



Republic of Mauritius

# MAINSTREAMING CLIMATE CHANGE ADAPTATION IN THE AGRICULTURE, TOURISM AND FISHERIES SECTORS IN THE REPUBLIC OF MAURITIUS AND IN THE WATER SECTOR IN RODRIGUES

## Synthesis Report



DECEMBER 2012

Ministry of Agro Industry & Food Security  
Ministry of Environment & Sustainable Development  
Ministry of Fisheries  
Ministry of Tourism and Leisure  
Rodrigues Regional Assembly



## TABLE OF CONTENTS

<b>LIST OF FIGURES.....</b>	<b>iii</b>
<b>LIST OF TABLES .....</b>	<b>iv</b>
<b>ACRONYMS.....</b>	<b>v</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>vii</b>
<b>EXECUTIVE SUMMARY.....</b>	<b>viii</b>
<b>CHAPTER I: BACKGROUND.....</b>	<b>1</b>
1.1 Introduction .....	1
1.2 Study Area.....	2
1.3 Overall Objective and Methodology.....	3
<b>CHAPTER II: OBSERVED EFFECTS OF CLIMATE CHANGE IN THE REPUBLIC OF MAURITIUS .....</b>	<b>5</b>
2.1 General Observation.....	5
2.2 Sectoral Observation.....	8
<b>CHAPTER III: REVIEW AND ASSESSMENT OF EXISTING SECTORAL POLICIES, STRATEGY PLANS, AND LAWS RELATED TO CLIMATE CHANGE.....</b>	<b>14</b>
3.1 Agricultural Policy .....	14
3.2 Fisheries Policy .....	15
3.3 Tourism Policy.....	18
3.4 Water Sector .....	19
<b>CHAPTER IV: CLIMATE CHANGE RISKS, IMPACTS AND ADAPTATION .....</b>	<b>21</b>
4.1 Climate Change Risks and Impacts.....	21
4.2 Adaptation Strategies .....	29
<b>CHAPTER V: INSTITUTIONAL MAPPING AND NEEDS .....</b>	<b>32</b>
5.1 Agriculture Sector .....	32
5.2 Tourism Sector .....	35
5.3 Water sector .....	35
5.4 Summary of Institutional Analysis .....	37
<b>CHAPTER VI: CLIMATE CHANGE MAINSTREAMING/ADAPTATION FINANCING AND FUNDING .....</b>	<b>38</b>
6.1 Overview of Financial Instruments to address Climate Change .....	38
6.2 Other Funding .....	41
6.3 Risk Reduction and Preparedness Programme.....	42
6.4 Micro-Financing Arrangements .....	42
6.5 National Budgeting Process .....	43
<b>CHAPTER VII: CONCLUSIONS AND KEY RECOMMENDATIONS.....</b>	<b>44</b>
7.1 Conclusion.....	44
7.2 Recommendations .....	44
<b>APPENDIX I: ACTION PLANS.....</b>	<b>48</b>
<b>APPENDIX II: LOGICAL FRAMEWORK .....</b>	<b>67</b>
<b>REFERENCES.....</b>	<b>98</b>

## LIST OF FIGURES

<b>Figure 2.1:</b> Mean Annual Rainfall in Rodrigues	5
<b>Figure 2.2:</b> Mean Annual Rainfall in Mauritius (1905 - 2007)	6
<b>Figure 2.3:</b> Mean Monthly Temperature Variability from the Long Term Mean Maximum and Minimum Temperature at Plaine Corail 2010	8
<b>Figure 2.4:</b> Major River Basins	12
<b>Figure 2.5:</b> Flood Hazard Map of Rodrigues	12
<b>Figure 2.6:</b> Trend Of Water Availability Between February And October 2012	13
<b>Figure 4.1:</b> Sugarcane Cane Production Trend (1975-2010)	21
<b>Figure 4.2:</b> Production Trend of Tea (1980-2010)	22
<b>Figure 4.3:</b> Tobacco Production Trend (1975-2010)	23
<b>Figure 4.4:</b> Annual Fish Production (2002-2010)	24

## LIST OF TABLES

<b>Table 4.1:</b> Level of Vulnerability to Drought and Prolonged Drought Conditions	28
<b>Table 5.1:</b> Mauritius Agricultural Sector Institutional Mapping for Climate Change Adaptation	33
<b>Table 5.2:</b> Functional Roles of Mauritius Agricultural Sector Institutions	34
<b>Table 5.3:</b> Levels of Institutions and their Coordination Function	36
<b>Table 5.4:</b> Information and Management Functions	36
<b>Table 5.5:</b> Institutional Arrangement for Implementation of IWRM	36
<b>Table A1:</b> Action Plans	48
<b>Table A2:</b> Mauritius Agricultural Sector Summary Logical Framework, October 2012	67

## ACRONYMS

AAP	Africa Adaptation Programme
AFRC	Albion Fisheries Research Centre
AMB	Agricultural Marketing Board
AREU	Agricultural Research & Extension Unit
CBOs	Civil Society Organizations
CCA	Climate Change Adaptation
CCIC	Climate Change Information Centre
CE	Commission for Environment
CEIF	Clean Energy Investment Framework
CG	Capital Guardians
DRR	Disaster Risk Reduction
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
FGD	Focus Group Discussion
FITEC	Fisheries Training and Extension Centre
FSA	Farmers Service Agency
GDP	Gross Domestic Product
GEF	Global Environment Facility
IOTC	Indian Ocean Tuna Commission
IUU	Illegal Unreported Unregulated
IWRM	Integrated Water Resources Management
LDCF	Least Developed Countries Fund
MCIA	Mauritius Cane Industry Authority
MCS	Monitoring Control and Surveillance system
MDGs	Millennium Development Goals
MOI	The Mauritius Oceanography Institute
MoU	Memorandum of Understanding
MRC	Mauritius Research Council
MSA	Mauritius Sugar Authority
MSIRI	Mauritius Sugar Industry Research Institute
MTPA	Mauritian Tourism Promotion Authority
NAPAs	National Adaptation Programmes of Actions
NDU	National Development Unit
NGOs	Non-Governmental Organizations
ROM	Republic of Mauritius
RRA	Rodrigues Regional Assembly
RTC	Regional Training Centre
SADC	Southern African Development Community
SCCF	Special Climate Change Fund
SEMPA	South East Marine Protected Area
SIDPR	Sustainable Integrated Development Plan for Rodrigues
SIDS	Small Island Developing States

SPA	Strategic Priority on Adaptation
SPSS	Statistical Package for Social Science
SWIO	South West Indian Ocean
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
VMS	Vessel Monitoring Systems
WAC	Water Advisory Council

## ACKNOWLEDGEMENT

Capital Guardians (CG) would like to thank the Permanent Secretary and entire Ministry of Environment and Sustainable Development, Ministries of Agro-Industry and Food Security, Fisheries, Tourism and Leisure and the Commission of water staff members for their contribution and support throughout the study.

Special gratitude goes to the Climate Change Division of the Ministry of Environment and Sustainable Development who assisted us in many ways, including coordinating and making flight arrangements to Rodrigues, stakeholder workshops and meetings

We are indebted to all stakeholders for their active participation and providing excellent comments that shaped this report. Without their participation, the collection of the information presented in this report would not have been possible. Their commitment to implementation of the study was commendable.

To the enumerators and field supervisors your dedication, meticulous attention to detail and buoyancy throughout field work deserves special thanks and accolades.

Lastly we would wish to thank all those whom we have not mentioned but contributed in one way or another towards the successful implementation of the assignment. However, any omissions and commissions detected in the report are solely ours to bear.

## EXECUTIVE SUMMARY

### 1. Introduction and Rationale

Mauritius as a SIDS is vulnerable to the threat of climate change, revealing itself in many ways, including atmospheric temperature and sea level rise, change in rainfall patterns, cyclones, droughts, floods, livestock and crops as well as human diseases. The threats are significant, especially considering that: i) water supply by 2050 will not be sufficient to satisfy projected demand; ii) agricultural production is declining in real terms in the medium and longer term due to rainfall variability; iii) the ecosystem and natural habitat of fish and other marine species are gradually being degraded, with some coral reefs now extinct; and iv) that the natural assets, such as beaches, which are the pillars of the tourism industry are slowly disappearing.

These scenario described above calls for action directed specifically towards climatic change mainstreaming and adaptation in the best possible way, bearing in mind that the impacts would impede sustainable development in ROM. Current policies in agriculture, fisheries, tourism and water should be reviewed to determine their adequacy in the current climate variability and future climate change-related challenges. This necessitates a new policy approach which is cross-sectoral and integrated in nature, and built on existing sectoral frameworks. The integrated approach should also combine knowledge and skills across stakeholders to provide a new perspective on the best path to reach climate-resilient growth and development in the context of AAP.

This report recognizes that there are costs and benefits associated with adaptation to climate change. While investing in climate change adaptation, it is expected that numerous benefits across sectors will accrue in the form of avoiding potential future losses and, where possible, securing extra benefits such as job creation, food security, and clean environment.

The current agricultural, fisheries, tourism and water policy frameworks consist of several strategies. However, the overarching goal of this assignment was to integrate and mainstream climate change adaptation into core development policies, strategies and plans of the sectors. Given the level of details and data accessibility, a more in-depth analysis is recommended for the island of Mauritius, while specific considerations are made for Rodrigues. Specifically, this report contains: i) Agricultural, Fisheries, Tourism and Water sectors Climate Change Adaptation Policies with projected time frames of up to 20 years; ii) Climate Change Adaptation Strategy and Action Plan for each of the four sectors capturing a time frame of 10 years; iii) Climate Change Adaptation Investment Plan for the four sectors estimated for a time frame of 3 years; and iv) Selected Sectoral Project Concepts.

Using a sectoral approach to climate change mainstreaming and adaptation analysis, water, agriculture, fisheries and tourism sectors of the Mauritian economy are analysed in detail with an eye for gender and in-country regional disparities. The impacts of climate change are also analysed from a broader perspective, encompassing socio-economic indicators, policy strategies, action as well as investment plans. As important, Disaster Risk Reduction (DRR) programmes, training and capacity building, strengthening of institutions and institutional arrangements to support the successful implementation of the interventions have been proposed.



The main elements of the study are as presented in the chart below and key findings are introduced with an emphasis on the overall policy principles at first followed by a more detailed proposal for sectoral action and investment plan.

The objective of Mainstreaming climate change adaptation in the development process in the agriculture, tourism, fisheries sectors of the Republic of Mauritius and the water sector in particular for Rodrigues in the context of the Africa Adaptation Programme (AAP) was to assist ROM to develop a robust institutional framework for the mainstreaming of climate change adaptation into core development policies, strategies and plans.

## 2. Key Findings

### a. Agriculture Sector

**Production trends:** Mauritius is self-sufficient in vegetable and poultry products while the rest of the remaining agricultural products are imported. Severe droughts have been observed for example in the 1998/99 period and during the year 2009/10 period. These had resulted into reduced production in the agricultural sector.

There were indications that over the years, food production in Mauritius has been more or less stable at around 93,000 to 114,000 tonnes.

Agriculture occupied 46% of the land area in the year 2000 and the percentage has gradually decreased to 43% in 2006. The sector is dominated by sugarcane production (about 90% of cultivated land) with about 70% of the sugarcane sector (43 000 ha) under corporate management (30- units) and the remaining 23,000 ha owned by some 23,500 small farmers. Food crops, tea, tobacco, palm, fruit and flowers are produced on the remaining 10% of the cultivated land area and the production is dominated by some 12,000 small growers. Livestock is practiced by 6,000 producers at a relatively low level on mainland Mauritius.

About 25% of the total land area of the Republic of Mauritius is still under forest cover. This forest land is mostly devoted to silviculture along with deer ranching. Special efforts have been made to promote conservation and protection with the creation of National Parks and Nature Reserves.

**Change in Cropping Zones for Some Crops from Lowlands to Higher Altitude:** Climate change impacts have also caused changes in cropping zones and cropping calendar due to changes in climatic factors such as temperature and rainfalls which affected the different growth and development stages. This has caused either shortening or lengthening of crop cycles. However, rise in temperature has had beneficial effects on certain crops such as litchi and mango, which are now flowering and fruiting in cooler, higher altitude where formerly they did not produce ripe fruits.

**Warmer temperatures and milder winters favour higher incidence of pests and diseases:** These conditions either affect late season crops or long maturing crops resulting in reduced yields leading to food security. Desktop review, discussions with key informants and survey findings established that warmer temperature and mild winter effects are being felt in the country.

**Livestock Subsector:** The impact of climate change in this sector were mainly related to heat stress, low feed quality, shortage of water and cyclonic conditions as well as emergence of diseases. The temperature increase has led to lower fodder productivity in the lowlands (e.g. lower carrying capacity in deer ranching). This condition, i.e., increase in temperature, has also led to decreased feed intake leading to low productivity (e.g. low milk yield in cattle) and mortality due to heat stress in poultry.

**Research and Development:** Discussions with key informant in the agricultural sector and baseline results indicated that farmers were mostly growing crops and rearing livestock in general in disregard to the effect of climate change.

**Policy and Regulatory Mechanism:** On the basis of documentary analysis of various agricultural sector policy/strategies, laws, regulations and other legislative documents, it was established that the issues of climate change were not explicitly expressed in many of the existing documents. This is being addressed in the report by the Consultants on “The Formulation of Climate-Resilient Policy and Legislation and Capacity Building in the context of the AAP”.

## b. Fisheries Sector

- Fish production in the lagoon ecosystem is declining and thus there is need to promote aquaculture to meet the demand for fish.
- The rich habitat like mangroves which protect and stabilize the ecosystem was threatened with depletion due to cutting for firewood but now are a protected species.—. The Ministry started a mangrove propagation programme in 1995 and an area of more than 130,000 m<sup>2</sup> (13 hectares) of the coastal strip has thus been successfully planted with mangroves with a survival rate exceeding 80% in many areas. The total mangrove cover around the island has significantly increased and presently stands at some 25 hectares. Presently, a few NGOs are actively involved in mangrove propagation; as of to date 263, 050 propagules have been planted.
- Corals which are food and refuge for fish and other marine organisms particularly those that are not resilient are being bleached during the warmer seasons.
- There is evidence of pollution arising from runoffs from the urban settlements and coastal plantations.
- **Policy:** There is political will but the policy frameworks are still weak and there is need to look critically at the following policy documents;
  - Policy Framework on Ocean fisheries including the EEZ
  - Policy Framework on the Impact of climate change on fisheries management
  - Policy on Imports of raw materials as inputs to value addition in fisheries
  - Policy Framework on the overall management of fisheries in the ROM
- The EEZ is 2.3 million km<sup>2</sup> and requires a lot of resources to manage. The current allocation does not allow the Ministry of Fisheries to oversee Agalega, Rodrigues and St Brandon in terms of the FAO Code of conduct for Responsible Fishing and to combat IUUs.

### **c. Tourism Sector**

- National standards exist for the construction of new buildings (shorelines).
- Climate change risk assessment and adaptive capacity in the tourism industry is limited.
- System to measure and monitor carbon emissions in destination is not well established.
- Extent of coastline erosion is visible. However, effective erosion protection measures are in place (vulnerable areas) but with direct/indirect side effects.
- Low awareness among small and medium sized industry operators of the predicted impacts from climate change and their likely adverse effects on the tourism sector.
- Inadequate measures to reduce vulnerability of hotels, marinas and associated tourism infrastructure to wave, storm surge and flood impacts.
- Cost of financing shoreline management and protection as well as relative responsibility of government and property owners in sharing such costs is limited.
- Gaps exist in meteorological, hydrological and socio-economic data critical to assessing environmental and socio-economic impacts associated with climate change and tourism.

### **d. Water Sector**

The assessment shows that Rodrigues' water system is inadequate while demonstrating the following pertinent characteristics:

- Water is extremely scarce and rationed, sometimes for up to 45 days.
- There has been no comprehensive Water Resources Assessment, and there is no Water Master Plan for the island.
- Water resources development has been uncoordinated.
- Borehole yields have decreased partly due reduction in rainfall.
- Water utilities have under capacity performance, especially the existing desalination plants, boreholes – due to breakages, power outages, etc.
- There is no water allocation regulation in which treated water is also used for irrigation.
- Limited water efficiency practices.
- Funding in water is insufficient; no water revenue policy, no donors at the moment.
- Shortage of human resources in the Commission for Water.

## **3. Key Recommendations**

### **a. Agriculture Sector**

- Review various agricultural policies/strategies and legislative documents and integrate climate change issues in the existing/new planning and development policies, to address shortcomings/risks to guide and implement climate change adaptation issues in the agricultural sector. With increasing drought, decreasing rainfall, and increasing climate change pressure there is need to foster inter-linkages between different agricultural sub-sector policies, and the other main water utilising domestic and industrial sectors.

- Investigate the potential and costs for increasing use of higher level treated waste water in agricultural sectors in addition to sugar cane and lawns.
- Integrate climate change adaptation into national and sub-national agriculture and forestry sector policies and plans, land use and water policies, food security programmes, legal frameworks and investment priorities, and ensure appropriate representation of the sectors in climate change and disaster risk management policies and strategies.
- Strengthen institutional capacities and coordination for climate change adaptation, in sectoral line agencies, education, research, extension and communication for development services.
- Strengthen community- and locally-based mechanisms (e.g. forest-user groups, agricultural cooperatives, community networks and media) for management and delivery of services for agriculture and forestry and other nature reserves to facilitate locally appropriate adaptation measures, including community-based adaptation.
- Reinforce national capacities for plant, forest and animal health and food safety and improve monitoring and control of variations in pests, diseases and food safety, related to climate change. Strengthen food value chains and, in particular, improve small-scale producers' access to markets to increase resilience of food systems, including higher capacity for storage and transformation / processing. Strengthen research in vaccines against priority livestock diseases and inoculants for improving productivity.
- Institute a Research Unit for Forestry and Parks / Nature Reserves, to include long-term climate change issues in its research programmes. Promote Research & Development on planting of forest trees with high carbon sequestration ability to mitigate climate change and protection of water catchment areas and water shed management. Use tree species valuable for use as timber and furniture for value-addition.
- Promote water conserving crops and production technologies such as mulching, leguminous cover crops (which have potential for use as fodder also) intercropping, soil fertility conservation measures and drip and micro sprinkler irrigation methods, deficit irrigation and planting of water efficient crop cultivars, quick maturing crops, minimum tillage, hydroponics and fertigation. Use valuable crops such as maize, bananas, and some creepers on trellises in field borders which can be used as windbreaks to reduce dehydration due to mild winds.

#### **b. Fisheries Sector**

- Increase financial resourcing to climate change adaptation and mitigation in the fisheries sector.
- Strengthen the governance and integrate climate change adaptation into the decision making process:
  - Into existing management programmes
  - Into policies and strategies
  - By initiating vulnerability assessments
  - Rebuilding fish stocks
- Improve monitoring and assessment of marine ecosystems.
- Coral farming to address coral reef damage.

- Strengthen management of fisheries resources to improve adaptation and resilience to climate change.
- Involve communities in climate change adaptation while recognizing gender issues and develop alternative livelihoods.
- Develop a system for easy access to information for decision makers and other stakeholders.
- Strengthen collaboration among stakeholders.
- Promote marine based research on climate change and its impacts particularly research to support low impact aquaculture where herbivorous species are favoured as they have lower carbon foot prints than carnivorous species.
- Enhance mangrove protection and replanting due its role in carbon sequestration capacity.

### **c. Tourism Sector**

- Training and capacity building on climate change in the tourism sector.
- Climate change awareness.
- Management of beach erosion arising from storm surge/sea level rise in relation with other policies.
- Management of sand movement and accumulation arising from man-made barriers in relation with other policies.
- Tropical storms and extreme events damage control.
- Enhancement of water supply through rain water harvesting, recycling and desalination to adapt to limiting water resources resulting from reduced precipitation and increased evaporation.
- Carbon credit offsetting arising from emissions in relation with other policies such as Transport, Energy and Building Policies.

### **Water Sector**

- Water governance framework needs to be strengthened.
- There is need to increase awareness of the benefits of rain water harvesting, soil and water conservation and catchment management.
- There is an urgent need to mobilize financial resources, be innovative to tap in to climate change financial windows, and seek external assistance to rehabilitate the infrastructure and quick-start IWRM process.
- Gather, analyse and disseminate relevant data and information required for science-led decision making to ensure that there is integrated water management.

## Investment Plan

Based on the review of various documents and analysis of data and information concerning the effect of climate change risks and impacts in Mauritius, at least six projects were identified for purposes of mitigating the effects of climate change in the Island and the summary of Action Plans are presented below.

No	Project	Estimated investment cost	Period
<b>Agriculture Sector</b>			
1.	Training and capacity building on climate change in the agricultural sector	USD.1,710,000	3years
2.	Food Production and Security	USD.1,160,000	5 years
3.	Climate Change Awareness creation	USD.327,000	1 year
4.	Soil and Water Conservation	USD.359,000	1 year
5.	The Forest Development Plan	USD.930,000	3 years
6.	Research and Technology development	USD.1,190,000	3 years
<b>Fisheries Sector</b>			
7.	Program 1: Fisheries management	256 million (MUR)	10 years
8.	Programme 2: Institution strengthening	678 million (MUR)	7 years
9.	Programme 3:Infrastructure	240 million (MUR)	5 years
10.	Programm4: Aquaculture	64 milliom (MUR)	3 years
11.	Programme 5: Conservation of marine environment	78 Million (MUR)	10 years
<b>Tourism Sector</b>			
12.	Training and capacity building on climate change in the tourism sector	USD.215,000	3 years
13.	Climate Change Awareness	USD.60000	1 year
14.	Beach Erosion Management	USD.1,250,000	5 years
15.	Management of Sand Movement and Accumulation	USD.950,000	5 years
16.	Coral Reef Bleaching Reduction	USD.500,000	5 years
17.	Tropical Storms Damage Minimization	USD.900,000	5 years
18.	Water Supply Enhancement	USD.750,000	7 years
19.	Extreme Events Damage Control	USD.350,000	3 years
20.	Carbon Credit offsets (Enhanced by Product Development and Diversification)	USD.5,000,000	5 years
<b>Water Sector</b>			
21.	Project 1: Rehabilitation of Present Water Systems, Construction of a workshop to repair pumps, chlorinators, meters, etc, and Replacement of galvanized iron pipes by laying HDPE pipes underground	USD. 25.2 million	3 years
22.	Project 2: Policy review, legislative reforms and coordination of the water sector by the Regional Assembly, including new water governance structures and regulations.	USD. 33,00	3 years

<b>23.</b>	Project 3: Establishment of the Water Sector Reforms Secretariat and Steering Committee	USD. 1.58 million	5 years
<b>24.</b>	Project 4: Rainwater harvesting for domestic and supplemental agriculture.	USD. 450,000	5 years
<b>25.</b>	Programme 5: Water resources assessment including data acquisition; reducing the cost of water production; Database development, Research and Information and Meteorological Services.	USD. 330,000	5 years
<b>26.</b>	Project 6: Capacity Building	USD. 126,000 f	5 years
<b>27.</b>	Project 7: Water for Domestic and Food Production	USD. 148,000	5 years
<b>28.</b>	Project 8: Watershed and Coastal management.	USD. 580,000	7 years
<b>29.</b>	Project 9: Flood risk management, risk reduction and the role of insurance.	USD. 9,000	5 years
<b>30.</b>	Project management Cost including Monitoring and Evaluation	USD. 2.0 million	

## CHAPTER I: BACKGROUND

### 1.1 Introduction

At the 1992 United Nations Conference on Environment and Development (Earth Summit) held in Rio de Janeiro, Brazil, Governments adopted sustainable development as the new development paradigm to address environment and development issues in a holistic and integrated manner. The Earth Summit had three major outcomes:

1. The Rio Declaration on Environment and Development consisting of 27 principles to ensure sustainable development governance;
2. Agenda 21, the blueprint of action to guide future sustainable development around the world; and
3. Three global conventions on climate change, biodiversity and desertification.

The international community also formally recognized the specificities of Small Island Developing States (SIDS). This led to the 1994 Global Conference on the Sustainable Development of SIDS and resulted in the adoption of the Barbados Programme of Action for the Sustainable Development of SIDS (BPoA). The 2005 Mauritius International Meeting, which resulted in the Mauritius Strategy for Implementation, strengthened commitment of the international community to support sustainable development implementation in SIDS.

Twenty years after the Earth Summit, progress to successfully implement sustainable development worldwide is still short of expectations. Food security, the energy crisis, climate change and the financial and economic shocks are exacerbating progress in sustainable development implementation. In such a situation, SIDs are more vulnerable.

The institutional framework pertaining to sustainable development has to be reviewed and strengthened to address implementation gaps and emerging challenges. This will be done in the context of the two themes: “a green economy in the context of sustainable development and poverty eradication” and “the institutional framework for sustainable development”

The first action aimed at implementing the Convention was the drawing up of a Climate Change Action Plan in 1998 highlighted the high vulnerability of the country to climate change as a SIDS. The Action Plan noted the importance to reduce GHG emissions and increase the sink capacity.

Presently, there are ongoing initiatives for integrating climate change into the sectoral plans and strategies under the Africa Adaptation Programme (AAP), funded by the Government of Japan and implemented by the Ministry of Environment and Sustainable Development. This Ministry has a Climate Change Division to spearhead all activities associated with adaptation to climate change.

To combat and be prepared for circumscribing climate change and its impacts, the Government of the Republic of Mauritius (ROM) signed a project agreement with the United Nations Development Program (UNDP), for the implementation of the Africa



Adaptation Program (AAP) – “Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa - The Republic of Mauritius (ROM)”. The aim of the project is to develop a robust institutional framework for the mainstreaming of climate change adaptation into core development policies, strategies and plans of the ROM. The outputs of the project will be: (i) dynamic long-term planning mechanisms to manage the inherent uncertainties of climate change introduced; (ii) leadership capacities and institutional frameworks to manage climate change risks and opportunities in an integrated manner at the local, regional and national levels strengthened; (iii) climate-resilient policies and measures in priority sectors implemented; (iv) financing options to meet national adaptation costs expanded at local, national, sub-regional and regional levels; (v) knowledge on adjusting national development processes to fully incorporate climate change risks and opportunities generated and shared across all levels.

## 1.2 Study Area

The **Republic of Mauritius** consists of a main island, Mauritius, and a group of small islands scattered in the South West Indian Ocean namely: Rodrigues, the Cargados Carajos (St. Brandon), Agalega, Tromelin and the Chagos Archipelago (Diego Garcia). The total land area of the Republic of Mauritius is 2040 km<sup>2</sup>. The ROM is surrounded by coral reefs and is situated at about 2000 km of the East Coast of Africa. The ROM is a member of Small Islands Developing States (SIDS) and is conscious of the potential dangers related to climate change. The potential threats and risks from climate change, especially when combined with already existing environmental problems are a grave concern to ROM.

### 1.2.1. Mauritius Island

Mauritius, an Indian Ocean Island, is situated between latitudes 19°50' and 20°30' South, and between longitudes 57°18' and 57°46' East. It has a surface area of 1865 km<sup>2</sup>. The Island consists of an irregular Central Plateau surrounded by mountain ranges and plains. The Central Plateau has a mean elevation of about 300-400 m and rises to a maximum height of about 600 m in the South of the Island, the highest peak being 828 m. The Island is the result of four major volcanic activity periods between 7.8 M and **25 000 years ago**. In mid 2012 the country population was estimated at 1.3 million inhabitants.

### 1.2.2 Rodrigues

Rodrigues is the second largest island of the RoM and is located 19°44 South and 63°34 East some 650 km north-east of the main island Mauritius. It is much smaller than the main Island Mauritius with an area of 108 km<sup>2</sup> and has a population of around 40,400 people as per 2011 census. The Rodrigues Island has an extensive lagoon which is around twice the size of the island. The topography of the island is quite hilly. The capital town Port Mathurin is the only port. There are daily flight connections between Rodrigues and Mauritius. The main economic sectors in Rodrigues are agriculture, fisheries and tourism. The productivity of agriculture and the fish stock in the lagoon have considerably reduced during the past decades. The decline of the fisheries and agriculture sectors have given rise to an acute unemployment problem causing major migration flows to the main island Mauritius since the 1980s. Since 2002, Rodrigues has been granted with the status of an Autonomous Region enabling the island to manage locally a considerable array of affairs.

### 1.2.3 Agalega

Agalega is made up of two small islands: North and South Islands, found approximately **1000 km** north of Mauritius Island. The two islands are separated by a strip of shallow water about 1 km wide. At low tide, it is possible to walk from one island to the other. North Island lies between latitudes 10°20' and 10°25' south and longitudes 56°34' and 56°38' east. It has an elongated shape extending along a northwest-southeast axis and is approximately 1 km wide. The South Island also extends in a northwest-southeast axis, is pear-shaped and lies between latitudes 10°26' and 10°28' South and longitudes 56°39' and 56°42' East. It is about 2 km at its widest part.

## 1.3 Overall Objective and Methodology

### 1.3.1 Overall Objective of the Assignment

The overall objective of the assignment was to provide support to the ROM to mainstream climate change concerns in the development process of the agricultural, fisheries, and tourism sectors. This also applies to Rodrigues, especially to the water sector.

