the fact that Education Programs (public awareness) had no correlation with engaging in PEBs could be connected to poor living standards, the competing priorities between shelter and engaging in PEBs and the fact that the tenure status of these individuals are in question and could be the determinant for the fact of greater responsibility being place on external parties by Marine groups, and the deficiencies in conditions may clarify why Terrestrial groups accept responsibility. This need to protect the community by the Terrestrial group may come from experiences faced because of the changes they have observed in the community (such as drought and higher temperatures) not by informational norms. Education/Knowledge and awareness of environmental

threats does not result in automatic PEBs. Hence, consideration must be given to current strategies for educating squatters about PEBs.

The absence of certain techniques of governance (such as enforcement), supports the claim for the need to implement local community managed PA, a practice occasionally referred to as community-conserved areas (CCAs) that has been found to be effective in saving species from extinction (Bray et al. 2003). This would be mutually beneficial to both areas as Terrestrial groups were able to recognize the absence of such important strategy for conservation for specific species of trees. Therefore, Governance shapes perception, has implications for approach to policy solutions, especially in the area of environment protection responsibility.

The results for governance and the use of environment educational awareness programs in these communities suggest that the assumptions in Hypothesis 4 and 5 cannot be fully accepted as neither subjective influence has led to fully engaging in PEBs and accepting responsibility for environment protection.

7.2.2 Squatters' Perception Weight on PA Environment

Hypothesis 1 and 2 assumes that squatters will not agree that the act of squatting will negatively impact the environment and would also agree that their day to day activities are not a threat. However, the analysis provides evidence of respondents' agreement that is important to protect the natural environment, that their daily routine activities are a complication for the environment and could clearly outline noticeable impacts arising from their habitation of these locations. The consequences were comparable to those expressed by Abubakar et al. (2012), "Human activities which cause destruction of wildlife habitat, soil erosion, pollution, rise in temperature and change in climate, will lead to the upset of the natural environment."

Past research done by Li (2015), assumes that the level of concern for the local environment, values, and their ability to notice issues in the environment dictates whether people will engage in behaviour that is either positive or negative towards the PA. The results of the Wilcoxon signed tests indicated that concerns for deforestation and endangered species were statistically significant between groups and are of greater than

concern for climate change, water pollution and improper solid waste disposal. However, the pro-environmental actions taken by the residents had no significant association with deforestation and endangered species. Instead, the "Concern for Climate Change" positively correlated "Dispose Garbage Properly", "Concern for Water Pollution" with "Recycle" and "Concern for Improper Solid Waste Disposal" with "Animal Protection". These actions are corresponding to the fact that their perception of "Water is Polluted by Improper Sanitation", "Swamp and River is Important to the Community" and 'Protected Animals are Important to the Community" is statistically significant and greater than how they perceive other resources between them. Also, there was significant negative correlation between "Concern for Climate Change" and "Save Water".

Although the residents display statistically significant concerns and perceptions towards the PA resources and environment, and further agreed their daily routine activities are a problem for the PA, they still strongly disagreed squatting is a problem. Though not a causal situation this tendency may have implications for the fact that the results of the correlation between the observed changes and implied PEBs is not automatic, even when armed with environmental knowledge, as in the case of Marine residents. This is contrary to the results indicated by Pelletier et al. (1996), which stated the extensive belief that knowledge about environmental conditions along with knowledge of pro-environmental strategies would result in PEBs. Therefore, Li (2015) assumptions that values will determine how the residents interact with the PA, would present as Willingness to Act on the part of the Terrestrial group in the form of their acceptance of responsibility.

The relationship between "Age" and the PEB "Plant Trees" would suggest that older people who have an affinity for the location may engage the positive actions, potentially because they may have family in that location. Mulder and Cooke (2009) pointed out that "the nearby presence of family members may make people reluctant to move away and family members living elsewhere may induce people to move in their direction," having such ties to a location should encourage individuals to perform PEBs and have greater concern for the area. However, although it is evident from the results of the analysis in Table 6-4 and Table 6-5 that there is significant relationship between

people who resides in “Family House” and “Environment Protection Responsibility”, and, there are significant positive relationship with the changes observed in the environment, that could be an indication of generational ties to a community, engaging into PEBs is still not an automatic behaviour, although significant correlation between “Family House” and the PEB “Save Water”. This analysis helps to support the assumption in Hypothesis 3, which indicates that the tenure status of the squatters has implications for their interaction with the PA environment.

