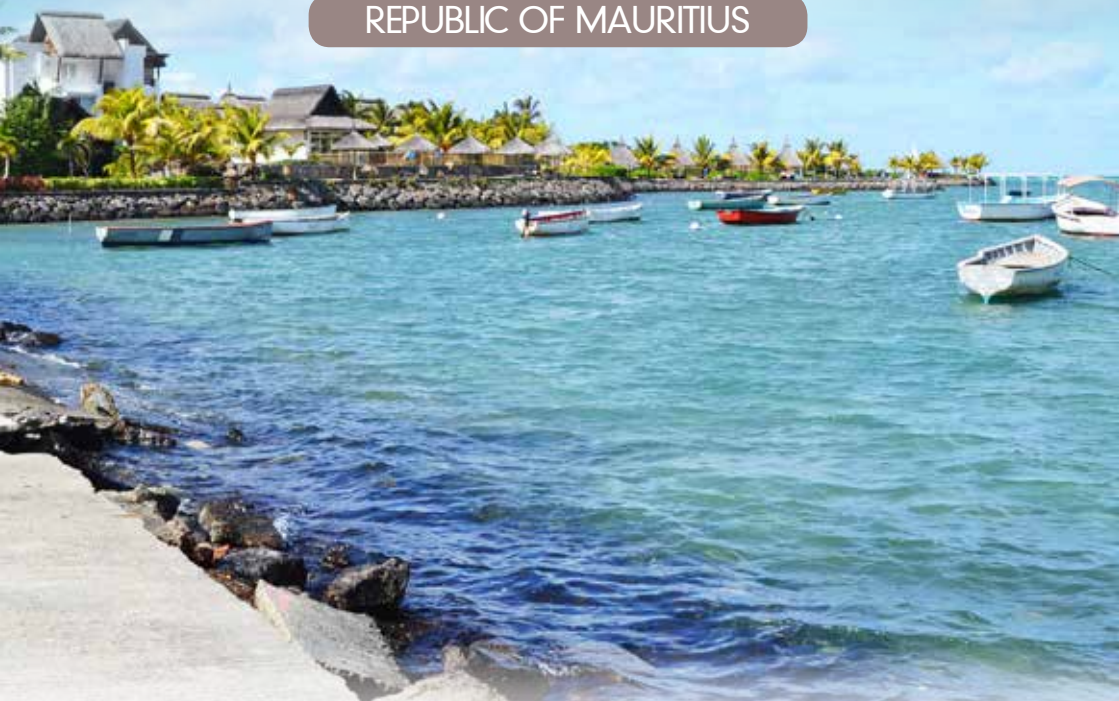


ASSESSING THE EVIDENCE:

OPPORTUNITIES AND CHALLENGES
OF MIGRATION IN BUILDING RESILIENCE
AGAINST CLIMATE CHANGE IN THE

REPUBLIC OF MAURITIUS



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TABLE OF CONTENTS

Acknowledgements	iii
List of tables, figures and box	vii
Acronyms and abbreviations	ix
Executive summary	xi
 I. Introduction	 1
I.1. Background and context	4
I.1.a. The context	4
I.2. Migration – Evidences from the past	9
I.2.a. Immigration and emigration	9
I.2.b. Internal and international migration	14
I.2.c. Development-induced migration	20
I.2.d. Relocation	22
I.2.e. Migration from Rodrigues to Mauritius	24
I.2.f. Role of remittances	25
 II. Key challenges: The migration, environment and climate change nexus	 27
II.1. Sudden-onset events and its effects on migration patterns	29
II.1.a. Tropical cyclones	30
II.1.b. Storm surges	32
II.1.c. Floods and flash floods	33
II.1.d. Landslides	37
II.2. Slow-onset processes and their effects on migration patterns ..	39
II.2.a. Sea-level rise	39
II.2.b. Increasing temperature	41
II.2.c. Ocean acidification and temperature anomalies	42
II.2.d. Salinization	43
II.2.e. Land and forest degradation	44
II.2.f. Loss of biodiversity	46
II.2.g. Coastal erosion	48
II.2.h. Declining soil fertility	48

