Community-Based Vulnerability Assessment of Agriculture, Fisheries and Tourism in Soufriere, St. Lucia

A Working Paper Draft for the Global Island Vulnerability Research, Adaptation Policy and Development (GIVRAPD) Project

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Introduction

This report summarizes the results of a Community-Based Vulnerability Assessment (CBVA) of the tourism, fishery and agriculture sectors in Soufriere Quarter, St. Lucia. Soufriere was chosen as an illustrative case study in an upper-middle income Small Island Developing State (SIDS) as part of the Climate and Development Knowledge Network (CDKN) funded Global Islands' Vulnerability Research Adaptation Policy and Development (GIVRAPD) project. The GIVRAPD project is a two-year comparative assessment of four learning sites in the Caribbean and Southern Indian Ocean (in Jamaica, St. Lucia, Mauritius and the Seychelles) who share similar characteristics: a high score on the United Nations Human Development Index, a significant reliance on tourism exports, the presence of an artisanal fisheries sector, and concerns about food security and the capacity of domestic agriculture to enhance this.

The GIVRAPD project (see http://givrapd.org) includes four research components: climate science, CBVA, Governance Assessment and Micro-Insurance. The CBVA component serves to identify existing adaptation deficits at the community scale, identify the range of vulnerabilities experienced by stakeholders within the community as well as associated adaptations to establish a vulnerability baseline. All four learning sites followed a consistent protocol for the

CBVA component with a view to the identification of comparing insights and identifying transferable lessons for each of the three sectors. Additionally, the CBVA was designed to provide contextual baseline information for the Governance and Micro-Insurance components of the larger project.

Soufriere Quarter, St. Lucia

St. Lucia is part of the World Bank's Upper Middle Income lending group. Since St. Lucia gained independence in 1979, it has experienced a tremendous growth in Gross Domestic Product from 316 Million USD (converted to 2005 USD) to 1.079 Billion USD (converted to 2005 USD) in 2013. For most of its history as an independent nation, St. Lucia has exhibited upward GDP growth, albeit with a few dips in the 1980s and from 2001-2003 (see Figure 1). St. Lucia has also experienced steady population growth over the same time interval (from just under 89,000 in 1980 to slightly more than 182,000 in 2013[1]). However, even with population more than doubling, per capita GDP has steadily increased, with a slight decrease beginning in 2009 (Figure 2). St. Lucia has been and continues to be a recipient of Official Development Assistance; this has represented an average of only 2% of Gross National Income (GNI) since the year 2000.

Aggregate economic data hide variation in income. St. Lucia conducted Poverty Assessments for the Caribbean Development Bank in 1995 and 2005. During this time, indigence was almost eliminated, falling from 7.1% to 1.6% of the total population. However, the share of St. Lucia's population considered poor rose from 25.1% to 28.8% (UNDP 2010). Given that vulnerability to environmental change is not evenly distributed in populations and is strongly related to poverty, there is value examining adaptation to climate change at the local scale and including stakeholders from multiple segments of society to shed light on not just the major productive sectors (tourism, agriculture and fisheries) but also the variation within these.

[1] The World Bank Development Indicators report a total population of 182,000 in 2013; the St. Lucian Census of 2010 has a slightly lower count at 166,526 for 2010, for which the World Bank reported 177,397.

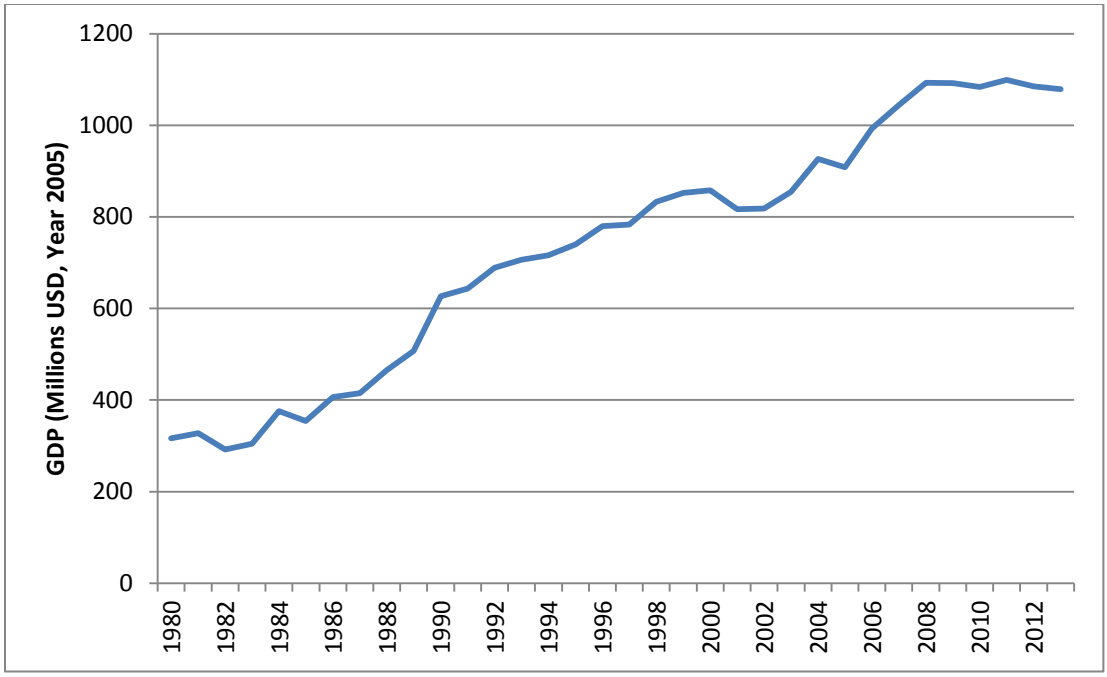

Figure 1 St. Lucia's GDP in Millions USD (2005 constant) (Produced with data from the World Bank Development Indicators)

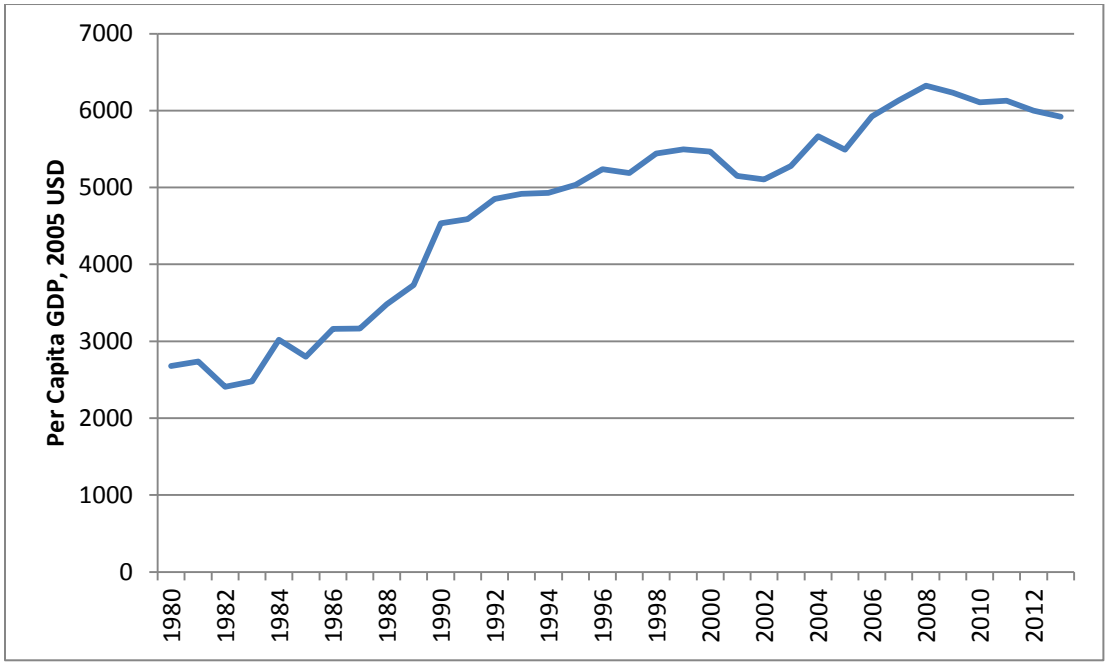

Figure 2 St. Lucia per capita GDP, USD (2005 constant) (Produced with data from the World Bank Development Indicators)

Climate Change and St. Lucia

St. Lucia has a tropical maritime climate. The island has historically had distinct wet (June to November) and dry (December to May) seasons. The wet season coincides with hurricane season, and rainfall during this time is dominated by tropical wind events (Second National Communication, 2011). Dry season rainfall is influenced by mid-latitude systems that reach the region, and precipitation during this time is less predictable than during the wet season (Second National Communication, 2011). Generally, interior mountainous areas receive more rainfall (up to 3420mm/year) than coastal areas (approximately 1265mm). Sunshine hours are highest during the dry season, with a peak from February to May, and lowest in September, and mountainous areas receive fewer hours of sun than coastal regions (Second National Communication, 2011). The island is warm year-round, with average annual temperatures of 28˚C, with slightly cooler temperatures during the December to March period. Sea surface

temperature fluctuates around 26.7˚C. Wind speeds are highest from January to July (average 24 km/hr), although extreme winds are most likely to occur from June to November.