Finally, the results of the regression model indicate there are certain variables that are important to predicting whether the squatters would demonstrate a positive perception towards environment and what would be best to explain how they view squatting as a threat. Most variables, though significant had a negative reaction, and therefore provide evidence that target specific solutions are paramount. In the case of “Age”, it is presented that older people would be more inclined to agree their activities affect the environment, which could be attributed to the place attachment and ties to the community; this strengthens the argument for target specific solutions. Also, the positive significant values for “Environment Protection Responsibility” demonstrate the positive identification of whoever is responsible the people will understand the impact of their routines. Notwithstanding, it is important to address individuals who indicate their concern for climate change and deforestation yet will not agree with daily routines, it suggest a greater need to connect the concerns and perceptions of the squatters to propose solutions.

7.3 Potential Solutions to Deficiencies in Governance

The results found deficiencies with proper collection and storage of information relating to the anthropogenic threat, squatting. In preventing the negative effects of squatting on the PA as a result of an inefficient governance system, we must address the lack of policy direction and an incomplete database for squatting, also should implement a robust, standardized computer data collection process, imputing location specific data that will provide individual approach to solutions for squatting and inform the squatter policy.

The results provided in the specific Examples 1-4 (Figure 5 (1-3) and Table 5-1), identifies the gap in the current governance situation. It also outlines the fact that solutions

for addressing the issue of squatting, has to first take a Top Down approach, as it was determined, the problems need to be fixed from the oversight bodies and then filtered down to the community, considering how they perceive the issue. The solutions call for four (4) cost effective approaches:

- Clear outline of the procedures to be taken when a situation of squatting or to go further other domestic or international anthropogenic threats that may arise, that becomes known by all involved in the governance of the PA.
- Clear identification of who is responsible and held accountable when the situation arises, for guidance to private and public sector individuals when dealing with PA threats and would communicate or initiate the procedure for addressing the issues.
- Collective approach that includes all key stakeholders to create barriers to prevent accessibility for housing development.
- Improved Monitoring techniques that may include adapting digital strategies (including the use of drones and Google Earth, also further use of the Arc GIS software already purchased by the government) by the Planning Authority to minimize the amount of new development that takes place in these locations.

Further, it is clear from the results that there are people who would like to relocate, this provides an opportunity to address areas at great risks. Since many strategies have failed, the implementation of simple land lease solutions such as the Board Scheme Concept, for low income families (successful both in Jamaica and other countries) that will create a suitable condition for inclusion in formal housing system should be considered. This strategy can specifically address according to the SEMU, approximately 50% of the total Squatter population (Grant and Taniguchi 2017).

The association with politics is deep-rooted and difficult to address, however top government leadership will have to determine nonpartisan ways to address environmental conservation without creating additional fear for property loss through demolition and eviction. Also, the notion that homeowners will resist anything that threatens their

property or investment (Short 2017), prompts recommendation for solutions that secure squatter investment and provide tenure security that will serve both sides.

The formal housing system and deficiencies with development from the Planning Authority has contributed to the increase in squatting with a Commensalism relationship, through the availability of idle lands and other infrastructure that can be tapped into. Therefore, it is recommended that prevention of this practice be done by proper developmental plans for new housing developments being executed in a timely manner and monitoring of the sites at each phase of development be done.

7.4 Recommendations for Solutions based on Squatter Perception

The Research presents an innovation opportunity to PA management approaches having insights into squatter perception, especially as it relates to day to day activities. In Table 7-2 a summary of solutions to squatting that considers the perception of squatters is proposed.

Table 7-2 Recommendations based on Squatter Perception of Squatting and the Environment

No.	Result	Recommendation
1	Figure 6-8, Greater percentage agreement that Daily Routine Affects Environment and Table 6-2 shows a positive significant Correlation with Daily Routine Affects Environment and Important to Protect Environment of value = 0.302 and no correlation between act of Squatting is a Threat.	The information suggests any solution to Squatting and its implications for the environment should be discussed from the avenue of the routine activities than looking at the general act of squatting by the communities.
2	Table 6-6 and 6-7 shows significant correlation with whether it is Important to Protect the Environment and Squatter Living Standards value = 0.26 and Lifestyle Change 0.31. Also, significance between Living Standards and Lifestyle Change value = 0.51.	This information suggests that consideration must be given to the living situation of the individuals before proposing solutions especially with competing priorities of the environment and a place to live. Therefore, an assessment of current Living conditions and economic factors must be done before interventions for environmental protection can

