

Saint Lucia Climate Change Baseline Assessment Report



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Supported by:

Government of Japan, through the United Nations Development Programme's Japan-Caribbean Climate Change Partnership (UNDP J-CCCP)

In collaboration with:

Government of Saint Lucia

Suggested citation: The Cadmus Group LLC (2016). Climate Change Baseline Assessment Report. The Cadmus Group LLC in collaboration with the Department of Sustainable Development, Ministry of Education, Innovation, Gender Relations and Sustainable Development.

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LIST OF ABBREVIATIONS

CARICOM	Caribbean Community
CBD	Convention on Biological Diversity
CCCCC	Caribbean Community Climate Change Centre
CHARIM	Caribbean Handbook on Risk Information Management
CPA	Country Poverty Assessment
DRR	Disaster Risk Reduction
DVRP	Disaster Vulnerability Reduction Project
ECMMAN	Eastern Caribbean Marine Managed Areas Network
EU	European Union
GAPP	Green Architecture Promotion Pilot
GCM	general circulation model
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GIS	geographic information systems
GNI	Gross National Income
HDI	Human Development Index
IA	Institutional Assessment
INDC	Intended Nationally Determined Contribution
IPCC	International Panel on Climate Change
IUCN	International Union for Conservation of Nature
J-CCCP	Japan Caribbean Climate Change Partnership
LEAP	Long-Range Energy Alternatives Planning
LED	light emitting diode
LUCELECS	Saint Lucia Electricity Services Limited
MW	megawatts
NAMAs	National Appropriate Mitigation Actions
NAP	National Adaptation Plan
NGOs	non-governmental organization
OECS	Organisation of Eastern Caribbean States
PPA	Participatory Poverty Assessment
PPCR	Program for Climate Resilience
PPCR	Pilot Program for Climate Resilience
PRECIS	Providing Regional Climates for Impacts Studies
RCM	regional climate model
ROI	return-on-investment
SIDS	small islands developing states
SLC	Survey of Living Conditions
SPCR	Strategic Programme for Climate Resilience

UNDP United Nations Development Programme
UNFCCC United Nations Framework Convention on Climate Change
USAID United States Agency for International Development
WRMA Water Resources Management Agency

EXECUTIVE SUMMARY

Saint Lucia has a strong track record of integrating climate change into relevant national strategies, policies, and projects, as evidenced by the extensive development of assessments, policies, legislation, and plans to support climate change efforts. The purpose of this report is to:

- Provide a baseline assessment of socioeconomic and environment information for Saint Lucia.
- Improve situational awareness of the status, and path toward completion and implementation, of the National Adaptation Plan (NAP) and National Appropriate Mitigation Actions (NAMAs) for Saint Lucia.
- Analysis of key sectors that are vulnerable to climate change and suggest potential interventions to reduce vulnerabilities.
- Identify key entry points for climate change pilot projects in Saint Lucia.

There were three phases to complete this report: 1) an initial review of literature and available information on climate change related projects, policies, and strategies in Saint Lucia, 2) a stakeholder engagement field visit to Saint Lucia to gain further understanding of the complex climate challenges facing Saint Lucia and improve understanding of NAP and NAMA status and path forward, and 3) analysis of information gathered during literature review and the stakeholder engagement visit and provide situational awareness of climate change issues and progress in Saint Lucia.

Some key findings of this Baseline Assessment include:

NAP: The Ministry of Sustainable Development is leading the development of the NAP for Saint Lucia; the NAP is in its early stages of development and the Ministry expressed that they would like it to include sectoral adaptation plans, specific thematic areas, as well as investment plans that tie directly to the sectoral adaptation plans and thematic areas. Currently, there are several policies and plans completed to support the NAP process. The foundation of Saint Lucia's efforts to develop a NAP is the National Climate Change Adaptation Policy and Strategic Programme for Climate Resilience (SPCR). This document and its programs may form part of the foundation for sectoral adaptation plans. For example, a National Adaptation Strategy and Action Plan has been developed for the tourism sector. Vulnerability and Adaptation Assessments have also been completed as part of the National Communication process to the UNFCCC (2nd and 3rd). The risks to the following sectors should be incorporated in the draft NAP: agriculture, coastal zone management, natural resources, fisheries, forestry, health, infrastructure, disaster risk reduction, tourism, and water.

NAMA: Saint Lucia has outlined a robust plan to reduce emissions in their NDC, as well as other policies. In addition, there are several projects that are working to reduce emissions, particularly in the energy sector. The Renewable Energy Division is the umbrella agency working in collaboration with the SDED on emissions reduction. However, there is not clear path to create a NAMA. Saint Lucia would benefit by having a NAMA to have all emission reduction efforts under a consolidated policy and/or action plan, with priority sectors and actions identified within the policy.

Sector analysis: As a small island nation that relies on natural systems to provide services and livelihoods, almost all sectors will be impacted by climate change in Saint Lucia. Tourism and agriculture, Saint Lucia's primary economic sectors, are especially at risk due to increases in temperature, sea level rise, increased intensity of storms, and changes in precipitation patterns.

Pilot projects: Pilot projects will be most effective if they target communities that are most vulnerable to climate change (such as impoverished communities, those living in coastal areas, women, and youth), have plans for

sustainable financing, and align with priorities outlined in key national strategies such as the NAP and the foundational documents for the NAMA.

Priority recommendations from the assessment include:

Begin process to develop NAMA: The foundational documents are in place to create a NAMA. A potential first step would be to have a workshop that maps the process to create a NAMA.

Continue and accelerate the process to develop the NAP: The foundational documents are in place to develop the NAP and multiple adaptation activities are already planned or underway, especially related to disaster risk reduction. The next step is consolidating the adaptation plans and activities that are occurring across sectors to develop plans for existing gaps in programming and funding.

Improve foundational knowledge across sectors for climate change work: There is a need for climate related knowledge or analysis to support decisions, and funding for climate related projects across sectors. Some examples include:

- Improved understanding of how climate change will impact watersheds and ability to meet future water demands. Related, monitoring stream flow and correlating with climate and weather data would improve Saint Lucia's ability to manage water resources.
- Better understanding of how climate change will impact fish species migration;
- Improved understanding of how climate change will impact inland ecosystems, which have a direct impact on downstream coastal environments and livelihoods; and
- Improved understanding of how ecosystems services provide livelihoods for Saint Lucians.
- A stronger cross-sectoral involvement in climate change adaptation and mitigation (led by the Government of Saint Lucia), coupled with robust education
- Capacity-building incentives, and poverty (vulnerability) reduction is highly warranted.

Institutionalize, identify, and access funding: Saint Lucia should include NAP and NAMA priorities (once they are formalized) in national budgets and strategic planning, as appropriate. The cost to implement the NAP and meet the goals of the NDC are not currently met, and are unlikely to be met through Saint Lucia's national budget. Through gaining access to the Green Climate Fund, as well as private sector investment and donor funding, Saint Lucia can implement the future NAP and NAMAs, and implement sectoral climate change related needs. Lastly, determining how to address needs through programming that provides multiple and cross-cutting benefits for climate change goals should be a long-term goal and considered continuously.

Improve baseline information on natural resources: Effective adaptation and mitigation plans rely on up-to-date information on the status of natural resources. Of particular urgency are a water resources inventory and assessment, an updated forest inventory, as well as a comprehensive marine habitats survey.

Create a climate portal: Consolidate geospatial data, reports, and policies relevant to climate change in a central location/agency. This will help government institutions work together on cross cutting climate issues. In addition, it will provide access to data to create comprehensive vulnerability maps.

A more comprehensive list of recommendations categorized by priority areas can be found in the Conclusions section.

INTRODUCTION

Island nations are disproportionately vulnerable to changes in the climate as their coastal areas are threatened with more intense storms, sea level rise, flooding and coastal inundation, loss of coastal resources, and displacement of communities. Freshwater resources, food and income, livelihoods, agriculture, and health in small island states are all vulnerable to climate change. Studies indicate that climate change has the potential to cost the Caribbean 10 to 22 percent of gross domestic product (GDP) through hurricane damage, loss of tourism, and unwanted impacts to infrastructure (Benjamin, 2010); thus, climate change adaptation and mitigation strategies are critically important to build national resilience. This includes adaptation measures for communities in a variety of settings (urban, rural, coastal, etc.) and industries such as tourism and agriculture. To make adaptation measures viable, and given the vulnerability of Caribbean countries and their collective negligible contribution to greenhouse gas (GHG) emissions, a priority for all Caribbean countries is for large emitters to mitigate contributions to emissions, which will, in turn, facilitate cost-effective measures being deployed to integrate climate change resilience. A major area of need for small island developing states in the Caribbean is in the area of climate finance and how to sustainably access funding to implement National Adaptation Plans (NAPs) and National Appropriate Mitigation Actions (NAMAs). Support can be provided to planners and stakeholders in each country to identify potential sources of funding for adaptation and mitigation activities. Stakeholder engagement activities and on-island data collection efforts will provide insight into current financing structures, the existing financial capacity of government institutions, and critical areas of need for climate finance.

Through this baseline assessment, it is hoped that information will be provided that strengthens the implementation of pilot projects and helps in developing future adaptation and mitigation projects. By improving understanding of the socioeconomic and environmental conditions in communities impacted by climate change in Saint Lucia, the country will be better prepared to implement activities to reduce climate vulnerability to sectors identified in NAPs and NAMAs, and improve the implementation and success of pilot projects.

Background

Saint Lucia is a small island located in the south-central portion of the Windward Islands, with mountainous topography and a limited, narrow coastal fringe. Topography is highly diverse; the highest peak, Mt. Gimie, is 1000 m above sea level; the island is characterized by deep valleys and steep mountain slopes, with significant natural forest cover in the interior. Forest land is increasingly being converted for agricultural and construction activities, particularly in fertile river valleys and along the coast. Annual precipitation is relatively high, but widely varying across the island due to topography, which is primarily driven by tropical weather disturbances during the rainy season. Economically, Saint Lucia is considered a middle-income small island developing state, with relatively consistent GDP growth since 2002. The primary economic driver is tourism, and the services sector made up 62% of GDP in 2010. Agriculture contributes minimally to GDP, and has decreased in importance since the early 2000s. Unemployment rates are high and have increased in recent years to approximately 25% (NAN Business Editor, 2016), with highest unemployment rates among women and in localized regions.

Similar to other mountainous island nations, the majority of the population lives in urban centers, and most settlements are along the narrow coastal fringe or in river valleys, increasing the vulnerability of the population to both sea level rise and intense storm events. Due to its geographic location along the hurricane belt and in a tectonically active area, Saint Lucia is vulnerable to natural hazards, including tropical storms, hurricanes, floods, drought, landslides, and earthquakes, which pose risk to the economic sectors, such as tourism and agriculture. Saint Lucia's mountainous terrain and volcanic geology make it especially vulnerable to landslides, particularly in the aftermath of heavy rains; other risks include low to moderate earthquake risk, storm surge, and flash floods. Much of Saint Lucia's housing is at risk of damage from landslides, as homes are distributed along the island's steep slopes. Furthermore, poor engineering and construction of homes exacerbates the risk of damage by landslides. Hurricanes can severely impact households via loss of assets, including crops,

homes, and loss of livelihoods. From 1990-2014, cyclones and storms were responsible for 74.4% of combined economic losses to Saint Lucia (<http://charim.net/stlucia/information>, 2014). Figure 1 presents a basic overview of administrative information for Saint Lucia.

Figure 1. General overview map of Saint Lucia.



Methodology

The Baseline Assessment was preceded by an initial desktop assessment, which consisted of reviewing relevant scientific literature, grey literature (e.g., annual project reports, white papers, and government documents), relevant policy papers, and documents related to regional INDCs, NAPs, and NAMAs. The team undertook the following steps for the preliminary desktop assessment:

1. To ensure the assessment includes the most up to date science, and is relevant for the current climate change policy situation in the Caribbean, the focus was on documents produced after 2010. When more recent information was not available, documents produced prior to 2010 were consulted;

2. Conduct a preliminary review of each document, specifically to identify the objective of the policy, plan, or assessment;
3. Identify data contained in each report, as well as likely data sources to target for additional research efforts;
4. Develop a short summary of each document, including objective, any methods used for assessments, results, and information on next steps;
5. Identify gaps in data or information that could be addressed with additional data collection and stakeholder engagement efforts; and,
6. Synthesize findings in a useful way to help understand the current status of, and guide a path forward for, Initial Nationally Determined Contributions (INDC), NAPs, and NAMAs in Saint Lucia.

After the initial review of documents produced since 2010, earlier documents were reviewed to expand understanding of climate-related planning efforts in Saint Lucia. Subsequent literature searches were conducted in cases where available documents indicated that updates should be available. There is a significant amount of overlap in the data and information contained in the documents reviewed for the preliminary desktop assessment. It was out of the scope of this preliminary assessment to understand the similarities and differences among datasets for the same subject. For example, multiple reports include various types of demographic data. It is unclear if these data were derived from the same source, such as a national census, or are from multiple sources. The comprehensive baseline development process will identify the most accurate and up-to-date information based on investigation of the data sources and communication with relevant stakeholders.

Based on this detailed data availability assessment, data gaps pertinent to the NAP and NAMA process were identified and incorporated into the country site visits and stakeholder interviews, which form part of the situation analysis. A subsequent field visit to Saint Lucia was carried out from September 11-14, 2016 and September 19-20, 2016. Approximately 25 persons were engaged in conversations regarding Saint Lucia's efforts towards establishing climate change adaptation, resilience and mitigation measures. Stakeholders were consulted in the form of group and individual meetings; and ranged from local community representatives to small business owners and government officials. Consultations included discussion of relevant data, as well as the identification of data and capacity needs to better address the NAP and NAMA development process.

In addition, six site visits were conducted during this period to corroborate and better understand needs for particular pilot projects, as well as areas vulnerable to flooding, infrastructure damage, and coastal erosion, and marine area impacts. Findings were compiled in the Stakeholders Engagement Report.

Results from the stakeholder's engagement report served as basis of the integrative evaluation of the current status the NAP and NAMA development process, as well as pilot projects in Saint Lucia. The synthesis of existing data and data gaps were incorporated into this evaluation to outline the major challenges and opportunities for significant advances in formulating and implementing a NAP and NAMA, supported by pilot projects, as presented herein.