Community-Based Vulnerability Assessment

The CBVA conducted in Soufriere followed the conceptual approach outlined in the GIVRAPD process. This approach is based on Smit and Wandel (2006), and conceptually outlined in Figure 3.

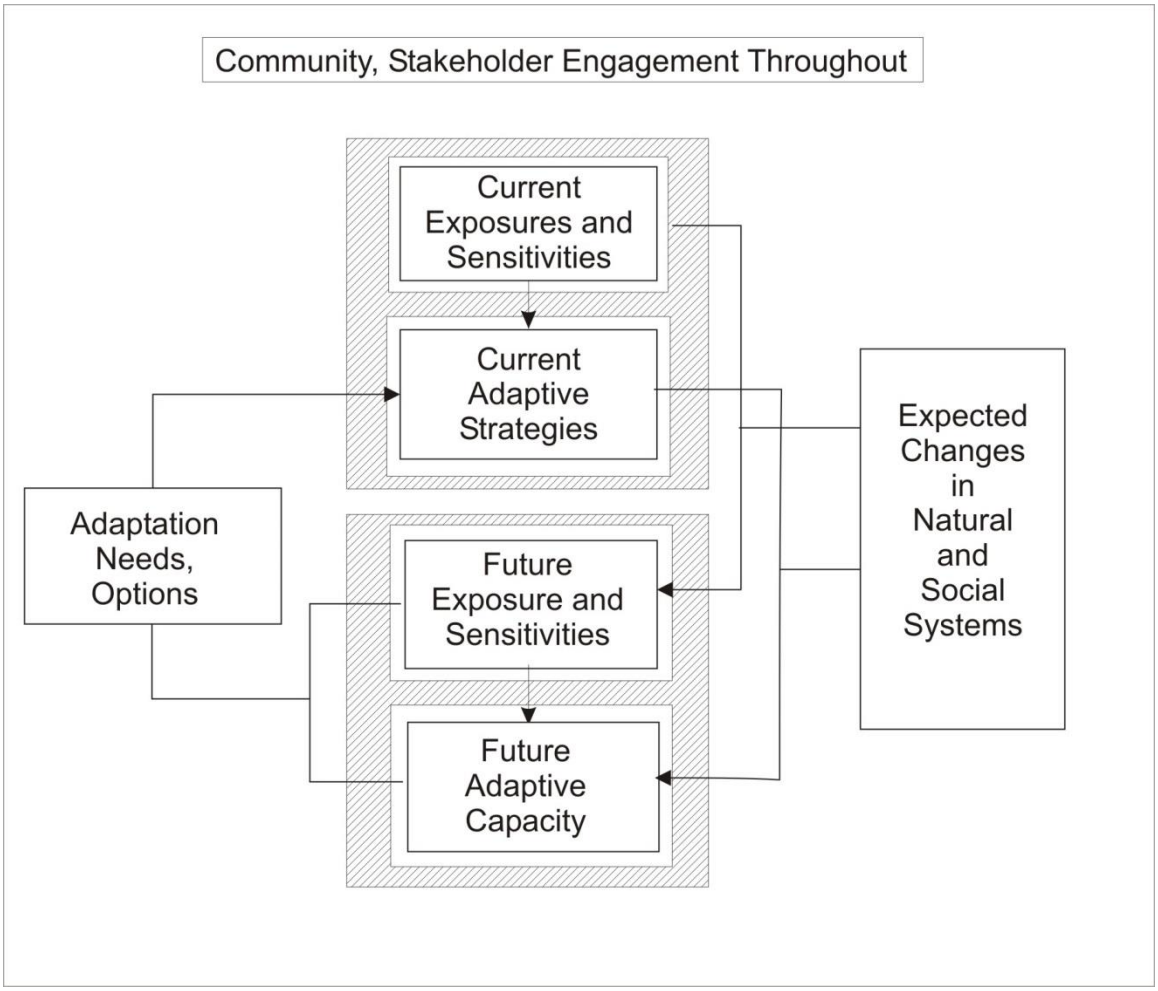

Figure 3 Conceptual Framework guiding the GIVRAPD CBVA (from Smit and Wandel, 2006)

The Smit and Wandel (2006) approach rests on a key set of assumptions:

1. Current vulnerability is a function of the exposure, sensitivity and adaptive capacity of a particular system of interest. Vulnerability is thus a pre-existing condition, which affects how and how well the system will be able to respond to climate change rather than the outcome of an experienced climate change-related stress.
2. Vulnerability is thus influenced not only by climate-related stresses (exposures) and how relevant these are to the system of interest (sensitivity), but also by the full set of resources (sometimes framed in terms of assets and entitlements) available to anticipate, prepare for, manage and recover from climate change. Consequently, considerations such as poverty, inequality, economic trends, governance arrangements and similar are key components of vulnerability.
3. Future vulnerability depends not only on changes in natural and social systems (e.g. climate change, trends in reliance on key economic sectors, poverty reduction and so on) but also on current vulnerability. This is due in large part to the concept of the adaptation deficit, as first identified by Burton (2004; 2009) with reference to a global increase in damage from extreme climatic events despite scientific increases in monitoring and prediction and continued development of emergency management. The adaptation deficit is defined as the "failure to adapt to adequately to existing climate risks" (Levina and Tirpak, 2006). This failure in turn becomes a barrier to pro-active adaptation, as addressing the adaptation deficit de facto places actors in a reactive mode. Thus, the adaptation deficit is a key component of current vulnerability that acts as a barrier, and is set to get larger with climate change (Burton, 2004; 2009).
4. Current vulnerability to climate change is reduced through the identification and implementation of adaptation. This adaptation can be anticipatory (in light of expected or projected climatic and non-climatic stresses) or reactive to current events. Examination of how the system currently adapts gives insights into what options already exist/which future stresses are already managed, and those where current strategies

are insufficient both in light of the current adaptation deficit and longer-term trends and anticipated climate change.

Methodologically, the approach is operationalized via case studies that document exposure, sensitivity and adaptive strategies/actions from all possible sources. While there are relevant data that can be derived from aggregate statistics (e.g. the World Bank's development indicators), vulnerability is not evenly distributed across sectors or communities (Smit and Wandel, 2006). For this reason, the CBVA followed here draws on the lived experience of stakeholders as well as insights from key informants to illustrate how vulnerability is expressed for the multitude of actors within an economic sector in a particular place. The Soufriere CBVA aims to answer a series of related questions for three key economic sectors:

1. What are the current and past climate-related exposures and sensitivities? What climatic conditions have been/are problematic for stakeholders in this sector? [exposure-sensitivity]
2. What are existing adaptations to climate-related exposures in the past? What strategies exist to manage climate-related stress? What are and have been barriers to successful management/what are/have been enabling factors? Where are current strategies insufficient [adaptation, adaptive capacity, adaptation deficit]
3. What changes can we expect, and how do general socio-economic trends interact with these? [future vulnerability]

The CBVA thus serves to identify a vulnerability baseline. While insights on vulnerability reduction can and do emerge, the intent is to identify the current adaptation deficit, upon which concrete strategies for vulnerability reduction may be built , although it is beyond the scope of a baseline assessment to do so. This report thus focuses on Questions 1 and 2 above.

Community Based Vulnerability Assessment in Soufriere

A CBVA was conducted in Soufriere Quarter in August 2012. A team of five international researchers collaborated with GIVRAPD's local partners (see Appendix 1) to conduct a total of 175 semi-structured interviews focusing on Questions 1 and 2 from the perspective of the relevant stakeholders. The research team was located in Soufriere, and followed a snowball sampling technique where initial introductions to key informants and some stakeholders were made by the country focal point, and researchers recruited subsequent participants based on recommendations from those already interviewed and the research team's own identification of knowledge gaps during daily debrief sessions in site. All interviews were audio recorded after research participants consented, and subsequently transcribed verbatim. In a few instances, research participants were most comfortable in St. Lucian Creole French and the interviewers used local interpreters. Only the English translations were transcribed in these cases. All interview texts were subsequently coded into thematic categories representing current/past exposure-sensitivities and adaptations using qualitative data management software.

Stakeholders from the tourism, fisheries and agriculture sector were interviewed. For each sector, interviews included those whose primary livelihood was in the sector as well as key informants who could speak to more than their own lived experience within this sector. For example, the agriculture sector interviews included farmers, those who were involved in agricultural products processing, and key informants from various government departments and organizations whose primary mandate included agriculture. In addition to sectoral key informants, 23 interviews were conducted for non-sector specific context (e.g with municipal authorities, emergency management organizations, community development organizations and local businesspeople not directly involved in one of the three sectors of interest). Table 1 summarizes the CBVA interviews by category.