No.	Result	Recommendation
		be propose especially when considering inclusion.
3	Tables 6 (8-14) Results of Chi-Square Test verifies that PA groups and governance variables were not independent of each other and 52% of the behaviour of squatters in the two (2) ecosystem types can be attributed to the influence of the Governance structure. Also, Anova One-Way Test suggests a significant difference in perception between groups.	The results suggest that governance system in a particular PA does have an effect (whether negative or positive) on the perception of those that are impacted by this system and provides insight for any approach towards a solution. Therefore, since the way the environment is viewed differs between groups, it means targeted approach must be taken based on the location, an umbrella system (one size fits all) may not be effective.
4	Tables 6-(15-18): Anova One-Way test suggests that the Perception of Squatters of Environment Protection Responsibility has significant differences between groups. Also, Chi-Square Tests has significant results and suggest knowing the type of PA the settlement is in, indeed may improve our prediction of Environmental Protection Responsibility by 56%.	Since squatters in Terrestrial Protected Areas have different views and accepted greater responsibility to protecting the environment over Marine Areas, even without the influences from governance, it is recommended that the willingness to act by this location be nurtured and allow for greater inclusion in the management of PA, such as using community members as rangers or assist in monitoring at lower costs. It therefore means that the current strategy used with Marine areas are less effective and requires a reassessment.

No.	Result	Recommendation
5	Table 6-13, Among the factors Education is Important for Environmental Protection and Educational Programs (exist or not), only Education is Important for Environmental Protection had a significant correlation with any change observed in the environment, soil erosion. Also, there was no correlation with PEBs or governance.	Consequently, it is my recommendation that deeper investigation into their willingness to act for the environment must be considered when trying to implement solutions. Also, to reassess the current educational programs mode of transfer to determine effectiveness and include target specific content that is relatable. Educational programs alone are not enough.
7	The results of Table 6-19 of the correlation between attitude and PEBs revealed that Concern for Climate Change, Water Pollution and Improper Solid Waste Disposal all had significant positive associations with PEBs. Also, that there was a significant positive correlation between Water Polluted by Improper Sanitation and Dispose Garbage Properly, and this factor was the only factor that correlated with a PEB.	This result suggests based on the concerns for the squatter's potential actions towards engaging in PEBs is not sufficient to demonstrate an automatic response, therefore it is recommended again that targeted response and support be provided beginning with areas of concern and how they perceive their environment.
8	Chi-Square test Table 6-4& 6-5 of Family House and Environment Protection responsibility are not independent of each other, as 41% of the behavior can be attributed to the housing status of Family House. Also, the correlation in Table 6-20 suggest Family House has positive significant correlation with Water Pollution, Soil Erosion and with implied PEB Save Water. Also, the correlation for tenure intention of the respondents does not automatically result in PEBs nor enable the respondents to observed environmental changes in the PA	This confirms that when proposing solutions towards environment protection the tenure status of the residents is significant. Therefore, recommendations for ensuring tenure security in the communities which may strengthen their resolve to engage more and pay attention to the problems within their communities. Potential to utilize persons in Family House status who may have greater ties to assist in managing the PA and promoting environmental awareness.

No.	Result	Recommendation
	environment. People who Own or Rent had no correlation.	
9	Tables 6- (21- 28), Daily Routine Affects Environment represents the best predictor of outcome for squatter perception towards the environment, at value 71%. Also, there is significant association between the coefficients Environment Protection Responsibility, Less Trees, Important to Protect Environment, Concern for Climate Change, Concern for Deforestation, Swamp and River Important to the Community, Age and Governance.	PA conservation management has to be considered in the context of their Daily Routines and not a blanket approach of squatting, meaning beginning at the grassroot. Their concerns, the perception of who is responsible, how they view their communities, age and the techniques used in governing the locations are key to proposing solutions and should be considered before imposing any strategies.

In summary, since the previous strategies and techniques were not effective, it demonstrates from the results that the views imposed were not coinciding with the perception of the respondents, nor considered a potential divide in perception and so failed, regardless of any inclusion. Therefore, effective governance and management of PA requires an understanding of the perception and attitudes of squatters affecting the location. In addition, considering regularization of the settlements were utilized as solutions in the past, it is integral to understand the perception of the residents to determine if that is the best solution for creating a balance between the two.

Chapter 8- CONCLUSION

The purpose of this research was to determine the impact (that is, any action that affects the quality of the environment, in either a positive or negative way) of squatting on protected natural environmental areas i.e. marine and terrestrial, from the angle of governance and squatter perception, with a view to provide recommendations for policy direction on protected area conservation and squatter housing policies. So, how will an understanding of the governance of the PA and the relationship to the perception of squatters about the act of squatting be recourse to better informing policy directions?

The analysis on the current governance situation and squatter perception suggests that governance hindered by lack of enough financial support and lack of implementation of policy directions in certain areas furthers the environmental impacts of squatter settlements. It is evident that the current governance situation alone will not guarantee a balanced relationship between squatting and the environment or motivate squatters to perform PEBs, however fixing the issues at the top of the hierarchy, through a Top Down approach for solutions and the potential for a "Willingness to act" when dealing with environmental threats plays a significant role in minimizing degradation and must be considered along with training.