SUMMARY OF ACTIVITIES

This section will summarize the documents reviewed to inform the baseline assessment; these documents were provided by United Nations Development Programme (UNDP), governments, via stakeholder interviews, and via online research; interpretation and relevance of these documents is discussed in the Results and Findings section. It summarizes Saint Lucia's efforts to-date related to understanding and planning for climate change.

Socioeconomic and Environmental Baseline Data Collection

Saint Lucia has collected the majority of the data required to develop a socioeconomic and environmental baseline as a result of numerous demographic, socioeconomic, and environmental assessments over the past decade, supported by both the Government of Saint Lucia as well as external donors. Many of these assessments have been conducted in support of policy or plan development, both national and sectoral, by internal and external institutions and stakeholders.

Demographic

The most recent national census in Saint Lucia was conducted in 2010. This census serves as the basis for the majority of the socioeconomic and demographic data that is reported in other more recent national plans, policies, and project documents. Data from this census was used to develop a community-level needs assessment in 2010 that defined a community-scale vulnerability score, described in more detail later in this section. Prior to the national census, Saint Lucia developed a poverty reduction strategy and action plan in 2003, although much of the data used to develop that plan is now outdated. In 2015, the Government of Saint Lucia released the National Social Protection Policy and the Strategic Plan of Action: Implementation of the Social Protection Policy, using data collected during the 2010 national census. No new social livelihood or demographic assessments were conducted during the development of the social protection policy.

The 2010 Population and Housing Census (national census) was conducted by the Central Statistics Office and analyzed to develop the Census Report. Data were collected for individuals and households, and compared to 2001 census figures, where appropriate. Specific data collected as part of the census are presented in Table 1.

Table 1. Socioeconomic data availability by type and year

Data Type	Date(s)
Population and household population	2010
Population by gender and other characteristics	2010
Household population by gender	2010
Number of dwellings by district	2001 and 2010
Trends in household population	1991, 2001, 2010
Population by political constituency and gender	2010
Population by age group	2010
Distribution of households by various characteristics (type of waste disposal, dwelling material, construction year, water supply source, fuel use,	2001 and 2010

Data Type	Date(s)
telecommunications, vehicle ownership)	
Crime rates	2010
Emigrant population by education and gender	Previous 10 years
Population by education and gender	2001 and 2010
Labour force indicators	2010
Employed and unemployed population by gender and age group	2010

As part of the analysis of demographic data collected for the 2010 National Census, and to support the development of other plans, policies, and assessments, Saint Lucia mapped poverty indices and other demographic data across the island. Census data were used to develop a “basic needs” index for Saint Lucia at the level of Small Areas, matching the data in the 2010 Community Ranking. Using this information, the National Social Protection Strategy (NSPS) was developed in 2015 to provide a policy framework to enhance equity, efficiency, and transparency in national social protection services. The strategy was designed to promote programs and interventions focused on poverty reduction and the protection of critically-vulnerable communities and demographic groups in Saint Lucia. The NSPS is the most recent national strategy related to demographics and socioeconomics, and was developed with data collected in 2005 for the Country Poverty Assessment and in 2010 for the National Census. No new data collection or assessment efforts have been conducted in the last five years.

The most recent comprehensive assessment of socioeconomic conditions in Saint Lucia, specifically focused on poverty and vulnerability, was the Country Poverty Assessment (CPA) conducted in 2005 and commissioned by the Caribbean Development Bank. This detailed assessment provides a significant amount of baseline socioeconomic data for Saint Lucia, but has not been updated in the past decade, leaving the relevancy of the data in question. The previous CPA was conducted in 1995, and current efforts are underway to produce an updated assessment. In July 2016, the Caribbean Development Bank disclosed its Enhanced Country Poverty Assessment Programme to produce high-quality data in participating Caribbean countries, including Saint Lucia. This program is expected to take approximately four years, with assessments completed by 2020, and will also result in the development of an Organisation of Eastern Caribbean States (OECS) Geographic Information Systems (GIS) platform to store and manage spatial demographic and socioeconomic data and support analysis, mapping, monitoring, and reporting. Primary objectives of the 2005 CPA included:

- Assessing current living conditions to evaluate the state of poverty in Saint Lucia, conditions and processes that foster poverty, institutional and programmatic responses to poverty, and a capacity assessment for further poverty reduction interventions;
- Identifying policies and programs that could reduce the extent and severity of poverty in Saint Lucia by encouraging social development and quality of life improvements;
- Developing a recommendations and an action plan for addressing issues related to poverty, including the existing legal and institutional framework for social development interventions; and,
- Train members of a National Assessment Team in the methodology for conducting poverty assessments.

The CPA provides a detailed breakdown, both quantitative and qualitative, of poverty in Saint Lucia, and attempts to provide recommendations and guidance on developing and implementing effective social development initiatives and programs. Details on the specific components of the Poverty Assessment are as follows:

- **Survey of Living Conditions (SLC):** This study was designed to collect the quantitative data that provides the foundation for a calculation of the national poverty line. It utilized household income and expenditure data and related it to demographic characteristics. Details on the types of data provided by this survey are included in the Results and Findings section.
- **Participatory Poverty Assessment (PPA):** This assessment was developed to complement quantitative data with responses from residents to expand the understanding of the characteristics of poverty in Saint Lucia. The PPA collected specific information on living conditions in selected communities to develop a holistic view of living conditions, analysed gender-specific data, identified vulnerabilities and risks faced by poor individuals and communities, and collected qualitative data from individuals, groups, and households to provide context and more detail to quantitative data. The PPA helps inform policies that focus efforts on the most critically vulnerable groups.
- **Institutional Assessment (IA):** To help inform national and community-level policy, this assessment determined the degree to which institutions and organizations consider poverty in their work, and how these entities currently and could potentially provide services to vulnerable communities and society overall. Information collected in the IA includes details on the objectives of each organization and its responsibilities and capacities. The IA determined a score for each organization based on interviews and secondary data. Scores reflect the level of institutional effectiveness in addressing living conditions and poverty mitigation.
- **Macro Socio-Economic Analysis:** To complement the more detailed assessments and provide a holistic view of SVG's economy, the macroeconomic analysis assessed how the quantitative and qualitative data collected as part of the other surveys and assessments can inform an understanding of nationwide conditions.

Data collected during the 2010 National Census was used to develop a “Basic Needs” score for communities in Saint Lucia at the Small Areas level. Scores were developed based on the presence or absence of certain conditions, and applied to each household or individual, aggregated to the household level, and normalized to the community based on the total number of households. Examples of scored conditions include household wall type, toilet type, and presence/absence of computers, light source, educational attainment, and employment. Scores for different conditions were developed, providing a roughly weighted approach that gives more “points” to conditions that decrease vulnerability or need to a greater degree. The resulting “needs score” for each community is therefore depending on factors like unemployment rate, overcrowding, household quality, and education, providing a powerful tool for identifying vulnerable communities.

Finally, the UNDP's Human Development Index measures long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge, and a decent standard of living. It is based primarily on international data from the United Nations Population Division (life expectancy), the United Nations Scientific and Cultural Organization Institute for Statistics (mean years of schooling and expected years of schooling data) and the World Bank (Gross National Income per capita data). Saint Lucia's Human Development Index (HDI) value for 2014 was 0.729, which placed the country in the high human development category. From 2000-2014, Saint Lucia's HDI value increased from 0.683 to 0.729, largely as a result of increased life expectancy, increases in mean years of schooling, and an increase in Gross National Income (GNI) per capita.

Climate and Weather

Efforts have been made in Saint Lucia to gather climate and meteorological data by both the Government of Saint Lucia and external organizations. Meteorological data is an important component of understanding current and historical conditions in Saint Lucia, as well as trends over time for long-term records, and can help organizations, researchers, and government officials compare actual weather data against climate projections from external groups. Meteorological data and services in Saint Lucia are the responsibility of the Saint Lucia Meteorological

Service, which manages two meteorological stations, one at the north end and one at the south end. The service provides 24-hour forecasting and observations, as well as some climatological support. Historical records are available from the Hewanorra International Airport station from 1973 to 2015, with daily rainfall data for 31 secondary stations across the island. During stakeholder meetings in September 2016, it was noted that maintenance of weather stations is challenging, especially for secondary stations, which are often damaged or lost in weather events or removed by individuals who may not realize the importance of the stations.

In addition to the collection and analysis of historical meteorological data, non-governmental organizations (NGOs) and research groups have developed climatological model projections using general circulation and regional climate models (GCMs and RCMs), following the projected change scenarios defined by the International Panel on Climate Change (IPCC) (<http://www.caribbeanclimate.bz/closed-projects/2009-2011-the-caribsave-climate-change-risk-atlas-cccra.html>). The most comprehensive climatological data was developed by CARIBSAVE for the CARIBSAVE Climate Change Risk Atlas - Climate Change Risk Profile for Saint Lucia in 2010, which provides detailed climate modeling results for Saint Lucia under three projected scenarios, in addition to a number of other assessments (<http://www.caribbeanclimate.bz/closed-projects/2009-2011-the-caribsave-climate-change-risk-atlas-cccra.html>). CARIBSAVE (part of the INTASAVE Caribbean group) is a regional non-profit organization that focuses on environmental and socioeconomic sustainability. The development of climate risk profiles for individual Caribbean nations was funded by the UK Department for International Development and the Australian Agency for International Development.

The methodology used by CARIBSAVE for climate projections utilized both a GCM ensemble of 15 individual climate models, and a RCM for the Caribbean region, Providing Regional Climates for Impacts Studies (PRECIS). The GCM provided large-scale simulations of future climate under different emissions scenarios, as defined by the IPCC, and the RCM allowed downscaling of the GCM projections to more accurately represent the specific climate projections for the region. Local observational meteorological data was incorporated into the models as applicable to validate projections at fine scales, further highlighting the importance of accurate historical and current meteorological data. For the Risk Profile, three IPCC standard marker scenarios were used – A2, a high emissions scenario; A1B, a scenario with rapid emissions increases followed by a plateau; and B1, a low emissions scenario. Projected changes were determined for a number of climate variables, including average temperature, average precipitation, average wind speed, relative humidity, sea-surface temperature, extreme temperature, and extreme rainfall. Projected increases in sea level rise were also modeled. CARIBSAVE attempted to model future changes in tropical storm and hurricane activity, and by consequence storm surge; however, climate models are still relatively primitive in regard to storm event modeling, making projections of frequency uncertain. Generally, climate models are in better agreement regarding the intensity of storms. As such, CARIBSAVE modeled projected changes in wind and precipitation intensities, with the objective of providing a rough indication of potential future conditions.

Some modelling work was also undertaken by the Climate Studies Group from Mona, under Saint Lucia's 2nd National Communication to the UNFCCC (2011), further to the preparation of vulnerability and adaptation assessments for various sectors. The development of the Tourism National Adaptation Strategy and Action Plan for SLU (2015) also included an impact assessment, to which this group contributed. The 3rd National Communication (2016) to the UNFCCC has also undertaken some modelling work on behalf of SLU. Further, under the Regional Track of the PPCR, at least three of the components are relevant to this kind of work, which complements work being conducted under the PPCR-DVRP for Saint Lucia specifically. There are four regional components, three of which are

- Component 1: Improving geospatial data and management for adaptation;
- Component 2: Meteorology and Hydrology;
- Component 3: Downscaling and expanded climate project models and high resolution maps;

Component 3 includes a Scientific Platform for Applied Research and Knowledge Sharing (SPARKS); a high performance computer system, funded by IDB under the Caribbean Regional Track of the PPCR; through UWI; two clusters of 34 very high powered computers; together, these can take in, store the large body of climate data that exists; climate modelling at the scale of Caribbean islands; regional tool, though it resides at Mona

Additional details on other components of the Risk Profile, including a sectoral vulnerability assessment and adaptive capacity assessment, are discussed elsewhere in this report.

Land Use/Land Cover and Natural Resources

Saint Lucia and multiple international groups have collected comprehensive land use and land cover data as part of risk assessments and national land use plans, with specific assessments for landslide risk and the agriculture sector. The relevant land management and land use policies and legislation in Saint Lucia include:

- Physical Planning and Development Act of 2001 and Amendments of 2005
- Coastal Zone Management Policy
- National Land Policy
- National Housing Policy
- National Energy Policy
- National Water Policy
- National Climate Change Policy and Adaptation Plan (2002/3); Revised Climate Change Adaptation Policy adopted in 2015
- National Agricultural Policy and Strategy (in development as of 2014)
- National Biodiversity Strategy and Action Plan
- National Tourism Policy
- Shore and Ship Waste Management Policy

The 2015 National Land Policy, which updated the 2007 National Land Policy, was finalized in late 2015 and was submitted to the Cabinet of Ministers for consideration and approval at that time. The National Land Policy used mapping and assessments of land use to support the policy, although it did not undertake a detailed assessment of natural resources as part of the update. The primary goals of the national land use policy are to improve the management of land resources; reduce vulnerability; optimize the contribution of land to socio-economic development, livelihoods, and cultural identity; and to rationalize land use and settlements.

A comprehensive forest inventory was undertaken in 2009. A natural resource management plan for the northeastern part of Saint Lucia was developed with support of GEF (GEF ID 5057).

Caribbean Handbook on Risk Information Management (CHARIM) is a regional initiative initiated by the World Bank to build capacity of government clients in the Caribbean, to generate landslide and flood and hazards and risk information for purposes of disaster risk reduction planning. It has various resources to help identify areas of high risk for landslides, floods, and other disasters, as well as resources to support planning to enhance resilience related to those disasters, via its Country Report for Disaster Risk Reduction. (<http://charim.net/Zero-a>). Finally, United States Geological Service (USGS) undertook land cover mapping of Saint Lucia and other Caribbean islands using Landsat Thematic Mapper and SPOT imagery in 2000 (http://lca.usgs.gov/lca/carland/dataproducts.php#st_lucia); however, no ground-truthing for these maps was undertaken.

