GIVRAPD
Global Islands' Vulnerability Research Adaptation Policy and Development

The Adaptive Capacity of Soufriere, St Lucia to Climate Change

1. Introduction

Over the coming years, the Caribbean islands are expected to experience increasing temperatures and changes in wind and rainfall patterns. These climate changes are likely to result in a variety of other changes including sea level rise, ocean warming, coral bleaching, the loss of marine biodiversity, increased coastal erosion and landslides, changes in growing seasons, and increased prevalence of pests, invasive species and contagious diseases (GoSL 2003).

This paper is part of a larger ongoing research project called the Global Islands' Vulnerability Research Adaptation Policy Development (GIVRAPD), which focuses on vulnerability and adaptation to climate change in four island communities in the Caribbean (St Lucia and Jamaica) and the Indian Ocean (Mauritius and Seychelles). Led by the not-for-profit organisation INTASAVE, the project aims to identify the multi-scale socio-cultural, economic, institutional and ecological factors that shape local vulnerability. This paper focuses specifically on the capacity of Soufriere, St Lucia to adapt to climate change. Soufriere is the westernmost town and district of St Lucia, which is located in the Lesser Antilles between the Caribbean Sea and the Atlantic Ocean (see Figure 1 on the following page). The town and district have a combined population of 8472.

As described in the subsequent two sections, the project used a methodology that combined qualitative research methods with the Local Adaptive Capacity (LAC) framework. The LAC framework was developed by the Overseas Development Institute in 2010 during its Africa Climate Change Resilience Alliance project. It characterises adaptive capacity based on five elements: asset base; institutions and entitlements; knowledge and information; innovation; and flexible forward-looking decision-making and governance. The selection of these elements was based on the empirical experience of the ODI research team. However, the LAC framework has not yet been applied in different contexts; nor has it been sufficiently grounded in academic theory.

Therefore, beyond offering a case study on the capacity of Soufriere to adapt to climate change, this paper will contribute to the literature in two ways. First, it will argue that the LAC's focus on institutions, knowledge, innovation and flexibility in decision-making and governance corresponds with an evolutionary perspective on adaptive capacity (as elaborated in Hogarth, Campbell and Wandell 2014). Second, by piloting the LAC framework in the Soufriere, it will offer a critical assessment of whether the tool captures important elements of adaptive capacity across different geographical contexts.

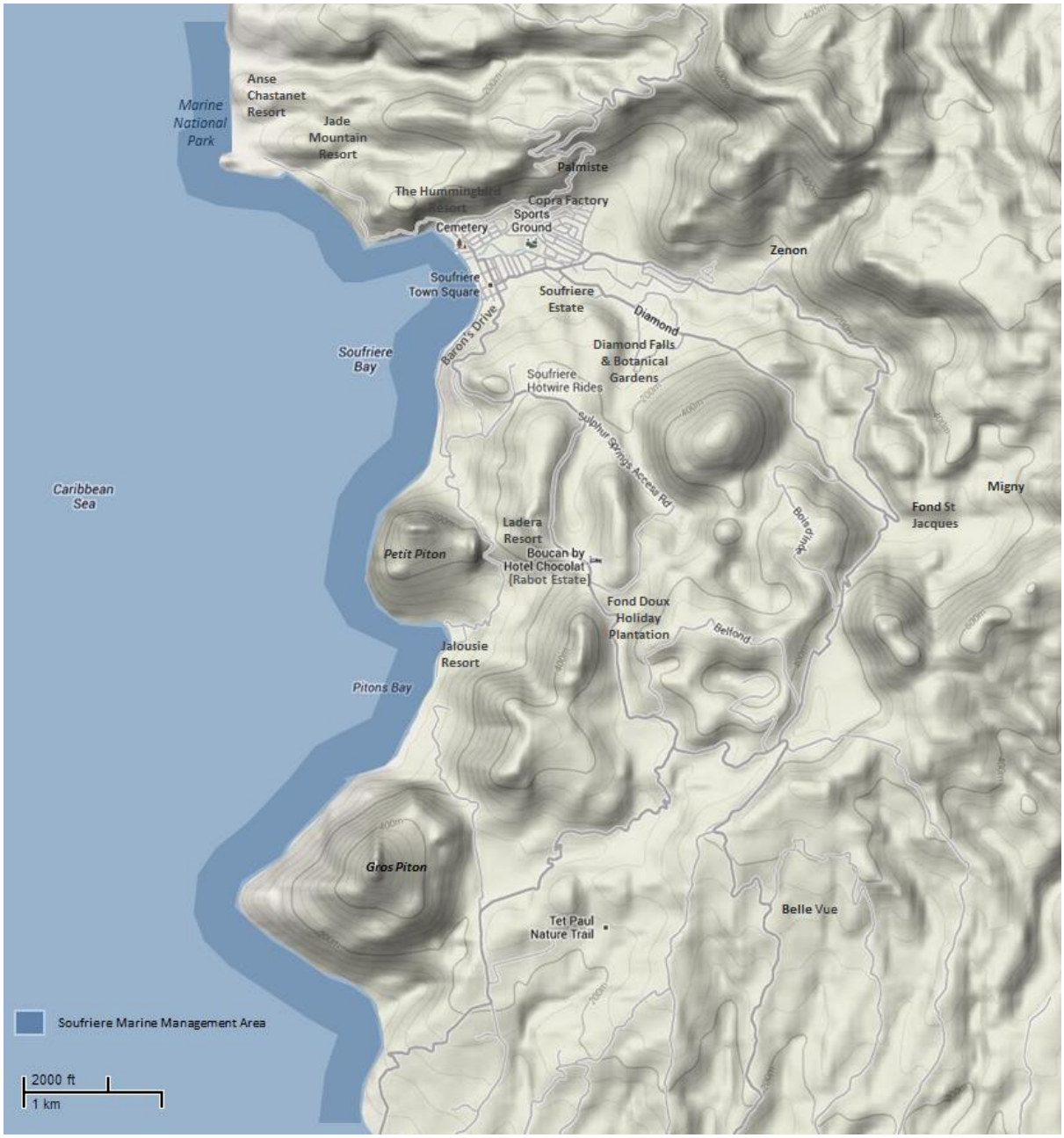

Figure 1. Map of Soufriere (Adapted from GoogleMaps 2014)

2. Conceptualising Adaptive Capacity

Human systems are thought to gradually adapt to local environmental and climatic conditions. From an evolutionary perspective, adaptation occurs when a behavioural routine, an institution or a technology that provides a competitive advantage within local conditions is selected and retained. This process is sometimes path dependent and irreversible in that events and decisions made in the past will limit the adaptive options available the future.

Over time, higher-level structural change will lead to a different selection environment in which current routines and technologies are less well adapted or even *maladapted*. Shifts in the selection environment can be driven by climatic, ecological, technological, cultural or institutional change. Such shifts can be gradual or rapid, and can be triggered by processes at a variety of *scales* (community, regional, national and global), not only by the micro-economic processes at the level of the individual and firm. Multiple shifts can also occur simultaneously making it difficult, if not impossible, to predict local outcomes.

Adaptive capacity refers to the ability of human systems to adjust to changes in selective pressures, including changes in climatic stimuli. To evaluate a system's adaptive capacity, it is first necessary to determine the elements that promote or hinder adaptation. Many frameworks for assessing adaptive capacity have focused on the different types of capital (natural, financial, human, physical and social) that the agents within a system have available to deal with changing selection pressures. While the availability of assets is essential, as argued by Jones Ludi and Levine (2010) "(...) asset-oriented approaches typically mask the importance of processes and functions in supporting adaptive capacity." They fail to capture the role of agency in adaptation, i.e. the behaviour, creativity and entrepreneurialism of the individuals and organisations within the system, as well as the role that historical and structural factors play in constraining or enhancing those agents' adaptive choices. Relevant structural factors could exist at a variety of different scales and, among others, could include class systems, gender inequalities, dysfunctional political systems, underdeveloped financial markets, and institutions governing land-use, resource extraction, and domestic and international trade. Finally, asset-oriented approaches fail to give weight to agents' ability to access information about hazards and adaptive options (Fankhauser and Tol 1997).

Therefore, beyond an evaluation of the asset base, a framework for assessing adaptive capacity must evaluate the adaptive flexibility of institutions[1] and governance structures in response changing conditions. It must assess a system's ability to generate knowledge about hazards and adaptive options, and to disseminate that knowledge. Finally, it must take into account a system's ability to retain diversity – for example, through institutions that promote cultural or ecological conservation – and foster diversity through innovative processes that add novelty to the system such as entrepreneurialism, academia, R&D and technology transfer. To this end, Jones, Ludie and Levine (2010) developed the LAC framework. Table 1 describes the different elements that make up the LAC framework. Section 4 will assess each of these elements in the context of Soufriere.

Table 1. Local Adaptive Capacity Framework (Jones, Ludi and Levine 2010)

Characteristic	Description
Asset Base	Tangible (natural, physical and financial) and intangible (human and social) capitals
Institutions & entitlements	Equitability of access to key assets and the process through which institutions evolve

[1] Institutions are the 'rules of the game' that structure behaviour, determine how assets are distributed, how decisions are made, and who has access to decision-making processes (Jones, Ludi and Levine 2010).

Knowledge & information	The system's ability to generate and disseminate information
Innovation	Degree to which the system fosters and retains novel behaviour, technology and institutions
Decision-making & governance	Degree to which governance and decision-making systems anticipate change and respond accordingly

3. Methodology

The GIVRAPD project employed a community-based vulnerability assessment (CBVA) methodology based on the work of Smit and Wandel (2006). Prior to a field study, interviews with key informants were carried out to determine which site-specific topics would be covered in addition to the general topics described below. The field study comprised semi-structured interviews with community members within or related to the tourism, fisheries and agricultural sectors. Local partners became part of the research team, with involvement ranging from introducing the GIVRAPD team to the field site to actively participating in interviews. Where English was not the respondent's first language, local interpreters joined the researchers. Respondents were selected through a snowball sampling methodology in which interviewed individuals were asked to suggest additional interview subjects. To ensure adequate representation of the population, multiple 'snowballs' were initiated, and interviews were carried out until 'saturation' was reached, i.e. no new information was being revealed by each additional interview. In total, 180 interviews were carried out in Soufriere, distributed approximately equally between the three sectors.