In the correlation analysis of Table 6-13, educational programs existing in the communities and education being important in protecting the environment alone is not adequate to motivate the squatters to protect the environment and requires added intervention for greater positive behaviours. This suggest that subjective influences have to be tailored (considering the other elements such as age, living conditions and general perception) and monitored when implementing solutions. Further, this result reiterates the fact that solutions must be explored with the environmental problems that are found to be of great concern and the way they view the PA environment specific to the communities. Although, Pelletier et al. (1996) indicated the extensive belief that knowledge about environmental conditions along with knowledge of pro-environmental strategies would result in PEBs, this is not necessarily the experience in this research, however a willingness to act and the needs of the participants may drive their engaging in PEBs.

Authorities need to explore the current tenure situation and include application of other simplified housing solutions to the growing squatting problem for those areas that are creating severe threats to the already vulnerable ecosystems. This may help to motivate the locals toward performing greater PEBs.

Consequently, greater research needs to be done in order to write and implement successful policy solutions to squatting and anthropogenic threats to PA environments, this as a result of the responses received from the interviews conducted with the two (2) lead agencies that indicated several key questions were not answered (Appendix II-Interview Questions), with the agencies citing that the information is not established, not known or there is no definitive response for the information being sought.

After evaluating the research and what has been accomplished, it has been determined from the results that the act of squatting is not the determinant, but the daily routine activities of the squatters should be the focus. Also, Perception and Governance are significant in explaining the potential extent of threats to P.A. impacted by squatting and therefore, further quantitative scientific analysis into specific threats in the form of water pollution, livelihood based land cover change, improper sewage disposal and other such extremely negative threats is required to evaluate the extent or severity.

It is recommended that future research explores the "Willingness to Act" by the Terrestrial PA communities in comparison to Marine PA and determine the driver for that difference in environmental responsibility to further provide solutions to minimize the effect of squatting on the PA environment.

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APPENDIX

Below are copies of the survey tools utilized to gather data:

I. Structured Interview questions- was used to ascertain information on governance strategies and monitoring techniques from the lead agencies.
II. Sample of Questionnaire
III. Images of PA & Squatter Community
IV. Description of Analysis Data (Variables)

I. Interview Questions

(NEPA, Parish Councils and Ministry of Agriculture and Forestry)

The following questions are aimed at determining the impact of Informal communities on the protected areas in Jamaica (i.e. Marine, Terrestrial and Biodiversity – Forest, water sources and sanctuaries- please see maps attached), in or within close proximity to the following:

- ***Kingston- Port Royal, Bay shore***
- ***Clarendon- Hayes***
- ***Westmoreland- Nonpareil***

Please represent statistical information where possible over a 30-year period, where possible at 5-10-year intervals.

1. What are the threats to the natural environment (Protected areas in these locations and other such squatter settlements) i.e. water, land/ land cover and biodiversity?

2. What is the extent of deterioration or impact on the natural environment by these communities?

3. Does the origination of the community determine the severity of the impact?

4. What led to the development of these communities in the specified areas?

5. How do the livelihood and routine activities of these communities impact the natural environment?

6. What is the comparative difference of impact on the natural environment as it relates to stand alone and mixed communities? Is there a trend in dependency or parasite relationships between formal and informal communities?

7. Is the current trajectory of the communities tolerable to the natural environment or will it be necessary for them to relocate? If tolerable are the practices applicable to planned communities?

8. Are the inhabitants aware of the threats they pose? Their views on the threats and who is responsible?

9. Are there any environmental awareness programs being instituted in the communities?

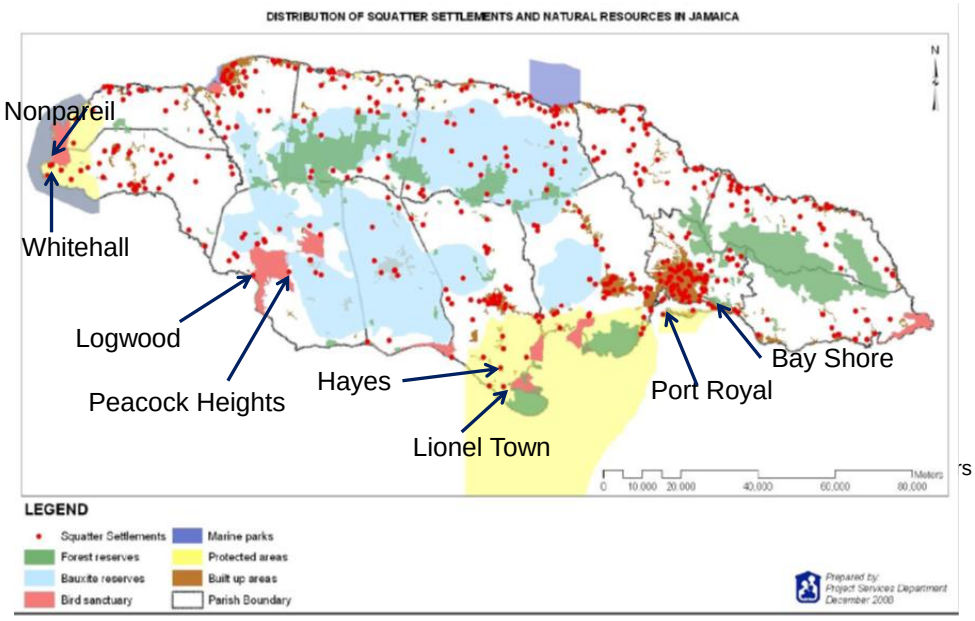
10. What kind of infrastructure available in these communities? Capacity for improvement and/ or systems for implementation to minimize environmental threats?

