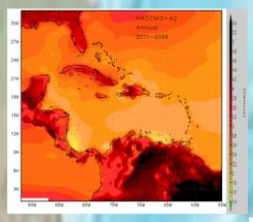
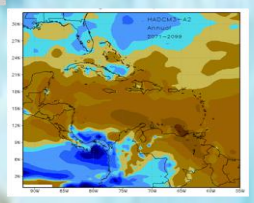
Caribbean Regional Strategic Program for Climate Resilience (SPCR)





Prepared for the

Pilot Program for Climate Resilience

April, 2012

Caribbean Community Climate Change Centre (CCCCC)

Document prepared in collaboration and assistance from the Inter-American Development Bank (IDB), the World Bank Group (IDA/IBRD and IFC) and the following participating countries and regional organizations

Countries	Regional Organizations
Dominica	Caribbean Community Secretariat (CARICOM)
Grenada	Caribbean Disaster Emergency Management Agency (CDEMA)
Haiti	Caribbean Institute of Meteorology and Hydrology (CIMH)
Jamaica	Caribbean Regional Fisheries Mechanism (CRFM)
St. Lucia	Caribbean Agricultural Research and Development Institute (CARDI)
St. Vincent and the Grenadines	Organization of Eastern Caribbean States (OECS) Secretariat
	University of the West Indies (UWI)
	Caribbean Development Bank
	Caribbean Environmental Health Institute (CEHI)

Contents

Acronyms

ACCC	Adaptation to Climate Change in the Caribbean
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CARIFORUM	The Caribbean Forum
CCCCC	Caribbean Community Climate Change Centre
CDEMA	Caribbean Disaster and Emergency Management Agency
CEHI	Caribbean Environmental Health Institute
CIMH	Caribbean Institute for Meteorology and Hydrology
CMC	Caribbean Meteorological Council
CMG	Climate Modeling Group
CMO	Caribbean Meteorological Organization
COTED	Council for Trade and Economic Development
CPACC	Caribbean Planning for Adaptation to Climate Change
CRFM	Caribbean Regional Fisheries Mechanism
ECLAC	Economic Commission of Latin America
EU	European Union
GCOS	Global Climate Observing System
GCCA	Global Climate Change Alliance
GCCI	Global Climate Change Initiative
GFCS	Global Framework for Climate Services
GLOSS	Global Sea Level Observing System
GOOS	Global Ocean Observing System
GPS	Global Climate Information and Data Producing Centers
ICZM	Integrated Coastal Zone Management
INC	Intergovernmental Negotiating Committee (UNFCCC)
MACC	Mainstreaming Adaptation to Climate Change
NOAA	National Oceanic and Atmospheric Agency (US)
PPCR	Pilot Program for Climate Resilience
RCC	Regional Climate Center
SLR	Sea Level Rise
SPACC	Special Programme on Adaptation to Climate Change
SPCR	Strategic Program for Climate Resilience

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WMO	World Meteorological Organization

Conventions:

Region refers to the Caribbean Region

mn = million

PILOT PROGRAM FOR CLIMATE RESILIENCE

Summary of Strategic Program for Climate Resilience (Caribbean Regional Track)

1. Country/Region:	The Caribbean Region	
2. PPCR Funding Request (in USD million):	Loan: n/a	Grant: $10.60[1]
3. National PPCR Focal Point:	Caribbean Community Climate Change Centre, Dr. Kenrick Leslie, Executive Director, k.leslie@sbcglobal.net	
4. Implementing Agency (Coordination of Investment Strategy):	Caribbean Community Climate Change Centre (CCCCC)	
5. Involved MDB	Inter-American Development Bank and the World Bank Group	
6. MDB PPCR Focal Point and Project/Program Task Team Leader (TTL):	*Headquarters-PPCR Focal Point:* *Gloria Visconti (IDB)* *Climate Change Senior Specialist* *gloriav@iadb.org*	*TTL: Gerard Alleng (IDB)* *Climate Change Senior Specialist* *gerarda@iadb.org*

7. Description of SPCR:

The following outlines the Caribbean Regional SPCR and the associated investment plan (IP) that is composed by four (4) components: (i) Improving Geospatial Data and Management for Adaptation Planning , Sea Level Rise and Storm Surge Impact Analysis ; (ii) Consolidating and Expanding the Regional Climate Monitoring Network and Global Platform Linkages ; (iii) Downscaling and Expanding Climate Projection Models and High Resolution Maps ; and (iv) Applied Adaptation Initiatives. As part of the total budgetary request, a Project Preparation Grant (PPG) for the amount of $0.15 million is also being included.

(a) Key challenges related to vulnerability to climate change/variability:

The key challenges related to vulnerability to climate change include (i) continued deficit of climate related baseline data to enable effective risk and hazard analysis and planning for resilience through adaptation to climate change; (ii) gaps in the regional climate monitoring system and unclear protocols for the exchange of and continued access to climate relevant data between and among national and regional agencies and users; (iii) a need to downscale global models of climate change impacts to ensure clarity in how Caribbean states would be affected and so inform planning and decision-making process; and (iv) a need to better understand climate change implications for priority sectors such as agriculture, fisheries, health and water, as well as the adaptation options applicable to these sectors.

(b) Areas of Intervention – sectors and themes

The areas of intervention of the regional SPCR are (i) data availability and analysis; (ii) data exchange, storage and access; (iii) modeling climate change and impacts and (iv) identifying, up-scaling and replicating adaptation measures in key sectors. These will be addressed through the following components-

i. Improving Geospatial Data and Management for Adaptation Planning , Sea Level Rise and Storm Surge Impact Analysis;

ii. Consolidating and Expanding the Regional Climate Monitoring Network and Global Platform Linkages;

iii. Downscaling and Expanding Climate Projection Models and High Resolution Maps

iv. Applied Adaptation Initiatives.

[1] The SPCR Regional Track request is for US $10.60 mn, with the understanding that there is an indicative range of US $9 – US $11.0 mn, and that the lower end will apply if the envelope materializes at the lower end of the projected range.

(c) Expected Outcomes from the Implementation of the SPCR

I. Improved regional process of data acquisition, storage and analysis to enable effective response to climate change

ii. Scaled up innovative climate resilience initiative

iii. Replication of PPCR initiatives in none PPCR-pilot countries\

8. Expected Key results from the Implementation of the Investment Strategy

Baseline and Result	***Success Indicator(s) and Baseline***	***Component***
Baseline: Dated sea level and hazard maps; incomplete global network, limited climate proofed plans.	Increase in quantity and improvement in quality of high resolution maps; at least 3 updated maps.	Component 1
Expected Result: Improved regional institutional capacity to respond to climate variability and climate change	Improvement in processes for management, storage and acquisition of climate relevant data; expanded linkage to GLOSS and GOOS.	Components 1 and 2
	Increase in number of persons trained in data management and climate modeling; baseline to be determined.	Component 3
	Number of national and sectoral plans climate proofed; 1 national and 4 regional plans climate proofed.	Components 1, 3 and 4
	Number of lifeline assets climate proofed	Component 4
Baseline: Key climate adaptation initiatives such as mangrove replanting currently being undertaken in select Caribbean countries.	Number of Climate Adaptation initiatives expanded or newly implemented.	Component 4
Expected Result: Scaling up and replication of climate variability and climate change initiatives	PPCR initiatives replicated in non-PPCR countries within the Caribbean;	Component 4
Baseline: Expanded public awareness and understanding of climate change adaptation needed. Specific baseline to be determined	Number of documented and disseminated lessons learned;	Components 1, 3 and 4
Expected Result: Dissemination of information on lessons learned	Number of non PPCR participants in PPCR activities	Components 1 through 4

9. Project and Program Concepts under the SPCR:

Project/Program Concept Title	***MDB***	***Requested PPCR Amount ($)[2]***	***Grant or Loan***	***Expected co-financing ($)***	***Preparation grant request ($)***	***Total PPCR request***	***MDB Fee***
Investment Proposal	IDB	9.15 million	Grant	n/a	0.15 million	9.30 million	0.4 million
Program Management	IDB	1.30 million	Grant	n/a	-	1.30 million	

[2] Includes preparation grant and project/program amount.

and communication							
TOTAL		10.45 million			0.15 million	10.60 million	0.4 million

10. Timeframe (tentative) – Approval[3] Milestones

Project Preparation Grant: April 2012

Caribbean Regional Investment Plan : August 2012

11. Key national stakeholder Groups involved in SPCR design[4]: the Caribbean Community Climate Change Center CCCCC, University of West Indies (UWI), Caribbean Institute for Meteorology and Hydrology (CIMH), Caribbean Meteorological Organization (CMO), Caribbean Agricultural Research and Development Institute (CARDI), Caribbean Regional Fisheries Mechanism (CRFM), Caribbean Environmental Health Institute (CEHI), Caribbean Disaster Emergency Management Agency (CDEMA).

12. Other Partners involved in SPCR: Implementation of most of the components will involve other collaborating agencies within and outside the region, including non-regional universities and international organizations with climate mandates.

[3] Expected signature of loan/grant agreement between government and MDB.

[4] Other local, national and international partners expected to be involved in design and implementation of the strategy.

Project/Program Preparation Grant Request

<table>
<tr><th colspan="4">PILOT PROGRAM FOR CLIMATE RESILIENCE

Project/Program Preparation Grant Request[5]</th></tr>
<tr><td>1. Country/Region:</td><td>Caribbean Regional Track/Caribbean</td><td>2. CIF Project ID#:</td><td>(Trustee will assign ID)</td></tr>
<tr><td>3. Project Name:</td><td colspan="3">Project design of the Investment Proposal for the Caribbean Regional SPCR</td></tr>
<tr><td>4. Tentative Funding Request (in USD million total) for Project[6] at the time of SPCR submission (concept stage):</td><td colspan="2">Loan: n/a</td><td>Grant: US$ 10.60 million[7]</td></tr>
<tr><td>5. Preparation Grant Request (in USD million):</td><td colspan="2">US$ 0.15 million</td><td>MDB: Inter-American Development Bank</td></tr>
<tr><td>6. National Project Focal Point:</td><td colspan="3">Caribbean Community Climate Change Center (CCCCC)
Dr. Kenrick Leslie, Executive Director
k.leslie@sbcglobal.net</td></tr>
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gloriav@iadb.org</td><td>TTL:
Gerard Alleng (IDB)
Climate Change Senior Specialist
gerarda@iadb.org</td></tr>
<tr><td colspan="4">9. Description of activities covered by the preparation grant:

The project preparation grant would allow the detailed design and costing of the five (5) components (4 as part of the Investment Program and 1 for the Program Management and Communication) that comprise the investment proposal, as well as to undertake a market study for private sector involvement and a study on climate change impacts on gender and vulnerable groups in PPCR participating countries of the Caribbean.

The specific activities to be funded under this grant are as follows:
A. Design and definition of the five (5) components under the investment proposal of the Investment Plan (IP) as well as detailed budgeting, monitoring indicators and implementation arrangements of the different activities under each of the components. This will include, at least:
i. Preparation of the project proposal document of the IP.
ii. Preparation of a procurement plan and disbursement schedule of the project proposal.
iii. Description and justification for implementation arrangements of each component of the proposal.
iv. Execution chronogram.
v. Preparation of terms of reference for consultancies to be undertaken under the IP.
vi. Finalization of the detailed budget with costing of the investment components, the components' financing and preparation of the financial and economic analysis.
vii. Preparation of the monitoring and evaluation plan for the different components, including the definition of monitoring indicators and mechanisms for collection, processing and dissemination of the data.</td></tr>
</table>

[5] A separate template needs to be presented for each project and program preparation grant request listed in the SPCR.

[6] Including the preparation grant request.

[7] The SPCR Regional Track request is for US $10.60 mn, with the understanding that there is an indicative range of US $9 – US $11.0 mn, and that the lower end will apply if the envelope materializes at the lower end of the projected range.

B. Development of a market study for private sector involvement in the Caribbean SPCR - This work will complement an ongoing market study being performed by Castalia on behalf of IFC. Therefore focus will be on, *inter alia*:
   i. The identification of on-lending opportunities for local and/or regional financial institutions to help small businesses (in the fishing, agriculture, small hotel/tourism, and manufacturing sectors) to become more climate resilient.
   ii. The identification of the specific needs of small enterprises related to climate adaptation and resiliency, such as (a) business tools for assessing climate related risk management and business readiness, including emergency management plans, (b) increased need for distributed energy and energy efficiency to enhance small firm energy security, (c) preparation for increased water stress and flooding events, including increased water capture and storage; and (d) the increased need for damage resiliency in private sector business assets.
   iii. The identification of private sector partners for the regional PPCR.

C. Study of the impacts of climate change on gender and vulnerable groups in the PPCR participating countries of the Caribbean. This study will include at least the following:
   iv. A review of the already existing information on gender and vulnerable groups in the Caribbean and the impacts of climate change on such groups (when available) as well as a gap analysis of the missing information on this area.
   v. Development of additional studies (if required) of the impacts of climate change on the identified vulnerable groups.
   vi. Generation of a report with recommendations in order to build climate change resilience within these social groups. This report should include specific measures for each component (where applicable) of the IP in order to reduce / minimize the impacts of climate change on vulnerable groups as well as applicable monitoring indicators and mechanism for collection, processing and reporting.

10. Outputs:

Deliverable	**Timeline**
(a) Project proposal document of the IP	July 2012
(b) Private sector involvement study	June 2012
(c) Final recommendations report on the impacts of climate change on gender and vulnerable groups	July 2012

11. Budget (indicative):

Expenditures[8]	**Amount (USD) -** estimates
Consultants	120,000
Equipment	
Workshops/seminars	
Travel/transportation	20,000
Others (admin costs/operational costs)	
Contingencies (max. 10%)	10,000
Total Cost	**150,000**

[8] These expenditure categories may be adjusted during project preparation according to emerging needs.

Other contributions:	
a. Government	n.a.
b. MDB	n.a.
c. Private Sector	n.a.
d. Others (please specify)	n.a.

12. Timeframe (tentative)

Submission of pre-appraisal document for PPCR Sub-Committee Approval: June 2012

Expected Board/MDB Management[9] approval date: October 2012

13. Other Partners involved in project design and implementation[10]: CCCCC, University of West Indies (UWI), Caribbean Institute for Meteorology and Hydrology (CIMH), Caribbean Agricultural Research and Development Institute (CARDI), Caribbean Regional Fisheries Mechanism (CRFM), Caribbean Environmental Health Institute (CEHI), Caribbean Disaster Emergency Management Agency (CDEMA).

14. Ongoing Complementary Initiatives:

European	Commission Global Climate Change Alliance initiative for CARIFORUM countries
AusAID:	Support for institutional strengthening for climate change adaptation
CDKN:	Support for the development of the Implementation Plan for the Regional Framework for Development Resilient to Climate Change and the development of a Risk Management Framework to enhance climate compatible development in the Caribbean
CDB:	The establishment and strengthening of the regional information clearing house at the CCCCC
DFID/CDB/ CCCCC:	Caribbean Regional Resilience Development Implementation Plan that is implementing some actions identified within the IP.
IDB:	Database Management System project to enhance connectivity of climate relevant data systems

15. If applicable, explanation for why the grant is MDB executed: n/a

16. Implementation Arrangements (incl. procurement of goods and services)**:** This project preparation grant will be executed by the Caribbean Community Climate Change Center (CCCCC), which is the designated Executing Agency for the Caribbean Regional Track of the PPCR.

[9] In some cases activities will not require MDB Board approval

[10] Other local, national and international partners expected to be involved in design and implementation of the project.

Part I: The Pilot Program for Climate Resilience and the Strategic Program

1. Introduction

The Pilot Program for Climate Resilience (PPCR), approved in November 2008, was the first program to become operational under the Strategic Climate Fund (SCF), one of two Climate Investment Funds.[11] The PPCR is executed globally through a number of regional and national programs and is intended to-[12]

- Pilot and demonstrate approaches for integration of climate risk and resilience into development policies and planning;
- Support the strengthening of capacities at the national levels to integrate climate resilience into development planning;
- Scale up and leverage climate resilient investment, especially by building on other ongoing initiatives;
- Enable learning by doing and lesson sharing at the country, regional and global levels;
- Strengthen cooperation and capacity at the regional level to integrate climate resilience in national and appropriate regional development planning and processes.

PPCR execution is done in two phases, with the first being generally less than one year's duration over which a mulit-year strategic program for climate resilience (SPCR) and relevant investment plan is designed. Once endorsed by the PPCR sub-committee, this SPCR is implemented (through the execution of the investment plan) over the second phase, which is anticipated to be of a four to five year duration for each of the participating countries and regions.

In the case of the Caribbean Region, six countries accepted an invitation to participate as part of a regional PPCR in May 2009. The Caribbean PPCR is designed into a national track with pilots in each of these countries, and a regional track. [13] First phase activities for the design of the SPCR has been completed and is near completion for five of the six national track pilots and for the regional track pilot.[14] The Caribbean Regional SPCR and related investment plan proposed for endorsement are set out in the remainder of this document.

2. The Regional Context

The process of designing the national and regional SPCRs is punctuated by consultative meetings referred to as Joint Missions, which involve the participating Multilateral Development

[11] The other is the Clean Technology Fund (CTCF).

[12] Climate Investment Funds, Guidelines for Joint Missions To Design PPCR Pilot Programs (Phase I), June 18, 2009.

[13] Caribbean pilot countries are (i) Jamaica (ii) Haiti (iii) Saint Lucia (iv) Saint Vincent and the Grenadines (v) Grenada and (vI) Dominica.

[14] National track SPCRs have been endorsed for Grenada, Saint Vincent and the Grenadines, Saint Lucia and Jamaica

Banks (MDBs) and respective PPCR stakeholders.[15] Participants at the second joint mission for the Caribbean regional PPCR, held in Kingston, Jamaica on 22nd and 23rd, September 2012, underscored that whilst only six countries within the region are participating in the pilot, benefits from its implementation are intended to accrue to the entire Region. In light of this, they recognize it as crucial that regional factors be taken into account in the design of both national and regional track SPCRs. This caveat is consistent with and reflective of the requirement for the regional track pilot to support the sharing of information and lessons learned from pilot activities with non-participating Caribbean countries.

The design of the regional SPCR takes account of the potential socioeconomic impacts of climate change, of the region's completed and ongoing efforts to confront these impacts and of the priorities identified for achieving climate resilience. The remainder of this section sets out the global and Caribbean context for climate change and the regional priorities identified, and describe completed and ongoing initiatives that together form the foundation on which the regional SPCR is grounded.

A. The Caribbean Climate Change Context

The PPCR is an appropriate measure for the Caribbean region which is prone to a range of natural hazards, including tropical cyclones, and is most likely to be directly affected by sea level rise. This is the most immediate result of climate change. The region consists of twenty four Small Island Developing States (SIDS) and low-lying countries. Many countries in fact have inhabited keys and atolls that make up a part of their national territory, and in some cases are significant economic enclaves. Most Caribbean countries have critical infrastructure and lifeline assets such as hotels and hospitals, on their coast or low lying areas.

For most of the countries' economies, the combined values of trade in goods and services exceed GDP. Tourism and commodity exports—economic activities over which they have no influence at the global level—are the most important income earners for most Caribbean territories. As a consequence, moderate changes on the international economy often have significant impacts on the national economies of Caribbean countries, whilst global downturns often lead to slowdowns or contractions.

Climate change is marked first by an identified increase in average global temperatures and resulting rise in sea surface temperatures, as well as in sea levels resulting from melting polar caps. The IPCC Fourth Assessment report indicated an accelerated rise in sea level of 0.6 meters or more by 2100, and pointed to the near intractable nature of this threat to coastal communities by the following-

> "Sea-level rise has substantial inertia and will continue beyond 2100 for many centuries. Irreversible breakdown of the West Antarctica and/or Greenland ice sheets, if triggered by rising temperatures, would make this long-term rise significantly larger, ultimately questioning the viability of many coastal settlements across the globe. The issue is reinforced by the increasing human use of the coastal zone.[16]"

The report showed climate change impacts as additional stressors to ecosystems and economic activities already affected by unsustainable management practices associated with low economic development and limited job opportunities. Subsequent to the IPCC Fourth

[15] The Inter-American Development Bank and the World Bank are the multilateral development bank partners on the Caribbean regional PPCR.

[16] IPCC. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, p. 317.*

Assessment, modeling of climate change impacts on the Caribbean by Simpson et al suggest that in fact 1.5 to 2.0 degree Celsius increases in mean global temperature will lead to sea level rise (SLR) of 1.5 to 2.0 meters by 2100.

The model results for the six PPCR pilot countries, extracted from the report and set out in Tables 1 and 2 below, showed that whilst up to 5% of agricultural land and urban areas would be affected by such levels of SLR, the extent of tourism resorts, airports and ports impacted would be much higher.

Table 1: Projected Impacts of a 1 Meter Sea Level Rise, Caribbean PPCR Pilot Countries

	Land Area	Popu-lation	Urban Area	Agricultural Land	Crop and Plantation	Major Tourism Resorts	Airports	Ports
Dominica	<1%	1%	<1%	5%	<1%	0%	0%	67%
Grenada	1%	1%	<1%	3%	1%	11%	100%	100%
Haiti	<1%	1%	1%	3%	1%	46%	50%	100%
Jamaica	<1%	0%	<1%	1%	<1%	8%	20%	100%
St. Lucia	1%	1%	<1%	1%	1%	7%	50%	100%
St. Vincent	1%	1%	1%	2%	1%	10%	50%	67%

Source: Adapted from: Simpson, M.C, *et al*, P.1 (2010) *Quantification and Magnitude of Losses and Damages Resulting from the Impacts of Climate Change: Modeling the Transformational Impacts and Costs of Sea Level Rise in the Caribbean* (Key Points and Summary for Policy Makers Document), United Nations Development Programme (UNDP), Barbados, West, p. 29.

Table 2: Projected Impacts of a 2 Meter Sea Level Rise, Caribbean PPCR Pilot Countries

	Land Area	Popu-lation	Urban Area	Agricultural Land	Crop and Plantation	Major Tourism Resorts	Airports	Ports
Dominica	1%	1%	1%	5%	<1%	6%	50%	67%
Grenada	2%	1%	1%	5%	2%	18%	100%	100%
Haiti	1%	2%	2%	5%	1%	61%	50%	100%
Jamaica	1%	1%	1%	2%	1%	18%	60%	100%
St. Lucia	1%	1%	1%	1%	1%	10%	50%	100%
St. Vincent	2%	2%	1%	3%	1%	24%	75%	67%

Source: Adapted from: Simpson, M.C, *et al*, P.1 (2010) *Quantification and Magnitude of Losses and Damages Resulting from the Impacts of Climate Change: Modeling the Transformational Impacts and Costs of Sea Level Rise in the Caribbean* (Key Points and Summary for Policy Makers Document), United Nations Development Programme (UNDP), Barbados, West, p. 30

For most of the six countries, a 1 meter SLR would impact 100% of ports and 50% or more of airports. The authors also demonstrated further impacts to tourism plants of up to 11.0% in all of the countries except Haiti, where 46% would be impacted. An increase of 2 meters in sea level would impact the same areas to a greater degree. In their summary report, Simpson et al detailed impacts of warming and SLR for key economic sectors as described below.[17]

[17] Simpson, M.C. el al. (2009). *An Overview of Modeling Climate Change Impacts in the Caribbean Regional with Contributions from the Pacific Islands.*

1. Coral bleaching, infectious disease outbreaks and ocean acidification (p. 34).
2. Insecurity of water resources due to decline in precipitation and resulting decreases in available sources of groundwater recharge. Where dependence on surface water is relatively high, stress on water storage due to more interspersed rainfall (pp. 40-41). In summary, the results would be reduced quality and quantity of fresh water due to lower levels of ground water (from evaporation), salt water intrusion (from higher sea levels), and possibly siltation of surface water (from runoffs).
3. Reduced agricultural yields and increased crop prices as a result of deterioration in the quality of surface soil and dehydration of crops due to shifts in rainfall patterns and droughts; The lower yields are projected to lead to lower nutrition due to lower consumption of meats and grains (p.43).
4. Coastal erosion and threat to the integrity of lifeline assets (hospitals, water and power supply plants, major roads and bridges) and other real estate (such as houses, schools, hotels and public buildings) as a result of sea level rise;

Closely linked to the increase in average global temperature in the Caribbean region is the expected higher intensity of tropical cyclones or hurricanes. The likely effect of this anticipated trend is demonstrated by historical data on losses in 14 Caribbean countries from a total of 163 natural events as compiled and assessed by the Economic Commission for Latin America and the Caribbean (ECLAC).[18] The assessment shows that the region experienced some US$135 billion in losses from a total of 165 events between 1990 and 2008, as summarized in Table 3 below.