Semi-structured interviews were based on an interview guide with thematic topics. Researchers guided the conversation and adjusted their questions based on respondents' situations. Each interview began with contextual questions about the individual's social and economic situation, followed by open-ended questions designed to explore, not probe. General topics that were covered at each field site included, among others, (1) changes that the respondent has observed in their community, regarding culture, social dynamics, environment and/or climate; (2) their livelihood strategies and the specific challenges that they face; (3) the diversity of practices and technologies within their occupation, how these have changed over the years, and whether these are 'good practice' in terms of quality, environment impacts, etc.; (4) interactions that they have had with their governments and/or other community organisations; (5) their access to insurance, credit, and other sources of financial capital; (6) experiences that they have had with climate-related stimuli, including both sudden shocks and slow onset stresses; and (7) the diversity of coping strategies that they have at their disposal to deal with those challenges. After an open-ended phase of the interview, in which the discussion was led by the respondent, the interviewers probed into any specific topics that had not yet been covered. Finally, the interviewer would ask the respondent about whether they were aware of anticipated changes in the climate, how potential changes in their exposure to climate-related stimuli might affect their livelihoods and communities, and what coping strategies they might employ in different scenarios.

The interviews were transcribed, and the software NVivo was used to 'code' the transcriptions according to the themes outlined in the LAC framework. The process of coding allowed for reflection on each interview adding rigour to the analysis. Findings were triangulated using a variety of third-party sources, including other studies, government documents and historical records. Section 4 presents the findings.

4. Results

4.1 The Asset Base

This section examines the stock of natural, financial, human, physical and social capital available to residents of Soufriere, how that stock affects their ability to deal with changing selection pressures, and, if applicable, how that stock may be affected by climate change.

Financial capital

St Lucia is classified as a middle-income country, with a per capita GDP of US$5544.20 (CSO St Lucia 2014). During most of the 20th century, its economy was based on a combination of tourism, agriculture, manufacturing and fishing. However, as explained in Section 4.2, international trade liberalisation has caused St Lucia to increasingly rely on tourism for foreign exchange earnings. Soufriere, in particular, has become specialised in tourism. As seen in Figure 2, between 1991 and 2012, the portion of residents in Soufriere with livelihoods in agriculture, fishing, and forestry declined from 25.5% to 8.3%. The portion of those in manufacturing more than halved from 10.9% to 4.9%, while the portion employed in hotels and manufacturing almost doubled from 15.6% to 29.9%.

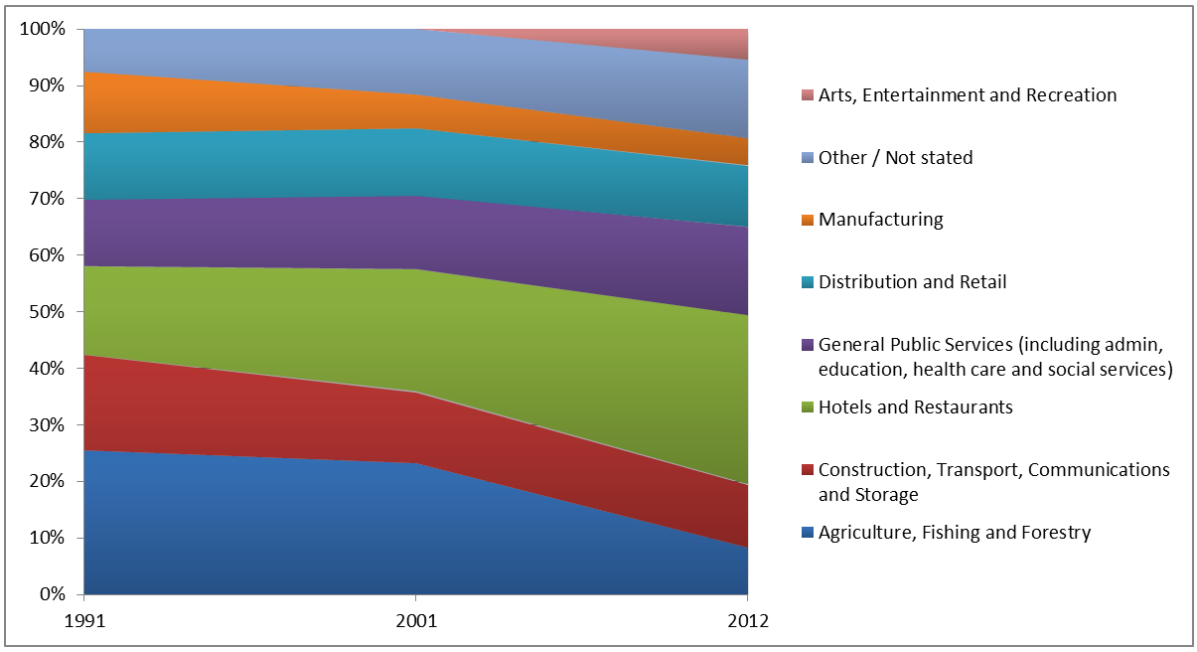

Figure 2. Employment in Soufriere by sector (Data from CSO St Lucia 2014)

Agriculture and fishing have traditionally been the industries that have absorbed surplus labour in Soufriere. With the decline in these industries, there are now fewer employment options outside of the service sector. Although the service industry was able to absorb some of the excess labour created by a decline in fishing, agriculture and manufacturing, unemployment in Soufriere remains high. In 2012, the unemployment rate was 23.8%, relative to a national average of 21.4% (CSO St Lucia 2014). As seen in Figure 3, unemployment has consistently been higher among women than men since 1994. This decrease in adaptive capacity will likely be exacerbated by the increased pressures on Soufriere's natural capital that threaten to undermine its remaining fishing and farming industries.

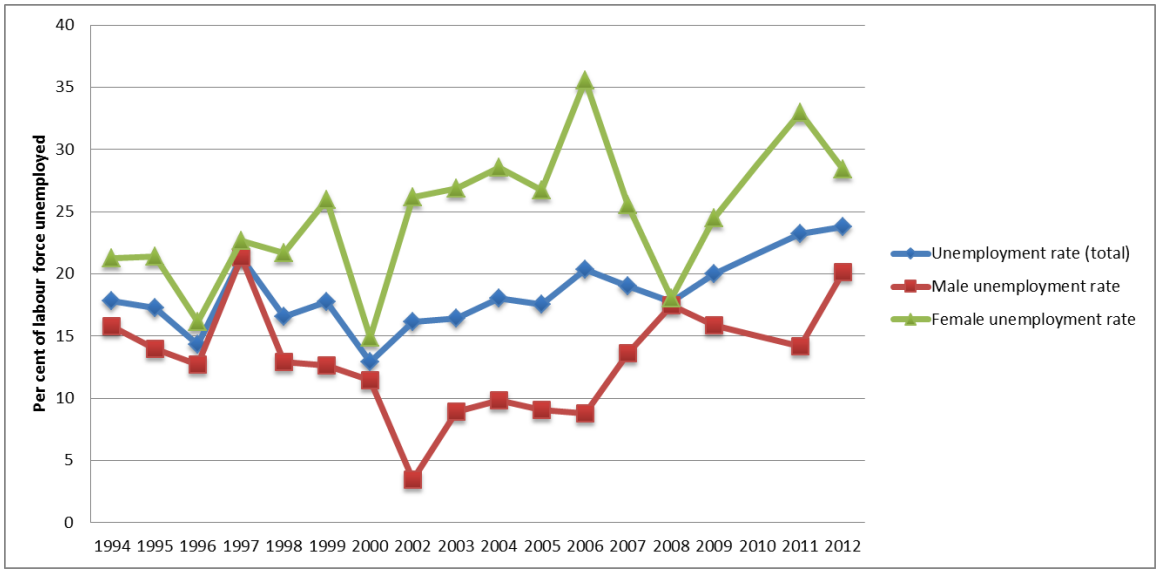

Figure 3. Unemployment rate in Soufriere, 1994 - 2012 (Data from CSO St Lucia 2014)

Due to its high unemployment rate, Soufriere has one of the highest poverty rates in the country despite being a major tourist centre. A 2005 St Lucia Country Poverty Assessment commissioned by the Caribbean Development Bank estimated that the minimum amount of money necessary to meet basic food and non-food needs in St Lucia was US$5.22 per day. As seen in Figure 4, it found that 42.9% of the residents of Soufriere lived below this poverty line, compared to 30.4% nationally. Among children under 14, this figure increased to 59.3% (Kairi Consultants Ltd. 2006).