11. What measures have been taken to minimize the threats to these protected areas by the GOJ or your Agency?

12. What has been the rate of growth for population over the period?

13. Water usage and Waste (sewage and solid waste) disposal practices by residents and their impact?

14. Given the threats posed and present in each of the select eight (8) communities, please assign intensity values based on your expert advice. Range should be between from 1 to 5, with 1 being a low impacting and 5 a high impacting community.



Source: Rapid Assessment of Squatting Jamaica Report 2008

N.B. Communities of Logwood, Peacock Heights, Whitehall and Lionel Town were illuminated from the research exercise as some were discounted by the SEMU as not being squatter communities but settlements and sample sizes were too small for a reliable analysis to be done.

II. Questionnaire on Informal Communities and the Protected Environmental Areas

This is academic survey is to determine inhabitant's perspective on the captioned. Respondents (**head of households)** are asked to complete this document anonymously. We appreciate your participation; you are not obligated to do this survey. Please answer the questions truthfully; there is no right or wrong answers.

Section 1: ***Place an X or use short answers where necessary.***

1. Sex: Female ( ) Male ( )

2. What is your age? _____

3. Please write the number of people living in the household on a permanent basis. _____

4. How many children are living in the house? _____

5. What is your occupation or means of livelihood? _____

6. How long have you lived in this community? _____

7. What is the status of your house?

Owner ( ) Rent ( ) Family House ( ) other, specify ( )

8. What made you live in a squatter community (***In the table below please place an X for the rating for your reason, 5 being highest factor and 0 being lowest, not a factor. Choose other and explain if reason is not there***)?

Reason	***Lowest (0)***	***1***	***2***	***3***	***4***	***Highest (5)***
Lack of collateral (support for a loan e.g. car, house, land etc.)						
Lack of savings						
Low Income job (minimum wage)						
Land cost						
Housing Cost						

Other

_____

_____

9. Why live in this specific community (***In the table below please place an X the rating for your reason, 5 being highest factor and 0 being lowest, not a factor. Choose other and explain if reason is not there***)?

Reason	***Lowest (0)***	**1**	**2**	**3**	**4**	***Highest (5)***
School (to attend tertiary or other educational institution)						
Work (in search for employment)						
Family (Family members encourage you to live here)						
Affordable Housing (cheap rent or cheaper way to build)						
Financial problems (unemployment, lack of savings etc.)						

Other, explain.

_____

_____

10. How would you describe your standard of living ***(place an X in the bracket for your choice***)?

Very Good ( ) Good ( ) Average ( ) Poor ( ) Very Poor ( )

Explain reason for your choice,

_____

_____

_____

11. In your opinion, how has the community population grown since you came here to live **(place an X in the bracket for your choice)**?

Fast Increase ( ) Average Increase ( ) Slowly Increase ( ) No increase ( ) Decrease ( )

Explain where possible,

_____

_____

Place a X in brackets ( ) for the answer or answers that fit your situation:

1. What kind of infrastructure is made available?	Road ( )	Drains ( )	Public Sewer ( )	NWC ( )	JPS ( )	None ()
2. How do you mainly get rid of your garbage	Burning ( )	Dumping ( )	Garbage Truck ( )	Bury ( )	Recycle ( )	Other ( )
3. What kind of toilet facilities do you have?	Indoor Flush ( )	Pit Latrine ( )	Public Flush Toilet ( )	Public Pit ( )	None ( )	Other ( )
4. Where do you get your main source of water for use?	River ( )	Swamp ( )	Piped (NWC) ( )	Rain ( )	Stand pipe ( )	Other ( )

Section 2:

Are you concerned about the following (please place an X in the column that suits your response)?