Table 3: Estimated Losses of Fourteen Caribbean Countries From Extreme Events, 1990 - 2008

Affected Sector	Value of Losses (in US$ billions)	% of Overall Losses
Economic	63	46
Social	57	42
Infrastructure	12	9
Environment	3	3
Total	**135**	**100**

Derived from ECLAC , 2008b, p. 5

Most of the events for which damages and losses were estimated by ECLAC were storms (60%) and floods (29%).[19] Of the countries affected, the highest losses were experienced by Haiti (29%), the Dominican Republic (20%), Jamaica (13%), The Bahamas and Belize (7% each). Six countries (including Belize, Dominica, Haiti, Jamaica, Saint Lucia and Suriname) experienced the highest level of damages and losses in their agriculture, forestry and fisheries subsector. Another seven countries (Anguilla, The Bahamas, Cayman Islands, The Dominican Republic, Grenada, the Netherland Antilles and Turks and Caicos) experienced the highest

[18] Economic Commission for Latin America and the Caribbean. (2010). *Analysis of Extreme Events in the Caribbean. 1990 – 2008.*

[19] Economic Commission for Latin America and the Caribbean (ECLAC), 2010b, p. 13.

damages and losses to their Tourism subsector. Only Guyana recorded highest damages and losses in the Industry and Commerce subsector.

As with damages and losses from extreme events such as hurricanes, the cost of climate change impacts and responses can be measured or estimated. This is done especially in terms of the costs and benefits of undertaking (action) or opting not to implement (inaction) adaptation and mitigation measures. In the face of climate change and catastrophic natural disasters, Bueno et al (2008) estimated that the cost of inaction within the Caribbean region could be 5.0% of 2004 GDP by 2025; 10.3 % by 2050; 15.9 % by 2075 and approximately 21.7 % by 2100.[20] These estimates were based on only three categories—increased hurricane damages, loss of tourism revenue, and infrastructure damages— and showed that the Caribbean's annual cost of inaction is projected to total $22.0 billion by 2050 and $46.0 billion by 2100. The costs estimated represent 10.0 % and 22.0 %, respectively, of the current Caribbean economy.[21] The projections comprise of the difference between a low impact (maximum emissions reduction actions) and high impact (business as usual) scenario.

Other efforts to measure costs and benefits of taking climate change adaptation measures have been spearheaded and facilitated by the Caribbean Catastrophic Risk Insurance Fund (CCRIF) and the Economic Commission of Latin America and the Caribbean. ECLAC's *Review of the Economics of Climate Change (RECC)* was comprised of assessments of the economic impacts of climate change in the water, agriculture, coastal and community, health, tourism and transportation sectors in a number of Caribbean countries. The RECC approach to determining the economic impacts of climate change are specific to the sector, so that impacts on agriculture are factor in the effect of rising temperatures and changes in rainfall patterns on yields whereas that to tourism factors in damages and losses to extreme events, which are anticipated to become more intense on average. The studies further factor in the cost of adaptation measures and benefit of reduced loss in earning vis-à-vis losses that would be incurred if no action is taken. The IPCC scenarios described above are critical to the determination of the extent of impact.

The CCRIF summary findings of its *Economics of Climate Adaptation (ECA)* initiative shows that in eight Caribbean countries current climate risk is already high, with expected losses of up to 6.0% of the respective local current GDPs, and related increases in damages from wind and inland and coastal flooding of an additional 1 - 3% of 2030 GDP given the worst case scenario.[22] The results further indicate that in some countries up to 90% of the loss expected by 2030 as estimated under the high climate change scenario can be averted cost-effectively. This includes the effect of risk mitigation initiatives such as appropriate adaptation measures.

The assessments outlined above point to a critical link between two temporal responses to climate change impacts. The first is the short term disaster risk reduction, and the second is the more long term adaptation. Both responses are described under the International Strategy for Disaster Reduction (ISDR) as having the common goal of reducing vulnerability of communities and achieving sustainable development. The link is further emphasized by the Hyogo Framework requirement to "promote the integration of risk reduction associated with existing

[20] Bueno et al, 2008. The Caribbean and Climate Change: The cost of inaction. Stockholm Environment Institute—US Center Global Development and Environment Institute, Tufts University. May 2008

[21] It is important to underscore that these estimates do not include losses from agriculture, energy and water resources, and from deteriorated public health.

[22] CCRIF, 2010. Enhancing the climate risk and adaptation fact base for the Caribbean: preliminary results of the ECA Study

climate variability and future climate change into strategies for the reduction of disaster risk and adaptation to climate change…"[23]

i. Anticipated Climate Change Impacts on Socioeconomic Groups

The incidence of climate change impact will vary for each of the sectors that would be affected. Impacts on the agricultural sector will result in higher input costs as a result of efforts to increase productivity. The potential contraction in the industry can lead to a reduction in the number of farmers, which in turn could lead to contractions in families' incomes. In addition to these two groups, entire populations of affected countries would be impacted by constraints in domestic food supply.

Warmer sea surface temperatures would affect marine ecosystems and disrupt fish stock. The most immediate impact of this would be a reduction in protein availability to the population in general, and a decrease in income levels of fisher folk, and possibly in their numbers. The decline in nutrition and income levels is likely to have a higher impact on the poor.

It should be emphasized that the most significant impact of climate change on agriculture and marine productivity would be on food security. This would in turn negatively impact nutrition levels across the region.

The socioeconomic groups that can be impacted by increasingly intense hurricanes are varied. In the first instance those residing in coastal areas in the low lying mainland states, and in much of the country in island states face risk of loss of life as well as property. This is especially true for poorer individuals and communities, who may have homes that are not sufficiently fortified to withstand higher intensity cyclones. Other groups impacted would be those engaged in sectors that would be most affected. The most obvious of these are agriculture and tourism.

ii. Gender and Vulnerable Group Dimensions

Women's rights issues can be linked to responses to climate change impacts as this sex is usually more vulnerable to climate change related disasters because of their social roles and responsibilities. In cases of disaster, women often shoulder domestic tasks whilst performing public sector related response roles. In addition they are primary care-givers for children, the sick and elderly and actively look after water and food security and energy supply. Disaster response protocols, such as timing of community meetings and distribution of relief supplies, can easily result in women's exclusion from, or delays in receiving, needed support.

Poverty assessments across the Caribbean showed that female-headed households are likely to have larger family sizes with a greater number of dependents. In addition, their dwellings are usually exposed to the adverse impacts of climate change since poorer households are often unable to afford the purchase of appropriate lands or bear the cost of materials needed to adhere to the prerequisite building codes.

Other groups vulnerable to climate change include young males, children and the elderly. In many Caribbean countries young males are underperforming and underrepresented in the national education systems given their high drop-out rates at the secondary level and low enrolment in tertiary institutions. Poverty assessments across the region show high rates of correlation between low educational attainment levels and poverty, and particularly lower

[23] International Strategy for Disaster Reduction. (2005). *The Hyogo Framework for Action 2005 – 2015. Building the Resilience of Nations and Communities to Disasters.*

attainments of tertiary level certification.[24] Furthermore, males demonstrate significantly lower educational attainment at this level than do females. This translates to markedly high levels of risk to climate change impacts faced by young males. One such risk is their withdrawal from schools and early entry into the workforce to support their families after climate change related disasters negatively impact their economic earnings, especially in the agriculture and fisheries sectors.

Children are also a vulnerable group as they are at highest risk from inadequate water supplies during drought, and from predicted changes in vector borne diseases. They are also at highest risk of malnutrition and, as with young males, can be forced into early entry into the workforce to cover lost family income.

The region's elderly are at high risk from climate-change related conditions such heat stress and malnutrition. In rural areas the risks arising from these conditions can be exacerbated by restricted access to healthcare.

B. Regional Institutional Arrangements for Monitoring and Responding to Climate Variability and Climate Change

The Caribbean's climate variability and climate change monitoring and response measures are anchored in at least four regional agencies, each described below.

i. Caribbean Meteorological Organization (CMO)

The Caribbean Meteorological Organization (CMO) is responsible for the coordination of the joint scientific activities of the region's national meteorological services and the establishment of joint technical facilities and systems. The CMO manages a Servir weather warning system to safeguard the region and advises governments in dealing with the international issues affecting weather, water and climate. The CMO has four divisions that include the Caribbean Meteorological Council (CMC), the Caribbean Institute or Meteorology and Hydrology (CIMH), the Headquarters Unit, and the Caribbean Meteorological Foundation.

ii. The Caribbean Institute for Meteorology and Hydrology (CIMH)

Of the CMO's divisions, the Caribbean Institute for Meteorology and Hydrology (CIMH) is perhaps the most well-known. The CIMH operates in a relatively autonomous manner. Its functions include education, training and research, and the maintenance of hydro-meteorological standards. The CIMH mission is "to assist in improving and developing the Meteorological and Hydrological Services as well as providing the awareness of the benefits or Meteorology and Hydrology for the economic well-being of the CIMH member states[25]. The CIMH achieves its mission through training, research, investigation and the provision of related services and advice.

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[24] Living Conditions in Antigua and Barbuda: Poverty in a Service Economy in Transition, Volume 1, Main Report, August 2007, p. 59; Trade Adjustment and Poverty in Saint Lucia, 2005/06, Volume 1 Main Report, June 2007, p. 56; Country Poverty Assessment: Grenada, Carriacou and Petit Martinique, Volume I-Main Report, 2007/08, p. 80; Caribbean Development Bank, Government of Dominica, Country Poverty Assessment, Final Report, Volume 1 of 2, Main Report, p. 82. Saint Kitts and Nevis Poverty Assessment Report, March 2001, p. 85. All reports were prepared by Kairi Consulting Limited in collaboration with respective national assessment teams.

[25] www.cimh.org

iii. Caribbean Disaster Emergency Management Agency (CDEMA)

The Caribbean Disaster Emergency Response Agency (CDERA) was transitioned to the Caribbean Disaster Emergency Management Agency in September 2009. This reflected a broader and more proactive role focused on risk management rather than on the more limited disaster response. CDEMA liaises with and supports the 16 national disaster associations each located within one of its participating states. The CDEMA is there to mobilize and coordinate the disaster relief in a state hit by natural disasters such as a hurricane or a volcano eruption. The agency also mitigates and tries to eliminate the immediate consequences in the participating states. Its role includes the mobilization of resources for strengthening disaster management programs in the participating states, as well as the provision of information and public awareness on disaster and emergency management. The CDEMA activities are becoming increasingly critical given the higher incidences and intensity of tropical storms and other natural disasters.

iv. Caribbean Community Climate Change Center (CCCCC)

The Caribbean Community Climate Change Center (CCCCC) was established in 2005 and has a mandate to provide climate change related policy advice and guidelines, and to be the official repository and clearing house for regional climate change data for the community. The CCCCC is in charge of coordinating the Caribbean region's response to climate change and provides change-related policy advice and guidelines to the Caribbean Community (CARICOM) Member States through the CARICOM Secretariat. The Centre is recognized by the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Program (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognized by the United Nations Institute for Training and Research (UNITAR) as a center of excellence[26].

C. Key Regional Response Measures to Climate Variability and Climate Change

As indicated in ECLAC's *Review of the Economics of Climate Change*, the Caribbean Region contributes less than 1.0% of total greenhouse gas emissions. This means that the Region would not be able to influence global trends through mitigation and therefore has historically placed higher emphasis on climate change adaptation (2010a, p.4). The *Review* chronicles the major milestones in the Caribbean's responses to the phenomenon, beginning with the 1994 Small Island Developing States (SIDS) conference. The milestones are set out below (p. 4).

Year	Action
1994	United Nations Small Island Developing States' Conference on Sustainable Development and the identification of climate change as one of the 14 priority areas in the Barbados Program of Action to be addressed in order to ensure the sustainable development of SIDS.
1994-1997	Design and funding proposal for a climate change adaptation project: The Caribbean Planning for Adaptation to Climate Change
1997-2001	The implementation of the Caribbean Planning for Adaptation to Climate Change (CPACC) Project.
2001	Decision by the Caribbean Community (CARICOM) Heads of Government to establish the Caribbean Community Climate Change Centre (CCCCC).

[26] www.caribbeanclimate.bz, May 23, 2011

Year	Action
2001-2004	Implementation of Adaptation to Climate Change in the Caribbean (ACCC) Project.
2004-2008	Implementation of Mainstreaming Adaptation to Climate Change (MACC) Project.
2005	Establishment of the Caribbean Community Climate Change Centre.
2006-2010	Implementation of Special Programme on Adaptation to Climate Change (SPACC) Project (implementation of adaptation measures).

Source: Review of the Economics of Climate Change (RECC) in the Caribbean Project, Phase I, Climate Change Profiles in Select Caribbean Countries, June 2010.

The initiatives cited punctuate sixteen years of active response to climate change at the national and regional level across the Caribbean. Many of these—either completed or under implementation—are set out at Annex 1. The list shows that the region's climate change response efforts have been aimed primarily at building capacity and generating key knowledge products for policy and action on climate monitoring, disaster risk reduction and management, climate change adaptation and renewable energy and energy efficiency. Over recent years there has been increasing focus on the importance of low carbon development, with at least one country (Guyana) articulating a national development strategy based on this principle.

i. Seminal Climate Change Adaptation Projects

The response measures above included the first regional adaptation projects which formed the foundation for later work on resilience, as well as for the now enabling Caribbean *Regional Framework for Achieving Development Resilient to Climate Change (the Regional Framework)* and the related Implementation Plan. Each of the major early projects and their outputs or achievements is described in this subsection, whilst the Regional Framework and its Implementation Plan are expanded on in the following subsection.

a. Caribbean Planning for Adaptation to Climate Change

In response to the region's articulation of the importance of adaptation to the Caribbean region, a first adaptation initiative, the Caribbean Planning for Adaptation to Climate Change (CPACC), was approved and funded by the Global Environment Facility (GEF). The CPACC was implemented across 12 countries of the Region between 1997 and 2001 by the World Bank and execution oversight was provided by a project advisory committee.[27] The project was intended to build capacity for adaptation to climate change impacts, especially as a result of sea level rise. It consisted of the following four regional activities and five pilot projects:

Regional CPACC Projects	Pilot CPACC Projects
Design and establishment of a sea level/climate monitoring network	Coral reef monitoring for climate change (Bahamas, Belize and Jamaica)
Establishment of databases and information systems	Coastal vulnerability and risk assessment (Barbados, Guyana and Grenada)
Inventory of coastal resources	Economic valuation of coastal and marine resources (Antigua and Barbuda, and Saint Kitts and Nevis)

[27] CPACC participating countries were Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, St. Kitts and Nevis, St. Vincent, and Trinidad and Tobago.

Regional CPACC Projects	Pilot CPACC Projects
Use and formulation of initial adaptation policies	Formation of economic/regulatory proposals (Antigua and Barbuda, and Saint Kitts and Nevis)
	National communications (Saint Vincent and the Grenadines)

The CPACC achievements included-

1. Establishment of a sea level rise and monitoring system consisting mainly of 18 state-of-the-art telemetry sea level and meteorological monitoring stations in 12 participating countries; the stations complied with the minimum standards of the Global Sea Level Observing System (GSLOS);
2. Development of regional and national capacities for long term management of the sea level rise monitoring stations;
3. Acquisition, analysis, archiving and dissemination of climate relevant data using information technology;
4. Increased awareness of climate change issues at the policy-making level;
5. Vulnerability assessments;
6. Establishment of coral reef monitoring protocols;
7. Articulation of national climate change adaptation policies and implementation plans; and
8. Creation of a network for regional harmonization – CPACC developed initial collaboration efforts with a number of existing regional agencies.

b. Adaptation to Climate Change in the Caribbean

The CPACC was succeeded by the Adapting to Climate Change in the Caribbean (ACCC) project, funded by the Canadian International Development Agency (CIDA). The ACCC was intended to sustain activities started under the CPACC and so further build capacity for climate change adaptation within the region. The ACCC outputs included-

1. Development and distribution of risk management guidelines for climate change adaptation decision making;
2. Development of a guide to assist environmental impact assessment (EIA) practitioners in CARICOM countries to integrate climate change in the EIA process;
3. Political endorsement by CARICOM of a business plan and establishment of the basis for financial sustainability for the Caribbean Community Climate Change Centre.
4. A draft regional public education and outreach (PEO) strategy;
5. The launch of a Master's Program in climate change, with the first cohort graduating in 2003;
6. Statistical downscaling of climate scenarios development for Jamaica, Trinidad and Tobago, and Barbados;
7. Staff training and development at the Caribbean Institute for Meteorology and Hydrology (CIMH) in climate trend analysis in order to strengthen climate change capacity;

8. Initiation of collaboration efforts on climate change issues with the South Pacific Regional Environment Programme (SPREP) and the Pacific Islands Climate Change Assistance Programme (PICCAP);
9. Implementation of pilot projects on adaptation studies in the water health and agricultural sectors;

c. Mainstreaming Adaptation to Climate Change

The ACCC was followed up by the Mainstreaming Adaptation to Climate Change (MACC) Project which was aimed at mainstreaming climate change adaptation strategies into the development agenda of small-island and low-lying CARICOM states. MACC participating countries were the same twelve included in the CPACC. The MACC project components focused mainly on building capacity in participating countries to-

1. Identify climate change risks
2. reduce vulnerability to climate change and
3. Effectively access and utilize resourced to minimize costs of climate change

Specific activities toward achieving the objectives above included development of national policy frameworks for adaptation, mainstreaming climate change issues into key sectoral activities, and facilitating the development of monitoring, analysis and the building of regulatory planning instruments for mainstreaming climate change issues in the region.

d. Special Program on Adaptation to Climate Change

The preparatory projects identified above set the foundation for applied adaptation initiatives—the first of which was the Special Program on Adaptation to Climate Change (SPACC). The SPACC is one of the first adaptation initiatives financed by the GEF. It complements the goals of the MACC Project and applies the lessons and information gathered through the CPACC initiative by piloting adaptation in countries that have already taken mainstreaming decisions and seek to execute specific actions to address climate change impacts. To this end, the SPACC aimed at supporting efforts to implement specific pilot adaptation measures along coastal and near-coastal areas in Dominica, Saint Lucia and Saint Vincent and the Grenadines, through-

1. the detailed design of pilot adaptation measures to reduce expected negative impacts of climate change on marine and terrestrial biodiversity and land degradation and
2. implementation of pilot adaptation investments.

These protection measures were also designed to induce economic benefits in the tourism, fisheries, agriculture and forestry sectors, help maintain the resource base upon which these economic activities rely and promote climate resilient sustainable development.

ii. Current Regional Framework for Climate Change Response

a. The Regional Framework for Achieving Development Resilient to Climate Change

The regional adaptation projects above set the foundation for the development of a strategy and plan of action for the Caribbean's coordinated response to climate change. Reflecting the importance of this phenomena to the region, CARICOM heads of government sought to consolidate response through endorsement in 2010 of the *Regional Framework for Achieving Development Resilient to Climate Change* (the Regional Framework). The *Regional Framework*

is a major policy and action initiative intended to facilitate a comprehensive and strategic approach to adaptation across the Caribbean. It is built around five strategic thrusts, each with a set of goals (Box 1), which together support adaptation and low-carbon development. The guiding principles of the regional framework are-

1. An integrated development planning approach
2. Early incorporation of adaptation into development planning initiatives through a multi-stakeholder approach founded on mutual respect and responsibility and
3. Sustaining strategy and action through public education and awareness Programs

The Regional Framework provides for governments, private sector, civil society and regional organization roles, and is intended to facilitate direction of international development efforts. The objectives of the Framework are to be met through the execution of an implementation plan aimed at achieving outcomes such as-

- Coral reef research program institutionalized and providing data to guide scientific research by 2021
- Increased output of peer reviewed and published research for contribution to teaching of climate science and to IPCC use
- Adequate food supplies produced to meet region's food and nutrition needs by 2021
- Common negotiating position on forest issues at UNFCCC
- Climate change mitigation and adaptation responses in the region are coordinated in an efficient and transparent manner

The Regional Framework is different from the SPCR in that it is more expansive and includes focus on information and capacity building for negotiating climate change issues and for implementing adaptation and mitigation measures. On the other hand, the SPCR is focused almost exclusively on adaptation. As a consequence, there is virtually no energy related activity within in the SPCR, and disaster risk reduction measures included target the climate change and disaster risk nexus. It is important to note further that achievement of SPCR objectives will contribute to the holistic resilience agenda for the Caribbean that in turn comprises the Regional Framework.

b. Implementation Plan for the Regional Framework for Achieving Development Resilient to Climate Change

The formulation of the Regional Framework was followed by an initiative to design an Implementation Plan (IP) that would ensure the achievement of its strategic objectives. The approach to the IP design included broad regional stakeholder consultation, executed in part through several country missions. In addition to specific actions for the achievement of each of the strategic objectives of the Framework, the IP champions the three-ones principle (one plan, one coordinating mechanism and one monitoring and evaluation framework) as the key modality for coordinated resource mobilization to facilitate climate change action. It further sets out the implementation roles of regional and national agencies and of development partners. Implementation actions were identified in the areas of food security, health, coastal and marine resources, water, energy, forests and tourism areas, as well as for cross sector priorities.

Box 1: Caribbean Regional Framework for Achieving Development Resilient to Climate Change Strategic Elements and Goals

Strategic Element I: Mainstreaming climate change adaptation strategies into the sustainable development agendas of the CARICOM member states

Goal 1: Assess the vulnerability and risks associated with a changing climate

Goal 2: Reduce vulnerability to a changing climate

Goal 3: Effectively assess and utilize resources to reduce vulnerability to a changing climate

Goal 4: Build a Society that is more informed about and resilience to a changing climate

Goal 5: Build the Caribbean Community Climate Change Centre's capacity to support the implementation of the strategy

Goal 6: Reduce the region's carbon footprint through the promotion of energy efficiency measures

Strategic Element 2: Promote the implementation of specific adaptation measures to address key vulnerabilities in the region. This is intended to strengthen the climate resilience of the most vulnerable sectors, with focus on (a) water supply, (b) coastal and marine ecosystems, (c) tourism, (d) coastal infrastructure and (c) health.

Goal 1: Promote the adoption of measures and disseminate information that would make water supply systems resilient to climate change

Goal 2: Promote the implementation of measures to reduce climate impacts on coastal and marine infrastructure

Goal 3: Promote the adoption of measures and dissemination of information that would adapt tourism activities to climate impacts

Goal 4: Promote sound conservation practices to coastal and marine ecosystems to shelter these resources from climate induced damage

Goal 5: Promote the adoption of sound practices and measures to prevent and/or reduce climate induced health impacts in the community

Strategic Element 3: Promote actions to reduce the vulnerability of natural and human systems in CARICOM countries to the impacts of a changing climate.

Objectives include revised building codes, development of new standards, integrated land use planning, national standards for sanitation, proven varieties of resistant crop, public education programs and insurance tools.

Strategic Element 4: Promoting the adoption of best practices for sustainable forest management.

Goal 1: Promote the adoption of best practices for sustainable forest management

Goal 2: Engage in negotiations with international partners to mobilize resources for the protection of standing forests

Goal 3: Undertake research aimed at improving current methodologies for estimating carbon sequestration rates in tropical forests

Strategic Element 5: Promoting action to derive social, economic, and environmental benefits through the prudent management of standing forests in CARICOM countries.

In addition to an extensive frame of actions for achieving the strategic objectives, the IP sets out priority actions for targeting institutional and governance building blocks, technical and physical impacts (of climate change) and cross-cutting challenges over the first two years of execution. The priority actions provide for -

- Transformational change and effective resource mobilization,
- building low carbon economies,
- mobilizing financial and technical assistance
- Development of a risk management ethic
- Asset inventory of Saint Lucia's water utilities and assessment of their vulnerabilities to climate variability and climate change
- Building on existing information, knowledge and expertise to expand capacity and knowledge
- Mobilizing resources for addressing the disaster risk reduction and climate change n
- Strengthening negotiating position by improving research

The specific priority actions for each of these areas are set out at Box 3 overleaf.

c. Development Partners' Support for Priority Implementation Plan

The articulation of priority actions under the IP allows development agencies to target their resources to the most critical issues for the region. This is reflected in areas and initiatives most recently supported by bilateral partners such as the Governments of Australia and the United Kingdom (See Box 2), and by agencies such as the Climate and Development Knowledge Network (CDKN). In addition to the support for the development of the IP by CDKN, investment areas supported collectively by these bilateral partners include-

- Financial management
- Climate Change Science, Adaptation and Mitigation including Renewable Energy
- Environmental Economics and Social Impacts
- Project Development
- Public Education and Awareness

The Australian Aid collaboration is targeted at this point to operational support for the Climate Change Centre and bridge financing for the SPACC project.