### 1.3.2 Methodology

The study started with a desktop review of existing agricultural, fisheries, tourism and water sector policies, strategies, plans, laws and financial instruments related to climate change. Consequently, several gaps related to climate change mainstreaming and adaptations were identified. The desktop review exercise was followed by consultative meetings and focus group discussions with key stakeholders including: Ministry of Environment and Sustainable Development, Agro Industry and Food Security, Fisheries, Tourism and Leisure and Rodrigues Regional Assembly. Other institutions consulted were: Irrigation Authority, Stats Mauritius (formerly Central Statistics Office), Forestry Service, Faculty of Agriculture of the University of Mauritius; Meteorological Services, Non-governmental organizations (NGOs), Albion Fisheries Research Center, Agricultural Research and Extension Unit (AREU), Mauritius Tourism Promotion Authority (MTPA), Mauritius Ports Authority, Outer Islands Development Corporation, Beach Authority and National Coast Guards.

**Interviews:** Several interviews with Senior Government Officials, key stakeholders and Development Partners were carried out as follows:

- Ministry of Environment and Sustainable Development
- Ministry of Fisheries and Albion Fisheries Research Center
- United Nations Development Programme (UNDP) Country Office
- Mauritius Meteorological Services
- Key Development Partners for fisheries, environment, infrastructure, Agriculture Industry and Commerce, Local Authority, Water Commission, Forestry Service etc.
- Non-governmental organizations (NGOs)
- Mauritius Oceanography Institute
- Mauritius Research Council
- Agricultural Research Extension Unit
- South East Marine Protected Area (SEMPA)
- Farmers, Fishermen and Tour Operators.

**Data Collection:** Data collection was conducted with the assistance of local enumerators. A broad analysis of climate change impacts on the different targeted sectors as well as the level of climate risks to each of the sectors in the short, medium and long-term were assessed.

Economic and social risk assessment for each sub sector including activities in vulnerable areas of the water, fisheries and agriculture subsectors, e.g. high slope areas, river banks, coastal zones were similarly undertaken. Special attention was given to gender mainstreaming, capacity needs assessment in terms of infrastructure, human resources, facilities available, technology being used and agricultural production and fish catch practices.

### **1.3.3 Data Analysis**

Data analysis tools used included **SPSS and Excel packages**. This analysis helped to identify data gaps, analyse scenarios and make necessary recommendations with respect to the targeted sectors. Comprehensive action plans with Log-frames were developed with respect to climate change adaptation and mitigation in the different sectors.

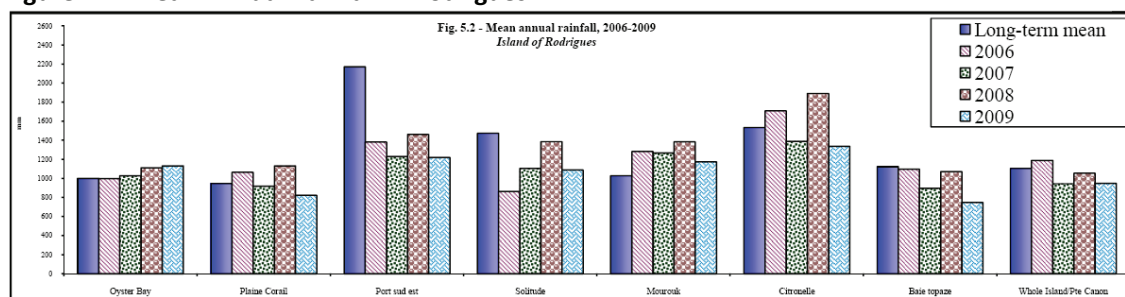
## CHAPTER II: OBSERVED EFFECTS OF CLIMATE CHANGE IN THE REPUBLIC OF MAURITIUS

### 2.1 General Observation

#### 2.1.1 Rainfall Variability

Secondary data analysed indicated that rainfall occurs throughout the year in the Republic of Mauritius. In terms of distribution patterns, September and October are the driest months with 20-30 mm/month on the south coast, 40-60 mm/month on the north coast and 50-80 mm/month inland. The rainy season starts in November and the wettest months are from January to April, with a maximum during February. From previous records for the period 1961-1990, it has been shown that summer rainfall accounts for about 63% to 73% of the total annual rainfall. Pointe Canon which has one of the oldest rainfall stations with a record from 1931 to present has shown that rainfall deficits ranging between 20% to 60% to the average have occurred over the 50 year period in a number of years. Minimum annual rainfall for the period of record ranges between 433 mm at Pointe Canon in Rodrigues and 304 mm at Medine in Mauritius. The annual maxima observed occurred at Vacoas (Mauritius) during the years 1979/80, 1986/87. Figure 2.1 below shows mean annual rainfall at Port Sud Est and Solitude in Rodrigues.

**Figure 2.1: Mean Annual Rainfall in Rodrigues**



Note: 'Long-term mean' refers to: 1971-2000 for Oyster Bay, Plaine Corail, Port Sud Est, Solitude and Pt Canon (mean for the Island); 1961-2000 for Mourook and St Gabriel; 1961-2000 for Citronelle and Baie Repaze; 1993-2000 for Baie Repaze.

**Source: Beedassy, Shakil**

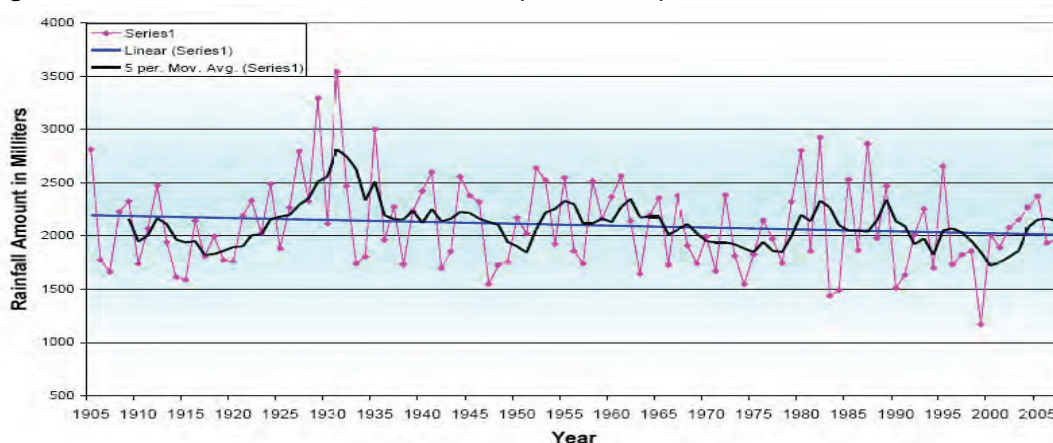
Winter rainfall, caused by the orographic ascent of the south-east trade winds, is mostly confined to the East, South and Central Plateau with the leeward side of the island remaining dry. Cold fronts passing over Mauritius from time to time bring appreciable amounts of rainfall. The long term decreasing trend in mean annual rainfall of around 8% has been recorded in Mauritius since the 1950s. There is also a decrease in annual rainfall over the outer islands, but more significant on the mainland. Lengthening of the intermediate dry season and shift in the onset of summer rains demonstrates a shift in seasons. Increasing number of consecutive dry days and decreasing number of rainy days have also been recorded.

Data was inadequate to detect any changes occurring on the frequency and magnitude of rainfall. However, according to the GCM Projections of future climate, the range of projections in mean annual rainfall from different models is large and both negative and positive changes range between -20% and +24%, with ensemble median changes close to zero. Seasonally, the projections show a more coherent picture, with the projections for

July, August and September (JAS) rainfall tending towards decreases. Changes in JAS range between -27 and +15% by the 2090s with ensemble median values -6 to -10%. Projected changes tend towards increases over the northern islands and decreases over the southern islands in all seasons. The projections of change in the proportion of rainfall that falls in heavy events range between both increases and decreases. Seasonal projections are more coherent in JAS indicating decreases, with changes ranging between -13% and +5%. The models are broadly consistent in indicating overall increases in 1- and 5-day rainfall maxima by the 2090s. The models indicate decreases in these values, however, in JAS. Figure 2.2 depicts the trend of mean annual rainfall in Mauritius. However, increasing erosion from agricultural lands are expected with increase in rainfall intensities and reduced groundwater recharge as a result of more frequent bouts of high intensity rainfall.

In the example mentioned, long-term time series of rainfall amount over the past century (1905 to 2007) over Mauritius show a decreasing trend in annual rainfall. In fact the average rate of decrease per decade is around 57 mm. The total decrease during the last ten years is about 8% when compared to the 1950s. Annual rainfall over the other islands indicate significant variation from year to year but long-term analysis do show decreasing rainfall trend, though lesser than the main island Mauritius. The large inter-annual and inter-decadal variations in rainfall mean that it is difficult to identify long term trends. Whilst there is no evident trend in annual rainfall, October, November and December (OND) rainfall has declined over the period 1960 to 2006, at an average rate of 7.7 mm per month (8.7%) per decade (Figure 2.2 below)

**Figure 2.2: Mean Annual Rainfall in Mauritius (1905 - 2007)**



Source: Meteorological Services, March 2009

**Rainfall distribution patterns in Rodrigues:** There are insufficient daily rainfall observations available for Rodrigues to identify trends in daily rainfall extremes. It is possible to relate climate change impacts to livelihoods, because of the length of the growing period as an indicator of agricultural sensitivity to climate, thereby integrating changes in both rainfall and temperature.

General awareness on the impact of climate changes and its impacts on agriculture are evident. The direct impacts include: Number of seasons per year – where there used to be regular, predictable seasons, presently there are none; the bimodal rainfall pattern (long

rains during March/April and short rains during October/November) has ceased. The rainfall patterns have become unpredictable thus affecting agricultural productivity. Small scale irrigation has increased in recent times but mostly employing bucket and drip irrigation. Maize production as staple crop has declined drastically among other key crops such as cassava, sweet potato, Irish potato and French beans due to drought and dependence on rain fed agriculture.

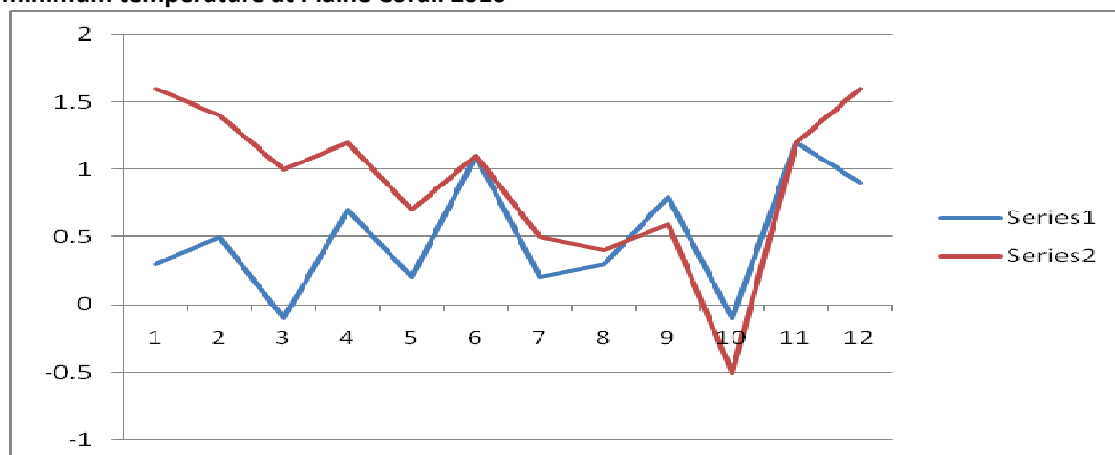
### 2.1.2 Temperatures and Evaporation

Increasing temperatures and their effects on ecological systems are already noticeable. Analyses of mean monthly maximum temperature and mean monthly minimum trends recorded in Pointe Canon in Rodrigues range from 0.1 to 1.3<sup>0</sup>C and 0.9 and 1.9<sup>0</sup>C compared to St Brandon and Agalega that show a definite warming of 0.74 to 1.2<sup>0</sup>C when compared to the 1961-1990 long term mean.

The trend shows an increase in mean annual temperature of 0.5 – 3.8<sup>0</sup>C by 2100. Additionally, there is increase in the annual number of hot days demonstrated by maximum temperatures and warm nights as shown by the minimum temperatures. Slightly greater increase in mean minimum temperatures than mean maximum temperatures at Plaine Corail and Pointe Canon representing the island's conditions for the period 1950 to 2005.

Shift in the climatic zones on the islands could not be detected from the present data. Analyses of Mean Monthly Maximum temperature and Mean Monthly Minimum temperature trends recorded in Ponte Canon in Rodrigues range from 0.1 to 1.3<sup>0</sup>C and 0.9 and 1.9<sup>0</sup>C showing a definite warming 1961-1990 long term mean. The mean annual temperature is projected to increase by 1.0 to 2.0<sup>0</sup>C by the 2030s, and 1.1 to 3.4<sup>0</sup>C by the 2050s. Annually, projections indicate that 'hot' days will occur on 29-48% of days by the 2030s, and 33-71% of days by the 2050s. Days considered 'hot' by current climate standards for their season are projected to occur on up 100% of days in JFM and JAS by the 2050s. Additionally, there is increase in the annual number of hot days demonstrated by maximum temperatures and warm nights as shown by the minimum temperatures (Figure 2.3). Slightly greater increase in mean minimum temperatures than mean maximum temperatures at Plaine Corail and Pointe Canon representing the island's conditions for the period 1950 to 2005. The extended dry periods (from a shift in the onset of summer rains) may affect water availability. Dry spells could spark heavy water loss through evapotranspiration, increased water demand for irrigation and create incentives for effective irrigation system.

**Figure 2.3: Mean Monthly Temperature Variability from the long term mean maximum and minimum temperature at Plaine Corail 2010**



## 2.2 Sectoral Observation

At the initial stage of the assignment, a reconnaissance survey was carried out and a number of important climate change impacts were observed in the various sectors of study. These included impacts attributed to extremes of temperatures, fluctuating and dwindling rainfall volumes, sea level rise and natural disasters. The following were the sectoral climate change impacts observed.

### 2.2.1 Agriculture Sector

Field observations and secondary data analysed showed that a lengthening of the intermediate dry season, the transition period between winter and summer were evident in the Mauritian agricultural sub-sector.

Additionally there has been a shift in the start of the summer rains. This shift in the onset of the rains is highly significant as it translates into much pressure on the water sector to meet increasing demands of the agricultural, tourism, industrial and domestic sectors. These observations corroborate the results from the primary data analysed relating to rainfall and temperature trends as established by respondents in the agricultural sub-sectors studied. Furthermore the number of consecutive dry days is increasing while the number of rainy days is decreasing. Other observed climate change impacts particularly on Rodrigues include Number of seasons per year – where there used to be regular, predictable seasons, presently there are none; The Island used to have a bimodal rainfall pattern i.e. March/April for Long rains and October/November short rains, but currently this is not the case; In the past e.g. over 2 decades ago, there used to be several rivers traversing the Island, today most of the rivers are intermittent or have completely dried up; Small scale irrigation has increased in recent times but mostly employing bucket and drip irrigation; Additionally, receding and inadequate pasture for grazing have also contributed to declining livestock production in the sector. The severe drought of the 1972-79 had a devastating effect on cattle and other small ruminants.

**Climate Change and Agriculture:** Climate is the most significant factor in determining plant growth and productivity e.g. Temperature, Precipitation, Solar radiation, Climate extremes, Nutrient supply and CO<sub>2</sub> concentration. However, as a result of climate change effects, rise in temperature has resulted in an extension of the cropping zone for certain crop and fruit species. For example, litchi and mangoes can now be produced on higher altitudes.

Climate change on Cropping Calendars: Seasonal variations due to climate change impacts on cropping calendars, flowering and productivity of some vegetables and fruits have been observed. Climate change affects the cropping calendar when temperatures become too hot which makes the conventional crops mature earlier. In conditions of drought the cropping calendar is shortened due to earlier crop maturity. Yields also reduce because of the stunted growth. In terms of crop flowering, drought or higher temperatures cause high flower-drop thereby reducing flowering intensity and uniformity leading to reduced yields. Pollination is also affected due to the fact that insect pollinators need favourable weather conditions.

### **2. 2.2 Fisheries sector**

Sectoral impacts attributed to climate change in the Fisheries sub-sector were mostly associated with environmental degradation as a consequence of climate change. The following were some of the important impacts noted during the initial reconnaissance survey and the secondary data analysis:



**Decline in Fish production:** There has been a gradual decline in fish production especially artisanal lagoon fishery in both main island Mauritius and Rodrigues

**Weather Fluctuation:** It has been observed that winters have become cooler while summers have become hotter than before especially the last 10 years. There is also evidence of fluctuation in both surface water and air temperature with some areas becoming much hotter than before.

**Sea level fluctuation:** Of late the sea level fluctuation has been noted, especially, during spring tide which never used to flood the beaches. Currently they are high, sometimes covering the bridges on the shoreline especially in Rodrigues.

**Sand Harvesting:** This activity is banned in mainland Mauritius but ongoing in Rodrigues. It was observed that sand extraction activities are still being done at Banc Catherine and Pointe L'Herbe on the South Western part of the Island. Although sand extraction conditions have been laid down some harvesters still violate them thus interfering with the ecosystem.

**Beach Erosion:** The beaches of the islands are generally classified as highly vulnerable to erosion (Cazes-Duvat, 2003). A study of shoreline levels, profiles, hydrodynamics, and geomorphology of the shore lines, lagoon survey and aerial photos suggest serious loss of several hundred square meters of patch reef. A detailed study shows the existence of debris, and submerged roots of trees the evidence of beach erosion.

**Wetland Infilling:** Aerial surveys indicate considerable wetland destruction.

**Coral Bleaching and Destruction:** Corals are under constant threat due to several impacts from, land based pollution, harmful fishing practices, and climate change. Coral bleaching has been occurring in Mauritius due to high sea surface temperatures and has caused mortality. In an area where coral bleaching has taken place recently, the corals are covered by filamentous algae and they may die if the bleaching phenomenon lasts for a longer period.

Corals are a very important component of the ecosystem and their destruction is very detrimental to the stability of the lagoons.

**Mangroves:** Mangrove ecosystem which earlier on had been adversely affected by overharvesting for firewood is a protected species under the law. The mangrove cover has greatly improved through the efforts of the Government and NGOs which have embarked on replanting of this useful plant.

### 2.2.3 Tourism Sector

Climate change has aggravated the problem of coastal erosion and loss of beach area and requires higher costs to protect and maintain coastal tourism infrastructure. Discussions

with stakeholders indicated that Mauritius tourism industry is predominantly beach based. However, the beaches are continuously affected by sand movements and accumulation therefore exposing them to environmental degradation exacerbating climate change impacts.

Flooding damage to historic architectural and cultural assets, damage to tourism infrastructure, altered seasonality are considered as consequences of climate change impacts.

Altered seasonality causes heat stress for tourists, cooling costs, changes in plant-wildlife-insect populations and distribution and infectious diseases.

#### 2.2.4 Water sector

This sector was specifically a major concern for the Island of Rodrigues and partially for Mauritius Main Island. Several important climate change impacts were observed and these include the following:

**River flows:** The river flows ranged from 1.4 l/s in River Grenade to 56.9 l/s in River Baie aux Huitres (Figure 1.21). The sum total of the flows in the 22 basins amounted to about 370 l/s. equivalent to about 32,000 m<sup>3</sup>/day. Marelus (1971) estimated that the total river flows do not fall below 100 l/s during the driest months, which is equivalent to 8,640 m<sup>3</sup>/day. The Commission for Agriculture has measured low flows of the order of 7,230 m<sup>3</sup>/day. More recently, a current metering exercise carried out between 21<sup>st</sup> October and 20<sup>th</sup> November 1998 estimated that the total water abstraction from the rivers and sources was about 3,750 m<sup>3</sup>/d during the dry weather of 1998. Besides Mourouk, the total yield from the rivers may have amounted to 1,500-2,500 m<sup>3</sup>/d during the periods of good weather. However the flow drops to near zero during dry weather or long periods of drought.

Rain measured on the basin upstream of the station on River Pistache for the period considered was 1540 mm while the flow at the station for the same period amounted to 896 mm, which gives a runoff coefficient of 58% at Pistache station and may have been up to 60 % due to draw offs upstream in the river. This order of magnitude for runoff coefficient is not exceptionally high. Anecdote information indicates that over two decades ago, there used to be several rivers traversing the Island, today most of the rivers are intermittent or have completely dried up (Focus Group Discussion).



Groundwater production capacity is about 2,800 m<sup>3</sup>/d and that of surface water is 1,500 m<sup>3</sup>/d during the drought period. Thus, if there are few episodes which recharge the aquifer, there are also few occasions when the rivers in Rodrigues are likely to run full.

**Trend of water availability between February and October:** Recent trend of water availability (m<sup>3</sup>) between February and at the close of this assignment is worrisome as indicated in Figure 2.6 below. The performance of desalination plants has been erratic ranging from 115 m<sup>3</sup> to 50 m<sup>3</sup> between July and September 2012.

**Figure 2.6: Trend of Water Availability between February and October 2012**

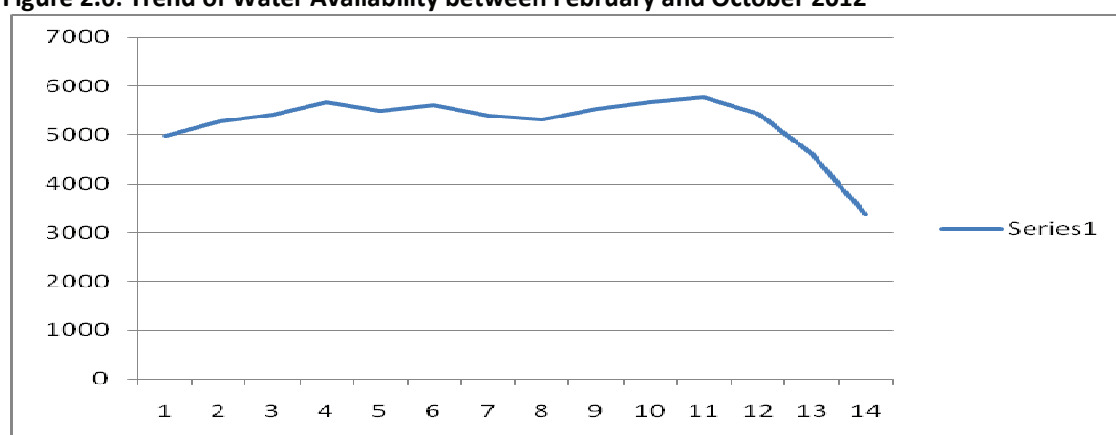


Figure 2.6 represents the daily production rates within the period of February to October 2012. The production figures have dipped to a record low in many decades.

## CHAPTER III: REVIEW AND ASSESSMENT OF EXISTING SECTORAL POLICIES, STRATEGY PLANS, AND LAWS RELATED TO CLIMATE CHANGE

### 3.1 Agricultural Policy

- Review various agricultural policies/strategies and legislative documents and integrate climate change issues in the existing/new planning and development policies, to address shortcomings/risks to guide and implement climate change adaptation issues in the agricultural sector. With increasing occurrence of drought, decreasing and irregular rainfall patterns, there is need to foster inter-linkage between different agricultural sub-sector policies
- Integrate climate change adaptation into national and sub-national agriculture and forestry sector policies and plans, as well as land use and water policies, food security programmes, legal frameworks and investment priorities, and ensure appropriate representation of the agricultural sub-sectors in climate change and disaster risk management policies and strategies.
- Strengthen institutional capacities and coordination needed for climate change adaptation, in particular in and among agricultural sub-sectors including, education, research, extension and communication for development services.
- Strengthen community- and locally-based mechanisms (e.g. forest-user groups, agricultural and commodity based cooperatives, community networks and media) for management and delivery of services for agriculture and forestry to facilitate locally appropriate adaptation measures, including community-based adaptation.
- Reinforce national and regional capacities for plant, forest and animal health and food safety and improve monitoring and control of pests, diseases in relation to climate change. Strengthen food value chains including postharvest handling, transformation, processing and storage capacity to increase resilience of small-scale producers and improve access to market.
- **Policies, legislation and Institutional Frameworks:** Based on the reviews of various agricultural policy/strategy and legislative documents, it was established that the issues of climate change are either excluded or not explicitly expressed in most of the existing documents.
- The impacts of climate change are likely to be considerable on water resources for agriculture use. Without supplemental irrigation, the overall crop yields may decrease by 10 to 20% by 2050 because of warming and drying, and the yield losses may be much more severe in the drier parts of the island where there is already local water stress thus requiring a further expansion of existing irrigation network.

### 3.2 Fisheries Policy

*Policy statement:* The current institutional framework for the fishery sub-sectors requires reorganizing, because without the right institutional set-up, fisheries development and management efforts are likely to achieve only partial success or fail. This policy seeks to ensure efficiency in the development and management of fisheries in the Republic of Mauritius through the establishment of an institutional framework to play the coordination role. In addition, the policy seeks to create a sustainable funding mechanism for the fisheries sector.

*Policy statement for Sustainable utilization of fishery resources:* Pressure on fish stocks on the lagoon, off-lagoons and the shores of the Indian Ocean islands has contributed to a decline in fish production. Some of the factors responsible for this are excessive fishing effort, competing demand for fish, destructive fishing technologies, environmental degradation and climate change. The distant water fishing fleet is also fishing heavily in the EEZ. Indicative data from the Indian Ocean Tuna Commission (IOTC) show that the fleets may be exploiting several tuna species at their maximum sustainable levels. If this trend continues it may lead to the collapse of these fisheries leading to economic loss, food insecurity and loss in biodiversity, which would be difficult to reverse.

To ensure sustainable exploitation of the country's fisheries resources, this policy seeks to address the three pillars:

- Economic empowerment,
- Environmental integrity, and
- Social concerns.

*Policy intervention for Encouraging sustainable exploitation of under-utilized fisheries:* The Ministry of fisheries, in liaison with other sector Ministries, shall improve infrastructure, by encouraging investment in sea food hub or fish preservation facilities, promoting micro finance schemes, in order to encourage utilization of under-utilized fisheries. The Ministry of Fisheries, in collaboration with relevant players shall organize market linkages for fishers and traders.

*Policy strategy for Participation in environmental conservation to ensure sustainability:* The most pressing environmental and conservation issues in the fisheries sector include pollution, sea level rise, siltation, unsustainable use of the catchment areas, high nutrient loading, habitat and biodiversity loss, unsustainable utilization of the fisheries resources. The responsibility of preventing, controlling, and managing such activities, lies with stakeholders and other arms of the Government. Without better, integrated environmental management and conservation programmes, and appropriate response to climate change impact mitigation, depletion of fish stocks and loss of valuable biodiversity will continue. Active participation in integrated environmental conservation shall be achieved by:

*Policy intervention for **Promoting integrated environmental management:*** The Ministry of Fisheries shall ensure that fishing communities are involved in all stages of environmental planning, climate change issues and management and that indigenous knowledge is utilized where appropriate. Environmental principles, including ‘polluter pays approach’, and issues of bio-safety and biotechnology shall be embraced in all aspects of environmental management and fisheries development.

*Policy intervention for **Discouraging fishing or related land activities that have negative impact on biodiversity in the catchment area:***

The Ministry of Fisheries shall encourage community participation in resource management to ensure that fishing activities do not have adverse impact on the ecosystem. In addition the Ministry shall take measures to identify, conserve and where appropriate protect unique or rare indigenous fish species of the country

*Policy intervention for **Protecting and rehabilitating fragile aquatic ecosystems including wetlands, which act as fish breeding grounds and buffer zones:*** The Ministry of Fisheries shall ensure that fragile fishery ecosystems are identified and surveyed, and an inventory of their biodiversity and economic value undertaken. The Ministry of Fisheries in liaison with relevant stakeholders shall promote good practices of watershed and wetland management. The Ministry in collaboration with relevant authorities, including local communities, shall facilitate integrated approaches to mitigate adverse environmental and climate change impacts in the catchments and coastal areas.

*Policy intervention for **Mainstreaming of Gender Equity:*** Under the coordination and guidance of the Ministry of Fisheries and gender experts, participants in the fisheries sector shall be encouraged to address issues of gender equity in the fisheries activities, and the Ministry shall be required to include gender equity in fisheries management and plans.

*Policy intervention for **adopting a co-management approach to the management of fishery resources:*** The Ministry of Fisheries shall ensure that a participatory approach is mainstreamed in fisheries management. The Division shall build the capacity of stakeholders for their effective participation in the development and implementation of fishery-specific management plans.

*Policy intervention for the **Development of an efficient Monitoring Control and Surveillance system;*** The MOF shall establish comprehensive MCS systems for the marine fisheries. In particular, the Ministry of Fisheries shall require that all foreign fishing vessels operating in the country’s EEZ install tracking devices such as Vessel Monitoring Systems (VMS). To ensure that fishing vessels are fishing legally and responsibly, aerial surveillance units will be established. The Department, moreover, together with other relevant stakeholders including the Coast Guards, shall collaborate and jointly manage the developed MCS system.

*Policy statement for the **Promotion of Aquaculture Development:*** Fish production from capture fisheries within lagoons including the marine inshore banks is on the decline. Therefore, there is an urgent need to increase aquaculture production. Aquaculture is an important subsector that can increasingly contribute to food security, reduce poverty, create employment and reduce pressure on the capture fisheries. Moreover, it is easily integrated into small holder farming systems. Currently, aquaculture is practiced more on a subsistence basis rather than as a commercial activity.