Several studies on landslide risk have been undertaken for Saint Lucia since 1985; these studies are listed on the CHARIM website (<http://www.charim.net/printpdf/183>). In 2013, the Landslide Risk Assessment for Saint Lucia's Primary Road Network was conducted as part of the Hurricane Tomas Rehabilitation and Reconstruction Project

(Final Feasibility Report). The report describes the methodology and relevance of landslide risk assessment and its utility for disaster risk reduction and climate resilience planning. It provides a comprehensive analysis of landslide risk throughout Saint Lucia, including details on existing landslide paths and a GIS-based assessment of landslide risk. Furthermore, it includes a review of previous landslide risk studies, including an assessment of landslide susceptibility and risk from 2012. As a basis for the risk assessment, the report summarizes information on the geology and seismicity of Saint Lucia, provides a comprehensive hazard assessment, vulnerability analysis, and risk assessment. The report concludes with recommendations for slope management and stabilization. The appendices contain summary information used in building the landslide risk assessment, including a detailed review of rainfall and runoff, flood vulnerability, modeling results, and historical landslides. Figure 2 shows landslide susceptibility in Saint Lucia.

Figure 2. Landslide susceptibility map.



Additional flood hazard maps for the entire island were produced in 2006, 2012, and again, in 2015. Wind hazard maps and storm surge maps were developed for Saint Lucia by Kinetic Analysis Corporation (year unknown). Furthermore, a study on wind speeds was undertaken for Saint Lucia by the International Code Council in 2008 as part of the GEF- World Bank Special Programme on Adaptation to Climate Change (SPACC) Project.

As climate change modelling projections predict reduced average annual rainfall for Saint Lucia, assessment of watershed and river flow is critically important for water resource planning. The most detailed source for water availability is the Watershed-river analysis of Saint Lucia, West Indies (2012), which has very detailed information on each watershed in Saint Lucia, including the flow rate of rivers and streams, existing water intakes, and a rank in terms of water availability during the wet and dry seasons. The report assessed potential surface water resources using ArcHydro software. The methodology does not appear to include any “ground truthing,” so the information presented is entirely modeled. While the report includes relevant maps for each watershed in Saint Lucia, as well as modeled flow and elevation data, minimal narrative analysis is included; as such, it does not make specific recommendations regarding watershed management or assessment the ecological condition of the various watersheds. A flood hazard map developed in 2016 by CHARIM is shown in Figure 3.

Figure 3. Flash flood hazard map.



The Climate-Resilient Eastern Caribbean Marine Managed Areas Network (ECMMAN) project developed a framework to advance national and regional data collection and strengthen marine managed areas in the region. This included the ECMMAN Monitoring Network which collects, analyzes and shares data through standardized methods, specifically focusing on ecological, socio-economic, and marine management effectiveness. CaribNode is a clearinghouse of natural resource maps and documents to create resource management tools. Finally, the project developed “Coral Reef Report Cards” which assess coral reef health to support marine protection efforts. Major threats to marine areas in Saint Lucia are domestic and agrochemical pollution, sewage contamination,

deforestation and associated sedimentation, sand mining, coastal development, unsustainable fishing and hurricanes.

Sectoral Economic Data

Most of the sectoral efforts in Saint Lucia have been focused on the agriculture sector. One comprehensive sectoral economic assessment in Saint Lucia is the Assessment of the Economic Impact of Climate Change on the Agriculture Sector (2011), which evaluated the economic impact of climate change on the agriculture, tourism, and health sectors in Saint Lucia. This document provides a detailed review of the agriculture sector, with statistics on crop production and consumption, as well as forecasts for each agricultural commodity under projected climate futures. Recently, a diagnostic study of the agriculture sector was undertaken as part of a Caribbean Development Bank project, however the document was not readily available online.

In 2007, Saint Lucia released the Census of the Agriculture Sector, which provides detailed baseline statistics on production by commodity, as well as other useful data. More recent statistical data on crop availability was collected for 2009 to 2013, although this is merely a timeline showing what time of year different crops can be harvested. There has been no detailed review of the agricultural sector since the 2007 assessment, although the ECLAC's Economic Impact of Climate Change Assessment (2013) does include more recent data and analysis.

The Food Production Action Plan includes production targets for 2013-2016, which can be evaluated against current production values to assess the success of food production interventions. The National Food and Nutritional Security Policy and Action Plan has detailed socioeconomic and sectoral statistics related to the agriculture sector and food security, (e.g., birth and fertility rates, causes of death, etc.), as well as detailed agricultural productivity statistics.

An Impact Assessment of climate risks to the tourism sector was conducted in preparation of the National Adaptation Strategy and Action Plan for the tourism sector. The assessment includes an overview of vulnerability issues and threats to different sectors that impact tourism, and a detailed economic analysis of existing and potential future trends in the tourism sector. Finally, the CARIBSAVE Climate Risk Profile includes a sectoral vulnerability assessment that incorporates climate change projections, and a sectoral adaptive capacity profile

Energy and Emissions

In 2014, Saint Lucia released a report on energy use by sector, titled Saint Lucia Energy Balances (2010-2012). This documents the energy landscape in Saint Lucia, an assessment of GHG mitigation potential, and various surveys related to the energy sector. In 2015, Saint Lucia submitted its INDC committing to reduce GHG emissions 16% by 2025 and 23% by 2030 relative to the Business As Usual projection.

A full sectoral GHG inventory for Saint Lucia was released in 2015; its GHG emissions are minimal contributors in global terms as the country contributed 3.88 tCO₂-eq per capita in 2010, which represents approximately 0.0015% of global emissions. The Sustainable Energy Plan (2001) provides the foundation for increasing use of renewable energy by up to 35% by 2020. This goal is further supported by Saint Lucia's Energy Policy (2010) and the revised Electricity Supply Services Act (2015, under review).

In addition, there are other reports that document energy use in the country, including the World Bank Energy Generation, Transmission, and Interconnection Report as well as a 2013 assessment of the economic and social impacts of climate change on the energy sector. This includes existing energy portfolios for multiple Caribbean nations including Saint Lucia, and also provides projected future load/consumption and energy portfolio scenario analysis.

Key national policies related to energy include the following:

- Adopted National Energy Policy (2010)
- 35% Renewable Energy Target by 2020
- Introduced incentives for renewable energy
- Revised Electricity Supply Act (2015)
- National Utility Regulatory Commission Bill to establish independent regulatory commission to oversee electricity production
- Draft Revised Building Code, which includes energy efficiency measures
- National Energy Efficiency Labeling Standards
- Geothermal Development Bill (in draft)
- Intended Nationally Determined Contribution (iNDC) to the UNFCCC (2015) which commits the country to providing up to 35% of electricity from renewable sources by 2020, further reflected in its Energy Policy (2010). Saint Lucia emission reduction target is 16% by 2025 and 23% by 2030.

Finally, the development of the National Energy Transition Strategy (NETS) is being led by the Renewable Energy Division of the Department of Sustainable Development, in collaboration with the Ministry of Infrastructure, Ports, Energy and Labour. The draft is not yet final or publicly available. A solar Resource Assessment and Grid Integration Study is also underway and led by the same Ministries identified above. These documents are not yet ready for public consumption, but hopefully will be available early 2017.

NAP Situation Analysis

Saint Lucia has numerous policies, legislation and actions to support adaptation planning; furthermore, assessments related to disaster and hazard risks, as well as some natural resource inventories are valuable inputs for the planning and implementation of a NAP. These documents provide a sound basis for developing a cross-sectoral NAP, identifying institutional capacity, and implementing adaptation approaches that will generate multiple benefits. Critical sectors for the future NAP include: agriculture, coastal zone management, environment, fisheries, forestry, health, infrastructure, and disaster risk reduction, tourism, and water resources. A fundamental piece of the NAP development is the recently approved Climate Change Adaptation Policy (CCAP) in 2015 that outlines the general strategy for understanding and addressing the risks posed by climate change. It seeks to “ensure that Saint Lucia and its people, their livelihoods, social systems, and environment are resilient to the risks and impacts of climate change.” The CCAP presents an integrated approach for climate change adaptation via adaptation facilitation, adaptation financing, and adaptation implementation. Additional strategies and actions related to NAP include development of the following policies and strategies:

- National Environmental Education Strategy (2010)
- National Food and Nutrition Security Policy and Action Plan (2013)
- Food Production Action Plan (2014)
- National Hazard Mitigation Policy (2006)
- National Land Policy

Saint Lucia has expressed interest in receiving assistance to move from the current climate change strategy to a more actionable NAP, focused on specific sectors. To support NAP development, Saint Lucia and partners have conducted assessments in critical sectors to identify risks and potential adaptation options. These include the Saint Lucia: Country Document for Disaster Risk Reduction (2014) as well as other hazard mapping, disaster mapping, and vulnerability assessments, including those done under various National Communications to the UNFCCC.

The Strategic Programme for Climate Resilience (SPCR) provides the broad project and program areas for all sectors and themes, in pursuit of enhanced climate resilience, beyond the timeframe and funding of the Pilot Program for Climate Resilience (PPCR). The key priority areas identified in the CCAP are re-iterated in the SPCR - adaptation facilitation, adaptation financing, and adaptation implementation. The CCAP, SPCR, Nationally Determined Contributions (NDCs), and outputs from the Third National Communication to UNFCCC are intended to serve as the foundation upon which to develop and implement a NAP. The SPCR also serves as the framework for sectoral adaptation and implementation plans.

Natural Resource Management

Numerous natural resource inventories and assessments have been undertaken for Saint Lucia over the past several years; many of these assessments are available online via the CHARIM site, the National Reports for the Convention on Biological Diversity, as well as the Government of Saint Lucia's Biodiversity Resources website.¹ A 2010 National Environmental Summary was prepared with support from UNEP. Additionally, the 2006 State of the Environment Report (GEO Saint Lucia), which includes an assessment of key ecosystems, was published by the Sustainable Development and Environment Unit of the Ministry of the Environment; this was updated in 2015 (GOSL, 2015c). The 2015 State of the Environment Report summarizes environmental pressures and impacts, including loss of ecosystem goods and services. Impacts of climate change on natural resources is integrated in the 2015 State of the Environment Report.

The Watershed-river Analysis (2012) appears to be the foundation for a water resources management plan. Saint Lucia also has reports outlining the progress towards various management plans (Towards the Development of a Coastal Zone Management Policy), as well as the Strategic Plan for the Water Resources Agency 2012-2017. As noted previously, the Watershed-River Analysis (2012) ranked the maximum flow rate during different seasons to identify the watershed with the greatest potential surface water resources. Due to uneven distribution of precipitation, watershed potential is not dependent on size. The Roseau, Troumassee, Cul de Sac, Soufriere, and Vieux Fort watersheds have the greatest water flow rate potential during the dry season. The analysis provides a basis for developing a greater understanding of the potential impacts of hydrological flow on key sectors, such as agriculture and infrastructure.

The 2015 National Land Policy, which updated the 2007 National Land Policy, outlines four main strategic priorities: conservation and sustainable management of natural resources while reducing risk and vulnerability; optimization of the relationship between land use and economic development; optimization of the relationship between the landscape and sociocultural development; and general management of land use and settlements. The National Land Policy sets out 16 policy imperatives to support specific actions for land use planning in the country. The policy discusses the existing institutional and legal basis for land use planning and management, including the Physical Planning and Development Act, which gives development responsibilities to the Ministry of Physical Development, Housing, and Urban Renewal. Furthermore, it establishes the foundation for a new institution, the National Land Commission that will oversee coordination between public, private, and civil society and take responsibility for evaluations of the land policy and its implementation.

The Fourth National Report for the Convention on Biological Diversity (CBD) provides a comprehensive overview of the biodiversity trends, threats, and progress related to biodiversity conservation in Saint Lucia. Furthermore, several studies are available on the status of reptiles, lichens, the biogeography of West Indian spiders, bush and wildfire in Saint Lucia, the benefit of marine reserves, coastal wetlands and sustainable livelihoods, coastal zone management, among others.

¹ Government of Saint Lucia's Biodiversity Resources website <http://biodiversity.govt.lc/Documents-Centre>

Unpublished forest surveys from the National Forest Demarcation and Bio-physical Inventory Project, undertaken in 2009, identified 17 major vegetation types in Saint Lucia and indicate high levels of diversity of forest species on the island. However, the Intended Nationally Determined Contribution (INDC) communication to the UNFCCC in November 2015 indicated that updated and improved forest inventories were critically needed to develop policies for forest management and protection to identify reforestation projects. Further, forest inventories are needed to quantify the potential for Saint Lucia's forests to act as a carbon sink. Forest inventories combined with updated hydrological studies and climate change models could also assist in management of bush fires. Forests play an important role in adaptation, helping to stabilize and build soils which, in turn, increases absorptive capacity of soils and helps reduce flood risk. Thus, understanding the extent and location of forests in Saint Lucia is critical for adaptation planning and actions.

Saint Lucia's coral reefs, seagrass beds, and mangroves were mapped under the Eastern Caribbean Coral Reef Reports Cards project, financed by The Nature Conservancy and supported by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of the German Bundestag in October 2015; results of the study can be found on the CaribNode site (www.caribnode.org). The western reefs of Saint Lucia were characterized as "average" receiving a score of 2.8/5 for reef health. There were insufficient data to characterize the reefs in the northeastern and southern parts of the island. Seagrass beds in Saint Lucia are quickly being displaced by an exotic seagrass (*Halophila stipulacea*); the long-term impacts on trophic structure is unknown. Habitats are threatened by direct removal and damage, overfishing, human use, coastal development, poor water quality, and global climate change. There are 14 highly productive mangrove forests on Saint Lucia, which have been historically used for timber or charcoal. Pollution and trash dumping are the immediate threats; mangroves protect shorelines from storm surge and improve water quality. Climate change is expected to increase vulnerability of nearshore ecosystems via increased bleaching, disease and mortality; ocean acidification which reduces coral calcification; and increasing storm intensity will damage corals, coastlines and infrastructure. Marine Management Areas remain important for protection of biodiversity and conserving critical habitats.

The Protecting and Valuing Watershed Services and Developing Management Incentives in the Fond d'Or Watershed Area of Saint Lucia (2008) report demonstrated the critical linkage between watershed management practices and coastal habitat health, underscoring the need for a "ridge to reef" integrated management plan for the island's watersheds. This type of approach could be integrated into a NAP to enhance resilience of people and ecosystems throughout the islands.