Description	Extremely	Very	Average	Slightly	None
5. Problems faced by the natural environment e.g. climate change and global warming?					
6. Our water getting more polluted each day?					
7. Deforestation such as cutting down of trees (loss vegetation) and soil erosion?					
8. The animals being endangered or going extinct through the loss of their homes?					
9. Improper garbage disposal (littering in the community)					

Other

_____

_____

Are you in agreement with the following (please place an X in the column that suits your response)

Description	Strongly Disagree	Disagree	Maybe	Agree	Strongly Agree
10. Squatter communities are a solution for low income housing.					
11. Development of squatter communities pose a threat to the natural environment					
12. That it's important for the natural environment to be protected					
13. Some of our daily routine activities impact the natural environment					
14. Water is polluted by improper sanitation and/or disposal of garbage?					
15. Improper garbage disposal and poor sanitation leads to increase of other animal species that creates health risks.					

Are you in agreement with the following (please place an X in the column that suits your response)

Description	Strongly disagree	Disagree	Maybe	Agree	Strongly agree
16. That changing our lifestyle can improve the environment.					
17. Improved living standards can minimize environmental threats.					
18. Educational programs are necessary to teach people about protecting the natural environment.					
19. That the sea is an important resource for this community.					
20. That the rivers and swamps are an important resource for this community.					
21. That the forests (trees) are an important resource to for this community.					
22. That the protected animals and others (crocodiles, birds etc) are important for the preservation of the natural environment.					

When you consider all that happens with the environment, who has the heaviest responsibility for its protection and preservation (Place X for the factor that corresponds with your choice, 5 being the highest and 0 lowest meaning not a factor)

	Lowest (0)	1	2	3	4	Highest (5)
23. Government and its agencies						
24. Non-governmental Environmental Agencies (NGO)						
25. Adults (Community)						
26. Children (individuals under 18 years Community)						

Section 3: Place an X in the brackets for the answer/s that best reflects your opinion and explain briefly:

1. Have you observed any changes in the natural environment or environmental problems in your community?

Water Pollution ( ) Soil Erosion ( ) Less Animals ( ) Less Trees ( ) Improper sewage disposal ( )

Explain where possible:

_____

_____

2. Giving the current state of the environment at home and globally, what have you done to protect the environment?

Recycle ( ) Plant trees ( ) Animal Protection ( ) Dispose Garbage properly ( ) Save on water ( )

***Explain where possible*:**

_____

_____

3. Given the opportunity, what would you prefer your status to be as it relates to this community?

Land owner ( ) Relocate ( ) Home owner ( ) Remain the same ( )

***Explain where possible*:**

_____

_____

4. Does the government or any charitable agency assist with educational programs that teach how to minimize the impact of this community on the natural environment?

Existing program/s ( ) Program being implemented ( ) Program Discussed ( ) None at all ( ) Programs no longer exist ( ) Other ( )

***Explain where possible*:**

_____

_____

5. Has the government or private built community/communities played a role in your community development and existence?

Very important ( ) Important ( ) Somewhat ( ) Little importance ( ) Not at all ( )

How?