*Policy intervention; **Implementation of the developed Master Plan for aquaculture:*** The MOF in consultation with relevant stakeholders and experts has developed a holistic Master Plan for aquaculture. This should be implemented in earnest.

*Policy intervention for the **Provision of an enabling environment for development of fisheries infrastructure:*** The Ministry of Fisheries, in liaison with relevant stakeholders, shall facilitate formation of a fisheries infrastructure-working group, to provide linkages with the relevant national sector-working groups. The Ministry responsible for fisheries shall develop guidelines and provide incentives for investment in critical areas such as cold chain infrastructure.

*Policy intervention for the **Enhancement of training of fisheries personnel:*** The Ministry of Fisheries, and other key players in the sector, shall establish formal collaboration with local and international training institutions, aimed at enhancing training opportunities for fisheries personnel. Such collaboration should include periodic reviews and development of fisheries training curricula particularly to include climate change science. The sector's training needs shall be reviewed regularly and adequate arrangements put in place for meeting those needs.

*Policy statement for the **Promotion and Coordination of Fisheries Research:*** Research is fundamental to fisheries management and development. There should be adequate research directed at post-harvest preservation, processing, marketing and economic analysis. With the close collaboration of the AFRC and Mauritius Research Council, an opportunity exists to integrate and enhance fisheries research within the fisheries sector.

*Policy statement on **Resources to implement the Research Agenda***

Resources to implement the agenda shall be made available to AFRC and other research institutions with the requirement that they report research findings in a timely and user friendly manner. AFRC and the other research institutions shall apply a participatory approach to fisheries research and observe professional standards and ethics, including impartiality, in carrying this critical task.

***Policy intervention for resources required for research:*** The Ministry for fisheries shall establish a sustainable financing mechanism for fisheries research particularly to benefit from subvention from the fisheries agreements with DWF.



**The Ministry of Fisheries shall create a data bank for all fisheries research:** A database on fisheries related research, accessible to all stakeholders, shall be established and maintained by AFRC or as directed by the Ministry. Fish traders, including domestic exporting firms, aquaculture producers and other relevant players, shall be required to provide data on trading quantities, prices and destinations, among other parameters, for this database. The data base shall also include climate change information relevant to fisheries

**Establishment of a formal mechanism of sharing and disseminating information within the sector:** Communication channels to provide routine information/education to investors, fishers and fish farmers, and other relevant stakeholders shall be put in place, under the overall guidance of Ministry of Fisheries. The communication mechanism shall be broad enough to include both public and private sector channels. There shall be a clear linkage between research, management, private sector, fishers, and aquaculturists in terms of data collection and synthesis, dissemination and feedback mechanisms. The establishment of a fisheries database to hold information on fish stocks, fish production, marketing, and credit and investment opportunities shall be a priority. The Ministry of Fisheries shall enhance capacity building in data collection, processing, storage and dissemination among other critical areas.

### 3.3 Tourism Policy

Planning Policy Guidance has been developed for various aspects of development design. It includes design guidance for a range of key land uses, including: hotel, ecotourism, golf and marina developments. Design factors include building height, plot coverage and minimum room size and promoters are urged to minimize the harmful visual effects by combining judicious land use principles with environment friendly development. Provision is also made in order to observe the appropriate setback distances from the high watermark for beach protection and sustainable management.

**Energy supply to the tourism sector:** The sector depends on several energy sources for energy supply to tourism sector but has yet to meet the demand.

**Management of tourism activities:** Tourism activities have contributed to the degradation of coral reefs through sea-based activities. Concrete measures are being taken to reduce detrimental impacts on coral reefs and marine ecosystems such as the installation of buoys at dive sites, installation of mooring buoys, imposition of speed limit boats and mandatory use of eco-friendly engines for pleasure crafts and sensitization of stakeholders on the preservation of the marine ecosystems.

**Hotel development and planning:** The low-density and low-rise hotel development policy is maintained and negative visual impacts continue to be avoided. Architectural designs continue to reflect distinctive Mauritian characteristics. Strict enforcement of EIA licence and planning guidelines continue to be undertaken.

**Protection of the coastal zone:** Protection of the coastal resources that make Mauritius appealing needs to remain a high priority area within Government policy development and planning.

**Capacity building:** There is need to continue establishing Environment Management Systems, audits and verification in hotels. Government should continually ensure that Industry operators are trained on green certification, environmental sustainability and eco-labeling schemes.

**Reduction of carbon footprint:** The Government should continue encouraging carbon-offset programmes for carbon emissions, for instance, through investments in forest restoration, while at the same time investigate and implement low carbon processes.

### 3.4 Water Sector

Sustainable Integrated Development Plan for Rodrigues and its application to Water Sector  
Sustainable Integrated Development Plan for Rodrigues (SIDPR) is the RRA's proposal for planning an integrated development. Regarding the water sector presented in chapter 8, the overall goal is to enhance and promote all efforts towards the efficient, equitable, and optimum mobilisation and utilisation of water resources of Rodrigues for significant socio-economic development on a sustainable basis. The policy objectives may be summarized as follows:

- Development of water resources for economic and social benefits of the people on equitable and sustainable basis;
- Allocation and apportionment of water resources based on comprehensive and integrated basin plans and optimum inter-basins allocation principles that incorporate sustainability of the resource and realistic cost recovery through progressive tariff taking into account equity of access, and willingness to pay, efficiency in water production, distribution and use, property water quality treatment, treatment of waste water and re-use of treated wastewater;
- Management and mitigation of drought effects, monitoring and protection of aquatic ecosystems and efficient allocation, redistribution, transfer, storage and use of water resources;
- Climate change adaptation leading to resilience to climate variability and shocks; and
- Conservation, protection and enhancement of water resources and their key role in ecosystem functions on sustainable basis.

Even though there is a strong political will to solve the water issue, there is a lack of policies to govern the water sector per se, lack of technical capacity (engineers, trained technicians and planners) but a strong imperative to set up a tariff system for financial reasons and to further sensitize the population on the importance of saving water. The Millennium

Development Goal (MDG) target 7 emphasizes the need for sustainable access to safe water adequate sanitation and safeguarding of the environment. Countries of the world subscribed to this and therefore remain a very important target for global action.

Without reforms in the water sector, socio-economic development of Rodrigues will be hampered by water scarcity and maladministration. The goals of Sustainable Integrated Development Plan for Rodrigues (SIDPR) and MDGs will not be achievable.

#### Rainwater Harvesting Policy

The Rodriguan population has already some experience of rainwater harvesting. The rain water harvesting system was encouraged and funded in 1992 and the government through the Village Committees helped in building concrete tanks to which rain water from their roofs is channelled. This policy of rain water harvesting has to be furthered as it contributes to increase water availability. Rainwater harvesting complements smallholder irrigation and it is known that it generates net profits of USD. 150 to 600 in Burkina Faso and USD. 110 – 500 in Kenya (Ngigi, 2009). It may be used for supplementing rain fed agriculture by increasing soil moisture or creating runoff storage. The policy of the Commission of Public Infrastructure and Housing is to encourage rain water harvesting system which previously had proved to be efficient to households' uses.

The rainwater harvesting structure regulations have been drafted under the Building Act and restricted to buildings such as commercial and public buildings. Most houses that the communities live in have inclined roofs but yet very few have gutters for collecting rain water. Some awareness does exist about the importance of rain water but there is a lack of capacity and incentives to install related equipment. With a mean annual rainfall of 1000 mm it is possible for most low/middle income houses to be fully sufficient in water through rainwater harvesting. A middle income household with a roof area of 75m<sup>2</sup> can collect 75,000 litres of water yearly. For a 3 person household, this represents 70 litres of water per day. Table 1.30 is an assessment of some of the key issues of the rain water harvesting in Rodrigues compiled from group discussion.

#### **Rodrigues Regional Assembly (Water) Regulations 2010**

The Water Regulations were formulated and passed by the Rodrigues Regional Assembly under sections 26(1), 26(2) (b) and Section 31 of the Rodrigues Regional Assembly (RRA) Act 2001). It established an institutional framework for water resources management which was unsuccessfully implemented and is due be reviewed.

## CHAPTER IV: CLIMATE CHANGE RISKS, IMPACTS AND ADAPTATION

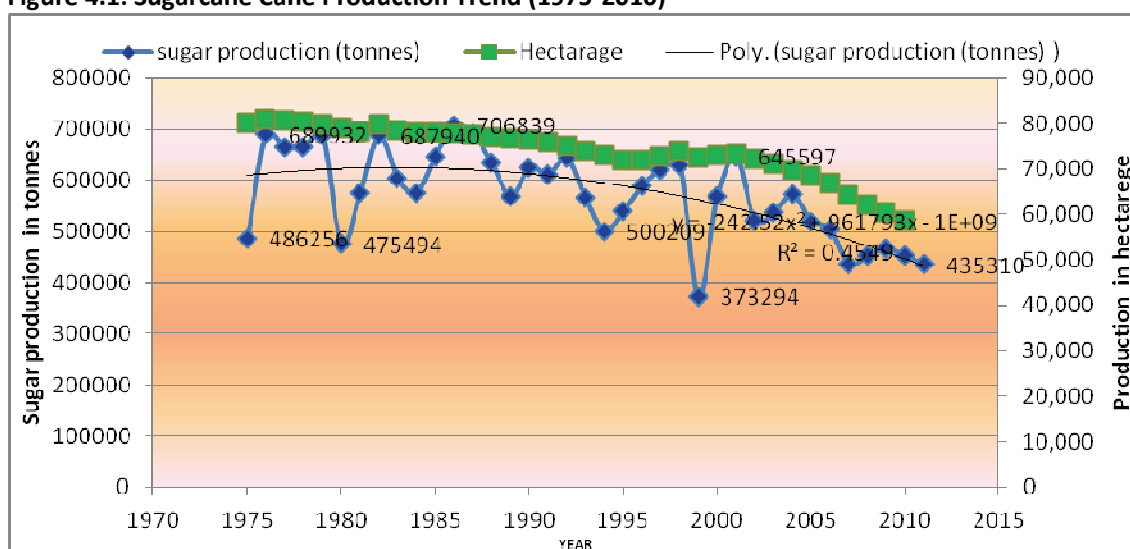
### 4.1 Climate Change Risks and Impacts

#### 4.1.1 Agriculture Sector

Effect of climate change on production trend of key crops in agricultural sector

**Sugarcane subsector:** Production trend of sugarcane cane in Mauritius has been characterized by fluctuations since 1976. The area under sugarcane has been steadily declining since 1975 which recorded an area under production of 80,000 hectares declining to just below 60,000 hectares in the year 2010.

**Figure 4.1: Sugarcane Cane Production Trend (1975-2010)**



In terms of yield in metric tonnes, **Figure 4.1** above shows that sugar production rose sharply between 1975 and 1976 from 468,256 tonnes (severe damage by cyclone “Gervaise” in 1975) to 689, 932 tonnes, respectively. This was followed by erratic production trends up to the year 1981 which registered a total production level of 475,494 tonnes. (peaks/lows-Climate and rainfall variability-2500mm/yr- well distributed.

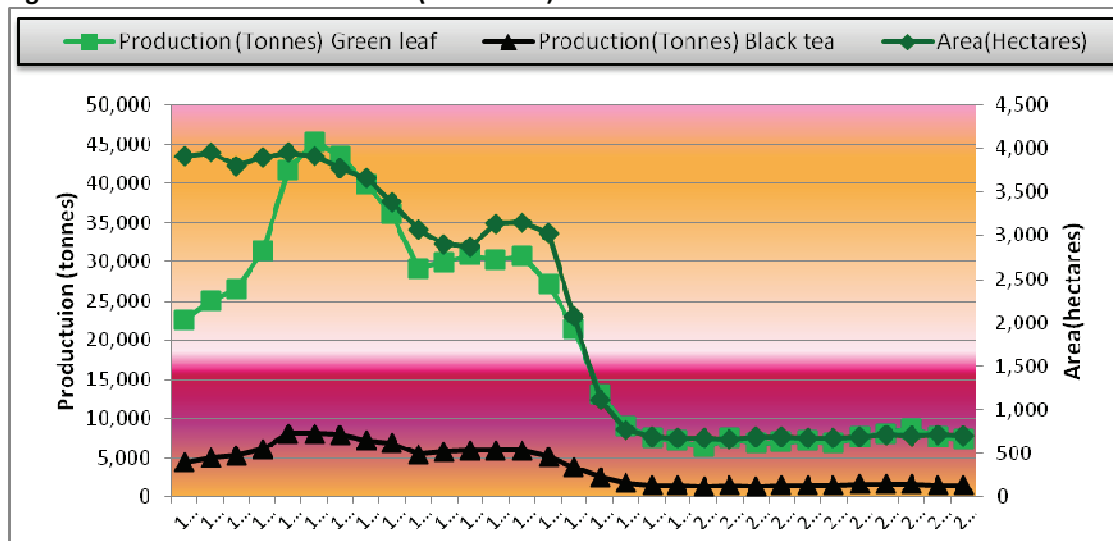
Thereafter production levels were evidently irregular rising sharply to a peak of 706,839 tonnes by 1986 and declining to an all-time low level of production of 373,294 tonnes in 1999. Subsequently there was an increase in levels of production climbing to 569,289 tonnes in the year 2000. This was followed by a general decline in production reaching a low figure of 435,972 tonnes in the year 2007 then rising slightly to about 467,234 tonnes in 2009 before declining to a low production level of 435,310 tonnes in the year 2011. The above scenario depicts a clear evidence of climate change as demonstrated by major decline in sugarcane production coinciding with decline in rainfall and high increases in temperature as reflected in the years 1975/76; 1982/83 and 1999/2000.

#### Tea Subsector

**Tea subsector:** Tea was the second major cash crop in Mauritius in terms of area under production and income with relatively high production levels during the initial period under

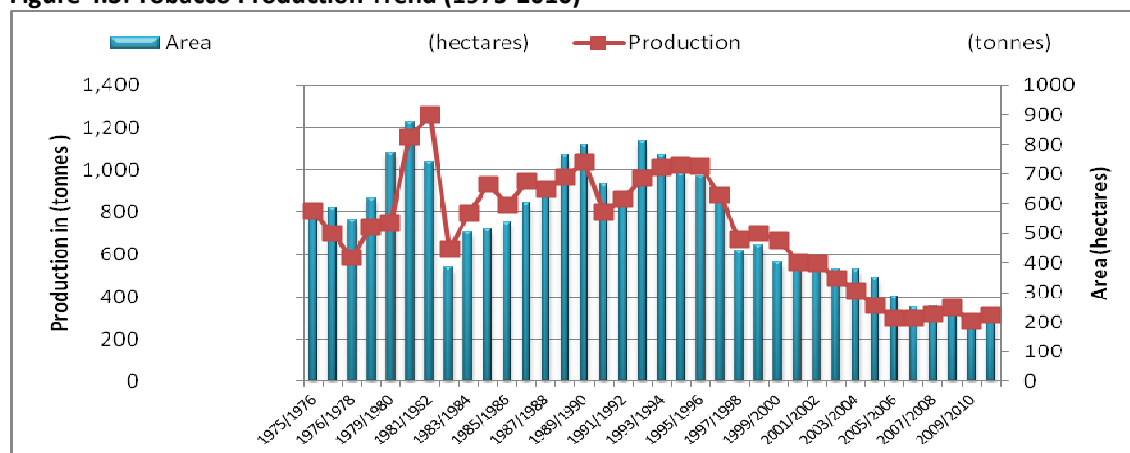
review, i.e. 1975-80 periods, with a production of 4386 tonnes in 1980, a peak of 8021 tonnes in 1984 then a decline to low levels such as 1467 tonnes in 2010 and 1787 in 2011.

**Figure 4.2: Production Trend of Tea (1980-2010)**



**Tobacco Subsector**

Over the three decades, tobacco production trends showed relatively higher levels of production in the initial years 1975-1994 period compared to the later years 2000-2010. Overall the production trends depict peak and trough periods. The peak production periods were the 1979/80 recording a high of 747 tonnes; 1989/90 registering 1,036 tonnes and the 1993/94 period with 1,015 tonnes. The trough production periods were represented by the year 1977/78 production of 587 tonnes; 1981/82 period recording 1259 tonnes and the year 2009/010 posting the lowest ever production level of 282 tonnes. These results show that the peak production periods coincided with periods of high rainfalls and the trough production periods were evident during periods of low rainfall (See Figure 4.3 below).

**Figure 4.3: Tobacco Production Trend (1975-2010)**


However, this sector will be phased out by 2015 due to economic factors.

**Biodiversity Conservation Efforts:** Natural disasters, namely cyclones and droughts are important pressures to native biodiversity as the latter is highly fragmented and populations are small, thus decreasing their resilience to weather fluctuations. For instance, cyclonic gusts of up to 285 km/h and accompanying torrential rainfall and invasive alien species damage native forests and habitats. Soil erosion due to flash floods, and droughts add to pressure on mountains and marginal ecosystems. It is expected that these negative impacts will be further accentuated by global warming, climate change and extreme weather events.

**Rodrigues:** Agricultural land use has declined dramatically over recent years as a result of limited market access low yields, high costs of inputs, limited access to credit, unavailability of water for irrigation and unpredictable weather conditions<sup>1</sup>. Land under agriculture has decreased by about 50% since 1993<sup>2</sup>. In addition, agricultural inputs are rarely used in largely subsistence farming.

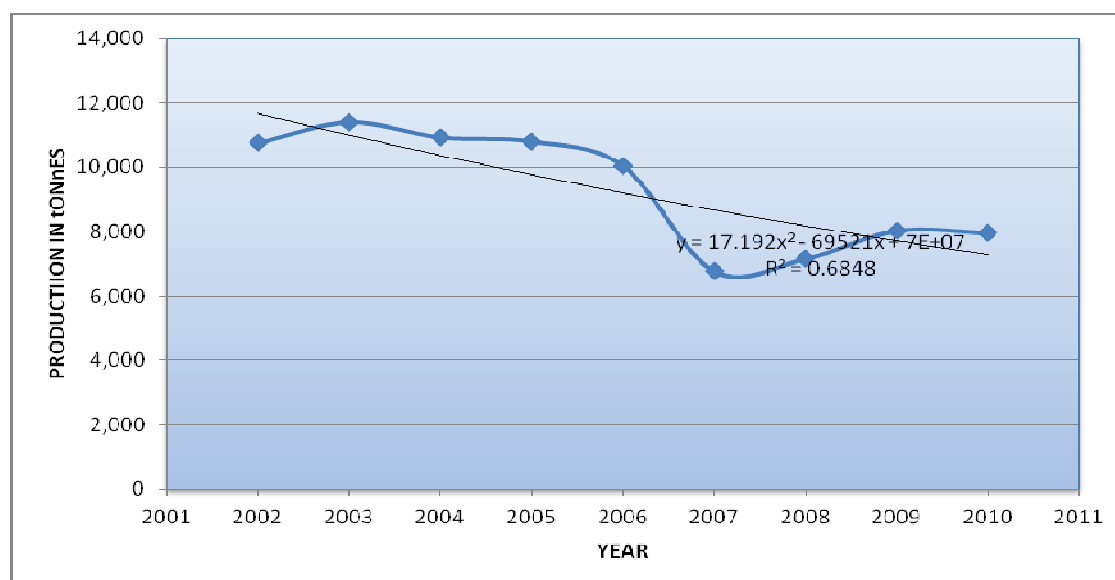
Although agriculture is still one of the main productive sectors of the economy, there has been a steady reduction in the overall agricultural activity in recent times. Over the last 20 years, the cultivated area has fluctuated considerably due to changing climatic conditions and other factors. It is estimated to have declined from a maximum of 1,800 hectares, to between 1200 and 1300 hectares at the beginning of the 1990's and declined to 504 ha in 1997. About 350 hectares of land are under crop production amounting to some 1800 tonnes of food crops annually. The decline of the fisheries and agriculture sectors have contributed to an acute unemployment problem causing major migration flows to the main island Mauritius since the 1980s.

#### 4.1.2 Fisheries sector

##### Fish production trend in Mauritius

**Fish production:** Artisanal small scale fish production in Mauritius has been declining from a production of 1,302 m tons in 2002 to 831 m tons in 2010. The tuna fish production and transhipments are done in Port Louis. The production from semi-industrial chilled fish has increased to 446 m tons in 2010. In the case of tuna fishery the production peaked in 2004 when it was 1,640 m tons. However on average, the production has been steadily increasing; for example, in 2002 production was 219 m tons while in 2010 production was 306 m tons. Marine aquaculture (cage) has been increasing from 325 m tons in 2004 to 498 m tons in 2010.

**Figure 4.4 Annual Fish Production (2002-2010)**



Changes in fish populations and ecosystems from climate change are likely to have resulting impacts on the fishers and national economy. Climate change may also directly affect fishing operations and fishing communities independently of impacts on fish and ecosystems (e.g. through sea level rises and increased storm severity affecting fishing and aquaculture, people’s homes and productive assets). Impacts can occur at two main levels, which correspond approximately to the domains of micro- and macro-economic analysis.

**The Micro-economic or within the sector level** - Impacts on the incomes, assets, and livelihoods of individual fishers, aquaculturists, processors, and those engaged in marketing and the provision of inputs to the sector.

**At the national or macro-economic level-** Impacts on revenues, exports, per capita fish supply, and contributions to employment and GDP.

The potential impacts on these two levels will vary by region/location, and differing levels of adaptive capacity of individuals, communities, fleets and economies and societies. In general terms, the impacts of climate change are likely to be experienced by all those within the sector, regardless of the relative importance of the sector in the wider economy, and investment in adaptation that is commensurate with the size of the sector will be required. Macro-economic concerns arise only when fisheries are sufficiently prominent in society and the economy to be a concern for national economic planning like in the case of Mauritius. This will be the case for many Small Island Developing States, where fisheries contribution is among the major export revenue sources.

Sector impacts may affect all links in the supply chain (e.g. producers, processors, those transporting and selling fish) in terms of incomes, value-added, employment and food security.

Changes in fishing/business strategies and methods (e.g. types of gear, forms of processing) to reflect changes in the abundance, distribution, and phenology of different fish species. Many small island developing States have important tuna and coastal reef fisheries, both which could be severely impacted.

Revenue generation from the sector -For many small island development States the value of fisheries in the EEZ is considerable and the sale of fishing licences to foreign vessels in return for access to national waters makes substantive contributions to GDP. Governments also generate revenue from domestic fisheries through the collection of various fees and taxes relating to fishing, processing and trading inputs and outputs. Where revenues are substantial, they can be used for general budget support and for investment in development that has benefits beyond the fishery sector. Even where revenues are modest, they are often used to support expenditures outside the sector. Key sources of revenue from fisheries, all of which are threatened by climate change, include:

- Licence fee income from both domestic and foreign fleets fishing in the EEZ
- Lease of fishing rights
- Vessel registration fees
- Taxes on landings and/or sales
- Export duties and royalties
- Income and company taxation from employees and owners of fishing and processing companies.

**Impacts on food and nutritional security-** Food security of fisher folk is achieved through income from fish sales, while having access to fish provides direct nutritional security (access to a healthy, balanced diet, rather than just access to sufficient calories). As population increases, per capita supply of fish is decreasing globally, despite the rapid rise of aquaculture production.

**Employment, safety nets' and the social and cultural role of fisheries** - The fisheries and aquaculture sectors can be important sources of employment, in many small island developing states and archipelago countries (e.g. Mauritius, Indonesia, and the Solomon Islands), the fisheries sector is an integral part of cultural identity. Climate change, coupled



with resource over-exploitation, may lead to shrinking of the fishery sector, with loss of the strong cultural affinity with the coast and marine environment. The accessible fisheries of inter-tidal and near-shore marine waters have a role as seasonal or crisis-related safety nets' for people displaced from other sectors; for example, drought and market and policy failures in agriculture led to an influx of people seeking employment in fisheries during the 1990s.

**Costs of adaptation** - To maintain the flow of benefits to the society and the economy from fisheries, governments are likely to have to increase their investments in developing coherent climate proof' sectoral policy and legislation, management and development. Costs are likely to occur in association with all the policy issues/options discussed in the chapter V below when we consider linkages between climate change policy and fisheries development policy supportive of adaptation and mitigation measures.

***The unique vulnerability of Mauritius as a Small Island Developing State***

Small islands and countries with low lying coastal areas have been given special considerations under Climate Convention and maintain an active presence in all the ongoing international negotiations to determine potential solutions.

Increasing global temperatures have the added effect of increasing temperatures of the sea water in the upper most layers of the ocean and which have been proven to be directly related to weather patterns. This situation is likely to affect ocean water circulation. For Mauritius, an island in the cyclone belt one major concern is the increase in intensity and frequency of cyclones can have secondary impacts on economics, infrastructure human health and the quality of life. Changes in oceans circulation can also affect migratory paths of pelagic fish which endangers the development of the fishing industry.

There are other international ramifications due to the overtopping of coastal reefs, because the coral atolls allows Mauritius to control huge Exclusive Economic Zone (EEZ) of ocean space with the right to exploit resources within 2.3 millions of square kilometers of the Indian Ocean. If atolls are to become submerged this could have impacts for the boundaries of the nation.

***Risks and impacts associated with fisheries in the short, medium (2020) and long term (2030)***

**Threats from Sea Level Rise:** On average, sea level rise is expected to occur as a result of thermal expansion of the oceans and melting of glaciers and ice sheets due to human interface with climate system. Assuming the best estimated values of climate sensitivity and ice melt sensitivity to warming, models have projected an increase of sea level rise of about 50 cm by the year 2100. The corresponding projection for the highest emission scenarios combined with high climate and ice-melt sensitivities gives a projected sea-level rise of about 95 cm by the year 2100. Sea level will continue to rise at a similar rate in future, even if conservation of greenhouse gases is stabilized by that time. However it should be borne in mind that regional sea-level rise value owing to eustatic land movement and ocean current changes should also be expected.

Sea level rise will have profound influence on coastal ecosystems particularly in Mauritius. In the short run ecosystems which will be at risk include sandy beaches, coral reefs, mangrove

ecosystems, coastal wetlands and river deltas. Changes in these ecosystems will have major negative effects on tourism, fresh water supplies, fisheries and biodiversity.

The coastline of Mauritius is about 200 km long with lagoon area amounting to 243 km<sup>2</sup> surrounding it. Mauritius is almost entirely surrounded by fringing coral reefs. Reefs however are absent in the opposite river mouths, estuaries and on the southern coast at two regions. The geomorphology of their formation has endowed the island with sandy beaches, protected bays and calm lagoons. In general lagoonal depth is comparatively shallow with the exception of where water depth reaches 15m in the inner reef pass.

The sediments are coralline in nature except in the south western segment near **Barachois** (closed coastal ponds using stones from aquaculture purposes), and major river confluences where they are muddy with large fractions of silt and clay. In the coastal areas which are in proximity with the reef such as in the southern section, the sand deposits on the beach and back shore are very coarse, rounded and spherical.

Mangroves usually grow near river mouths and estuaries such as Terre Rouge, Riviere Noire, Baie du Cap, and Riviere du Rempart or where there is resurgence of fresh water near the sea, such as Trou d'Eau Douce, Poste Lafayette, Bras -d'Eau, Roches Noires, Poudre d'Or. These mangrove trees are of direct ecological importance. They entrap terrigenous sediment that would otherwise get deposited on coral population, with consequential effects on the production capacity of the marine ecosystem of that locality. Two species of mangroves – *Rhizophora mucronata* and *Brugiera gymnorhiza* occur in the island.

#### **Projected impacts of Sea Level Rise on the Coastal Zone**

The principal impact of sea level rise for the coastal area around Mauritius is land loss through submergence of low lands and loss of wetlands as well as erosion of beaches. Coastal environment are incredibly diverse. Approaches to land loss estimate data and information therefore makes use of detailed up to date information that provides the following;

- Geomorphic type – e.g. sandy beach or rocky headland (Long run)
- Relative elevation – estimates of 1 metre and 2 metre contour locations (Long run)
- Land use – e.g. agricultural area and tourism beaches – (immediate impact)
- Affected population – estimates from the number of domiciles in impacted areas – (short and medium)

#### **Other risks on the coastal wetlands**

Coastal wetlands which are ecologically sensitive areas and play a vital role in the functioning of coastal ecosystems are located mainly in the northern and north western regions. They provide the essential habitat for many important marine species such as shore birds, crabs, fish and shrimps. The tides and semi-diurnal and tidal range is an average of 0.70 m during spring tides, where during neap tides, the amplitude between high tides and low tides are quite subtle. Waves in the lagoons are not usually more than 1 m in height except during cyclones when they have devastating effects on the coast line causing significant modification of the shoreline permanently in some regions and widespread destruction of the coral reefs.

### Vulnerability of the Fisheries of Mauritius

Generally, pelagic fisheries are threatened by the global warming effects of sea temperature rise more than sea level rise. It is uncertain what the effect of regional and global changes in temperature will have on the ocean water circulation but these are directly related phenomenon.

Most probably ocean currents will change. It is also being studied how migratory fish stock are likely to change their migration path not to mention hatching and spawning pattern. What is certain is that some species of ocean will try to find out the optimal level of sea temperature and may go deeper or closer to the surface to find their comfort zone. This has major impacts on the types of fishing gear that will be needed to catch them, with implication for investment in certain types of gear which may be appropriate currently but not when sea temperatures increase.