Disaster Preparedness

Multiple projects, plans, and assessments have been implemented or developed under the Disaster Vulnerability Reduction Project (DVRP), including a series of public service announcements and other community outreach efforts. The Saint Lucia Disaster Vulnerability Reduction Project (DVRP) is currently undertaking assessments that will support the NAP process, including assessments of spatial planning, the built environment, vulnerability, coral reef restoration, and remote sensing (specifically Light Detection and Ranging – LIDAR) mapping to support analysis for sea level rise. DVRP work also includes specific projects, such as rehabilitation of one or two community centers, rainwater harvesting and water conservation, and public outreach related to disaster vulnerability and climate resilient planning. The public outreach has focused on schools, churches, businesses, and insurance companies, among other entities. To date, they have reached approximately 5,000 individuals. Additionally, public service announcements are planned for 2017. The hotel sector is recognized as a target for water and energy efficiency by the Sustainable Development Department.

The OECS-USAID Climate Change Project (2011-2015) is a regional project that focused efforts in Saint Lucia on a GIS platform for the water sector to facilitate management, and supported DVRP/PPCR activities. Generally, the National Emergency Management Organization provides support for community disaster plans under the DVRP/PPCR.

The National Hazard Mitigation Plan (2006) outlines overall strategy for hazard risk reduction, with goals and objectives related to vulnerability. It was developed through a collaborative effort, including stakeholders from public and private sectors. The plan describes the status of hazard vulnerability, current risk reduction efforts, and the institutional and policy framework. However, the strategy for policy implementation is relatively vague, with limited actionable information.

The Landslide Risk Assessment (2013) was conducted using funds from the Hurricane Tomas rehabilitation and reconstruction project. The report includes a comprehensive review of existing landslides, a landslide risk analysis focused on the primary road network, and discussion of management and slope stabilization options. Management and stabilization options for high risk sites are provided with feasibility-level detail, allowing this landslide risk assessment to serve as a feasibility assessment for reconstruction projects. The information contained in this risk assessment can be integrated into a NAP and pilot projects given the relationship between climate impacts and landslides.

The Hurricane Tomas Emergency Recovery Project from 2011-2014 supported recovery and reconstruction following the hurricane in 2011. It was designed to support SPCR and DVRP goals to build climate-resilient infrastructure and facilitate adaptation. The 2014 Country Document for Disaster Risk Reduction (DRR) (2014) followed this assessment; it summarizes the national circumstances; legal, regulatory, and institutional framework; the state of disaster risk in Saint Lucia; risk assessment for DRR; and strategic recommendations for DRR.

A hydraulic assessment for flood risk reduction was started as indicated by an inception report; however, it is unclear if the project was completed. Regardless, CHARIM, a regional initiative initiated by the World Bank to build capacity of government clients in the Caribbean, has generated landslide and flood hazard and risk maps for the purpose of disaster risk reduction planning. It has various resources to help identify areas of high risk for landslides, floods, and other disasters as well as resources to support planning to enhance resilience related to those disasters via its Country Report for Disaster Risk Reduction (<http://charim.net/Zero-a>). Finally, USGS undertook land cover mapping of Saint Lucia and other Caribbean islands using Landsat Thematic Mapper and SPOT imagery in 2000 (http://lca.usgs.gov/lca/carland/dataproducts.php#st_lucia); however, no ground-truthing for these maps was undertaken.

The impacts of Hurricane Tomas, more recent tropical storms, and heavier than usual rain events have underscored the critical need to incorporate disaster and hazard planning information into the NAP. Identification of highly vulnerable areas to flood, storm surge, landslides, and the like will enable Saint Lucia to strategically plan for future development, as well as prepare for and respond to natural disasters. Additionally, a DRR framework integrated with the NAP will support strategic and more effective investments for climate adaptation.

Tourism

In 2011, ECLAC provided an assessment of the economic impact of climate change on the tourism sector. Saint Lucia released the National Adaptation Strategy and Action Plan for the Tourism Sector in 2015, which included an impact assessment of the risks faced by the tourism sector under a changing climate. The impact assessment includes details on vulnerabilities faced by different sectors that impact tourism, and an economic analysis of the impact of climate change on tourism. Information from this assessment was used to develop the national action plan for tourism, which provides overall strategic objectives, information on implementation and evaluation, and a rough budget for tourism adaptation activities. The document also includes a review of the institutional framework for implementation and recommendations for increasing capacity for climate adaptation in the tourism sector. Additionally, the Country Report for Disaster Risk Reduction identifies areas of the island that are particularly vulnerable; tourism was identified as a critical sector at risk from climate change impacts.

Education

The National Environmental Education Strategy was developed in 2012 to cover 2012-2017 as part of an initiative to improve environmental management. It provides objectives and more actionable information to support the National Environmental Education Policy. The strategy was designed to identify activities in education, outreach, and training that can enhance individuals' and communities' knowledge of the interactions between humans and the environment. The overall goal is to foster sustainable development. Specifically, it includes an assessment of key institutions and groups that are involved in education and outreach efforts, and targeted actions for each of the key actors to implement. To aid in implementation, the strategy identifies a mechanism to foster coordination of environmental education activities. Indicators to measure progress are provided with an overall monitoring and evaluation framework.

Another component of education is development, under the PPCR-DVRP Project, of a Public Education and Awareness Strategy Implementation Plan, which includes disaster vulnerability and resilience newsletters, audio public service announcements on a variety of climate change topics and environmental education, and video PSAs. The public outreach has focused on schools, churches, businesses, and insurance companies, among other entities. To date, they have reached approximately 5,000 individuals. Additionally, public service announcements are planned for 2017.

The Education Sector Development Plan for 2015-2020 was produced in 2015 to define priorities and strategies for the education sector. The plan does not include a significant climate change component, but may be a source of information on areas where climate change adaptation and mitigation implementation activities may benefit the education system. One priority in the plan is the management of risks to education infrastructure, which includes an objective to enhance the resilience of education infrastructure to the risks posed by climate change and natural disasters.

Schools are often community gathering points during natural disasters and several have to remain closed post disaster due to sustained damage or risk; as such, the Ministry of Education is planning to retrofit schools to enhance their resilience during natural disasters. Based on stakeholder interviews in September 2016 with the Ministry of Education, assessments are underway to identify which primary and secondary schools will be retrofitted with solar panels and water collection tanks. In addition, school locations are being assessed for risk related to flooding and landslides.

Agriculture and Food Security

In the 2014 DRR Country Report, agriculture is identified as a critical sector at risk from climate change impacts and hazards. These risks include floods, droughts, temperature extremes, erosion, and high winds. One comprehensive sectoral economic assessment in Saint Lucia is the Assessment of the Economic Impact of Climate Change on the Agriculture Sector (2011), which evaluated the economic impact of climate change on the agriculture, tourism, and health sectors in Saint Lucia.

The Food Production Action Plan (2013) is a nutrition-based production action plan with several specific goals, some relevant to climate change, including:

- Reduce food import bill by increasing local production
- Foster an agriculture sector that provides sustainable and long-term employment
- Diversify the agriculture sector with less dependence on production for export, and a broader portfolio to decrease vulnerabilities to the sector posed by natural disasters, climate change, price fluctuations, and other risks.

The National Food and Nutritional Security Policy and Action Plan (2013) is focused on poverty and food security, with primary objectives to reduce the vulnerability of poor residents and communities to food insecurity. It was

designed to complement the Food Production Action Plan. The food security plan includes an assessment of existing demographic and socioeconomic conditions as they relate to food availability and accessibility. Policy instruments and the institutional framework for implementation are also provided, with information on existing capacity to address food security. An action plan is also included to aid implementation. This policy and action plan includes a significant climate change component; specifically, it assesses the impact of climate change on food security and potential interventions to increase the resilience of the food sector to climate change. Climate change is considered a critical priority area in the plan.

The Assessment of the Economic Impact of Climate Change on the Agriculture Sector (2011) provides the foundation for the development of a comprehensive adaptation plan for the agriculture sector and inclusion in a NAP. It can also help in the identification of potential pilot project interventions, despite being five years old. The assessment provides suggested adaptation options in the agriculture sector and includes a detailed cost-benefit analysis for different adaptation activities. Agriculture has received attention in both the Second National Communication and is also addressed in the Third National Communication to the UNFCCC.

Under climate change scenarios, banana, fisheries, and root crop outputs are expected to fall with climate change, but tree crop and vegetable production are expected to rise. Costs to the agricultural sector due to tropical cyclones were estimated to be \$6.9 million and \$6.2 million under different scenarios. Recommended adaptation strategies include 1) design and implementation of integrated water management plans; 2) establish food storage systems; 3) establish early warning systems. Finally, it is critical that agriculture be included in the NAP, as well as integrated into agricultural policies, strategies and action plans.

NAMA Situation Analysis

NAMAs refer to 'any action that reduces emissions in developing countries. In this regard, Saint Lucia has made significant progress; however, codifying this progress and a path forward would help ensure that Saint Lucia's GHG emission priorities are implemented. Saint Lucia's iNDC outlines a strong commitment to reduce emissions by transitioning to 35% renewable electricity generation by 2020. Saint Lucia has committed to conditional target of a 16% reduction in CO₂-eq emissions by 2025 and a 23% reduction by 2030. Cost estimates for reaching this target by 2025 are in the realm of US\$183 million, which will require external financial and technical assistance to reach the target. The iNDC also provides thorough background information outlining which sectors are responsible for GHG emissions; the sectors evaluated include energy generation, transportation, industrial processes, agriculture and waste. Of these, energy, electricity generation, and transportation were identified for proposed interventions in the iNDC. The lack of land use policy and a land use plan precluded inclusion of forests in the INDCs and the National Communications. Furthermore, the economic value of forests was not considered in the initial steps of the INDC; however, a 2006 study analyzed the ecosystem service value of forests in Saint Lucia.

The Government of Saint Lucia has several policies and projects focused on GHG emission reduction that span across ministries and focus land uses, renewable energy development and other sectors that emit. Furthermore, the Government drafted the Third National Communication to the UNFCCC in 2016, which includes an inventory of GHGs. The iNDC was developed following the development of the GHG Inventory, involving the same team and therefore, the former was informed by the latter. Aligning the iNDC with the Third National Communication is important and will make drafting a formal NAMA easier.

The NAMA priority areas for Saint Lucia were identified as transportation or energy during a NAMA workshop with UNDP. However, due to price stabilization, self-reliance, foreign exchange rates, and climate sensitivity, a recent decision was made to select "Greening Schools (related to energy)" as the NAMA focus; this effort also may support adaptation efforts as well. Regarding next steps for a NAMA, the government must first understand the different efforts on-going across sectors to reduce GHG, then prioritize areas for mitigation actions, especially those that will generate multiple benefits. It is likely that the energy sector, along with sustainable and responsible

land use/management, will be the two areas where the government could have the most impact to reduce emissions. Given the current exclusion of land use change in the calculations and projections in the iNDC and National Communications related to the lack of land use policy and a land use plan; this is a priority area for future action. Challenges to successfully creating and implementing NAMAs are costs and reliance on fossil fuels.

Table 2. Existing Policy and Regulatory Framework for Energy Efficiency

Renewable Energy	
Feed-in Tariff	
Net Metering/Billing	In place
Interconnection standards	
Renewables Portfolio Standard/Quota	
Tax Credits	In place
Tax Reduction/Exemption	In place
Public Loans/Grants	
Green Public Procurement	
Energy Efficiency	
Energy Efficiency Standards	
Tax Credits	
Tax Reduction/Exemption	In development
Restrictions on Incandescent Bulbs	
Appliance Labeling Standards	
Mandatory Building Standards	
Targets	
Renewable Energy	In place
Energy efficiency	

The energy sector is where Saint Lucia has decided to focus efforts related to reaching mitigation goals. Specifically, the government is supporting installation of renewable energy in schools and according to discussions with the Ministry of Education, the cost savings will be re-invested in the schools. Solar installation combined with water collection tanks provides an integrated opportunity to support both mitigation and adaptation in Saint Lucia. Solar panels reduce dependency on fossil fuels while also providing an independent and continuous source of energy, which is especially important in the aftermath of natural disasters. Since schools are natural community gathering spaces, solar power and water tanks could also serve as community emergency shelters. Additionally, there is a Green Architecture project planned for Output 2 of the J-CCCP project. Given the cost of implementing the NAMA, financial and technical support is needed for NAMA development and subsequent implementation. Understanding the contribution of Saint Lucia’s forests is an information gap that should be prioritized in future National Communications. The Third National Communication on Climate Change, currently under development, will include an updated GHG inventory and mitigation scenario analysis.

Initial Screening and Baseline for Potential Pilot Projects

- Saint Lucia has conducted multiple assessments of community-scale vulnerability. Based on the results of the 2010 national census, Saint Lucia developed a vulnerability or “needs” score for each community and ranked them. The score was based on housing density, unemployment rate, and other demographic metrics, and identifies the most critically vulnerable communities.
- The Landslide Risk Assessment (discussed in more detail in baseline data section) was conducted as part of the Hurricane Tomas reconstruction effort. It provides a comprehensive landslide risk assessment that identifies the most vulnerable portions of the road network in Saint Lucia.

- The data from the landslide risk assessment, social vulnerability and poverty assessments, and community needs assessment provide the foundation for targeting pilot projects to specific vulnerable communities or demographic groups.
- Saint Lucia receives funding through the Global Environment Facility (GEF) small-grant program, which to-date, has funded 51 small-scale projects across the island, with others currently under way. (https://sgp.undp.org/index.php?option=com_countrypages&view=countrypage&country=144&Itemid=271)
 - Many of the projects are related to sustainable and healthy food production, including an apiculture production chain improvement, introduction of aquaponics and organic farming, optimization of organic farming. Other representative projects include riverbank restoration, provision of a mobile desalination facility; and establishment of sustainable energy cells in selected communities.
 - The GEF country portfolio by area of work is as follows: biodiversity (33.33%), land degradation (22.81%), climate change mitigation (14.01%), community-based adaptation (14.04%), chemicals (8.77%), and international waters (7.02%).
 - Some small projects related to Climate Change Adaptation
 - Projects have been conducted in administrative areas across the island, with a wide range of focus areas. Details on specific projects are provided in the Results and Findings section.