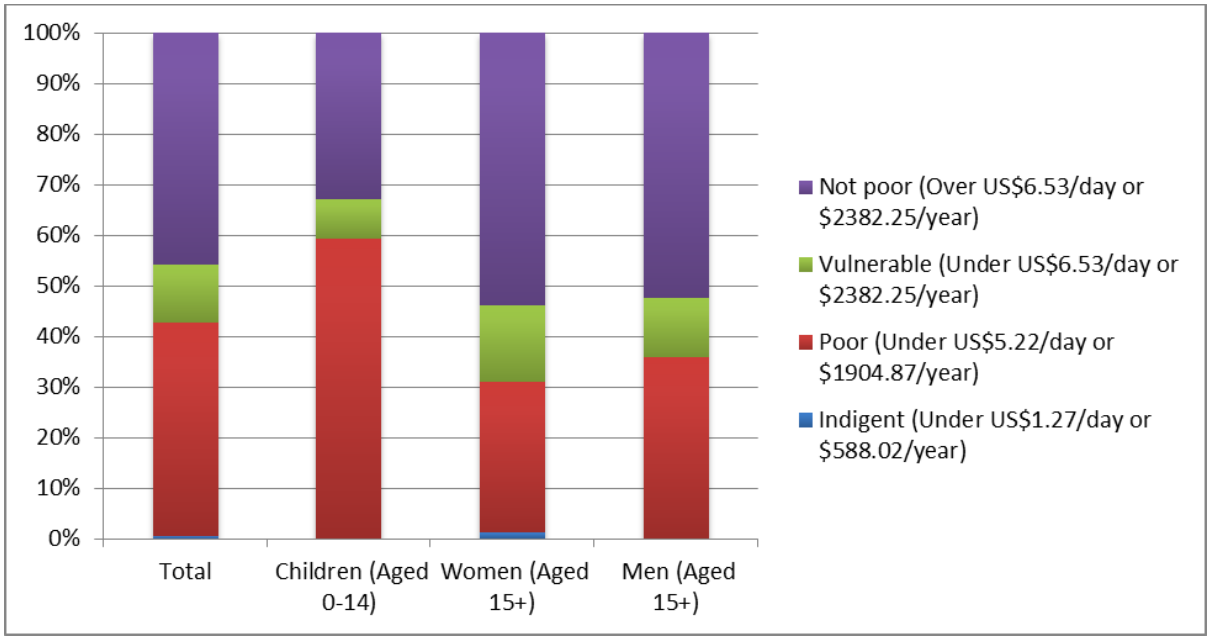

Figure 4. Poverty levels in Soufriere (Data from Kairi Consultants Ltd. 2006)

With little financial capital to invest in adaptive measures, the adaptive capacity of many of the residents in Soufriere is severely curtailed. Many respondents explained that they lack the financial capital to invest in adaptive technologies such as drip irrigation systems, water catchments and greenhouses. Others were unable to invest in higher education. Some who wished to start a new business, for example, in agroprocessing or tourism, were hampered by their lack of investment capital.

Also reducing Soufriere's adaptive capacity is the lack of insurance against climate-related damages. A survey conducted in Soufriere by CARIBSAVE (2012) found that only 8.7% of the sample had flood, fire or storm insurance. The main reasons cited by our respondents for not purchasing insurance against flood, fire or storm risk were the high cost of premiums, lack of knowledge about insurance products and a lack of trust of insurance companies. Furthermore, our research identified no farmers that had purchased crop insurance against weather-related risks, nor any financial institution providing such insurance products.

Human capital

While Soufriere's stock of human capital is improving, it remains lacking. The Ministry of Education introduced universal secondary education in St Lucia 2006. At that time, as seen in Figure 5, the majority of the population's highest level of education was primary school. Only 10.3% of St Lucia's population had any training beyond secondary school. Of those that have completed secondary school, few have received scientific and technical training, making the workforce unfit to take advantage of global technological advances. Furthermore, many of those from Soufriere that do receive technical training move to Castries or abroad to find work, resulting in a brain drain.

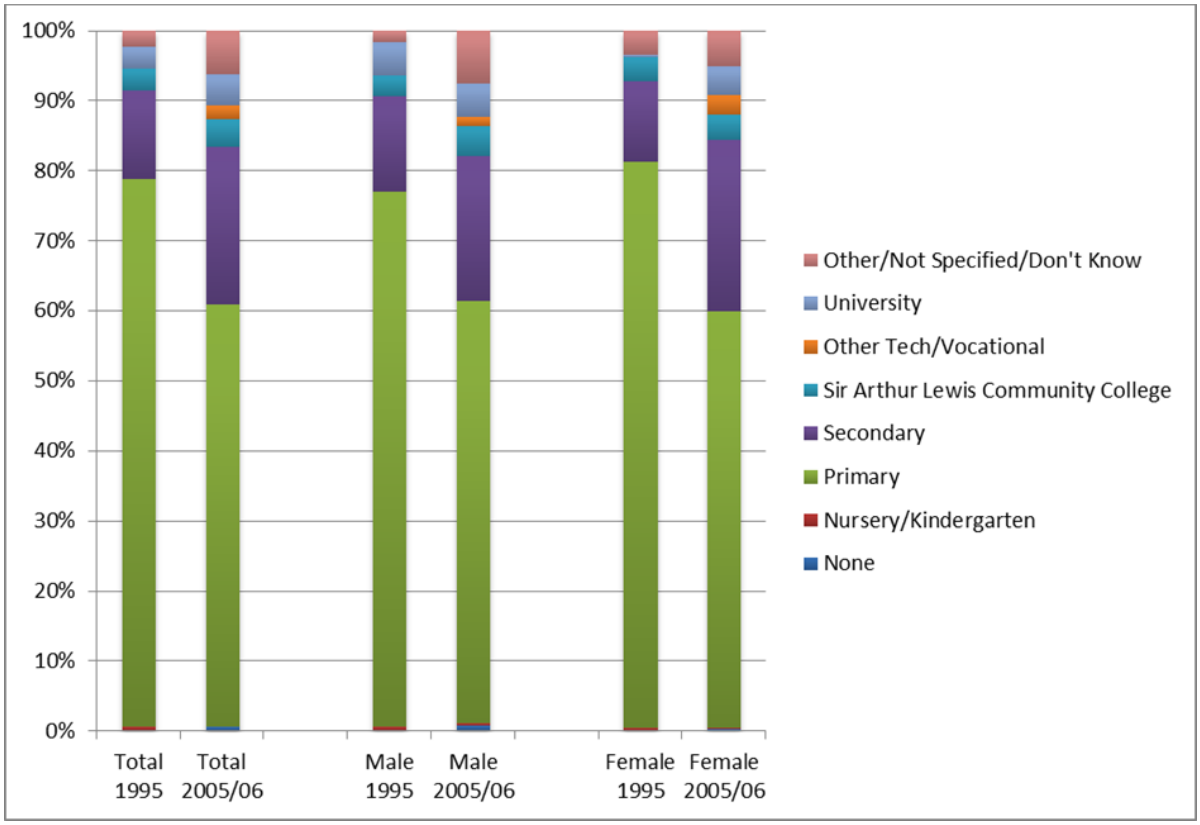

Figure 5. Highest level of educational attainment in St Lucia in 1995 and 2005/06 (Kairi Consultants Ltd. 2006)

Soufriere's lack of human capital contributes to its high unemployment rate because its workforce is unable to compete in an increasingly knowledge- and service-based economy. Numerous respondents from both public and private organisations explained that a lack of human capital also presents significant barriers in implementing adaptive strategies. For example, a lack of technical expertise was cited as a major impediment to monitoring and managing the coral reefs or to developing a national land-use plan. Springer (2005) found that weak human resources also inhibited "water and wastewater management, pollution control, finance, integrated water resource planning, and the operation and maintenance of water-related infrastructure and services."

Natural capital

Soufriere has a rich stock of natural capital that underpins its three main industries – fisheries, agriculture, and tourism. The main tourist attractions in Soufriere are forms of natural capital. The Pitons, two volcanic plugs that rise 743 and 771 meters from the sea directly to south of the city, have earned Soufriere its status as a World Heritage Site. Tourists are also drawn to Soufriere for its volcanic sulphur springs, tropical forests, sandy beaches, waterfalls, coral reefs, and comfortable climate.

Both tourism and agriculture rely on Soufriere's reliable supply of freshwater, and because agriculture in the area is predominantly rainfed, it depends on sufficient and predictable precipitation. Due to St Lucia's volcanic geology, groundwater sources are relatively few (CARIBSAVE 2012). However, if managed properly, St Lucia's water resources are believed to be sufficient to meet current and projected demands (CARIBSAVE 2012; Geoghegan 2002), and as seen in Figure 6, Soufriere is less susceptible to drought than elsewhere on the island.

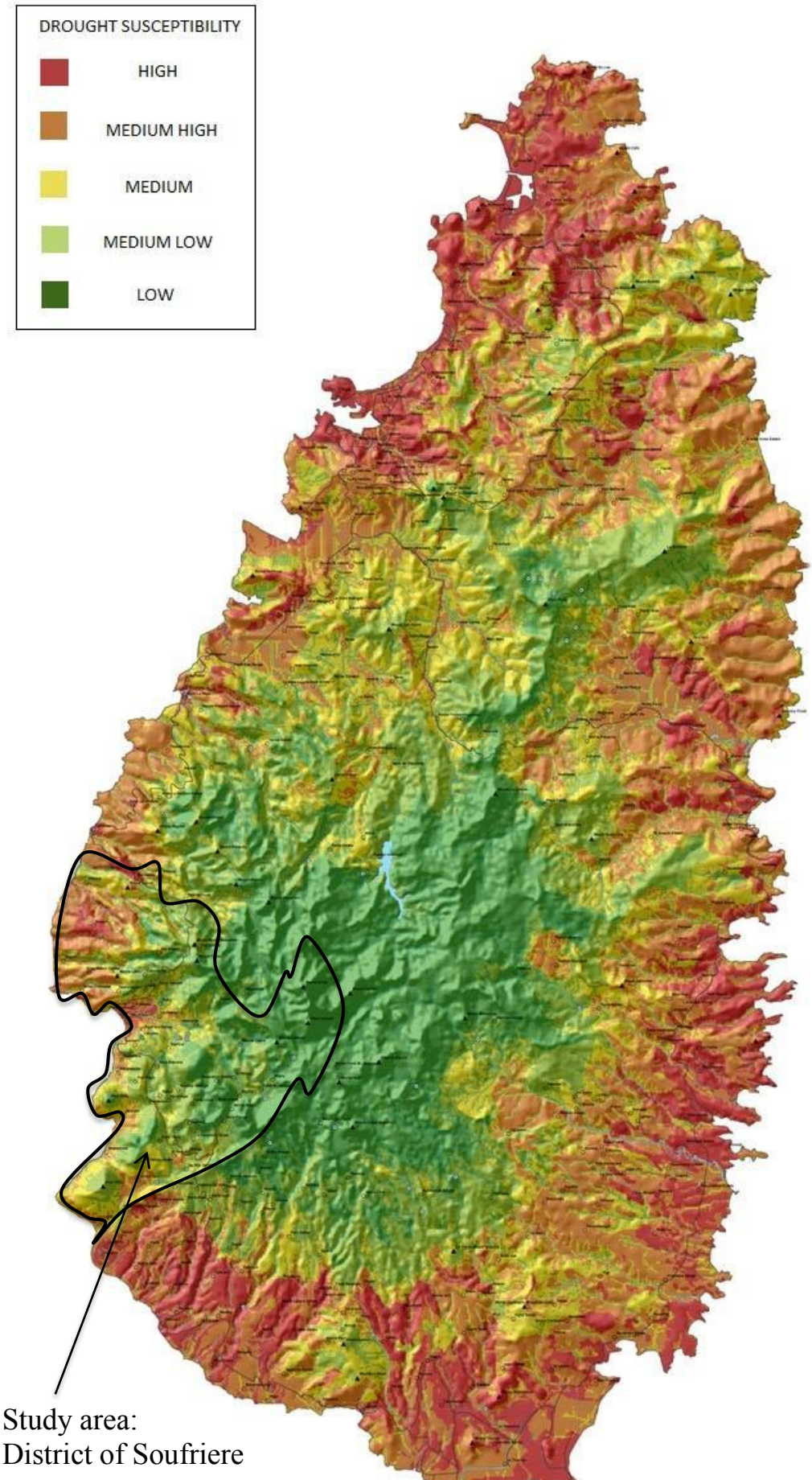
DROUGHT SUSCEPTIBILITY
HIGH
MEDIUM HIGH
MEDIUM
MEDIUM LOW
LOW
Study area:
District of Soufriere