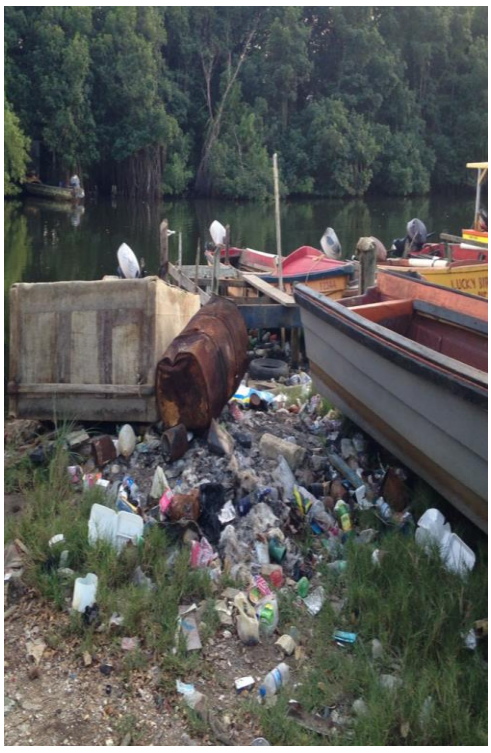
_____

_____

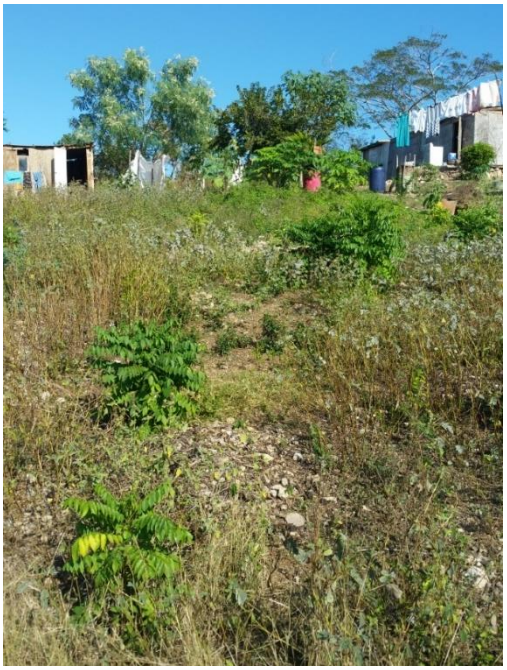
_____

II. Images of Degradation of PA and Threats by Squatter Community

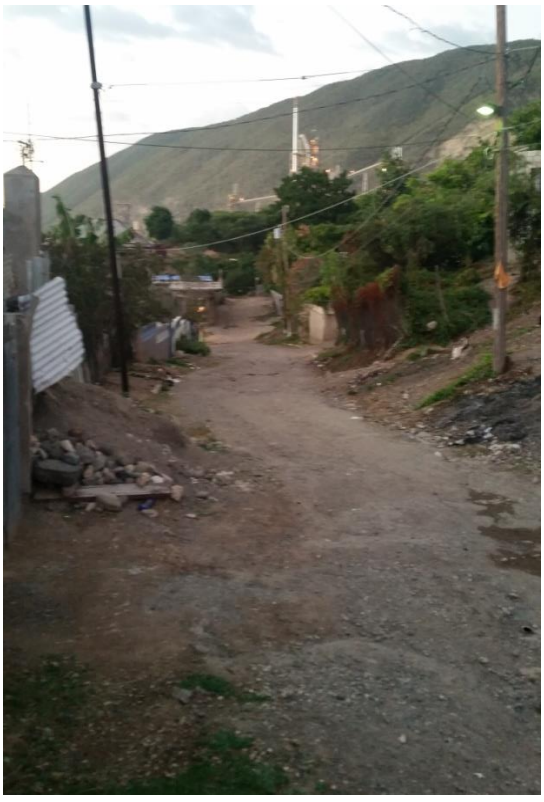
PA .1/ SS.1 – Nonpareil



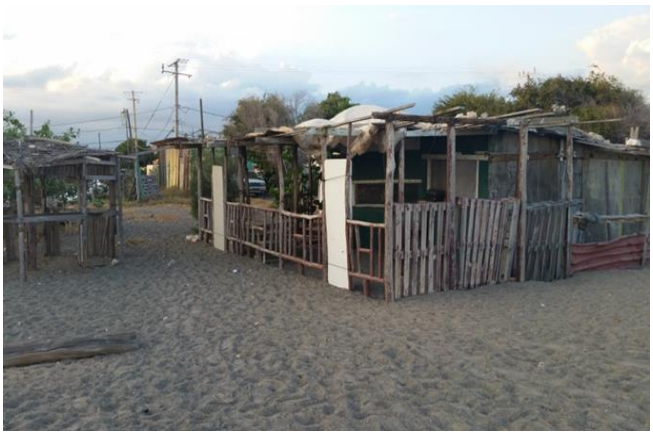
PA. 2/ SS. 2 — Hayes／Cornpiece



PA 3. / SS.3- Harbour Heights



PA 4/ SS. 4 – Port Royal



IV. Description of Analysis Data

No	Section of Questionnaire	Question	Variable	N	Min.	Max.	Mean	Std. Deviation	Data type
1	Protected Area type	Marine or Terrestrial	Protected Area	100	0	1	0.50	0.503	nominal
2	Section 1. Q.2	What is your age?	Age	100	1	6	3.14	1.326	scale
3	Section 1. Q.1	Sex	Gender	100	0	1	0.49	0.502	nominal
4	Section 2. Q. 23-26	When you consider all that happens with the environment, who has the heaviest responsibility for its protection and preservation?	Environment Protection Responsibility	100	0	6	2.18	1.946	nominal
5	Section 3. Q.1	Have you observed any changes in the natural environment or environmental problems in your community?	Water Pollution	100	0	1	0.15	0.359	binary
6			Soil Erosion	100	0	1	0.12	0.327	binary
7			Less Animals	100	0	1	0.14	0.349	binary
8			Less Trees	100	0	1	0.37	0.485	binary
9			Improper Sewage Disposal	100	0	1	0.19	0.394	binary
10	Section 3. Q.2	Giving the current state of the environment at home and globally, what have you done to protect the environment?	Recycle	100	0	1	0.18	0.386	binary
11			Plant Trees	100	0	1	0.45	0.500	binary
12			Animal Protection	100	0	1	0.13	0.338	binary
13			Dispose Garbage Properly	100	0	1	0.65	0.479	binary
14			Save Water	100	0	1	0.55	0.500	binary
15	Section 3. Q.4	Does the government or any charitable agency assist with educational programs that teach how to minimize the impact of this community on the natural environment? **Response of Existing programs utilized.**	Education Programs	100	0	1	0.31	0.465	binary
16	Section 1. Q.9	Why live in this specific community?	School	100	0	1	0.09	0.288	binary
17			Work	100	0	1	0.37	0.485	binary
18			Family	100	0	1	0.56	0.499	binary
19			Affordable Housing (Aff. Hou)	100	0	1	0.44	0.499	binary
20			Fin. Prob.	100	0	1	0.27	0.446	binary