II.3. Vulnerability mapping	49
II.3.a. Geographically	49
II.3.b. Types of livelihood affected (and co-stressors).....	51
II.3.c. Internal migration and displacement dynamics	56
II.4. Potential effects of (environmental) migration on vulnerability	57
II.4.a. Environmental degradation and human security	57
II.4.b. Urbanization and migration flows.....	58
III. Toolkit for policymakers	59
III.1. Existing policy framework.....	61
III.2. Policies in the process of being elaborated	63
III.3. Policy options and research priorities:	
Some initial suggestions	66
IV. Conclusion.....	69
Bibliography	73

LIST OF TABLES, FIGURES AND BOX

Table 1:	Trends in selected macroeconomic aggregates for Mauritius, 1980–2015	6
Table 2:	Sectoral contribution to GDP, 1976–2015 (%)	8
Table 3:	Migration dynamics for Mauritius, 2003–2014	13
Table 4:	Foreign workers employed in large establishments, March 2011–March 2014	17
Table 5:	Work permits issued for manual workers by country of origin, 2005–2010	17
Table 6:	Net migration between districts of migrants 5 years of age and over	21
Table 7:	Inflows and outflows of remittances of Mauritius, 2003–2012 (millions USD)	26
Table 8:	Worst tropical cyclones in Mauritius, 1960–2012	31
Table 9:	Mean annual precipitation in millimetres for Mauritius, 2007–2014.....	34
Table 10:	Rainfall for islands of Mauritius and Rodrigues, 2011–2014 (mm)	34
Table 11:	Average temperature recorded in Mauritius and Rodrigues, 2014 (°C)	41
Table 12:	Average maximum summer temperature at Vacoas, 1971–2012 (°C)	42
Table 13:	Land use in Mauritius, 1995–2005.....	45
Table 14:	Forest – Land cover as a percentage of total land area, 2003–2014	45
Table 15:	Threatened plant species in Mauritius indicative of biodiversity loss.....	47
Table 16:	Marine protected areas in 2014 – Island of Mauritius in hectares	47
Table 17:	Level and ranking of overall development and population size of some areas at risks	49

Table 18:	Vulnerability of some communities to climate change.....	50
Table 19:	Fish production in metric tons, 2003 to 2014.....	54
Table 20:	Evolution of rural and urban population – Island of Mauritius.....	58
Figure 1:	Plot of long-term emigrants trends: Male and female, 1972–1994.....	11
Figure 2:	Histogram of long-term emigrants trends: Male and female, 1972–1994.....	12
Figure 3:	Satellite picture of intense cyclone Dina approaching Mauritius on 21 January 2002	31
Figure 4:	Flooding map	36
Figure 5:	Landslides potentiality map.....	38
Figure 6:	Sea surface temperature, 2002–2012.....	43
Box 1:	The flash flood of 30 March 2013 affecting Port Louis, the capital city of Mauritius.....	35

ACRONYMS AND ABBREVIATIONS

AFB	Adaptation Fund Board
CSR	Corporate social responsibility
EEZ	Exclusive economic zone
GDP	Gross domestic product
GPS	Global positioning system
ILO	International Labour Organization
IMF	International Monetary Fund
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
MMS	Mauritius Meteorological Services
MOAIF	Ministry of Agro Industry and Fisheries
MOESD	Ministry of Environment and Sustainable Development
MOESDDBM	Ministry of Environment, Sustainable Development, and Disaster and Beach Management
MOFED	Ministry of Finance and Economic Development
MUR	Mauritian rupee
NEF	National Empowerment Foundation
NGO	Non-governmental organization
RDI	Regional Development Index
SADC	Southern African Development Community
SIDS	Small island developing State
SIS	Small island State
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

The *World Risk Report* (UNU, 2015) ranks the Republic of Mauritius seventh among the 15 most exposed countries to natural hazards, namely sea-level rise, cyclones and floods; and thirteenth among 171 countries for its disaster risk. However, being aware of climate change challenges, the Government of Mauritius has initiated studies more than a decade ago and subsequently took action to develop adaptation and mitigation strategies.