- ○

Box 2: The UK Support to Caribbean Climate Change Priorities

The most recent UK program works at regional, national and local levels to support-

- Better resource mobilization for national adaptation priorities,
- A joint Caribbean position in international negotiations
- Integration of risk management and adaptation into national planning processes
- Mapping and valuation of coastal and marine ecosystems
- Demonstration adaptation projects in water resource management and critical infrastructure
- Improved fisheries and coral reef diversity
- Monitoring and evaluation

Box 3: Priority Actions of the Implementation Plan for the Regional Framework for Achieving Development Resilient to Climate Change

IP Focus Area	Intended Priority Action	Planned Duration
Institutional and Governance Building Blocks		
Transformational change and effective mobilization of scarce resources	Adoption of three-ones principle (one plan, one coordinating mechanism and one monitoring and evaluation framework) at the regional level by CARICOM and at a national level by each government	2 Years
Building a low carbon climate resilient economy as an integral element of the wider sustainable development agenda	CARICOM Secretariat, national government and regional organizations review of existing strategies, policies and actions to ensure their alignment and consistency with and contribution to resilience building and a low carbon economy, as well as the wider development objectives in the context of climate change	2 Years
Mobilizing financial and technical assistance to …	CARICOM and member states development of a region-wide position on the most effective and equitable funding mechanisms and engagement donors and IFIs on the basis of country led needs assessments and processes.	12 months
Fundamental role for the private sector in providing and financing solutions	Assessment and review of risk profiles for each CARICOM state in partnership with the private sector to identify a a 5 year transformational program to deliver the actions needed to improve the risk balance and attract private sector investments.	Review within 12 months, Implementation over 5 years
Regional action for national delivery	Detailed financial, technical and human resource capacity assessment, and of each regional organization and development of action plan to enhance their capacity.	
Development of risk management ethic in decision making	Revision of the CARICOM Climate Risk Management Framework to take into account the latest developments in climate risk management techniques.	2 years

Box 3: Priority Actions of the Implementation Plan for the Regional Framework for Achieving Development Resilient to Climate Change

IP Focus Area	Intended Priority Action	Planned Duration
Technical and Physical Impacts		
Taking immediate action to respond to climate change	Full asset inventory of Saint Lucia's water utility assets, followed by a risk assessment of their vulnerability to climate variability and climate change.	Capacity assessments within 12 months and securing of sustainable financial positions within 2 years.
Transforming Caribbean states into low-carbon economies		Fast Start financing program projects to be identified within 12 months, pathways to be mapped within 5 years
Cross cutting challenges		
Data and information as public goods	Governments and regional organizations development of their own "clearing house" facilities with free access to data and information.	2 years
Building on existing information, knowledge and expertise to expand understanding and knowledge and develop capacity	Undertake skills and expertise audit to identify additional training and knowledge areas needed for technicians, professionals, the private sector, politicians and civil society.	2 years
	Assess resource needs in the Caribbean to deliver the strategy elements and goals of the Regional Framework, and identify actions to fill research gaps and to develop decision-making tools, and development of a coordinated program across the Caribbean's research institutions.	Development of audit and training packages within 12 months, and roll out across the region over a 2 year period
Addressing disaster risk reduction and climate change link	Secure necessary funding for disaster risk reduction in the Caribbean through the implementation of the CDEMA Regional Program and Plan of Action for Climate Change Adaptation and Disaster Risk Reduction actions.	Continuous

Box 3: Priority Actions of the Implementation Plan for the Regional Framework for Achieving Development Resilient to Climate Change

IP Focus Area	Intended Priority Action	Planned Duration
Meeting impending additional climate change related challenges	Strengthen the Caribbean's international negotiating position and its long term capacity to plan through an enhanced, resourced, comprehensive program of evidence based peer-reviewed research on the science of climate change and the social, environmental and economic impacts.	Continuous

a. Key Multilateral Agency Implementation Plan and Adaptation Measure Support

i. The Global Climate Change Alliance (GCCA) under the 10th EDF Intra-ACP financial framework

The CPACC, ACCC and MACC were focused on establishing the foundation for climate change adaptation through improving information, establishing systems, raising awareness and building capacity, whilst the SPACC builds on their gains by piloting applied adaptation. Efforts to expand on these initiatives, especially the information system and capacity development outputs, are now being embarked on through a recently approved grant from the European Union's Support to the Global Climate Change Alliance (GCCA) initiative to be executed for CARIFORUM by the Climate Change Centre. Specific assessments that rationalize the focus of this initiative, as indicated in the project document, are that-

- There is as yet insufficient development of climate scenarios and climate impact models in the region (p. 10).
- The Caribbean region's early warning system is unable to adequately predict extreme climate related events (p. 10).
- Climate related events are significantly impacting the biophysical and socio-economic systems but there is insufficient vulnerability studies conducted in the region (p. 11).
- The region has inadequate technical, institutional and financial capacity to respond appropriately to climate change and position itself to access carbon financing (p. 12).

The EU-CARIFORUM GCCA effort therefore aims, among other things, to help strengthen Caribbean States' data-gathering and management capabilities to enable them to cope with economic uncertainty and still provide meaningful emission targets in the near term (p. 13). To address this it advocates that Caribbean states be encouraged to build up reliable data at the sectoral levels which, combined with the appropriate levels of technical capacity building, can support development of nationwide data that would make future emission controls easier to monitor (ibid).

A key activity under the GCCA initiative is the expansion (through new installations) of the region's climate monitoring system, which includes the eighteen GLOS telemetry stations. This will comprise of the procurement and installation of some 48 hydrological stations, 58 meteorological stations and 6 coral reef early warning systems. Of these, 19 hydrological stations, 12 meteorological stations and 1 coral reef early warning system will be installed in PPCR participating countries.

Other program activities include development of methodologies for Caribbean specific hazard and risk analysis, training in the two tailored systems developed and application of the methodology to sectors such as water, agriculture, health and infrastructure.

The main EU-CARIFORUM GCCA activities or components are outlined at Annex 2, whilst the stations to be installed for expanding the climate monitoring system are set out at Annex 3.

ii. Role of the Caribbean Development Bank

The Caribbean Development Bank has had a long history of supporting BMC's disaster risk reduction programs and intends to place greater emphasis on supporting increase resiliency to natural hazards and climate change at the community level and disaster risk reduction efforts in BMCs. The Bank's Disaster Management Strategy makes provision for providing pro-active assistance for disaster risk reduction and climate change adaptation projects. CDB has financed significant reconstruction and rehabilitation investments in BMCs and provided grant resources to support DRR initiatives at both the regional and national levels.

CDB has provided resources for capacity building and institutional strengthening to the CCCCC and more recently CIMH to enable these institutions to improve delivery on their mandates to support BMCs and the Regions' climate change decision-making.

The Bank's Draft Climate Resilience Strategy was endorsed by the Contributors to its Special Development Fund and its Board of Directors in March, 2012. The Strategy proposes to provide support to BMCs and the Region's climate change agenda in the following broad areas:

Box 4: Indicative CDB Knowledge Building and Capacity Development Interventions at Regional and National levels

- Support BMCs design and mainstream climate risk management strategies;
- Facilitate design of appropriate legal, administrative and management arrangements to help with adoption
- refinement and downscaling of climate prediction models,
- Establishment of robust information and reporting systems for climate risk monitoring;
- Design, adoption and use of building codes;
- Improving spatial and environmental planning systems
- Improving technical capacity for mainstreaming environment, disaster risk reduction and climate change.
- Establishment of mechanisms that strengthen collaborative arrangements between public sector, privates sector and civil society to finance and implement climate resilient development initiatives

- Mobilise and increase access to concessionary financing to support BMCs and regional institution's climate change work programmes;
- Provide investment financing for building resilience in priority climate sensitive sectors (agriculture, water, energy, and critical physical and social infrastructure) in BMCs as well as support interventions that strengthen degraded natural resource systems to deliver ecosystem services needed to sustain climate resilience and poverty reduction
- Provide support for mitigation investments and initiatives that will increase competitiveness of private sector, promote adoption of clean technology and reduction of GHG.
- Support knowledge building and capacity development for climate resilience at the regional and national levels.

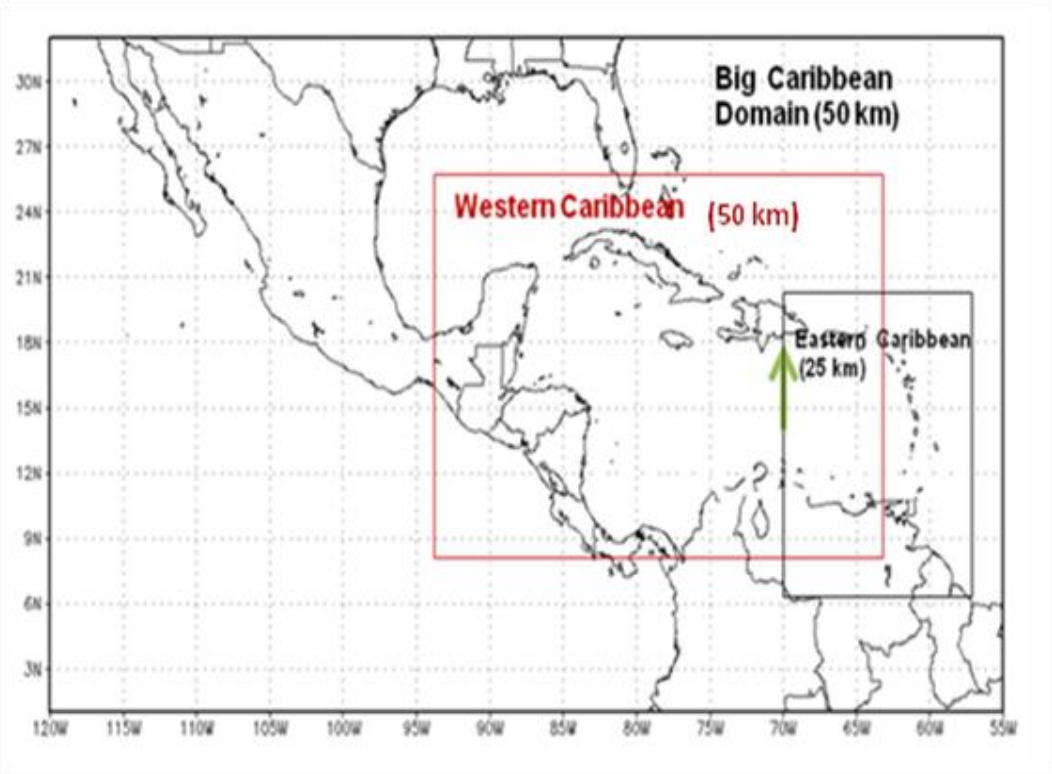
CDB is committed to collaborate and partner with other development institutions to deliver its climate resilience strategy and as such will work with BMCs and regional institutions to design and finance priority projects and initiatives within the framework of the PPCR.

iii. Select Regional Data and Information Initiatives for Up-scaling or Enhancing

a. Caribbean Climate Modeling Initiative

An area critical to the region's climate change response and central to the Regional Framework is the downscaling of global climate models to the regional level to allow for effective planning. This need has been addressed particularly over the past five years by the operation of a Caribbean Climate Modeling Group (CMG). The CMG consists of the two sub-groups which either (1) operate regional models or (2) use models generated. The user sub-group consists mainly of sector specialists in areas such as agriculture, water, coastal zones and health, as well as of those involved in socio-economic studies of climate change impact using approaches such as cost benefit analysis of adaptation options. The CMG domains of focus are the 1) broader Caribbean Basin, (2) Western Caribbean and (3) Eastern Caribbean, as seen in Figure 1 below.

Figure 1: Caribbean Climate Modeling Domains



The modelling projections are done at spatial resolution of 25 kilometers and efforts are geared toward supporting socio-economic scenarios that are contextually appropriate. The runs completed so far are based on the scenarios for climate change impact as described in the Special Report on Emissions Scenarios (SRES) within the IPCC *Climate Change 2007: Synthesis Report* (p. 44), and summarised below :

Scenario A1: Very rapid economic growth and global population peaking in the mid-century and rapid introduction of new and more efficient technologies. This is further divided into sub-groups A1F (fossil intensive), AIT (non-fossil energy source) and A1B (a balance of fossil and non-fossil energy sources).

Scenario A2: High population growth, slow economic development and slow technological change.

Scenario B1: Same population growth rate and levels as A1, but with more rapid changes in economic structures toward a service and information economy.

Scenario B2: Intermediate population and economic growth with local solutions to economic, social and environmental sustainability.

Some key needs that will be addressed by the CMG work going forward are (1) factoring in adequate climatology at the region and country levels in order to undertake point downscaling and (2) model verification runs, as well as (3) data on sea surface temperature and salinity and with sufficient disaggregation to allow for sectoral analysis. There is also a need to access the new IPCC scenarios. It is anticipated that this will be achieved in the very near future.

The climate modelling runs completed by the CMG for the various domains of the Caribbean so far, along with the scenarios factored in respectively, are as listed in Table 4 below.

Table 4: Modeling Runs Completed for the Caribbean so far by the Climate Modeling Group

Domain and Resolution	Scenarios Used
Caribbean basin	B2 (30 years) & A2 (30 years)
50 x 50 km	Baseline (30 years)
	Reanalysis (15 years)
Caribbean Basin	A2 (30 years) & B2 (30 years)
50 x 50 km	Baseline (30 years)
Eastern Caribbean	A2 (30 years) & B2 (30 years)
25 x 25 km	Baseline (30 years)
Caribbean and Eastern Caribbean – CORDEX domain at 25 km resolution	A2 (30 years) & B2 (30 years)
	6 Baseline (1960-1990)
	6 Near Future (2010-2040)

b. The Database Management System for a Regional Observing Network for Environmental Change in the Wider Caribbean

The Database Management System (DMS) for a Regional Observing Network for environmental Change in the Wider Caribbean is an Inter-American Development Bank supported effort aimed at addressing data related needs of the Region's countries. The DMS particularly provides for rapid access to, and dissemination of, a range of spatio-temporal data and information, including-

- up-to-date geographically referenced maps and imagery,
- hazard and vulnerability maps;
- change detection mapping and monitoring;
- climate, land use and socioeconomic data; and
- metadata and information.

The DMS is in the starting phases, and is designed to provide an "appropriately scaled and properly functioning DMS that serves the wider Caribbean" and reduce the financial risks to individual countries while providing the desired benefits and outcomes. It will facilitate the open access to data products, useful for observing environmental change in the wider Caribbean region, as a Regional Public Good (IDB, 2011, p. 4). The key participating agencies are the Caribbean Community Climate Change Centre, the Caribbean Institute for Meteorology and Hydrology, the Center for Tropical Water for Latin America and the Caribbean (CATHALAC) and the United States National Oceanic and Atmospheric Administration (NOAA).

The DMS effort is structured as follows-

1. Gap Analysis and Regional Plan of Action, aimed at identifying the existing and planned regional and national deployment of environmental sensors across the Caribbean, and the desired deployments, and developing a regional plan to address the gaps in hydrographic capacity and in tidal and geospatial framework.
2. Selection of DMS inputs and outputs and conceptual design, particularly participating countries' development of existing and planned data inputs and outputs, and of their development of conceptual design that would take account of sustainability considerations.
3. Creation and implementation of a basic, expandable operational DMS by enhancing existing systems at the CIMH.
4. DMS outreach and sustainability, which would include creation of a management structure for the operation of the DMS, the design and operation of an outreach program targeted to a broad base of users such as those involved in hydrography, ecological monitoring and forecasting, and storm surge and management of marine protected areas.

The intended results of the DMS initiative are (i) improved access to data, data products and decision support tools for addressing climate and other environment changes at the regional and national level; (ii) increased regional and national level institutional capacity for knowledge based decision making and for mainstreaming climate information into this process; and (iii) a framework for the establishment and operational implementation of an integrated regional observation network for monitoring environmental change in the Caribbean.

The DMS design and operation are linked to both the PPCR and the Information Clearing House. DMS Component 1 activity will incorporate the outputs of and complement a PPCR Phase 1 evaluation of the (climate relevant) data collection and management system currently being undertaken for five of the PPCR pilot countries. Additionally, the DMS and ICH will be linked as part of the sustainability plan under Component 4 of the DMS. It is important to note that the link will provide for access of the information through the portals or nodes whilst allowing each agency to autonomously maintain their respective database. In this way the users' access to information is to be expanded cost effectively.

An important consideration for DMS design and installation is the the ongoing development of a Geonode system in Saint Lucia under Phase 1 of that country's national PPCR, and an effort under that program to engage at least the OECS PPCR pilot countries in the installation and networking of Geonode systems in each. Connectivity of this system with the ICH and DMS systems may require moderate but still notable investment of time and resources in ensuring compatibility. This highlights the fact that both the stated objectives of **enhanced information sharing** and of **avoiding duplication and overlaps** will require effort to ensure collaboration and coordination across the DMS, EU GCCA and regional and national track PPCR initiatives.

Regional track SPCR execution will incorporate measures to ensure collaboration and information sharing across the regional and national SPCR teams, whilst coordination and collaboration of the three projects—DMS, ICH and PPCR is already being undertaken amongst the respective team within the CCCCC, where all of the projects are being managed.

3. The Regional Strategic Program for Climate Resilience

A. Background, Approach and Guiding Principles

Given the magnitude of the potential impacts as described above, climate change is identified by the Regional Framework as severe and presenting a serious threat to the region's sustainable development. The approach to adaptation in the Caribbean has been based on the premise that the Region is already vulnerable to the vagaries of climate variability, and that these would be exacerbated by climate change. Consequently, action to cope with the present exposure of the Region's human, natural and built environments can be considered as the starting point for building resilience to future climate change risk. Operating from this premise, therefore, the Caribbean is strongly committed to identifying no regrets actions that would contribute to resilience building across the region. To this end, CARICOM heads of government have mandated the Climate Change Centre to work with countries to develop portfolios of adaptation proposals which would be eligible for climate financing.

Reflecting the priority identified, the Region's adaptation response is an ongoing process which is now proposed to be contributed to and built on by the regional SPCR. This approach is consistent with CIF *Guidance Note on PPCR Regional Programs* (2009a) guidelines that, where a mechanism for and history of cooperation exists within a regional grouping participating in the PPCR, program activities may include-

> "regional cooperation and implementation of an expanded range of issues, such as regional climate monitoring and early warning systems, identification of trans-boundary opportunities to effective reduce vulnerabilities and risks, as well as inclusion of climate change in regional planning strategies, policies and financing mechanisms for strengthening climate resilience, in the medium and longer-term (p. 4).

In light of the historical cooperation within CARICOM, the Region's experience with adaptation measures and the ongoing and deepening initiatives aimed at achieving resilience, the proposed approach to the regional SPCR was further refined by consensus at the 1st Joint Mission to--

1. Directly support climate change adaptation per priorities set out in the CARICOM Regional Framework for Development Resilient to Climate Change.
2. Complement ongoing measures to address the consequences of climate change in the region.
3. Be of broad benefit and applicable to the Caribbean economies.
4. Be more efficiently undertaken at a regional level in order to address issues that are common to the region and will benefit from a common approach and economies of scale.
5. Provide for better use of resources and creation of useful information on climate change adaptation through linkages between national and regional institutions
6. Build on and/or draw lessons from existing collaborations on climate sensitive development issues and/or on prior regional programs.

Taking account of the guidelines identified and refined above, the SPCR was formulated through review of literature on prior adaptation activities and their impacts, as well as through stakeholder consultations (see Box 5). Specific activities through which the design was informed include-

1. Participation in national PPCR processes—including multi-stakeholder consultations—and the resulting national SPCRs.
2. Consultations in regional and international agencies involved in climate variation and climate change activities in the Caribbean.
3. Review of the Caribbean Regional Framework for Development Resilient to Climate Change, work products of the preparation process for the Implementation Plan of the *Regional Framework,* and the draft final Implementation Plan.
4. Involvement in regional forums, such as the Caribbean Regional Conference, Global Climate Change Alliance and meeting focused on identifying issues related to climate relevant data organized under the PPCR regional track Phase I initiative.

Box 5: Organizations Consulting in Preparation of SPCR

Caribbean Community Climate Change Center (CCCCC);

Caribbean Disaster Emergency Management Agency (CDEMA);

Caribbean Institute for Meteorology and Hydrology (CIMH);

Caribbean Regional Fisheries Mechanism (CRFM)

OECS Sustainable Development Unit

University of the West Indies; Caribbean Environmental Health Institute (CEHI),

The document review, consultations and national SPCR documents highlighted priorities for the strategic program. These in turn informed and were built on and reinforced by proposals for specific initiatives by regional organizations. These initiatives, which together comprise the proposed SPCR, were conceptualized and articulated in consultation with proponent regional agencies and non-government organizations. The program design further incorporated stakeholders' consensus, during the 2nd Joint Mission of the regional SPCR, that -

1. Holistic coverage in terms of capacity improvement efforts will include skills and competencies are covered in the program.
2. Effort is to be made to ensure sustainability through, inter-alia, capacity building and documentation of methodologies, processes and lessons learned.
3. Execution is to be done wherever possible through public-private partnerships, including provisions for some exploration of a dialogue involving regional financial groups such as the . Caribbean Association of Indigenous Banks or Regional Association of Credit Unions.
4. The scope of private sector involvement be broadened to include, inter-alia, dialogue with and involvement of fishermen and fishing communities

B. Focus and Structure

The focus of the proposed Caribbean SPCR reflects IPCC assessment that the South, South-East and East Asia regions, Africa and the Small Island States are the ones most vulnerable to

climate change impacts.[28] The IPCC asserted that these regions have high levels of human activity in coastal areas, low average incomes and inadequate systems in place to respond to climate change threats. Furthermore, the levels of carbon emissions and industrial activities they undertake are far outstripped by those in developed countries.[29] The IPCC therefore concludes that the weight of mitigation measures that can be taken by these most affected regions cannot reverse the current trend in warming and sea level rise sufficiently or early enough to eliminate impacts. Assessments such as these lead to the generally accepted position that the best response to climate change for these regions, and in particular for small island states, is to undertake measures to adapt to its impacts. The viability of this approach has been underscored so far by the results of cost-benefit analyses of adaption and inaction options.

The CIF *Guidance Note on PPCR Regional Programs (* 2009a) recommends that regional pilots be anchored in the overall PPCR objectives (see above) and should, in addition, "aim to strengthen cooperation at the regional level to integrate climate resilience into national and appropriate regional development planning and processes (p. 2)." Moreover, where there is already a history of and framework for regional cooperation, PPCR activities may include regional climate monitoring and early warning systems, identification of trans-boundary opportunities to reduce vulnerabilities and risks and inclusion of climate change in regional planning strategies, policies and financing mechanisms for strengthening climate resilience (ibid, p.4). Consistent with the, this Caribbean regional SPCR is designed to address barriers related to scale, resources and capacity constraints due to size. It is further intended to support sharing of the costs and benefits of climate change adaptation efforts amongst countries by facilitating the development and retention of "relevant technical capacity on a regional level that would be too expensive to retain on a national level (ibid, p. 6). *Consequently, the initiatives that make up the SPCR are to be executed through or co-coordinated by regional entities to support incorporation of climate resilience into regional planning strategies, policies and financing mechanisms.*

Drawn from national PPCR processes and on the results of consultations under the PPCR Regional Track Phase I and those related to the preparation of the Implementation Plan for the *Regional Framework for Achieving Development Resilient to Climate Change*, the following priorities are to be addressed through the Caribbean regional SPCR.

1. Baseline data and capacities or systems for data collection and analysis within national and regional agencies.
2. Processes for archiving, transmitting and accessing national level meteorology and hydrology data.
3. Climate products for analysis of climate change impacts and determination of adaptation measures on and for agriculture, water resources, coastal and marine ecosystems, tourism, coastal infrastructure, and environmental and human health.
4. Incorporation of climate change consideration and adaptation measures in policy and legislation, and in protocols for managing natural resources and built environments.

These priorities correspond generally to the progressive nature of the climate change adaptation process, as outlined by the intergovernmental negotiating committee (INC) of the UNFCCC. The INC identified three stages that countries should pursue for climate adaptation: Stages 1

[28] IPCC. (2007).