Figure 6. Drought susceptibility in St Lucia (modified from GoSL 2005b)

The fishing industry in Soufriere depends on a renewable fish stock. Offshore fisheries target pelagic fish species including tuna, mahi mahi, flying fish, wahoo, and black fish, while the near shore fisheries target species that populate the coral reefs including grunts, snappers, parrotfish and groupers. The near shore area around Soufriere is governed by the Soufriere Marine Management Area (SMMA), which was established in 1994 and is discussed in detail in subsequent sections. A baseline assessment of fish stock was conducted at the outset of the SMMA by Goodridge et al. (1997) and a follow-up study was done five years later by Roberts et al. (2001). As demonstrated in Figure 7, it was found that reef fish biomass increased four-fold within the marine reserves and three-fold within the fishing grounds during the five-year period.

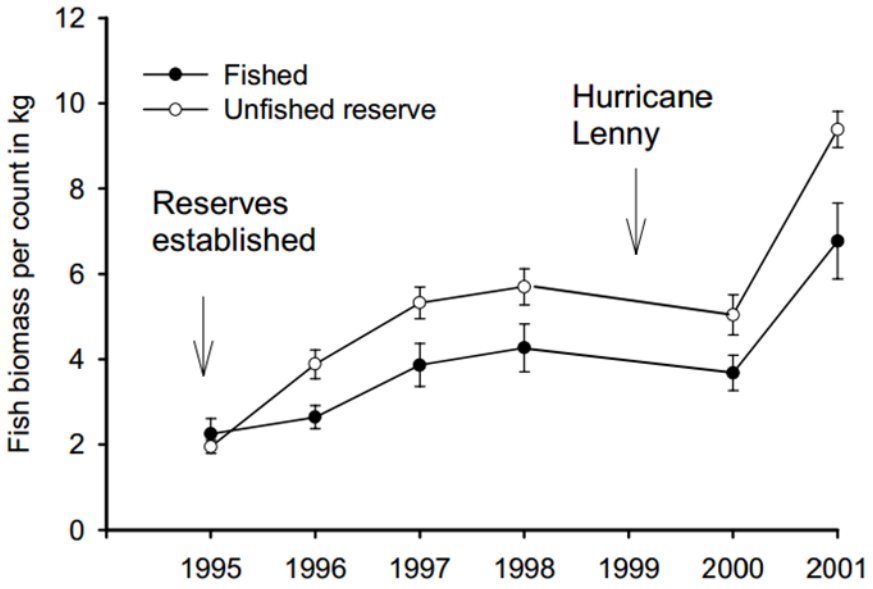

Figure 7. The mean biomass of commercially important fish per count in kilograms in fished and un-fished areas of the SMMA from 1995 to 2001 (Roberts et al. 2001)

Much of the natural capital that is vital to fisheries, agriculture and tourism is at risk from local human activity and climate change, and it is likely that without institutional or technical intervention, projected declines in natural capital will reduce Soufriere's adaptive capacity. Downscaled Regional Circulation Models (RCMs) based on the IPCC's higher emissions scenario project[2] that mean annual temperatures in St Lucia will increase by between 2.4˚C and 3.3˚C by 2080 relative to the 1970-1999 mean. While it is not yet possible to determine exactly what impact climate change will have on precipitation in Soufriere, most climate models point to a decrease in precipitation, and an increase in areas with rainfall deficit (GoSL 2005b). Depending on what parameters are fed into General Circulation Models (GCM), projections of the change in average

[2] The IPCC's A2 scenario

monthly precipitation range from a large decrease in rainfall of 37 mm (–66%) to a moderate increase of 7 mm (+14%) by 2080 (CARIBSAVE 2012).

As explained by some respondents, Soufriere has already experienced occasional shortages of water during the dry season from February to May. During these shortages, supplying water to the large hotels becomes problematic and farmer's productivity and income is reduced. An impact assessment conducted by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC 2011a) projected that by 2050 increased temperatures and decreased rainfall in St Lucia will lead to a decrease in yields of root crops, bananas and other tree crops,[3] and an increase in the yields of vegetable crops.

The IPCC (2014) projects that warming ocean temperatures caused by climate change will lead to a poleward shift in the distribution of pelagic fish species. If these projections are accurate, St Lucia, at a latitude of 14° North, will likely experience a decrease in pelagic fish stock. Pauly (2009) estimated that by 2050 global warming will cause the Caribbean Large Marine Ecosystem to experience a decrease in catch potential of 10 – 20% relative to 2005 levels (all other things remaining constant). Currently, when the catch is poor offshore, fishers tend to rely on fishing in shallow waters. However, this adaptive strategy may not be an option in the future, because St Lucia's coral reefs and associate fish species are also under threat.

Despite the SMMA's success in reducing pressure from near-shore fishing, the coral reef ecosystem faces a number of other stressors. Coastal development, poor waste management and intensive agricultural practices have led to damaging sediment and pollution. Tropical storms cause mass sediment outflow by triggering erosion and landslides. The combination of Tropical Storm Debbie (1994) and Hurricane Lenny (1999) caused up to an estimated 50% mortality of the reefs around Soufriere Bay through sediment smothering (Australian Caribbean Coral Reef Collaboration 2007). Respondents reported that Hurricane Tomas (2010) also had devastating effects. Finally, climate change will create significant stressors for the coral reef ecosystem. The IPCC (2014) predicted with *high confidence* that globally, even under the most projections, warming oceans and ocean acidification will cause a 50% loss of coral to bleaching by 2050. Soufriere has already experienced two large-scale bleaching events, in 1998 and 2005. The 2005 event was reported to have affected 43.8% of the corals. Only 4.3% of the corals affected died in 2006. In St Lucia, climate models project that bleaching will occur every year after 2040 due to thermal stress, and coral calcification is projected to decline 10% due to ocean acidification (Australian Caribbean Coral Reef Collaboration 2007). While the extent that coral bleaching will affect the near-shore fish stock in Soufriere is not yet clear, Pratchett et al. (2011) predicted that in a higher emissions scenario productivity of coastal fisheries in the Pacific will decrease by between 10 and 35% by 2100. Coral bleaching will also likely impact negatively on tourism as it will cause a decline in the quality of snorkelling and scuba diving (ECLAC 2011b).

[3] While the models showed that the yields of non-banana tree crops will decrease, predicted increases in the prices of these crops caused their projected value to increase.

There is also risk that Soufriere's temperature and weather patterns will become less hospitable with climate change. Increased frequency of heat waves, water shortages, flooding, intensity of storms and risk of vector borne diseases such as dengue fever, combined with biodiversity loss and shoreline erosion, may reduce the attractiveness of Soufriere as a tropical destinations (ECLAC 2011b; Simpson, Gossling and Scott 2008).

Physical capital

Much of Soufriere's physical capital is ill equipped to deal with current climate pressures, and there is risk that it will become increasingly maladapted with a changing climate. Respondents reported that Soufriere's drainage system reaches its capacity after an ordinary rainfall of only 25 minutes, and that larger rainfalls lead to flooding in parts of the town centre. St Lucia has only one large water storage facility, and few households have private water storage tanks. Hence, despite 98% of the population having piped-water in their houses, St Lucia remains vulnerable during periods of low precipitation. Moreover, after a heavy rainfall, treatment plants are sometimes incapable of treating water due to high water turbidity, causing some communities to lose access to water for up to four days (CARIBSAVE 2012).

As seen in Figure 8, the District of Soufriere is more prone to landslides than elsewhere on the island. These are usually triggered by heavy rainfall, often during hurricanes. The hilly farming community of Fond St Jacques is particularly at risk. In 2010, the wind and rainfall of Hurricane Tomas triggered a landslide that destroyed numerous homes and killed ten residents. The total impact of Hurricane Tomas on St Lucia was estimated to be US$336 million (ECLAC 2011c). Relative to the rest of the island, Soufriere suffered the greatest damage to its housing stock (CARIBSAVE 2012). During Hurricane Thomas, the road to Castries was damaged by erosion and landslides triggered by Hurricane Thomas. Respondents reported that it has not yet been adequately repaired and poses a risk of further slippage. Some of the hillsides along Soufriere's roads and near residences have been reinforced, but the majority have not.