Vulnerability maps pertaining to flooding risks, landslides and storm surges have been established for better planning and monitoring. Climate change is now well established on the agenda of the Government and central to several policies being adopted. However, there are still some tasks that are yet to be addressed, especially when taking into account the Intergovernmental Panel on Climate Change's predictions and their threats to human settlements. Coastal communities, including island populations of Rodrigues, St Brandon and Agaléga, are far more exposed to the immediate impacts of extreme climatic events. As such, relocation of specific communities at Rivière des Galets and Quatre Soeurs is currently under consideration, though relocation remains an expensive option, logistically challenging and exclusively adopted as an ultimate solution.

This study analyses the prospects that migration could offer to mitigate the effects of climate change both in the short run and over the long term for the Republic of Mauritius. In fact, the migration profile of the country is multifaceted. It has been found that there is an increasing demand for international labour to work in the low-skilled sectors, while there is currently a high number of Mauritians, particularly those who study abroad, who seek to migrate because of better job prospects and opportunities. Within Mauritius, there is a high mobility of people migrating across districts and to and from Rodrigues. There is now evidence that some people from Rodrigues are coming to settle to Mauritius Island because of environment and climate-related issues. In addition, as the population is becoming older, Mauritius will, in a decade or so, become a human capital-stressed economy. These migration dynamics must be put in perspective to encompass climate change threats besides addressing socioeconomic, political and demographic challenges.

Some of the policy recommendations that emerge from the study are as follows:

- Develop an action plan that emphasizes the restoration of degraded or potentially degradable natural capital over the long term to contain migration and sustain livelihoods.
- Institute a disaster management protocol for areas with high population density and where built-up areas fail to respond to unexpected natural hazards.
- Establish comprehensive relocation plans for highly exposed and vulnerable communities, including squatters both in coastal and urban areas, living in precarious conditions.
- Set up a framework to address the long-run sustainable livelihoods schemes with respect to internal migration and the outer islands. A special framework could be devised for those who have to migrate due to the degradation of the natural capital caused by climate change.
- Foster dialogues on migration management and potential migratory outcomes of natural hazards within a regional context.

I

INTRODUCTION



Beach erosion: Filao trees' roots exposed to constant rise in sea level.
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I. INTRODUCTION

While migration in the context of the Republic of Mauritius¹ is multifaceted, its relationship with climate change is of particular importance. Observed changes in climatological variables, such as rainfall, storm occurrences, humidity, temperature, sea-level rise, are already having an impact on people and communities in both the islands of Mauritius, Rodrigues, as well as outer islands, such as Agaléga and St Brandon. Water shortages, the spread of airborne and vector-borne diseases, food insecurity, threatened livelihoods and loss of lives are mere facts related to climate change and extreme weather events. Forecasts made by the Intergovernmental Panel on Climate Change (IPCC) over the past decade indicate worsening scenarios for small island States (SIS), including the Republic of Mauritius. The *World Risk Report* (UNU, 2015) clearly indicates that Mauritius is among the most vulnerable countries to natural hazards. In particular, it is ranked seventh among 15 of the most exposed countries to natural hazards, namely sea-level rise, cyclones and floods; and is ranked thirteenth among 171 countries for its disaster risk. Complemented with other reports on potential adverse impacts on communities, livelihoods and the economy at large by the Government of Mauritius (2012a), the United Nations Development Programme (UNDP) (2014), and United Nations Framework Convention on Climate Change (UNFCCC) (2014), it is clear that the Republic of Mauritius will have to face much more serious challenges in the near future.