RESULTS AND FINDINGS

This section presents an overview of the results of various assessments described in the Summary of Activities section, as well as specific details on some critical climate change adaptation and mitigation plans, or policies that consider climate change risks and resilience. It is meant to give an analysis of key sectors that are vulnerable, as well as a more detailed situational analysis of the NAP and NAMA in Saint Lucia. The information presented here does not constitute an exhaustive literature review of all plans, policies, and projects in Saint Lucia; rather, it highlights documents and projects that are focused on climate change adaptation and mitigation, or provide relevant information to support ongoing planning efforts, including NAP development and NAMA implementation. A document library with information on all documents reviewed for this effort is provided as a stand-alone electronic file.

Socioeconomic and Environmental Baseline Data Collection

Below are analyses of demographic information, climate and weather knowledge, land use/cover and natural resources, and sectoral issues related to climate change (biodiversity, health, water). Some sectors (agriculture and food security, disaster preparedness, tourism) are addressed in the NAP Situational Awareness section. Key gaps needed to address climate adaptation and mitigation in Saint Lucia are also identified, as well as missing plans and policies.

Demographic

The majority of the data needed to develop a socioeconomic and environmental baseline for Saint Lucia is readily available. The 2010 national census provides population and housing data, and also serves as the foundation for the community-level needs assessment. Economic and poverty indicators are available from the social vulnerability and poverty assessments. Demographic data and poverty indices for Saint Lucia are available as GIS files, and can be mapped to show their spatial distribution across the island. Additional spatial demographic data is available from the CHARIM GIS data repository. Geospatial data are stored in various government departments and the lack of a centralized spatial database presents challenges in accessing and utilizing spatial data for use in climate change vulnerability analyses, planning, and management.

Climate and Weather

Historical climate data and projected climate under a variety of future scenarios is available from the CARIBSAVE Climate Risk Profile for Saint Lucia from 2010. Updated climate projections are not readily available, although global climate models and downscaled regional climate models may be available. The projections from the 2010 risk profile are likely accurate enough to provide a baseline for Saint Lucia in moving forward with climate adaptation and mitigation plans.

There are multiple meteorological stations across Saint Lucia that provide data on air temperature, precipitation, and other metrics. There are historical datasets from these stations, primarily for monthly and annual averages. The weather stations often are damaged or removed by individuals who may not understand their importance, according to stakeholders. Thus, weather data can often be spotty across the island, which presents challenges in assessing long-term trends, especially in mountainous terrain with many micro-climates. Temperature and precipitation impact surface water availability across Saint Lucia; thus, consistent measurements are critical for development of accurate hydrological models.

Hydro-meteorological hazards, such as tropical cyclones, thunderstorms, and coastal storm surges, heavy rainfall resulting in flash floods, drought, heat waves, and cold spells are likely to increase in frequency and intensity under climate change scenarios. Thus, predictive capacity, as well as early warning systems are a critical component of disaster preparedness and adaptation. To this end, the Government of Italy is providing financial support for

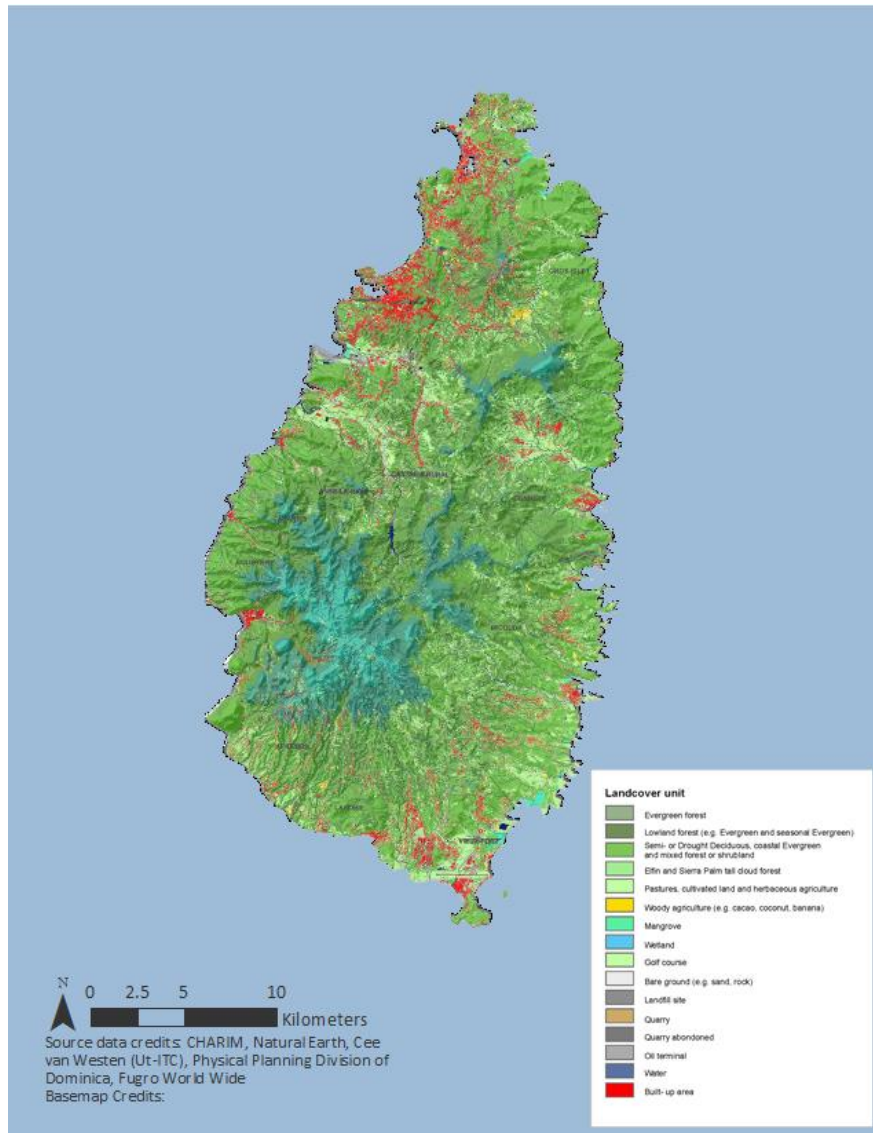
development of a flood and hazard early warning system and information center in Saint Lucia². The information center will provide the following services: extreme weather events forecast and early warning; flood hazard mapping and alerts; multi-hazard risk assessment; fisheries control; oil spill detection; and forest monitoring.

Land Use/Land Cover and Natural Resource

Land use/land cover data is readily available for Saint Lucia in both tabular and GIS form, including land use, vegetation cover, and forest reserve area. Additional data is available for water resources, including production capacity, sources, and consumption. The CaribNode project has spatial data layers for protected areas and coral reef, mangrove, and sea grass extent, including a coral reef report from 2016. Data was originally derived from national governments, the Nature Conservancy, and the International Union for Conservation of Nature (IUCN). Additional natural resources data is available from CHARIM. As noted previously, there is limited hydrological data for the island, which hampers strategic planning to avoid and/or minimize the effects of floods and droughts, as well as overall planning for provision of water for agricultural, domestic, and industrial use. Figure 4 shows a map of current land cover in Saint Lucia.

² Caribbean News Now. 2016. <http://www.caribbeannewsnow.com/topstory-Italy-to-finance-flood-early-warning-system-in-St-Lucia-30273.html>

Figure 4. Land cover in Saint Lucia.



Sectoral Economic Data

Recent climate change adaptation work has focused on the costs of climate change to specific sectors and how adaptation measures can help reduce those costs. The IPCC 5th assessment highlighted risks to various sectors for small islands developing states (SIDS), including the impacts of climate change on loss of livelihoods, coastal settlements, infrastructure, ecosystem services, overall economic stability, decline and possible loss of coral reef ecosystems through thermal stress, and the interaction of rising global mean sea level that will threaten low-lying coastal areas. Through taking various adaptation measures, the cost of climate change on these sector can be significantly curbed.

In Saint Lucia, assessments in various sectors have identified specific threats due to climate change that will impact Saint Lucia's economy. Both tourism and agriculture, two of Saint Lucia's main economic drivers, are particularly

threatened due to climate change. In addition, climate change threatens health, biodiversity, and water resources that all support the tourism and agriculture industries.

Economic data is available from recent sectoral assessments, focused primarily on agriculture and food/nutrition security. These data include crop availability, descriptive agricultural statistics, production targets, actual and projected loss estimates from storm events, and tourism statistics. Saint Lucia has also conducted a cost-benefit analysis for adaptation options in the agriculture sector. The results of this analysis are useful for identifying and implementing pilot projects. The manufacturing sector is the most diverse in the Eastern Caribbean area. Crops such as bananas, mangos, and avocados continue to be grown for export, but Saint Lucia's once solid banana industry has been devastated by strong competition. Saint Lucia is vulnerable to a variety of external shocks, including volatile tourism receipts, natural disasters, and dependence on foreign oil.

Regional economic data is available for CARICOM in CARICOM's Selected Economic Indicators report, which provides a statistical profile of the CARICOM single market and economy. This is useful regional context for Saint Lucia, and also provides some specific sectoral metrics for each country (e.g., structure of CARICOM GDP with % contribution by sector from each country). Country-specific economic details are not provided.

The World Travel and Tourism Council conducted an economic impact assessment for Saint Lucia in 2016. In 2014, tourism contributed 39.5% of GDP and was forecast to rise by approximately 5% in 2015, making tourism the largest economic sector in Saint Lucia. It supports 15,500 jobs and employment within the tourism sector is expected to continue to increase. Since Saint Lucia relies heavily on tourism as a significant part of its GDP, this increases its vulnerability as the sector could be severely impacted by a single catastrophic event. According to the CaribSave Climate Change Risk Profile for Saint Lucia, under a 1-m sea level rise scenario, 7% of tourism properties will be at risk, while 10% will be at risk with a 2-m sea level rise. Depending on location, the impact of sea level rise is variable, for example, the beach on Rodney Bay would be inundated even under a 0.5-m sea level rise as would 52% of the beach at the Sandals Grande Resort in Rodney Bay.

Banana production has been a historical mainstay of the agricultural sector in Saint Lucia, but competition has caused a steady decline in production. Despite reduced production, bananas constitute 41% of gross agricultural output. Overall, the agricultural sector is highly sensitive to climate, especially extended drought, changing precipitation patterns, and natural disasters. Predicted losses in the agricultural sector range from US \$6.2 – US \$6.9 million under various scenarios (ECLAC, 2011). Deteriorating soil conditions from increased erosion and land degradation from flooding and increased crop loss from high temperatures and unpredictable rainfall contribute to vulnerability in the agricultural sector. Finally, uncontrolled expansion of agriculture, especially into steep hillsides, intensifies vulnerability of the sector.

Energy and Emissions

Saint Lucia conducted an assessment of the energy sector and mitigation options as part of the development of the National Energy Policy. In support of development of National Communications and INDCs, the country has also collected abundant data in the energy sector. Multiple mitigation options were assessed to identify budgetary issues and establish an approach for assessing and developing a mitigation budget. The results of this assessment are relevant to the identification and implementation of potential pilot projects, as well as the development of a NAMA.

As stated in the NDC, per capita emissions are considerably less than the global average; the primary sources of emissions in Saint Lucia are energy and transportation sectors. As tourism has grown in Saint Lucia, energy use and emissions associated with the sector has followed suit because energy generation is largely dependent on imported fossil fuels. Almost 70% of national emissions are associated with tourism-related energy use, of which aviation and accommodations are the largest contributors to CO₂ emissions (CaribeSave 2012). The traditional and renewable energy infrastructure is vulnerable to climate change impacts, as demonstrated by Hurricane Tomas in

2010, which disrupted energy production and distribution, including generating facilities, transmissions lines, and pipelines. Coastal area power infrastructure is also vulnerable to sea level rise, storm surge, and flooding.

Baseline energy and emissions data is available for Saint Lucia including the following:

- Energy sector growth trends and sales by sector
- Electricity plant capacity
- Energy production and consumption data
- Proposed GHG reductions, as articulated in the country's 2015 INDC
- Sectoral GHG emissions inventory

As part of the Second National Communication, a LEAP model was conducted to assess potential GHG mitigation options. Mitigation options are focused in energy efficiency and development of renewable energy, especially geothermal and solar power. Saint Lucia has significant geothermal power potential in the southwestern part of the island, which is currently being assessed for viability to provide baseload power and financing for development of the resource. The Third National Communication (June 2016) includes mitigation goals to reduce dependence on fossil fuels via retrofit of more than 20,000 high pressure sodium and mercury vapour streetlights on the island and plans to transition from conventional energy generation to renewable energy generation, including geothermal energy.

The Caribbean Regional Electricity Generation, Interconnection, and Fuels Supply Strategy, an assessment of regional energy systems conducted for the World Bank, provides details on Saint Lucia's energy portfolio and its relationship to the regional energy system. The report details existing and planned generation and transmission, existing and potential fuel supply, and renewable energy potential. It also includes current demand and electricity load forecasts for Saint Lucia. The report includes a range of potential scenarios for power generation, supply, transmission, and consumption, and analyses these scenarios to determine recommended development strategies. Several key barriers must be overcome for development of the renewable energy sector. These barriers include a small local energy market; current policy and legal climate for new entrants into the power sector; and the initial high cost of mitigation technologies. Saint Lucia Electricity Services Limited (LUCELEC) has the sole right to generate, transmit and distribute electricity on the island; the current arrangement provides no incentive to promote or facilitate independent power producers. In order to achieve NAMA goals, LUCELEC will need to be engaged as a partner in renewable energy development on the island.