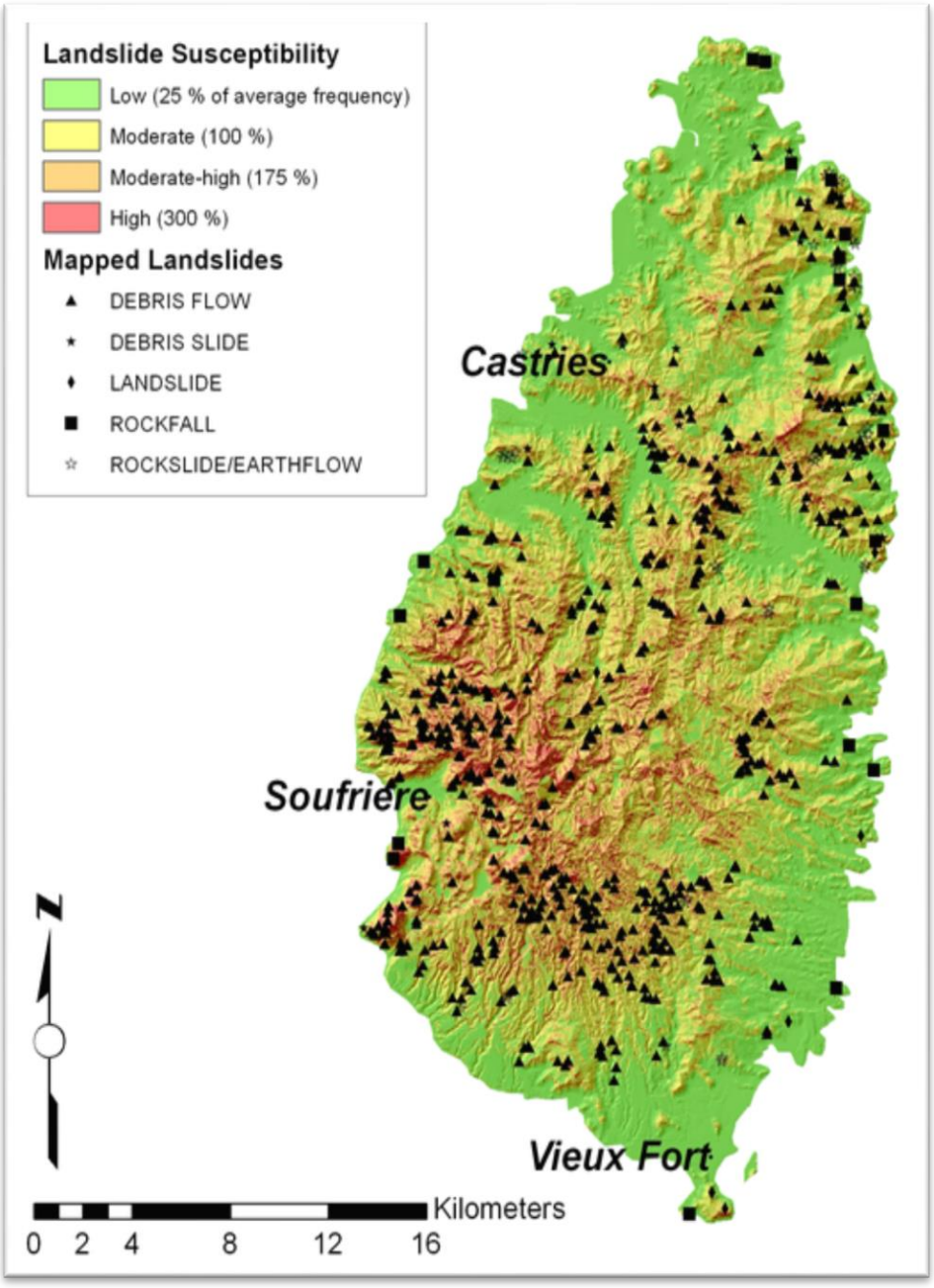

Figure 8. Landslide susceptibility map for Saint Lucia (Quinn 2012)

Fond St Jacques also experienced landslides in 1960, during a tropical depression that became Hurricane Abbey, which killed six people and caused EC$4 million (US$1.48 million) in damage to physical capital; as well as in 1994, during Tropical Storm Debbie, which killed three people and caused EC$250 million (US$92.6 million) damage (GoSL 2005a). Figure 9 tracks the historical hurricanes and tropical storms in the vicinity of St Lucia, giving an indication of frequency. The tracks of Allen, Debbie and Tomas are in red.

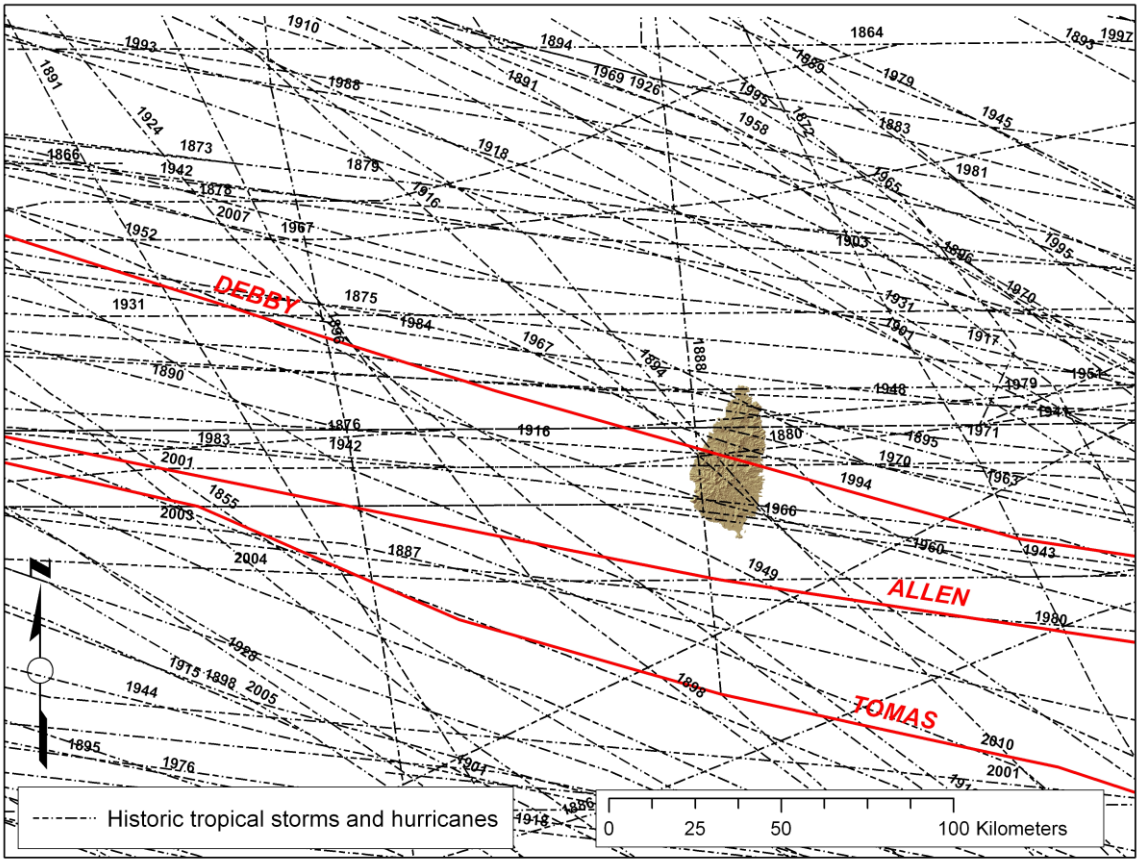

Figure 9. **Historical storm tracks in the vicinity of Saint Lucia since 1848** (Quinn 2012)

Hurricanes tend to strike St Lucia from the east placing Soufriere on the leeward side of the island. The exception to this rule was Hurricane Lenny, which in 1999 travelled an unprecedented eastward route from the southwest Caribbean through the Lesser Antilles to the Atlantic Ocean. Throughout the region, Lenny caused extensive damage to communities on western coasts, which, unlike eastern facing communities, had not evolved under direct exposure to hurricanes. Soufriere was the hardest hit town in St Lucia. The river flooded the town cutting off the southern half from the hospital. Wave action damaged the seawall, the coastal road and numerous coastal homes. The most damage occurred to homes in Baron's Drive, a small fishing settlement on the southern shore of Soufriere Bay that consisted of approximately 100 households, many of which were of poor quality construction and lacked legal tenancy (USAID 2000).

While a reversal in the direction of hurricane tracks in the Caribbean is not a projected outcome of climate change, Hurricane Lenny illustrates how human systems will tend to evolve with little or no capacity to cope with extreme events unless they are foreseen and planned for. Much of Soufriere's infrastructure is built on or near the coastline. The main road, jetties, town centre, numerous residences, hotels and resorts, hospital, and the police, fire and ambulance stations are

located just above sea level. As a result, it has very little capacity to cope with any increase in storm surge.

The position of Soufriere's infrastructure close to sea level also makes it sensitive to sea level rise. The IPCC (2014) projects that in the year 2100 the global average sea level will be between 0.35 to 0.70 meters higher than present day due primarily to thermal expansion (Church and Clark 2014). However, there is also a possibility of much larger and irreversible sea level rise.[4] While the onset of sea level rise will be slow, the adaptive capacity of infrastructure tends to be low due to the long life spans and the large sunken costs involved in constructing road networks, buildings, water and sewerage systems, electricity grids, etc. For this reason, without forward-looking planning and institutional interventions to guide private decision-making, the location and design of Soufriere's infrastructure will likely become increasingly maladapted.

Beyond the risk of maladaptation due to the physical impacts of climate change, Soufriere's infrastructure is also at risk of becoming maladapted in the face of the global institutions that may be implemented to combat climate change. Saint Lucia generates almost all of its energy through the combustion of heavy oil. Between 2002 and 2010, St Lucia's diesel consumption increased by 68% and its aviation fuel consumption increased by over 300%. If policies are implemented at the global level to tax or cap greenhouse gas emissions, given the lack of alternatives in place, the cost of energy and of long-haul flights to St Lucia would increase, both of which would be damaging to tourism (CARIBSAVE 2012).

Social capital

Social capital refers to the norms of reciprocity and trustworthiness between individuals. Social capital is thought to facilitate co-operation within communities because it reduces uncertainty and costs involved in enforcing contracts (Putnam 1993). Therefore, communities with higher levels of social capital are better able to overcome problems of collective action.