[29] IPCC. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, p. 317.*

and 2 would address capacity building for adaptation, whilst stage 3 would involve actual implementation of adaptation interventions. The Caribbean region, under the succession of projects (CPACC, ACCC and MACC) described above, has gone through stage 1 and stage 2 activities as stipulated by the INC. These projects allowed the region to embark on a suite of activities aimed at identifying the-

- extent of the climate change hazard (regional climate modeling),
- vulnerabilities of the regional social, economic and environmental systems to climate risk
- impacts of climate risk on these systems
- adaptation options necessary to mitigate those impacts and
- most feasible adaptation options based on cost and benefits analysis.

Under the CPACC project, the region embarked on a process to develop national climate change adaptation policies and implementation plans. In two countries, Dominica and Saint Lucia, these plans were approved by Cabinet. It is noteworthy that the process adopted to prepare these policies was identical to that endorsed subsequently by the Conference of the Parties for the preparation of National Adaptation Plans of Action in the LDCs. Further, the adaptation recommendations coming out of the NAPAs are being funded and implemented through a special LDC adaptation fund. The adaptation actions identified in the policy documents developed for the Caribbean and more or less reiterated in national communications prepared by member countries have been developed on an even more robust information platform than exists for the preparation of many of the NAPAs.

These prior initiatives provided an adequate platform for moving to Stage 3 activities, which was done initially through the SPACC. In its design, it was anticipated that SPACC activities would be replicable for implementation across the wider Caribbean. To advance toward resilience, it is necessary for the Region to continue building on the adaptation actions implemented under the SPACC and other initiatives undertaken within the last fourteen years. Consequently, the INC's recommended approach and the direction of the region inform the design of the SPCR into the four components listed below.

i. Improving Geospatial Data and Management for Adaptation Planning , Sea Level Rise and Storm Surge Impact Analysis

ii. Consolidating and Expanding the Regional Climate Monitoring Network and Global Platform Linkages

iii. Downscaling and Expanding Climate Projection Models and High Resolution Maps

iv. Applied Adaptation Initiatives

The objectives of the first three SPCR components are consistent with INC Stages 1 and 2 capacity building and adaptation focus, whilst component 4 is consistent with the adaptation focus of Stage 3. It is recognized that there may not be a clear linkage between the first three components and component 4 within the SPCR, there are sufficient building blocks from the CPACC, MACCC, SPACC and other climate related projects which, together with the no-regrets approach, make the applied adaptation aspect of the SPCR a critical one. The investment

request for this strategy is US$10.45 mn for a range of US$9.0 – US$11.0 mn in grant funding, based on expectation of the PPCR envelope for the Caribbean pilot.[30]

The SPCR is programmed for five year implementation, with components as detailed below.

i: Improving Geospatial Data and Management for Adaptation Planning , Sea Level Rise and Storm Surge Impact Analysis

Lead institutions: CCCCC **Collaborating Institutions:** UWI, CIMH, CDEMA **Lead/Focal Point Country:** Saint Lucia **Estimated Budget:** $2.4 mn
Identified Issue/Gap: Effective adaptation responses to climate change at national levels depends on easily accessible, high quality and current/updated bathymetric and near shore topographic data to establish baseline for sea-level rise and storm surge analysis, and allow for regular updates and monitoring.
Objective: improve the quality of geospatial data crucial for understanding the impacts of climate change in order to support decision making in development planning, adaptation strategies and disaster risk reduction through- a. Collection of topographic and bathymetric data and aerial imagery and development of digital elevation model (DEM) for Jamaica, Saint Lucia, Saint Vincent and the Grenadines, Dominica and Grenada. b. Data processing and analysis. c. Training for data hosting, management and application. d. Applied analysis, knowledge management and information sharing.
Main sub-component activities- i. Collection and generation of coastal topographic and bathymetric data, aerial imagery and DEM for select areas. ii. Data gap analysis to identify and prioritize other types of data acquisition. ii. Training in GIS and data management in participating PPCR pilot countries. iii. Integrated work with land use planners and coastal zone managers. iv. Sharing of information and lessons learned with other PPCR and non-PPCR participating Caribbean countries

[30] It is understood that the lower end of grant funding will apply if the envelope realized is at the lower end of the projected range.

ii: Consolidating and Expanding the Regional Climate Monitoring Network and Global Platform Linkages

Lead institutions: CIMH
Collaborating Institutions: CARICOM Secretariat, CCCCC, UWI, CDEMA and CARDI
Lead/Focal Point Country: Dominica
Estimated Budget: $1.0 mn

Identified Issue/Gap: Users of climate data require accurate and timely information to help to prevent humanitarian disasters and socioeconomic losses.

Objective: Consolidate and expand the regional climate monitoring network connectivity and linkage with global networks.

Main sub-component activities:

i. Support for regional connectivity and data interpretation and use for the existing hydro-meteorological networks region wide
ii. Consolidation of archiving and interpretation center and support for open connectivity to all countries and parties in the region
iii. Consolidation and expansion of regional archiving center and back up site outside the region.
iv. Consolidation of coastal topography and bathymetry data
v. Expansion of region's linkage and connectivity with GCOS, GLOSS and GOOS

iii: Downscaling and Expanding Climate Projection Models and High Resolution Maps

Lead institutions: University of the West Indies,
Collaborating Institutions: CDEMA, CCCCC, CARDI
Lead/Focal Point Country (N.A.)
Estimated Budget: $2.4 mn

Identified Issue/Gap: Global climate models do not provide sufficient detail to assess the likely impact of climate change within the Caribbean, especially on economic sectors that are critical to the region, such as agriculture and water.

Objective:

a. Make available regional and, where appropriate, downscaled future climate projections to enhance climate modeling capacity in the Caribbean.
b. Increased number of climate variables analyzed and range of analysis performed, including the examination of extreme events and hurricanes
c. Utilize climate data projections and tier 1 modeling outputs to generate framework for tier 2 (sectoral) modeling that would support improved adaptation planning and decision making and incorporation of climate change considerations into Agriculture, Water, Health, Forest/Ecosystems, Integrated Coastal Zone/Coastal Area Management and Land Use Planning.

Note: requires active participation of local governments and the development of participative planning processes/methodologies, especially to achieve objective c.

Sub-component activities-

i. Application of downscaling to develop high resolution maps for 5/6 selected sites and generation new outputs, including:
   a. Hazard maps showing projected sea level rise; hurricane intensity; precipitation: trends, distribution, high intensity events; and, Coastal (geomorphological) processes
   b. Coastal Zone/Coastal Area Management Plans; Land Use Plans with corresponding policies and regulation

ii. Document and disseminate lessons learned

iii. Capacity building: Training in ICZM and land use planning and management

iv: Applied Adaptation Initiatives

Lead institutions: CCCCC
Coordinating Institutions: CCCCC, CRFM, CARDI, CEHI
Collaborators: Climate Modelling Group, National Planning Agencies, stakeholders, invited agencies
Lead/Focal Point Country: Jamaica
Estimated Budget: $3.35 mn

Identified Issue/Gap: Effective adaptation requires measures to reduce vulnerability and increase productivity arising from climate change impacts on food and nutrition security, economic livelihoods and human health.

Objective:

a. Enable the assessment, design, up-scaling and replication of practical adaptation measures, including cost benefit analysis.
b. Develop appropriate incentive regimes to encourage the implementation of adaptation measures by the private sector
c. Document and disseminate assessment results (including cost benefit analysis), good practices and lessons learned.

Sub-Component Activities:

i. Scale up proved adaptation measures through the design and implementation of financial and regulatory instruments, including for rainwater harvesting, agriculture resilience practices.
ii. Assess and design adaptation measures with preliminary feasibility analysis on, inter-alia, Dengue surveillance system, water aggregation/augmentation, coastal fishing.
iii. Assess of policy and legislative framework and determination of enhancements to enable climate change adaptation
iv. Document and disseminate lessons learned
v. Design and deliver training modules on successful adaptation activities and approaches, including gender and vulnerable groups

C. Governance and Program and Information Management

i. SPCR Execution and Governance Arrangements

Execution of the SPCR will be coordinated by the Caribbean Community Climate Change Centre, working in close collaboration with the CIMH and UWI, which each have a lead coordinating role in at least one of the four components of the program.

In addition to the coordinating and collaborating regional agencies, each of the components will benefit from the oversight of at least one of the six countries participating in the PPCR pilot. Participation will be as focal point, and criteria for acceptance of offer to undertake the role will include the possession of adequate skill sets in the area of focus of the component within the respective country and active involvement in the PPCR process.

SPCR execution will be guided by a Program Steering Committee which will be made up at any one time of the following members-

i. A representative of the CIF donor countries.

ii. Four country representatives.

iii. A representative of a regional academic institution.

iv. A Representative of the Executing Agency.

v. Representation of regional organization which each have lead responsibility for coordinating one of the four components of the program.

Representation of donor and participating countries on the steering committee shall be on a rotational basis. Rotation will be structured in such a way as to ensure that all countries shall have a chance to be members of the committee during the life of the program. The SC shall meet no less than twice per year, with at least one meeting being in person.

A technical advisory board (TAB) will provide advice on technical aspects of the program, with the main objective of ensuring the achievement of the program objective and ensuring the best technical options are pursued. The TAB will consist of five (5) members, of which one (1) is to be appointed by the World Bank, one (1) appointed by the Inter-American Development Bank and the other three (3) should be regional experts in areas relevant to the SPCR.. Furthermore, the TAB will have the option to co-opt other experts as the need for input in their technical area arises. The areas of expertise shall include climate relevant data and climate modeling.

The TAB shall meet at least once per year and will consider and input into the SPCR annual work program. Subsequent meetings or round-robin consultations will be as required to provide advice on the technical aspects of the program. The governance arrangement described here is represented in the organogram at Annex 5.

ii. Development and Coordination of Communication and Information Sharing Strategy

A critical aspect of SPCR execution is the coordination of a communication and information sharing strategy toward the following three main objectives-

1. Support to capacity building within regional and national organizations, especially in areas of policy articulation and advocacy of adaptation and climate resilience issues;

2. Sharing lessons learned from PPCR activities with non-PPCR pilot countries;

3. Raising public awareness on the PPCR and on climate resilience and adaptation,

The first objective of this coordination activity is seen as especially important to maximizing impact of the PPCR.

1. Coordinating and harnessing output from the documented issues and lessons learned under each of the four SPCR components;
2. Coordinating the design and implementation of training modules in joint or independent training workshops and/or seminars;
3. Coordinating the development and dissemination of PPCR lessons learned using various communication medium, such as video and publications.
4. Liaise with website managers, including at the CCCCC and the UWI, to agree on and facilitate the dissemination of prepare information to raise awareness of the PPCR and of climate resilience, and to support capacity building.

iii. Monitoring and Evaluation

SPCR monitoring will include a minimum of biannual reviews of program implementation to be undertaken by a monitoring and evaluation committee. For best effect, the monitoring and evaluation meetings shall be undertaken no later than six weeks prior to meetings of the steering committee. The M&E committee will include representatives of the CIF donor group, at least three of the six SPCR countries and two regional organizations.

Budgetary allocations for SPCR administration and for the execution of the communication and monitoring and evaluation activities for the total life of the projects (at least 4 years) are found in the table below.

Lead institutions: CCCCC **Strategic Overview: COTED** **Estimated Budget:** $1.3 mn
Identified Issue/Gap: Given multiple stakeholders and lead and coal point roles, effective execution of regional SPCR requires active coordination, consistent information sharing and public education.
Objective: a. CCCCC lead on overall SPCR implementation, and CIMH, UWI and CCCC project coordination of the relevant components. b. Administrative, procurement, financial and managerial support for the implementation of all planned interventions c. Design and implementation of a monitoring, evaluation and verification platform, and provision of timely information on execution, progress and goal and target achievements. d. Support to capacity building and documentation and dissemination of information and lessons learned.
Component Activities: i. Project management: trimester progress: advances in the execution of the IP and the annual POA. ii. Monitoring, evaluation and verification system: design and implementation iii. Documentation and dissemination of lessons learned for each component, including

through collaboration with component lead agency.

iv. Design and delivery of training modules, including for capacity building in advocacy

D. Coherence with Related Regional and National Initiatives

i. The SPCR in the Context of the Implementation Plan of the Caribbean Regional Framework for Achieving Development Resilient to Climate Change

The SPCR components and anticipated outputs are particularly consistent with the Regional Framework goals and implementation plan activities under the following strategic elements-

Regional Framework Strategic Element	Relevant SPCR Component
Strategic Element I: Mainstreaming climate change adaptation strategies into the sustainable development agendas of the CARICOM member states	SPCR Component 1: Improving Geospatial Data and Management for Adaptation Planning , Sea Level Rise and Storm Surge Impact Analysis
	SPCR Component 3: Downscaling and Expanding Climate Projection Models and High Resolution Maps
	SPCR Component 4: Applied Adaptation Initiatives
Strategic Element 2: Promote the implementation of specific adaptation measures to address key vulnerabilities in the region. This is intended to strengthen the climate resilience of the most vulnerable sectors, with focus on (a) water supply, (b) coastal and marine ecosystems, (c) tourism, (d) coastal infrastructure and (c) health.	SPCR Component 4: Applied Adaptation Initiatives
Strategic Element 3: Promote actions to reduce the vulnerability of natural and human systems in CARICOM countries to the impacts of a changing climate.	SPCR Component 4: Applied Adaptation Initiatives
Strategic Element 4: Promoting the adoption of best practices for sustainable forest management.	No SPCR component match, reflecting separation of CIF PPCR from CIF Forest Investment Program
Strategic Element 5: Promoting action to derive social, economic, and environmental benefits through the prudent management of standing forests in CARICOM countries.	No SPCR component match, reflecting PPCR focus on adaptation

ii. Transformation and Replication in the Context of National and Regional Track PPCRs

The PPCR has two main objectives, which are to be captured through the overall results framework. These are that (1) the PPCR be transformative and that (2) it promotes replication and up-scaling of best practices. The two tracks of the PPCR—regional and national—are each more suited primarily to one of the two intended results. PPCR national track activities provide the best opportunity for transformation given that implementation involves the stakeholders who are affected by climate change and who can carry out and benefit from adaptation efforts. On the other hand, the regional track provides more opportunity for replication and up-scaling since implementation is through regional organizations and across countries.

The effectiveness of transformation and replication efforts further depends on the extent to which PPCR activities complement, build-on or upscale initiatives that are identified as priority within the *Regional Framework* and the corresponding *Implementation Plan*. Furthermore, since SPCRs are anticipated for some four years, measuring resulting transformational change, would be challenging given these normally occur over a longer period. In this context, measurable transformational change will likely materialize from building onto or up-scaling current initiatives that are critical for propelling climate change adaptation efforts.

Box 6: Caribbean PPCR Pilot Country Priorities

Haiti: Agriculture and food security, coastal zone management and reconstruction (sectors/themes) are the main areas, with sub-sectors/themes being infrastructure, land planning and data management.

Jamaica: Agriculture, land-use planning, health, water resources, integrated coastal zone management, climate proofing of national and sectoral plans, tourism, and data management.

Saint Vincent and Grenadines: Monitoring and evaluation of environmental hazards, watershed management, public sensitization and awareness, integrated planning, and data management.

Grenada: Integrated water resource management, capacity building at the sector level, and data management.

Saint Lucia: Agriculture, coastal and marine resources, financial sector, forestry, biodiversity, health, human settlement, critical infrastructure, tourism, and water resource management. Data needs were also highlighted for Saint Lucia particularly the need for Bathymetric and Hydrometric data.

Dominica: Agriculture and food security, water quality and quantity, Fisheries, climate change impacts on coastal and marine resources, infrastructure and human settlements, tourism, forestry.

iii. Regional and National Tack PPCR Linkages

National and regional PPCRs links are pursued at the process, design and implementation levels. In terms of process, links are

established in the first instance through active correspondence with national track focal points on the design of the regional SPCR. Furthermore, the PPCR Regional Coordinator participates in joint missions of national track programs, and focal points from both the regional and national tracks are included in consultations on respective pilot outputs and in joint programs.

Linkages are sought at the design level through identified opportunities for the regional track to support or complement activities in the priority areas indicated by PPCR pilot countries. These include (i) agriculture and food security, (i) coastal zone management, (iii) tourism, (iv) water resource management, (v) health, (vi) ecosystem-based adaptation, (vii) infrastructure and land use planning (see Box 6). Specific links identified are outlined in Annex 4 and center mainly on-

- intended use of Regional Track Component outputs intended to update climate relevant data and information,
- complementary nature of the regional track assessment of the policy and legal framework with similar activities that are being intended in PPCR pilot countries such as Saint Lucia and Jamaica, and
- use of information drawn from the modeling and applied adaptation initiatives under Components 3 and 4 to inform hazard mapping and coastal planning intended for select national tracks.

iv. Considerations for Gender, Vulnerability and Poverty Reduction

Measures to build on gender roles and ensure gendered impacts of the PPCR have been considered in the design of the regional SPCR. In the first instance, implementation modalities will seek to involve agents that can be instrumental in increasing the level of recognition of the gender impacts of climate change and the need for policy and action that will ensure that these are adequately addressed. This will be sought particularly for policy related activities, where collaboration with key groups, such as the OAS ”Inter-American Council for Women”, will be sought to ensure that (1) policy makers are effectively lobbied to ensure gender impacts are understood and prioritized and (2) proposed measures within model legislation and draft regional policies are gender neutral or provide for amelioration of negative impacts to the extent that equity can be realized.

The SPCR articulates the gender dimensions of specific regional track initiatives and the measures to be taken within the program to address these where appropriate. This is done especially in the case of water, agriculture and marine resource adaptation initiatives. As part of the total funding, a Project Preparation Grant (PPG) has been requested in order to undertake, among others, a study of the impacts of climate change on gender and vulnerable groups in the PPCR participating countries of the Caribbean. This study is expected to generate a report with recommendations in order to build climate change resilience within these social groups. This report should include specific measures for each component (where applicable) of the Investment Proposal in order to reduce / minimize the impacts of climate change on vulnerable groups as well as applicable monitoring indicators and mechanism for collection, processing and reporting.

For the impacts of climate change on the poor, it is important to underscore that these groups often include some of the primary stakeholders of the PPCR priority areas. Examples of these are fisher-folk, agricultural workers and pockets of residents in coastal communities. Whilst national adaptation efforts will address the needs of such stakeholders within the six PPCR pilot countries, the regional SPCR provides for both direct and indirect action to ameliorate impacts on the poor. Direct action will materialize through activities specific to water resources,

agriculture and marine resources, whilst indirect benefits will materialize especially through initiatives targeting gaps in data and data management systems.

v. Private Sector Role

Private sector participation in the PPCR is framed mainly in terms of market incentives and financial instruments to facilitate resilience measures. In this regard, resources can be leveraged to provide for second and first-tier financial institutions on-lending to the private sector for climate change resilience. This may facilitate, *inter alia,*

1. Market demonstrations for a business approach to climate resilience, including risk assessment and management,
2. Increased business energy security as an adaption response,
3. Water capture and storage,
4. Emergency management plans,
5. Damage resiliency, and
6. Improved energy efficiency systems.

Public Private Partnerships also have potential within the regional Caribbean PPCR, as does working with insurance companies, to help the private sector to better adapt to climate risks.

The SPCR will be informed by a market study in support of selected countries in the Caribbean regional PPCR that is included as one of the activities under the requested Project Preparation Grant. This study will add to and complement a current initiative commissioned by the IFC, which in turn is aimed, inter-alia, at identifying three initiatives that will involve the private sector. The study is intended to involve regional financial groups, such as the Caribbean Association of Indigenous Banks or the Regional Association of Credit Unions.

There are also private sector links enshrined in the involvement of many of the individual and micro-enterprise stakeholders, especially in the applied adaptation activities. Foremost amongst this group are small farmers and fishermen who would be directly impacted by climate change. Where these stakeholders are unable to access incentives and adaptation measures from large markets, it will be important for the PPCR to identify adaptation measures commensurate to their needs.

Part II: The Investment Plan

1. Structure and Rationale

The process of adaptation follows an evolutionary trend through progressive stages of (i) data collection, gathering, processing for quality control and archiving; (ii) data analysis and interpretation; (iii) formulation, interpretation and continuous improvements of hypothesis and models (iv) identification of technical options to deal with the problems identified in stages (i) through iii; (v) formulation of adaption strategies and measures, and their initial piloting to verify hypothesis and assumptions; (vi) implementation of policies and programs to scale up, replicate, and/or foster, induce or guide all actors in the community to adopt proven adaptation measures.

The regional SPCR consists of four components which are designed and aligned to follow the evolutionary adaptation trend. Consequently, the first three components focus on the process of updating and mainstreaming resilience in land use planning and management. This is quite possibly the most important tool available to governments to guide or foster a sustainable and climate resilient development.

The fourth component corresponds to the last two stages of the adaptation evolution. It incorporates three main thrusts. The first is the scaling up, replication and/or definition of mechanisms and/or financial instruments to foster the scaling up of proven adaptation measures. The other thrusts are based on the recognition that the Caribbean is highly vulnerable to global warming in many sectors and all locations, and that, whilst the first and more relevant impacts have been the subject of previous climate change operations, new areas of impact have emerged that require further analysis and consideration. These areas are critical for future climate change adaptation operations. Therefore, even whilst work continues on the first generation of impacts, there is need to address them. In this regard the Caribbean, through its regional institutions and governments, have expressed the need to initiate the process of dealing with: the impacts of climate change on the marine ecosystem and marine resources and addressing the growing need to deal with the health impacts of global warming on a very exposed and vulnerable people.

This second type of activities has remained, up until now, at a very early stage of evolution. Some information exists, some partial studies are available, and few scholarly articles have being published. The SPCR will accelerate the production of knowledge products and generate information useful to document the magnitude of the impacts of climate change in these areas, identify potential avenues to deal with such impacts and suggest a course of action. In this general approach the critical analysis of the results obtained and the dissemination of lessons learned are fundamental, and the program contains provisions to conduct these essential tasks.

It is important to note too that, as with the first three, this component also addresses land-use challenges being exacerbated by climate change, in this case with sectoral impacts. An example of this is the need to have more climate change resilient crops and livestock. This is linked to the conversion of previously agricultural lands to other uses and to the use of marginal lands that tend to be more susceptible to climate change for crop and livestock cultivation. Similarly, the focus on water management is connected to expansion in impermeable structures and reduced infiltration which reduces aquifer recharge. In addition, some of the Region's states are located on volcanic islands with virtually impossible access to ground water. Consequently, alternatives have to be found for persons to sustain habitat on these islands and mitigate against migration.

It is recognized that women and other vulnerable groups are highly dependent on natural resources for their livelihood and are very vulnerable to climate change effects and hazards.

Improving the capacity at national and regional institutions for using data and assessments for making decisions, development planning, adaptation strategies, and disaster risk reduction will improve resilience of theses vulnerable groups and reduce their exposure to climate change impacts.

2. Program Components

Component 1: Improving Geospatial Data and Management for Adaptation Planning , Sea Level Rise and Storm Surge Impact Analysis

a. Background

One of the main challenges in managing the existing climate risk and adapting to climate change in the Caribbean has been the lack of reliable climate relevant data and of consistent protocols for their use to inform decision making. The availability of accurate and standardized geo-referenced topographic, vegetative cover and coastal resource data, and of near-shore bathymetric and land-sea interface imagery at sufficiently high resolution or localized scale would have significant and positive implications for understanding and assessing climate hazard and risk. It is important also that Bathymetric data be processed using scientifically sound methodologies.

Although a number of climate-related projects within the Caribbean have cited the intention of accessing and updating baseline data to enable vulnerability assessment, there is still an indicated data collection and storage deficit facing the region. One reason for this may be that the project approach to data collection lends to fragmentation and information gaps, and makes duplication possible. The proposed component intends to close the gap through a more efficient approach.

The most crucial data to be collected is related to topography and bathymetry. While a number of data acquisition methods exist, research on other approaches has indicated that the use of LIDAR (Light Detection And Ranging) appears to be the most appropriate and cost-effective technology that aptly considers the particular requirements of the Caribbean SIDS. LIDAR has been successfully employed by a number of countries, such as neighboring Latin American countries, given the ability of the methodology to simultaneously gather both topographic and bathymetric data, and the economies of scale that can be realized by flying one aircraft equipped with LIDAR technology along the coasts of more than one island.

Bathymetric data through airborne LIDAR collection is particularly challenging to access and utilize since there are only some four (4) companies offering this service worldwide. The Caribbean is at a fortuitous point because capacity and knowhow for development of laser technology and use resulting data is currently indigenous to the region. In addition, there are strategic relationships with NOAA and the United States Geological Service (USGS). These factors together enable the collection and use of bathymetric data for selected strategic areas in the Caribbean countries in a cost effective manner.