Based on a literature review and stakeholder interviews, this study tries to assess the implications of environmental and climate change for migration, particularly taking into consideration the vulnerability of communities that are at risk and which are already being impacted. Necessarily therefore, it evaluates the potential climate change risks based on the experiences of people living in Mauritius and Rodrigues in

1 The Republic of Mauritius is located in the South-West Indian Ocean. It includes the islands of Mauritius, Rodrigues, Agaléga, Tromelin, Cargados Carajos and the Chagos Archipelago, including Diego Garcia and other islands comprising the State of Mauritius. Its total area is about 2,040 km² with the mainland Mauritius occupying about 1,865 km², and Rodrigues about 108 km². Its ocean territory is very vast in large disproportionate to its land size, with an exclusive economic zone (EEZ) of about 2.3 million km², including an extended continental shelf of 396,000 km² in the region of the Mascarene Plateau jointly managed by the Republic of Mauritius and Seychelles, outside the border of their respective EEZ. Mauritius has made a submission for an extended continental shelf of an area in the region of Rodrigues Island. It has also deposited a Preliminary Information to the United Nations for an extended continental shelf in the Chagos Archipelago region with the intent to make a complete submission. Owing to data paucity, the assessment is essentially focused on Mauritius island, while reference is also made to Rodrigues in many instances.

order to map their vulnerability. The case study of Mauritius is indeed interesting as it pertains to a country that started as being agrarian over more than three centuries before becoming today a service-based upper middle-income economy. Its location in the South-West Indian Ocean (some 2,000 km east of the African mainland) makes it highly vulnerable to extreme weather conditions as a small island developing State (SIDS). In fact, one of the factors that motivated the structural transformation of the Mauritian economy from its agro-base is its vulnerability to natural disasters. Granted independence in 1968, the island has been ruled by different European colonizers, namely the Dutch, the Portuguese, the French and, finally, the British. The island's plural population today comprises people of Indian (the majority), African, Chinese and European origins. In 2015, the population was estimated at 1.26 million, of which 42,058 were citizens of Rodrigues and 274 from the other islands (Statistics Mauritius, 2015a). In spite of its cultural diversity, the country has benefited both from political and relative social stability since independence in 1968. This has been catalytic in the economic progress and success of the island nation (Subramanian and Roy, 2001). Today, one of the key challenges of the Government is how to integrate migration within the development strategies of the Republic of Mauritius in a holistic manner, particularly in the context of environmental and climate change.

1.1. Background and context

1.1.a. The context

Mauritius has opted for economic diversification as an engine for economic growth some four decades ago and has both departed and evolved rather fast from a monocrop agricultural economy, in the late 1960s, to an upper middle-income country today. Based on data from Statistics Mauritius (2015c), Mauritius' per capita income has risen from USD 200 at the time of independence in 1968 to the current figure of USD 9,187. The structural transformation of the economy can be summarized as follows: as a share of gross domestic product (GDP), agriculture has shrunk from 23.1 per cent in 1968 to 3.5 per cent in 2015, manufacturing output rose from 24.1 per cent in 1968 to 31.2 per cent in 1996, then fell to 21.6 per cent in 2015, while the services sector has experienced a rise of 13 per cent between 1968 and 2015. Its share of GDP rose from 52.8 per cent in 1968 to 74.9 per cent in 2014. This trend was also accompanied by a significant rise from non-tradable to

exportable services. The transformation was also marked by a drastic change in the composition of the labour force. Employment levels in the primary, secondary and tertiary sectors, which were in the ratio of 27 per cent to 10 per cent to 63 per cent in the mid-1970s, changed to 8.4 per cent to 29.4 per cent to 62.2 per cent, respectively, in 2014. Financial intermediation, tourism and the real estate sector remain the main drivers of the services sector today.