#### 4.1.3 Tourism sector

There is evidence to show that climate change is being exacerbated by human activities. Researchers have begun to include a tourism climatic index into tourism sector studies. The increasing volume of literature on the impact of climate on tourism development is due to the recognition that a more precise modelling of tourism demand must include weather and climate, since they are significant influences on the tourism industry. The climatic factors identified as having significant impact on tourism are temperature, sunshine, radiation, precipitation, wind, humidity and fog.

In some cases higher temperatures are positively associated with tourist arrivals, average length of stay (ALOS), tourists' nights and hotel-rooms occupancy levels. These factors are significant both to the tourist's assessment of his or her health and well-being, and to the tourism industry. It is essential that the elements are measured and evaluated, since they form an important resource for tourism.

#### 4.1.4 Water Sector

**Groundwater:** Most of the boreholes are sensitive to climatic conditions. Table 4.1 shows the level of vulnerability to drought and prolonged drought conditions. The yields are reduced by up to more than one half during the extremely dry period demonstrating a seasonal water scarcity rather than total scarcity.

**Table 4.1: Level of vulnerability to drought and prolonged drought conditions**

No	Borehole	Wet conditions	Dry conditions	Extremely Dry Conditions	Difference between wet and extremely dry
1	Les Choux	10	6	6	-4
2	Lataniers	40	30	27	-13
3	Dans Bebe	9	4	0	-5
4	Malabar	25	10	6	-19
5	Bois Noir	30	25	20	-19
6	Bassin Gallard	20	15	10	-10
7	Mourouk FAC	40	30	20	-20
8	Cascade Victoire	5	5	3	-2

No	Borehole	Wet conditions	Dry conditions	Extremely Dry Conditions	Difference between wet and extremely dry
9	Mont Lubin			55	
10	Nassola			35	
11	Les Choux			16	
12	Graviers			10	
13	Camp du Roi			12	
	Total abstraction- (m3/hr)			220	
	<b>Abstraction (m<sup>3</sup>/day)</b>			5280	

The bore holes are demonstrating possibility of over-pumping especially during extremely dry conditions. Besides saline intrusion of coastal groundwater aquifers will likely occur not only because of over-abstraction but also as a result of sea level rise. Most of the groundwater situated in low lying valleys will be affected most thus increasing pressure of water demand during the summers.

#### 4.2 Adaptation Strategies

**Adaptation is defined as** adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including proactive and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (IPCC TAR, 2001 a) Climate change activities in the Republic of Mauritius have been consistent towards sustainable development goals. The concept of a sustainable island is clearly defined in the “Maurice Ile Durable” programme presented in Parliament in June 2008.

**Since then, various efforts have been initiated to integrate climate change in new development strategies.**

##### 4.2.1 Agriculture Sector

Crop subsector: In addition to the above, in agricultural sector, the following adaptation strategies have been employed:

- Storage and processing (e.g. curing of onions prior to storage) of produce;
- Changes in consumption patterns in terms of dietary components associated with disaster incidences;
- Local initiatives during disaster include: donation of seeds, food and piglets, Insurances :
- Use of drought and heat tolerant cultivars;
- Use of flood tolerant cultivars and improving drains, and
- Research on availing low transpiring cultivars.

**Forest Sector:** The sector will be affected by climate change by loss of less adaptable fruit tree species from droughts, floods, cyclones, high temperatures and pests and diseases. Adaptation strategies that can mitigate the impacts of climate change include:

- Plant drought tolerant trees;
- Use heat and drought tolerant trees;
- Plant flood tolerant trees;
- Use pest and disease tolerant trees;
- Discourage fires and tree cutting;
- Reafforestation;
- Use of Trees for Mitigation of Climate Change, and
- Plant trees with high carbon sink ability; Plant trees with high carbon sequestration ability

**Greenhouse gas (GHG) Mitigation:** There was a rise in net CO<sub>2</sub> emissions from 3075 thousand tonnes in 2009 to 3375 thousand tonnes in 2010 but similar at around 3351 GT in 2011. CO<sub>2</sub> was the major greenhouse gas injected in the atmosphere. Most of this gas resulted from fuel combustion activities such as electricity production, transport and manufacturing processes.

The energy industries were the main source of CO<sub>2</sub> emissions. Public and private sectors of the economy and the population of the ROM in general, are gradually becoming aware of the threat posed by climate change and climate variability. Some concrete efforts have already been made to mitigate GHG by integrating climate change issues into new development strategies. There is strong political will to further enhance the existing policies as to develop resilience to the adverse impacts of climate change and to ensure the achievement of sustainable developments goals.

#### 4.2.2 Fisheries Sector

Fisheries-specific adaptive measures offer potential to maintain or increase fisheries trade both domestically and internationally, because they help to ensure that production levels from capture fisheries and aquaculture will be maintained or increased on a sustainable basis. These include the following:

- Re-building stocks and improving fisheries governance.
- Strategies regarding onshore fisheries and coastal infrastructure.
- Managing declining incomes if fish catches fall due to lower catches, and efforts aimed at diversification and fostering alternative livelihood activities.
- Dealing with fisheries' status as a 'safety net' activity.
- Disaster preparedness and response. Policy-level responses can include:
  - Invest in improved weather information and storm warnings.
  - Ensure that the fishery sector is included in national disaster preparedness and response planning.
  - Ensure that fisheries line management agencies are familiar with disaster preparedness and response procedures.
  - Ensure that specialist fisheries sector technical expertise is available to disaster relief agencies.

- Rehabilitation periods (after emergency relief has been delivered) aimed not at restoring the flawed structures of the pre-disaster period, but at affecting the kinds of transformation to future reduce vulnerability.
- Aquaculture development.
- Inclusion of fisheries in the UNFCCC, NAPAs.
- Ecosystem-based adaptation (coral farming, mangrove propagation).

#### 4.2.3 Tourism sector

Using rainwater collectors; Increasing storage tank capacity; Construction of desalination plants; Water conservation (including the application of water-saving devices and guest and employee education, revising landscaping practices and limited use of pools); Considering long-term weather forecasts; Monitoring health and environmental protection; Recycling (use of treated water for irrigation); Development of water conservation programs such as universal water meters, water audits and public awareness/education campaigns; Reduce resource use and in particular packaging; Hotels can substantially reduce overall waste produced, as well as recycle most of the remaining waste; Whenever new accommodation establishments are built, they should be constructed in a way to make them independent of fossil energy sources – it is now possible to extensively use renewable energy for operations if this is considered prior to the commencement of building; New buildings should be constructed using a high proportion of low-carbon, recycled materials, and high levels of insulation to keep rooms cool or warm.

## CHAPTER V: INSTITUTIONAL MAPPING AND NEEDS

### 5.1 Agriculture Sector

#### ***Institutions, Policies and Financing to Strengthen Capacities for Adaptation in agriculture sector***

Adaptation to climate change requires adjusting institutional structures and arrangements. This includes defining adequate national policy and legislative frameworks, and assigning and coordinating responsibilities within the governance structures of countries and regions. Iterative planning, participatory and systems-based approaches, and strong stakeholder engagement should be key principles in adaptation.

Access to adaptation financing is usually a prerequisite for countries to implement adaptation activities effectively. In addition, FAO emphasizes that institutions and decision making must remain flexible for dealing with uncertainties of potential climate change impacts. Advocate at the regional and international level for a stronger recognition of the challenges to and potential of agriculture, forestry and fisheries sectors in climate change adaptation frameworks and financing mechanisms, and ensure that main stakeholders, including indigenous people and vulnerable groups, have a voice in advocacy.

Integrate climate change adaptation into national and sub-national agriculture, forestry and Fisheries sector policies and plans, land use and water policies, food security programmes, legal frameworks and investment priorities, and ensure appropriate representation of the sectors in climate change and disaster risk management policies and strategies. Strengthen institutional capacities and coordination needed for climate change adaptation, in particular in and among sectoral line agencies, education, research, extension and communication for development services.

Enhance national capacities of countries to access the financial resources available for technology development and transfer, investments and capacity development for climate change adaptation in the agriculture, forestry and fisheries sectors. Strengthen dialogue and networks and develop multi-stakeholder partnerships for adaptation across public and private sectors, non-governmental organizations and communities at all levels.

Strengthen community- and locally-based mechanisms (e.g. forest-user groups, agricultural and fisheries cooperatives, community networks and media) for management and delivery of services for agriculture, forestry and fisheries and to facilitate locally appropriate adaptation measures, including community-based adaptation. Reinforce national and regional capacities for plant, forest and animal health and food safety and improve monitoring and control of variations in pests, diseases and food safety, related to climate change. Strengthen food value chains and, in particular, improve small-scale producers' access to markets to increase resilience of food systems.

#### ***Strong Institutions Are Crucial for Adaptation***

The governance and coordination of climate change issues at global, regional, national and local levels pose additional challenges to existing governance systems which may need

strengthening. This could require developing new decision support tools and the strengthening of formal and informal structures and institutions in areas such as research, communication and finance. Institutions shape and modify the capacity of farmers, fishers and forest-dependent people to adapt their livelihoods to climate change.

Adaptation requires information generation through research systems. Enhancing communication between producers and users of climate science is clearly a requirement. Institutions to facilitate this exchange can be existing communications and information dissemination networks including, e.g. extension or farmer field schools. Communication for development methods and tools are instrumental for this purpose.

Producer organizations may play a more important role in the future by, for example, offering new avenues to input supplies. Effective plant breeding and seed systems are essential to provide adapted varieties to farmers. Property rights and systems to regulate use and access to natural resources are essential to manage these resources. Climate change creates new financing requirements in terms of both amounts and financial flows associated with needed investments, which will require innovative institutional solutions.

Various forms of informal insurance mechanisms exist in many rural communities in developing countries, and new mechanisms, such as index insurance, are being developed. Safety nets are a form of social insurance comprising programmes supported by the public sector or NGOs that provide transfers to prevent the poor from falling below a certain poverty level. Safety nets are likely to become increasingly important in the context of climate change (FAO 2010).

**Table 5.1: Mauritius Agricultural Sector Institutional Mapping for Climate Change Adaptation**

Institution	Mandate/Function	Relevance to CCA
<b>1</b> The National Agricultural Research Systems	Is an organized system mobilizing the contribution of stakeholders in agriculture: 1. Research institutions (public, private and professional) 2. Universities and Professional Training institutions 3. Extension organizations 4. Farmers' organizations 5. Private companies and their organizations 6. Non-Governmental Organizations (NGO) and Civil Society Organizations (CBOs)	Relevant but from the documents there are no clear projects directly addressing CCA
<b>Policy Organizations</b>		
<b>Mauritius Cane Industry Authority(MCIA)</b>	The MCIA has been established in 2012 to manage existing service providing institutions in the sugar cane sector (MSIRI, Farmers Service Agency, Arbitration and Control Board, Agricultural Mechanisation Unit). Some of the main functions include: 1. Monitor, oversee and coordinate all activities relating to, and ensure a fair, efficient and effective administration and operation of, the cane industry. 2. Promote and support the sustainable development, efficiency and viability of the industry. 3. By means of research and investigation, ensure the	<b>Relevant but from the documents there are no clear projects directly addressing CCA</b>



	<p>technical progress and efficiency of the cane industry.</p> <ol style="list-style-type: none"> <li>4. Co-ordinate the activities of organisations concerned with the cane industry in the private and public sectors.</li> <li>5. Ensure that necessary essential services are available to planters.</li> <li>6. Facilitate the adoption of modern and efficient agricultural practices by planters.</li> </ol>	
<b>Mauritius Chamber of Agriculture</b>	<ol style="list-style-type: none"> <li>1. The Chamber provides a high-level forum for exchange of ideas and views and for the formulation of general policies and strategies on all major issues pertaining to the development of agriculture and agricultural industries in Mauritius.</li> </ol>	<b>Relevant but from the documents there are no clear projects directly addressing CCA</b>
<b>Mauritius Research Council</b>	<ol style="list-style-type: none"> <li>1. To advise the Government to identify present and future needs for knowledge and research in all fields;</li> <li>2. A funding agency for promoting research mainly in areas not covered by existing research institutions through the provision of grants</li> <li>3. A co-coordinator of research, promoting co-operation and synergy among research institutions, the public sector and business.</li> <li>4. MRC has funded a large number of projects in agriculture and related fields.</li> </ol>	<p><b>There are funded projects on CC adaptation under AAP.</b></p> <p><b>Should give more emphasis on funding sources in future</b></p>

**Table 5.2 Functional Roles of Mauritius Agricultural Sector Institutions**

<b>Role</b>	<b>Institution(s)</b>	<b>Relevance to CCA</b>
<b>Service Providers under Ministry of Agro Industry and Food Security</b>	<ol style="list-style-type: none"> <li>1. Food and Agricultural Research Council</li> <li>2. Agricultural Research &amp; Extension Unit</li> <li>3. Irrigation Authority</li> <li>4. Mauritius Cane Industry Authority (MCIA)</li> <li>5. Farmers Service Agency (FSA)</li> <li>6. Mauritius Sugar Industry Research Institute(MSIRI)</li> </ol>	<p>Research relevant to CC adaptation is partly being addressed by AREU in the non-Sugar and food crop sectors.</p> <p>Research relevant to CC adaptation is being undertaken by MSIRI in the sugar sector.</p>
<b>Marketing</b>	Marketing supports are provided by the Agricultural Marketing Board (AMB)	Relevant but from the documents there are no clear projects directly addressing CCA
<b>Research</b>	<p>Research activities are carried out by the following organizations:</p> <ol style="list-style-type: none"> <li>1. Mauritius Sugar Industry Research Institute</li> <li>2. Food and Agricultural Research Council</li> <li>3. Agricultural Research and Extension Unit (AREU)</li> <li>4. Agricultural Services</li> <li>5. University of Mauritius</li> </ol>	Relevant but from the documents there are no clear projects directly addressing CCA

Role	Institution(s)	Relevance to CCA
<b>Training Institutions</b>	<ol style="list-style-type: none"> <li>1. University of Mauritius</li> <li>2. Mauritius Institute of Training and Development (MITD)</li> <li>3. AREU</li> <li>4. Agricultural Services (AS) of the Ministry of Agro-Industry &amp; FS (for Food Safety, Apiculture, Veterinary Services, etc)</li> <li>5. Regional Training Centre (RTC)</li> </ol>	<b>Research and training on CC is being carried out by UoM, AREU and AS</b>

## 5.2 Tourism Sector

From deskwork and focus group discussions, it was noted that Climate change is not fully mainstreamed in operations. Climate change data is not centrally collected, processed and shared.

From the functions of various institutions related to tourism, the following barriers with respect to climate change and the tourism sector were compiled:

- Limited knowledge/data by tourists, tourism operators and other stakeholders.
- Limited adequate legislation that requires compliance e.g. policy gaps in licensing processes.
- Limited incentives by government e.g. financial support for specific measures such as pollution control and inadequate fiscal policies to support climate change adaptation.
- Lack of skilled staff.
- Limited technological solutions.

## 5.3 Water sector

### 5.3.1 Government of the Republic of Mauritius

The government needs to be equipped with relevant information, appropriate capacity for integrated, cross sectoral development planning, or multi-disciplinary and cross-sectoral approaches to understand impacts of climate change and their corresponding adaptation measures. Implementation of adaptation measures is requires staff compliments in appropriate disciplines. Government without support of local, regional and international institutions is incapable of effective implementation and scaling up of adaptation measures and development.

### 5.3.2 Coordination Function

There is a lack of coordination among the different players in the water sector to provide an efficient and reliable service and to manage the water resources (Table 5.3). Similarly Table 5.3 below shows that there is a lack of technical expertise for the effective planning of water infrastructures and regulation of the functioning of its networks. There is also a lack of information and statistical data on rainfalls, water surface, underground water and waste water. It is a major constraint for proper analysis and planning.

**Table 5.3: Levels of Institutions and their Coordination Function**

Key Issues	Elements
Key sectors requiring coordination	Rodrigues Regional Assembly Government of Mauritius - Central water authority NGOs Local Communities – Village Committees Donor Agencies – AFD, World Bank, EU, AfDB etc Executing Agencies, UNDP, UNEP etc
Body Responsible for Coordination	Rodrigues Regional Assembly
Current Level of Coordination	Not well established since the regulations and policies are inadequate. Governance framework needs to be strengthened Acts of vandalism are common and in many cases go unpunished There are also claims that corruption are prevalent in the water distribution
Possible improvement in coordination	Political divergence sometimes leads to discussions between stakeholders. The coordination between Mauritius and Rodrigues Authorities must be strengthened.

**Table 5.4: Information and Management Functions**

Key Issues	Elements
Appropriateness of data gathering system	Meteorological data up to date Statistics on data consumption per category not concise Lack of resources and capacity to collect and manage data Socio economic impact of climate change on agriculture not well documented.
Is there focal point for information	The RRA through the Ministry of Economic Planning and management Unit should be empowered for the gathering, management and dissemination of information.
Current effectiveness of Information management	There is widespread awareness of the importance of rain water harvesting; there are some information gaps to be addressed in terms of dissemination of best practices and lessons learnt.

**Table 5.5 Institutional Arrangement for Implementation of IWRM**

Institution	Roles
Regional Assembly	Lead role, 'owner' of the process Mobilize funding for the workshop and future investments Set macro-economic policy environment
Steering Committee, Director of Water Resources	Guide the process (group with wide representation) Mobilize support across sectors and interest groups Guarantee quality output Monitor implementation progress
Management Team (8 members)	Manage day-to-day processes for strategy development, implementation and capacity building Reviews draft reports

Department of Water / Environment	Provide neutral platform for dialogue Support strategy development process by providing advice and sharing knowledge Foster capacity building and training
-----------------------------------	--

#### **5.4 Summary of Institutional Analysis**

The current institutional capacities and relationships are insufficient to provide effective solutions to water problems that have been exacerbated by climate change. Specifically:

- a) Beneficiaries/consumers are not incorporated in the management of water resources.
- b) Decision-makers require relevant information to ensure that there is balance in water decision since RRA and the Water Commission have the greatest influence while State Government and RRA wield the greatest power.
- c) There is political will to resolve the water issues, but lack of resources, poor/lack of policies and capacity, lack of transparency in water distribution systems seem to be the major stumbling blocks.
- d) Governance framework needs to be strengthened in the water sector.
- e) There is widespread awareness of the importance of rain water harvesting.
- f) There is an urgent need for external assistance to quick-start IWRM process and channel all resources and provide guidance

## CHAPTER VI: CLIMATE CHANGE MAINSTREAMING/ADAPTATION FINANCING AND FUNDING

### 6.1 Overview of Financial Instruments to address Climate Change

International Adaptation Funds will take into account the potential for the private sector in areas such as farming, tourism, fisheries and water sectors to finance adaptation, supplement national budgetary allocations, and expected return from international adaptation funds and revenues from innovative financing options such as Payments for Ecosystem Services.

There are three sources of international public climate finance:

- Finance from bilateral agencies such as the Agence Française de Développement (AFD) or the UK Department for International Development (DFID), that support mitigation or adaptation activities as part of their broader development activities.
- Support from international financial institutions including Multilateral Development Banks (MDBs, i.e. the World Bank and regional development banks) and United Nations agencies, which likewise support mitigation or adaptation activities as part of their broader remit.
- International climate finance funds: these are funds dedicated to supporting climate change activities. They in turn, can be sub-divided between those explicitly linked with the United Nations Framework Convention on Climate Change (UNFCCC, e.g. the Adaptation Fund), those associated with MDBs (e.g. the Climate Investment Funds (CIFs)), those associated with UN agencies and those that are dedicated bilateral funds

#### 6.1.1 The Global Environment Facility (GEF)

Global Environment Facility (GEF), as the financial mechanism of the UNFCCC, has allocated over \$3.3 billion to projects addressing climate change, mostly renewable energy and energy efficiency projects since its inception in 1991, with further co-financing of \$14 billion. Most of this funding has been for renewable energy and energy efficiency projects. The GEF share of total multilateral and bilateral funding between 1997 and 2005 was 1.6 %. GEF-managed funds available for adaptation projects, including the Strategic Priority on Adaptation (SPA) of the GEF Trust Fund, the Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF), amount to over \$275 million. Since 2005, the GEF has provided \$110 million for adaptation projects.

#### 6.1.2 Examples of GEF-Funded Projects

**Energy Efficient Buildings** - Increased market penetration of energy-efficient technologies, practices, products and materials in the residential and commercial building markets.

**Industrial Energy Efficiency** - Increased deployment of energy-efficient technologies and adoption of energy-saving practices.

**Renewable Energy** - Growth in markets for renewable power in participating program countries.

**Sustainable Energy from Biomass** - Adoption of modern and sustainable practices in biomass production, conversion and use for modern energy.

**Sustainable Transport** - Innovative sustainable transport systems

### **Financing from Development Agencies and Multilateral Banks**

In addition to the UN-World Bank collaborative projects already mentioned, the World Bank and other multilateral banks are committing even more funding for climate change. The **Clean Energy Investment Framework (CEIF)** was the World Bank's response to the G8 request for an investment framework on climate change boosting the financing of renewable energy and energy efficiency projects by 45%. In addition, following a World Economic Forum and World Business Council for Sustainable Development partnership set up to explore stimulate private sector investment, multiple funds earmarked for a number of countries was committed.

**The Climate Investment Funds (CIFs)**, have since 2008 provided interim (through the post-2012 negotiations) funding to help developing countries mitigate greenhouse gas emissions and adapt to climate change. Two trust funds have been created under the CIFs, with total investments, based on preliminary indications from donor countries, targeted to reach US\$5 billion.

The funds help set up and maintain emerging initiatives by donor countries including the UK, US and Japan in partnership with multilateral development banks (MDBs), including the Asian Development Bank (ADB), the African Development Bank (AfDB), the European Bank for Reconstruction and Development (EBRD), and the Inter-American Development Bank (IDB). These funds will complement GEF funds and the Adaptation Fund, to be disbursed as grants, highly concessional loans, and/or risk-mitigation instruments, and will be administered through the MDBs and the World Bank for quick and flexible implementation of country-led programs, investments, and development strategies. Developing countries will have an equal voice in the governance structures of the funds and decisions on the use of funds will be made by consensus. The annual Partnership Forum aims to provide a venue for discussing strategic directions, results and impacts of the CIFs.

**The Clean Technology Fund (CTF)** aims to engage the private sector and provide large-scale financial resources for developing countries to accelerate the transfer of low-carbon technologies. The fund includes investments in the power and transport sectors, as well as energy-efficient building, industry and agriculture. The CTF uses a blend of concessional financing instruments (grants, concessional loans) and risk mitigation instruments (guarantees), mostly at the country level, but possibilities for regional programs. The CTF specifically addresses the dichotomy between perceived and real risks, and the disincentive for private investors created by high costs associated with being in a new market. Private sector initiatives have been set up to create an initial market for projects without subsidies.

The **Strategic Climate Fund (SCF)** is a broad, flexible overarching fund designed to support programs that test innovative approaches to climate change. It aims to:

- Promote collaboration and learning among MDBs in the area of climate change;
- Promote and channel financing for targeted programs;
- Provide opportunities for sharing and disseminating lessons learned.

The programs under this fund will be targeted to provide financing to pilot new approaches with potential for scaling up. One of the first proposed programs of the SCF is the Pilot Program for Climate Resilience (PPCR). Other potential future programs include greening

energy access and sustainable forest management, for example, the Forest Investment Program (FIP), established in 2008 to mobilize funds to reduce deforestation and forest degradation, and to promote improved sustainable forest management, leading to emission reductions and carbon reservoir protection. The FIP aims to support investments in low-income countries for energy efficiency, renewable energy and access to modern sustainable energy.

The **Pilot Program for Climate Resilience (PPCR)** aims to increase the ability of countries to adapt to climate change, and includes pilot countries that were chosen based on vulnerability criteria, preparedness and the ability to move towards climate resilient development, and distribution across regions and hazards. The PPCR aims to explore practical ways to mainstream climate resilience into core development planning and budgeting, build National Adaptation Programs of Action (NAPAs), ensure strategic alignment with the Adaptation Fund, and generate lessons for the wider development community.

The PPCR will mainly support two types of activities: Technical assistance and capacity building to integrate climate resilience into development plans; and financial resources to help fund investment identified in the plans. The PPCR has close links with the Adaptation Fund Board and PPCR's governing body.

The **World Bank Carbon Finance Unit (CFU)** uses money contributed by governments and companies in OECD countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition. The emission reductions are purchased through one of the CFU's carbon funds on behalf of the contributor, and within the framework of the Kyoto Protocol's (CDM) or Joint Implementation (JI). Approximately \$2 billion from both private and public sources have been pledged so far.

The **Carbon Partnership Facility (CPF)** aims to scale up the delivery of carbon finance through programmatic and sectoral initiatives, promotion of long-term investment programs, and helping to create enabling environments. Other potential CPF programs include renewable, fuel substitution, energy efficiency, new power generation using advanced technologies, industrial process efficiency, efficient lighting, transport systems, urban energy efficiency, waste management systems, gas flaring and leak reduction, and carbon capture and storage (CCS).

The **Forest Carbon Partnership Facility (FCPF)** has aimed since 2008 to reduce deforestation by compensating developing countries for greenhouse gas emission reduction. 14 tropical and subtropical countries are the first developing nations to receive grant support as they build their capacity for reducing emissions from deforestation and degradation. They include Guyana, the Democratic Republic of Congo, Gabon, Ghana, Kenya, Liberia, Madagascar, Bolivia, Costa Rica, Guyana, Mexico, Panama and Nepal, Lao PDR and Vietnam.

## 6.2 Other Funding

Other funding sources for climate change-related programs include multilateral funds and a number of specialized funds that include:

**Multilateral Funds:** The multilateral development banks' (MDBs) core mission is to promote growth and reduce poverty, and, thus, ensure that developing countries have access to adequate financial resources and appropriate technology for climate change. Activities financed by these funds are generally country-led and integrated into country-owned development strategies.

The Asian Development Bank (ADB), the African Development Bank (AfDB), the European Bank for Reconstruction and Development (EBRD), the Inter-American Development Bank (IDB) and the World Bank (more on Multilateral Development Banks in the International Organizations Module in this series) joined forces to establish a portfolio of funds to scale up investments to address climate change. In 2005, the ADB launched the Energy Efficiency Initiative with the aim of providing US\$1 billion assistance a year for clean energy projects. In 2006, the EBRD launched the Sustainable Energy Initiative, which aims to foster €5 billion of investment in cleaner energy through to 2011.

**UK Environmental Transformation Fund:** In late 2007, the UK announced an £800 million International Environmental Transformation Fund for reducing poverty through environmental management and developing country help in responding to climate change. Of that, £50m has been earmarked for helping 10 countries in Central Africa to tackle deforestation in the Congo Basin. The Fund will be administered by the World Bank mainly in the form of concessionary loans, which poor countries will have to pay back to the UK.

**US Clean Technology Fund:** The US announced the establishment of a multibillion dollar Clean Technology Fund in 2008 to help China and other developing countries finance technologies to cut greenhouse gas emissions, including additional costs of using cleaner energy technologies, filling part of the funding gap existing between more expensive, advanced technologies and older, cheaper technologies that reduce pollution and energy use. In addition to deploying clean technologies more rapidly, the Fund also aims to: help stimulate private-sector investment in existing clean technologies, accelerate the deployment of new technologies, and encourage emerging economies to adopt more environmentally-friendly policies. The proposed US contribution to the Fund of \$2 billion will be matched by up to US\$8 billion from other donors. The CTF will be housed at the World Bank.

**Japan Cool Earth 50:** Japan Cool Earth 50 is a Japanese plan to reduce global CO<sub>2</sub> emissions by 50% by 2050. It has short-term and long-term components. Short-term components include a post-Kyoto framework and international environmental cooperation, while the longer-term focus is innovation. Over a five-year period beginning in 2007 up to US\$2 billion will go towards assistance for adaptation. The Africa Adaptation Programme (AAP) has been a major project addressing climate change in different sectors in 20 African countries including Mauritius.



## **Financial Instruments to address Climate Change in Mauritius**

### **Sources of Financing:**

In the context of climate change mainstreaming and adaptation in Mauritius, a full range of public and private financing mechanisms are often used by Ministries of Finance/sectoral ministries, and National and sub-national planning bodies to support low emission climate resilient development. Incentive structures designed to effect behavioural adjustments by the public and private sectors should be implemented by Ministries of Finance/sectoral ministries, and National and sub-national planning bodies. From the documentary analysis, the following were some of the on-going programmes touching on climate change mainstreaming and adaptation financing and their areas of focus in Mauritius.

### **6.3 Risk Reduction and Preparedness Programme**

- ▶ The National Environment Policy, 2007 highlighted the importance of climate change to Mauritius.
- ▶ The objective of Government is to enhance preparedness of the country so as to address the impacts of extreme weather events, climate change and sea level rise and other environmental disasters.
- ▶ Presently there exists a Disaster Management Committee under the chairmanship of the Prime Minister's Office which meets as and when necessary for pre- and post-event actions.
- ▶ A Blueprint for a Sustainable Diversified Agri-food Strategy for Mauritius, 2008-2015 – addresses the food security through improving self-sufficiency status of a number of strategic crops in the short to medium term.
- ▶ A Food Security Fund has been set up to: Increase the resilience of Mauritius towards food self-sufficiency and face subsequent global food and feed crunches by increasing production of foodstuff locally and at the regional level by partnering with neighbouring countries. This will help to curtail the adverse effects of climate change.
- ▶ The Fund also provides funds for adaptation such as the Food Crop Insurance Scheme and Sheltered Farming.
- ▶ In Rodrigues, it is planned to rehabilitate some 100 ha of abandoned agricultural lands and to set up irrigation facilities.