It is also important to ensure that the bathymetric and topographic data collected are incorporated into a platform that will support regular and reliable access, and that will enable the formulation of the required analysis of sea level rise and storm surge impacts. In addition to an integrated platform with features that will allow for such an analysis, adequate “archiving” of the data for sustained future access will be sought. This is especially vital to ensuring that the value of the investment is preserved and can be built on. In this regard, the input and support of the CMG group, which has been working on climate change modeling, will be vital.

In addition to information on bathymetry and topography, reliable data on climate variability and the hydrological cycle as well as the interaction between atmosphere and hydrosphere is indispensable for adequate decision-making. The demands on National Meteorological and Hydrological Services (NMHS) for the delivery of climate information and services have rapidly increased in the Caribbean. The ability of the NMHS to deliver such information and services depends on, inter-alia, (i) a reasonable knowledge of and access to latest information on Caribbean climate variability and climate change (ii) a working knowledge of the climate information needs in significant sectors (water, natural resources, disaster management), (iii) an appreciation of the significance of the role of data collection and management in the provision of accurate and timely information, and (iv) the ability to manipulate such data to provide basic or analyzed climate and climate change information.

This component seeks to foster and further enhance the capacity of the NMHSs to deliver these services.

b. Development and specific objectives

The proposed concept seeks to improve the quality and accessibility of the relevant data crucial for understanding the impacts of climate change in order to support decision making in development planning, adaptation strategies and disaster risk reduction and to build resilience to climate change impacts in the Caribbean region. The overarching result of this will be the development of land use plans in strategic coastal zones of the participating pilot countries, including maps, action plan and recommended regulations, developed through analytical and participatory processes.

Determination of the areas for which data is to be collected will be guided by the SPCR technical advisory board (TAB), described under the "SPCR Execution and Governance Arrangements" section of this document.

The specific objectives of this component include:

1. Improvement of the quality of geospatial data at regional and national level for climate relevant analysis.
2. Improvement of the practice of data management, including data storage, accessibility, and sharing with special focus on geospatial data.
3. Improvement of the understanding of hydro-meteorological hazards and risk as a result of more reliable and accurate data.
4. Improvement of the capacity at national and regional institutions for using data and assessments for decision-making, development planning, formulation of adaptation, and disaster risk reduction.

c. Key indicators and baseline

The baseline information for this component is drawn from outputs of prior regional climate change initiatives, as described below.

- *Adapting to Climate Change in the Caribbean, (2001 – 2004)*
  - Risk management guidelines for climate change adaptation decision making;
  - Guide to environmental impact assessment (EIA) practitioners in CARICOM countries for the integration of climate change in the EIA process;

- Statistically downscaled climate scenarios for Jamaica, Trinidad and Tobago, and Barbados;
- Training and development of CIMH staff in climate trend analysis in order to strengthen climate change capacity.

- *Mainstreaming Adaptation to Climate Change, (2004 – 2009)*
  - Increased regional capacity to identify climate change risks and reduce vulnerability, including-
    - national policy frameworks for adaptation and climate change issues mainstreamed in some key sectors;
    - better monitoring, analysis and regulatory planning instruments for mainstreaming[;
  - Greater capacity to effectively access and utilize resources to minimize the costs of climate change and
  - Higher public awareness of climate change issues and response options.

Considering the achievements of the previous projects, the current challenge is to scale up the baseline in order to foster and improve the results. Insufficiencies which must be addressed have been found particularly in the following areas:

1. Availability of reliable and updated high resolution topographic, bathymetric and other geographic data critical for climate impact assessment.
2. Adequate processing of available data (e.g. from regional climate change models) in order to derive conclusions which could facilitate decision-making such as indices for climate extremes.
3. Transparent and sustainable data hosting and management which could facilitate data application by various stakeholders throughout the region.

Specific indicators of results under this component are-

1. New and updated bathymetric and coastal topographic maps and digital elevation models for select areas in Dominica, Saint Lucia, Grenada, Saint Vincent and the Grenadines and Jamaica.
2. Personnel within PPCR pilot countries trained in data quality management and standardization techniques.
3. Climate relevant data management practices harmonized.
4. Peer review journal articles on data collection and processing outputs for target countries.
5. Documented case studies and lessons learned.

d. Sub-components and activities

The component includes the following anticipated sub-components and respective activities:

Sub-component	Activities
1) Data collection, specifically topographic and bathymetric data	• Collection of high resolution topographic and bathymetric data, Aerial Imagery and DEM for selected areas in Dominica, Saint Lucia, Grenada, Saint Vincent and the Grenadines and Jamaica (potentially through the design and deployment of a Caribbean- based airborne LIDAR system). • Data gap analysis to identify and prioritize other types of potentially required data. • Acquisition of the data identified under the previous activity.
2) Data processing and analysis	• Analysis and processing of the data collected for the PPCR Caribbean pilot countries to provide new and updated high resolution bathymetric, coastal topographic, DEM and land use maps. • Sharing of high resolution bathymetric and topographic data, aerial imagery and digital elevation models with national and regional agencies. In addition to respective national agency, data will be deposited with the CCCCC, UWI, CIMH and national mapping agencies to facilitate mapping and/or climate and impact modeling.
3) Training in data hosting, management and application.	• Training/re-training of Caribbean data managers in appropriate techniques for data quality management and homogenization, with data emphasized as the underpinning for all climate information delivered. • Training in GIS and data management in participating PPCR pilot countries in support of land use agencies/units and Integrated Coastal Zone Management groups/programs. • Publication of a peer-reviewed journal article updating analysis of changes in extremes in the Caribbean. • Training and education on application of risk assessments for policy and decision making in risk reduction.
4) Applied analysis, knowledge management and information sharing	• Integrated work with land use planners and coastal zone managers developing land use plans and coastal zone guidelines for selected strategic sites/areas in PPCR participating countries. • Preparation of case studies/lessons learned based on component implementation. • Collaboration with program management unit for information sharing and capacity building drawing from lessons learned.

e. Institutional arrangements

The Caribbean Community Climate Change Centre (CCCCC) will act as lead agency for this component of the regional Caribbean SPCR. Through its responsibility as archive and clearing house for regional climate change data and documentation in the Caribbean it is particularly capable of assessing data needs and coordinating the generation of required data between all involved agencies. Furthermore, its mandate includes the training of national and regional agencies in the sound interpretation and application of the generated data.

Collaborating agencies will be the CMG (supported by the Climate Studies Group Mona) and the UWI Department of Geomatics Engineering and Land Management (Trinidad) as well as the Caribbean Institute for Meteorology and Hydrology.

Key participating agencies include the national mapping agencies of the participating PPCR pilot countries, which will be the repositories of the respective data and maps generated.

f. Risks

The investment component faces the risks of a lack in cooperation among the regional agencies. This risk will be mitigated through the precise identification of the lead and the specific roles of each of the agencies at the beginning of the project and regular meetings to ensure transparency and clear frontlines within the collaborative process.

A second risk of this component is that either the knowledge of, or the maps created, would not be adequately accessible by users. This will be mitigated in the first instance by the development and application of a memorandum of understanding (MOU) that will facilitate the sharing of information developed especially to national, and wherever feasible, regional users. Furthermore, the development of the DMS and the data related initiative under the GCCI project, as well as the Global Framework for Climate Services, will together serve to maximize the opportunity for the sharing of the information. As far as possible, the MOU to be implemented here will include provision in this regard.

A third risk identified is the overlap of the proposed project activities with activities carried out under other existing or proposed programs and projects within the region. In order to mitigate this risk, an extensive review of existing and proposed projects as well as in-depth consultation of regional and national agencies and stakeholders have been undertaken in order to avoid overlap between projects and ensure complementarity and mutual benefit.

g. Investment costing

The total estimated budget for this component is $ 2.4 million, with sub-component costing as set out below.

Component 1, Budget for PPCR Investment, 2012 – 2016

Item	Costs (USD)	Comment
Data Collection	1,800.00	Collection of topographic and bathymetric data, GIS and digital elevation models. Includes use of LIDAR technology, aerial photography and other appropriate technologies.
Processing and data archiving	400,000	Analysis and processing of data collected by

Component 1, Budget for PPCR Investment, 2012 – 2016

Item	Costs (USD)	Comment
Training in GIS and data hosting and management	200,000	Training in GIS and related tools, such as Geoweb, to enable better use of high resolution data to produce climate products.
Knowledge sharing	100,000	Development and dissemination of lessons learned, including for peer review publication
Total PPCR Investment	**2,400,000**	

h. Results and Performance Framework

The following are the indicators, outputs and outcomes expected from this component.

Sub-component	Indicator	Output	Outcome
1) Collection of topographic and bathymetric data and preparation of high resolution maps	High resolution maps available for selected strategic sites/areas in four participating countries.	LIDAR a data available for selected sites; Digital Terrain Models built for selected areas.	Increased ability to plan the use of the territory Increased understanding of the link between territorial planning, vulnerability to natural hazards, and adaptation to the impacts of climate change
2) Data processing	Determination of 100 year precipitation events for selected areas / stations	Estimate of impact of extreme events in selected strategic areas.	Decision makers with access to improved extreme event information
3) Training in data hosting, management and application	Number of training offered, number of data management trained. Number of agencies with personnel trained in GIS and in the use of LIDAR products	Meteorological data managers trained in quality control quality assurance methods and tools Land and coastal zone planners trained in GIS and the utilization of LIDAR imagines and products	Improved reliability of basic climate data, and climate related services.

i. Gender and Vulnerable Groups Measures

To ensure that this component supports measures to address differential impacts of climate change on gender and vulnerable groups, care will be taken to disaggregate data collected wherever possible. In many cases, it is anticipated that this will require a combination of the data collected under this component with those drawn from surveys such as living standards measurement, household expenditure, and gender assessments.

Component 2: Consolidating and Expanding the Regional Climate Monitoring Network and Global Platform Linkages

a. Background

Climate change and variability pose significant challenges to communities worldwide, especially those located in Small Island Developing States (SIDS) and low lying coastal areas. The likely impacts of climate change and variability is well documented, dating back to the Barbados Plan of Action (1994), which noted that-

> "... while small island developing States are among those that contribute least to global climate change and sea level rise, they are among those that would suffer most from the adverse effects of such phenomena and could in some cases become uninhabitable. Therefore, they are among those particularly vulnerable States that need assistance under the United Nations Framework Convention on Climate Change, including adaptation measures and mitigation efforts ..."

Climate information is important for national planning, managing development opportunities and risks and for mitigation and adaptation. Timely Accurate and on-time communication of climate change information is essential for helping to prevent humanitarian disasters and socio-economic losses and setbacks that can result from climate extremes caused by extreme climate variability and long term climate change. From 2009 through to present, the impacts of climate extremes on Caribbean SIDS has been significant, with several islands experiencing both severe drought which impacted inflation and Gross Domestic Product (GDP) and extreme environmental degradation, loss of life and significant economic setbacks from tropical storms and localized extreme rainfall events. Mitigating the impacts of extreme climate variability and long term change requires climate information and services to become integrated into sector policies at the national and community levels.

The Global Framework for Climate Services (GFCS) represents an important outcome of the Third World Climate Conference (WCC-3). It's goal is "… the development and provision of relevant science-based climate information and prediction for climate risk management and adaptation to climate variability and change, throughout the world ..." The GFCS has four major components (i) User Interaction Mechanism, (ii) World Climate Services System, (iii) Climate Research and (iv) Observation and Monitoring. This proposal effectively addresses all aspects of the GFCS but is most strongly aligned with (ii) and (iv) with the latter expected to strongly support (iii).

The GFCS recognizes that decision-makers in various sectors are increasingly concerned about climate risks but are ill-equipped to assimilate the available climate information and effectively apply it. As a result, the core mission of the GFCS is to increase and improve interaction between climate service providers and those who wish to make use of climate services. It is expected that by strengthening the development, provision and application of climate services, the GFCS will support poverty alleviation, disaster risk management and sustainable development.

Among the building blocks for the delivery of climate services are global climate information and data producing centres (GPCs); National Climate Centres that provide climate information for sectors and perform national climate monitoring and Regional Climate Centres (RCCs) designed to provide climate services at the regional level thereby bridging the gap between national and global climate service providers. In that role, RCCs will convert global information and convert it to regionally relevant formation that national climate centers can utilize. RCCs will also support regional climate monitoring as well as regional data collection. RCC will

facilitate the flow of information from national and regional scales to GPCs. RCCs will also function as centers for regional climate relevant research. The Caribbean Institute for Meteorology & Hydrology is currently in the process of becoming a WMO RCC.

This Component 2 of the SPCR takes account of the key aspects of the GFCS which include the **timely collection and sharing of high quality climate data among national, regional and international stakeholders** as well as the strengthening of regional and national institutions to deliver targeted climate products for key socio-economic sectors at the regional, national and community scales. The initiative is consistent with activities already initiated by CIMH to support (i) climate monitoring in the region, (ii) collection, archiving and dissemination of climate data, (iii) delivery of climate services to key economic sectors and (iv) capacity development of climate, hydrological and meteorological personnel in the region. The component also factors in the needs of various socio-economic sectors expressed at key fora in the region.

It is to be note further that the European Union supported CARIFORUM program and the IDB supported regional public good project, both described in the previous section of this document, are intended to support expansion and inter-linkages of the climate monitoring system and to provide for a more integrated, cost-effective, expandable and flexible system that would allow for ready access to needed data and information from a wide base of users. The Component described below is coherent with these two initiatives, and it is intended that the efforts together will provide the critical mass needed to enable the region to definitively meet the information needs for effective climate resilience.

b. Development and specific objectives

This initiative will be carried out over four years and is in harmony with the overall objectives of the Pilot Project for Climate Resilience (PPCR). Specific objectives of the proposed project include:

1. Enhancement of regional climate data collection networks and near real-time transmission of data between (i) national and sub-national networks and national data collection and processing entities, (ii) national data collection and processing and regional data collection, quality control and quality assurance centers, and product development centers and (iii) regional/national centers and international data collection and product producing centers;
2. Development of risk based approaches for the identification, development and delivery of key climate products and services to support socio-economic development in the Caribbean;
3. Strengthening of national and regional climate centers to support regional and national climate monitoring and development of focused climate products for community, national and regional socio-economic sectors;
4. Establishment of alternative data backup mechanisms and security policies for national and regional climate data.

These objectives can only be reached if a greater coherence, transparency and collaboration as well as connectivity between the different climate monitoring centers is achieved.

c. Key indicators and baseline

The early projects adaptation projects implemented across the Caribbean established monitoring systems and initiated networking efforts. For this component, the most relevant of

these are the CPACC outputs set out below which are now to be expanded on through the EU GCCA initiative. Value will be added to this expanded network through the enhanced connectivity to the global systems that is to be undertaken in this component.

- 18 state-of-the-art telemetry sea level and meteorological monitoring stations in the 12 participating countries that complied with the minimum standards of the Global Sea Level Observing System (GSLOS) network stations;
- Enhanced regional and national capacity to maintain the stations in the long term, conduct data acquisition, analysis, archiving and data dissemination activities using automated computer-enhanced technology; and
- Strengthened Regional and National Institutions and improved professional and technical skills through technology transfer.

Specific Objective	Baseline	Indicator
1. Enhancement of regional climate data collection networks and near real-time transmission of data	Number of stations in PPCR participating states currently supporting national, regional and global climate monitoring networks that are providing reliable data at regular reporting (transmission) intervals. National and regional coverage of the climate observation networks.	Strengthening of regional and national climate observation networks to support near real time reporting to national, regional and international climate data centers. Enhanced coverage of climate monitoring networks
2. Development of risk based approaches for the identification, development and delivery of key climate products and services to support socio-economic development in the Caribbean	Number of risk based regional and national climate products and services developed and regularly delivered to national and regional sectors.	Enhanced approach to support the identification of critical products and services required by regional and national socio-economic sectors. Increased number of products and services identified to support
3. Strengthening of national and regional climate centers to support regional and national climate monitoring and development of focused climate products for community, national and regional socio-economic sectors	Ability of national and regional climate centers to quality assure climate data and develop products and services from the data stored.	Increased number of climate products and services developed and provided to national and regional socio-economic sectors.

Specific Objective	Baseline	Indicator
4. Establishment of alternative data backup mechanisms and security policies for national and regional climate data	Security of national and regional climate back up centers in the Caribbean	Enhancements to the security of national and regional climate back up centers

d. Sub-components and activities

The project includes the following anticipated components and respective activities:

Component	Activities
1. Enhance regional data collection and transmission between National Meteorological Climate Centers, WMO Regional Climate Centers, global databases and global weather and climate product producing centers.	• Support for regional connectivity and data interpretation and use for the existing data hydromet networks region wide • Consolidation of archiving and interpretation center and support for open connectivity to all countries and parties in the region • Expansion of region's linkage and connectivity with GCOS, GLOSS and GOOS
2. Development of a risk based approach by CIMH for the identification and delivery of key climate products and services to support sustainable socio-economic development in the Caribbean.	• Assess and develop better understanding of the dynamics of rainfall variability • Develop tools to estimate extreme weather events • Assess information needs and respond accordingly
3. Development of a mechanism and policies to support the establishment of national climate data and product producing centers to support climate monitoring and climate risk reduction at the national level.	• Training in and disseminate of analytical tools for the provision of met information services • Distribution of climate products to users
4. Establishment of an alternative backup center for regional climate data	• Consolidation and expansion of regional archiving center and back up site outside the region

e. Institutional arrangements

The CIMH will provide leadership to the project that will engage climate data collection and monitoring centers in PPCR participating countries (generally assumed to be NMHSs but not limited to such entities), the CARICOM Secretariat, the CCCCC, UWI, CDEMA, CARDI, the Caribbean Knowledge and Learning Network (CKLN) and key national socio-economic sectors in PPCR participating states. CIMH has various agreements and arrangements with many of these stated regional institutions and some of the national entities. It is anticipated that the project will build on these arrangements in the areas of training, scope of the activities and mainstreaming of project outputs and outcomes. As indicated in the introduction, the project is expected to, where appropriate, build on existing initiatives to help the region achieve national, regional and global objectives. As a result, the institutional arrangements may include extra-regional organizations such as the World Meteorological Organization, the US National Oceanic and Atmospheric Administration (NOAA) among others. The precise nature of the institutional arrangements will depend in part on the resources that can be leveraged from each institution as inputs to the project and how the project's outputs and outcomes integrate into the activities of other institutions.

f. Risks

As in all projects, risk management is key to achieving the desired outputs and outcomes. Risks associated with the execution of this project include (i) poor communication between the project and stakeholders, (ii) inadequate resources by project participants to effectively support the project; and (iii) unwillingness of participants to some or all data. To mitigate these risks the following actions will be required (i) adequate funding to support effective execution of agreed and realizable project objectives, (ii) establishment of clear objectives that blend with national and regional priorities leading to a high probability for buy-in, (iii) establishment of a good communication strategy with stakeholders, (iv) twinning of the project with other regional and national projects to share resources where possible and (v) defining the public good that can come from sharing of data, products and services.

Risks may also result from the overlap of the proposed project activities with activities carried out under other existing or proposed programs and projects within the region. When this occurs appropriate mitigating actions will be undertaken following a consultative process with all stakeholders.

A further risk anticipated is the resistance of the sector stakeholders to shifts toward a risk based approach to development. This risk will be addressed through public education and training.

g. Investment Costing

The investment cost for this component is $ 1.0 million, with sub-component allocations per the table below.

Activity	Cost (USD)
1. Enhancement of regional climate data collection networks and near real-time transmission of data between (i) national and sub-national networks and national data collection and processing entities, (ii) national data collection and processing and regional data collection, quality control and quality assurance centres, and product development centres and (iii) regional/national centres and international data collection and product producing centres;	500,000
2. Development of risk based approaches for the identification, development and delivery of key climate products and services to support socio-economic development in the Caribbean;	150,000
3. Strengthening of national and regional climate centres to support regional and national climate monitoring and development of focused climate products for community, national and regional socio-economic sectors;	290.000
4. Establishment of alternative data backup mechanisms and security policies for national and regional climate data.	60,000

h. Results and Performance Framework

As noted in the above, this initiative is consistent with existing and emerging global regional and national models for building sustainable climate resilient societies and processes. The approach proposed is consistent with national and regional initiatives to monitor regional climate through climate observations and the development of monitoring tools. Supporting climate observations and the development of monitoring tools will require capacity development in national and regional institutions. This will occur during the execution of the project and will lead to institutional strengthening which is key for the sustainability of this initiative beyond the PPCR investment phase. The outputs from the climate monitoring process will be designed to risk inform socio-economic sectors so that high level of communication will have to occur between the development and delivery of the climate monitoring service and the national and regional users of the service. The enhanced climate observation and monitoring networks will provide the global climate modeling centers with critical information required by the global scientific community to improve climate models (both model parameterization and model verification).

The outcomes from data and product sharing should result in improved long and short term forecasts for the Caribbean thereby leading to more effective and cost-efficient planning and adaptation policies. The outputs of the data backup component of the project, when combined with other ongoing national and regional initiatives, are expected to result in more effective and accessible climate data in the region. It is also expected that an important outcome of this component of the project will be improved data security which is an area not always considered in the region, but one of growing international concern given the possibility for data modification and theft. While theft is unlikely, addressing data modification risk is critically important since it

can lend to significant bias in climate science, model outputs and ultimately decision making on adaptation and mitigation policies at the global, regional and local scales.

Component	Indicator	Output	Outcome
1. Enhancement of regional climate data collection networks and near real-time transmission of data between (i) national and sub-national networks and national data collection and processing entities, (ii) national data collection and processing and regional data collection, quality control and quality assurance centers, and product development centers and (iii) regional/national centers and international data collection and product producing centers;	Improved data transfers to regional and global databases (including WMO Information System, COOS and GLOSS) by 2015	Increased regional and global climatic data exchanges in near real-time.	Improved connectivity and data delivery services regional and international data centers and databases.
2. Development of risk based approaches for the identification, development and delivery of key climate products and services to support socio-economic	Approaches developed to identify and deliver key climatic products and services for regional and national sectors.	Risk based approaches to identify seasonal and longer term climatic products and services required by key national and regional sectors	Increase in the range of targeted climate services developed for the regional and national sectors.

Component	Indicator	Output	Outcome
development in the Caribbean;			
3. Strengthening of national and regional climate centers to support regional and national climate monitoring and development of focused climate products for community, national and regional socio-economic sectors;	Regional climate related workshops such as Caribbean Climate Outlook Forum (CariCOF) and technical exchanges held to build capacity and facilitate integrated decision making to increase adaptation and resilience of sectors. Products developed based on developed human and technical capacity.	Capacity built in PPCR countries for the provision of targeted climate services.	Increased regional capacity to provide climate information required for sustainable and resilient development
4. Establishment of alternative data backup mechanisms and security policies for national and regional climate data.	Regional climate data backup center established and functional.	At least one alternative archiving center in operation	Increased reliability of regional met data

i. Gender and Vulnerable Groups Measures

Women and other vulnerable groups are highly dependent on natural resources for their livelihood and are very vulnerable to climate change effects and hazards. The strengthening of existing climate monitoring networks is crucial to facilitate closing existing monitoring gaps, enhance comparability between data sets and the foster complementarity between data generated by national agencies and regional and global institutions. The information generated will improve resilience of theses vulnerable groups and reduce their exposure to climate change

impacts thanks to the understanding of how future climate will impact quality of life and integrity of ecosystems in the region.

Component 3: Downscaling and Expanding Climate Projection Models and High Resolution Maps

a. Background

The Caribbean region is extremely sensitive to variations in climate, with all major socio-economic sectors and chief infrastructural development exhibiting vulnerabilities. Modelling the effects of such changes is a critical resilience tool, and can be undertaken at two levels or tiers. The first is the modelling of climate data to generate projections of changes in global temperatures and related trends, such as precipitation and sea level rise. The second tier looks at modelling the likely impact of the changes on sectors such as agriculture and water. The effectiveness of modelling is advanced by the use of the outputs to generate projections on likely socioeconomic impacts of climate change.

Given the small physical size of most of the Region's states, global climate change models do not provide sufficient details of the likely future impacts of climate change within the region and especially at the national level. Efforts to address this have been spearheaded over the past few years by the Climate Modelling Group (CMG), so that the region's capacity to answer climate change questions and provide climate change information at the scale relevant to Caribbean states has been significantly increased.[31] Part of future resilience building is the enhancement of the modelling network beyond this initial phase by creating a structured and sustainable framework for continued growth. This would build on recognition that Tier 1 modelling work is a critical precursor to follow-on activities needed to improve regional climate change assessments and cross-disciplinary adaptation in all socio-economic sectors.