Table 1 Summary of Research Interviews by Sector

	Interviews

Agriculture	
Farmers	47
Agricultural processors (current and past)	3
Key informants	6
Agriculture total	**56**
Fishing	
Fishers	21
Key informants	17
Fishing total	**38**
Tourism	
Tourism establishment owner/manager	16
Tourism workers	31
Tourism total	**47**
Non-sector-specific Key Informants	23
Total research interviews	**175**

The Agriculture Sector

Historically, agriculture was the dominant sector of the St. Lucian economy. Like other Caribbean islands, St. Lucia was dominated by plantations which were operated with African slaves. There were up to 92 plantations in Soufriere Quarter in 1815, though this had already declined to 72 at the time of Emancipation in the British Empire in 1834. This decline in the number of plantations was consistent with the number of plantations in St. Lucia generally, and Soufriere contained the largest number of plantations of any Quarter, and the numbers here represented 20-22% of the island's total plantations (Soufriere Foundation, n.d.). Chief plantations crops included cacao, copra, coffee and sugar – Soufriere had 20 sugar plantations in 1843, which represented more than 25% of the total sugar plantations in St. Lucia (Soufriere Foundation, n.d.). Given this dominance of agriculture, Soufriere has been referenced as the "bread basket of St. Lucia" (Soufriere Foundation, n.d.). After emancipation, smaller plantations persisted with indentured servants and freed slaves, though many slaves established their own holdings on steeper land not owned by plantations (the legacy of this is "family land", which is often passed down without formal land tenure through title.)

Soufriere has always been tied into a global agricultural system given its plantation legacy. The production of sugar in the West Indies benefitted from favourable trade relationships until Britain's Equalization Act in 1846, which removed the preferential treatment of sugar. Production consequently shifted to coffee, sugar and some spices. Soufriere established a copra processing facility in 1959, though this ceased operation the year before this research was conducted. Banana production began to dominate St. Lucia during the latter half of the 20th Century following 1953's contract between the UK's Geest Industries and the St. Lucia Banana Growers' Association, through which Geest committed to buying all export quality bananas (Saint Lucia Country Strategy Paper for the Banana Industry, n.d.). St. Lucia benefited from a preferential trade relationship between Europe and selected former colonies collectively referred to as African, Caribbean and Pacific (ACP) countries under the Lomé Convention. Trade liberalization in the early 1990s removed preferential European treatment for Caribbean over

Latin American bananas, and banana production declined starting in 1993. Subsequent increases in the incidence of Black Sigatoka disease, which damages banana and plantains, have led to further declines in St. Lucia's banana industry.

While banana farming existed in Soufriere, the area's steep mountain slopes and relative inaccessibility meant that it did not benefit from the banana boom as much as other parts of the island. Soufriere continues to produce some non-export bananas and plantains, though the Quarter is characterized by a highly diversified agricultural system which includes tree crops (avocado, cashew, cacao, papaya, passionfruit, various citrus), vegetables (primarily tomato and cabbage, but also others including salad beans), ground provisions (dasheen, yam, sweet potato) and non-tree fruit (melons, pineapple). There is some very minor livestock production, though this is primarily for smallholders' own consumption as there is no commercial slaughterhouse in the Quarter (a modern facility was under construction in Vieux Fort, some distance from Soufriere).

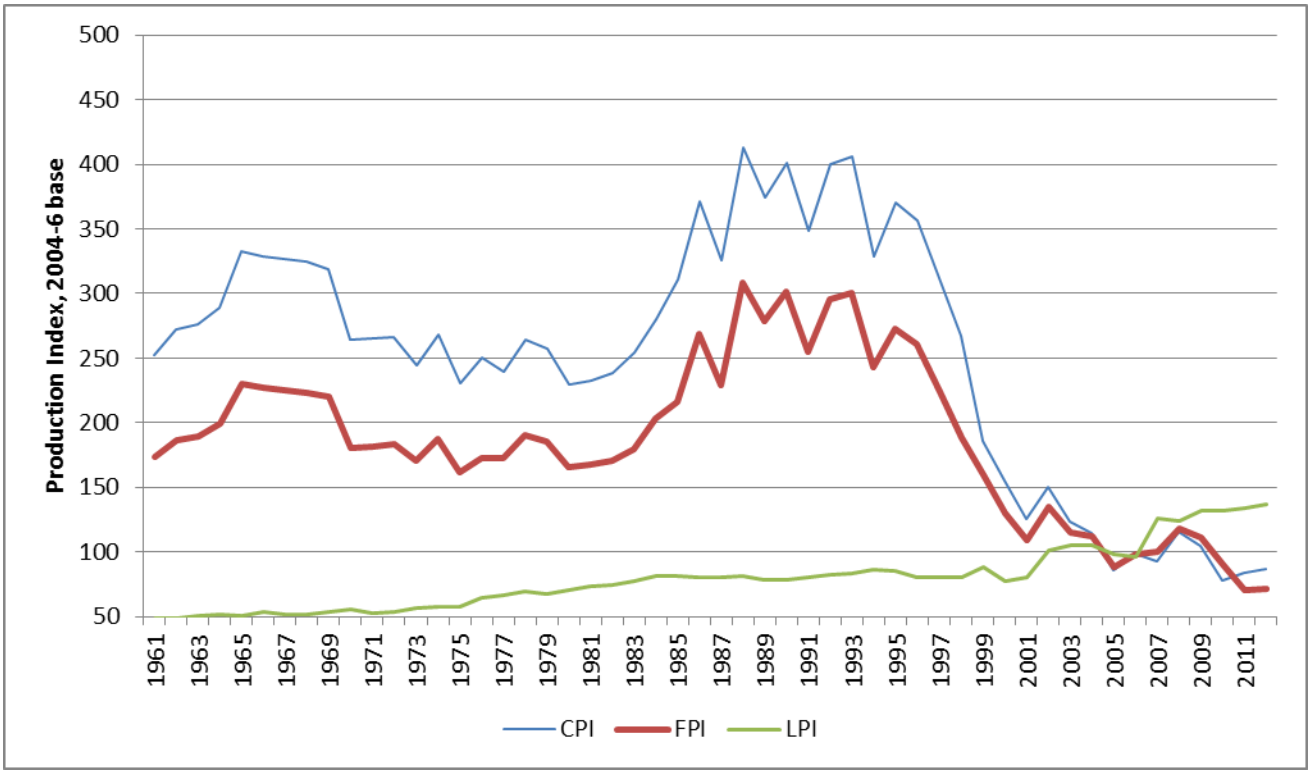

Figure 4 Crop Production, Food Production and Livestock Production Indices, St. Lucia. Produced with Data from World Bank Development Indicators.

Figure 4 shows the relative historical importance of crops, livestock, and agriculture overall through the Crop, Livestock and Agriculture Production Indexes, which the World Bank calculates as production value relative to the 2004-2006 reference period (set at 100). Crop production historically was up to four times the value of the reference period during the banana boom in the late 1980s, and the overall food and crop production values have declined since then, while the livestock sector has experienced growth in the past eight years.

Just under 15% of St. Lucia's employment was in agriculture in 2005 – 18.8% of the male and 9.8% of the female workforce (World Bank Development Indicators). In the same year, 76.9% of the population was classified as rural. Since then, the rural share of the total population has increased to just over 80% (World Bank Development Indicators). Soufriere Quarter is broadly consistent with this – in 2010, Soufriere Town and settlement of Baron's Drive (considered part

of Town) accounted for 1431 and 685 of the Quarter's 8,472 persons (Soufriere Foundation, n.d.).

There are currently no large agricultural estates in Soufriere, although some former estate properties, which are primarily used for tourism, do include significant agriculture. The agricultural sector is dominated by small to medium sized enterprises (0.5 acre or even smaller up to the five to seven acre range). The farmers included in the CBVA were primarily small and medium-sized enterprises, but two managers who were responsible for significant estate lands were also included.

Exposure-Sensitivities in Agriculture

Key challenges for agriculture identified through the CBVA include both climatic and non-climate-related exposure sensitivities.

Environmentally Related Exposure-Sensitivities

Mass wasting. Many of the smaller farming enterprises are on family land on steep slopes. These slopes are already exposure-prone, though this is exacerbated by the removal of forest cover for agriculture. ***Intense rainfall events*** such as those associated with tropical storms coupled with already vulnerable soils has, in the past, led to widespread landslides in Soufriere. Most respondents generally recognized the contributing causes, for example:

> *"it's good to have you know good forest cover because that definitely breaks down the force you know of the water the rain that is falling down and there were places you know within after Tomas that because the forest was intact you know nothing happened. There was no damage so the forest cover does have a crucial role. But there are other factors you know that influence landslides and I think slope factor you know is also important. In areas where there have been some kind of disturbance you know of the terrain of the soil along the roads these places will always have landslides" (Respondent 73)*

Soil Erosion and Degradation. In addition to the landslide events, one respondent noted the decrease in soil stability is due not only to land clearing, but to management practices. In this case, he noted the increased use of fertilizers (which replaced the use of organic matter such as "compost" (green manure) and animal manure):

> *"Now when we were farming bananas it was slash and boom, we cut down our forest you burn it and we get our bananas and we get a good three years crop, after about 10/15/20 years the ground started to deteriorate a little bit to deplete in terms of ability to sustain the bananas and then we started bringing in fertilizers and chemicals, and we then, I would say not more than 15 years after using a lot of that pesticide and insecticide and a lot of the chemicals, man we destroyed our, I don't know if the term is eco-system, but we destroy the places, we had a lot of wet-lands, this thing just disappeared and because St. Lucia is mountainous, what we have, every time we had a tropical storm, a good heavy rain, we lose a good bit of good soil because we would have a lot of these little ravines just slide out to the river and disappear" (Respondent 35)*

Similarly, widespread tree clearing and the soil's associated diminished ability to absorb and retain water have meant water availability in secondary streams (ravines) has decreased. Several respondents indicated that rainfall moved through the system much more rapidly, leading to flash flooding in rivers followed by lack of access to water:

> *"When I was little the rivers were like creeks, now when it rains it's so huge, you can't even cross." (Respondent 87)*

People in low-lying areas close to the river have experienced **flooding** in the past, and anticipate that this will return:

> *"when it rains it has to do, it all depends on the weather, that's the biggest change around here. If it rains we are quite vulnerable still because the river has not been desilted, so when it rains we are living in fear here and sometimes the river does rise quite high up and we're not certain it's not going to come back over here." (Respondent 6)*

In addition to too much water, too little water is an issue for agriculture during dry periods. Irrigation is not widespread, but there are few sources of irrigation beyond the Water and Sewage Company of St. Lucia (WASCO) piped water (which some respondents noted using, but also noting that this is an expensive option). St. Lucia's Water Management Plan for Drought Conditions (2009) states that conservation measures for agricultural uses are necessary under drought warning conditions, and allocation restrictions on irrigation can be implemented during Phase 4 (Restriction) drought conditions. Even if water supplies were secure, the cost of irrigation is prohibitive for many smaller farmers:

> *"the cost for the irrigation, in fact a farmer just, just ask me for the cost for a roll of drip lines. It's $550 ...that's what the farmer was asking me, one roll of drip lines and that's ..might not be twice the size of that room. $550 if you in a dry area and you need to put water and then you need an irrigation pump which might cost you another three to five thousand dollars. We talking about small farmers you know, so the cost of mitigating now to adapt to climate change is very high." (Respondent 17)*

There have been reports of drought conditions in the past, though these did not emerge as a significant concern in the CBVA interviews. However, many respondents noted that changing seasonality from a distinct wet and dry regime made planning much more difficult:

> *"Well the weather has not been good to us lately because when you plant a crop you think it's a sun crop, there comes the rain and the sun is ruined it. Example, a sala beans, you need sun for that and if you plant you think January's sun in St. Lucia it's supposed to be hot. But then comes the rain." (Respondent 87)*

Other Exposure-Sensitivities

By far the most common challenge reported by farmers in Soufriere was the **cost-price squeeze**. Since July 1976, the East Caribbean Dollar (XCD) has been pegged to the US Dollar (USD), meaning that St. Lucia is vulnerable to any devaluation in the USD. Respondents noted that all purchased agricultural inputs (primarily fertilizer, pesticide, fungicide, seeds) have increased tremendously, but commodity prices have remained constant. This is particularly challenging to small farmers, who do not carry cash reserves or have access to credit to purchase input:

> *"Well the difference if before we used to buy the fertilizer $40 a bag, now it's about $175 a bag. Because sometimes for you to buy some fertilizer you have to leave the dasheen and go and make a 2 days, 3 days work just to buy some fertilizer." (Respondent 50)*

A factor which frequently exacerbates the cost-price squeeze is cyclical over-supply of highly perishable commodities, which triggers a fall in price. Although local farmers cannot meet overall domestic demand for St. Lucian produce, they are in constant competition with imported products which in turn limits how much local farmers can charge for their products:

> *Interviewer: Who sets the prices for the produce that you sell here at Belle Vue?*
>
> *Respondent: More or less are the buyers. The buyers are the ones who set the prices but it all depends on supply and demand. When they can't get the produce, obviously, the price would go up. But when there's a lot of produce on the market, prices fall.*
>
> *Interviewer: And you mostly sell to locals, like hotels, shops, local people?*
>
> *Respondent: Yes, yes. Most times of the year we are not able to supply the local market.(Respondent 127)*

The same respondent went on to note *that "Anytime there's a short fall in local production, the hotels or whatever, they import. The buyers they import from overs."*

Farmers face challenges with **labour shortages and farm succession.** Many of the farmers interviewed reported difficulties in securing consistent labour supply on their farms, and the related issue of rising wages without a corresponding rise in commodity prices. Younger generations are reported to have higher expectations, with new opportunities in tourism and the construction industry. As one respondent noted,

> *"you find with farmers, we work in an environment where we must compete for labour with other sectors that may have a higher end in terms of being able to pay better and because of that we are forced to compete. So you find somebody working in the construction industry for $55, maybe $60 a day… bu in these parts in particular, a farmer may be paying maybe $40" (Respondent 120).*

The same respondent noted that construction workers would put in an eight hour day, but farmers would only be hiring for four hours, so the hourly wage expected from farmers was actually higher.

Most farmers, when asked how they saw the future of farming for their own children, noted that younger people do not want to go into farming and that they would not encourage their own children to do so. Reasons for this included young people's expectations, but also the overall profitability of the sector.

> *"One of our biggest concerns is… the fact that we're able to, we're not able to bring in young people into the sector and young people can only be brought into the sector if they're seeing success stories around them. A lot of people talk about bringing people into agriculture sector but for me it's not a matter of bringing … young people into the sector, it's a matter of making those farmers who are already there successful. As long as they're successful, young people will want to come in." (Respondent 17).*

Finally, there was much concern about **access to suitable land**. Given the plantation past, most relatively flat parcels in the Soufriere area are under private ownership, and small farmers are on steep family land. This led to frequent mentions of a lack of land use policy, coupled with calls for the government to give access to flat land to farmers:

> *"you gradually see that a lot of lands are now being used for housing and as more people start building and they would build on areas that usually you would use for farming, you're creating a situation where soon farmers would not have any good area to farm. They would probably have to use the same hillsides and in areas like Shozel and Soufriere, you don't have too much flat lands, the gentle slopes that you have, you put houses on them and you have to think of some other way of giving people a livelihood. (Respondent 145)*

Adaptations in Agriculture

Agriculture as a sector has traditionally been very accustomed to dealing with climatic variability. However, there are a number of managerial and strategic responses that have been or could be implemented to lessen the effect of some of the exposures outlined above.

Landslide risk can be reduced with enhanced tree planting, including agro-forestry, and a number of farmers reported doing so at the individual level. In addition, some noted that there had been some institutional support for tree planting. There were a few calls for better land use planning to prevent deforestation in the uplands (however, there were also some expressions of frustration at not being allowed to clear forest for agriculture). While little can be done about extreme rainfall events, a return to more forested land and agroforestry using deep root crops could reduce the landslide risk somewhat, as can adding more organic matter to soils via composting. At the time of the interviews, there was a composting program funded by the Global Environment Facility underway in Soufriere.

The notion of government intervention in land use policy was raised several times, for example:

> *"the government has the authority to declare any place can declare any place or it could acquire you know any piece of land you know for some interest some reason that's in the public's interest so if say for example what happened in Fond St. Jacques and the government through NEMO, the National Emergency Management Office and all its other you know resource agencies we determined that this place is not fit for people to live it is not safe and you know people need to evacuate there totally and the government has the resources to relocate those people it has the authority to do so even under our Wildlife Protection Act we can declare places as protected areas you know as reserves you know. We have had some acquisition you know for water shed purposes and the government would pay the people in exchange. I think one or two of them have gotten land exchanged but where we determine those areas were key or conservation watershed protection of water then we made recommendations for the government to acquire those parcels of land." (Respondent 73)*

However, an even better solution would be to concentrate agriculture in more suitable flat lands to avoid areas prone to mass wasting and flooding. This in turn would allow more mechanized production, which would lead to higher yields. One respondent pointed to opportunity:

> *These estates were one of the major producing estates when I was a young man. In cocoa and coconut oil and other crops, bananas, and it is well suitable for proper agricultural development. But right now they have decided to pour concrete over it, by offering, you know, dividing up this land into lots… They are filling up these low lands*

> *which is very good lands that you could plant crops like dasheen, crops like rice and bananas because bananas is a water plant and bananas don't mind this heavy clay type of soil. Some areas could be utilized for vegetables, cabbages and so forth. (Respondent 74)*

However, this type of intervention would require a comprehensive land use policy, including agricultural land reserves. This in turn is difficult to reconcile with the established system of land tenure, which relies on family land. From 1961 to 2007, the total area of agricultural holdings in St. Lucia decreased from 87,375 to 30,204 acres (MAFFF, 2007). More than 4000 of these are less than 1 acre, and these are frequently on family land. Since 1986, the proportion of agricultural land that is privately owned decreased from 60% to 40%, while family land's share of agriculture increased from under 25% to over 40% (MAFFF, 2007). This is the result of the conversion of titled land to other land uses, while production on family land did not face the same competition from land developers.

Changing seasonality has been managed through low-tech interventions. There is little irrigated farming in the Soufriere area (According to the Agricultural Census of 2007, under 25% of all St. Lucian holdings irrigate, and many of these are concentrated on less steep land). However, too much moisture for vegetable crop production is well managed in medium-sized holdings who are in a position to invest through the implementation of greenhouse (primarily hoop house) technology. Beginning in 1990, the Ministry of Agriculture, Land, Forestry and Fisheries has promoted the use of this technology as part of import substitution in a number of key vegetable crops to decrease dependency on offshore vegetables (Girard, 2010). Greenhouses can be uncovered if rain is desirable, and recovered to keep excessive moisture from crops. However, they also represent a substantial investment, with costs of approximately 10,000XCD for an 18-meter long greenhouse (Girard, 2010). This means that year-round production is only available to larger farmers:

> *"So when farmers realized hey, he could only produce in the dry or semi-wet season to get a crop, but the green house he could produce all year round, there about just in the mid-90s coming in to just around 2000, you had a lot of farmers went into greenhouse*

> *production. So greenhouse has become a thing of the day for major farmers and I use the name major" (Respondent 62)*

This investment in turn can be damaged by tropical storm events. None of the farmers involved in this study carried insurance, and thus a farmer taking on credit to invest in a greenhouse is, in some ways, more vulnerable to hurricanes. However, more consistent year-round production using greenhouses can also contribute to more consistent supply of produce, and, if production is co-ordinated, eliminate some of the seasonal gluts. Furthermore, agricultural production in a controlled environment has the potential to better meet the needs of major tourism-related buyers such as hotels and restaurants if production can be predictably ramped up for periods of traditional high demand (i.e. peak tourist season).