### **UNDP Administered Funds**

- ▶ As the UN development network, present in 176 countries and territories, UNDP administers over 750 Trust Funds. These trust funds include:
  1. "Single-country Trust Funds that operate at the national level.
  2. "Geographic Trust Funds that encompass a region of countries (e.g., Fostering Knowledge Transfer in Disaster Preparedness/Risk Reduction within the Caribbean), a continent (e.g., Integrated Water Management in Africa) or a region at the sub-nation.

### **6.4 Micro-Financing Arrangements**

Micro-financing opportunities can be used to stimulate entrepreneurial activities particularly for women and youth to engage in sustainable enterprises that target climate change mitigation and adaptation. Microfinance provides a valuable alternative to insurance

for poor households and at a community level to support disaster prevention and risk management through mitigation programmes. The MoESD and MOF will need to cooperate closely with local communities in risk management and disaster preparedness.

### **6.5 National Budgeting Process**

The Government of Mauritius has recently institutionalized Programme Based Budgeting (PBB) as part of a comprehensive budget reform programme aimed at transforming ROM into a competitive and resilient economy. The PBB has shifted the focus of the budgetary process from an input-based annual activity to a performance-based multi-annual (three year planning framework) exercise that links the use of public funds to outputs (the goods and services produced by GOM) and outcomes (the changes observed by citizens in their life, over time, as a result of the supply of these goods and services). Under its PBB statement, the Ministry of Environment (MoE) (the focal point for climate change in ROM) has a strategy to 'assist in the adaptation and mitigation of climate change impacts'. The multi-annual focus of the PBB makes budget allocation a compatible tool to deal with long-term issues like adaptation to climate change. Under Programme Based Budget (PBB) Fisheries development and management programme contains performance measures and targets to focus the programme on measurable outputs and outcomes and to highlight the resource needs.

## CHAPTR VII: CONCLUSIONS AND KEY RECOMMENDATIONS

### 7.1 Conclusion

The study established that the Agriculture, Fisheries, Tourism and Water sector (Rodrigues) in the Republic of Mauritius is very susceptible to visible risks of climate change, including: Change in rainfall pattern, incidence of pests and diseases, droughts, floods, cyclone and temperature rise. The challenges ahead are significant, and these threats call for action to adapt to climatic changes in the best way possible. As a consequence, and to effectively support ROM's long-term vision, current policy/strategies and legislative framework need to be reviewed to determine their sufficiency in terms of climate variability and any new climate change related threats.

Due to these threats, there is need for updated policy/strategies in the agriculture, fisheries, tourism and water sectors that are cross-sectoral and integrated by nature and that would build on existing sectoral frameworks. The integrated /policy strategies way will also include knowledge and skills for stakeholders in the agricultural sector to offer a new view point on the best route to arrive at climate-resilient growth and development in the context of a changing climate.

### 7.2 Recommendations

The following are some of the major recommendations for climate change mainstreaming and adaption in the RoM:

#### Agriculture Sector

##### Crop Subsector

- Introduce and develop improved (drought and heat tolerant, early-maturing, disease and pest-tolerant, high yielding) crop varieties; and strengthen phytosanitary measures for crop production.
- Carry out countrywide assessments to determine regional vulnerability of the sector to climate change elements in areas prone to drought, floods, and soil erosion.
- Promote organic farming, Integrated Pest Management (IPM), integrated nutrient management and Good Agricultural Practices (GAP). This combines technologies, policies and activities aimed at enhancing agricultural production and food security and safety, protecting the environment and preventing degradation of soil and water quality.
- Research on planting of forest trees with high carbon sequestration ability to mitigate climate change and protection of water catchment areas and watershed management, with economic value for use in the timber industry.
- Promote water conserving crops and production technologies such as mulching and intercropping, soil fertility conservation measures, drip and micro sprinkler irrigation methods and planting of water efficient crop cultivars, short cycle crops, minimum tillage, hydroponics and fertigation.
- Diversification of crop production.
- Promote Agro-processing particularly to cater for women entrepreneurs in the food sector.

- Introduce protected crop production methods such as greenhouse farming.
- Introduce agroforestry systems for climate change mitigation, food security and soil conservation.
- Promote postharvest technologies that reduce postharvest losses. Adopt an agro-ecological approach.

#### **Livestock Sector**

- Introduce select and breed livestock types for improved productivity and resilience to climatic stress conditions such as drought, and heat stress.
- Intensify fodder production and conservation.
- Encourage improved livestock housing adapted to heat, cold and wind stresses.
- Reinforce pest and disease surveillance such as African swine fever and Avian Flu.
- Strengthen research in vaccines against priority livestock diseases and inoculants for improving productivity.

#### **Capacity Building and Networking**

- Establish strong regional collaborative networks with research bodies, Universities and other interactive agencies on research related climate change adaptation mechanisms for agriculture.
- Increase climate change awareness and adaptation mechanism.
- Identify funding sources.
- **Carry out** sustained and targeted capacity building to strengthen capability of agricultural sector and national agro industry institutions, private sector and local communities in the areas of science, policy, adaptation, mitigation and technology generation (carbon trading and carbon markets), resource mobilization and economic analysis.

#### **Policies, Legislation and Institutional Frameworks:**

- Review various agricultural policy/strategies and legislative documents and integrate climate change issues in the existing/new planning and development policies, to address shortcomings/risks to guide and implement climate change adaptation issues in the agricultural sector. With increasing drought decreasing, rainfall increasing pressure there is need to foster inter-linkage between different sectoral policies.
- Integrate climate change adaptation into national and sub-national agriculture and forestry sector policies and plans, land use and water policies, food security programmes, legal frameworks and investment priorities, and ensure appropriate representation of the sectors in climate change and disaster risk management policies and strategies.
- Strengthen institutional capacities and coordination needed for climate change adaptation, in particular in and among sectoral line agencies, education, research, extension and communication for development services.
- Strengthen community- and locally-based mechanisms (e.g. forest-user groups, agricultural and fisheries cooperatives, community networks and media) for management and delivery of services for agriculture, forestry and fisheries and to facilitate locally appropriate adaptation measures, including community-based adaptation.

- Reinforce national and regional capacities for plant, forest and animal health and food safety and improve monitoring and control of variations in pests, diseases and food safety, related to climate change. Strengthen food value chains and, in particular, improve small-scale producers' access to markets to increase resilience of food systems.
- The socio-economic profile of respondents on climate change mainstreaming and adaptation in the Mauritius agricultural sector showed that the sector is pervaded by persons with basic educational background, that is, primary and secondary educational levels with some respondents with no formal education. Thus implying that if social or technological change would be recommended, for example climate change adaptation, the strategy would be to employ more basic training cum educational methods and techniques for information dissemination and capacity building. This would require adoption of appropriate dissemination methodologies and techniques requiring high level of synthesis and interpretation.

### **Fisheries Sector**

- Increase financial resourcing to climate change adaptation and mitigation in the fisheries sector.
- Strengthen the governance and integrate climate change adaptation
  - into the decision making process;
  - into existing management programmes;
  - policies and strategies, and
  - By initiating vulnerability assessments.
- Rebuilding fish stocks.
- Improve monitoring and assessment of marine ecosystems.
- Strengthen management of fisheries resources to improve adaptation and resilience to climate change.
- Involve communities in climate change adaptation while recognizing gender issues and develop alternative livelihoods.
- Develop a system for easy access to information for decision makers and other stakeholders.
- Strengthen inter-collaboration among stakeholders.
- Promote marine based research on climate change and its impacts particularly research to support low impact aquaculture where you culture herbivorous species which have lower carbon foot prints than carnivorous species.
- Coral farming to rehabilitate degraded coral reefs.
- Mangrove protection and replanting due its role in carbon sequestration.

**Tourism Sector**

- Training, capacity building and creation of climate change awareness.
- Construction and operation of environmentally sound accommodation; establish environmental management systems, reduce energy use, use renewable energy only, reduce use of materials, recycle wastes, rethink food in restaurants, construction guidelines and communicate green action.
- *Sustainable tour operations*; support low-carbon holiday options and carbon labelling, develop new low-carbon products and develop high standard carbon offsetting schemes.
- *Tourists' awareness creation*; recognise airlines with sound environmental management, offset flights that cannot be avoided, recognise pro-environmental and pro-development tour operators and certify and standardize destinations and accommodation.
- *Destination management*; officially highlight and work towards the goal of tourism sustainability, consolidate existing markets and tap emerging markets, provide low-carbon public transport, achieve carbon neutrality and communicate pro-environmental action.

**Water Sector**

- Water governance framework needs to be strengthened.
- There is need to increase awareness of the benefits of rain water harvesting, soil and water conservation and catchment management.
- There is an urgent need to mobilize financial resources, be innovative to tap in to climate change financial windows, and seek external assistance to rehabilitate the infrastructure and quick-start IWRM process.
- Gather, analyse and disseminate relevant data and information required for science-led decision making to ensure that there is integrated water management.

## APPENDIX I: ACTION PLANS

Action plan is defined as a sequence of steps that must be taken, or activities that must be performed well, for a strategy to succeed. An action plan has seven major elements including: Project objectives, specific objectives i.e. what will be done and by whom; implementation actives /strategies; expected outputs; estimated costs; Implementation period; and Status. Based on the review of various documents and analysis of data and information collected concerning the effect of climate change risks and impacts in Mauritius, at least six projects were identified for purposes of mitigating the effects of climate change in the Mauritius and presented in the action plan below. The rationale for the action plan involved identifying project overall objectives, and looping in the action plan elements as discussed above.

**Table A1: Action Plans**

Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
<b>Agriculture Sector</b>								
Training and capacity building for climate change refers to development and strengthening of personal skills, expertise, relevant institutions and organization to reduce GHG emissions and or reduce vulnerability to climate change related impacts. The need for capacity building is enshrined in Article 9(d) of UNFCCC, which calls upon the subsidiary Body for scientific and technological Advice(SBSTA)- the body created under Article 9 of the convention-to provide ways and means of supporting endogenous capacity building in developing countries .In view of the risks, impact and opportunities presented by climate change in the	To raise awareness and build capacity of ministry of agriculture in Mauritius Island and Commission for Agriculture in Rodrigues Island and related staff, to effectively respond to and integrate climate change adaptation and mitigation into relevant existing and future programs to contribute to long term sustainable	<ol style="list-style-type: none"> <li>To enhance and strengthen the capacity of the staff and communities in order to respond effectively to climate change</li> <li>To provide training and capacity building activities that ensure a wide distributed skills and knowledge that is sustainable in the longer term</li> <li>To strengthen agro industry institutions</li> </ol>	<ol style="list-style-type: none"> <li>Organizing of short courses for increasing awareness of CC and adaptation / mitigation Demonstrations on adaptation measures to climate change impacts</li> <li>Development of climate change websites and information network- Publication of climate change newsletter Development of climate change</li> </ol>	<ol style="list-style-type: none"> <li>E-bulletin available on the Climate Change Information Centre (CCIC) website, for all subscribers, 10 quarterly Newsletter, in digital form, uploaded to the Climate Change Information Centre website, will be sent to members of the 2 networks and other stakeholders. Newsletter printed(500 copies/each and</li> </ol>	1,710,000	3 years	Depends on availability of funds.	

Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
	agriculture sector, sustained capacity building is required to strengthen capability of the agricultural sector institutions in country like Mauritius which have very limited climate change specialists the areas of science, policy, adaptation, mitigation, carbon trading and carbon markets..	development of Mauritius		curricula in schools, colleges and universities 3. Training of farmers in adaptation measures	sent to partners of the 2 networks' members			
<b>Food /crop Production and Security</b>	Agriculture and forestry are reference points for adaptation activities through crop diversity. The national scenario indicates that over the years agricultural production in Mauritius has been changing due to economic, social and other factors such a climate change, including land degradation, soil erosion and water scarcity. Diversification of crop production in these areas is a useful risk-mitigation approach. Encouraging improved production practices and introducing high yielding drought resistant varieties are such measures that should be promoted to increase crop productivity and sustainable land management.	To increase food production by introducing high yielding adapted crop species and varieties	<ol style="list-style-type: none"> <li>1. Diversify crop species and varieties</li> <li>2. Identify water efficient crops</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction and testing of heat and drought tolerant cultivars(importation of germplasm for testing, -</li> <li>2. Introduction and testing water efficient cultivars(importation of germplasm</li> <li>3. Recommend the selected cultivars to farmers</li> <li>4. On-farm demonstration of adaptation measures (IPM, IPNS, new improved</li> </ol>	<ol style="list-style-type: none"> <li>1. Climate change adapted cultivars introduced</li> <li>2. High crop yields and quality realized</li> <li>3. Optimum agronomic practices introduced</li> <li>4. Improved crop productivity</li> </ol>	1,160,000	5 years	Depends on availability of funds



Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
				cultivars/ technologies ) 5. Technology testing and transfer 6. Improve and disseminate fodder of high nutritive value 7. Improve post-harvest management to reduce losses 8. Increase food processing and transformation 9. Increase storage capacity for horticultural produce 10. Diversify into crops for import substitution				

Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
<b>Climate Change Awareness</b>	Climate change awareness is low countrywide. This was evident from the findings of the study c. The need for awareness creation, targeting specific groups and communities, and using different tools and media such as the print and electronic media, drama, community forums is therefore pressing. Equally important is the incorporation of climate change into the nation's curriculum at different levels, starting with primary through tertiary institutions and universities.	To mitigate and adapt to climate change through education	<ol style="list-style-type: none"> <li>To disseminate climate change information through media</li> <li>To create awareness of climate change by developing curricula in schools, colleges and university</li> <li>To create climate change awareness through administrators in meetings</li> <li>To develop short courses on climate change.</li> </ol>	<ol style="list-style-type: none"> <li>Climate change information published in the media</li> <li>Curricula on climate change developed from elementary to tertiary institutions</li> <li>Government administrators used to create climate change awareness</li> <li>To strengthen information and dissemination units</li> </ol>	<ol style="list-style-type: none"> <li>Publishing climate change information on newspapers, posters, leaflets, videos, reports and newsletters (purchase of printing paper, Cost of printing and binding).</li> <li>Developing curricular on short courses in colleges and universities</li> <li>Training of curriculum developers in different key sectors</li> <li>Short term climate change consultancy to integrate climate change in existing programme at primary, secondary and tertiary levels.</li> </ol>	327,000	1 year	Depends on availability of funds
<b>Soil and Water Conservation</b>	The increasing pressure on land use due to varying uses and unsustainable management	To apply appropriate soil and water	<ol style="list-style-type: none"> <li>Create awareness of soil fertility</li> </ol>	Education of communities to emulate best	<ol style="list-style-type: none"> <li>Increased crop productivity</li> <li>Reduced soil</li> </ol>	383,000	1 year	Depends on availability of funds.

Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
	such as wetland backfilling and occasional severe droughts have resulted in several areas of land degradation, environmental pollution and decline in crop productivity and has undermined the capacity of the ecosystem to provide food, water and other ecosystem services leading to declines in the welfare of the rural agricultural population. The major policy intervention should be to improve land management and forestry resources and overall agricultural systems. The avoidance of land degradation, intensive agricultural production and unsustainable land management has the potential to reduce GHG emission and generate carbon credit under the CDM mechanism	conservation techniques for optimum environmental management	<p>management and conservation practices</p> <p>2. Introduce water conserving techniques</p> <p>3. Introduce best farming practices / GAP to optimize environmental conservation</p> <p>4. Protect water bodies by planting trees</p> <p>5. Introduce tree species which do not consume too much water</p>	<p>farming practices through newsletters, reports, journals, demonstrations and field days.</p> <p>Demonstration of soil and water (conservation measures )</p>	<p>erosion</p> <p>3. Reduced climate change impacts</p> <p>4. Improved food security</p>			
<b>The Forest Development Plan</b>	The project aims at the planting of 1 million trees in the next 30 years. This will be achieved by planting of trees by schools, women groups and youth groups, in addition to afforestation and reforestation by the authorities. Each school	To increase the forest cover of Mauritius as a way of mitigating climate change	<p>1. To reduce GHG emissions through carbon sequestration by forest trees</p> <p>2. To reduce climate change impacts</p>	<p>1. Introduction of tree species with high carbon sequestration ability through research. –</p> <p>2. On farm</p>	<p>1. Awareness created on tree planting and management in schools, colleges and communities.</p> <p>2. Reduction of</p>	930,000	3 years	Depends on availability of funds

Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
	will be supplied with water tank, to support the establishment and management of tree nurseries and tree seedlings. In addition, large scale owners of land will be encouraged to construct dams for water harvesting and storage in order to support establishment of irrigated private forests		<p>3. To reduce soil erosion</p> <p>4. Create awareness in the planting of trees for climate change mitigation, and their management.</p>	<p>demonstrations of tree planting and management and in schools and colleges.</p> <p>3. –Research on impacts of trees on GHG emission and controlling soil erosion</p> <p>4. -Production of newsletters, radio and TV programs on tree planting and management</p> <p>5. -Introduction and rapid multiplication (including tissue culture) of tree seedlings.</p>	<p>climate change impacts.</p> <p>3. Forest cover increased by 30% by 2030.</p>			
<b>Research and Technology development</b>	The project shall include the selection and development of superior (drought-tolerant, flood tolerant, heat tolerant, fast maturing, pest and disease resistant) crop varieties: country wide assessments to determine regional vulnerability of the sector to	Increase agricultural production through sustainable environmental management	<p>1. Introduce and select stress tolerant crop species / varieties (sugarcane, tea, vegetables, fodder etc) (for heat,</p>	<p>1. Cultivar adaptation trials</p> <p>2. Introduction and testing crop cultivars for heat and water use efficiency</p>	<p>2. Superior livestock breeds, livestock feeds introduced. Efficient nitrogen fixation methods introduced</p> <p>4. Sustainable environmental management</p>	1,190,000	3 years	Depends on availability of funds

Project	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Remark
	<p>climate change elements and strengthening research in vaccines against livestock diseases, introducing drought and heat tolerant livestock breeds, livestock nutrition, inoculants for improving soil nitrogen and phosphorus. In addition sustainable agriculture implies management of resources for agriculture land management while maintaining the environment and the ecosystem. This combines technologies and policies and activities aimed at enhancing agricultural production, integrated nutrient management, protecting the environment and preventing degradation of soil and water quality</p>		<p>drought, salinity, strong winds, pests and diseases, low-nutrient soil status).</p> <p>2. Introduce and select livestock species for breeding for resistance to stress including temperature extremes, pests and diseases</p> <p>Breed and select for earliness in crop maturity.</p> <p>3. Investigate various nitrogen fixing techniques and organic farming methods</p> <p>4. Investigate in high value fodder species and fodder conservation and livestock nutrition</p>	<p>3. Cultivar adaptation trials</p> <p>4. Experiments on nitrogen fixation and adaptation trials)</p> <p>5. Livestock breed introduction and testing</p> <p>6. Livestock feed experiments fodder conservation and agronomy and vaccine development(C</p>	<p>5. Increased agricultural production</p> <p>6. Reduced vulnerability to climate change</p>			

Demonstration Projects(Agriculture Sector )				
Project	Project Description	Activities	Time Span	Cost (USD)
Irrigation projects for strategic crops	This will involve establishing Model demonstration plots of drip & micro sprinklers on strategic crops (tomato, onion, potato,)in three sites. Farmers will be shown the modern management and agribusiness aspects of production	<ol style="list-style-type: none"> <li>1. Identify sites for establishing demo plots.</li> <li>2. Procurement of farm inputs( irrigation equipment, seed, fertiliser and other inputs)</li> <li>3. Planting the crops.</li> <li>4. Care for the crops</li> <li>5. Training of farmers</li> </ol>	<ol style="list-style-type: none"> <li>1. First quarter of 2013</li> <li>2. Second quarter of 2013</li> <li>3. Third quarter of 2013</li> <li>4. Third quarter</li> <li>5. Second quarter</li> </ol>	25,000
Zero Grazing Dairy cattle production	Farmers will be shown a modern dairy unit with all the accompanying facilities such as milk parlour, feeding unit, and calf pens. This unit will be in include four sites	<ol style="list-style-type: none"> <li>1. Identify the sites for demonstration</li> <li>2. Procurement of facilities</li> <li>3. Construction of the unit</li> <li>4. Farmer training</li> </ol>	<ol style="list-style-type: none"> <li>1. First quarter of 2013</li> <li>2. First quarter of 2013</li> <li>3. Second quarter of 2013</li> <li>4. Second quarter of 2013</li> </ol>	30,000
Irrigated pasture/fodder production& Conservation	<ol style="list-style-type: none"> <li>1. Irrigated pasture/fodder production&amp; Conservation practices at 4 sites at cost of</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify sites for demonstration</li> <li>2. Procurement of inputs</li> <li>3. Sowing of seeds and management of plots</li> </ol>	<ol style="list-style-type: none"> <li>1. First quarter of 2013</li> <li>2. First quarter of 2013</li> <li>3. Second quarter of 2013</li> </ol>	32,000
Soil and water conservation measures	Demonstration of Soil and water conservation methods e.g. earth dams rain water harvesting , field borders, drainage ,mulching	<ol style="list-style-type: none"> <li>1. Identify sites</li> <li>2. Construction of earth dams &amp;purchase of water storage tanks.</li> <li>3. training of farmers</li> </ol>	<ol style="list-style-type: none"> <li>1. First quarter of 2013</li> <li>2. First quarter of 2013</li> <li>3. First quarter</li> <li>4. Second quarter of 2013</li> </ol>	100,000
Tree planting demonstration plots	5, Tree planting demonstration plots including tree nurseries and management practices	<ol style="list-style-type: none"> <li>1. Identify sites</li> <li>2. Establishment of tree nurseries,</li> <li>3. Planting of trees</li> <li>4. Care of trees</li> <li>5. Training of farmers</li> </ol>	<ol style="list-style-type: none"> <li>1. First quarter of 2013</li> <li>2. First quarter of 2013</li> <li>3. Second quarter of 2013</li> <li>4. Second quarter of 2013</li> <li>5. Second quarter</li> </ol>	20,000
Sheltered farming	6. Demonstration of Sheltered farming in three sites Training of farmers in modern management & agribusiness practices /	<ol style="list-style-type: none"> <li>1. Identify the sites for demonstration</li> <li>2. Procurement of rain shelter structures and seeds &amp; inputs ( irrigation equipment, water tank)</li> <li>3. Establishing greenhouse and low cost structures</li> <li>4. Training of farmers</li> </ol>	<ol style="list-style-type: none"> <li>1. First quarter of 2013</li> <li>2. First quarter of 2013</li> <li>3. Second quarter of 2013</li> <li>4. Second quarter of 2013</li> </ol>	18,000

Fisheries Sector						
SUPPORT TO PROGRAMME 1: FISHERIES MANAGEMENT						
Goal: To manage fish resources on sustainable basis for the long term benefit of the people of Mauritius						
SN	Project	Goals & Objectives	Implementations Strategies and Activities	Estimated Costs in MUR	Project Duration	Responsibility
1	Preparation of Fisheries management plans (FMP) and their implementation  Effective management of artisanal Fishery ensuring that catching capacity is in line with resource availability	For the sustainable management of fish resources	<ol style="list-style-type: none"> <li>1. Preparation of management plans for the different types of fisheries.</li> <li>2. Purchase of equipment and materials required.</li> <li>3. Monitoring of each type of fishery and stock assessment.</li> <li>4. Monitoring of FAD fisheries.</li> <li>5. Prepare legal/administrative framework for FMP.</li> <li>6. Promulgate appropriate new regulations.</li> <li>7. Revision of plan every five year or when the need arises.</li> </ol>	12 million per fishery per year	Medium to long term (5 to 10 years)	MOF
2.	Develop appropriate monitoring control and surveillance (MCS) plan in collaboration with the Coast Guard and develop reporting system for VMS vigilance in collaboration with AFRC	To enforce laws and regulations for a good management of fisheries resources	<ol style="list-style-type: none"> <li>1. Prepare policy paper and implementation plan for approval by the MOF.</li> <li>2. Capacity building for staff.</li> </ol>	15 million per annum	Continuous	MOF COAST GUARD
3	Stock assessment of existing fisheries and survey to determine resource potential carried out	To evaluate the level of fish stocks in the Mauritian waters	<ol style="list-style-type: none"> <li>1. Catch assessment surveys and Stock assessment surveys</li> </ol>	20 million	2013/2014	MOF
4.	New organigram proposed and implemented and scientists trained climate change adaptation	HR Study for needs and placements	<ol style="list-style-type: none"> <li>2. Contract awarded and report produced</li> </ol>	2 million	2013/14	MOF and concerned stakeholders

SUPPORT TO PROGRAMME 2: INSTITUTIONS STRENGTHENING						
Goal: To ensure that fisheries administrators can efficiently implement defined strategies						
SN	Project	Goals & Objectives	Implementations Strategies and Activities	Estimated Costs in MUR	Project Duration	
	Capacity building in conjunction with FITEC/HRDC started					
1	<p>Provide Specialized Skills required to effectively administer the fisheries sector in an efficient and cost effective manner by the Fisheries administration taking into account climate change activities adaptation</p> <p>Purchase additional equipment/boats to better serve the industry in view of climate change adaptation</p> <p>Computerization the Ministry for efficiency</p>	To improve efficiency in the management and control of fisheries activities	<ol style="list-style-type: none"> <li>Local and Overseas training</li> <li>Purchase of equipment/boats and computers</li> </ol>	50 M	2013/20	MOF
2.	<p>Encourage fishers to embark on aquaculture projects through training &amp; technical support</p> <p>Business Plans for integrated aquaculture completed and stakeholder identified</p>	<p>Development of an aquaculture industry.</p> <p>Attract fishers from the capture fisheries to fish farming</p>	<ol style="list-style-type: none"> <li>Increase area under aquaculture.</li> <li>Assess the number of registered fishers who have moved from lagoons.</li> </ol>	1,5 M	2013/15	MOF
3	Implement a comprehensive training programme	To build capacity for an efficient management sector	<ol style="list-style-type: none"> <li>Implement short courses for managers/stakeholders/ fishers</li> <li>Development of appropriate training modules to upgrade staff skills ( computer management administration and decision making)</li> </ol>	2.9 M	2014 onwards	MOF



4.	Ensure that stakeholders have been consulted on regular basis on policy design and implementation	Encourage participatory approach in management of fisheries sector	1. Develop a schedule for quarterly meetings of advisory groups 2. Monitor work groups and develop modus operandi.	0.5 M per year	2013/14 continuous	MOF
<b>SUPPORT TO PROGRAMME 3: INFRASTRUCTURE</b>						
<b>Goal :To improve on shore/landing facilities in Mauritius</b>						
<b>SN</b>	<b>Project</b>	<b>Goals &amp; Objectives</b>	<b>Implementations Strategies and Activities</b>	<b>Estimated Costs in MUR</b>	<b>Project Duration</b>	
1	Construction of a modern quay space, in anticipation of sea level rise	To assist the fishers to adapt to climate change impact	Construction of elevated embankments	50.0 M	2013/2020	MOF
<b>SUPPORT TO PROGRAMME 4: Aquaculture</b>						
<b>Goal: To develop aquaculture activities in Mauritius</b>						
<b>SN</b>	<b>Project</b>	<b>Goals &amp; Objectives</b>	<b>Implementations Strategies and Activities</b>	<b>Estimated Costs in MUR</b>	<b>Project Duration</b>	
1.	Provide assistance to fish farmers to start aquaculture projects with emphasis on highly marketable species as seaweed sea cucumber Oysters and Kono Kono  Hire a consultant for transfer of technology for aquaculture of new species as appropriate	To decrease pressure in the lagoon and provide for an alternative/complementary income generating activity for fishers through aquaculture projects  Consultant to assist in propagation of sea cucumber Delineate specific ecosystem area for specific species of fish	1. Carry out preliminary survey and identify sites 2. Seek collaboration of MRC/AFRC 3. Consultation/explanation with stakeholders 4. Provide technical assistance to interested parties 5. Sale of larva and fingerlings 6. Development of market with farm gate prices consistent with the cost of production and quality of product consistent with health conditions 7. Recruit and train required personnel 8. Delimit sea area as per consultant recommendations (SRM study) implement project	12.0 M        8 M	2013/2020	MOF

Support to programme 5: Conservation of the Marine Environment						
Goal: To ensure that the marine environment is efficiently managed and sustainably exploited						
SN	Project	Goals & Objective	Implementation strategies Activities	Estimated costs in MUR	Project Duration	
1	Carry out an audit of fish resources, corals, sea weeds and mangroves ecosystems to ensure their preservation and conservation	Long term conservation of the marine resources and ecosystem	Collaborate with Shoals Mauritius/other NGOs and implement project Sensitization programme for the general public Publication of posters/guides lines/brochures etc	4.5 million	2013/2014	MOF
2	Revisit existing legislature and promulgate new regulation to protect the marine environment	To better protect and conserve the biodiversity of Mauritius	Appraisal of the existing laws relating to fisheries and the marine environment and propose new regulation in line with RRA policy	6.0 million	2013/2014	MOF
3	Capacity building for the effective protection and conservation of the marine environment	To ensure sustainability of the marine environment	Training of staff and non-state actors for the monitoring of the ecosystems	4.0 million	2013/2014	MOF
4	Promote ecotourism	To promote coral ecosystem and other biodiversity as a unique asset of Mauritius	Train divers to promote ecotourism Production of information materials Promote cottage industries linked to ecotourism	9.0 million	2013/2014	MOF