NAP Situation Analysis

The Department of Sustainable Development is leading the development of the National Adaptation Plan (NAP) for Saint Lucia; the NAP is in its early stages of development and the Department expressed the wish for it to include sectoral adaptation plans, specific thematic areas, as well as investment plans that tie directly to the sectoral adaptation plans and thematic areas. Currently, there are several policies and plans completed to support the NAP process. The foundation of Saint Lucia's efforts to develop a NAP includes the National Climate Change Adaptation Policy, vulnerability and adaptation assessments conducted under the National Communications to the UNFCCC and the Strategic Programme for Climate Resilience (SPCR). This latter document and its programs form the foundation for sectoral adaptation plans as discussed in more detail in the Summary of Activities section. The future sectoral adaptation plans would be useful to inform the development and implementation of a NAP. The general process of developing and implementing sector adaptation plans in Saint Lucia includes the development of: 1) strategic actions for the sector (e.g., climate smart buildings), 2) priority action areas (e.g., climate smart schools), 3) adaptation measures (actions such as retrofitting schools to make them more climate resilient), and 4) an investment plan for the sector (e.g., 5-10 year plan) with actionable initiatives.

Currently, the NAP approach, as described, would include overarching goals and sector-specific targets. However, other plans and studies critical to the NAP process have not been completed, such as the National Development Plan and the National Vision for Saint Lucia, as well as a water resources and an updated agricultural assessment, which could inform the sector-specific targets. Ten to eleven sectors are under consideration for inclusion in the NAP, though stakeholder consultations are needed in order to identify which sectors to ultimately include. Significant work has been undertaken under the Pilot Program for Climate Resilience (PPCR) in which sectors were prioritized for strategic climate interventions. In 2015, Saint Lucia reviewed the status of the SPCR investment plan as part of monitoring and evaluation activities under PPCR. This document outlines approved adaptation activities under the SPCR investment plan, the status of SPCR investment plan implementation, including DVRP and PPCR activities, as well as other projects that contribute to the objectives of the SPCR, and the results of country-level monitoring and reporting as part of the PPCR.

Current adaptation projects in Saint Lucia include:

- Public awareness and outreach efforts, specifically related to the Disaster Vulnerability Reduction Project (DVRP) and the Pilot Project for Climate Resilience (PPCR). Public outreach efforts include radio and video PSAs and regular newsletters updating community members on activities related to disaster risk reduction.
- Past adaptation projects included the Hurricane Tomas Emergency Recovery project, in which key infrastructure was rehabilitated and emergency communications and the National Disaster Management Plan were updated.
- The Special Adaptation to Climate Change (SPACC) project to implement integrated climate change adaptation pilot projects focused on climate change impacts on natural resource base, specifically biodiversity and land degradation in coastal areas.
- OECS and the United States Agency for International Development (USAID) have supported climate change and adaptation in the tourism and agriculture sectors, with a focus on freshwater and coastal resources in the USAID- RRACC Project. The project mapped all water infrastructure in the north of the island (Castries and Gros Islet districts).
- The Ministry of Agriculture supported a project to enhance resiliency in the agricultural sector, focused on decreasing crop damage risks from extreme meteorological events and building resilience to climate change in the agriculture sector through agroforestry; specifically, the use of cocoa, which is tolerant to high temperatures.
- Additional projects include water supply redevelopment projects, development of an early warning system and hydrological monitoring system (supported by the Government of Australia), and climate change awareness campaigns.
- In 2013-2014, Caribbean Community Climate Change Centre (CCCCC)-EU-GCCA Project for Tourism NASAP provided training in vulnerability assessments and met-hydro equipment and training.
- The 2014-2015 CDB capacity building project included State of the Environment Report (2015) and policy briefs in climate change and governance, finance, and RSO.
- Implementation of local adaptation measures for the sustainable improvement of coastal ecosystems relevant for climate change financed by CCCCC, the German Development Bank, and the CARICOM Secretariat from 2014-2018.

In terms of “actionable projects”, some of the GEF small-grant projects are also related to climate adaptation including: beekeeping; agricultural production; “ridge to reef” planning and management frameworks; sustainable management of mangroves; small business development; riverbank rehabilitation; aquaponics; provision of a mobile desalination facility and increasing awareness regarding climate change.

In the National Planning Act, there is no specific mention of use of hazard information for planning purposes, even though the planning unit can seek advice from departments on natural hazards; it is unclear if this institutional consultation occurs and with what frequency.

Natural Resource Management

Saint Lucia has made efforts to update national natural resource management plans with a focus on climate adaptation and resilience; an understanding of impacts of climate change on natural resources is critically important for Saint Lucia, as the primary contributors to GDP, tourism and agriculture, are highly dependent on intact natural resources. Many of the GEF small-grant projects have been related to natural resources management, biodiversity, land degradation (including sustainable natural resources management practices), and pollution. Although these projects were all conducted at a very local and small scale, they reflect the importance Saint Lucia places on natural resources. A Strategic Plan: 2012 to 2017 - Water Resource Management Agency and development of a draft Coastal Zone Management Strategy and Action Plan for Saint Lucia are both developed; however, progress on implementation of these plans and studies is unclear. The Government does have a program to purchase critical watersheds as recommended by the Forestry Division, which could be a high-impact climate adaptation practice; however, the program is often constrained by lack of funds.

The National Biodiversity Strategy and Action Plan (2005) recognizes the effect of anthropogenic impacts on marine and terrestrial environments; an updated version is currently in final stages of review (December 2016). The 2015 State of the Environment Report: Saint Lucia summarizes drivers of environmental change, pressures driving environmental change, impacts of those changes, and provides recommendations for transition to a sustainable future. An updated forestry inventory is on-going; and a coral reef health rapid assessment was undertaken in 2015, in partnership with The Nature Conservancy and with support from the German Bundestag. Despite significant efforts to assess resources, these plans often proceed in a piecemeal manner and lack coordination with other on-going efforts. Harmonization and collection of data in a single repository for ready access to support planning, management and decision-making is a critical need.

Current gaps include:

- Inadequate scientific data to support policy and programs;
- Lack of an integrated water resources management plan, supported by hydrological data;
- Outdated forestry inventory, including mangroves;
- Inadequate assessment of climate change impacts to the principal ecosystems of Saint Lucia;
- Absence of a comprehensive fisheries management plan and policy;
- Absence of a coastal zone management strategy and action plan;
- Inadequate long-term monitoring of critical environmental parameters for both terrestrial and marine habitats;

The National Environmental Summary for Saint Lucia (2010) identified the following key barriers for effective natural resource management in Saint Lucia. These include:

1. Lack of integrated environmental governance;
2. Inadequate and inconsistent public awareness and education programs for behavior change;
3. Absence of political will to make the needed policy shifts to integrate environmental considerations into development planning;
4. Lack of both human and financial resources hinders enforcement of legislation and implementation of policies;
5. Political interference hinders designated environmental agencies from carrying out their mandated roles;
6. Weak judicial involvement in prosecuting environmental crimes;

7. Lack of clear mandates for many agencies;
8. Lack of a defined mandate and mechanism for interagency cooperation and coordination.

Decisions related to effective natural resource management, especially in light of the potential effects of climate change, depend on sound data and information. The uneven access to baseline data on natural resources impedes identification of changes in critical resources and may result in well-intended, but ineffective management decisions.

Disaster Preparedness

The DVRP is a major focus for Saint Lucia that will lead to the implementation of some of the primary components of the larger SPCR. Multiple documents and assessments have been undertaken to evaluate and plan for disaster preparedness in Saint Lucia, including the SPCR, the World Bank financed DVRP, and the 2014 Country Profile for Disaster Risk Reduction. Implementation of the recommendations in these key documents is the logical and needed next step for both disaster reduction, as well as climate adaptation. Thus, integration of disaster resilience and vulnerability is integral to the development of a NAP.

Tourism

The resilience of the tourism sector has been a major focus of Saint Lucia and external entities for many years. Under various climate change scenarios, the tourism sector would be negatively impacted by climate change because of loss of coastal areas and negative impacts on ecosystems and landscapes. It is estimated that this shift in tourism features could cost Saint Lucia about 5 times the 2009 GDP over a 40-year horizon because of impact in two broad areas: (1) coral reefs degradation, due to their intimate link to tourism, and, (2) land loss, as most hotels tend to lie along the coastline (ECLAC, 2011). Given the potential for significant damage to the tourism sector, a large number of potential adaptation measures were considered and three options were recommended by ECLAC (2011): (1) increased recommended design specifications for new tourism-related structures; (2) enhanced reef monitoring systems to provide early warning alerts of bleaching events, and, (3) deployment of artificial reefs or other fish-aggregating devices.

The tourism sector contributes significantly to Saint Lucia's GDP and the potential impacts of climate change on the sector cannot be ignored. However, planning for climate change must occur as an integrated approach to maintain the unique attributes of Saint Lucia's tourism industry. This includes infrastructure, natural resources, water, and energy. As discussed in the Summary of Activities section, in 2016 Saint Lucia released the Impact Assessment and National Adaptation Strategy and Action Plan to Address Climate Change in the Tourism Sector of Saint Lucia. This comprehensive document is one of the primary examples of a well-formed and actionable sectoral adaptation plan, and will inform the development and implementation of a NAP.

Agriculture and Food Security

Agriculture is sensitive to changes in temperature and precipitation, while food security is threatened due to local, regional, and global food availability and price. In addition, the most vulnerable populations in Saint Lucia are impacted most when agricultural systems are changed or food prices rise. Many of the GEF small-grant projects in Saint Lucia were and are currently focused on sustainable agriculture and fishing practices, with a focus on preventing further degradation of the land, while providing sufficient food to meet national food security and nutrition goals. These goals are defined in the National Food and Nutrition and Security Policy and Action Plan of 2013, as well as other similar national agricultural policies. Additional recommendations for adaptation strategies include: (1) designing and implementation of holistic water management plans; (2) establishment of systems of food storage; (3) establishment of early warning systems; (4) adoption of improved techniques for soil conservation; and (5) promotion of rainwater harvesting on farms (ECLAC, 2011). Data gaps in the agricultural sector were identified as follows: monthly data harvest and prices; monthly data on all areas under production; monthly data for meats; type of irrigation used, including acreage; monthly data on input use at the farm level,

including fertilizers, pesticides, and herbicides; farm machinery; and labor and technology (ECLAC, 2011). Government policy and international support should focus on the development of targeted adaptation options where they are not currently being pursued and strengthen those that have already been initiated, such as the mainstreaming of climate change issues in agricultural policy, provision of on-farm technical assistance; introduction and financing for climate resilient technologies, such as use of drip irrigation, improved soil conservation techniques, among others.

NAMA Situation Analysis

NAMAs refer to ‘any action that reduces emissions in developing countries.’ In this regard, Saint Lucia has made significant progress; however codifying this progress and a path forward would help ensure Saint Lucia’s GHG emission priorities are implemented. Saint Lucia’s iNDC outlines a strong commitment to reduce emissions by transitioning to 35% renewable electricity generation by 2020. Saint Lucia has committed to conditional target of a 16% reduction in CO₂-eq emissions by 2025 and a 23% reduction by 2030. Cost estimates for reaching this target by 2025 are in the realm of US\$183 million, which will require external financial and technical assistance to reach the target. The NDC also provides background information outlining which sectors are responsible for GHG emissions; the sectors evaluated include energy generation, transportation, industrial processes, agriculture and waste. Of these, energy, electricity generation, and transportation were identified for proposed interventions in the NDC. Land use and land use change was not included in the baseline projection because of uncertainty in land use data, which impacts estimates of sources and sinks. The Government of Saint Lucia has several policies and projects focused on GHG emission reduction that span across ministries and focus land uses, renewable energy development and other sectors that emit. Furthermore, the Government drafted the Third National Communication to the UNFCCC in 2016. Aligning the NDC with the Third National Communication is important and will make drafting a formal NAMA easier.

The NAMA priority areas for Saint Lucia were identified as transportation or energy during a NAMA workshop with UNDP. Price stabilization, self-reliance, foreign exchange rates, and climate sensitivity are the primary drivers behind the decision to focus the NAMA on renewable energy. As of 2015, most of the island’s energy (99.9%) is produced from imported diesel; as a result, the share of GDP spent on electricity is 6.75% and the 2015 electricity rates were \$0.34 per kilowatt-hour (kWh). The commercial sector has the highest rate of energy consumption (49.2%), followed by domestic (29.7%), industrial (5.2%), and losses from the grid (9.3%). LUCELEC is the sole electrical utility for Saint Lucia and has a generating capacity of 78.4 megawatts (MW), with a peak demand of 60 MW; they will be an important partner for achieving mitigation targets. Furthermore, there is significant potential for renewable energy, specifically solar and geothermal power. However, distributed photovoltaic systems produce modest amounts of power and there are no plans to expand solar on the island. Geothermal potential is estimated at more than 30 MW of technical geothermal potential; initial studies show that geothermal development is economically feasible. A study funded by the World Bank, the United Kingdom Department for International Development (DFID) and the Government of New Zealand (2014-2017) is providing support to the government of Saint Lucia to support their decision-making regarding geothermal exploration and development (Third National Communication Report, June 2016). A recent decision was made to select “Greening Schools (related to energy)” as the NAMA focus; this effort also may support adaptation efforts as well. Additionally, there is a Green Architecture project planned for Output 2 of the J-CCCP project.

The Ministry of Education plans to implement a “greening schools” program as part of the NAMA to reduce energy costs and reliance on fossil fuels for power in primary and secondary schools. In addition, this also serves as a disaster risk reduction strategy as the schools would serve as community resource centers, especially during times of natural disasters. Greening would further facilitate the operation of schools post disaster, as they are often closed due to power outages and water shortages. The program includes both installation of solar photovoltaic panels and rainwater harvesting equipment that will reduce day-to-day energy costs, but also provide a location

that will have power and water throughout emergencies. During disasters, water supply on the island is often compromised because of siltation and blockages, disrupting the water supply in isolated communities. Water collection infrastructure at schools would enhance community resiliency via provision of emergency water supply during and immediately post disasters.

There are 73 primary schools and 23 secondary schools; of these, the secondary schools tend to consume more energy than the primary schools. The Ministry of Education's plans to improve energy efficiency in schools include transition to light emitting diode (LED) lighting and reducing the "heat island" effect of buildings via changing paint color, improving vegetation around buildings, among other strategies. To undertake this program, the Ministry of Education is coordinating with the Ministry of Infrastructure, Ministry of Economic Development, Ministry of Sustainable Development and the Water Resources Management Agency (WRMA). Furthermore, the Ministry of Education has recently initiated an internal evaluation on the return-on-investment (ROI) related to energy efficiency updates. Under the "green schools initiative," the financial savings related to the energy efficiency measures will be re-diverted into the maintenance funds for the schools, thus supporting long-term continuity of the project.