However, what remains a matter of concern is the rise in both income inequality and poverty in recent years. The Gini coefficient according to Statistics Mauritius (2015c) has shown a rise from 0.371 to 0.388 between 2000 and 2006/2007 and has reached 0.413 in 2012. All in all, relative poverty has shown a corresponding rise as well from 12.1 per cent to 13.5 per cent. The local reference level in absolute terms relates to half median monthly household expenditure amounting to 9,275 Mauritian rupees (MUR) in 2012 (Statistics Mauritius, 2012a, 2014). Pockets of poverty are spread across the island and found in the outskirts of main cities. However, according to Statistics Mauritius (2009), the highest proportion of poor people was to be found in the category of fishing communities, craftsmanship, plant and machinery operators and assemblers, amounting to 47.6 per cent, followed by those with an elementary job occupation, amounting to 42.3 per cent. In addition, unemployment rate in general was 7.9 per cent in 2015, while among the youth, it exceeds 25 per cent and among women this rate is one and a half times higher than that of men (Statistics Mauritius, 2013a, 2015b). The economic activity rate of women was only 46.5 per cent in 2014 as compared to their male counterparts, whose proportion was 76.1 per cent. In 2014, female unemployment rate stood at 11.4 per cent. Over the period 2000–2014, the Human Development Index (HDI) dropped slightly from 0.78 to 0.77.

Table 1 shows the macroeconomic evolution of the Mauritian economy over the past three decades. In particular, the increase in per capita income by eight folds between 1980 and 2015 must be noted, along with the average growth of the economy around 5 per cent over the past few decades. The deceleration of the growth rate over the recent past is due to the downturn of the world economy characterizing the world financial recession. Growth beyond 2012 has remained still shy and would still not exceed 5 per cent as per forecasts and would remain below the average of sub-Saharan economies' growth performance estimated currently

at 4.7 per cent (Svirydzenka and Petri, 2014). Actually, as reported in Table 1, in 2015, the growth rate amounted to 3.5 per cent.

Table 1: Trends in selected macroeconomic aggregates for Mauritius, 1980–2015

Item	1980	1985	1990	1995	2000	2005	2015
Population (million)	0.97	1.02	1.06	1.13	1.19	1.24	1.26
Urban population (%)	42.3	42.3	43.9	43.3	42.7	42.3	41.0
Economically active population	35.5	38.1	40.9	42.2	43.7	59.7	71.0
Income per capita (USD)	1,010	1,050	2,300	3,360	3,740	5,250	9,187
Real GDP growth (%)	4.5	6.9	7.2	4.3	9.0	1.2	3.5
Public revenue as a % of GDP	21.1	22.9	23.2	18.9	20.7	19.9	21.6
Public expenditure as a % of GDP	31.6	28.2	25.3	22.4	24.0	24.9	25.2
Inflation rate	24.5	8.3	7.0	6.0	4.2	4.9	1.3
Unemployment rate	22.1	19.7	15.3	2.8	5.7	8.8	7.9

Source: Statistics Mauritius (2012a, 2012b, 2015a, 2012b, 2012c) and Digest of Demographic Statistics (2012d).

While the inflation rate has been kept below two digits over the past two decades, it has been well monitored under 5 per cent lately (1.3% in 2015). On the other hand, unemployment rate has been rising quite steadily after the year 2000, basically due to the closure of many firms in the export processing zone (EPZ) producing textile products following the phasing out of the Multi-Fibre Agreement in 2005. This trend has been exacerbated by the downturn of the world economy in recent years as well, consequently leading to a high pool of unemployed women, as the latter constitute the majority of employees in the EPZ, accepting a low wage rate. Despite the expansion of GDP as the tax base, fiscal deficit has been recurrent for quite a few years, albeit within 5 per cent of GDP. Increase in public expenditure, over public revenue, can be explained

by the massive investment made in recent years in public infrastructure to reduce traffic congestion and render road transport more efficient. In addition, public spending has been on the increase to respond to the needs of human capital development and support the welfare state.

Table 2 shows the alternative sectors that drive economic growth in the Mauritian economy in recent years.