Tourism Sector								
Programme	Project description	Project objective(s)	Specific objectives	Implementation strategies /activities	Expected Results	Estimated cost (US\$)	Implementation period	Status
<b>Training and capacity building on climate change in the tourism sector</b>	Development and strengthening of personal skills, expertise, relevant institutions and organizations so as to not only reduce GHG emissions but also reduce vulnerability to climate change related impacts. Target Tour operators, Tour Guides, Skippers, and Scuba Divers.	To raise awareness and build capacity of ministry staff, to effectively respond to and integrate climate change adaptation and mitigation into relevant existing and future programs to contribute to long term sustainable development of Mauritius	Development and strengthening of skills and expertise  To raise awareness among ministry of tourism and related staff	Organizing of short courses for staff  Organization of demonstrations on climate change  Development of climate change websites and information networks  Publication of climate change newsletters, radio and TV programmes	E-bulletin available on the Climate Change Information Centre website for all subscribers,  2 quarterly Newsletters, in digital form, uploaded to the Climate Change Information Centre website, will be sent to members of the 2 networks and other stakeholders.  Newsletter printed (500 copies/each) and sent to partners of the 2 networks' members	215,000	Short Term	To be started by 2013
<b>Climate Change Awareness</b>	Creation of climate change awareness amongst local communities	To mitigate and adapt to climate change through Education	To disseminate climate change information through media To use other methods such as administrators to create awareness in their meetings	Climate change information published in the media  Government administrators to create climate change awareness	Publishing climate change information on newspapers, reports and newsletters	60,000	Medium Term	To be started by December 2012

<b>Management of Beach Erosion</b>	Monitoring of Beach Erosion	Enhance modalities of beach erosion monitoring	with communities Identify ways of controlling more intense beach erosion	Identify more coastal sites prone to erosion	Reduced beach erosion	1,250,000	Long Term	Beach Authority and other stakeholders
<b>Management of Sand Movement and Accumulation</b>	Monitoring of Sand Movement and Accumulation	Enhance modalities of monitoring sand movement and accumulation	Identify ways of controlling sand movement and accumulation	Identify sites prone to this phenomena Install suitable devices for monitoring	Controlled sand movements	950,000	Long Term	Beach Authority and other stakeholders
<b>Reduction of Coral Reef Bleaching</b>	Development of the Coral Bleaching Response Plan	Evaluate the implications of bleaching events for tourism management policy and strategies	Identify more sites prone to bleaching	Identify sites prone to this phenomena Install suitable devices for monitoring	Reduce economic shocks from tourism sector	500,000	Long Term	Ministry of Fisheries and other stakeholders
<b>Water Supply Enhancement</b>	Addressing water shortage for accommodation providers	Initiating water harvesting, conservation and sustainability programmes	sustainability planning	small-scale infrastructure improvements water conservation	Minimize water shortage Rationalize water utilization	750,000	Long Term	Water Development Department
<b>Tropical storms and Extreme Events Damage Control</b>	Addressing extreme wind events (cyclones) and storm surges	To prevent damage from storm surges and sea-level rise	To minimize structural damage and shoreline erosion.	Adopt more sophisticated warning devices	Disaster preparedness	350,000	Long Term	Ministry of Environment and Sustainable Development and other stakeholders
<b>Carbon Credit Offsets</b>	Marketing low-carbon holiday packages and carbon labeling and journeys. Developing attractive low-carbon packages. Offering high	Enhance carbon credit offsetting mechanisms	Develop credit offsetting mechanisms such as carbon sinks, carbon credits	Selling low-carbon holiday packages	Reduced carbon emissions	980,000	Long Term	Ministry of Environment and Sustainable Development and other stakeholders



Water Sector							
Project	Description	Project Objectives	Specific Objectives	Implementation Strategy/Activities	Estimated Budget	Implementation Period	Remarks
<b>Project 1: Rehabilitation of Present Water Systems</b>	Construction of a workshop to repair pumps, chlorinators, meters, etc Replacement of galvanized iron pipes by laying HDPE pipes underground	To improve the distribution system, including construction of new main trunks rationalized. To increase water production and efficient delivery of supply services	1. To repair boreholes 2. To desilt dams and rehabilitate their catchment 3. To repair existing desalination plants	Contract most of the work; Install flow meters, carry out repairs, improve distribution network. Repair/replace old pipes; install meters; standardize tools and equipment.	USD. 25.2 million	5 years	Sustainable funding essential.  Capacity of CFW increased to ensure efficient delivery.
<b>Project 2: Policy reviews, legislative reforms and coordination of the water sector by the Regional Assembly, including new water governance</b>	To create an enabling environment for effective and efficient water governance in Rodrigues	To create a suitable environment for sustainable water management	1. Revise existing policies, strategies, plans, laws related to water resource management completed. 2. Prepare tools and instruments to climate-	RRA support and stakeholders' involvement essential. Consultancy studies, preparation of policy briefs and tool kits; participation by stakeholders.	USD. 33,000	3 years	RRA to provide leadership; Cross sector cooperation essential for success.

<b>structure</b>										
<b>Project 3: Establishment of the Water Sector Reforms Secretariat and Steering Committee</b>	Ensure that water resources are sustainably managed and conserved for all uses.	Create an integrated and sustainable water resources management	proof sectoral and national policies developed and implemented	Establish Secretariat; Form multidisciplinary Steering Committee; Prepare a Reform programme, Carry out stakeholders' consultation	Establish the Secretariat, Thematic Committees, carry out wide consultation; Consultancy studies.	USD. 1.158 million	5 years	Political leadership essential.		
<b>Project 6: Rain water harvesting for domestic and supplemental agriculture</b>	Increasing water stock.	Increase water stock by tapping on rainwater.				USD. 450,000	5 years	Rainwater Harvesting Assoc. very useful in mobilization and technology transfer.		
<b>Programme 7: Water resources assessment including Data acquisition, Database development,</b>	Water resources assessment will determine the quantity and quality of water resources now and in the future noting the					USD. 330,000		Linkages with Meteorological Services, Marine Institute, Oceanographic Institute, Water, National Security		

Research and Information and Meteorological Services	impacts of climate change							
<b>Project 7: Capacity Building</b>	Capacity of water and water related institutions, stakeholders will be built to bridge the gaps in water services (uses) and water management (policies, laws and regulation).						USD. 126,000	5 years
<b>Project 8: Water for Domestic and Food Production</b>	Traditional uses of water for kitchen gardens exist and may need to be strengthened. Water for food production gives additional value to water.						USD. 140,000	5 years
<b>Project 9: Watershed and Coastal management</b>	Water has been diminishing, partly because of decrease in cover	Increase tree planting, preserve catchments, ensure	Identify and map vulnerable areas; Survey areas for legal protection; replace high water				USD. 580,000	7 years
								Linkages with forestry, environment, water, fisheries Agriculture, Lands, Ecotourism and Attorney General's



<p><b>Project 11:</b>  <b>Flood risk management, risk reduction and the role of insurance</b></p>	<p>is prone to climate related disasters. The programme minimizes impact of disaster, increases resilience</p>	<p>protection</p>		<p>consuming trees; develop planting programme.</p>	<p>USD. 9,000</p>	<p>5 years</p>	<p>Office.                  Linkages with Meteorological Services, Marine Institute, Oceanographic Institute, Water, National Security</p>
<p><b>Project 12:</b>  <b>Project Management Cost including Monitoring and Evaluation</b></p>	<p>Programme coordination;                  Set up a monitoring protocol                  Midterm and end programmer evaluation</p>				<p>USD. 2.0 million</p>	<p>7 years</p>	

## APPENDIX II: LOGICAL FRAMEWORK

Logical framework refers to a matrix with both a vertical logic as a hierarchy of objectives – *activities* delivering *outputs*, which help bring about the overall *goal*; and a horizontal logic showing how progress against each objective can be assessed (indicators and means of verification) and the external factors (assumptions and risks) which might affect whether the reaching of the objectives contributes to the next level. The logical framework plays a role in each phase of the project cycle, from planning to implementation to evaluation. It is a master tool for creating other tools, such as the breakdown of responsibilities, the implementation timetable, the detailed budget, and the monitoring plan. It becomes an instrument for managing each stage of the project, and is updated regularly.

**Table A2: Mauritius Agricultural sector Summary Logical Framework, October 2012**

Agriculture sector				Responsibility
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	
<b>Project 1 : Training and capacity building on climate change in the agricultural sector</b>				
<b>General Objective;</b> To raise awareness and build capacity of Ministry of Agro-Industry and Food Security and related staff, to effectively respond to and integrate climate change adaptation and mitigation into relevant existing and future programs for long term sustainable development of Mauritius				
1. At least 10% of staff and other stakeholders trained during the 1 <sup>st</sup> year of project initiation.	1. Monitoring and evaluation report produced.	1. Lack of cooperation from the targeted groups.	1. Ministry of Agro-Industry and Food Security and its para-statal bodies	
2. Publication series related to climate change adaptation	2. Annual Report of Ministry of Agro-Industry and Food Security	2. Delayed disbursement of funds		
		3. Availability of appropriate resource person		
<b>Specific Objectives:</b>				
1. To impart skills (including socio economic assessment on climate change adaptation options) among the tagged staff	1. At least 10% of the targeted staff able to demonstrate climate change adaptation skills	1. Availability of project reports on the number of staff with Monitoring and evaluation reports	1. Lack of coordination between staff and institutions	Ministry of Agro-Industry and Food Security and its parastatal bodies
2. To strengthen Agro-industries Institutions	2. Number of Climate change related adaptation equipment , materials bought/installed	2. Annual reports of Ministry of Agro Industry& Food Security	2. Delayed disbursement of funds	
	3. Number of staff trained in cc adaptation and mitigation strategies		3. Lack of commitment	
			4. Inadequate number of resource persons providing training and	

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility
To create awareness on climate change impacts and risks	1. At least 10% of the targeted staff demonstrating knowledge of climate change impacts and risks to stakeholders	1. External evaluation reports on climate change impacts and risks awareness by the targeted staff	1. Timely training of the trainers 2. Untimely Disbursement of needed funds.	Ministry of Agro-Industry and Food Security and its parastatal bodies
<b>General objective Output</b> 1. Number of staff trained 2. E-bulletin available on the CLIMATE INFORMATION CENTRE website, for all subscribers, 3. Ten (10) quarterly Newsletters, in digital form, uploaded to the CLIMATE INFORMATION CENTRE website, will be sent to members of the 2 networks and other stakeholders. Newsletter printed(500 copies/each and sent to partners of the 2 networks' members	1. At least 10% of the targeted staff trained by the end of first year of project initiation. 2. E-bulletin accessible on the CLIMATE INFORMATION CENTRE website. 3. Production of ten quarterly newsletters in digital form by the end of the first year	Project reports and external monitoring and evaluation output	Availability of funds Availability of expertise on training, establishment of e-bulletins and quarterly newsletters.	Ministry of Agro-Industry and Food Security and its parastatal bodies
<b>Specific objective 1-Output</b> <b>Number of staff acquiring climate change adaptation skills</b>	At least 10% of the targeted demonstrating skills on climate change adaptation by end of first year of project initiation	Monitoring and evaluation reports External evaluation reports, Project reports	Availability of funds Availability of resource persons	Ministry of Agro-Industry and Food Security and its parastatal bodies
<b>Activities</b> 1. Organization of short courses for staff 2. Organization of demonstrations on climate change 3. Development of climate change websites and information networks	1. At least 5 courses organized on climate change by end of first year of the project 2. At least 5 demonstrations on climate change organized within the first year of project initiation. 3. At least 2 websites and	Project reports, Monitoring and evaluation reports, External evaluation reports	Availability of funds and resource persons Cooperation from the targeted groups	Ministry of Agro-Industry and Food Security and its parastatal bodies

Agriculture sector			
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption
4. Publication of climate change newsletters, radio and TV Projects 5. Development of climate change curricular in schools, colleges and universities	information networks established by end of year 1 of project implementation. 4. At least 5 newsletter publications produced by end of first year of project. 5. At least 2 climate change curricular produced per institution over the first year of the project		
<b>Project 2: Research and Technology development, crop production and Food Security</b>			
<b>General objective:</b> To increase crop production by introducing high yielding heat and drought varieties and tolerate to pest and disease as well			
<b>Specific Objectives</b> 1. Introduce varieties adapted to changing climate scenarios 2. Initiate a breeding programme for heat and drought tolerant varieties 3. To recommend water conserving practices such as mulching, crop rotation intercropping, greenhouse production 4. Promote minimum tillage to reduce evaporation of water from the soil. 5. Introduce short cycle crop varieties 6. Investigate various N fixing techniques 7. Promote IPM	1. At least 2 suitable varieties identified for recommendation  1. At least 2 heat tolerant varieties identified for recommendation 2. At least develop one or two heat and drought tolerant varieties and the breeding to start in the first year. 3. At least 4 water conserving technologies introduced by the end of first year of project initiation. 4. At least two minimum tillage technique introduced by the end of first year of the project. 5. At least 3 short cycle crops introduced by the end of first year of the project. 6. At least 3 IPM projects	1. Project reports, 2. Monitoring and evaluation reports, 3. External evaluation  Project reports, Annual reports from AREU	1. Ministry of Agro-Industry and Food Security and its parastatal bodies  Ministry of Agro-Industry and Food Security and its parastatal bodies

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility
8. Need bio-products for pest and disease control and and bio fertilizers	<p>implemented</p> <p>7. At least 3 Nitrogen efficient methods introduced by end of first year of project initiation.</p> <p>8. At least 5 % increase in agricultural production by the end of first year of project implementation/initiation.</p> <p>9. At least 5% reduction in climate change vulnerability by end of first year of project initiation</p>	Means of verification		
<p><b>Output</b></p> <p>1. Climate change adapted cultivars introduced and bred</p> <p>2. High crop yields realized</p> <p>3. Optimum agronomic practices introduced and disseminated</p> <p>4. Reduced vulnerability to climate change</p> <p><b>Activities</b></p> <p>1. Introduction and testing of drought tolerant cultivars(</p> <p>2. Introduction and testing of heat tolerant cultivars</p> <p>3. Breeding for heat and drought tolerant crop varieties</p> <p>4. Multiplication and distribution of adapted cultivars to farmers</p> <p>5. Introduction and testing of agronomic practices</p> <p>6. Experiments on N fixation and adaptation trials</p> <p>7. Evaluation of IPM in crop</p>	<p>1. At least 5 climate change adapted varieties introduced and tested.</p> <p>2. At least 5 % increase in crop yield sustained</p> <p>3. At least 10 new improved practices recommended</p> <p>1. At least 2 drought resistant cultivars introduced and recommended</p> <p>2. At least 2 heat tolerant cultivars introduced and recommended.</p> <p>3. At least 2 heat and drought tolerant varieties bred and breeding started by end of first year</p> <p>4. At least 2 adapted cultivars distributed to farmers by end project</p> <p>5. At least 5 agronomic practices</p>	<p>Project reports, Annual reports of AREU</p> <p>Project reports, AREU reports</p>	<p>Availability of qualified and experienced staff. Continued funding Availability of lands and other related inputs for research</p> <p>Availability of facilities for research work to be implemented</p>	<p>Ministry of Agro-Industry and Food Security and its parastatal bodies</p> <p>Ministry of Agro-Industry and Food Security and its parastatal bodies</p>

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility
<p>production (experts to reflect text for capacity building for all stakeholders)</p> <p><b>8.</b> On farm demonstration of adaptation technologies (</p> <p><b>Project 3: Climate Change Awareness</b></p> <p>General Objective: To mitigate and adapt to climate change through awareness campaign</p> <p><b>Specific Objectives</b></p> <ol style="list-style-type: none"> <li>To disseminate climate change information through media</li> <li>To create awareness of climate change by developing curricular in schools, colleges and university</li> <li>To use other methods such as administrators to create awareness in their meetings with communities</li> <li>To develop short courses on climate change</li> </ol>	<p>introduced by end of the project.</p> <ol style="list-style-type: none"> <li>At least 20% of the targeted groups educated on climate change adaptation by the end of first year of the project initiation</li> <li>At least 10% of the targeted groups are reached by each of TV, radio and print media respectively by the end of first year of project initiation.</li> <li>Climate change adaptation curricular developed each by schools, colleges and universities respectively by the end of first year of the project initiation.</li> <li>At least 10% of the targeted groups educated by the Government administrators about climate change adaptation by end of first year of project.</li> <li>At least 5 short courses developed on climate change adaptation by end of first year of project.</li> <li>At least 5 magazines and newsletters produced on</li> </ol>	<ol style="list-style-type: none"> <li>Project reports</li> <li>CCIC websites</li> <li>CC information networks and sites</li> <li>Climate change newsletters</li> <li>Project reports</li> <li>Monitoring &amp; evaluation reports</li> <li>CCIC websites</li> <li>Ministry of Environment &amp; Sustainable development reports</li> </ol>	<ol style="list-style-type: none"> <li>Willingness of targeted groups to be trained.</li> </ol>	<ol style="list-style-type: none"> <li>Ministry of Agro-Industry and Food Security and its parastatal bodies and Ministry of Environment &amp; Sustainable Development</li> <li>Ministry of Agro-Industry and Food Security and its parastatal bodies</li> </ol>
<p>Output</p> <ol style="list-style-type: none"> <li>Climate change information</li> </ol>	<ol style="list-style-type: none"> <li>At least 5 magazines and newsletters produced on</li> </ol>	Ministry of Environment &		Ministry of Agro-Industry and Food Security and its parastatal

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility bodies
<p>published in the media</p> <ol style="list-style-type: none"> <li>Curricula on climate change developed from elementary to tertiary institutions</li> <li>Government administrators used to create climate change awareness</li> </ol> <p>Activities</p> <ol style="list-style-type: none"> <li>Publishing climate change information on newspapers, reports and newsletters)</li> <li>Developing curricula on short courses in colleges and universities</li> <li>Developing curricula on climate change at certificate, diploma, degree levels up to doctorates)</li> </ol>	<ol style="list-style-type: none"> <li>climate change adaptation by the end of first year of project initiation.</li> <li>Curricular developed per school, college and university by end of first year of project initiation</li> </ol> <ol style="list-style-type: none"> <li>At least 5 magazines and newsletters produced on climate change adaptation by the end of first year of project initiation.</li> <li>At least 2 climate change adaptation short courses developed each for schools, colleges &amp; universities by end of first year of the project initiation.</li> <li>curricular developed each for certificate ,diploma, bachelor, masters and Doctorate by the end of project</li> </ol>	<p>Sustainable Development reports Project reports</p> <p>Project reports Universities' catalogues Ministry of Environment &amp; Sustainable development reports CCIC websites CC information networks</p>		<p>Ministry of Agro-Industry and Food Security and its parastatal bodies and Ministry of Environment &amp; Sustainable Development</p>
<b>Project 4: Soil and Water Conservation</b>				
<p><b>General Objective</b></p> <p>To apply appropriate soil and water conservation techniques for optimum environmental management</p>	<ol style="list-style-type: none"> <li>At least 2 soil conservation technologies introduced by the end of first year of project initiation.</li> <li>At least 3 water conservation technologies introduced by end of first year of the project initiation.</li> <li>At least 2 soil management techniques promoted by the end of first year of project initiation</li> </ol>	<ol style="list-style-type: none"> <li>Ministry of Agro-industry Food security reports</li> <li>Ministry of Environment Sustainable development reports.</li> <li>Ministry of Agro-industry security reports</li> <li>Ministry of Food security reports</li> </ol>	<p>Continued funding Availability of qualified and experienced staff</p>	<p>Ministry of Agro-Industry and Food Security and its parastatal bodies</p>
<p><b>Specific Objective</b></p> <ol style="list-style-type: none"> <li>Create awareness of appropriate soil management practices</li> </ol>				<ol style="list-style-type: none"> <li>Ministry of Agro-Industry and Food Security and its parastatal bodies.</li> </ol>

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility
<ol style="list-style-type: none"> <li>2. Promote rainwater harvesting</li> <li>3. Introduce appropriate farming practices which optimize environmental conservation</li> <li>4. Protect water catchment areas by planting trees</li> <li>5. Introduce tree species which do not consume too much water</li> </ol>	<ol style="list-style-type: none"> <li>2. At least 3 water conserving technologies introduced by the end of first year of project initiation</li> <li>3. At least 3 appropriate farming practices introduced by the end of first year of project initiation</li> <li>4. At least 2 water catchment areas protected by the end of first year of the project</li> <li>5. At least 5 forest trees introduced by the end of first year of the project</li> </ol>	<ol style="list-style-type: none"> <li>Environment Sustainable development reports.</li> <li>3. Ministry of Agro-Food industry security</li> <li>4. Forest service reports</li> <li>5. Ministry of Environment Sustainable development reports</li> <li>6. Project reports</li> <li>7. Forest Service reports</li> </ol>		
<p><b>Output</b></p> <ol style="list-style-type: none"> <li>1. Increased crop productivity</li> <li>2. Reduced soil erosion</li> <li>3. Reduced climate change impacts</li> <li>4. Improved food security</li> </ol>	<ol style="list-style-type: none"> <li>1. At least 10% yield increase per input of fertilizer applied by the end of first year of project.</li> <li>2. At least 20% Reduction of soil erosion by the end of first year of project initiation</li> <li>3. At least 20% reduction in climate change impacts by end of first year of project initiation.</li> <li>4. At least 20% increase in food security</li> </ol>	<ol style="list-style-type: none"> <li>1. Ministry of Agro-Industry &amp; Food security reports</li> <li>2. Ministry of Environment &amp; Food security reports.</li> <li>3. Project reports</li> <li>4. Central Statistical Office Reports.</li> </ol>		Ministry of Agro-Industry and Food Security and its parastatal bodies
<p><b>Activities</b></p> <p>Education of targeted groups on soil&amp; water conservation</p> <p>Demonstration of soil and water</p>	<ol style="list-style-type: none"> <li>1. At least 10% of targeted groups educated on soil&amp; water conservation by end of first year of project</li> <li>2. At least 3 demonstration</li> </ol>			Ministry of Agro-Industry and Food Security and its parastatal bodies



Agriculture sector			
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption
Responsibility			
plots established by end of first year project initiation Measures(US 20,000D)			
<b>Project 5: The Forest Development Plan</b>			
<b>General Objective</b>			
To increase the forest cover of Mauritius as a way of mitigating climate change )	1. Increase forest cover by 1% by the end of first year of the project initiation	1. Forest service reports 2. Project reports	Ministry of Agro-Industry and Food Security and its parastatal bodies
<b>Specific Objectives</b>			
1. To reduce GHG emission	1. At least 5% reduction in GHG emissions by the end of first year	1. Project reports 2. Ministry of Environment & Sustainable development	1. Lead institution: Ministry of Agro-Industry and Food Security and its parastatal bodies
2. To enhance C sequestration	2.Reduce climate change impacts by 10%	3. Forest service reports	2. Line Ministries: Ministry of Environment & SD, CSO
3. To reduce climate change impacts	3. Reduce soil erosion by at least10 % by end of first year of project initiation	4. Ministry of Environment&sustainable development	
4. To prevent soil erosion	4. Awareness on planting trees created on at least 10% of the targeted groups by end first year of project initiation.		
5. To encourage tree planting in order to prevent soil erosion			
<b>Output /Immediate Results</b>			
1. Awareness created on tree planting and management in schools, colleges and communities	1. Awareness created on 10 % of targeted groups by end of first year of project initiation	1. Project report 2. Forest service reports	Ministry of Agro-Industry and Food Security and its parastatal bodies
2. Reduction of climate change impacts	2. Climate change impacts reduced by 10% by end first year of project initiation.	3. Ministry of Environment &sustainable development reports	
3. Forest cover increased	3. Forest cover increased by 30% by end of project		
<b>Activities</b>			
1. Introduction of tree species with high carbon sequestration ability through research	1. At least 5 tree species introduced by end of first year of project initiation, with high carbon sequestration ability.	1. Project reports 2. Forest service reports	Ministry of Agro-Industry and Food Security and its parastatal bodies
2. On farm demonstrations of tree planting and management and demonstration in schools and	2. At least 5 demonstrations	3. Ministry of Environment &sustainable development reports	

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility
<p>colleges</p> <p>3. Measuring of impacts of trees on climate change parameters and soil erosion by research staff</p> <p>4. Production of newsletters, radio and TV programs on tree planting and management</p> <p>5. Introduction and purchase of tree seedlings</p>	<p>established by end of first year of project initiation.</p> <p>3. Research concluded on impacts of climate change concluded on at least</p> <p>4. 5 tree species by end of first year of project initiation.</p> <p>5. Production of 2 newsletters, 2 radio programs and 2 TV programs by end of first year of project initiation.</p> <p>6. Introduction &amp; purchase of at least 50,000 forest tree seedlings by end of first year of project initiation</p>	<p>4. Project reports</p> <p>5. Forest service reports</p>		
<b>Project 6 : Research and Technology development for livestock production and food security</b>				
<b>General Objective</b>				
<p>1. Increase livestock production through R&amp;D</p> <p>2. To increase livestock production (expert to reflect recommendation throughout action plan and logical framework)</p>	<p>1. Livestock increased by at least 10 % by end of first year of project initiation.</p>	<p>1. Ministry of Agro _industry &amp; Food security reports</p> <p>2. Project reports</p>		<p>1. Ministry of Agro-Industry and Food Security and its parastatal bodies</p>
<b>Specific objectives</b>				
<p>1. Breed for high performing livestock</p> <p>2. Breed for earliness in crop maturity</p> <p>3. Investigate fodder agronomy, livestock nutrition and fodder conservation</p> <p>4. Introduction of animal breeds and access their adaptation in</p>	<p>1. At least 2 livestock breeds selected for breeding for adaptation in our local conditions by the end of first year</p> <p>2. At least 10 trials conducted on forage agronomy, livestock nutrition &amp; fodder conservation by end of first year of project initiation.</p>	<p>Project reports, AREU reports</p>	<p>Introduction of superior livestock breed</p>	

Agriculture sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsibility
Mauritius				
Output/intermediate				
1. Superior livestock breeds introduced, 2. livestock feeds developed	1. At least 2 superior livestock breeds selected for breeding by end of first year.	Project reports AREU reports Ministry of Agro-Industry reports		Ministry of Agro-Industry and Food Security and its parastatal bodies
<b>Activities</b>				
1. Livestock breed introduction and selection 2. Livestock feed experiments 3. Fodder conservation 4. Vaccine development	2. At least 5 livestock breeds introduced for adaptation in our local condition and for breeding programme by end first year	AREU reports Ministry of Agro-Industry & Food security reports Project reports	Ability to introduce livestock breeds from abroad	Ministry of Agro-Industry and Food Security and its parastatal bodies

Fisheries Sector			
Narrative summary Activity Description	Indicators of Achievements (OVIs)	Monitoring and Evaluation	Risks and Assumptions
<p><b>Programme 1 Resource Evaluation</b></p> <ul style="list-style-type: none"> <li>Stock assessment of existing fisheries and survey to determine resource potential carried out</li> <li>New organigram proposed and implemented and scientists trained climate change adaptation</li> <li>Capacity building in conjunction with FITEC/HRDC started</li> </ul>	<p><b>Short /Long Term Implementation</b> Objective is increasing knowledge on the resource and aquatic ecosystems</p> <ul style="list-style-type: none"> <li>Survey to be completed Implementation by March 2014</li> <li>New staff recruited and over 50% of staff retrained on climate change issues and fisheries management</li> <li>MoU with HRDC with respect to training signed</li> </ul>	<ul style="list-style-type: none"> <li>Survey Report submitted</li> <li>Capacity building undertaken and report submitted</li> <li>Training in line with Training Needs Assessment. Training carried and a report produced</li> <li>Training report submitted and MoU signed</li> </ul>	<ul style="list-style-type: none"> <li>Rational fisheries exploitation requires knowledge of fish stocks.</li> <li>Lack of Funds</li> <li>Lack of commitment</li> <li>MoF support</li> <li>Delay in recruitment</li> <li>Delay in application of new organigram</li> </ul>
<p><b>Programme 2.: Fisheries management</b> Short /Long Term Implementation ten years duration Objective is fisheries management resources at sustainable levels</p>			
<ul style="list-style-type: none"> <li>Fisheries management plans and their implementation for the major five fisheries (5 years FMP) prepared in collaboration with AFRC/Consultants.</li> <li>Management of Lagoon fisheries improved by 2017 ensuring sustainability of resource</li> <li>Continued training of fisherman for fishing on FAD to decrease pressure from the lagoon</li> <li>Legislation for regulating the amateur fisherman</li> </ul>	<p><b>Short /Long Term Implementation</b> ten years duration</p> <ul style="list-style-type: none"> <li>Major management plans produced for all major fisheries by March. 2013. Management Plan for Bank Fisheries is Ready, Management plan for other fisheries will follow</li> <li>Number of measures taken and reduction in number of registered fishermen</li> <li>Number of measures taken and reduction in the number of licence/ permits given to ensure improvement of lagoons in line with resource management</li> <li>Illegal fishing reduced.</li> <li>Appropriate control operation and report method devised</li> <li>Number of fisherman trained</li> <li>Legislation devised</li> </ul>	<ul style="list-style-type: none"> <li>Production of management plans</li> <li>Management plan published</li> <li>Publication of report</li> <li>Number of fisherman who have moved out of the lagoon</li> <li>Legislation in place</li> </ul>	<ul style="list-style-type: none"> <li>Lack of capacity and funding</li> <li>MOF Support</li> <li>Delay in devising appropriate reporting system</li> <li>Delay due to prioritization of projects</li> <li>resistance from fisherman</li> <li>Loss of FADs</li> <li>Lack of funds</li> <li>Lack of enforcement personnel</li> <li>Amendments brought to legislations not approved</li> <li>Resistance from amateur fisherman</li> </ul>
<p><b>Programme 3: Institutional Strengthening</b> Short term implementation (2-3 years) Objective is institutional &amp; human resource for fisheries management and development.</p>			
<ul style="list-style-type: none"> <li>Provision of Specialized Skills required to effectively manage the fisheries sector in</li> </ul>	<ul style="list-style-type: none"> <li>Number of training courses held and</li> </ul>	<ul style="list-style-type: none"> <li>Training courses prepared and</li> </ul>	<ul style="list-style-type: none"> <li>Lack of funding</li> <li>Interest of stakeholders not</li> </ul>