It is equally important to provide a framework for utilization of Tier 1 results in the conducting of new impact and sector studies and to show how the latter will in turn be utilized in the generation of new socioeconomic scenarios of climate change specific to the region. The utilization of climate modeling output to drive regional sector impact studies is at present piecemeal, haphazard and lacking in a regional consensus on an approach to doing so. This may in part be due to lack of understanding of the Tier 1 results or the inability to incorporate the results in sector studies. A successful framework will however be critical for the achievement of Component 4. It is to be noted that there are similar limitations in moving from sector studies (once completed) to the development of socioeconomic scenarios.

In this context the overall aims of Component 3 will be-

- A coordinated framework for pursuing climate science in the Caribbean and for the delivery of timely results. This will be harmonized with other ongoing modeling initiatives
- A framework for conducting new impact and sector studies, and for generating new socioeconomic scenarios to improve the adaptation practices.

[31] The Climate Modeling Group is a consortium of Caribbean institutions working together to provide downscaled climate change science for the region.

b. Development and Specific Objectives

This component responds to the need for advancing the climate modeling work initiated by the CMG, and will be carried out over four years (2012-2016). The component is in harmony with the overall objectives of the Pilot for Climate Resilience (PPCR). The core functions anticipated will strengthen cooperation and capacity at the regional level to integrate climate resilience in national and appropriate regional development planning and processes. Specifically, the Component seeks to accomplish the following:

Objective 1: Fully utilize data already available as output from the PRECIS[32] model to enhance regional climate modeling in the Caribbean;

Objective 2: Increase the number of climate variables analyzed and the range of analyses performed including the examination of extreme events and hurricanes;

Objective 3: Formulate a mechanism or strategy for incorporating Objective 1 and 2 results in sector models, especially for PPCR pilot country priority areas such as agriculture, water, health, forest, fisheries, as well as integrated coastal zone management and land use planning.

c. Key indicators and baseline

The key indicators for this Component include the following:

- Analyses (including graphics) of climate extremes including but not limited to hurricanes, droughts, and floods.
- The number of new climate variables analysed.
- Number of cross-disciplinary and on-going studies benefitting from Component outputs.
- Number of socioeconomic scenarios and adaptation plans incorporating climate change.

The baseline for these indicators will be the existing outputs from the first phase of modelling efforts. These include temperature and rainfall projections for various islands using two scenarios, namely the A2 and B2 SRES.

d. Sub-components and Activities

The objectives will be carried out through the implementation of five main activities as follows:

Sub-component	Activities
1. Tier 1 Modelling	• Calculation and analysis of climate extremes and climate indices for Caribbean states and comparison with available outputs e.g. from global and regional models.
	• Generation of climate change scenarios verified for the local conditions of the Caribbean and at a resolution useful for adaptation measures, including the design of infrastructure. Simulations with other regional climate models and different forcing from global climate models (GCMs), as well as simulations with new Representative Concentration Pathways (RCPs) will also be undertaken.

[32] The Acronym PRECIS stands for Providing Regional Climates for Impact Studies.

Sub-component	Activities
2. Tier 2 Modelling	• Identify most appropriate methodology and tools to apply to the various sectors.
	• Generation of strategies/framework to link Tier 1 and Tier 2 modelling and socioeconomic scenarios (including consultations, refinement of Tier 1 output, derived science-socioeconomic variables and platform for dissemination.)
	• Generation of new outputs, building on the Tier 1 climate data driven outputs, to analyse sector impacts of climate change particularly in agriculture, forests, health, water and fisheries.
3. Sharing of information and lessons learned	• Knowledge Management which will include semi-annual meetings of the modelling team; regular forums with second tier modellers, climate change and climate variability practitioners and decision-makers; publication and dissemination of results using different media; enhancement of existing interfaces and platforms for communicating with, and sharing new information and outputs.
4. Capacity Building	• Training in climate modelling.

e. Institutional Arrangements

This Component will engage in training of scientific, technical, and managerial personnel; institutional strengthening; providing systematic long-term technical assistance; and strengthening scientific information support capacity that allows the CCCCC to effectively support the Member States in policy development and applied adaptation project implementation. The Component will be coordinated by the inter-campus UWI Climate Studies Research Group and include all other Caribbean institutions with active modeling units. Such agencies include the UWI Cave Hill Campus currently modeling climate change impacts on water, the UWI St. Augustine Campus undertaking impact modeling for biodiversity, ecosystem services and health and the UWI Mona Campus and the Caribbean Agricultural Research and Development Institute (CARDI), currently collaborating to pilot the modeling of climate change impacts on agriculture crop production.

The institutional arrangement, with overall coordination of the various focal points for impact modeling, will strengthen cross-sector coordination and enhance assessment of climate change impacts on key socioeconomic sectors both within countries and across the region.

Of key importance is that this work will advance the “two-tier modeling” approach and other work by developing integrated land use maps, plans and regulations in selected strategic areas. Chiefly these initiatives are the development of Socio-economic Climate Change Adaptation to be generated jointly by the inter-Campus UWI Climate Studies Research Group, in partnership with the Caribbean Community Climate Change Centre and the Stockholm Environmental Institute. In this way the project also forms a critical nexus between the current and future work in climate change adaptation by building regional capacity and creating the technical tools necessary to ensure development in the region is resilient to climate variability and change.

f. Risks

Insufficient Data for Climate Change projection could be a limiting factor. The CIMH will provide observational and other data. Where gaps exist, statistical methods will be employed to provide reliable estimates.

Untimely Provision of new Scenarios-Representative Concentration Pathways (RCPs) are a concern. To address this, existing scenarios will be used until updated RCPs are available.

There is no exclusive pool of funds for modeling. The new outputs and generated capacity should be able to generate new revenue and funding opportunities.

g. Investment Costing

The total investment for this component is US$ 2.4 mn, as outlined below.

Component 3, Budget for PPCR Investment, 2012-2016

Item	Costs (USD)	Comment
Data collection, quality control and assurance	82,000	Labour by Grad Students subsidizes cost
Modeling and Data Analysis	470,000	Use of existing and new data, impact assessment using RCPs (Spell out)
Hardware and software costs	496,000	Computers, UPS, storage media, web conferencing facility (NEFSIS), Regional Climate Models
Training and capacity building in tier 1 and tier 2 modeling	250,000	Two sessions per year for four years, including experts fees, production of training tools
Meetings and seminars	120,000	Semi-annual meetings of modeling groups, and scenarios meetings with practitioners and decision makers, seminars with two-tier modelers; includes air travel costs, accommodation and per diem.
Publication and dissemination of results	112,000	Costs includes editing, peer review and press production and duplication of material
Equipment maintenance	38,000	Routine servicing and testing-Quality assurance checks
Land use/ICZM plans in selected areas of strategic interest	730,000	Joint effort with national units responsible for territorial planning
Project management and administration	80,000	Overall coordination, accounting and report writing
Miscellaneous	22,000	To account for currency fluctuations, provide buffer for force majeure.
Total PPCR Investment	**2,400,000**	

h. Results and Performance Framework

This modelling initiative will support Caribbean Regional Framework for Development Resilient to Climate Change, developed by the CCCCC. It will utilise the clearing house mechanism of the centre and partner with other on-going modelling initiatives. It will yield a number of very useful results and outcomes for the region. The principal results are listed below:

i. Methodology for detecting and projecting climate extremes, including droughts, changes in tropical cyclone frequency and intensity in the Caribbean.

ii. Multi-model analyses (under different GHG concentration paths) of climate change to produce climate change scenarios (that capture the climate specificities of the Caribbean) at the scale required for decision making in the Caribbean.

iii. At least 3 new regional experts in climate change modelling and in impact modelling

i. Gender and Vulnerable Groups Measures

Women and other vulnerable groups are highly dependent on natural resources for their livelihood and are very vulnerable to climate change effects and hazards. Downscaling and Expanding Climate Projection Models and High Resolution Maps and other follow-on activities for Climate Resilience in the Caribbean will improve resilience of theses vulnerable groups and reduce their exposure to climate change impacts

Component 4: Applied Adaptation Initiatives.

a. Background

The higher average temperatures, increased intensity levels of extreme weather events, including greater frequency of droughts and flooding, would impact the sustainability of food production systems. There are also impacts on human health anticipated from changes in air and water quality, and from shortages in food that would negatively affect nutrition. These threaten water and food security, as well as the economic livelihoods of agriculture and aquaculture producers in small developing states such as those within the Caribbean. In particular, they increase the vulnerability and reduce the productivity and resilience of agro- and marine ecosystems. This has direct implications for food and nutrition security, since the ability to grow, harvest and market aquaculture products, agriculture crops and livestock within an uncertain environment will be severely compromised, unless measures are taken to reduce risks and enhance climate resilience.

Regional Approach

CARICOM countries have considerable cause for concern as the threats posed by climate change and climate variability to their development prospects are severe and adaptation will require sizeable and sustained investment of resources that governments are unable to provide on their own. This concern is reflected in the *Liliendaal Declaration* which CARICOM Heads endorsed at their meeting in Guyana in July 2009. In the Declaration, Heads expressed grave concern that the region's efforts to promote sustainable development and achieve the MDGs are under severe threat from the devastating effects of climate change and sea level rise. Of particular note is the increasing intensity of extreme weather events, resulting in severe damage to the region's socio-economic resource base. **CARICOM Heads also emphasized that dangerous climate change is already occurring in all Small Islands and Low-lying Coastal Developing States (SIDS) regions including the Caribbean and that many SIDS**

will cease to exist without urgent, ambitious and decisive action by the international community.

Further cause for concern is that the estimated total annual impact of potential climate change on all CARICOM countries is estimated at US$9.9 billion in total Gross Domestic Product (GDP) at 2007 US$ prices or about 11.3% of the total annual GDP of all 20 CARICOM countries (Member States and Associate Member States), reflecting an almost 300% increase compared to 2004 (World Bank, 2009). During this period the countries of CARICOM grew by approximately 1.2%.

Regional Strategy

At the same meeting in Guyana in which the *Liliendaal Declaration* was endorsed, Caribbean heads of government approved the Regional Framework clearly articulating the strategic direction for the region's response to climate change risks.[33] Goal 2 of the Framework calls for action to reduce vulnerability to a changing climate. This is to be achieved by building in-country capacity to formulate and analyze adaptation policy options and develop and implement multi-sectoral adaptation strategies. Further, the strategy calls for CARICOM Member States to prepare these sectoral adaptation strategies. This Framework represents a long-term vision on climate issues and reflects the political will of the region. It is one of the first regional strategies drafted in developing nations, joined by a common purpose to face the climate challenge. Especially given the context of limited resources the Caribbean Community Climate Change Centre (CCCCC), the institution mandated to coordinate the region's climate change response, has followed a pilot adaptation oriented approach that is intended to be replicated and scaled up.

With reference to Goal 2 of the Regional Framework CARICOM countries have been building regional capacity to carry out multi-sectoral vulnerability assessments, as initiated under the CPACC and ACCC. Under the recently concluded MACC project, adaptation strategies were developed for the water, agriculture and tourism sectors in some pilot countries. Indeed, based on studies in the region carried out under the CPACC, ACCC and MACC projects. The First National Communications exercise expanded on issues related to the availability of water for domestic, industrial, agricultural, recreational and environmental (ecosystem services). From the region's modeling exercises there emerged an indicated need for early warning hydro-meteorological systems, protection of coral reefs, and implementation of community-based adaptation measures emerged as critical measures to deal with projected change in rainfall patterns, increased temperature, decreased precipitation, and greater acidification of oceans.

It was this sense of urgency that informed the selection of the water sector for focus in the ongoing SPACC project in Saint Lucia and St Vincent and the Grenadines. The vital importance of this issue to the sustainable development aspirations of the region is further underlined by the present disruption of the region's socioeconomic well-being by the prolonged and severe El Niño episode experienced throughout the region in 2009/2010. Given this new reality the region is becoming increasingly aware of the challenges associated with attaining the modest requirements of the MDGs.

[33] See www.caribbeanclimate.bz/index.php?option=com_docman&task=cat_view&gid=58&Itemid=3).

Rationale for Bilateral and/or Multilateral Aid involvement

Mainstreaming climate change adaptation strategies into the sustainable development agendas of the CARICOM Member States, by promoting actions to reduce the region's vulnerability to climate change while building the capacity within the region, inclusive of the CCCCC, is the main strategic area of support identified in the Regional Framework for Achieving Development Resilient to Climate Change. The PPCR, which is aimed at improving the region's capacity to adapt to climate change will be formulated in the context of the Caribbean Regional Framework which identifies national development strategies that focus on protecting the biophysical resources of the region while simultaneously enhancing social welfare. A comprehensive climate change response program will be crucial to achieving the stated goals of the Regional Framework, which will require, inter-alia, **significant improvement in the management of freshwater resources; strengthened hydro-meteorological forecasting capacity, improved food security, effective livelihood strategies, and strengthened institutional and technical capacities within the region**.

PPCR support will be complementary to other climate change adaptation initiatives already being undertaken in the region, including: (i) specific institutional support provided by the Government of Italy, (ii) the GEF-funded SPACC project; (iii) the Caribbean Development Bank/GTZ/Greece funded Clearinghouse Facility of the Centre, (iv) the Greece-Funded program that seeks to, inter alia, collect, analyze, and disseminate meteorological and sea level data for the observation of climatic change and the measurement of its impact on the potentially vulnerable sectors of the region's economies; and (v) the Australian Aid support.

Aim of the Collaboration

The PPCR would support the region's efforts at accelerating and sustaining its growth and development through enhanced environmental resilience and sustainability and improving quality of life of the Caribbean people. **The program supports the region's climate change adaptation initiatives by embedding the necessary institutional capacity within the region and implementing adaptation projects to advance the physical, social and economic welfare of the region**. This strategic objective is based on the *Regional Framework for Achieving Development Resilient to Climate Change* 2009-2015 and the draft Implementation Plan to implement the regional strategy that aim at raising the standard of living of CARICOM Member States by improving the effectiveness of climate change adaptation interventions.

b. Development and Specific Objectives

This component will assist the region to combat the threat of climate change through the development and implementation of appropriate adaptation interventions, based on the expressed desires of the national governments, drawing on the lessons learned from the SPACC project and related interventions.

Higher temperatures, reduced rainfall and sea level rise will further exacerbate water availability in the region. Many small islands such as Carriacou, Petite Martinique, and Union Islands in the Grenadines, Gales Point in Belize and Saint Lucia are already experiencing difficulty in accessing potable water. It is against this backdrop that saltwater desalinization and water harvesting are being pursued as critical activities to alleviate the critical water situation in these islands. This component will seek to develop public/private partnerships for the installation of: (i) desalinization systems using renewable energy sources, similar to those which have already been designed, under the SPACC for Bequia, (ii) water catchment systems, (iii) efficient water management systems including the minimization of leakage, (iv)

recycling of grey water, and (v) more efficient irrigation systems and practices, especially in the agricultural sector.

Training and capacity building are critical factors in the region's to response to the challenges of climate change. In this regard, collaboration will be sought to enhance the region's capacity areas such as sector impact, vulnerability and risk assessment studies, and regional climate, ocean and ecosystem impact modeling. This component will assist the region in: (i) enhancing its modeling capacity; (ii) sustaining the regional capacity for the planning and implementation of climate change adaptation projects; (iii) replicating across the region positive results of adaptation pilot projects previously implemented across the region; and (iv) enhancing capacity to quantify and more accurately assess potential costs to better inform appropriate adaptation measures.

Objective 1: Enabling adaptation through the articulation of climate change impacts on priority sectors, such as agriculture, marine resources, water and health.

Objective 2: Support for the development and advocacy for national adoption of climate change adaptation policy and legislation applicable to priority sectors, such as agriculture, water, health and marine resources, for select participating countries.

Objective 3: Articulation of climate change adaptation measures.

Objective 4: Development of incentives to promote climate change adaptation measures.

Objective 5: Piloting of design, implementation and evaluation of integrated surveillance system for vector borne disease in Jamaica, Haiti, and St. Lucia in the first instance, and replicated in remaining PPCR pilot countries.

Objective 6: Compilation, publication and dissemination of best practices for large agro system pre, post-harvest and marketing adaptation initiatives, large-scale rain water harvesting, dengue surveillance and marine ecosystem adaptation measures.

d. Key indicators and baseline

The baseline for this component is drawn from the agriculture, fisheries, water and health sectors across the region. Specific baseline measures will be identified in the detailing of the investment plan.

The indicators are itemized below. Wherever possible, gender disaggregated data will be collected in the indicator monitoring process.

- Endorsed regional strategy for incorporating climate risk into agriculture practices
- Climate resilient production, post-harvest and marketing systems for select commodities.
- Evaluation report on the impacts of climate change on Caribbean agriculture and climate resilience options
- Tertiary training regime and decision modeling (Increased Regional expertise in areas of risk and resilience associated with climate change)
- Dynamic model for climate change impact on marine ecosystems and results report
- Economic analysis of climate change impact on coastal communities and policy recommendations, taking account of data on vulnerable groups and gender.

- Design of a regional monitoring of marine ecosystem and key fish species and related report
- Water aggregation policies adopted by at least two PPCR countries.
- Three Integrated Surveillance and Control Systems designed and at least one adopted

c. Key Activities

Consolidation Stream

The set of activities under this stream will help to consolidate the outputs of the first three components, and identify linkage to ongoing and pipeline parallel adaptation activities to ensure that the implementation of adaptation initiatives.

i. Assessment of Caribbean policy and legislative framework for Climate Resilience.

This activity will involve a stock-taking of the actual and proposed national policies and related legislation to promote and enable mainstreaming of climate change adaptation. The stock take will focus in the first instance on the PPCR pilot countries, as well as the two non-pilot OECS countries. The stock take will identify critical policy and legislative enhancements that should be taken to propel adaptation efforts within the eight countries. *This activity coincides with an identified priority need within the Implementation Plan for the CARICOM Regional Framework for Climate Resilience, and so will meet a critical regional need.*

ii. Targeting Adaptation Initiatives

This activity will comprise of refinement of the adaptation measures under this second stream of this component. It will include the conduct of pre- feasibility activity which will utilize the regional level data to identify the collection and complementary national level activities as well as on information from Phase I PPCR, and through parallel non-PPCR activities being implemented within the region. Key activities in this regard are the updating and piloting of the *Caribbean Risk Management Guidelines for Climate Change Adaptation Decision Making."*

Applied Adaptation Stream

The activities in this applied adaptation stream will be guided in part by the pre-feasibility assessments under the consolidation stream.

Agriculture

Imminent changes in climate such as higher temperatures, extreme weather events, droughts, flooding and the rising levels of carbon dioxide will impact the sustainability of food production systems and by extension the livelihoods of producers and food and nutrition security of small developing states such as those within the Caribbean. Specifically, such changes in climate will increase the vulnerability and reduce the resilience of agro-ecosystems. This has direct implications for food and nutrition security, since the ability to grow and market food crops and livestock within an uncertain environment will be severely compromised, unless measures are taken to reduce risks and enhance climate resilience.

Introducing adaptation strategies that will seek to minimize the impact of the changing environment is critical for the sustainability of food production systems. Such strategies include the provision of good information on expected future climate, the strengthening of extension services and government programs to target vulnerable small and medium farmers, eliminate

market barriers and market failures, and support in-farm adaptation activities. The latter includes the use of drought, heat, salt and flood tolerant crop varieties, new efficient irrigation and water harvesting and storage techniques, sustainable soil management practices to increase soil carbon. Forecasting, surveillance and control systems for pests and diseases are also critical.

Many of these "climate smart agriculture" techniques are not new and there is a growing body of evidence to support their effectiveness to reduce the negative impacts of climate variability and change. Within the context of the Caribbean, however, there is a dearth of empirical evidence to support the potential of these practices/techniques in building resilience into agro-ecosystems. Empirical evidence is needed to (i) build the body of evidence needed to change current policy and promote agricultural growth, food security and poverty reduction within the face of climate change (scaling-up of interventions), and (ii) sensitize and build the adaptive capacity of small resource farmers and other key stakeholders to the vagaries of climate change.

This sub-component will take the following four pronged approach to developing and promoting more resilient food production systems within the Caribbean Region.

i. Data gathering to compile evidence related to climate change phenomena in the Caribbean, including but not limited to temperature and precipitation trends; map/measure the vulnerability of food production, post-harvest and marketing systems to extreme weather events and identify the most appropriate adaptation strategies for sustaining production.

ii. Presentation of evidence-based climate change scenarios on agriculture to policy makers to get buy-in and engagement for the development of the policy and regulatory framework that will be needed to support the proposed climate-resilient production, post-harvest and marketing strategies.

iii. Improving the knowledge and skill of producers and key stakeholders in the area of developing and implementing climate resilient production, post-harvest and marketing systems (learning by doing) as well as capacity building (formal training that will include tertiary level assignments) to increase the cadre of professional scientists working within the area of climate change and agriculture.

iv. Facilitating the implementation of policies and other regulatory mechanisms that will allow the mainstreaming/scaling-up and sustainability of climate smart agriculture within the development framework that supports national food and nutrition security programs (through engagement and communication among policy makers and agriculturalists).

This sub-component will also address gender and vulnerability issues emanating from climate change: Farmers are predominantly males, and so that men are likely to be impacted by climate change. This especially because a reduction in productivity can lead to a lower numbers of farmers and elevate the unemployment among men. On the other hand, rural women (who tend to be engaged in agriculture) and their families are among the poorest segment of populations. Women in the agricultural industry earn lower wages than men and in many cases are heads of household, single parents and main providers for their families. This suggest a ripple effect of climate change where female farmers are concerned.

Marine

Whilst there has been high visibility of climate change impact studies on land based resources, similar initiatives and knowledge products for marine resources generally receive less attention, and appear to be done at a lower scale. Since the Caribbean Sea is the indisputable shared resource of all PPCR countries and considering the critical importance of fishing and marine resources to the livelihoods, export markets and economic growth of the countries, assessing climate change impacts on and determining effective resilience measures for communities and marine resources can have substantial benefits to PPCR countries. Given the trans-boundary nature of the sea and living marine resources, including the migratory and straddling nature of most commercially important fish species, a regional approach to achieve such an objective would be the most effective.

Increasing levels of carbon dioxide, whilst beneficial for plan growth, has detrimental impact on water since it increases acidity when dissolved. This poses a direct threat to marine ecosystems.

The expected outcome of this subcomponent are-

a. Improved understanding of likely impacts of climate change on fish production and productivity in the Caribbean sea in the short and long term
b. Improved understanding of the economic and social implications and on food security arising from changes in availability, stability, access and utilization of marine fish and fishery products.
c. Monitoring systems established to determine impact of climate change on fish stocks and other key marine ecosystem components
d. Fishers, fisher's organizations and fishing communities engaged in developing climate change adaptation, mitigation and disaster risk management strategies including, improved preparedness and resilience, and reduced vulnerability to climate change, and associated disasters.

Improved public awareness and education of the implications and consequences of climate change on the regions' fishing industries

Box 7: Rainwater Harvesting in the Caribbean

Rainwater harvesting (RWH) offers a practical avenue for securing water to reduce the possibility of adverse health outcomes and business processes interruptions. RWH is easy to implement and manage and can meet that critical gap during times of need. The Implementation Plan of the Caribbean Climate Change Regional Framework identifies the need for investment in RWH within Strategic Element *1: "Mainstream climate change Adaptation Strategies into Sustainable Development Agendas of CARICOM Member States*".

The Caribbean Environmental Health Institute (CEHI) has been collaborating with regional and international partners in the promotion of RWH. These efforts centered on the application of domestic RWH systems, with emphasis on aspects such as rooftop rainwater capture potential, determining storage capacity based on household size, and reducing contamination of stored water. On the other hand, the CCCCC has piloted RWH systems at large-scale facilities, produced costs and benefit estimations, and developed financial tools to assess the potential interest of private sector investors.

Water Resources

In many counties, investment in upgrading water supply systems will remain a slow process due to financial constraints that will likely lag behind the pace of development in many communities. Securing water supplies during times when service reliability is compromised such as during drought and other weather related phenomenon, must be regarded with highest priority for governments, and water resources management policies and strategies must be articulated that point to this need. With the anticipated impacts of climate change all options to address water security must be explored. These include those for water aggregation and harvesting measures.

This subcomponent will include activities to compile and analyze available information on water aggregation in the Caribbean and to promote the development of economic and financial tools and products to induce the public and private sectors to increase the use of aggregation systems, such as rain water harvesting. Complementary activities will also be undertaken toward the formulation and implementation of water aggregation policies within select countries of the Region.