One very low-tech strategy to deal with tropical storms employed by subsistence and small-scale farmers is to plant ground provisions such as dasheen (taro), which have a greater ability to withstand storms. However, too much rainfall and waterlogged soil will still contribute to crop spoilage before the crop can be harvested and marketed. In addition, several respondents called for post-harvest storage facilities:

> *"I think because of the glut that we sometimes have on the market, we need to look at storage. Storage which is an important factor in terms of chilling facilities." (Respondent 62)*

When produce is in oversupply, traditional marketing channels (directly to hotels, supermarkets and to agricultural cooperatives) offer low prices or simply will not buy produce. Similarly, traditional channels require a minimum level of quality. Several small-scale farmers then resort to selling at produce markets (in Soufriere, but more commonly at the larger market in Castries):

> *"Otherwise, if it's not a good quality for here, I give it to a friend of mine who goes by the market, a lady, she sells by the market. Sometimes I sell it in the area by my home to my neighbours, especially when I have tomatoes. Sometimes on Saturday I go down on the highway with a table and stuff and I sell my things there. To me it's going good. I go a Saturday I had tomatoes, I had only one crate of tomatoes, about 50 lbs that was over ripe*

> *because during the week I sold some here but they were over ripe I could not sell it here but when I went with that one crate of 50 lbs of tomatoes I make about $180 in it in parcels of $5, from about 7 to 11 o'clock " (Respondent 84)*

Travel to market poses additional burdens on small-scale farmers, who generally do not have access to vehicles. To hire transportation for a day from Soufriere Quarter to Castries costs 300XCD, and the bus costs 12XCD but separate seats must be purchased for produce and thus this option is only open to very small-scale sales.

In some ways, St. Lucia is undergoing de-industrialization of agriculture in the sense that, contrary to global trends, the size of holdings is decreasing, the use of industrial machinery and equipment is becoming more common, and fewer farmers were using improved seed varieties in 2007 than they were in 1996. In large part this is due to the collapse of the banana industry, and vegetable and tree crop production has not yet adopted industrial principles.

There is little an individual farmer can do to set higher commodity prices in an environment of competition with similarly priced inputs which meet more consistent quality standards. The most common strategy employed by St. Lucian farmers is to join one of the agricultural co-operatives, who collectively have a stronger bargaining potential, eliminate the need for expensive transport to markets, and even facilitate credit for farm inputs. As one co-operative representative noted:

> *"what makes it quite difficult for us is the cost...the cost of inputs, cost of the raw material...most of our farmers they have no other form of income generation so during that time it makes it difficult for them to produce in large volumes. You know sometimes what happens is you'd plant one crop, you may succeed, then you try to do a subsequent crop but with that subsequent crop you still end up losing – you lose to a lot of maybe disease infestation, extreme weather patterns you know. As a company what we … we try to assist our farmers in terms of assisting them with credit you know, giving them the support that they need you know to grow those produce and at the point of sale what we do is, we subtract a certain amount of money towards at least going towards the debt and then we try to store 5% you know, towards savings for these farmers so that in the long run they would be able to you know, tap into*

> *these funds to be able to sustain themselves. But it's very difficult, the cost of labour, cost of inputs, very difficult" (Responent 74)*

However, it should be noted that farmers face many barriers for export, including meeting quality and packing standards. This is particularly difficult in the St. Lucian context due to the experience with bananas:

> "*But with the banana industry the model that, it's claim to fame made people think that marketing is, plant, deliver and get paid… They don't realize that … you paying the gentleman to do the marketing for you so since there's no structure like that for non banana products there's obviously a gap in the market. But so even understanding, but even sometimes our officers have that same mentality so you can't even get the framers out of it because they people needed to get them out of it in the same place with them*." (Respondent 132)

Many farmers raised this established culture of expecting the government to secure markets for agricultural producers, some going so far as to suggest that there should be a regulated, guaranteed price (without any attendant discussion of the quota and trade barrier side of supply management, the latter of which is inconsistent with St. Lucia's trade liberalization policies.) One key informant termed this reliance on government as "dependency syndrome":

> *"sad to say the banana industry is not the only industry, farming industry, agricultural industry where we have that much of a dependency syndrome – we tend to depend quite a lot on the structures that are in place to assist them in getting whatever inputs that are required" (Respondent 74)*

The lack of an export sector coupled with a seasonally dominated vegetable production sector has food security and foreign exchange leakage implications beyond agriculture, but this can also be seen as an opportunity:

> *"millions of dollars are spent every year to buy food, you know, to feed our people and supply the hotels. What sense it makes, you have visitors, tourists coming from their countries, coming in here and we still have to buy the food stuff or whatever their needs are from their country to feed them. That's a good opportunity for us to produce and to sell to them, you know? (Respondent 127)*


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The Tourism Sector

Like many SIDS, St. Lucia's economy has a high reliance on tourism, which was worth 335,000,000USD and represented 56% of the country's exports in 2012. As agriculture's share of the country's GDP had decreased, St. Lucia's tourism export revenue has increased.

Tourism plays an important economic role in the Caribbean Given this important share of export revenue and what Timms (2006) characterizes as its "relative non-extractive nature", the development and maintenance of the sector are of high priority for economic stability. St. Lucia has been explicitly encouraging expansion of the tourism industry through 1996's Tourism Incentives Act, which provides tax relief and import duty exemptions for investors (Jules, 2005), and tourism has been established as a strategic economic development priority. Figures 5 and 6 illustrate general positive growth in tourism arrival and revenue since the implementation of the Act, albeit with a number of fluctuations which correspond to events in the United States (the period following Sept. 11, 2001; the economic downturn beginning in 2008) as well as disruptions in the industry due to hurricane activity (Hurricane Dean, 2007; Hurricane Tomas, 2010).

Stayover data do not capture cruise ship arrivals, which consistently exceed 600,000 visitors annually for St. Lucia (Caribbean Tourism Organization). Cruise passengers generally have access to full board on ships, and in-country revenue is limited to souvenir sales (e.g. crafts), local transport, visits to local attractions and some limited restaurant revenue.

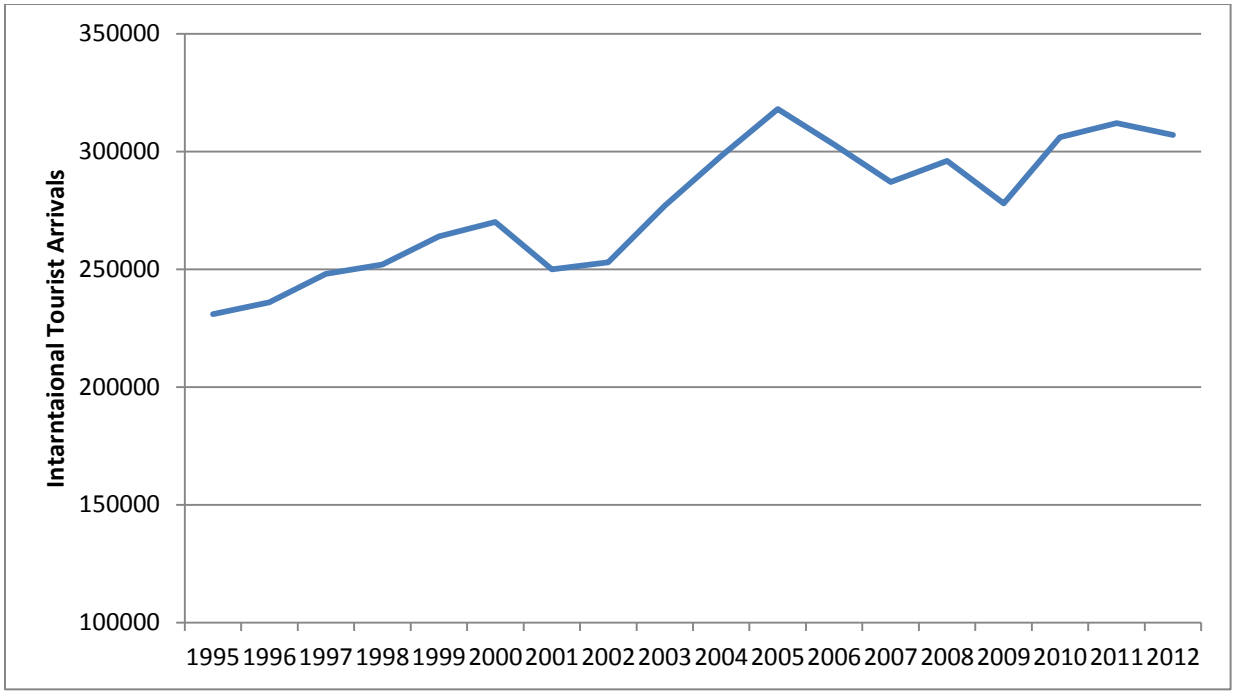

Figure 5 International Tourist Arrivals, St. Lucia, 1995-2012 (Produced with data from the World Bank Development Indicators)