<p>an efficient and cost effective manner by the Fisheries administration taking into account climate change activities adaptation</p> <ul style="list-style-type: none"> <li>• Additional equipment/boats purchased to better serve the industry in view of climate change adaptation</li> <li>• Computerization for efficiency in the Ministry</li> <li>• A comprehensive training linked to Climate Change for fishers and stakeholders designed and implemented. Stakeholders consulted on proposed policy and legislation implementation</li> </ul>	<p>skill evaluations done within 5 years</p> <ul style="list-style-type: none"> <li>• Number of computers with desired software and other equipment purchased within five years</li> <li>• Training designed and implemented</li> </ul>	<p>imparted</p> <ul style="list-style-type: none"> <li>• Procurement finalized</li> <li>• Training courses designed and imparted</li> <li>• Regular meetings held</li> </ul>	<p>compatible</p>
<p><b>Programme 4: Infrastructure Development</b>    <b>Medium / Long Term -5-10 years Objective is to minimize post-harvest losses</b></p>			
<ul style="list-style-type: none"> <li>• Construct modern quay with specification to endure Sea Level Rise and other impacts of Climate Change for semi industrial fishing boats along with cold/chilled facilities constructed in anticipation of rise in temperatures</li> <li>• Improve Landing sites for artisanal fishermen to accommodate sea level rise</li> </ul>	<ul style="list-style-type: none"> <li>• Number of cold stores and chill room constructed with properly raised embankments</li> <li>• 2 Fully equipped landing sites constructed</li> </ul>	<ul style="list-style-type: none"> <li>• Infrastructure plans finalized</li> <li>• Construction plans ready</li> </ul>	<ul style="list-style-type: none"> <li>• MOF support</li> <li>• Lack of funds</li> </ul>
<p><b>Programme 5: Aquaculture Development</b>    <b>Short Term (2-5) years Objective Mariculture development and alternative to livelihood</b></p>			
<ul style="list-style-type: none"> <li>• Promote aquaculture programmes to ease pressure from the lagoon fisheries</li> <li>• Business Plans for integrated aquaculture completed and stakeholder identified</li> <li>• Introduce commercial aquaculture</li> </ul>	<ul style="list-style-type: none"> <li>• Offer technical advice Facilities provided</li> <li>• Preliminary studies completed</li> </ul>	<ul style="list-style-type: none"> <li>• Reports made available Facilities surveyed and business plans of the project done</li> </ul>	<ul style="list-style-type: none"> <li>• MOF to take decision</li> <li>• Lack of funding,</li> <li>• Environmental impact</li> <li>• Lack of technical know how</li> </ul>
<p><b>Programme 6: Conservation of marine environment with respect to climate change</b></p>			

<ul style="list-style-type: none"> <li>• Continue monitoring of coral reef and ecosystems (ongoing) to ensure their preservation and conservation.</li> <li>• Continue coral farming activities at different sites in the lagoon around Mauritius</li> <li>• Continue mangrove propagation at potential sites</li> <li>• Legislations reviewed to accommodate Climate Change issues</li> <li>• Capacity building for the effective protection and conservation of the environment including ecotourism have been provided to fisheries officers and all key stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Annual report published</li> <li>• Number of coral tables set at the different sites</li> <li>• Number of propagules planted at the different sites</li> <li>• Legislations revisited</li> <li>• Number of training courses held</li> <li>• Number o of sensitizations campaigns held and people sensitized</li> </ul>	<ul style="list-style-type: none"> <li>• Audit report submitted</li> <li>• Assessment of success rate</li> <li>• Assessment of success rate</li> <li>• Amended legislations in place</li> <li>• Training course designed/imparted</li> <li>• Sensitization campaign carried out</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of funds</li> <li>• Bad weather conditions</li> <li>• MOF Decision</li> <li>• Vandalism</li> <li>• Lack of enforcement personnel</li> <li>• Amendments brought to legislations not approved</li> <li>• Lack of interest from stakeholders</li> </ul>
---	---	--	--

Tourism sector				
Narrative summary	Objectively verifiable indicator	Means of verification	Risk and Assumption	Responsible Institution
<b>Programme 1 : Training and capacity building on climate change in the tourism sector</b>				
<p><b>General Objective;</b></p> <p>To raise awareness and build capacity of ministry of tourism and related staff, to effectively respond to and integrate climate change adaptation and mitigation into relevant existing and future programs for long term sustainable development of Mauritius</p> <p><b>Specific Objectives</b></p> <p><b>To impart skills on climate change adaptation among the targeted staff</b></p>	<p>At least 10% of staff trained during the 1<sup>st</sup> year of project initiation.</p> <p>At least five fliers series related to climate change adaptation</p>	<p>Monitoring and evaluation report produced.</p>	<ul style="list-style-type: none"> <li>Lack of cooperation from the targeted groups.</li> <li>Delayed disbursement of funds</li> <li>Lack of commitment</li> </ul>	<p>Ministry of Tourism and Leisure and other concerned stakeholders</p>
<p><b>To create awareness on climate change impacts and risks</b></p>	<p>At least 10% of the targeted staff able to demonstrate climate change adaptation skills</p>	<ul style="list-style-type: none"> <li>Availability of project reports on the number of staff with</li> <li>Monitoring and evaluation reports</li> <li>Annual reports of Ministry of Tourism</li> </ul>	<ul style="list-style-type: none"> <li>Lack of cooperation from targeted staff</li> <li>Delayed disbursement of funds</li> <li>Lack of commitment</li> <li>Inadequate number of resource persons providing training and capacity building.</li> </ul>	<p>Line Ministries Heads of Departments/Units/Sections</p>
<p><b>General objective Output</b></p> <ol style="list-style-type: none"> <li>Number of staff trained</li> <li>E-bulletin available on the CCIC website, for all subscribers,</li> <li>Five (5) quarterly Newsletters, in digital form, uploaded to the CCIC</li> </ol>	<p>At least 10% of the targeted staff demonstrating knowledge of climate change impacts and risks</p>	<p>External evaluation reports on climate change impacts and risks awareness by the targeted staff</p>	<ul style="list-style-type: none"> <li>Lack of cooperation from the targeted groups</li> <li>Lack of commitment</li> <li>Inadequate disbursement of needed funds.</li> </ul>	<p>Relevant Departments/Divisions within the Line Ministries</p>
	<ol style="list-style-type: none"> <li>At least 10% of the targeted staff trained by the end of first year of project initiation.</li> <li>E-bulletin accessible on the CCIC website.</li> </ol>	<p>Project reports and external monitoring and evaluation output</p>	<p>Availability of funds</p> <p>Availability of expertise on training, establishment of e-bulletins and quarterly newsletters.</p>	<p>Ministry of Tourism and Leisure and other concerned stakeholders</p>

<p>website, will be sent to members of the 2 networks and other stakeholders. Newsletter printed(250 copies/each and sent to partners of the 2 networks' members)</p> <p><b>Specific objective 1-Output</b> <b>Number of staff acquiring climate change adaptation skills</b></p>	<p>3. Production of ten quarterly newsletters in digital form by the end of the first year</p>	<p>Monitoring and evaluation reports External evaluation reports, Project reports</p>	<p>Availability of funds Availability of resource persons</p>	<p>Relevant Departments/Divisions within the Line Ministries</p>
<p><b>Activities</b></p> <p>6. Organizing of short courses for staff 7. Organization of demonstrations on climate change 8. Development of climate change websites and information networks 9. Publication of climate change newsletters, radio and TV Projects</p>	<p>At least 10% of the targeted demonstrating skills on climate change adaptation by end of first year of project initiation</p> <p>6. At least 3 courses organized on climate change by end of first year of the project</p> <p>7. At least 3 demonstrations on climate change organized within the first year of project initiation.</p> <p>8. At least 2 websites and information networks established by end of year 1 of project implementation.</p> <p>9. At least 3 newsletter publications produced by end of first year of project.</p>	<p>Project reports, Monitoring and evaluation reports, External evaluation reports</p>	<p>Availability of funds and resource persons Cooperation from the targeted groups</p>	<p>Relevant Departments/Divisions within the Line Ministries</p>
<p><b>Project 2: Climate Change Awareness</b></p>				
<p><b>General Objective:</b> To mitigate and adapt to climate change through Education</p>	<p>At least 20% of the targeted groups educated on climate change adaptation by the end of first year of the project initiation</p>	<p>Project reports CCIC websites CC information networks and sites Climate change newsletters</p>	<p>Willingness of targeted groups to be trained.</p>	<p>Ministry of Tourism and Leisure and other concerned stakeholders</p>
<p><b>Specific Objectives</b></p>	<p>1. At least 10% of the</p>	<p>Project reports</p>		<p>Relevant Departments/Divisions</p>



5. To disseminate climate change information through media	targeted groups are reached by each of TV, radio and print media respectively by the end of first year of project initiation.	Monitoring & evaluation reports CCIC websites Ministry of Environment & Sustainable development reports	within the Line Ministries
6. To create awareness of climate in the Tourism Sector	2. At least 10% of the targeted groups were sensitised by the Government officials about climate change adaptation by end of first year of project.		
7. To use other methods such as administrators to create awareness in their meetings with communities	At least 3 magazines and newsletters produced on climate change adaptation by the end of first year of project initiation.	Ministry of Environment & Sustainable Development reports Project reports	Relevant Departments/Divisions within the Line Ministries
8. To develop short courses on climate change	At least 3 magazines and newsletters produced on climate change adaptation by the end of first year of project initiation.	Project reports Universities' catalogues Ministry of Environment & Sustainable development reports CCIC websites CC information networks	Relevant Departments/Divisions within the Line Ministries
<b>Output</b>			
4. Climate change information published in the media			
5. Government administrators used to create climate change awareness			
<b>Activities</b>			
Publishing climate change information in newspapers, reports and newsletters			
<b>Programme 3: Management of Beach Erosion and Lagoon Quality</b>			
<b>Narrative summary</b>	<b>Objectively verifiable indicator</b>	<b>Means of verification</b>	<b>Risk and Assumption</b>
<b>General Objective</b> Enhance beach management	% of eroded beaches being monitored	Beach Authority Reports	Monitoring Funds are available
<b>Specific Objectives</b> Identify ways of controlling intense beach erosion	Effectiveness of control techniques and mechanisms	Beach Authority Reports	Control mechanisms available
			<b>Responsibility</b> Beach Authority and other concerned stakeholders Beach Authority and other concerned stakeholders

Output Reduced Beach Erosion <b>Activities</b>	5% eroded beach recovery	Beach Authority Reports	Monitoring mechanisms are reliable	Beach Authority and other concerned stakeholders Beach Authority and other concerned stakeholders Ministry of Tourism and other concerned stakeholders
<ul style="list-style-type: none"> <li>• Adopt use of appropriate techniques to control beach erosion</li> <li>• Review existing legislation and regulations with respect to construction and general planning around the beach especially for older buildings already in existence</li> <li>• Enhance public access to beaches</li> <li>• BLUE flag compliance</li> </ul>				
<b>Narrative summary</b>	<b>Objectively verifiable indicator</b>	<b>Means of verification</b>	<b>Risk and Assumption</b>	<b>Responsibility</b>
<b>Programme 4: Management of sand movement and accumulation</b>				
<b>General Objective:</b> Enhance the monitoring of sand movement and accumulation	% of recovering bleached coral reefs	Beach Authority Reports	Funds for recovery are available	Beach Authority and other stakeholders
<b>Specific Objectives:</b> Identify ways of controlling coral reef bleaching	Effectiveness of control techniques and mechanisms	Beach Authority Reports	Technology is available	Beach Authority and other stakeholders
<b>Output:</b> -Reduced coral reef bleaching	15% of bleached coral reefs recovered	Beach Authority Reports	Recovery techniques are reliable	Beach Authority and other stakeholders
<b>ACTIVITIES</b> -Predicting bleaching risks -Provide early warnings -Measure the extent of bleaching Assess the ecological impacts of bleaching -Involve the community in monitoring health of the reef -Communicate and raise awareness				Beach Authority and other stakeholders
<b>Narrative summary</b>	<b>Objectively verifiable indicator</b>	<b>Means of verification</b>	<b>Risk and Assumption</b>	<b>Responsibility</b>

<b>Programme 5: Tropical Storms and Extreme Events Damage Control</b>					
<b>General Objective</b>	% of reduction in damage	Meteorological Services	Funds for damage control are available	National Disaster Committee	
Enhance damage control mechanisms					
<b>Specific Objectives</b> Identify ways of minimizing damage	Effectiveness of damage control mechanisms	Meteorological Services Reports	Control mechanism are available	National Disaster Committee	
<b>Output</b> Reduced damage	85% possible reduction in damage in case the event occurs	Meteorological Services Reports	Damage minimization mechanisms are reliable	National Disaster Committee	
<b>Activities</b>					
-Explore ecological options for protection -Evacuation plans -Insurance cover -First Aid kits -Buffer stock of basic food and water -Disaster Preparedness by tourists		National Disaster Committee			
<b>Narrative summary</b>	<b>Objectively verifiable indicator</b>	<b>Means of verification</b>	<b>Risk and Assumption</b>	<b>Responsibility</b>	
<b>Programme 6: Enhancement of Water Supply</b>					
<b>General Objective</b>	% of water supply enhanced	Department of Water Reports	Funds for water supply enhancement are available	Ministry of Public Utilities/Water Resources Unit	
Enhance water supply					
<b>Specific Objectives</b> Identify ways of enhancing water supply	Effectiveness of water supply enhancement techniques and mechanisms	Department of Water Reports	Water enhancement Technology is available	Ministry of Public Utilities/Water Resources Unit	
<b>Output</b> Enhanced water supply for tourism industry	Water deficit reduced by 10% yearly	Department of Water Reports	Water enhancement techniques are reliable	Ministry of Public Utilities/Water Resources Unit	
<b>Activities</b>					
-Using rainwater collectors -Increasing storage tank capacities -Construction of desalination plants -Water conservation and efficient use of water					

<p>-Recycling (use of treated water for irrigation)                  -Adopt water conservation programmes such as universal water meters and water audits                  -Wetland conservation</p>						
<b>Programme 7: Carbon credit offsetting</b>						
<b>Narrative summary</b>	<b>Objectively verifiable indicator</b>	<b>Means of verification</b>	<b>Risk and Assumption</b>	<b>Responsible</b>		
<p><b>General Objective</b>                  Enhance carbon credit offsetting mechanisms                  Enhance product development and diversification by extension to such areas as Agalega</p>	<p>Number of new carbon credit offsetting mechanisms</p>	<p>Tourism Stakeholders Reports</p>	<p>Carbon credit offsetting mechanism are understood</p>	<p>Tourism Stakeholders</p>		
<p><b>Specific Objectives</b>                  Develop Credit Offsetting Mechanisms                  -Carbon Sinks                  -Carbon Credits</p>		<p>Tourism Stakeholders</p>		<p>Tourism Stakeholders</p>		
<p><b>Output</b>                  Reduced Carbon emissions/Increased Absorption of Carbon</p>	<p>At least 30% low carbon packages offered</p>	<p>Tourism Stakeholders Reports</p>	<p>Stakeholders willingness to co-operate</p>	<p>Tourism Stakeholders</p>		
<p><b>Activities</b></p>						
<p>(i) Tour Operators                  Market low-carbon holiday options.                  Carbon label packages and journeys.                  Develop attractive low-carbon packages.                  Offer high standard carbon offsets for journeys by air.                  (ii) Tourists                  Offsetting flights that cannot be avoided through voluntary carbon offsets.                  Tourists encouraged to ask for certified accommodation                  (i) Greener Mauritius</p>				<p>Tour Operators, Travel Agencies, Accommodation providers and other tourism stakeholders</p>		

Water Sector				
Narrative summary	Objectively Verifiable Indicator	Means of Verification	Risk and Assumption	Responsible Agency
<b>Project 1: Rehabilitation of Present Water Systems Replacement of galvanized iron pipes by laying HDPE pipes underground and Construction of a workshop</b>				
<p><b>General Objective:</b></p> <p>To improve the distribution system, renewal/construction of new main trunks, service and distribution mains, repair leaks, reduce friction losses and improve on water service delivery. And install meters.</p>	<p>Increase water production by 10%</p> <p>125 km of pipeline need to be replaced.</p> <p>Efficiency of maintenance and servicing of plants reduced by a half</p> <p>Reduction in Unaccounted for water from 30% to 16%</p>	<p>Reports from the Commission for Water.</p>	<p>Funding for major works forthcoming</p> <p>Capacity of the Commission to cope with additional work.</p>	<p>Commission for Water.</p> <p>RRA,</p>
<p><b>Specific Objectives:</b></p> <p>1. To repair trunk, service and distribution mains, rehabilitate boreholes, and desilt dams</p> <p>1. Water production maintained at 90% efficiency.</p> <p>2. Formulate and disseminate the Water Service Charter</p> <p>3. To repair existing desalination plants</p> <p>4. Repair leaks.</p>	<p>No. of boreholes, dams and desalination plants rehabilitated.</p> <p>Increase in water production.</p> <p>Unaccounted for water due to leakages, waste, illegal connections reduced from 30<sup>3</sup>% to 16%.</p> <p>Reduce rationing duration from 45 days to 10 days.</p>	<p>Reports from the Commission for Water.</p>	<p>Funding for major works forthcoming</p>	<p>RRA, Commission for Water</p>
<p><b>Output:</b></p>	<p>Report on completed works</p>	<p>Monthly reports on</p>	<p>Capacity Commission of for</p>	

<sup>3</sup> Unaccounted for Water is presumed to be much higher than 60% although the Commission advises that it is about 30%. Non revenue water is presumed to be upward of 90% of the unaccounted for water.

<p>1. Survey of current water supply system 2. Effective and efficient water maintenance.</p> <p><b>Activities:</b></p> <ol style="list-style-type: none"> <li>1. Establish flow measurement network and data bank and analysis.</li> <li>2. Carry out repairs</li> <li>3. Regular maintenance of mechanical equipment, reservoirs and dams.</li> <li>4. Rationalize and invest in mobilization of the water system.</li> <li>5. Rehabilitate and improve the distribution system of potable water the South</li> </ol> <ul style="list-style-type: none"> <li>• Extend rehabilitation works/improving the distribution system Replace galvanized iron pipes by laying HDPE pipes underground</li> <li>• Install break pressure tanks and / or pressure reducing valves</li> </ul> <ol style="list-style-type: none"> <li>1. Install meters and ball cocks at consumers' premises</li> <li>2. Water workshop (store facilities) set up for the maintenance of all electro-mechanical equipment</li> <li>3. Tools purchased/provided to the staff for on-site repair and maintenance of the electromechanical equipment</li> <li>4. Preventive Maintenance program established;</li> <li>6. Standardization of equipment especially on especially of frequent consumables.</li> </ol>	<p>Report on completed works. A central workshop budgeted, approved and constructed  Maintenance programme approved.  10 staff members deployed to carry out maintenance work  List of parts commonly required can easily be established.  Spare parts purchased and records kept.</p>	<p>rehabilitation.  Report of various reports.  Data and information on water.</p>	<p>Water.  Funding arrangements required</p>	<p><b>Project 2: Policy reviews, legislative reforms and coordination of the water sector by the Regional Assembly, including new water governance structure</b></p> <p><b>General Objective:</b> To create a suitable environment for sustainable water management</p> <p>Awareness, actions and management adopt new governance structure and operations.</p> <p>RRA proceedings</p> <p>RRA seatings devoted/available for and supportive of the reforms agenda.</p> <p>RRA Commission for Water</p>
--	--	--	--	--

<p><b>Specific Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Revise existing policies, strategies, plans, laws related to water resource management completed.</li> <li>2. Prepare tools and instruments to climate-proof sectoral and national policies developed and implemented</li> </ol>	<p>New Water Policy in place</p> <p>Revised/New Water Legislation passed by RRA</p>	<p>Reports on number of reports discussed and passed</p>	<p>Sufficient impetus available, momentum and knowledge concerning climate change adaptation measures able to propel adaptation mainstreaming into overall water governance.</p>	<p>Commission for Water and other natural resources based units.</p>
<p><b>Output:</b></p> <ol style="list-style-type: none"> <li>1. Reviewed/ revised water legislation, policy on allocation, tariff, funding, and private sector and users' participation.</li> </ol>	<p>Harmonized policies, legislation and regulations for sustainable and efficient water management</p>		<p>Capacity and technical support available to carry timely and effective revisions and research.</p>	
<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>• Prepare policy briefs, targeted policy support, toolkits for decision-makers and RRA briefings.</li> <li>• Review and, where necessary, revise institutional mandates and existing policies, strategies, plans and sectoral laws</li> <li>• Develop tools and instruments to climate-proof sectoral and national policies developed and implemented.</li> <li>• Review and establish new water regulations and new tariffs</li> <li>• Review land policy and land tenure.</li> </ul>	<p>No. of policy briefs prepared and discussed by members of RRA Revised institutional arrangement for water management Increased number of stakeholders' participation Communication strategy. Commission for Lands establishes Land Policy Committee.</p>	<p>Reports and documents discussed and adopted at appropriate committees. Participatory and gender analysis tools developed. Survey of water users' awareness to the ongoing reforms. Report on Land Policy and Land tenure.</p>	<p>Resources mobilized for sector reforms</p>	
<p><b>Project 3: Establishment of the Water Sector Reforms Secretariat and Steering Committee</b></p> <p><b>General Objective:</b> Ensure that water management is set on a sustainable path.</p> <p>Water Sector Reforms Secretariat and Steering Committee established and functioning.</p> <p>Commission for Water Resources and the Rodrigues Water Company, Customer Contract between</p> <p>Political leadership essential for reforms to be operationalised.</p> <p>RRA; Commissions for Water, Agriculture, Forestry,</p>				

		<p>the Rodrigues Water Company and its customers, the Terms of Reference of the Water Advisory Council</p>	<p>Resources adequately mobilized and efficiently used to ensure reform momentum.</p>	<p>Fisheries.</p>
<p><b>Specific Objectives:</b>  <b>1.</b> Water resources are sustainably managed/  <b>Output 1:</b> Legal, policy and institutional reforms implemented.  1.</p>	<p>Integrated water plans formulated.  1. Policy and Legal review completed  Water Commission review and staffing needs completed</p>	<ul style="list-style-type: none"> <li>• Established physical linkages between land use and surface and groundwater quantity and quality;</li> <li>• Economic linkages between various, and sometimes competing water uses;</li> <li>• Social linkages between water development schemes and potential beneficiaries or those adversely affected.</li> <li>• Institutional linkages, both horizontally and vertically, among various formal and non-formal stakeholder</li> </ul>	<p>Other institutions and stakeholders willing to collaborate.</p>	



<p><b>G Activities</b></p> <ol style="list-style-type: none"> <li>2. Gazette the reforms</li> <li>3. Establish Water Sector Reforms Secretariat</li> <li>4. Carry out public consultation and awareness</li> <li>5. Establish Water Master Planning Team, Stakeholders' Forum, Donor Coordination Team established</li> <li>6. Implement the RRA Water Regulations 2010</li> <li>7. Establish sustainable financing of water sector.</li> </ol>	<p>Increased water budget by 20% of total RRA budget.</p>	<p>institutions. Water Master Plans; comprehensive Water Resources Assessment report.</p>	
<p><b>Project 5: Rain water harvesting for domestic and supplemental agriculture</b></p>			
<p><b>General Objective:</b></p> <ul style="list-style-type: none"> <li>• Increasing water supply to meet current domestic and small scale irrigation demands</li> </ul>	<p>Number of glass fibre tanks (2,500 - 3,000 L capacity) at the consumers' premises. 2,000 families benefitting from a loans' scheme</p>	<p>Additional 30 to 40 m3 added to water stock through water harvesting and water saving measures</p>	<p>Cost of such glass fibre tanks is estimated at Rs.10,000 x 7,000 = Rs. 70 million</p>
<p><b>Specific Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Understanding the effects of climate change</li> <li>2. Select and apply appropriate methods and tools to prepare for adaptation. development of technology;</li> <li>3. Improve on use and integration of traditional knowledge on rainwater harvesting.</li> <li>4. Capacity build and strengthen governance structure at national, sub-national and local including the private sector to embrace rainwater harvesting.</li> </ol>	<p>Popular version of Climate change impacts printed and distributed Compendium of IK on rainwater harvesting techniques printed and distributed Workshop convened for stakeholders.</p>	<p>Reports and documents  No. stakeholders attended workshops</p>	<p>RRA; Commission for Water for Agriculture; Commissioner for Housing and Land.  Min. of Local Government; Service, Wildlife (NGO). Forestry Mauritius Foundation</p>
<p><b>Output:</b></p> <p>Water availability through rainwater harvesting to households increased.</p>	<p>No. of households adopting rainwater harvesting Amount of water added to total water productivity</p>	<p>Report of the water produced.</p>	<p>Funding schemes by private sector Resource mobilization.</p>
<p><b>Activities</b></p> <ol style="list-style-type: none"> <li>1. Create incentives for rain water harvesting for</li> </ol>	<p>Number of persons benefitting from the incentive schemes.</p>	<p>Survey reports and</p>	

domestic and supplemental agriculture. 2. Revise bylaws and regulatory mechanisms. 3. Retrofit houses to gather rain water 4. Creating public on rainwater harvesting.	Revised Housing bylaws No. houses retrofitted each year	incentivisation data.		
<b>Project 6: Capacity Building</b>				
<p><b>General Objective:</b></p> <p>1. Water resources developed and managed in a sustainable manner.</p>			Credibility to IWRM and support longer-term IWRM governance changes	RRA; Commission for Water for Agriculture; Commissioner for Housing and Land. Min. of Local Government; Forestry Service, Mauritius Wildlife Foundation (NGO).
<p><b>Specific Objectives:</b></p> <p>1. Raise awareness amongst policy makers on monitoring climate information and observation systems</p> <p>2. Empower stakeholders and train on IWRM and participatory approaches.</p> <p>3. Train on data analysis (hydrological, hydrometric data and preservation.</p> <p>4. Capacity build water demand management.</p>	<p>1. Port Mathurin is selected to test and pilot methods for increasing adaptation leadership and capacity at a local level</p> <p>No. of workshops convened</p> <p>No. of WUAs and WUCS established.</p> <p>No. participated in stakeholders' workshops</p>	<p>Progress reports</p> <p>IWRM Training Manuals for Water Users' Associations.</p>	Political leadership essential	
<p><b>Output:</b></p> <p>Capacity of water stakeholders for sustainable management of water resources and services.</p> <p><b>Activities</b></p> <ul style="list-style-type: none"> <li>• Establish and build capacity of Irrigation Water Users Associations</li> <li>• Raise awareness and consolidate the gaps between institutions and end users.</li> <li>• Strengthen and Pilot Local Climate Change Adaptation Leadership and Capacity Building</li> </ul>	<p>1.</p> <p>2. Training programme on climate change adaptation;</p> <p>3. Training Manual for WUAs and WUCS</p> <p>4. National level policy and legislation workshops convened.</p>	<p>No. of workshops</p> <p>No. of stakeholders (of various categories) attended</p>	Reliable and sustainable funding essential.	

Programme 7: Water Resources Assessment					
<ul style="list-style-type: none"> <li>• Train on conflict resolution/management</li> </ul>					
<b>Programme 7: Water Resources Assessment</b>					
<p><b>General Objective:</b></p> <ul style="list-style-type: none"> <li>• Determine the current water stock and suggest sources of water to meet future water deficits.</li> </ul>	Water resources management plans and water efficiency plans.				RRA; Commission for Water for Agriculture; Commissioner for Housing and Land. Min. of Local Government; Forestry Service, Mauritius Wildlife Foundation (NGO).
<p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>• Determine the water resources availability for now and potential for future uses with a view to Climate Change especially regarding groundwater resources</li> <li>• Prepare guidelines for data acquisition, monitoring networks.</li> <li>• Acquire equipment, recruit personnel and establish database development.</li> </ul> <p>Strengthen water research and information systems and Meteorological Services</p> <p><b>Output:</b></p> <ul style="list-style-type: none"> <li>• Water Master Plans</li> <li>• Water Resources Assessment report.</li> <li>• Study on present levels and potential water pollution.</li> <li>• Data collection network system established.</li> <li>• Communications network established</li> </ul>	Improved water resources data acquisition, analysis and information sharing				
	<ul style="list-style-type: none"> <li>• Draft Master Plan.</li> <li>• Draft WRA Report</li> <li>• Draft Report on Water Quality</li> <li>• Reduction of energy Costs of desalination</li> <li>• Artificial groundwater recharge and hydro fracturing.</li> </ul>	Each river gauging network station will be equipped with a Steeling Well that consists of automated water level recorder, a floater, and a rain gauge.			Collaboration with research institutes, universities and climate related stations.