Installation of water collection tanks on school buildings would vary in size, depending both on water collection capacity and size of the school. The primary schools would typically have a 4,000-6,000 gallon tank, while secondary schools, which serve a larger population, would have tank volumes of greater than 8,000 gallons.

Both primary and secondary schools have already benefited from other initiatives geared at climate change mitigation and adaption under different projects, e.g. the DVRP, USAID's RRACC, etc. Furthermore, some schools are currently being relocated or refurbished, and climate smart considerations have been taken into account for these schools, especially related to building resistance to natural hazards.

Primary challenges related to the energy efficiency efforts in the education sector noted by the meeting participants include:

- 1) Financing for projects;
- 2) Policy approved by Cabinet to support these measures;
- 3) Lack of energy efficiency standards;
- 4) Sensitization and/or awareness for roles and responsibilities;
- 5) Approved land use plans, especially related to location of vulnerable schools;
- 6) Institutional coordination

Even though a formal NAMA has not yet been developed in Saint Lucia, there are several on-going efforts and policies to support energy efficiency, which, in turn, will reduce emissions. Saint Lucia adopted a National Energy Policy in 2010 that serves as the framework for ongoing efforts to evaluate mitigation options and develop a formal NAMA. The National Energy Policy establishes the regulatory and institutional framework for Saint Lucia's energy sector, and a key objective was the incorporation of renewable energy into the national energy profile. The National Energy Policy does not include any actionable projects or implementation activities. As part of the development of the energy policy, Saint Lucia conducted an assessment of the energy sector and mitigation options. Furthermore, energy assessments have been undertaken via UNECLAC, a GHG inventory for the 2nd and 3rd National Communications, and the 2015 INDC to the UNFCCC. Specific mitigation activities were assessed to identify budgetary issues and establish an approach for assessing and developing a budget for mitigation activities.

Numerous challenges exist within the energy sector for improving efficiency; one significant barrier is the lack of enforceable building codes that promote energy efficiency in commercial and residential buildings. Regarding next steps for a NAMA, the government should first understand what efforts are ongoing across sectors to reduce GHG, then prioritize areas for mitigation actions, especially those that will generate multiple benefits. It is likely that the energy sector, along with sustainable and responsible land use/management, will be the two areas where the

government could have the most impact to reduce emissions. Given the gap of land use change in the iNDC, this is an area for further investigation. Challenges to successfully creating and implanting NAMAs are costs and reliance on fossil fuels.

Initial Screening and Baseline for Potential Pilot Projects

To date, Saint Lucia has implemented and completed multiple projects related to climate change, both at the national and community level. The country has also already identified critically vulnerable communities and demographic groups, and identified areas vulnerable to landslides and flood risk, positioning it to identify and implement pilot project interventions related to climate change adaptation and mitigation. In 2003, Saint Lucia developed the Interim Poverty Reduction Strategy and Action Plan, which should be compared to existing policies and projects to identify progress in the past decade. This comparison could be used alongside updated vulnerability assessments to identify future pilot projects.

To-date, 53 GEF-funded small-grant projects³ have been conducted across Saint Lucia. These community-scale projects can be categorized by GEF focal areas, including: Biodiversity Conservation, Land Degradation, Capacity Development, Chemical/Persistent Organic Pollutants, Climate Change Adaptation, and Climate Change Mitigation. To date, Saint Lucia has implemented and completed multiple projects related to climate change, both at the national and community level. The country has also already identified critically vulnerable communities and demographic groups, positioning it to identify and implement pilot project interventions related to climate change adaptation and mitigation.

Given that Saint Lucia has not developed a defined NAP or a NAMA, pilot projects were selected in sectors that either support NAMA priorities (green architecture) or target sectors that are particularly vulnerable to climate change (e.g., agriculture, coastal systems). The pilot projects that were short-listed for support by the UNDP Japan-Caribbean Climate Change Partnership (J-CCCP) focused on agriculture, energy, and coastal adaptation, as follows:

1. Livelihood development by introducing aquaponics to reduce vulnerability of small farmers in Saint Lucia to the impacts of climate change;
2. Increased capability for income generation through building resilience of the Honey Bee to the impacts of climate change using genetics;
3. Evaluation of Shoreline Stabilization Technologies in Selected Vulnerable Coastal Areas in Saint Lucia, in the Face of Climate Change;
4. Green Architecture Promotion Pilot (GAPP) toward Building Resilience to the Adverse Effects of Climate Change

In the agricultural sector, both aquaponics and apiculture have been the focus of GEF Small Grants projects in recent years; therefore, it would be useful to understand how the project proposed under the Japanese Caribbean Climate Change Project (J-CCCP) will build upon and/or expand the work already undertaken by the GEF Small Grants programs. It is unclear if the projects will be in different geographic areas, focus on new technologies, expanding the numbers of beneficiaries, or providing other additional benefit. It is recommended that the small grants proponents utilize the “lessons learned” from the GEF Small Grants programs to build on these pilot projects.

In the absence of an operating coastal zone management plan to inform site selection, the shoreline stabilization technologies pilot must critically evaluate pilot site locations. A suite of potential project sites, justified by use of existing information in the CaribeSave Climate Risk Profile and other sources, should be included with the pilot

³ GEF Small Grants Program

https://sgp.undp.org/index.php?option=com_sgpprojects&view=allprojects&limit=100&limitstart=0&paging=1&Itemid=278

project proposal. The sites should be evaluated by the UNDP Focal Point in the field. While coastal areas are certainly at risk from sea level rise, storm surge and coastal development, the pilot project proposal lacked detail related to site selection and proposed techniques for shoreline stabilization.

The GAPP is aligned with Saint Lucia's National Energy Policy (2010), as well as the island's intended NAMA under the J-CCCP Project. The Government of Saint Lucia has made progress toward national energy targets through implementation of energy efficient lighting and appliances in buildings, as well as developing legislative support, such as the draft Energy Efficiency Bill and the new Electricity Supply Services Bill. The pilot project will promote awareness of "Green Architecture" techniques as they related to energy, water, and waste water in the current and future designs of buildings in Saint Lucia. Furthermore, the project will increase awareness of the impact of design on energy use. Given the importance and vulnerability of the tourism sector in Saint Lucia, a recommendation is to include both public and private sector stakeholders in the pilot project.

CHALLENGES

The consultant team encountered the following challenges during the site visit:

- Multiple-island stakeholder engagements in Lesser Antilles, by a single team during a comparatively short period of time are subject to the inherent difficulties due to chronic flight delays and the inevitability of having limited access to stakeholders during the constrained field visit.
- Capacity constraints (e.g., financial, sufficient staff, political support) were mentioned in almost all stakeholder meetings via the semi-structured interviews; however, it is difficult to evaluate the exact reasons for capacity challenges without details on the structure and budgets available to individual ministries and divisions, and the actual training/experience level of personnel.
- Site visits are an essential component of the stakeholder engagement, especially with reference to pilot projects, yet these are quite time-consuming. Priorities were difficult to set based on the project introduction received during the meetings. In order to improve the outcome of such visits, the scale and status, and in some cases exact location of the sites and persons involved in providing access should be previewed by the local focal point or stakeholder. More comprehensive project descriptions, with visual aids (photos/maps) are recommended for future consultations. This would allow for a better prioritization of site visits under a limited timeframe.
- Saint Lucia has a known but underutilized data base, including GIS maps (Physical Planning), studies and projects. However, stakeholder engagements demonstrated an inconsistent level of awareness of these data and how or where to access them. In that regard, challenges persist in determining whether certain data are available or not and how those data are utilized to develop plans and make decisions.

RECOMMENDATIONS AND NEXT STEPS

Based on the Inception Report, site visits, and analyses conducted while developing the Baseline Assessment, below are recommendations for next steps organized by high and medium priority. This classification does not take into account costs, just need and urgency.

High (immediate action recommended):

Begin process to develop NAMA: The foundational documents are in place to create a NAMA. A potential first step would be to have a workshop that maps the process to create a NAMA.

Continue and accelerate the process to develop the NAP: The foundational documents are in place to develop the NAP; however, adequate financing and staffing must be allocated to advance development of the NAP, while drawing on the significant body of work already undertaken for Saint Lucia.

Improve foundational knowledge across sectors for climate change work: There is a need for climate related knowledge or analysis to support decisions, and funding, for climate related projects across sectors. Some examples include:

- Improved understanding of how climate change will impact watersheds, and ability to meet future water demands. Related, monitoring stream flow and correlating with climate and weather data would improve Saint Lucia's ability to manage water resources.
- Better understanding of how climate change will impact fish species migration;
- Improved understanding of how climate change will impact inland ecosystems, which have a direct impact on downstream coastal environments and livelihoods;
- Improved understanding of how ecosystems services provide livelihoods for Saint Lucians.
- A stronger cross-sectoral involvement in climate change adaptation and mitigation (led by the Government of Saint Lucia), coupled with robust education and capacity-building incentives, and poverty (vulnerability) reduction is highly warranted.

Institutionalize, identify, and access funding: Saint Lucia should include NAP and NAMA priorities (once they are formalized) in national budgets and strategic planning. The cost to implement the NAP and meet the goals of the NDC are not currently met, and are unlikely to be met through Saint Lucia's national budget. Through gaining access to the Green Climate Fund, as well as private sector investment and donor funding, Saint Lucia can implement the future NAP, begin processes to develop NAMAs, and implement sectoral climate change related needs. Lastly, determining how to address needs through programming that provides multiple and cross-cutting benefits for climate change goals should be a long-term goal and considered continuously.

Improve baseline information on natural resources: Effective adaptation and mitigation plans rely on up-to-date information on the status of natural resources. Of particular urgency are a water resources inventory and assessment, an update forest inventory, as well as a comprehensive marine habitats survey.

Create a climate portal: Consolidate geospatial data, reports, and policies relevant to climate change in a central location/agency. This will help government institutional work together on cross cutting climate issues. In addition, it will provide access to data to create comprehensive vulnerability maps.

Medium priority (long term perspectives and commitment recommended):

Create a comprehensive national land use plan: This will address long-term land use needs, with future climate scenarios in mind, to properly accommodate areas for settlement, agriculture, nature/forest reserves, commerce, manufacturing, energy generation and storage. It is likely that the energy sector along with sustainable and

responsible land use/management will be the two areas where the government could have the most impact to reduce emissions. Given the gap of land use change in the iNDC, this is an important area for further investigation.

Develop a new poverty assessment: The last poverty assessment was completed over 10 years ago, in 2003. A better understanding of the current poverty situation, and driving factors, will help identify vulnerable groups that climate resilience activities can target.

Develop/enhance enforceable energy efficiency standards: Given Saint Lucia's focus on energy for its NAMA and the increase in energy use related to the tourism sector, as well as day-time energy use (e.g., air conditioning), development and integration of enforceable energy efficiency standards for new developments, as well as building retrofits, are critical components for successful progress on the NAMA.

Ensure that the environmental Review Process incorporates Climate Change: The environmental review process provides an opportunity for the Government of Saint Lucia to integrate climate change, building codes, mitigation and adaptation components to projects. However, the environmental review process seems to be used informally and its use as a pre-requisite for any new development or land use change should be strongly promoted as a mechanism for climate change integration across sectors.

Prepare a comprehensive summary of potential climate change impacts on biodiversity and ecosystems, such as mangroves, forests, coral reefs, seagrasses, soils, water supplies, etc.: Developing a vulnerability assessment for ecosystems will aid in understanding how climate change may impact provision of ecosystem services and support design of targeted interventions to enhance resiliency.

CONCLUSION

Through addressing climate change in both policy and on the ground action via a broad range of policies, legislation, and small projects, most of the information and policies needed to develop an actionable NAP and NAMA exist. However, financial needs and knowledge gaps are the two biggest limitations preventing Saint Lucia from addressing climate change adaptation and mitigation priorities. These needs can be met through using relevant policies and documents (e.g. SPCR, CCAP, National Energy Policy, Tourism Impact Assessment, Strategy and Adaptation Plan, Vulnerability and Adaptation Assessments, GHG Inventories, iNDC, etc.) as guides on where to focus and for engaging with NGOs, donors, and the private sector on climate related needs. Therefore, Saint Lucia, as well as donors, are challenged to focus on seeding long-term benefit projects, while addressing short-term relief needs, where necessary. Immediate needs in that regard include improving coordination among governmental agencies and centralizing relevant data into single resource center, to facilitate and expedite sound decision-making processes and to establish and maintain key international partnerships and alliances.

One cross cutting and important area is the role of communication and education to address climate issues. This includes raising awareness, but also providing the technical skills and capacity for workers to thrive in an economy where solar power may be common, climate policy is the norm, and communities are required to adapt to climate change to protect their livelihoods.

Saint Lucia has an exceptionally strong record of stakeholder consultations via the development of the SPCR and other environmental (including climate-related) processes and has an extensive database, reports, and assessments to complete the NAP and develop mitigation actions for the NAMA.