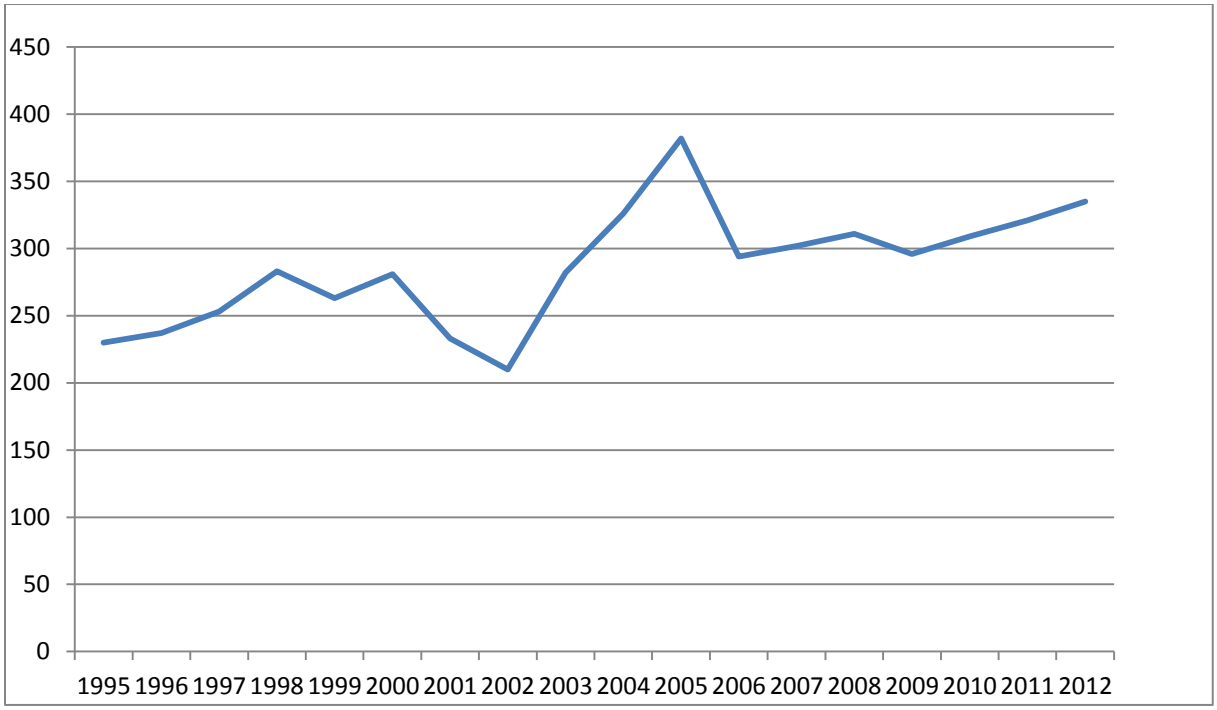

Figure 6 Receipts from International Tourism, Current USD, in Millions (produced with Data from the World Bank Development Indicators)

At the aggregate scale, growth in revenue from St. Lucia's tourism industry paints a positive picture. However, there is evidence that much of this revenue does not stay in the country and thus benefit St. Lucians as much as it could at the community scale due to tourism leakage. Tourism leakage is the share of revenue spent by international tourists which does not remain in the domestic economy (e.g. airlines, after-tax profits from foreign-owned enterprises, food import costs). Caribbean tourism generally has very high leakage, with many all-inclusive developments under international ownership exhibiting rates up to 80%. St. Lucia's tourism leakage was estimated at 56% in 1996 (UNEP, n.d.). The St. Lucia Tourist Board estimated that foreign companies own at least 55 to 60% of all hotel rooms, and recent increases in package tour visitors (all-inclusives) contribute to leakages (Jules, 2005). However, leakages can also be lowered through better linkages between sectors (in particular, between tourism and agriculture, or tourism and fisheries), and evidence from 1999-2003 indicated that imports

were declining as a share of gross revenue (Jules, 2005). However, direct impacts on the livelihoods of local populations are primarily felt at the community level.

St. Lucia experiences two tourism peaks – during the late northern hemisphere winter (March) and during July (northern hemisphere summer holidays, which can include non-resident St. Lucians returning home.)

Tourism in Soufriere

The Organization of American States at the request of the Government of St. Lucia prepared a Tourism Development Plan for Soufriere in 1985. Soufriere is somewhat distinct from many Caribbean tourist destinations as it is considered the main non-beach attraction in St. Lucia (OAS, 1985). This presents opportunities for a unique product, but also poses challenges with realizing local benefits as, historically, tourists stayed elsewhere on the Island (primarily in the north, from Marigot Bay to Cap Estate) and visit Soufriere for only a number of hours (OAS, 1985).

The chief attractions in Soufriere Quarter are the Pitons National Park and Sulphur Springs, with Soufriere Town, the rainforest, Diamond Baths and various beaches serving as supplementary attractions. The 1985 OAS Study estimated that 30% of all stay-over and 25% of cruise ship arrivals visit Soufriere.

Tripadvisor.com currently lists 25 formal accommodation properties, 43 vacation rental properties and 25 restaurants in Soufriere Quarter. The majority of the formal accommodation and vacation rental properties are small (e.g. staffed villas, unstaffed villas, guest houses, bed and breakfasts). There are a number of midsize (10-20 rooms) properties, and only a handful of larger ones. These are Jade Mountain/Anse Chastanet (49+29 rooms), Sugar Beach (formerly Jalousie) (78 rooms) and Ladera (32 rooms). Very few of the properties are located on the beach – the chief exceptions to this are Anse Chastanet and Sugar Beach, which include beachfront suites. Even “beach houses” are usually situated somewhat above the beach, with ocean views. The majority of the accommodations, including some premium accommodations

such as Boucan/Hotel Chocolat are located inland. This is representative of Soufriere's somewhat non-traditional reliance on non-beach amenities, though the area does include some nice beaches. Most of the larger properties and serviced villas offer full board (or the option of full board), while smaller and in particular in town properties only include breakfast.

Soufriere is a popular stop for cruise ships, with up to seven ships stopping in per month. Peak months for cruise tourism are December, January and February.

Exposure-Sensitivities in the Tourism Sector

Tourism, while dependent on a natural resource, is not as intimately tied to variations in weather as agriculture. However, there are a number of climate-related exposures relevant for the Soufriere tourism sector.

Small Island Development States are frequently dependent on beach tourism, and there has been some concern about beach loss due to **erosion**, particularly **hurricanes**, and **sea level rise**:

> *"Well, you know, the sea swells, the movement, because as a young... I was born here... and as a young boy we had a huge gap from the sea wall to the sea, where you could run and dive. And now the water's really right up to the sea wall, so we have had some changes." (Respondent 102.*

And

> *"The beaches have changed, every time you get a hurricane, every time you go and look at the beach it's changed, it's got shorter and we lose a lot of beach because our water's very deep, it doesn't come back in to shore, once it's gone off shore it doesn't come back so" (Respondent 30)*

Concern about beach loss and sea level rise was much lower than would be expected in a Caribbean Island, but this is related to Soufriere's primarily non-beach tourist product. However, non-beach tourism does include reef tourism (primarily snorkeling), and the area has experienced coral reef degradation. Two respondents commented on past coral bleaching events (which is linked to sea surface temperature), in 2005 and 2010. Coral bleaching makes

the reef less visually attractive to snorkeling, and repeated events weaken the reef and thus increase exposure on shorelines.

There was significant concern about reef degradation due to runoff from land, particularly after major precipitation events such as Hurricane Tomas, but also due to sewage pollution:

> *"Especially the hotels dumping the sewage into the water. I don't want to mention names but everybody knows, people have lost their jobs for this." (Respondent 157)*

Reef degradation particularly impacts glass bottom tour and dive tour operators:

> *"But I wouldn't go diving there in that reef, it's dead. A lot of it is from environmental reasons – hurricanes and surges, and so on and so forth – but a lot of it is pollution, because a lot of these places, they don't have proper sewerage systems. If you go to Anse Chastenet you'll smell it." (Respondent 168)*

Tour operators were also concerned with a decrease in fish diversity and abundance:

> *"some days when you're out there you don't see any fish and you have to turn it into a like conservation and educational tour to let them see what' coming out of the river and speak to them about what you don't want and the effects on the sea and that kind of thing, because there is not much to see in terms of the fish" (Respondent 44)*

and

> *"Seen a drastic drop in the fish. Even the turtles, you know, don't see them as often as you used to. Even the dolphins, I guess because we don't have as many fish, even the dolphins don't come here as often as they used to." (Respondent 156)*

Anecdotal reports of reef degradation are supported by scientific data. St. Lucia's State of the Environment Report (2006) notes that the reefs near Anse Chastanet evidenced a 62.5% decrease in deep water hard coral cover, while, at the same time, algal cover (which is linked to nutrient contamination from agricultural and sewage runoff) increased by 45.45%.