The share of the primary sector has shown a marked decline as its contribution to GDP, from 22.5 per cent in 1976 (first election year after independence) to 3.5 per cent in 2015. It is worth noting that this sector was sugar-dominated, and correspondingly its contribution has dropped from 17.8 per cent to 0.8 per cent over the same period. The share of the secondary sector has remained more or less constant with an insignificant drop of 1.6 per cent, falling from 23.2 per cent in 1976 to around 21.6 in 2015. However, within the tertiary sector, there has been major diversification accompanied by an expansion of services from 54.3 per cent to 74.9 per cent. Particularly, the latter transformation has been generated by expansion of the “financial intermediation” and “real estate, renting and business activities”. Furthermore, in 2015, the services sector was dominated by trade and retail services accounting for 12.1 per cent of the overall tertiary sector’s contribution to GDP.

Table 2: Sectoral contribution to GDP, 1976–2015 (%)

Sector of Economic Activity	1976	1980	1985	1990	1995	2000	2005	2010	2015
Agriculture, forestry and fishing	22.5	12.4	15.3	12.9	10.4	6.5	5.7	3.7	3.5
of which sugar cane	17.8	8.1	11.1	8.0	5.7	3.3	3.0	1.2	0.8
Manufacturing	15.2	15.2	20.6	24.4	23.0	22.5	19.2	18.0	14.8
Sugar	5.5	2.4	3.2	3.4	1.6	0.8	0.8	0.3	0.2
Food	—	—	—	—	—	3.9	4.9	6.3	5.2
Textiles and clothing	2.6	4.3	9.5	12.0	11.5	11.5	6.8	5.1	4.6
Construction	8.0	7.6	5.6	6.7	6.4	5.3	5.4	6.9	4.4
Wholesale and retail	11.3	14.2	13.2	13.0	12.8	11.5	11.9	11.8	12.1
Hotels and restaurants	1.8	2.3	2.4	3.9	5.1	6.0	7.1	7.0	6.5
Transport, storage	8.5	11.3	10.9	10.4	11.4	12.7	11.9	9.5	6.2
Communications (including information and communications technology)	—	—	—	—	—	—	—	—	4.3
Financial intermediation	5.7	5.0	4.7	4.9	6.5	8.8	9.2	10.0	12.0
Insurance	4.2	3.3	2.9	1.5	2.1	2.3	2.8	2.9	3.2
Banks and leasing	1.5	1.7	1.8	3.5	4.4	5.7	5.1	5.7	7.5
Real estate, renting and business activities	10.2	12.7	11.1	8.9	8.5	8.4	9.8	8.4	5.7
Other activities (including public administration)	18.6	21.6	18.6	18.8	21.0	24.3	26.9	20.8	30.5

Source: Statistics Mauritius, 2012b, 2015a, 2015b, 2015c.

I.2. Migration – Evidences from the past

This section addresses the different types of migration that occurred over these last few years and decades in the Republic of Mauritius. Besides in- and outmigration, information about internal migration, labour migration, development-induced displacement and relocation are provided. The main drivers of these different migration flows are discussed and supported with empirical evidence. Altogether, evidence that (some of) these migration movements could potentially be linked to environmental and climate change is also addressed.

I.2.a. Immigration and emigration

Since its discovery, Mauritius has been populated over the past five centuries from different nations, starting with people of European, African and Asian origins. The population of the island has strongly been dictated by the colonizing countries and their ties with Africa and Asia. Today, the 1.3 million inhabitants of the Republic of Mauritius constitute mostly people of Indian origins (about 68% and of which 17.3% are Muslims), while the remaining – defined as “general population” by nationals – involves mostly people of European, African and Chinese origins. Mauritius’ population has been increasing ever since the abolition of slavery in 1834, followed by the arrival of indentured labourers from India to work in the sugar cane fields from 1835 onwards. Chinese workers were also brought prior to the arrival of Indian immigrants to work in the cane fields, but were soon found to operate as commercial traders. According to the International Organization for Migration (IOM, 2014), when the British took over the island from the French in 1810, the population of Mauritius was around 100,000, and this comprised mainly (80%) of slaves. The latter proportion changed eventually and did actually fall with the abolition of slavery around 1835 whereby many slaves returned to their homeland in Eastern Africa including the Malagasy Republic. The arrival of indentured labourers from India boosted the population of the island with the coming of more than 100,000 people of Indian origins (IOM, 2014). The population rose rapidly until the 1860, after which there was a major decline in the recruitment of indentured people. The highest growth rate of the Mauritian population peaked between 1851 and 1861 at 5.5 per cent. This figure gradually declined until 1962 when the natural rate of increase in population attained 3.1 per cent. More recently, the growth rate of the population as computed over the last census 2000–2010, was of