In general, respondents felt that there was a scarcity of social capital in Soufriere Town. It was suggested that much of this lack of social capital is deeply rooted in history:

> *They know each other's history so they use it sometimes to say that they won't work with this person, because this person… his family steal… It's a small community – everybody knows everybody. As long as I know your last name I can know who you are.*

Another respondent felt that social capital has eroded over time:

> *A lot of our vulnerability comes from the fact that we are losing the things that give us strength… We are losing communities. We are losing community life. And so, not just the naturally vulnerable sectors, but everybody – the nation, the communities – are*

[4] Sustained warming could lead to the near-complete loss of the Greenland ice sheet over the next millennium or more, which would result in up to 7 meters rise in average global sea-levels (Church and Clark 2014).

> *becoming more and more vulnerable as we lose our strength... We are losing the very thing that gave us strength as a people – that we took care of each other within the community.*

Lack of social capital reduces Soufriere's adaptive capacity for a number of reasons. It undermines institutions and increases enforcement costs. It also makes it difficult individuals to work together to implement and scale-up adaptive options:

> *In St. Lucia it is already difficult to get groups going because one other thing is lack of trust… Everybody wants to be an individual... We called it 'ti-mo-ti' in St. Lucia, which means small shop mentality… It is not going to work here, because right now even the funding agencies don't fund individuals; they only fund groups...*

Interestingly, there was noticeable difference in the views of respondents from Soufriere Town and those from Fond St Jacques. In Fond St Jacques respondents highlighted the community's strong social capital, and stressed its importance in coping with Hurricane Tomas and the landslide:

> *All the people in the community just came together as one after that storm, helped out, pulled people out that were trapped in their house, and put them on stable ground. We didn't need no paramedic to do that. That's my third hurricane that I saw already here in that community… Debbie I lost a cousin and two nephews. And Tomas was a cousin… It was the community coming together, because just a day or two after the hurricane you cannot expect government to do anything... It is 6-7 days after that you can expect the government will try to do something.*

4.2 Institutions and Entitlements

Central to adaptive capacity of human systems is the adaptive flexibility of institutions and governance structures in responding to changing conditions. Well-designed institutions can promote rational forward-looking decision-making, the creation of economic opportunity and the conservation of diversity. Poorly designed or enforced institutions can reduce economic opportunity, undermine the functioning of organisations and promote irrational and myopic decision-making. This section will discuss institutions at different scales that respondents highlighted as having influence on their adaptive capacity.

The historical institutions of a plantation economy

As a colonial settlement in the 18th and 19th Centuries, Soufriere was the parish with the most sugar, coffee and cocoa plantations on the island (Margot 2006). When the British solidified control of St Lucia with the Treaty of Paris in 1814, the population of the island included "1200 whites, 1800 coloured, and 14,000 blacks, the vast majority of which were slaves" (Jesse 1962). It was not until the 1830s, that the British Parliament passed the 'Act for the abolition of slavery throughout the British colonies' (Jesse 1962).

It is difficult to determine the extent of the effects of Soufriere's history of slavery on today's community. However, it likely contributed to the inequality that still exists in the area. After emancipation, many of the newly freed black slaves began subsistence farming in small plots in the hills. Others began subsistence fishing (Soufriere Foundation 2010). These livelihoods still dominate the lower-income populations of Soufriere. Others still continued to work the estates as free labourers in return for food and shelter. This economic model has only recently changed, as explained by one interview respondent:

> *My father used to pay the people EC$20. They now want EC$60/80... Back then the people respected the white man... He had just one set of guys. They would work from 7 in the morning until 1 o'clock; and from 1 until 4 o'clock would be their time to do the garden, their vegetable garden for themselves. So they would feed their family that way… You don't get people doing that anymore… The younger generation has moved away from farming and into tourism – quick money.*

A more tangible impact of slavery is Soufriere's pattern of land ownership. After Emancipation, with the plantations still in control of the most fertile and accessible agricultural land, freed slaves founded communities in the hills, including Zenon and Fond St Jacques, where they lived as small-scale subsistence farmers. This path-dependent land ownership continues to constrain the production and adaptive capacity of these communities. The steep slopes prevent mechanisation and irrigation and inhibit transportation. Without irrigation, farmers are limited in crop types and timing and at the mercy of increasingly unpredictable weather patterns (Weis 2004). Perhaps most worrisome, the clearing of vegetation on this land has intensified soil erosion and increased the risk of landslides (CARIBSAVE 2012).

International trade law

International trade law has had a substantial impact on Soufriere's stock of financial capital and, as a result, its adaptive capacity. Over the last three decades, international trade liberalisation has led to a flood of cheap imports into St Lucia and the loss of its protected foreign markets for cash crops. In Soufriere, the industry hit hardest by increased cheap imports was coconut (copra) oil production. Since 1959, the St Lucia Coconut Growers Association (SLCGA) and Coconut Manufacturers Limited operated a copra factory in Palmiste, near Soufriere town. The factory processed coconut jelly into cooking oil, margarine, suntan oil and soap, and sold the products within the CARICOM region. At its height, in the 1970s and 80s, the factory was a major source of employment in Soufriere, employing over 200 people, mostly women. Moreover, the factory created a guaranteed market for members of the coconut growers of the SLCGA, which numbered approximately 3000, 95% of which produced less than 10 tons of copra per annum. However, the availability of cheaper alternatives, including soybean and palm oil, due to international trade liberalisation caused St Lucia's copra industry to become increasingly reliant on the protectionist

policies entrenched in CARICOM's Oil and Fats Agreement.[5] As these policies were relaxed in the 1990s, business for Soufriere's copra factory rapidly slowed and the factory went bankrupt the year before this research project began.

Across the entire island of St Lucia, the industry that was impacted the most by international trade liberalisation was banana production. St Lucia was historically entitled to privileged access to the EU banana market as a former UK colony.[6] However, after the World Trade Organisation (WTO) was formed in 1995, this privileged access was gradually eroded. Years of preferential treatment for Caribbean banana producers led St Lucian farmers to specialise in banana production, and the impact of the policy shift on St Lucia's economy was profound. Between 1992 and 2008, the number of banana farmers decreased 85% from 10 thousand to 1500 (Fairtrade Foundation 2009). As seen in Figure 10, exports declined from 133 thousand tonnes in 2002 to 30 thousand tonnes in 2010, and revenues fell from EC$157 million (US$58 million) to EC$39 million (US$14 million) (CSO St Lucia 2014).

[5] CARICOM's Oil and Fats Agreement provided for negotiated guaranteed prices for copra oil and strict controls on imports of substitutable products. In 1988, when this price was set at EC$1120 (US$415) per ton, CARICOM countries were purchasing edible oil from non-CARICOM countries at 50% the agreed upon price. Given this price differential the policies were relaxed somewhat in the 1990s. Despite common external tariffs on substitutable products, including 40% tariffs in 2007, the CARICOM market for copra oil was undercut by cheaper forms of edible oil.

[6] This access was formalised with the Lomé Convention in 1975, which allowed most agricultural and mineral goods from 71 African, Caribbean and Pacific (ACP) countries to enter the then European Community free of duty. The goal was to allow former British, Dutch, Belgian and French colonies to make the transition to independent statehood and grow their economies without recourse to foreign aid. After the formation of the single European market in 1992, EU-wide tariffs were imposed on bananas from non-APC countries and country-specific guaranteed quotas were granted to ACP states. These policies enabled Caribbean countries to secure a 7% market share in the 1990s despite the fact that Latin American producers, which held three-quarters of the EU-market, were much more efficient.

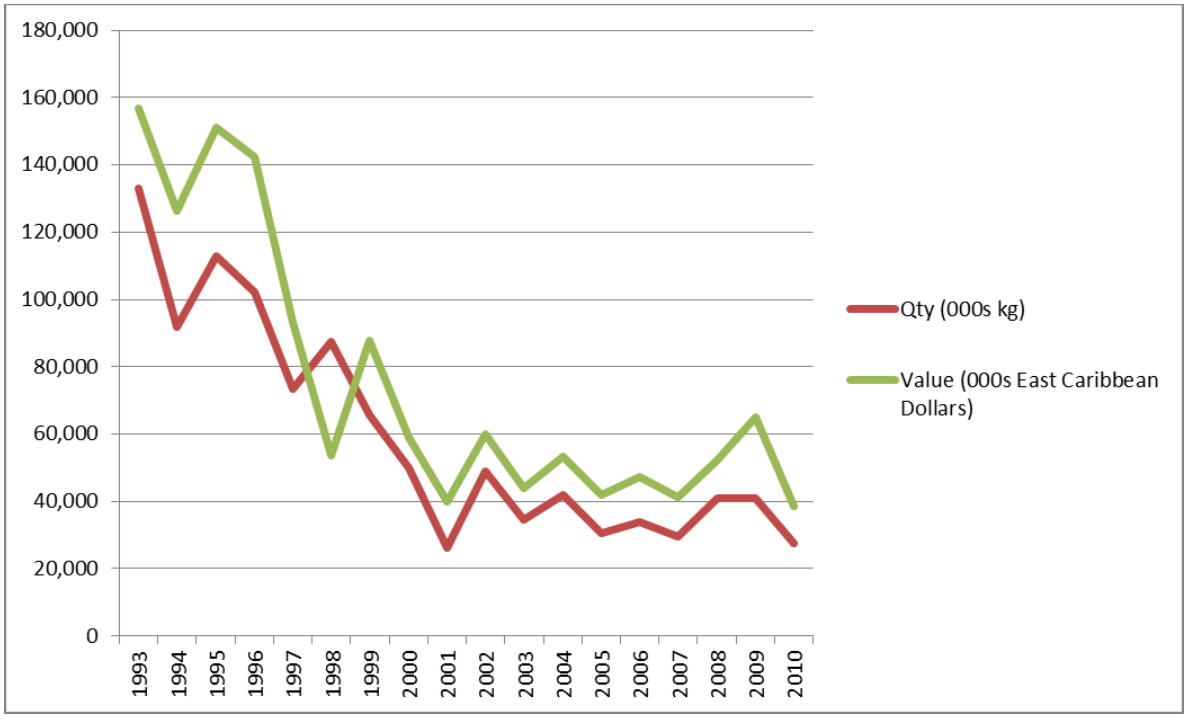

Figure 10. St Lucia banana exports, 1993-2010 (Data from CSO St Lucia 2014)

Soufriere did not specialise in banana production as much as other parts of the island due to its hilly terrain. However, interview respondents explained that other regions' preoccupation with export markets had allowed Soufriere to secure a large share of the domestic for vegetables. As the banana industry in St Lucia declined, competition in the domestic vegetable market increased. Hence, the indirect effects of the decline of the banana industry on farmers in Soufriere were significant.