No	Section of Questionnaire	Question	Variable	N	Min.	Max.	Mean	Std. Deviation	Data type
21	Section 2. Q.11	Development of squatter communities pose a threat to the natural environment.	Squatting is a Threat Environment	100	1	5	2.63	1.261	ordinal
22	Section 2. Q.12	That it is important for the natural environment to be protected.	Important to Protect Environment	100	1	5	4.24	0.866	ordinal
23	Section 2. Q.13	Some of our daily routine activities impact the natural environment	Daily Routine Affects Environment	100	1	5	3.42	1.224	ordinal
24	Section 1. Q.10	How would you describe your standard of living?	Living Standard	100	1	5	2.99	0.810	ordinal
25	Section 3. Q.4	Does the government or any charitable agency assist with educational programs that teach how to minimize the impact of this community on the natural environment? **All responses utilized.**	Governance (Action/ No Action)	100	0	1	0.79	0.409	binary
26	Section 2. Q.5-9	Are you concerned about problems faced by the natural environment e.g. climate change and global warming?	Concern for Climate Change	100	1	5	2.69	1.454	ordinal
27		Are you concerned about our water getting more polluted each day?	Concern for Water Pollution	100	1	5	2.44	1.395	ordinal
28		Are you concerned about deforestation such as cutting down of trees (loss vegetation) and soil erosion?	Concern for Deforestation	100	1	5	2.16	1.496	ordinal
29		Are you concerned about the animals being endangered or going extinct through the loss of their homes?	Concern for endangered species	100	1	5	1.96	1.377	ordinal
30		Are you concerned about improper garbage disposal (littering in the community)?	Concern for improper solid waste disposal	100	1	5	2.51	1.480	ordinal
31	Section 1. Q.7	What is the status of your house?	Owner	100	0	1	0.49	0.502	binary
32			Rent	100	0	1	0.16	0.368	binary
33			Family House	100	0	1	0.31	0.465	binary

No	Section of Questionnaire	Question	Variable	N	Min.	Max.	Mean	Std. Deviation	Data type
34	Section 2. Q.16	Are you in agreement that changing our lifestyle can improve the environment?	Lifestyle Change can Improve Environment	100	1	5	3.94	0.930	ordinal
35	Section 2. Q.17	Are you in agreement improved living standards can minimize environmental threats?	Improve Living Standards Can Reduce Environmental Threats	100	1	5	4.00	0.765	ordinal
36	Section 2. Q.18	Are you in agreement educational programs are necessary to teach people about protecting the natural environment?	Education is Important for Environmental Protection	100	1	5	4.30	0.644	ordinal
37	Section 2. Q.14	Are you in agreement water is polluted by improper sanitation and/or disposal of garbage?	Water Polluted by Improper Sanitation	100	1	5	3.37	1.331	ordinal
38	Section 2. Q.15	Are you in agreement improper garbage disposal and poor sanitation leads to increase of other animal species that creates health risks?	Improper sanitation leads to health risks	100	1	5	3.86	1.279	ordinal
39	Section 2. Q.19	Are you in agreement that the sea is an important resource for this community?	Sea is important to the community	100	1	5	3.78	1.186	ordinal
40	Section 2. Q.20	Are you in agreement that the rivers and swamps are an important resource for this community?	Swamp and river important to the community	100	1	5	2.94	1.309	ordinal
41	Section 2. Q.21	Are you in agreement that the forests (trees) are an important resource for this community?	Forests are important to the community	100	1	5	4.07	0.832	ordinal
42	Section 2. Q.22	Are you in agreement that the protected animals and others (crocodiles, birds etc) are important for the preservation of the natural environment?	Protected Animals are important to the Community	100	1	5	3.70	1.030	ordinal
43	Section 3. Q. 3	Given the opportunity, what would you prefer your status to be as it relates to this community?	Landowner	100	0	1	0.34	0.479	binary
44			Relocate	100	0	1	0.3	0.463	binary
45			Homeowner	100	0	1	0.34	0.479	binary
46			Remain the same	100	0	1	0.18	0.388	binary
			Valid N (listwise)	100					