	<ul style="list-style-type: none"> <li>• Rain for irrigating high yielding crops.</li> </ul>		
<p><b>Activities</b></p> <ol style="list-style-type: none"> <li>1. Undertake an assessment of climate change impact on water resources in Rodrigues for the 2030 and 2050 horizons.</li> <li>2. Propose strategies for water conservation, reuse, quality control and monitoring</li> <li>3. Protect groundwater resources from Stalination and reduce agro-chemical pollution</li> <li>4. Establish mechanisms for water reuse</li> <li>5. Identify and develop aquifer recharge.</li> <li>6. Carry out measurement, mapping and computer modeling of the ground water lenses</li> <li>7. Carry out technical assessment of water quality and quantity information measures;</li> <li>8. Knowledge dissemination to promote community knowledge and understanding;</li> </ol> <ol style="list-style-type: none"> <li>1. Institutional strengthening and human resource capability development measures Construct and equip a water laboratory.</li> <li>2. Two 2 new tide gauges, Sea surface temperature.</li> <li>3. Establish data base for data collection and management</li> <li>9. Monitoring of Climate Change and Sea Level Rise.</li> </ol>		<p>Water Resources Assessment Reports</p>	
<b>Project 8: Water and Soil Conservation</b>			
<p><b>General Objective:</b> Sustainable land management and improved</p>	<p>Water and agricultural productivity</p>	<p>Survey Report on household incomes and</p>	

livelihoods	increased	water availability		
<p><b>Specific Objectives:</b> To reduce soil erosion, increase water infiltration and moisture retention To increase agricultural productivity</p>	<p>900-1000 ha. abandoned arable land conserved and brought back to production.</p>	<p>Water resources monitoring report</p>	<p>Clarify land tenure issues and community rights.  Coordination between Agriculture, Lands, Forestry, Water, Ecotourism and Attorney general's office.</p>	<p>Agriculture, Forestry, Ecotourism and Attorney general's office.  Lands, Water, and Attorney general's office.</p>
<p><b>Output:</b> Infiltration and recharge to groundwater system. Reduction on land degradation.</p>	<p>Improved crop yields and soil-water infiltration increased.</p>	<p>Water reports</p>		
<p><b>Activities</b> 1. Carry out feasibility for irrigation projects 2. Construction of new reservoir at Petit Brûlé. 3. Carry out soil and water conservation for dams at Baie aux Huitres, Rivière Cocos, Mourouk and Baie Pistache.</p>	<p>Soil erosion has decreased</p>	<p>Reports on feasibility.  Land degradation Reports</p>		
<b>Project 9: Watershed and Coastal Management</b>				
<p><b>General Objective:</b> Protect and conserve watershed and coastal resources.</p>	<p>Economic evaluation of Watersheds and Coastal Resources.</p>		<p>Sustainable funding available.  Regular participation of RRA in Nairobi Convention.</p>	<p>RRA; Commission for Water for Agriculture; Commissioner for Housing and Land. Min. of Local Government; Forestry Service, Mauritius Wildlife Foundation,</p>

				Cooperative (NGO).	Societies
<p><b>Specific Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Groundwater Conservation areas;</li> <li>2. Protection of environmental quality and ecological systems</li> <li>3. Legislative and policy review of all laws pertaining to management of the coastal zone for coping with sea-level rise and non-living marine resources.</li> </ol> <p><b>Output:</b></p> <ol style="list-style-type: none"> <li>1. PES approach for watershed protection, carbon sequestration, biodiversity benefits</li> <li>2. PES scheme to services provided by coastal areas</li> </ol>	<p>Muti-disciplinary Committee of ICZM established</p> <p>Coastal Documentation and Data Service developed/capacity enhanced.</p>	No. of ICZM stakeholders trained.			
<p><b>Activities</b></p> <ol style="list-style-type: none"> <li>1. Reforest watershed via tree planting campaigns</li> <li>2. Develop/review the forest policy for sustainable forest</li> <li>3. Fund regular periodic survey of coastline every 3 to 5 years</li> <li>4. Establish coral reef regeneration and monitoring programme.</li> <li>5. Plant mangrove plantation in erosion risk areas.</li> <li>6. Coastal protection works (beach erosion, rock revetment, creation of parking spaces to prevent trampling, etc.).</li> <li>7. Establish beach unit associations to monitor and manage erosion</li> <li>8. Establish nature reserves.</li> </ol>	<p>48 km of coastal rehabilitation works completed.</p> <p>Coral reef regeneration and monitoring programme developed and budgeted.</p> <p>Mangrove plantation programme approved and funded.</p>	Forestry Policy passed by RRA.		Linkages with Forestry Unit, agriculture, fisheries and MPAs.	

Project 10: Flood risk management, risk reduction and the role of insurance					
<b>General Objective:</b>					
<b>Specific Objectives:</b> 1. To promote awareness of floods and water related disasters; 2. To encourage information sharing amongst stakeholders; 3. Increase capacity of communities to respond appropriately to disasters. 4. Introduce insurance, bonds, etc to alleviate losses resulting from disasters.	Micro-insurance, Catastrophe bonds and reduced insurance premiums as an incentive to take preventative measures.	Discussions with private sector players.	Availability of funding	RRA; Disaster Management Office; Commission for Water for Agriculture; Commissioner for Housing and Land. Min. of Local Government; Forestry Service, Mauritius Wildlife Foundation, Cooperative Societies.	
<b>Output:</b> Water-related disaster risk reduced by up to 20%	Risk assessment enhanced.			Availability of geospatial data	
<b>Activities</b> 1. Construct inundation risk maps (indicating contours of less than 2 m) to establish the full extent of SLR and flash flooding events. 2. National flood hazard vulnerability reduction policies; and an insurance scheme 3. Network of automatic weather stations • Create hazard vulnerability reduction policies 4. Catastrophic Risk Insurance Facility (CRIF) 5. Establish strategies, responses and projects.	Increased awareness to climate related disasters Early warning strategy and Action Plan in place Capacity of relevant institutions enhanced to cope with different levels of disasters.	Flood maps; erosion maps; Landslide maps. Potentiality Shoreline potentiality potentiality	Technical capacity		
Project 11 : Project Management Cost including Monitoring and Evaluation					
<b>General Objective:</b> To ensure effective and efficient programme implementation and management				Availability of consultants	RRA; Commission for Water for Agriculture; Commissioner for Housing and Land.

					Min. of Government Service, Wildlife (NGO); Local Forestry Mauritius Foundation
<b>Specific Objectives:</b> Participatory monitoring and evaluation		Monitoring and evaluation Protocol in place			
<b>Output:</b> Effective and efficient programme execution.					
<b>Activities:</b> Programme coordination; Set up a monitoring protocol Midterm and end programmer evaluation	Implementation modalities and strategies in place Key project personnel recruited Work programme in place			Stakeholders mobilized and participation strategies in place Availability of funding.	



## REFERENCES

1. Agricultural Services Report(2002-2012
2. Albion Fisheries Research Centre (AFRC). 1995-2002. Annual Reports (Fisheries) 1995-2002. Ministry of Fisheries. Republic of Mauritius. Alison, E.H., W.N. Adger, M.C. Badgeck, K. Brown, D. Conway, N. E. Dulvy, A. Halls, A. Perry and J. D. Reynolds (2005). Effects of climate change in the sustainability of capture and enhancement fisheries important to the poor analysis of the vulnerability and adaptability of fisher folk living in poverty. Project {No. R4778}. Fisheries Management Science Programme Department for International Development 157pp
3. Albion Fisheries Research Centre (AFRC). 1995-2002. Annual Reports (Fisheries) 1995-2002. Ministry of Fisheries. Republic of Mauritius.
4. Alison, E.H., W.N. Adger, M.C. Badgeck, K. Brown, D. Conway, N. E. Dulvy, A. Halls, A. Perry and J. D. Reynolds (2005). Effects of climate change in the sustainability of capture and enhancement fisheries important to the poor analysis of the vulnerability and adaptability of fisher folk living in poverty. Project {No. R4778}. Fisheries Management Science Programme Department for International Development 157pp
5. Annual Reports M/ Fisheries ( 2006, 2007, 2008, 2009, 2010)
6. Anon. 1998. A Ten Year Development Plan for the Fisheries Sector. Volume 2. The Ten Year Plan. Project No. TCP/MAR/6712 (A). Government of Mauritius/UNDP/FAO, 189p.
7. Anon. 1998. A Ten Year Development Plan for the Fisheries Sector. Volume 2. The Ten Year Plan. Project No. TCP/MAR/6712 (A). Government of Mauritius/UNDP/FAO, 189p.
8. Baltz, D.M.P., Vondracek, I. R. Brown and P.B., Moyle (1897). Influence of temperature on microhabitat choice by fishes in California stream. *Transactions of the American Fisheries Society* 116:12-20
9. Baltz, D.M.P., Vondracek, I. R. Brown and P.B., Moyle (1897). Influence of temperature on microhabitat choice by fishes in California stream. *Transactions of the American Fisheries Society* 116:12-20
10. Beedassy, Shakil (no date) Formulation of a Climate Change Resilient Action Plan for the agricultural community of Riviere Banane in Rodrigues.
11. Beneras, R.J. and J.R. Davis (1998) Comprehensive approaches to eutrophication management: the Australian example. *Water Science and Technology* 37: 217-225
12. Beneras, R.J. and J.R. Davis (1998) Comprehensive approaches to eutrophication management: the Australian example. *Water Science and Technology* 37: 217-225
13. Birkett, L. 1999. Western Indian Ocean Fishery Resources Survey Report on the cruises of R/V Professor Mesyatsev, Dec 1975- June 1976/ July 1977- Dec 1979. IOP/Tech/79/ 26, TR No. 26, FAO 1979.
14. Birkett, L. 1999. Western Indian Ocean Fishery Resources Survey Report on the cruises of R/V Professor Mesyatsev, Dec 1975- June 1976/ July 1977- Dec 1979. IOP/Tech/79/ 26, TR No. 26, FAO 1979.
15. Blasco, F. P. Saenger & E. Janodet, 1996. Mangroves as indicators of coastal change. *Catena* 27, 167-178).
16. Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M., Osman-Elasha, B., Tabo, R. and Yanda, P., 2007. Africa: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University UK, 433 – 467.
17. Cazes-Duvat, 2003 Etudes de vulnérabilité des plages du littoral corallien de l'île de La Réunion, Office National des Forêts, Avril 2003
18. **Central Statistics Office, 1995-2009**, "Digest of Statistics on Rodrigues"
19. **Central Statistics Office, 2009** "Digest of International Travel and Tourism"

20. Chapter 6. Rodrigues, 6.1 Overview of the Biodiversity of Rodrigues
21. Christy, C. 1986. Fisheries legislation in Mauritius. Fisheries Law Advisory Programme. Indian Ocean Region. Project for the development and management of fisheries in the South West Indian Ocean. FI: GCP/INT/400/NDR, FL/ IOR/85/16. FAO 1986.
22. Christy, C. 1986. Fisheries legislation in Mauritius. Fisheries Law Advisory Programme. Indian Ocean Region. Project for the development and management of fisheries in the South West Indian Ocean. FI: GCP/INT/400/NDR, FL/ IOR/85/16. FAO 1986.
23. CIA World Factbook 2008 (<https://www.cia.gov/library/publications/the-world-factbook/geos/mp.html>).
24. Commission for Environment and National Development Unit Convention on Biological Diversity Third National Report for the Republic of Mauritius in collaboration with UNEP/GEF, 2006).  
[http://www.worldwildlife.org/wildworld/profiles/terrestrial/at/at0120\\_full.html](http://www.worldwildlife.org/wildworld/profiles/terrestrial/at/at0120_full.html)
25. Commission for Finance & Economic Development, Programme-Based Budget Estimates 2008-2009 & Indicative Estimates: 1 July 2009 to 31 December 2009 & 1 January 2010 to 31 December 2010, Port Louis, Mauritius.
26. Commissioner for Environment & Public Infrastructure Reports
27. Cunningham, S CEMERE Readings, Integrating Fisheries into Coastal Area Management
28. Cunningham, S CEMERE Readings, Integrating Fisheries into Coastal Area Management
29. Development of a Climate Change Adaptation Framework for the Republic of Mauritius and Rehabilitation of Degraded and Highly Vulnerable Sites”
30. **Development of an Integrated Coastal Zone Management Framework (ICZM) for the Republic of Mauritius (2008/2009)**-Various Issues
31. **Development of an Integrated Coastal Zone Management Framework (ICZM) for the Republic of Mauritius (2008)**- Rodrigues ICZM Strategy
32. **Development of an Integrated Coastal Zone Management Framework (ICZM) for the Republic of Mauritius (2008/2009)**-Various Issues
33. **Development of an Integrated Coastal Zone Management Framework (ICZM) for the Republic of Mauritius (2008)**- Rodrigues ICZM Strategy
34. Dixon, R.K., Smith, J. & Guill, S. 2003. Life on the edge: Vulnerability and adaptation of African ecosystems to global climate change. *Mitigation and Adaptation Strategies for Global Change*, **8**: 93-113
35. Ebi, K.L., Lewis, N.D. & Corvalan, C. 2006. Climate variability and change and their perspective health effects in small island states: information for adaptation planning in the health sector. *Environmental Health Perspectives*. **114**(12): 1957 – 1963.
36. **ELP Publication, 2010**, “Resource Atlas for Mauritius and Rodrigues”
37. **ELP Publication, 2010**, “Resource Atlas for Mauritius and Rodrigues”
38. Gastineau, G. and B. J. Soden, 2009. Model projected changes of extreme wind events in response to global warming, *Geophys. Res. Lett.* **36**, L10810, doi: 10.1029/2009GL037500.
39. Gilman, E. 2004. Assessing and managing coastal ecosystem response to projected relative SLR and climate change. Prepared for the Research Foundation for Development Forum on Small Island Developing States: Challenges, Prospects and International Cooperation for Sustainable Development. Contribution to Barbados + 10
40. Initial National Communication of the Republic of Mauritius under the United Nations Framework Convention on Climate Change (1999)
41. IOTC. 2004. Report of the Eighth Session of the Indian Ocean Commission, Victoria, Seychelles, 7-13 December 2003. IOTC-S-08-03R [E].
42. IOTC. 2004. Report of the Eighth Session of the Indian Ocean Commission, Victoria, Seychelles, 7-13 December 2003. IOTC-S-08-03R [E].
43. Jehangeer, I. Review of the state of World capture fisheries, Country review Mauritius
44. Jehangeer, I. Review of the state of World capture fisheries, Country review Mauritius

45. Lal, M., Harasawa, H., Takahashi, K. 2002. Future climate change and its impacts over Small Island Developing States. *Climate Research*. 19: 179 – 192.
46. Lozachmeur, J., Venkatasami, A., Soondrons Beeharry, S.P. & Silvestrini, G. 1991. Development of Deep Water Shrimp fishery in Mauritius. Ministry of Agriculture, Fisheries and Natural Resources and FAO. Project UNDP/FAO/MAR/88/004. FAO. 1991. 44p
47. Lozachmeur, J., Venkatasami, A., Soondrons Beeharry, S.P. & Silvestrini, G. 1991. Development of Deep Water Shrimp fishery in Mauritius. Ministry of Agriculture, Fisheries and Natural Resources and FAO. Project UNDP/FAO/MAR/88/004. FAO. 1991. 44p
48. Mauritius Country Programme 2009-2011.
49. Mauritius Meteorological Services: Climate change impacts on Mauritius. 2008.
50. Mauritius, One Nation, One Destiny. A Comprehensive Development Framework. Operations Policy and Country Services. The World Bank.
51. Mauritius. Chapter 9: Published by the Development Bank of Southern Africa in collaboration with the Southern African Institute for Environmental Assessment, Midrand. 420 pages.
52. Mauritius: NEPAD – CAADP National Medium-Term Investment Programme.
53. *McSweeney, C, M. New and G. Lizcano*, United UNDP Climate Change Country Profiles Mauritius
54. **Ministry of Agriculture, Food Technology and Natural Resources, 2004**, “The Islets National Park Strategic Plan”
55. **Ministry of Agriculture, Food Technology and Natural Resources, 2004**, “The Islets National Park Strategic Plan”
56. **Ministry of Environment & NDU, 2009**, “Study on Environmentally Sensitive Areas”
57. **Ministry of Environment & NDU, 2009**, “Study on Environmentally Sensitive Areas”
58. **Ministry of Environment & SD, 2010**, “Development of an Integrated Coastal Zone Management Framework for the Republic of Mauritius”
59. **Ministry of Environment & SD, 2010**, “Development of an Integrated Coastal Zone Management Framework for the Republic of Mauritius”
60. **Ministry of Environment and National Development Unit, 2007**, “National Environment Policy, 2007”
61. **Ministry of Environment and National Development Unit, 2007**, “National Environment Policy, 2007”
62. **Ministry of Environment and Sustainable Development, 2010**, “Development of an Integrated Coastal Zone Management Framework (ICZM) for the Republic of Mauritius”.
63. **Ministry of Environment and Sustainable Development, 2010**, “Development of an Integrated Coastal Zone Management Framework (ICZM) for the Republic of Mauritius”.
64. **Ministry of Environment and Sustainable Development, 2010**, “Policy Guidance for Environmentally Sensitive Areas”.
65. **Ministry of Environment and Sustainable Development, 2010**, “Policy Guidance for Environmentally Sensitive Areas”.
66. **Ministry of External Communications, Prime Minister’s Office, 2002**, “Blue Print on Cargados Group of Islands (Saint Brandon)”
67. **Ministry of External Communications, Prime Minister’s Office, 2002**, “Blue Print on Cargados Group of Islands (Saint Brandon)”
68. Ministry of Fisheries. 2004. Internet website [www.ncb.intnet/fish/about.html](http://www.ncb.intnet/fish/about.html).
69. Ministry of Fisheries. 2004. Internet website [www.ncb.intnet/fish/about.html](http://www.ncb.intnet/fish/about.html).
70. **Ministry of Tourism and Leisure, 2009**, “Mauritius Sector Strategy Plan on Tourism (2009-2015) & its Related Programme Budgeting Report”
71. **Ministry of Tourism and Leisure, 2009**, “Mauritius Sector Strategy Plan on Tourism (2009-2015) & its Related Programme Budgeting Report”

72. MMS Climate Change - Impacts on Mauritius, 2008.
73. National Biodiversity Strategy and Action Plan 2006 – 2015: Chapter 6 Rodrigues.
74. **National Parks and Conservation Service, 2008**, “Development of Management Plans for the Conservation & Management of Offshore Islets for the Republic of Mauritius: Phase II”.
75. **National Parks and Conservation Service, 2008**, “Development of Management Plans for the Conservation & Management of Offshore Islets for the Republic of Mauritius: Phase II”.
76. National Reports: Mauritius from the Second ODINAFRICA Seminar (24-26 April 2006, Ostend, Belgium).
77. NCAER, 1988. Techno-Economic Survey
78. NES 2 Final Report, Volume 1 2008.
79. Ngigi, S.N. Climate Change Adaptation Strategies: Water Resources Management Options for Smallholder Farming Systems in Sub Saharan Africa, Earth Institute at Columbia University, NY, December 2009, 189p.
80. Nurse, L., et al, 2001, Small island states, In *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, J.J. McCarthy et al (eds.), Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, pp. 842-975.
81. Ochumba, P.B.O. (1990), Massive fish kills within the Nyanza Gulf of Lake Victoria Kenya *Hydrobiologia* 208: 93-99
82. Ochumba, P.B.O. (1990), Massive fish kills within the Nyanza Gulf of Lake Victoria Kenya *Hydrobiologia* 208: 93-99
83. Republic of Kenya 2008: Draft Sessional paper on National Fisheries Policy
84. Republic of Kenya 2008: Draft Sessional paper on National Fisheries Policy
85. Republic of Mauritius 1988. The National Coast Guard Act 1988.
86. Republic of Mauritius 1988. The National Coast Guard Act 1988.
87. Republic of Mauritius 1991. State of the Environment in Mauritius. A report prepared for presentation at the United Nations Conference on the Environment, Rio De Janeiro, Brazil, and June 1992. Ministry of Environment and Quality of Life, Government of Mauritius. Port-Louis, Mauritius 1991. 403p.
88. Republic of Mauritius 1991. State of the Environment in Mauritius. A report prepared for presentation at the United Nations Conference on the Environment, Rio De Janeiro, Brazil, and June 1992. Ministry of Environment and Quality of Life, Government of Mauritius. Port-Louis, Mauritius 1991. 403p.
89. Republic of Mauritius 1998. The Fisheries and Marine Resources Act 1998, Act No. 22 of 1998.
90. Republic of Mauritius 1998. The Food Act 1998.
91. Republic of Mauritius 1998. The Food Act 1998.
92. Republic of Mauritius 1998. The Ports Act 1998.
93. Republic of Mauritius 1998. The Ports Act 1998.
94. Republic of Mauritius 1999. National Environment Strategies for the Republic of Mauritius: Review of the Legal and Institutional Framework for Environmental Management in Mauritius (Appendix to NEAP2) July 1999. 78p.
95. Republic of Mauritius 1999. National Environment Strategies for the Republic of Mauritius: Review of the Legal and Institutional Framework for Environmental Management in Mauritius (Appendix to NEAP2) July 1999. 78p.
96. Republic of Mauritius 1999. The Food Regulation 1999.
97. Republic of Mauritius 1999. The Food Regulation 1999.
98. Republic of Mauritius 2001. The Fisheries and Marine Resources (Marine Protected Areas) Regulation 2001. Government Notice No 172 of 2001.
99. Republic of Mauritius 2001. The Fisheries and Marine Resources (Marine Protected Areas) Regulation 2001. Government Notice No 172 of 2001.

100. Republic of Mauritius 2002. The Environment Protection Act 2002 (Act No 19 of 2002).
101. Republic of Mauritius 2002. The Environment Protection Act 2002 (Act No 19 of 2002).
102. Republic of Mauritius 2007. The Fisheries and Marine Resources Act 2007, Act No. 22 of 2007
103. Republic of Mauritius National Environmental Strategies 2008
104. Republic of Mauritius, National Forestry Policy, Forest Service, Ministry of Agro-industry and fisheries, 14 April 2006.
105. Republic of Mauritius. Mauritius Environmental Outlook Report: Summary for Decision Makers, Ministry for Economic and Sustainable Development.
106. Republic of Mauritius. Mauritius Strategy for Implementation of National Assessment, 2010.
107. Republic of Mauritius: Climate Change Action Plan. 1998. Prepared with the assistance of the United States Country Studies Programme for Climate Change.
108. Republic of Mauritius: Climate Change Action Plan. 1998. Prepared with the assistance of the United States Country Studies Programme for Climate Change.
109. **Resource Atlas for Mauritius and Rodrigues**, Editions Le Printemps Publishing, 2010.
110. **Resource Atlas for Mauritius and Rodrigues**, Editions Le Printemps Publishing, 2010.
111. **Rodrigues Regional Assembly, 2009**, "Sustainable Integrated Development Plan for Rodrigues"
112. **Rodrigues Regional Assembly, 2009**, "Sustainable Integrated Development Plan for Rodrigues"
113. **Rodrigues Regional Assembly**, Programme Based Budget Estimates 2010 and Indicative Estimates 2011 and 2012
114. **Rodrigues Regional Assembly**, Programme Based Budget Estimates 2010 and Indicative Estimates 2011 and 2012
115. Rughooputh, S.D. SIDS and Climate Change Indicators Faculty of Science, University of Mauritius, Mauritius
116. Sanders, M.J., Sparre, P., & Venema, S.C. 1988. Proceedings of workshop on Fisheries Resources of the SWIO. Albion, FAO/ UNDP/RAF/79/065/ WP/41/48/E. 277pp.
117. Sanders, M.J., Sparre, P., & Venema, S.C. 1988. Proceedings of workshop on Fisheries Resources of the SWIO. Albion, FAO/ UNDP/RAF/79/065/ WP/41/48/E. 277pp.
118. Second National Communication (SNC) under the UNFCCC
119. Shakil Beedassy, Formulation of a Climate Change Resilient Action Plan for the agricultural community of Riviere Banane in Rodrigues. Consultant in energy and sustainable development [shakilbdc@yahoo.com](mailto:shakilbdc@yahoo.com)
120. **Shoals Rodrigues, 2008** "The Status of the Coral Reefs in Rodrigues"
121. **Shoals Rodrigues, 2008** "The Status of the Coral Reefs in Rodrigues"
122. SIDPR, 2007. Sustainable Integrated Development Plan for Rodrigues (SIDPR), RRA
123. Sugunan, V.V. and M. Simba (2001). Sustainable capture and culture fisheries in freshwater of India. In Sustainable Indian Fisheries. T.J. Pandian (ed.) National Academy of Agricultural Sciences, New Delhi, 43-70
124. Sugunan, V.V. and M. Simba (2001). Sustainable capture and culture fisheries in freshwater of India. In Sustainable Indian Fisheries. T.J. Pandian (ed.) National Academy of Agricultural Sciences, New Delhi, 43-70
125. Sugunan, V.V. and Praveen Maurye (2003) Global warming and climate change perspective on impact over inland fisheries. *Fishing Climate*, 23, 27-36
126. Sustainable Development Plan For Rodrigues (2009)
127. **Tatayah V., Khadun A., 2002**, "A 2002 Survey of St Brandon, Mauritius Wildlife Foundation, Unpublished report.
128. **Tatayah V., Khadun A., 2002**, "A 2002 Survey of St Brandon, Mauritius Wildlife Foundation, Unpublished report.

129. Thaunoo-Chadee, P. & Sham-Jacmohum, S. 2007. Status on the environment: Status on Mauritian statistics. Workshop on Environmental Statistics, Country Report.
130. UNDP Project Document: Capacity Building for Sustainable Land Management in Mauritius; Updating of the National Environmental Strategies and review of the implementation of the Second National Environmental Action Plan. Final Report. Volume I: Updating of the National Environmental Strategies (NES2). 2008.
131. UNDP, Project Document for Maurice Ile Durable Support Project, UNDP (Mauritius). 2009
132. UNDP, Project Document: Capacity Building for Sustainable Land Management in Mauritius
133. UNFCCC, 2006. Application of environmentally sound technologies for adaptation to climate change, Technical paper, 10<sup>th</sup> May 2006
134. United Nations Framework Convention on Climate Change with input provided by Dr. Graham Sem.
135. United Nations International Meetings on Sustainable Development of Small Island Developing States, Port Louis.
136. Updating of the National Environmental Strategies and review of the implementation of the Second National Environmental Action Plan. Final Report. Volume I: Updating of the National Environmental Strategies (NES2). 2008.
137. Updating of the National Environmental Strategies and review of the implementation of the Second National Environmental Action Plan. Final Report. Volume I: Updating of the National Environmental Strategies (NES2). 2008.
138. Updating of the National Environmental Strategies and review of the implementation of the Second National Environmental Action Plan. Final Summary Report. 2008.
139. Veterinary Reports(2002-2012
140. Vulnerability and Adaptation to Climate Change in Small Island Developing States. Background paper for the expert meeting on adaptation for Small Island Developing States
141. Walmsley, B. & Tshipala, K.E. 2007. Handbook on Environmental Assessment Legislation in the SADC region
142. Water Management Unit: Hydrology Data Book. Chapter 7: Hydrology of Rodrigues and Agalega.
143. Welcomme, R. (1998) *Fisheries Ecology of Floodplain rivers* Longman, Inc. New York
144. WIOMSA/MOI/UNEP/CI/Nairobi Convention, Regional Conference on Climate Change Adaptation in the Coastal Areas of WIO, Conference Guide and Book of Abstracts, 25 March 2011

**Ministry of Agro Industry & Food Security**

Levels 8 & 9, Renganaden Seeneevassen Building  
Cnr Jules Koenig & Maillard Streets  
Port Louis, MAURITIUS  
Tel: +(230) 212 0854, +(230) 212 2940  
Fax: +(230) 212 4427  
URL: <http://agriculture.gov.mu>

**Ministry of Environment & Sustainable Development**

Level 10, Ken Lee Tower, Cnr St Georges & Barracks Streets  
Port Louis, MAURITIUS  
Tel: +(230) 203 6200  
Fax: +(230) 212 9407  
URL: <http://environment.gov.mu>

**Ministry of Fisheries**

Level 4, L.I.C Building  
John Kennedy Street  
Port Louis, MAURITIUS  
Tel: +(230) 2112470-75, +(230) 212 2940  
Fax: +(230) 2081929  
URL: <http://fisheries.gov.mu>

**Ministry of Tourism and Leisure**

Level 12, Air Mauritius Centre, John Kennedy Street,  
Port Louis, MAURITIUS  
Tel : +(230) 211 7930  
Fax : +(230) 208 6776  
URL: <http://tourism.gov.mu>

**Rodrigues Regional Assembly**

Commission for Environment, Tourism, Forestry,  
Fisheries and Marine Parks  
Ex-Water Company Building,  
Port Mathurin, RODRIGUES  
Tel: +(230) 832 1520  
Fax: +(230) 832 1535  
URL: <http://rra.gov.mu>