Environmental impact assessments and building codes

Institutions surrounding land-use and construction have significant implications for adaptive capacity, because they influence private decisions that have long-term consequences. Major developments in St Lucia are subject to approval of an environmental impact assessment (EIA) by the Development Control Authority (DCA). Respondents raised a number of concerns about the EIA process. One explained that EIAs were not made public, and due to a lack of transparency, there was inadequate public discussion and consultation about the approval of developments. Another was concerned that when approving developments, inadequate consideration was given to landslides and flooding.

St Lucia also has a building code. However, it is considered a guideline, not an instrument of law, and is therefore not enforced by the DCA. One respondent explained how the enforcement has allowed for myopic decision-making during construction:

> *The building of houses still hasn't taken into account hurricanes… Older buildings, in the 19th century, 18th century, they have been built with gable roofs, principally for hurricanes. That's the whole idea of the gable roofs in the tropics… everything was to offset the weight. Now we [can] forecast hurricanes… we seem to [have] less care… with the kind of designs – flat roofs and things without hurricanes in mind. And you see it in public buildings, which shouldn't be… Before we had a widely distributed public water system, every house was to have some water harvesting system. Either they would use their own oil drums or they would use these metal tanks… to collect rainwater for use. With the emergence of the public water system, people started building houses of all sizes with no allocation for water harvesting. Incidentally, in the Developing Control Authority Act… every household above a given size is supposed to have its own water harvesting equipment. Nobody pays heed to it.*

Immediately prior to this research project, the government had revised the voluntary guidelines so that wind speeds up category 4 and 5 hurricanes would be taken into account when considering the structural engineering of public buildings. Moreover, the Caribbean region is in the process of developing a Caribbean Uniform Building Code (CARIBSAVE 2012). Nonetheless, lack of enforcement of the both the building code and EIA within private sector remains problematic.

Compounding the issue, a portion of construction and farming in Soufriere occurs without legal tenure in place, thus is not subject to any regulations at all. One respondent explained how insufficient regulation has contributed to Soufriere's vulnerability:

> *It's contributing to the changes in use that make our environment more vulnerable to further degradation and to damage or impacts by storms and global warming and climate change… Those types of interventions by squatters, they will not pass under the scrutiny of planning. The guys go in and cut down, build on a steep slope, put a house there… And so we saw a lot of that in Hurricane Tomas that, a lot of the places that were affected were places that had less than optimal standards in construction and planning standards.*

Soufriere Marine Management Area

In 1986, the Government of St Lucia passed legislation designating many reefs in St Lucia as marine reserves. However, without funds for marking boundaries or enforcement, the legislation proved ineffective. Meanwhile, in Soufriere, conflicts were breaking out between fishers, yachtsmen, scuba divers and snorkelers over entitlement to the use of near-shore resources. In 1992, the Department of Fisheries began a consultation process to identify the conflicts between the various users and the condition of coastal resources around Soufriere. In 1994, the Government of St Lucia approved the creation of the Soufriere Marine Management Area (SMMA) and the designation of a local NGO, the Soufriere Marine Management Association, as the Local Fishery Management Authority. The SMMA was launched in 2005.

The SMMA's boundaries stretch along 11 km of coastline (See Figure 1), and its width extends either 100m off shore or to a depth of 70 metres, whichever is greater. Within the SMMA there are five different types of management zones: marine reserve, where no fishing is permitted; fishing priority areas; recreational areas; yachting areas; and one sanctuary, where no activity permitted, except scientific studies.

The SMMA has enhanced Soufriere's adaptive capacity in multiple ways. First, it has reduced conflict over near-shore resources, hence increasing social capital. Second, as discussed in Section 4.1, it has conserved biodiversity and increased local fish biomass. Gell and Roberts (2003) attributed this success to the SMMA's institutional design, in which continuous reef habitat across the zones allows fish to breed in four no-take marine reserves and 'spill-over' into fishing priority zones. Respondents also highlighted the importance of the consultation process in laying the ground for high levels of compliance.

4.3 Knowledge and Information

Adaptation to any change in selection pressures requires that agents have an understanding, not only about the pressure itself, but also about their adaptive options (Fankhauser and Tol 1997). In general, most respondents in Soufriere were aware of climate change, but had a poor understanding of how it might affect them and how they might respond. Particularly concerning was the lack of awareness amongst individuals whose livelihoods are highly sensitive to climate change, such as farmers and fishers, as well as those that live or work in high risk areas, including areas on the waterfront and areas on steep slopes.

There are a number of measures in place in Soufriere to both generate knowledge about hazards and adaptive options, and to disseminate that knowledge. The CARIBSAVE Partnership has been influential in producing detailed climate modeling projections for St Lucia and disseminating the results in an easily interpreted Climate Change Risk Atlas (CARIBSAVE 2012). CARIBSAVE also developed maps of areas at risk of inundation from sea level rise elsewhere on the island, but not of Soufriere. It is not yet scientifically possible to predict the many of the impacts of climate change with precision, hence the large ranges provided for projected annual precipitation and sea level rise. Public officials explained that this uncertainty makes it difficult to make decisions concerning long-term infrastructure investments.

The information that is available about potential future impacts has not always resulted in sufficient systems being put in place to monitor those impacts. For example, it is known that climate change will likely result in coral bleaching, which will in turn impact the health of fish populations within the SMMA boundaries. However, multiple respondents explained that monitoring of corals and fish is done on an ad hoc basis, largely by foreign researchers. Coral bleaching is generally reported to the SMMA informally by scuba diving tourist operators. Adaptive governance necessitates much more systematic and thorough monitoring.

In other areas, appropriate monitoring systems have been put in place. For example, water supply is monitored at stations that measure rainfall across St Lucia, and in 2006, approximately 90%

of the water users on the island had meters installed in 2006, allowing for monitoring of water demand (CARIBSAVE 2012). Likewise, the Met Office monitors approaching storm systems in the Atlantic

To enable a response, these monitoring systems must be linked to systems that disseminate information about hazards to all stakeholders. Most respondents agreed that the early warning system in place for hurricanes is effective. The Met Office red flags any approaching storms for the National Emergency Management Office (NEMO), the Cabinet Secretary and the Prime Minister. NEMO then informs District Disaster Committees, which hold pre-strike meetings. The Prime Minister initiates meetings with government agencies and ministries and utility companies. Hurricane warnings are then disseminated to people via NEMO's Facebook page, text messages via the telephone companies, radio stations and the cable service providers.

NEMO recently installed a pilot early warning system for flooding in the community of Corinth in northern St Lucia. However, there is no early warning system in place for flooding in Soufriere. The Ministry of Agriculture and the Water Resources Management Authority are in the early stages of developing an early warning system for drought, and the Ministry of Health has early warning systems in place for epidemics, etc. Such systems could prove vital in increasing Soufriere and St Lucia's capacity to cope with extreme events.

A number of government agencies have taken steps to get information about adaptive options to relevant stakeholders. For example, the Department of Fisheries has an Extension and Technology Adaptation Unit that offers presentations and training programmes for fishermen on new practices and technologies. At the time of research, an exhibition had recently taken place on environmental considerations in diving and other water-based activities. The Forestry Department engages in awareness campaigns targeted at farmers about maintaining forest cover on slopes to mitigate the risk of landslides. Finally, the Development Control Authority offers training workshops on the northern part of the island for architects, planners, builders, engineers and contractors on construction practices that take into account the risk of hurricanes. These workshops were not offered in Soufriere.

4.4 Innovation

Innovation is the process through which economic agents 'search' for new products, processes and forms of organisation that offer a competitive advantage in local selection pressures, and bring those novelties into use (Nelson and Winter 1982). It is a socio-technical process that involves dynamic interplay between knowledge flows, market forces, social norms, politics and institutions (Sovacool 2009). The diffusion of knowledge about the new behaviour or technology and the development of skills, organisational structures, and financing mechanisms necessary to apply it, are often as important as the discovery of product or practice. Innovation is central to adapting to climate change, because it involves the adoption of new behaviours and technologies that are more suited to changing local conditions.

In general, Soufriere has few formal processes in place to actively 'search' for novel behaviour or technologies. A notable exception would be the nursery of the Belle Vue Farmers' Co-operative's, which trials new seedlings to determine which are most appropriate within the current local climatic conditions. Future changes in temperature and precipitation will likely change the species and strains of crops that are suitable locally. There was no evidence of research being conducted – among private actors, NGOs or by the government – to determine the most appropriate crops in projected future climate conditions.

The Fisheries Department had implemented adhoc 'search' processes, such as a one-off exchange in which three fishers were taken to Grenada to be trained in long-line fishing in hopes that upon their return, the technique would diffuse among the other fishers.[7] The ultimate goal was to continue to shift the fishing effort to pelagic fisheries in order to reduce pressure on the near-shore stock. However, the new technique did not catch on as hoped, reportedly due to a lack of lack of training for other fishermen and the lack of financial capital for new equipment.

The Fisheries Department has been much more successful in shifting the burden through its technology transfer of Fish Aggregating Devices (FADs), which consist of a float attached to concrete blocks on the ocean floor and serve to attract schools of fish. FADs are often run over and dislodged by large ships, and need to be replaced frequently. The Fisheries Department hopes that eventually it will be able to hand the FAD programme over to the local fishermen co-operatives, but the technical capacity among fishers is not yet adequate. At the time of research, the Fisheries Department was training fishermen in FAD construction.