the order of 0.44 per cent (Statistics Mauritius, 2012d). Immigration of Indian labourers stopped officially in the second decade of the twentieth century. After independence, however, in 1968, Mauritians have been maintaining very good trade relationships through their ancestral ties.

- Labour migration dynamics in the context of Mauritius may be characterized by alternative type of mobility, based on elements provided by Lincoln (2012), namely Mauritian migrant workers, seeking jobs abroad, both on a short-term and a long-term basis;
- People from Rodrigues coming to settle in mainland Mauritius for job prospects;
- Skilled and non-skilled migrant workers who come to work in Mauritius, normally for a period not exceeding three years; and
- Foreign direct investors who invest in the different sectors of the economy, and who may seek to apply for permanent residency under well-established criteria.²

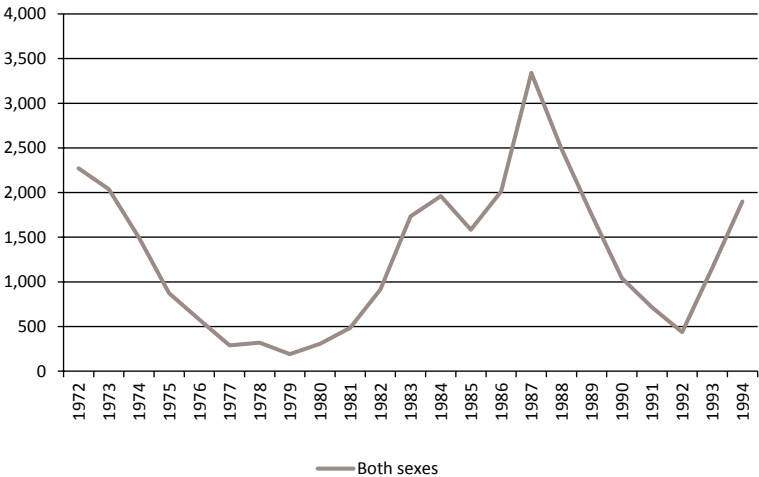
Figures 1 and 2 relate to the trends observed for the Republic of Mauritius over the period 1972 and 1994. The data were obtained from Statistics Mauritius (2012b) and available only for these years. However, from the information provided and illustrated for both sexes in Figure 1, it can be deduced that in the first decade or so following independence from 1972 to 1980, there was a marked decline in emigration, which picked up as a rising trend after 1980, until it peaked in 1987 at 3,339. After this year, there was a continuous decline until 1992, year after which a reversible trend was observed. In Figure 2, the emigration patterns for male and female Mauritians are illustrated separately and show their corresponding magnitude as well as direction across years. The annual average for the period 1972–1994 was 663 for male, 637 for female and 1,300 for migrants of both sexes combined. One could attribute the emigration patterns of the Republic of Mauritius to the macroeconomic evolution of the country. The poor performance of the Mauritian economy³ (negative and low growth rate of the Mauritian economy and rising unemployment) in the late 1970s and early 1980s could well explain the sharp rising trend in emigration until the economy improved significantly in the mid-1980s and early 1990s. Again by mid-1990s,

2 The Government of the Republic of Mauritius (2014), through the Prime Minister's Office, has laid down the various criteria for foreign nationals having occupational permits and operating in the country to become eligible to obtain a Permanent Residence Permit.

3 See for instance Subramanian and Roy (2001) and Sobhee (2009) on the macroeconomic conditions and evolution of the economy since independence.

when economic conditions were not as prosperous as the preceding years, emigration started to rise over again.