Health

Work at the global and regional level demonstrates a strong link between the climate change and health. Within the Caribbean, links to climate change have been identified between health related threats such Dengue. [34]

Considerable experience has been generated in the wider Caribbean basin on Integrated Surveillance and Control Systems (ISCS) of Dengue and other tropical vector borne diseases. This activity seeks to bring relevant knowledge and experiences to design ISCS in selected participating countries including, as applicable, the formulation and implementation of surveillance systems for Dengue.

Women are men are exposed in different ways to the effects of climate change in health. Women play a key role in health issues related to climate change. They are the primary caregivers of those affected by the diseases produced by climate change. It takes time away that they could use in other activities as going to the school, working or participating in the public life.

Box 8: Dengue and Climate Change Risk

Sufferers of dengue experience high fever, severe headaches and joint pain. The hemorrhagic form of dengue is life-threatening. The disease is estimated to cause 20,000 deaths in tropical and sub-tropical countries while some 50 - 100 million people are infected annually in over 100 countries. There is as yet no known vaccine for dengue and as such the emphasis of the medical community focuses on prevention of the disease.

The transmission of dengue among populations in Caribbean countries is likely to increase with the onset of climate change, since the increase in temperatures and the change in humidity will directly impact on the lifecycles and population of vectors.

[34] Taylor, M., Chen, A., Baily, W. (2010). *Review of Health Effects of Climate Variability and Climate Change in the Caribbean.*

d. Anticipated sub-components and Activities

Sub-components	Activities
Agriculture for climate risk reduction and resilience	a. Assessment of agriculture vulnerability to climate change and identification of regional policy options and the formulation of a plan of action. b. Selection of high priority interventions (aiming at knowledge, know-how and demonstration pilots) to be conducted at the regional level (for the benefit of all PPCR countries). c. Development of field experiences to demonstrate climate resilience production (varieties, practices/methods) and the collection of costs and production data for economic and financial analysis. d. Collection and utilization of information for sensitization of stakeholders (review, collect and analyze information, regional w/shop, development of strategies and plans). Wherever possible, this would include gender data. e. Dissemination of lessons learned; including related impacts as appropriate.
Measuring climate change impacts on fishing communities and marine resources	a. Development of dynamic models to assess climate change impacts on the productivity, abundance, seasonality, distributional range and species composition of key commercially important fish stocks in the Caribbean, and incorporation of these into the management planning and decision-making process b. Development of models and assessment of future social and economic implications (including food security) on Caribbean coastal fishing communities and economies using modern econometric techniques based on economic growth theory, available historical data (including fisheries and biological) on the resources and industry operations, and outputs of the models in item (2a) above, and incorporation of these into the management planning and decision-making process c. Design of regional monitoring system to assess the impacts on key fish species, marine biodiversity and marine ecosystems components d. Identification and assessment of strategies for improving the resilience and preparedness of coastal communities in selected CARICOM countries to reduce vulnerability of fishing and fish farming communities to climate change, taking in to account both short-term action to address current needs and longer term considerations (e.g. reduced productivity or changed distribution of commercially important species, changes in local and international markets)

Sub-components	Activities
Promoting water augmentation and harvesting for resilience	a. Identification of water harvesting and augmentation measures. b. Development of flexible and friendly financial and economic tools to assess water harvesting systems for a wide range of conditions in the Caribbean. c. Formulate and design financial and economic inducements for early adoption of water adaptation systems in commercial buildings. d. Support government efforts in the formulation, analysis and advocacy for enactment of water harvesting and augmentation policies and inducement programs. e. Design and implementation of a program supporting early adopters of RWH f. Dissemination of lessons learned, including a gender module.
Establishing early warning system to reduce climate change related health risks	a. Assessment of risks from health related conditions and vector borne diseases likely to be exacerbated by climate change to identify and map climate and non-climate related epidemic risk areas using geographical information systems b. Knowledge and experience sharing on dengue: impact of global warming on dengue infectivity; surveillance systems that work; experiences with Integrated Surveillance and Dengue Control Systems; response strategies to dengue outbreaks c. Support to three government in planning, designing and defining a detailed plan of action for the implementation of Integrated Surveillance and Dengue Control system, including Dengue surveillance system as applicable. Pilot countries - Jamaica, Haiti, and St. Lucia d. Dissemination of lessons learned, including gender model.
Advocacy and dissemination	a. Documentation of lessons learned on adaptation in agriculture, marine and aquaculture, water and health sectors and disseminate to non-PPCR countries. Documentation of lessons learned should include information on vulnerable groups and gender. b. Support to cross-country dialogue on best practices

e. Institutional Arrangements

Overall coordination: CCCCC
Responsible Agencies: CARDI (Agriculture); CRFM (Marine), CEHI (Water), CAREC, and UWI (Health).

f. Risks

The main risk in the implementation of this Component is a lack of coordination amongst the stakeholders.

g. Results and Performance Framework

The results and performance framework for this component of the SPCR are linked directly to the replication outcomes of the PPCR results framework, as well as to Strategic Elements 1 and 2, and to a lesser extent 3, of the *Regional Framework for Achieving Development Resilient to Climate Change*. Specific results expected are-

1. Identification of key adaptation options to benefit marine and agriculture stakeholders
2. Replicated adaptation initiatives benefiting multiple countries across the region
3. Water augmentation initiatives up-scaled to commercial levels
4. Determination of climate change link with resurgence in Dengue for improved surveillance

h. Investment Costing

The total investment for this component is US$3.35 mn, allocated per the table below.

Component 4, PPCR Investment for 4 Year Implementation

Sub-component	Costs (USD)
Consolidation Stream	**150,000**
Policy and Legislative Assessment	100,000
Consolidation and Refinement of Applied Adaptation Measures	50,000
Applied Adaptation Stream	**3,200,000**
Agriculture for climate risk reduction and resilience	1,200,000
Measuring climate change impacts on fishing communities and marine resources	800,000
Promoting water augmentation and harvesting for resilience	300,000
Establishing early warning system to reduce climate change related health risks	700,000
Advocacy and dissemination of lessons learned	200,000
Total PPCR Investment	**3,350,000**

3. Program Implementation and Information Management

Coordination Arrangements

SPCR implementation over the four (4) year period of the program will be done through collaboration amongst the lead agencies. Per the profiles above, the main lead agencies are the CCCCC, the CIMH and the UWI. It is important to note here too that there are coordination costs inherent in the sub-components of Component 4, particularly where activities are to be led by CARDI, CRFM, CEHI and UWI.

Major inputs for the execution of the agencies' roles include technical and program management capacities, travel and administrative costs, such as communication and information management. The costs related to these inputs are to be drawn down from an assignment of $1.0 mn and will be allocated to each of the lead agencies on the basis of cost factors such as the-

- level of required expertise and experience of program or technical coordinator,
- extent of travel required and
- cost of administrative equipment, supplies and services for maintaining records and facilitating communication.

The coordination costs to be financed for each agency will be fully identified in a comprehensive investment plan through which the proposed expenditure for regional SPCR implementation is to be detailed. The modality for resource distribution is for the CCCCC, as lead agency, to manage the overall PPCR funds, and to distribute allocations to the respective agencies per agreed schedule and triggers. Such agreement is to be an integral part of a Memorandum of Understanding between the coordinating agencies.

Project Preparation and Capacity Assessment

MOU indicated above is to be informed in part by an Institutional Capacity Assessment (SECI) of each of the agencies.

Coordination and Communication,
PPCR Investment, 2012 - 2016

Sub-component	Costs (USD)
Coordination and travel cost*	1,100,000
Communication	200,000
Total PPCR Investment	**1,300,000**

* Covers SPCR coordination and travel cost of the CCCCC, the CIMH and the UWI.

Dissemination of Information and Lessons Learned

Allocation of some $200,000 has been made also for the execution of a communication and information management strategy that will in part facilitate the lesson sharing and support the intended benefit to non-pilot countries within the region. This will be executed in tandem with the DMS initiative, and will support

- the development of portals linking the websites of the lead agencies and
- direct communication and exchange of data and information among stakeholders.

A second key activity within the strategy is the development and dissemination of public information products that effectively communicate the progress and achievements of the PPCR.

4. The SPCR Results Framework

Results	Indicator	Country/Regional Institution	Baseline	Target(s)	Means of verification
1. Improved regional institutional capacity to respond to climate variability and climate change.	Updated maps	Saint Lucia, Jamaica, Saint Vincent and the Grenadines, Grenada, Dominica	No high resolution Bathymetric maps available	At least 3 updated high resolution bathymetric and 3 updated hazard maps produced	High Resolution Maps
	Linkage of national, and regional and climate centers to global networks	Saint Lucia, Jamaica, Saint Vincent and the Grenadines, Grenada, Dominica, Haiti, CIMH	Linkage exists with GCOS	Expanded linkage to GLOSS and GOOS	Administrative reports; MOU or agreement for information/data sharing
	Number of persons trained in climate modeling, GIS and application of climate data and tools	Saint Lucia, Jamaica, Saint Vincent and the Grenadines, Grenada, Dominica, Haiti	Baseline for number of experts will be determined	At least 12 new resource persons, of which at least 4 are females	Workshop reports
	Number of adaptation financing mechanisms established	Saint Lucia, Jamaica, Dominica	No national adaptation mechanisms exist	At least 2 mechanisms established	Project and M&E Reports
	Number of national and sectoral plans and strategies climate proofed	Jamaica, Saint Lucia, Dominica, Saint Vincent and the Grenadines, Haiti	Not all priority sectors climate proofed. Specific baseline of climate proofed sectors to be determined	At least 1 national plan and 4 priority sector plans climate proofed; At least 2 sets of measures for vulnerable and/or	Project and M&E Reports

Results	Indicator	Country/Regional Institution	Baseline	Target(s)	Means of verification
				indigenous groups included in each sectoral plan	
	Number of lifeline assets climate proofed	Grenada	Baseline to be established	At least 2 lifeline assets—bridges, hospitals, power supply facility—climate proofed	Project and M&E Reports
2. Scaled-up and/or replicated initiatives for climate resilience.	Number of adaptation initiatives expanded or newly implemented.	Regional	One regional adaptation initiative (SPACC)	At least 2 expanded or replicated adaptation initiatives	Project and M&E reports
3. Dissemination of PPCR learning to non-PPCR countries.	Number of none-PPCR countries participating in regional track forum, data and information sharing initiatives	Regional	2 non-PPCR countries engaged so far	At least 5 non-PPCR countries participating in PPCR information sharing and/or training initiatives.	Forum logs, website counters, PPCR administrative unit communication records, activity or project reports

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Annex 1: Select Ongoing and Pipeline Climate Related Initiatives in the Caribbean

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Caribbean Carbon Neutral Tourism Program	Climate Resilience	IDB	CCCCC	NA	Assist the Caribbean region in responding to climate change by enhancing its climate resilience. The specific objectives are to devise ways of attracting new resources of financing for: (1) the scaling-up of low carbon investment in tourism sector, and (2) reducing the sector's vulnerability to climate change.	2009-2011	$1,088,550	Strategic Element (SE) 3.1 - Goal 6
Regional	Regional Monitoring and Evaluation System for DRM and Climate Change Adaptation in the Caribbean Tourism Sector	Climate Resilience	IDB/Regional Public Good Initiative	CDEMA	Caribbean Tourism Association	Mainstream Comprehensive Disaster Management in the tourism sector in the Caribbean. The purpose is to develop a regional monitoring, evaluation and reporting information system for disaster risk management and climate change adaptation in the tourism sector, as a Regional Public Good.	2010-2013	$1,050,000	SE 3.1

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Caribbean Disaster Management (CADM) Project Phase II	Disaster Mitigation	JICA	CDEMA	NA	Strengthen institutional mechanisms to mitigate damages in the CDEMA participating states (Belie, Dominica, Grenada, Guyana and Saint Lucia), especially against flood hazards. Expected results are (1) early flood analysis and flood hazard map in pilot countries, (2) establishment and implementation of early warning systems for flood hazards in the five pilot states and (3) hydrological database at CIMH.	April 2009-December 2011	JPY 230 mn	SE 3.2 Goal 5
Regional	Adaptation for Climate Change and Disaster Mitigation: Township Planning Strategies for Storm Surge in the Caribbean.	Climate Resilience	IDB/Netherlands Environmental Partnership Trust Fund	CDERA	NA	Assist Caribbean countries in the development of adaptation strategies needed to deal with the impact of natural disasters and severe weather events anticipated to occur in association with climate change, and to strengthen their capacity for adaptation to this phenomenon. The specific focus will be on developing the capacity and methodology for incorporating risk analysis into the long-term development strategies of	4 years, completed in 2009	$250,000	SE 3.1 Goal 2

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						town planners and emergency managers.			
Regional	Regional framework for an integrated observation network for environmental change in the wider Caribbean	Climate Resilience	IDB/Regional Public Goods Initiative	**CCCCC**	NOAA	The goal of the project is to contribute to building regional capacity to respond to the challenges and adverse impact of climate change adaptation in the Caribbean. The purpose is to develop a regional strategy and action plan for the establishment of an open access observation network for environmental change in the wider Caribbean region, as a Regional Public Good.	2010-2013	$750,000	S.E. 1, Goal 3
Regional	Mainstreaming Disaster Risk Management in OECS Countries	Disaster Risk Management	IDB/ Disaster Prevention Fund	CDB	OECS Secretariat	The project will support the mainstreaming of disaster risk management in the OECS. The specific objectives are to (a) strengthen institutional capacity of the OECS member countries and its Secretariat in community-	2008-2011	$400,000	S.E. 1, Goals 2, 3 & 4

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						based disaster risk management; and (b) enhance disaster resilience in vulnerable, low income communities.			
Regional	Climate Change Modeling for Latin America and the Caribbean	Climate Change	IDB/ SECCI	IDB/ SECCI	National Center for Atmospheric Research (NCAR)	Support the development of a science and technology transfer program between LAC scientific community and the National Center for Atmospheric Research (NCAR), which will contribute to build or strengthen existing capacity for the generation, analysis and visualization of climate, climate variability and climate change data and its integration in vulnerability and impacts assessments	2009 to 2011	$1,200,000	SE 3.1 Goal 1
Regional	Caribbean Risk Atlas Project	Climate Resilience	WB	UWI	CIMH, CDERA and C5	The objective of the Project is to build capacity in theCaribbean Region to analyze disaster risk in terms of potential losses and to use this type of analysis in the development of comprehensive risk management strategies.	2009 to 2011	$510,000	SE 3.1 Goal 1

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						The project will seek to institutionalize the use of probabilistic loss analysis in regional planning activities as a risk reduction mechanism for future development planning.			
Regional	Caribbean Emergency Legislation Project	Climate Resilience	WB	CARICOM/OAS	NA	The objective of the Project is to build legislative capacity to enhance the legal and institutional framework for state of emergency budget appropriation in the Dominican Republic and CARICOM Member Countries. It aims to raise awareness among government decision makers and make recommendations to improve legislative channels and administrative procedures during, and immediately after, the occurrence of a natural disaster.	2008 to 2011	$350,000	SE 3.1 Goal 4
Regional	Disaster Risk Reduction in the Health Sector of CARICOM	Disaster risk management	CIDA	PAHO	Participating Country Health Disaster Coordinators	hospital safety index & post disaster plans for mental health	2008-2013	CAN$2.5M	SE 3.1 Goals 1,2 and 3

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
	Member States								
Regional	CDM Harmonized Implementation Program	Comprehensive Disaster Management	CIDA	CDEMA	DFID & OECS	Nat'l capacity strengthening for DRM & Community resiliency	2008-2013	USD$8M (CAN$3M - CIDA)	SE 3.1 Goals 1,2 and 3
Regional	Canada-Caribbean DRM Fund	Disaster Risk Management	CIDA	CIDA	NA	Small grants - community based DRR	2007-2012	CAN$3.0M	SE 3.1 Goals 1,2 and 3
Regional	Mainstreaming DRR in Education Sector - UWIDRRC (Proposed)	Disaster Risk Management	CIDA	UWIDRRC (tbd)	tbd	Proposal in negotiation/discussion	tbd	tbd	SE 3.1 Goal 4
Regional	Community resiliency and CBDRR (Proposed)	Disaster Risk Management	CIDA	CRC/IFRC (tbd)	National Societies	Proposal in negotiation/discussion	tbd	tbd	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Mainstreaming Climate Change into Disaster Management for the Caribbean Region	Climate Resilience	Gov. of Austria			Strengthen regional, national and community level capacity for mitigation, management and coordinated response to natural and technological hazards & effects of climate change by: (1) developing a regional program and plan of action for mainstreaming climate change in the disaster risk management agenda in the region; (2) building community resilience through enhancement of the existing Community Disaster Planning Training Manual to include a component on climate change, establishing a cadre of trainers and community-based disaster management training, and deepening coordination for advancing community-based planning initiatives; and (3) strengthening the sub-regional response units to more effectively coordinate responses on behalf of member states in their sub-region when disaster events occur	2009-2011	$880,150	SE 3.1 Goal 2

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Building Capacity for Conducting Vulnerability and Adaptation Assessments in the Caribbean Region	Climate Change Adaptation	GEF	UNDP		This training would be implemented in three phases. In Phase 1, countries would complete a comprehensive assessment of national data and expertise and prepare a detailed draft V&A work plan. In Phase 2, a two-week workshop will be held in the region. In Phase 3, a three-day workshop will be held so that countries may share experiences and resolve problems encountered during the early stages of V&A assessment.	1999-	$117.744,00	SE 3.1 Goal 2
Regional	Integrating Coastal and Watershed Management in the Small Island Developing States of the Caribbean (IWCAM)	Climate Change Adaptation	GEF	UNDP	Co-financed	The long-term goal is to enhance the capacity of the countries to plan and manage their aquatic resources and ecosystems on a sustainable basis. The project recognizes the integrated and interlinked nature of watersheds and coastal areas in small islands and aims to develop a more sectorally-coordinated management approach, both at the national and the regional level, with a strong emphasis on an expanded	2006-	$103.000.000	SE 3.1 Goal 2

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						role for all stakeholders within a participatory management framework.			
Regional	Building Wider Public and Private Constituencies for the GEF in Latin America and the Caribbean: Regional Promotion of Global Environment Protection through the Electronic Media	Climate Change Adaptation	GEF	UNDP	co financed	Increase public awareness of global environmental issues and international environmental agreements (MEAs)2. Increase motivation, interest and participation of general public and Latin American & Caribbean owners of SMEs in global environment issues, and in replicating environmentally sustainable initiatives.	2001-	$1.957.194,00	SE 3.1 Goal 4
Regional	Support to the Global Climate Change Alliance (GCCA) under the 10th EDF Intra-ACP Financial	Climate Change Adaptation	EU	CCCCC					

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
	Framework								
Regional	Comprehensive Disaster Management - Harmonised Implementation Programme (CDM-HIP)	Disaster Risk Reduction and Climate Change Adaptation	DFID (Other partners- CIDA and EC)	CDEMA		Support for the regional Comprehensive Disaster Management (CDM) Strategy- assisting the Caribbean Disaster and Emergency Management Agency (CDEMA) to a) strengthen institutional support for CDM Program implementation at national and regional levels; B) build community resilience (e.g. safer building and landslide protection for the most vulnerable) in CDERA states/ territories to mitigate, respond to, and recover from the adverse effects of climate variability and change and disasters.	April 2009-March 2013	£2,400,000	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Caribbean Review of Economics of Climate Change (RECC)	Climate Change Resilience; Environment and Energy	DFID (other partners IADB; AusAid + CDB tbc); DFID Caribbean	**UNECLAC and CCCCC**		Caribbean governments (12 with DFID funding) will be provided with an economic assessment of the impacts of climate change looking at key vulnerable sectors with different socioeconomic development scenarios and emission trajectories. This includes costs and benefits of inaction (known as business as usual or baseline) versus adaptation to reduce vulnerability, and transition towards sustainable low carbon economy. It will include analysis of poverty, equity and gender where possible The programme also includes training of professionals across the region in modeling the economic impacts of climate change and adaptation to boost technical capacity in this area.	June 2009-January 2011	£750,000	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Caribbean Climate Change Risk Atlas (CARIBSAVE CCRA)	Climate Change, Disaster Risk Reduction	DFID Caribbean (Other partners- AusAid supporting CCRA for five additional countries) DFID Caribbean	**OUCE and CCCCC**		Climate Change Country Risk Profiles and Plans for the tourism and related sectors will be produced for 10 countries (the Bahamas, Jamaica, Barbados, Dominican Republic, Turks and Caicos, St. Lucia, Anguilla, St. Kitts, Suriname, and Grenada). They will contribute to the design and implementation of an effective Comprehensive Disaster Management (CDM) programme in these countries; Other outputs include increased public awareness, media communication material (e.g., three new films) and strengthened institutional capacity and knowledge base of the regional climate modeling group.	March 2010-June 2011;	£750,000	
Regional	CCCCC/regional task force support	Climate Change	DFID Caribbean :	**CCCCC**		Development of Caribbean Strategy to address CC risks and support for regional engagement and international negotiations on CC response planning and strategy implementation.	Oct 2007-June 2010	£179,290	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Copenhagen and beyond- Capacity building for CARICOM policy makers involved in climate change negotiations	Climate Change and Energy	DFID Caribbean	UNDP (with CCCCC)		Prepare CARICOM leaders for UNFCC Copenhagen negotiations and facilitate regional efforts of the task force- through support of modeling impacts to provide information for COP 15 of 1,5 vs. 2.0 degree warming scenarios; renewable energy initiatives (sector assessment and implementation strategy) ; and a communication web portal.	Sept 2009- June 2010	£149,664	
Regional	Catastrophic Risk Insurance Facility	Disaster Risk Reduction (risk transfer)	DFID Caribbean : Contact	WB		Grant to capitalize insurance facility	2007	£3,772m	
Regional	Guyana Flood mitigation- WB Conservancy Dam/Cunha Canal rehabilitation works * tbc	Disaster Risk Reduction /Climate Change Adaptation	DFID Caribbean - co-fund the World Bank's Global Environment Facility's (GEF) project	WB / G of Guyana		To adapt to climate change and reduce flood risk from the East Demerara Water Conservancy (EDWC) by increasing discharge capacity through the Cuhna Canal.	2009- tbc	£750,000	
Regional	ECACC- Enhancing	Climate Change	DFID (Overseas	**CCCCC**		Support efforts by the United Kingdom Overseas	2007-2010	£300,000	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
	Capacity for Adaptation to Climate Change in the Caribbean Overseas Territories		Territories Dept)			Territories (UKOT) in the Caribbean to adapt to climate change and climate variability within the context of sustainable development. The identified UKOT are Anguilla, British Virgin Islands (BVI), Cayman Islands (CI), Montserrat, and Turks and Caicos Islands (TCI). Six (6) major outputs are expected to be achieved viz. Output 1 - Project management arrangements in place and operational; Output 2 - Climate change focal points identified and national coordinating mechanisms for implementation in place and operational;Output 3 - Public education and outreach (PEO) programmes developed and implemented; Output 4 - National capacities to undertake environmental monitoring, vulnerability and risk assessments in key environment and socio-economic sectors enhanced; Output 5 - National climate change			

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						strategies and action plans developed and implementation initiated; and Output 6 - Mechanisms for sharing information and experience established and functioning effectively.			
Regional	DRR Capacity building in the UK Overseas Territories	DRR	DFID (Overseas Territories)	National disaster offices		Technical assistance fund (£100,000 per year) for DRR activities in UK Overseas Territories	2008-2011	£300,000	
Regional	Smart Health Care Facilities in the Caribbean	DRR/CC Adaptation	DFID	Pan American Health Organization		Support PAHO to implement a programme of 'climate smarting' health facilities in the Caribbean. This would enable health care facilities to be both environmentally greener and safer against disasters and climate change impacts.	March 2012-October 2013	£913,750	
Regional	Agricultural Catastrophic Hazard Insurance	Climate Change Adaptation	DFID			To help develop and introduce affordable catastrophe weather insurance to protect farmers in the Caribbean against the impacts of natural disasters and climate change. Initially, the insurance will be offered to banana farmers in the Eastern Caribbean, but the intention is to	March 2012	£1.5 mn	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						expand to other crops and countries within four years.			
Regional	IFRC Improving Climate Change Resilience in the Caribbean	Climate Change Adaptation	DFID	International Federation of Red Cross and Red Crescent Societies		Support to the International Federation of Red Cross and Red Crescent Societies (IFRCS) to build climate change and disaster resilience of vulnerable communities. Safer building, flood and health protection measures will be implemented in three Caribbean states,. Antigua, Jamaica and Suriname.	Sep 2011 – March 2015	£540,508	
Regional	IDEAS Energy Enterprise Innovation Contest for the Caribbean	Climate Change Mitigation	DFID	Global Village Energy Partnership		enable a competition to select up to 12 innovative renewable and sustainable energy projects for the Caribbean, providing local benefits, green jobs and carbon savings as well as the potential to scale up to bring about much bigger impacts and policy changes.		£1.46m	
Global Initiatives									