Indeed, the lack of soft technologies – the knowledge, technical skills and the availability of financing mechanisms – combined with the lack of financial capital, were frequently cited as the main barriers to the adoption of fitter technologies and practices. For example, greenhouses and drip irrigation systems are technologies that could increase farmers' capacity to cope with current selective pressures, let alone future climate conditions. Respondents repeatedly cited a lack of financial capital as a barrier to uptake of both of these technologies.

In efforts to overcome these barriers, the Belle Vue Co-operative has partnered with the Fond St Jacques Credit Union to secure affordable loans for its members for the purchase of adaptive technologies, including greenhouses. It has also partners with external agencies to promote innovation in agricultural practices. For example, to adapt to the rising costs of fertiliser, and to try to restore the fertility of its topsoil, it has partnered with the Global Environment Facility to implement a project that promotes the practice of supplementing or substituting the use of chemical fertilisers with natural compost.

[7] Long-line fishing involves floating a surface line, which, at intervals at different depths, has branch lines drop off with baited hooks. The advantage is that is uses significantly less fuel than the predominant local method of trolling.

Numerous respondents felt that there was also room for innovation and entrepreneurialism in the area of agro processing. They pointed to the frequent gluts of fruit, many of which go to waste in farmers field due to lack of markets. One agro processing initiative that has been successful is Rainforest Cereal, a group of women supported by the Soufriere Foundation that produces granola. Respondents generally cited lack of human capital and financial capital as the main barriers to further agro processing businesses.

In contrast to fisheries and agriculture, the tourism industry in Soufriere has displayed a high degree of entrepreneurialism with nascent businesses and varieties of tours emerging regularly. Many of these new operations are launched and managed by foreign nationals that have a more financial capital and technical training than most local residents. Despite this entrepreneurialism, the tourism industry has demonstrated limited capacity to innovate in the area of water conservation. While recycling wastewater to water lawns and gardens has become common practice, water conservation technologies remain inadequate and rudimentary (CARIBSAVE 2012; Springer 2005).

4.5 Flexible forward-looking decision-making and governance

Central to the adaptive capacity of a system is the capacity of the agents within that organisations to anticipate changes in selection pressures and to respond accordingly (Jones, Ludi and Levine 2010). Responding to an anticipated change often requires long-term planning in order to prevent maladaptive behaviour (Ayers and Huq 2009). In theory, private actors have the incentive to plan for anticipated changes in selection pressures. However, private decision-making is often myopic due to asymmetric information, public goods, externalities, a lack of financial capital and the tendency of individuals and organisations to act according to routines. Examples of myopic behaviour that have been discussed in this paper include the clearing of steep land for agriculture, the construction of homes in areas prone to landslides or flooding and the use of weak building materials. In cases where private decision-making tends to be myopic it is often necessary for more centralised planning, either by government or community groups, and/or the creation of institutions to guide private behaviour.

Successful planning initiatives to guide decision-making have occurred at the local and national levels. At the local level, the launch of the SMMA marked a significant step in planning the use of near-shore resources in Soufriere. The SMMA's success in protecting the biodiversity and ecological resources is integral to maintaining Soufriere Soufriere's adaptive capacity. However, the challenges faced by the SMMA are dynamic. Further planning is required to address the challenges that Soufriere's near-shore resources are expected to face in the future including coral bleaching and the decline in near-shore fisheries, invasive species and increased intensity of storms.

St Lucia developed its National Climate Change Policy and Adaptation Plan (NCCPAP) in 2003. The NCCPAP broadly outlines the government's policy goals and objectives of addressing potential impacts of climate change including impacts on marine and terrestrial biodiversity, water resources, human health, infrastructure and agriculture. The Plan provides a useful framework for government action on climate change. A number of sector specific plans have also been developed at the

national level that address challenges created by climate change. In 2004, St Lucia developed a National Water Policy, which governs the allocation of water among competing uses; and in 2009, the Cabinet approved a revised Water Management Plan for Drought Conditions. During periods of drought, the government-run Water and Sewerage Company (WASCO) manages abstraction levels and rations water resources to prevent overuse (GoSL 2009). In 2006, St Lucia passed a National Disaster Management Act, which defines the roles of various agencies involved in disaster response, including NEMO, and sets guidelines for emergency shelter operations.

Planning at the national level in St Lucia has partly been driven by funding and initiatives at the regional and international levels.[8] Despite this support, a number of priority actions listed in St Lucia's NCCPAP have yet to materialise. For example, a high priority action was to "Develop a comprehensive national land use and management plan, which, *inter alia*, incorporates climate change concerns and which based upon such concerns, makes prescriptions regarding the location of future settlements and urban development without compromising water supply and other such requisites for the sustainability of settlements" (GoSL 2003). This priority was reiterated by numerous respondents who argued that private decision-making about land-use has frequently resulted in myopic behaviour such as the clearing of steep hillsides for agriculture and construction in areas prone to landslides, flooding, and inundation from sea level rise and storm surge. Such decisions are highly prone to maladaptive outcomes due to the path-dependent and often irreversible nature of development. To reduce this risk, respondents stressed that a national land-use strategy must incorporate no-build zones in high-risk areas and begin to accommodate sea level rise through coastal setbacks.

The Ministry of Physical Planning and the Environment has developed planning guidelines that call for setbacks from the high water mark, buffers next to rivers and ravines, and consideration of slopes in construction. Moreover, the Ministry of Physical, Development Environment and Housing established a Coastal Zone Management Unit in 2005 to enhance public awareness about coastal zone issues and to provide technical input in decision-making concerning coastal zone management (Walker 2006). Nonetheless, no binding institutions have been created that mandate coastal setbacks, the relocation of settlements at risk or the types of developments allowed in areas along the coast or on steep slopes (CARIBSAVE 2012).

Respondents explained that St Lucia's existing institutions concerning land-use are inflexible and make land-use planning unlikely. The country's constitution guarantees landowners' rights to

[8] St Lucia has participated in the Caribbean Planning for Adaptation to Climate Change project (1997 to 2001), the Adaptation to Climate Change in the Caribbean Project (2001 to 2004), and the Mainstreaming Adaptation to Climate Change project (2004 to 2009). These projects sought to build adaptive capacity in the region by encouraging governments to mainstream adaptation considerations into development agendas. St Lucia has also benefited from World Bank funding to help strengthen the government's capacity to respond to adverse natural events such as hurricanes and floods. Finally, the country is part of Pilot Programme for Climate Resilience (PPCR), a long-term project with US$60-75 million dollars in grant funding for the Caribbean region from the Climate Investment Funds, which are managed by multilateral development banks. Like previous projects, the PPCR aims to integrate considerations of climate risk into national development planning.

enjoy their land, which could be interpreted broadly, and there is reluctance among politicians to pass laws that may encroach on these rights:

> *Government needs to show that it has vision and it has the wellbeing of the residents at heart… They'll articulate a policy, but the enforcement of will not go ahead because that affects political survival.*

Such political impasse can sometimes be overcome during windows of opportunity created by external pressures or events. For example, the damage to property caused by the storm surge from Hurricane Lenny created a window of opportunity for the Government of St Lucia to engage with the residents of Baron's Drive regarding resettlement away from the shoreline. A new settlement was built on what was subsequently named "Lenny's Hill" and with government support, a number of households on Baron's Drive relocated. The event also prompted the government to begin the process of coastal development planning in Soufriere (USAID 2000).

5. Discussion and Conclusion

This case study demonstrated that when assessing Soufriere's adaptive capacity, it is important to consider not only the assets that it has at its disposal. It is also necessary to consider the processes whereby decisions are made, knowledge is generated and disseminated, novel practices and technologies are introduced and retained, and institutions evolve to govern private behaviour. The LAC framework provides a useful tool for capturing different elements.

To illustrate, the adaptive capacity of Soufriere as a whole is significantly curtailed by its inadequate stock of financial, human, physical and social capital (though the distribution of each of these assets within the community is highly unequal); and adaptive capacity is enhanced by the community's rich in natural capital – its fertile soil, fresh water, coral reefs, near shore and pelagic fish populations, hospitable climate and the Pitons. As we have seen, much of this natural capital is at risk from pollution, overexploitation, as well as from climate change, which threatens to undermine the very assets that are the foundation of Soufriere's economy. This rather crude assessment paints a stark picture of Soufriere's capacity to adapt to climate change. However, an assessment of Soufriere's adaptive capacity would be incomplete without an examination of factors such as the NEMO's early warning system for hurricanes, the Belle Vue Co-operative's trial nursery or the SMMA. The success of the SMMA in establishing such an innovative institution to enhance social capital and to protect the biodiversity of Soufriere's near shore ecosystems demonstrates a high degree of adaptive capacity that would not be captured through an approach that focused exclusively on assets.

This case study also validated a number of other themes prevalent in evolutionary literature, and revealed how these themes can be taken into account within each of the categories of the LAC framework. For example, it demonstrated the path-dependency of economic change in Soufriere, and the influence that the location's history has had on its adaptive capacity. Much of Soufriere's lack of social capital is the result of historical social divisions that have undermined trust and made it

difficult for community members to cooperate to implement adaptive strategies. Soufriere's landownership patterns are a path-dependent product of slavery and colonialism. Institutions, including clauses in the Constitution that guarantee landowners' rights to determine the use of their land, reinforce this path-dependency of land-use by reducing the government's flexibility in instituting mandatory coastal set backs or land reforms.

This case study further revealed that consideration must be given to scale. For example, Soufriere's stock of financial capital has been heavily influenced by the institutions that govern trade at the national and international scale. At first, these institutions protected the markets for St Lucia's copra and banana industries; subsequently, they undermined them. Understanding Soufriere's declining agriculture sector and its increasing specialisation in tourism would not be possible without consideration of the evolving institutional environment at the national and international scales.

To unearth these evolutionary themes, rich descriptive data is required that can only be captured through qualitative research methods that place strong emphasis on the local context – the local culture, history, social dynamics and institutions and how this context is shaped by forces at different scales. This case study captured a wealth of such data, which will be valuable to decision-makers in deciding which interventions are most appropriate in enhancing Soufriere's adaptive capacity and how they can be effectively implemented.

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