Tourist arrivals are naturally sensitive to **hurricane activity**, and the impact of Hurricane Tomas was felt not only during the event but also during the rebuilding phase:

> *"business was pretty much like after that, the whole month was very quiet because most of the hotels we worked, the hotels in Soufriere, so you find that there were no guests at the hotels and so we had no tours going out. Like there was no cash flow, no money coming in so there were no tours going out" (Respondent 107)*

A temporary decline during hurricane recovery affected all elements of the tourism sectors, from accommodations through tour operators, restaurants and craft vendors.

Finally, there was some minor concern that rain might deter tourists, and that a shift in the predictability of the wet and dry seasons would affect this. However, given the short-term nature of rain events, this primarily affects tour operators – and, unless rain lasts for multiple days, most visitors will simply wait for a better time.

Non-climatic exposure-sensitivities

Given its reliance on offshore markets, St. Lucia is exposed to shifts in travel behaviour. The primary market for St. Lucia's tourists is the United States, followed by Europe and Canada. Even leaving aside variations in tourist arrivals, some respondents noted that tourists were spending less money.

> *"But definitely you can see a big difference in the cruise ship industry the numbers of cruise ships and also the clientele and how they are spending. People not spending like they used to, you know so I guess economic crisis throughout the world." (Respondent 157)*

This in turn has led to some resentment from informal vendors:

> *"I'm going to tell you who benefits from the industry; I'll be honest and tell you that. You see people like us we'll not benefit" (Respondent 154)*

However, others are frustrated with their fellow citizens for not keeping the tourism resource more attractive:

> *"there aren't any garbage bins in the town of Soufriere. I speak to the guys, don't throw their plastic on the beach, they will say bossman where you want me to throw it. So I'd say give it to me I'll throw it in my bin cause there aren't any." (Respondent 4).*

Many of the tour operators, craft operators and some restaurant operators and boutique operators are concerned about the impact of all-inclusive hotels, given that tourists would spend all their money in one place (and, if the resort is owned by an offshore company, these benefits would not remain locally). For example:

> *"Sometimes the peak season we don't do as well. Because most times the peak season the boat will just take the people from the boat to the volcano and the other places and then go back to Castries and the low season you would find them walking about. When they didn't come on big tours you would find them walking about the area, in the town and they would come in." (Respondent 78)*

Adaptations in the Tourist Sector

Tourism development in St. Lucia and Soufriere has been a success. For example, the town has recently experienced an increase in cruise ship arrivals, with attendant benefits for Soufriere Town and tourism operators. Although Soufriere experiences many of the challenges of other Caribbean destinations (visitor harassment, dependence on the global economy, high leakages), is has not seen major disruptions.

Climate change and its attendant effects – changing storminess, sea level rise, beach erosion, coral reef degradation – are certainly on the horizon in Soufriere. There are some issues such as storminess which are beyond the control of a community; others can be influenced. The primary adaptation in Soufriere with respect to the reef (and thus reef tourism and erosion protection) has been the establishment of the Soufriere Marine Management Area (discussed extensively in Pittman and Armitage, forthcoming, based in part on this field season).

Soufriere is in a comparatively good position with respect to sea level rise and beach erosion because it is already far less dependent on a beach tourism product than other destinations. However, it is not immune from these issues, as many of Soufriere's visitors stay in beach-oriented locations elsewhere on the island. If these beaches degrade, tourist numbers are at

risk. However, Soufriere's primary tourist attractions and many of its accommodations do not directly rely on the beach for their success.

The Fishing Sector

St. Lucia's fisheries sector is primarily artisanal. Fisheries contribute only 25% of the GDP attributable to agriculture and fisheries (James, 2002), but provide employment for 2319 registered fishermen (FAO, 2007) and up to 3000 persons total (James, 2002). Despite a shelf area of 522 square kilometers and a substantial fishing population, St. Lucia is primarily a fish importer. In 2003, 1440 tonnes of fish were harvested from St. Lucian waters, but only 13 tonnes of this was exported while a further 3303 tonnes were imported (FAO, 2007).

In addition to the over 2000 registered fishermen (59% of which are full-time) and some unregistered fisherfolk, the sector includes approximately 120 fish vendors and processors (FAO, 2007).

Traditionally, fishing relied on wooden boats, though many of these have largely been replaced by fibreglass pirogues and now account for less than 40% of the 690 registered vessels (FAO, 2007). The majority of the boats are now open pirogues, although there are a small number of longlining vessels greater than 12m in length. Both pirogues and longliners are powered by 40-115 hp outboard (or inboard, in the case of longliners) engines.

More than 65% of the fish harvested in 2006 were migratory pelagics (primarily tuna, dolphinfish/mahi mahi, wahoo, flying fish and shark). In addition, St. Lucia harvest shallow reef fish (snapper, various finfish) and shellfish (lobster, conch, sea urchin) as well as some minor octopus fishing (FAO, 2007). The primary fishing season runs from November to June. St. Lucia has seventeen fish landing sites, which are characterized as being of primary (n=4), secondary (n=4) and tertiary importance. Soufriere is classified as a secondary landing site.

Soufriere accounted for just under 7% of St. Lucia's total landings by weight in 2006, at 88.48 tonnes harvested (FAO, 2007). The most common species landed by weight is tuna, followed by dolphin; however, fishermen in our study reported fishing mostly for jacks, ballyhoo and sardines (all of which fall into the FAO's "other" category, which represents over half the fish

volume landed in Soufriere). In 2000, landings at Soufriere were valued at 1,035,639XCD, and there were 92 registered full-time and 61 registered part-time fishers in the community. Soufriere faces some challenges relative to other landing sites in that the landing site is located furthest of all the sites from St. Lucia's offshore fishing grounds, which is where migratory pelagics are primarily found. The fishermen included in our study still relied on traditional technologies such as seine nets and fish pots, although some of the fishermen had received training on tuna long lines in Grenada. Until the late 1990s, gill nets were also commonly used, but these are no longer permitted in the Soufriere Marine Management Area.

Fisheries Exposure-Sensitivities

Fishermen working out of Soufriere report declining species abundance, which leads to lower catches. While no climate link to fish abundance was made explicit, fisherfolk were not entirely sure on the reasons:

"*The catches nowadays are rather low. From 2011, it's rather low. Some people are saying due to climate change, or there are not enough FADs in the water, or the water gets warm so the fishes go deeper cause now the fishermen have to go deeper for the fish or they're saying probably because of the seaweed that's in the area now. The catch is very low*." (Respondent 115)

However, others noted that declining catches are in part related to poor management practices, primarily the capturing of juvenile fish:

> *"The local fishermen they use the nets and of course the diameter is so tiny that they entrap every little baby fish and of course if you destroy the small fishes there is no need for the big fishes to come here and feed. So this is a major problem that we are experiencing right now, the fishes, the catches are every limited now" (Respondent 142)*

This affects the fishery not only by taking fish before they have a chance to grow bigger, but also because larger predatory fish are less likely to be present if there are no small fish:

> "*Whatever I get to make a dollar, I'll take. That's their mentality, but they don't think about ten years down the line, they don't think about their livelihood. It's the same thing about the small fishes. When they go to sea, they catch the small fishes they*

don't let it go they bring it cause that will give me a dollar. But then at the end of the day people don't want the small fish and they end up throwing it back." (Respondent 115).

Although declines have been reported in catches of all pelagic species, the outright disappearance of the migratory flying fish in St. Lucian waters starting in 2010 is particularly noticeable:

> "*But it is about two years now we eh see no flying fish. We used to have flying fish every year, from the time I was born. Up to this year and last year we eh see no flying fish, that's the only two years we eh see no flying fish*." (Respondent 25)

While fisherfolk frequently made the link between a healthy reef and an abundance of reef fish, they did not specifically link this to changing climate (and reef health, as discussed above, has both climatic and non-climatic components.) The only direct links to climate-related exposures were changing ocean currents and changing wind patterns:

"Well the weather patterns for example, you have more hurricanes. I think this year might be a bit different but last year storms and high seas you could see a difference. For example before about 20 years ago around that time fishers used to go out after some small flying fish. They use to call that, there' a patios name for that, and right now you not seeing that." (Respondent 13).