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Pilot Programme for Climate Resilience PPCR-Caribbean			CCCCC		To scale up adaptation efforts in recipient country. It will strengthen a country's ability to plan and implement resilient development programs, particularly focusing on highly vulnerable sectors and through strengthening institutional processes and structures.			
Regional	Forest Carbon Partnership Facility(FCPF)					Prepare national action plans for participation in REDD+ pilot schemes.			
Regional	Research - DFID+IDRC: Climate Change Adaptation in Asia, Latin America and the Caribbean (CCA-ALAC)					Innovative and scalable technologies/ approaches developed (and adopted) to help poor people respond to climate change challenges and opportunities in their livelihood systems and development challenges			
Concepts									
Regional	Ecosystem based adaptation (EbA), key island ecosystem approaches - coasts and coral reefs	Climate Resilience	TBD	TBD	Potential Partners: IUCN, CCCCC, CARIBSAVE	The proposal seeks to raise awareness and improve capacity by conducting workshops on ecosystem based adaptation. The objective is to improve the skills of key government agencies and focal points in incorporating ecosystem based approaches to	2010-2011	$200,000	SE 3.1 Goals 1, 2 and 4

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						building resilience especially into the management of reefs and other coastal resources			
Regional	Using CRiSTAL to integrate climate risks into adaptive planning and management and link communities and livelihoods to ecosystem management	Climate Resilience	TBD	TBD	Potential Partners: IUCN, CCCCC, CANARI	The proposal will introduce the Community Based Risk Screening Tool - Adaptation & Livelihoods (CRiSTAL) to help project planners and managers to integrate risk reduction and climate change adaptation into community-level projects, and so reduce community vulnerability to climate stress	2010-2011	$200,000	SE 3.1 Goals 1 and 2
Regional	Strengthening regional and national policy frameworks for incorporating ecosystem based approaches to reducing vulnerability and climate stress	Climate policy and resilience	TBD	TBD	Potential Partners: IUCN, CCCCC, CARIBSAVE	Maintaining healthy ecosystems and their ability to provide valued services over the long term (e.g. provisioning, protecting) is a key strategy for improving islands and community resilience over the long term. The proposal will examine existing regional and national policy frameworks that will facilitate such long term approaches.	2010-2011	$300,000	SE 3.1 Goals 1 and 2

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
						Recommendations for policy improvements or adjustments along with key implementation strategies, will feature evidence-based modeling and scenario forecasting			
Regional	Strengthening regional fisheries planning framework for sustainable use of coastal and marine living resource	Climate Resilience	JICA	CARICOM/CRFM	CRFM/ICNET	Master Plan for the sustainable use of fisheries resources in the Caribbean, focusing on small-scale operators in coastal communities (This project is not climate change project but will address some aspect of CC)	2009-2012	JPY 360 mill	
Regional	Strengthened governance of trans-boundary Living marine resource of the Caribbean Sea	Climate Resilience	GEF/Countries	UNDP/IOCARIBE	UNDP/IOCARIBE/UNEP/UWI/OSPESCA/CRFM/TNC/IUNC/NOAA	The overall objective of the CLME project is sustainable management of the shared living marine resources of the Caribbean LME and adjacent areas through an integrated management approach that will meet WSSD targets for sustainable fisheries (This project is not climate change project but will address some aspect of CC)	2009-2014	$56 mill	

National/ Regional	Project / Program	Area	Financing	Implementing Agency	Other Partner Institutions/projects	Brief Description	Duration	Value Approximate ($US unless otherwise stated)	Link to the Caribbean Regional CC Strategy
Regional	Strengthen fisheries management in ACP Countries	Climate Resilience	EU	Project Implementation office in Brussels	CARIFORUM/ CRFM	The overall objective of the Programme is to contribute to the sustainable and equitable management of fisheries in ACP countries. It is recognized that effective governance of the fisheries sector has the potential to bring about considerable gains for society (This project is not climate change project but will address some aspect of CC)	2009-2014	$3.3 mill	

Annex 2: Objectives and Activities/Focus of the European Union-CARIFORUM Global Climate Change Adaptation Initiative

Result	Activity	Focus/Description
1. Enhance the predictive powers of regional climate models and the region's ability to design and implement cost-effective adaptation activities	Regional Workshop on ensemble climate modeling	Identify and procure resources for ensemble climate modeling; conduct training workshop, 1 in Eastern Caribbean, 1 in Northern Caribbean
	Study tours and attachments on ensemble modeling	10 places for short term training in ensemble modeling and downscaling
	Establish national and regional climate-related data nodes	Central and regional node in each state and in regional agencies
	Data management system	Retrieval of data through the GCOS system to ensure collection, storage and retrieval (by academia, climate scientists, sector specialists and policy makers)
		Development of Data Management System for sharing (public goods?)
	Regional workshop on use of climate models in impact studies	2 training workshop focused on impact modeling in agriculture, water and health
	Application of climate studies to impact modeling	
2. Improved Climate Monitoring, Data Retrieval and Space-based tools for Disaster Risk Reduction	Weather station requirements	Identify best positioning and specification for weather stations, working with national authorities
	Weather station procurement	CCCC C and CIMH collaboration on procurement of at least 112 weather stations
	Weather station installation	Sub-contraction of CIMH for installation of the 112 weather stations procured
	Weather station linkage	Network and interconnect the 112 stations placed into the GCOS; for integration into 18 system. Collaboration includes CCCCC, CIMH, INSPET, and related institutions in the Dominican Republic
	Data and information	Work with the hydrometeoreological departments in the region in identifying, collecting and documenting their climate related data bases
		Digitise and store the various databases that are still in hardcopy

Annex 2: Objectives and Activities/Focus of the European Union-CARIFORUM Global Climate Change Adaptation Initiative

Result	Activity	Focus/Description
		Establish protocol for data sharing between the region and the Centre's Information Clearinghouse Facility
3. Refined vulnerability and risk assessment methodologies that are more contextually relevant, and build local capacity to better assess the current and future vulnerabilities and risks of specific states and communities within those states	Regional workshop on vulnerability assessment techniques	Employ an internationally recognized consultant to develop contextually relevant vulnerability assessment techniques and deliver two regional workshops to impart these
	Conduct vulnerability assessment	10 vulnerability studies, including on environmental (extreme weather), social (policy change) and economic (market change)
		Implement the précis model downscaling at component 1 to project
		Use of complementary geographic systems for topographic mapping of the most vulnerable areas; collaborators include CANARI.
	Regional workshop on risk assessment techniques	Employ an internationally recognized consultant to develop contextually relevant risk assessment techniques and deliver two regional workshops to impart these
	Conduct risk and hazard assessment	Risk assessments in collaboration with communities, on critical sectors--infrastructure, tourism, agriculture and water.
4. Reduce the states vulnerability to climate change through embarking on adaptation pilots	Identification and presentation of adaptation options	Retrofitting building code in at least 1 Caribbean country
		Reverse osmosis in at least 2 Caribbean states
		In-situ and ex-situ agro-biodiversity conservation in at least 2 communities (in cassava and maize)
		New farming techniques-drip irrigation, greenhouse production, mulch utilization, low tillage land preparation, organic farmin
		Design insurance modalities for small farmers/small business owners/low income dwellers.
	Produce project feasibility options for pilots	Identification of appropriate pilots
	Implement adaptation pilots	Implementation of at least 2 (GCCA funded) pilots

Annex 3: Stations to be installed under the EU-CARIFORUM Global Climate Change (Caribbean) Project

No.	Country	Hydrological Station		Meteorological Station		Coral Reef Early Warning Monitoring Station	
		No. of Stations	***Cost (Euros)***	***No. of Stations***	***Cost (Euros)***	***No. of Stations***	***Cost (Euros)***
1	Antigua & Barbuda			1	12,000		
2	Bahamas			5	30,000		
3	Barbados					1	110,000
4	Belize	4	40,000	5	40,000	1	110,000
5	Cuba	10	100,000	10	100,000	1	110,000
6	Dominica	2	12,000	2	12,000		
7	Dominican Republic	5	50,000	5	50,000	1	110,000
8	Grenada			1	12,000		
9	Guyana	10	100,000	10	100,000		
10	Haiti	5	50,000	5	50,000		
11	Jamaica	2	12,000	2	12,000		
12	Saint Kitts & Nevis			1	12,000		
13	Saint Lucia			1	12,000	1	110,000
14	Saint Vincent & Grenadines			1	12,000		
15	Suriname	8	80,000	6	60,000		
16	Trinidad & Tobago	2	12,000	2	12,000	1	110,000
	Total	**48**	**456,000**	**58**	**526,000**	**6**	**660,000**

Annex 4: Regional and National Track SPCR Linkages

Saint Vincent and the Grenadines' SPCR	Regional SPCR
Component 1: ***Climate Vulnerability, Risk Assessment and Risk Reduction.*** This component focuses on Union Island and the Arnos Vale and Georgetown watersheds, and entails- • Collection of a range of data relative to components 2 through 4. • Assessment of climate change on the marine ecosystem and commercial fisheries, • Preparation of coastal zone management policy and plan The following are the specific sub-components. 1.1.1. Pilot Area One: Union Island. Activities under this subcomponent include evaluation of Union Island's ICZM plan and community awareness strategy; implementation of appropriate shoreline numerical and physical modeling techniques on Union Island; geological assessment of Union Island as a single drainage basin; replanting of mangroves in selected areas; drainage designs for Union Island 1.1.2. Pilot Area Two: Arnos Vale Watershed-activities include River defense and rehabilitation of river crossings, geological assessment of Arnos Vale, Forestry management (including silviculture), designation and delineation of drainage channels and buffer zones, application of relevant effluent regulations/standards at the coastal area of Arnos Vale and Warraworrow/Greathead beach management 1.1.3. Pilot Area Three: Georgetown Watershed. Forestry management (including silviculture), designation and delineation of drainage channels and buffer zones in the Georgetown watershed, testing and monringoting of enforcement of new building code provisions, Appropriate numerical and physical modeling to determine optimum shoreline stabilization techniques, coastal defense. 1.1.4. Assessment of climate change impacts on coastal and marine ecosystems and commercial fisheries, including the completion of a coastal zone management policy and plan. ***Intended Result***: Strengthened Community Resilience **Indicators:** *Census data questions on vulnerability and resilience, decrease in economic and social losses post-disaster events, decreased loss of roads and bridges, damage to river banks, decreased loss of livelihoods, lower levels of overall community impacts from climate hazards, improved ability to cope with disaster events (social survey).*	Data collected under Component 1 of the regional SPCR will contribute to the types of data to be collected under this national component.

Saint Vincent and the Grenadines' SPCR	Regional SPCR
Component 2: ***Data Collection, analysis and information management.*** Focuses on comprehensive data collection, analysis and information management to ensure components 2, 3 and 4 of this national pilot program. Agencies that will be involved include Agriculture, Lands, Forestry and Fisheries, Ministry of Transport and Works, Meteorological Office, Statistical Department, Ministry of Physical Development and the Environment (including the Physical Planning and Survey and Mapping Units; Ministry of Health, Wellness and the Environment; CWSA and the National Emergency Management Organization. Sub-components include- 2.1. Acquisition and installation of telemetric weather stations and software; 2.2. Coastal zone impact modeling 2.3. Development of a harmonized platform for data analysis and data management. ***Intended Result:*** Increased Socio-economic stability **Indicators:** Lower levels of community losses. Improved water accessibility in the Grenadines, increases use of rainwater harvesting and storage in St. Vincent.	Assessment of data collection and management system implemented through Regional Track Phase 1 activity will provide critical information to improve the protocols for transmission of data from national agencies to the regional organizations. This will in turn inform and be informed by the protocols to be applied by the national level agencies identified under Component 2 of this national SPCR.
Component 3: ***Strengthening of existing policy, legal and institutional framework to address climate change.*** Focuses on strengthening the existing policy, legal and institutional framework. 3.1. Integrated Watershed Management Plan 3.2. Institutional strengthening for the MoFEP, MoHE, Ministry of Works and Physical Planning to boost climate change capabilities in-house 3.3. Strengthened capacity of the Mt Office for forecasting and inter-ministerial coordination 3.4. Strengthened capacity for CSWA for hydrology, drainage and waste water management 3.5. Preparation of a small booklet , "climate Change Governance in SVG" 3.6. Development of draft policy and legislation in support of mainstreaming climate change resilience into development planning 3.7. Water conservation and management in the Grenadines 3.8. Institutional strengthening NEMO	

Saint Vincent and the Grenadines' SPCR	Regional SPCR
Intended Result: Increased capacity in government institutions **Indicators:** Six Ministries/Agencies (Agriculture, Physical Planning, NEMO, Works, Lands and Statistics-MoFEP) have equipped and skilled persons for data management and GIS mapping. Eight Ministries/Agencies have had personnel trained in climate change impacts assessment (sector-specific), increased attendance in Regional climate discussions and activities, Climate change expertise available in Ministry of Finance, Ministry of Health and Environment, publications on Governance available to Government officials (all Ministries).	
Component 4: Design and implementation of a public education and capacity building program. 4.1. National curriculum development (including teacher training) for secondary schools in climate change and disaster risk reduction. 4.2. Planning and development of an early warning system in SVG 4.3. Technical training for monitoring programs in support of climate resilience 4.4. Technical training in GIS data processing 4.5. Production of community based Climate Risk Base Maps in the three pilot areas 4.6. Training for senior Data/information management specialist 4.7. Extension of Social Risk Assessment to cover all constituencies in St. Vincent and the Grenadines 4.8 Prepare Guidelines for Commercial Fishing and Recreational boating 4.9. Development of information packages for families and communities in the "Red Zone" 4.10. Prepare strategic plans for the development of partnerships between Government and the Private Sector 4.11 Awareness and education program for farmers and communities in the pilot areas, on the use of agrochemicals that leads to surface freshwater contamination.	Exchange of information and lessons learned under the regional track will help to inform public education. Training in data hosting will contribute to the capacity development under this component

Saint Vincent and the Grenadines' SPCR	Regional SPCR
Intended Result: Strengthened knowledge and awareness **Indicators:** *Curriculum active in all schools, teachers trained to deliver climate change and disaster reduction education, climate change information and materials available to schools and teachers, number of community leaders trained in Hurricane Preparedness, number of brochures and publications available to the general public on climate change impacts at community level, early warning system (EWS) installed, number of communities trained in EWS leadership. Responses to climate questions in the Census*	

Grenada's SPCR	Regional SPCR
Investment Project 1: Disaster Vulnerability and climate risk reduction **Intended Result:** Reduced vulnerability to natural hazards and the adverse impacts of climate change in Grenada ***Indicators:*** *Improved flood mitigation /drainage works; improved prevention of rock falls, land slides; mitigation of erosion; climate proofing of critical bridges; increased drought resilience in water supply systems; climate proofed public buildings schools, old age homes and warehouses for emergency operations; improved capacity for disaster response.*	Data collected under Component 1 of the regional track SPCR will contribute to the information base for this component.
Investment Project 2: Forest Rehabilitation **Intended Result:** Reduced vulnerability to climate change through the restoration and preservation of valuable forest resources through effective land use practices that also promote sustainable livelihoods, contribute to environmental sustainability and reduce poverty ***Indicators:*** *Development of nursery, production and propagation of seedlings, acreages reforested or afforested, forest roads upgraded.*	
Technical Assistance 1: Water resources assessment and management study ***Indicators:*** Identification of water resources on basis of use or catchment, public education campaign for protection and maintenance of watersheds, review of policies and recommendation s for enhancements,	
Technical Assistance 2: Roadmap for coastal zone management ***Indicators:*** Charting roadmap for systematic collection of data and information for CZM; proposed legislative and institutional framework changes; improved capacity for CZM; physical investment plan for CZM.	
Technical Assistance 3: Improving the use of data and GIS for climate change adaptation	

Grenada's SPCR	Regional SPCR
Indicators: Action plan for systematic improvement of government capacity for GIS use, and systems for climate change adaptation planning and vulnerability management systems.	
Technical Assistance 4: Preparation of the project for rehabilitation of Bathway Sandstone Reef ***Indicators:*** Information and designs for technically sound and sustainable coastal zone investments.	

Saint Lucia's SPCR	Regional SPCR
Component 1: Adaptation Facilitation Focuses on creating an adequate enabling environment for building climate resilience at all levels by strengthening the existing policy, legislative, institutional and fiscal framework. Activities will include- • Building on existing institutional capacities for research and systematic observation and for data and information acquisition, management, sharing and analysis. At community level, this includes- ○ key groups such as construction sector, will be addressed ○ Assessment and analysis of vulnerable groups Subcomponent/activities • Strengthen national level policy. Legislative and institutional framework for climate resilience and enhancing PPCR implementation ○ Review/development of national legislation and policies, strategic plans and development guidelines/codes to inform climate change considerations ○ Review of methodology for determining coastal setbacks and facilitation of the implementation of new netbacks into the development planning in the context of sea level rise ○ Formulation, adoption and implementation of fiscal incentives and regimes to encourage the adoption of climate adaptation/resilience measures. • Public education and outreach for climate resilience building • Research and systematic observation and data and information acquisition and knowledge management for climate change adaptation ○ Expansion and provision of institutional support for Geonode further to and building on outputs of Phase I and implementation of Disaster Risk Modeling Pilot ○ Conduct of advanced assessment, validation and enhancement of outputs of local SLR model developed under the SNC project to guide development policy, land use, risk assessment, adaptation and resilience building measures. ○ Enhancement of public health data management systems for monitoring vector and waterborne diseases which are expected to become more prevalent in climate change ○ Enhancement/upgrading of nation and community-based meteorological and hydrological monitoring network.	Collection of near shore bathymetric and topographic data under Component 1 of the SCPR will contribute to the information base for sub-component activities related to coastal planning and to research and systematic observation and data and information acquisition.

Saint Lucia's SPCR	Regional SPCR
○ Assessment and analysis of vulnerable groups to inform interventions for building climate resilience. • Human resource capacity building for climate resilience ○ Support of community based and sector level training for target groups.	
Component 2: Adaptation Implementation Focuses on implementation of tangible resilience building measures at the community and national level, includes- • Retrofitting of public and key community buildings for climate change resilience and for demonstration and replication of climate-appropriate design. • Assessment of existing coastal engineering structures and formulation of design guidelines/standards in the context of storm surge, coastal flooding and sea level rise; • Redesign and modification of critical infrastructure such as ports to adapt to storm surge, coastal flooding and sea-level rise • Piloting or supporting water conservation and interventions., such as communal rainwater harvesting and construction of macro-dams	Information gathered through bathymetry and near shore topographic surveys under Component 1 of the regional SPCR will help form a part of the inputs for this component.
Component 3: Adaptation Financing This will focus on the creation of a funding mechanism to assist *local* banks with building loan portfolios in climate change adaptation. • Creation of Climate Adaptation Loan Facility (CALF). • Transition to Climate Adaptation Trust (CAT) Fund.	

Jamaica's SPCR	Regional SPCR
Component 1: ***Intended Result:*** Improved climate data and information management • Improved climate data and information management • More accurate predictions and early warnings of extreme weather • Greater awareness of impacts of climate change and increased capacity to interpret climate change scenarios and translate them into the sectoral planning process	Data collected under component 1 of the Regional Track SPCR will contribute to the information base for this component. The Regional Track Phase 1 analysis of data collection and management systems will support improved climate data and information management under this component.
Component 2: Climate change adaptation in local, sectoral and national plans mainstreamed and integrated in climate change adaptation strategies in targeted river basins implement • Incorporation of climate change considerations into policy and development planning processes and development plans • Enhanced learning and knowledge sharing on integration of climate resilience into development, at the community, national and regional levels. • Improved climate resilient river basin planning and management in targeted river basins. • Increased capacity of farmers to practice climate sensitive farming • Increased stocks and Improved quality of groundwater in the Rio Minho hydrological basin.	Regional track initiative to coordinate on the update and application of the Caribbean Risk Management toll will help to inform the approach to this component's activities.
Component 3: Financing mechanisms for sustained adaptation initiatives by private sector and community based organizations institutionalized. • Sustainable mechanisms for financing of private sector and community based climate change adaptation initiatives developed.	

Dominica's SPCR	Regional SPCR
Component 1 – i. Inventory of surface and ground water resources, water balance assessment, continued monitoring of water resources, ***hydro-met and coastal monitoring stations*** (including US$800,000 for hydro-met and coastal monitoring equipment). ii. Development of ***Land Use Capability, Coastal Zone and Water Resource Management Plan*** and supporting legislation (as part of supporting mechanism for the National Physical Development Plan being developed with support from CDB). Component 3 – i. Community vulnerability mapping and adaptation planning for all Dominica (based on pilot process developed under SLM) which is integrated into National Physical Development Plan being developed with support from CDB. ii. Establishment of community early warning systems based on real-time hydro-met data.	Component 1 – i. Collection and generation of coastal topographic and bathymetric data, aerial imagery and DEM for select areas. ii. Data gap analysis to identify and prioritize other types of data acquisition. iii. Training in GIS and data management in participating PPCR pilot countries. iv. Integrated work with land use planners and coastal zone managers. v. Sharing of information and lessons learned with other PPCR and non-PPCR participating Caribbean countries. Component 2 – i. Support for regional connectivity and data interpretation and use for the existing hydro-meteorological networks region wide; ii. Consolidation of archiving and interpretation center and support for open connectivity to all countries and parties in the region; iii. Consolidation and expansion of regional archiving center and back up site outside the region iv. Consolidation of coastal topography and bathymetry data; v. Expansion of region's linkage and connectivity with GCOS, GLOSS and GOOS.

Dominica's SPCR	Regional SPCR
	Component 3 – i. Utilize climate data projections and tier 1 modeling outputs to generate framework for tier 2 (sectoral) modeling that would support improved adaptation planning and decision making and incorporation of climate change considerations into Agriculture, Water, Health, Forest/Ecosystems, Integrated Coastal Zone/Coastal Area Management and Land Use Planning. ii. Hazard maps showing projected sea level rise; hurricane intensity; precipitation: trends, distribution, high intensity events; and, Coastal (geomorphological) processes iii. Coastal Zone/Coastal Area Management Plans; Land Use Plans with corresponding policies and regulation; iv. Document and disseminate lessons learned; v. Capacity building: Training in ICZM and and use planning and management.
Component 1 - i. Food security program - design and construction of a pilot rain-fed organic greenhouse, and organic food processing/storage facility utilising renewable energy sources to determine technical and financial viability. ii. Food security program - pilot transplanting and restocking of climate resilient corals to determine technical and financial viability with a view to replication in other critical coral reef areas.	Component 4- i. Enable the assessment, design, up-scaling and replication of practical adaptation measures; ii. Develop appropriate incentive regimes to encourage the implementation of adaptation measures by the private sector; iii. Document and disseminate good practices and lessons learned; iv. Scale up proved adaptation measures through the design and implementation of financial and regulatory instruments, including

Dominica's SPCR	Regional SPCR
Component 2 – i. Legal establishment of the Climate Change Trust Fund and seed funding to support financing of priority climate change risks management measures at community level. ii. Establish micro-finance and micro-insurance for farmers, fisherfolk and vulnerable communities, in particular the Kalinago people and women (40% of funding to be reserved for women, 10% for Kalinago, and 10% for organic farmers). iii. Establishment of climate change adaptation standards (Private Sector). Component 3 – i. Community vulnerability mapping and adaptation planning for all Dominica (based on pilot process developed under SLM) which is integrated into National Physical Development Plan being developed with support from CDB. ii. Capacity Building/training program in Ministry of Public Works to climate proof the design and construction of critical infrastructure including roads + Climate proofing of critical infrastructure.	for rainwater harvesting, agriculture resilience practices. v. Assess and design of adaptation measures with preliminary feasibility analysis on, inter-alia, Dengue surveillance system, water aggregation/augmentation, coastal fishing. vi. Assessment of policy and legislative framework and determination of enhancements to enable climate change adaptation; vii. Documentation and dissemination of lessons learned; viii. Design and delivery of training modules on successful adaptation activities and approaches, including gender and vulnerable groups.

Annex 5: Governance Arrangements for the Implementation of the Regional Strategic Program for Climate Resilience