REFERENCES

- Auth, A., Konold, M., Musolino, E., & Ochs, A. (2013). *Caribbean Sustainable Energy Roadmap (C-SERMS), Phase 1: Summary and Recommendations for Policymakers*. Caribbean Community (CARICOM). Retrieved from [http://www.worldwatch.org/system/files/nPhase%201%20C-SERMS%20Summary%20for%20Policymakers%20\(1\).pdf](http://www.worldwatch.org/system/files/nPhase%201%20C-SERMS%20Summary%20for%20Policymakers%20(1).pdf)
- Benjamin, L. (2010.) *Climate Change and Caribbean Small Island States: The State of Play*. International Journal of Bahamian Studies. <http://journals.sfu.ca/cob/index.php/files/article/viewFile/129/148>.
- Caribbean Community (CARICOM) Secretariat. (2016). *CARICOM's selected economic indicators 2005, 2010-2014: A statistical profile of the CARICOM single market and economy*. Greater Georgetown, Guyana: CARICOM Secretariat. Retrieved from <http://www.caricomstats.org/handbookpub.html>
- Caribbean Community Climate Change Centre. (2015). *Volumes I & II: Impact assessment and national adaptation strategy and action plan to address climate change in the tourism sector of Saint Lucia*.
- Catherine, E. S. (2011). *A "Basic Needs" Index for Saint Lucia at the level of Small Areas for the 2010 Population and Housing Census*.
- Caribbean Development Bank. (2007). *Trade adjustment and poverty in Saint Lucia 2005/06, Volume I: Main report*. Prepared by Kairi Consultants Ltd. Retrieved from <http://www.caribank.org/uploads/2012/03/SLUCPAMainReport.pdf>
- Caribbean Disaster Emergency Response Agency (CDERA) and Caribbean Development Bank (CDB). (2005). *Saint Lucia Country Report: Legislative review and institutional capability assessment for hazard mitigation*. Prepared by Ecoisle Consulting Inc. Retrieved from <http://www.caribank.org/wp-content/uploads/2012/03/LegReviewCountry-Report-Final-Saint-Lucia-31.09.05.pdf>
- Caribbean Environmental Health Institute (CEHI). (2010). *Roadmap towards the preparation of an Integrated Water Resources Management (IWRM) plan for Saint Lucia*.
- Central Statistics Office. (2011). *2010 population and housing Census: Preliminary report*. Retrieved from <http://192.147.231.244:9090/stats/images/OtherPublications/StLuciaPreliminaryCensusReport2010.pdf>
- Climate change technology needs assessment for Saint Lucia*. Retrieved from http://unfccc.int/ttclear/misc/_StaticFiles/gnwoerk_static/TNR_CRE/e9067c6e3b97459989b2196f12155ad5/4c895377b6734667b7781adeb0d7bd04.pdf
- Economic Commission for Latin America and the Caribbean Subregional Headquarters for the Caribbean. *An assessment of the economic impact of climate change of the agriculture sector in Saint Lucia*. (2011). Retrieved from <http://www.cepal.org/en/publications/38566-assessment-economic-impact-climate-change-agriculture-sector-saint-lucia>
- ECLAC. 2011. *Assessment of the Economic Impact of Climate Change on the Tourism Sector in Saint Lucia*. <http://www.cepal.org/en/publications/38612-assessment-economic-impact-climate-change-tourism-sector-saint-lucia>
- ECLAC. 2011. *Economic Impacts of Climate Change in the Caribbean*. <http://www.cepal.org/publicaciones/xml/2/45412/LCARL.346.pdf>

Ephraim, J. & Tulsie, B. (2010). *National issues report on key sector of energy (mitigation) for Saint Lucia*. United Nations Development Programme. Retrieved from [http://www.undpcc.org/docs/National%20issues%20papers/Energy%20\(mitigation\)/26_St%20Lucia%20NIP_energy%20mitigation.pdf](http://www.undpcc.org/docs/National%20issues%20papers/Energy%20(mitigation)/26_St%20Lucia%20NIP_energy%20mitigation.pdf)

Flynn and Rothwell Ltd. (1998). *Comments on "Saint Lucia: Southern region water supply project."* UK Development Program.

Forestry Department. (2015). *Saint Lucia forests and lands resources development department strategy 2015-2025*.

German Technical Cooperation & CARICOM Secretariat. (2010). *Saint Lucia national energy policy*. Retrieved by http://www.oas.org/en/sedi/dsd/Energy/Doc/NEP_StLucia_web.pdf

GOSL. (2001). *Saint Lucia's initial national communication on climate change*. Edited by Bishnu Tulsie, Crispin d'Auvergne, and Devon Barrow.

GOSL. (2002). *Saint Lucia national climate change policy and adaptation plan*. Ministry of Physical Development Environment and Housing. Retrieved from http://www.caribbeanelections.com/eDocs/strategy/lc_strategy/lc_climate_change_policy.pdf

GOSL. (2004). *National water policy*. Ministry of Communications, Works, Transport and Public Utilities.

GOSL. (2006). *Saint Lucia final hazard mitigation policy*. Prepared by Theresa Louis. Retrieved from <http://www.caribank.org/wp-content/uploads/2012/03/St.-Lucia-Final-National-Hazard-Mitigation-Policy-May-2006.pdf>

GOSL. (2009). *Saint Lucia's fourth national report to the Convention on Biological Diversity*. Retrieved from <https://www.cbd.int/doc/world/lc/lc-nr-04-en.pdf>

GOSL. (2011a). *National environmental education strategy for Saint Lucia 2012-2017*. Castries, Saint Lucia: Ministry of sustainable Development, energy, Science and Technology. Retrieved from <http://www.pnuma.org/publicaciones/Final%20NE%20-%20St%20Lucia-2010-%20edited.pdf>

GOSL. (2011b). *Second national communication on climate change for Saint Lucia*. Ministry of Physical Development and the Environment. Retrieved from <http://dipecholac.net/docs/xfiles/544-lcanc2.pdf>

GOSL. (2013a). *Food and nutrition security policy and action plan*. Retrieved from http://infoagro.net/programas/seguridad/politicas/RegionCaribe/politica_SLucia.pdf

GOSL. (2013b). *Landslide Risk Assessment for Saint Lucia's Primary Road Network*. Castries, Saint Lucia: Ministry of Infrastructure, Port Services and Transport.

GOSL. (2014a). *National food production action plan*. Retrieved from <http://www.caribbean-agriculture.com/FPP-Final.pdf>

GOSL. (2014b). *Public education and awareness strategy implementation plan*. Saint Lucia's Strategic Programme for Climate Resilience (SPCR): Under and Beyond the Pilot Programme for Climate Resilience (PPCR).

GOSL. (2015a). *Saint Lucia: Intended nationally determined contribution under the United Nations Framework Convention on Climate Change (UNFCCC)*. Retrieved from <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Saint%20Lucia%20First/Saint%20Lucia's%20INDC%2018th%20November%202015.pdf>

GOSL. (2015b). Saint Lucia social protection policy: A national roadmap to transformative social protection. Castries, Saint Lucia: Ministry of Social Transformation, Local government and Community Empowerment. Retrieved from <http://www.govt.lc/media.govt.lc/www/resources/publications/NSPP---FINAL-05.03.15.pdf>

GOSL. (2015c). State of the Environment Report: Saint Lucia. Supported by the Caribbean Development Bank.

GOSL. (2016). *Third national communication on national circumstances for Saint Lucia*. Ministry of Physical Development and the Environment.

Latin American Energy Organization (OLADE). (2014). *Saint Lucia energy balances 2010-2012*. Retrieved from <http://biblioteca.olade.org/opac-tmpl/Documentos/old0332.pdf>

Marketing Unit. *Crop availability chart – Saint Lucia*. Ministry of Agriculture, Lands, Fisheries and Forestry.

Martin R, C Gomes, D Alleyne, W Phillips. 2013. An Assessment of the economic and social impacts of climate change on the energy sector in the Caribbean. ECLAC Project Document. http://repositorio.cepal.org/bitstream/handle/11362/38280/1/LCCARL397_en.pdf

Ministry of Agriculture, Lands, Forestry and Fishing (MALFF). (2002). *Coastal zone Management in Saint Lucia: Issues paper*. Retrieved from http://biodiversity.govt.lc/Portals/0/Resources/Coastal_Zone_Management.pdf

MALFF. (2007). *2007 Saint Lucia census of agriculture: Portrait of the main findings*. Castries, Saint Lucia: Author.

MALFF. (2015). *Policy brief: National agricultural policy 2009 – 2015*. Retrieved from <http://faolex.fao.org/docs/pdf/stl146715.pdf>

MALFF and Food and Agriculture Organization of the United Nations (FAO). (2011). *Strategic framework for the Ministry of Agriculture, Lands, Forestry and Fisheries – for disaster risk reduction in agriculture, forestry, and fisheries*. Retrieved from <http://www.fao.org/climatechange/32715-063749da6a00a2bba0e843260256f61b7.pdf>

Ministry of Finance and Economic Affairs. (2012). *Watershed-river analysis of Saint Lucia, West Indies*. Prepared by Frank D. Morgan and Burke J. Minsley.

Ministry of Infrastructure, Port Services and Transport. (2013). *Hydraulic assessment for flood risk reduction for the watershed communities of Marc and Bexon, Saint Lucia: Inception report*. Prepared by Dillon Consulting Ltd.

Ministry of Physical Development, Housing and Urban Renewal. (2015). *Proposed revised national land policy for Saint Lucia*.

Ministry of Social Transformation, Culture and Local Government. (2003). *Interim poverty reduction strategy and action plan for Saint Lucia*. Castries, Saint Lucia: Author. Retrieved from https://www.unicef.org/easterncaribbean/spmapping/Planning/national/St.Lucia/i-prsp_St.Lucia.pdf

Ministry of Sustainable Development, Energy, Science and Technology. (2010). *Save energy costs: A guide*. Retrieved from http://www.credp.org/Data/EE_Guide.pdf

Ministry of Sustainable Development, Energy, Science and Technology. (2013). *The Saint Lucia climate change adaptation policy: Adapting one individual, one household, one community, one ENTERPRISE and one sector at a time*. Retrieved from <http://dms.caribbeanclimate.bz/M-Files/openfile.aspx?objtype=0&docid=6566>

Ministry of Sustainable Development, Energy, Science and Technology. (2014). *Resilience: Disaster Vulnerability Reduction Project (DVRP) Newsletter, 1(1)*.

Ministry of Sustainable Development, Energy, Science and Technology. (2015a). *Resilience: Disaster Vulnerability Reduction Project (DVRP) Newsletter, 2(1)*.

Ministry of Sustainable Development, Energy, Science and Technology. (2015b). *Resilience: Disaster Vulnerability Reduction Project (DVRP) Newsletter*, 2(2).

Ministry of Sustainable Development, Energy, Science and Technology. (2015c). *Resilience: Disaster Vulnerability Reduction Project (DVRP) Newsletter*, 2(3).

Ministry of Sustainable Development, Energy, Science and Technology. (2015d). *Resilience: Disaster Vulnerability Reduction Project (DVRP) Newsletter*, 2(4).

Ministry of Sustainable Development, Energy, Science and Technology. (2015e). *PPCR annual M&E report: Status of SPCR*.

Ministry of Sustainable Development, Energy, Science and Technology. (2015f). *Saint Lucia national greenhouse gas inventory report 2010*. Prepared by Seton Stiebert and EnviroEconomics.

Morgan, F. Minsley, B. (2012). Watershed-river analysis of Saint Lucia, West Indies. National Reconstruction and Development Unit, Ministry of Finance and Economic Affairs, Government of Saint Lucia.

National Emergency Management Organisation (NEMO). (2014). *Saint Lucia: Country document for disaster risk reduction, 2014*. Prepared by M. Luvette Thomas-Louisy. Retrieved from <http://dipecholac.net/docs/files/869-documento-pais-saint-lucia-para-la-web.pdf>

National Renewable Energy Laboratory (NREL). 2015. *Energy snapshot Saint Lucia*. Energy Transition Initiative: Islands. Retrieved from <http://www.nrel.gov/docs/fy15osti/62688.pdf>

National Emergency Management Organisation. 2014. Saint Lucia: Country Document for Disaster Risk Reduction. <http://dipecholac.net/docs/files/869-documento-pais-saint-lucia-para-la-web.pdf>

The CARIBSAVE Partnership. (2012). *CARIBSAVE climate change risk profile for Saint Lucia: Summary document*. Retrieved from <http://www.caribbeanclimate.bz/closed-projects/2009-2011-the-caribsave-climate-change-risk-atlas-cccra.html>

The CARIBSAVE Partnership. (2012). *The CARIBSAVE Climate Change Risk Atlas (CCRA): Climate change risk profile for Saint Lucia*. Retrieved from <http://www.caribbeanclimate.bz/closed-projects/2009-2011-the-caribsave-climate-change-risk-atlas-cccra.html>

The Nature Conservancy (TNC). (2016). *Saint Lucia Coral Reef Report Card 2016*. Retrieved from http://www.nature.org/media/coral-reef-report-cards/STL_Report_Card_2016_WebLowRes.pdf

United Nations Climate Change Secretariat. *Emissions summary for Saint Lucia*.

United Nations Development Programme (UNDP). (2012). *United Nations Conference on Sustainable Development (Rio +20) national preparatory process: National synthesis report*.

UNDP. Human Development Report 2015. Work for Human Development. http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/LCA.pdf

UNDP. (2016). *Japan-Caribbean Climate Change Partnership (J-CCP) PSC Meeting minutes*.

UNDP. (2016). *Japan-Caribbean Climate Change Partnership (J-CCP) Project Mission to Saint Lucia: Mission notes*.

United Nations Environment Programme (UNEP). (2010). *National environmental Summary Saint Lucia 2010*. Retrieved from <http://www.pnuma.org/publicaciones/Final%20NES%20-%20St%20Lucia-2010-%20edited.pdf>.

U.S. Government. (2012). *Meeting the fast start commitment: U.S. climate finance in Fiscal Year 2012 Saint Lucia*. Retrieved from <http://www.state.gov/documents/organization/201130.pdf>

Vickery, PJ. 2008. [The Impact of Climate Change on Design Windspeeds in St. Lucia](#), Caribbean Community Climate Change Centre, Belmopan, Belize.

Walker, L. A. (2005). *Towards the development of a coastal zone management strategy and action plan for Saint Lucia*. Retrieved from http://www.un.org/depts/los/nippon/unff_programme_home/fellows_pages/fellows_papers/walker_0506_stlucia.pdf

Water Resources Management Agency. (2012). *Strategic plan 2012 to 2017*. Prepared by Deborah Bushell, Vasantha Chase, & Luvette Louisy.

Willette D and Ambrose, R. 2012. Effects of the invasive seagrass *Halophila stipulacea* on the native seagrass, *Syringodium filiforme* and associated fish and eipbiota communities in the Eastern Caribbean. *Aquatic Botany* 103:74-82.
http://www.academia.edu/3709874/Effects_of_the_invasive_seagrass_Halophila_stipulacea_on_the_native_seagrass_and_fish_community_in_the_Eastern_Caribbean

World Travel & Tourism Council. (2016). *Travel & tourism economic impact 2016: Saint Lucia*. Retrieved from <http://www.wttc.org/research/economic-research/economic-impact-analysis/country-reports/>.

ANNEX A: PILOT PROJECT PROPOSALS

(Attached separately)