And

> "*When I was growing up and becoming a fisherman the current was real mild, no strong current or nothing, but because of this weather pattern it's like moon phase and the current, everything has just changed… it's not the same. This right now, this is time that you supposed to be getting good current where you could go out fishing, doing a bit of bottom fishing, but you cannot, because of the current*" (Respondent 66)

Non-climate-related exposures included the high price of gas, particularly so as fishers are now traveling further for harvesting:

"Well what I might change if I woulda be there is like try and put the petrol down. Because the petrol is a little bit too expensive you know, paying a gallon of petrol almost $16. And we sell a pound of fish for $7 you understand. So that's why I don't much go to sea now because I seeing it don't make no sense. When you buying a

> *gallon of gas for almost $16 and you selling a pound of fish for $7, you have to do a big catch for you to have something for yourself, as though you working for petrol." (Respondent 68)*

Furthermore, there is no formal marketing of fish. Many fisherfolk reported using their catch for direct consumption, and some take it to the Soufriere and Castries markets. Fishermen with larger operations do sell to local restaurants and hotels, though they have noted that the unpredictability of their catches in recent year has meant that fishers out of Vieux Fort (a primary landing site) have been encroaching on this market:

> *"I sell for Anse Chastanet once, sometimes Jalousie but fishermen in Vieux Fort mostly taking the market…. Yeah. Not really fishermen, there have some guys they buying the fish, they have the contact with the hotels. But they..we talk about ..they talk about that in Soufriere. We in Soufriere we suppose to sell fish for the hotels in Soufriere." (Respondent 19)*

Finally, not all fisherfolk are clear on fishing regulations. Questions as to net sizes yielded various results, and several respondents noted the need for more training particularly with respect to invasive species such as the lion fish but also non-traditional technologies such as longlines and GPS navigation. However, there was a perception of insufficient support for this:

> *"There was one training that they did to build a long line but how many persons can afford to do it? How many persons remember how to do it? So off and on you must have refreshers to have them less concentrate on the shore and go deeper." (Respondent 115).*

Adaptations in the Fishery Sector

Individual adaptation in the fishery sector is limited to changing how fish are harvested, where fish are harvested, or the choice to pursue fishing altogether. Several fishers reported travelling further from Soufriere to find migratory pelagics, though there was no discussion on changing technologies for more effective harvesting. By far the most common adaptation employed by fishers was livelihood diversification (i.e. reliance on non-fishery income):

"*You can't, in St. Lucia you can't survive in with fishing alone you must to do other things. Sometimes if you get a little job on the shore, you have to go and do it, leave the fishing and go and do it because fishing so hard outside there*." (Respondent 141)

At the institutional level, St. Lucia has implemented two major adaptations targeting the fishery. The Soufriere Marine Management Area (SMMA) (discussed more extensively in Pittman and Armitage, forthcoming) was established in 1994. 11km of coastline were designated with various priority areas, including yachting, fishing, recreational, marine protected area and multiple use. Reef protection contributes to the recovery of reefs by prohibiting direct contact (e.g. anchoring) and resource harvesting in crucial fish nurseries. However, several fisherfolk do not see the benefit of the SMMA, and perceive it to be primarily for tourism:

> *"The marine reserve because all the proper place we used to go and fish they take it and divers is taking over now, they do money on it and we get nothing out of it. All the divers to go on dive there you have to pay. A vessel come ashore anchor on the marine, they have to pay for that. They do a route and the poor people here they don't get nothing from it." (Respondent 20)*

and

> *"Where these fellas take for marine reserve, that is where I used to fish before and catch some good fish. Now right now they say it is marine reserve you can't fish from there but I know it's there....what they said again...they tell you that is where fish have to come and lay so people cannot fish there." (Respondent 142)*

The second major institutional adaptation is far more popular with fishers. Since the late 1980s, St. Lucia has been using Fish Aggregating Devices (FAD) (man-made anchored fish attractants). There are over 12 FADs in St. Lucian waters (CRFM, 2013), three of which are within 6-12km of the Soufriere landing site. FADs take pressure off inshore fisheries. Fishermen generally were in favour of FADs, and felt they improved their catch:

> *"When you see that fad there, the people not suffering that much .. but they need to be better marked so that larger boats passing by don't cut the line: For instance, when*

we put the fad in, outside there, they should direct the boats and cargos; tell the boats where to pass." (Respondent 141)

Summary

This report presented a preliminary baseline community-based vulnerability assessment for three sectors in Soufriere Quarter, St. Lucia. While all three sectors are vulnerable to climate change, there was significant variation among agriculture and tourism operators for dealing with this variability. In agriculture, the larger farmers had access to more technology and credit, which increased the suite of adaptation options available to them. Conversely, smaller farmers had less invested, and were able to return to "business as usual" more quickly. The tourism sector was generally well adapted to current variability, and somewhat less exposed to climate change than more beach-dependent destinations. However, the prospect of sea level rise, coral reef degradation and beach erosion do present threats to a significant part of the St. Lucian tourism product that is largely beyond the control of the local industry. The fisheries sector was dominated by artisanal production, and has already experienced significant decline and an attendant decrease in full-time fishing and an increase in pluriactivity.

The three sectors were reported on independently, but it should be noted that they are mutually interdependent. The agriculture sector relies on the tourism industry for some of its market, particularly in commodities such as fresh flowers. The fishery sector similarly looks to the tourist industry for markets. However, given that St. Lucia cannot presently meet either its agricultural or fishery needs with domestic production, this dependence is not as strong as it would be in a situation of over-supply. However, St. Lucia's liberal trade policies mean that domestic production must compete with low-priced imports.

The tourist industry, while economically dominant, is strongly affected by changes in fishing and agriculture. Beyond the direct supply linkages (which influence tourism leakage), the tourism product relies on well-managed resources for clean beaches and healthy reefs. These in turn are influenced by agricultural practices that minimize runoff and fisheries management that minimizes damage to the reef. The tourist industry has direct impacts on agriculture through competition for suitable land, and on the fishery through nutrient contamination from sewage

runoff and some damage from tourism use of reefs. Consequently, all three sectors rely on sound multi-sector land use policy.

This report represents a vulnerability baseline which can be applied to climate and socio-economic trends to give insights into future vulnerability. Limitations include an under-representation of powerful players in the tourism industry, as none of the larger, high-end tourism establishment owners participated. We thank the interviewers and the 175 research participants. This report is a draft working paper, and all misinterpretations are on the part of the authors.

References

Burton, I. and May, E. (2004), The Adaptation Deficit in Water Resource Management. IDS Bulletin, 35: 31–37.

Burton, I. 2009. Climate change and the adaptation deficit. In E.L. Schipper and I. Burton (Eds.), The Earthscan Reader on Adaptation to Climate Chang. London: Earthscan,. 89–98.

Caribbean Regional Fisheries Management Secretariat (CRFM). 2013. Report of the CRFM/JICA Fish Aggregating Devices (FAD) Management Workshop for OECS Countries, 13 March 2013, Roseau, Dominica. CRFM Technical and Advisory Document, No. 201/5. 61p.

Caribbean Tourism Organization (various years). Country statistics for St. Lucia. Online at http://www.onecaribbean.org/statistics/

Food and Agriculture Organization of the United Nations (FAO). 2007. Pofil de la pêche par pays – St. Lucia. Online at http://www.fao.org/fi/oldsite/FCP/en/LCA/profile.htm.

Girard, F. 2010. Making a case for greenhouse farming. The Voice. Online at http://www.thevoiceslu.com/features/2010/july/17_07_10/Making.htm

James, C. 2002. National Report of Saint Lucia; in Western Central Atlantic Fishery Commission (WECAFC). Fishery Governance Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 26 August 2014 (St. Lucia last updated 2002). Online at http://www.fao.org/fishery/rfb/wecafc/en

Jules, S. 2005. Sustainable Tourism in St. Lucia: A Suitability Assessment of Trade and Liberalization in Tourism-services. Winnipeg: IISD.

Ministry of Agriculture, Forestry and Fisheries (MAFFF). 2007. 2007 St. Lucia Census of Agriculture: Portrait of the Main Findings. Summary of Censal Results and their Comparison with Previous Censuses. Castries: Government of St. Lucia.

Organization of American States (OAS). 1985. Tourism Development Plan for Soufriere, Saint Lucia. Prepared by Division III, Department of Regional Development. Online at http://soufrierefoundation.org/assets/resources/Tourism_Development_Plan_for_Sourfriere_Saint_Lucia.pdf

Pittman, J. and Armitage, D. Forthcoming. Governance fit for climate change in a Caribbean coastal-marine context. Forthcoming in Marine Policy.

Saint Lucia Country Strategy Paper for the Banana Industry, Agricultural Diversification and the Social Recovery of Rural Communities. No date. UNCTAD Discussion Paper. Online at: http://www.unctad.info/upload/Infocomm/Docs/bananas/sl.pdf

Second National Communication on Climate Change for Saint Lucia. 2011. Prepared on behalf of the Government of Saint Lucia Ministry of Physical Development and the Environment Sustainable

Development and Environment Division, in fulfilment of its obligations under the United Nations Framework Convention on Climate Change. Online at unfccc.int/resource/docs/natc/lcanc2.pdf

Smit, B. and Wandel, J. 2006. Adaptation, Adaptive Capacity and Vulnerability. Global Environmental Change 16 (2006) 282–292.

Timms, B. 2006. Caribbean agriculture-tourism linkages in a neoliberal world: problems and prospects for St. Lucia. International Development Planning Review, 28(1): 35-56.

GEO Saint Lucia 2006 – St. Lucia's State of the Environment Report, 2006. Ministry of Physical Development and Housing. Online at http://www.pnuma.org/deat1/pdf/GEOSaintLucia2006.pdf

United Nations Environment Programme (UNEP). No date. Negative economic impacts of tourism. Online at http://www.unep.org/resourceefficiency/Business/SectoralActivities/Tourism/FactsandFiguresaboutTourism/ImpactsofTourism/EconomicImpactsofTourism/NegativeEconomicImpactsofTourism/tabid/78784/Default.aspx

Soufriere Foundation (website). No date. http://soufrierefoundation.org/about-soufriere/economy and http://www.thevoiceslu.com/features/2010/july/17_07_10/Making.htm Accessed October 2014.

World Bank Development Indicators – Saint Lucia. 2014. Online at http://data.worldbank.org/country/st-lucia

Appendix 1

GIVRAPD Research Team – St. Lucia

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