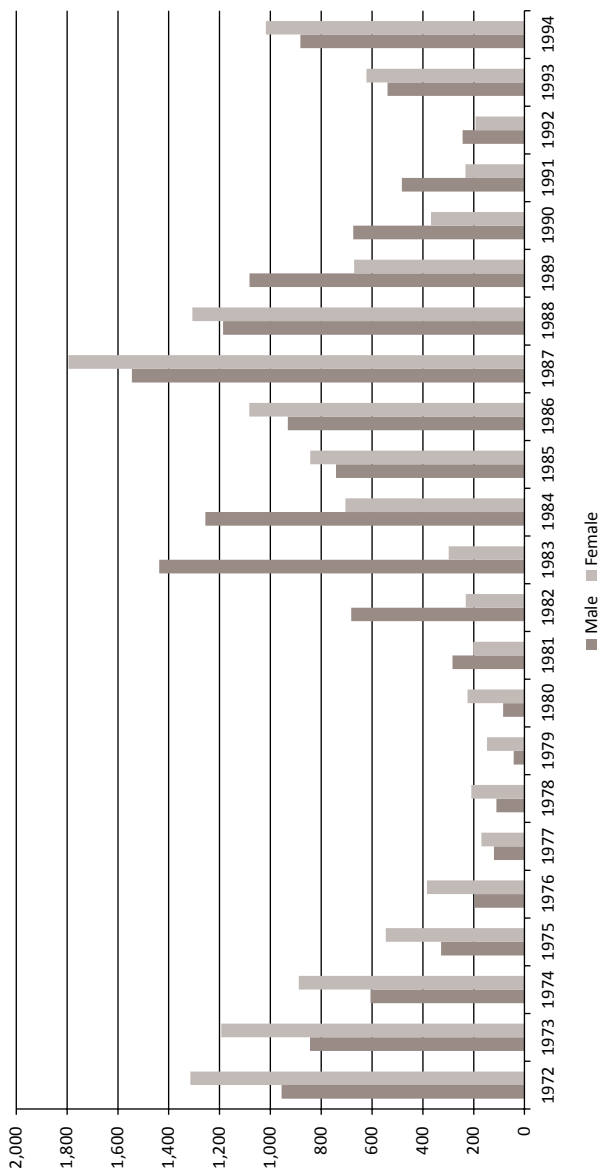
Figure 1: Plot of long-term emigrants trends: Male and female, 1972–1994



Source: Author’s own elaboration based on Statistics Mauritius, 2012b.

The increase in international migration could be better explained by the high inflation and unemployment rates prevailing in the early 1980s to the tune of 24.5 per cent and 22.1 per cent, respectively, while the declining trend after 1987 could be attributed to better economic conditions, whereby inflation rate dropped to 7.65 per cent on average and unemployment rate fell to an average of 17.5 per cent between 1985 and 1990, while over the same period the growth rate of the economy was 7.05 per cent as revealed in Table 1. However, it might be difficult to reconcile the exodus of people after 1992 with factors linked to inflation and unemployment, which remained on average lower than precedent years.

Figure 2: Histogram of long-term emigrants trends: Male and female, 1972–1994



Source: Author's own elaboration based on Statistics Mauritius, 2012b.

Table 3 illustrates the dynamic changes that have characterized the evolution of the increase in population over the past decade, more specifically, for the period 2003–2014.

Table 3: Migration dynamics for Mauritius, 2003–2014

Year	Natural increase in population	Net increase in migration	Increase in population	% change in population due to migration
2003	10,823	+524	11,347	+4
2004	10,755	-822	9,933	-7
2005	10,174	+350	10,524	+3
2006	8,442	-300	8,142	-2
2007	8,536	-400	8,136	-3
2008	7,368	-200	7,168	-2
2009	6,120	-300	5,820	-2
2010	5,874	-310	5,564	-2
2011	5,531	-3,068*	2,463	-0.2
2012	5,151	-1,800	3,351	-0.1
2013	4,248	-1,900	2,348	-0.1
2014	3,733	-1,850	1,883	-0.2

Source: Statistics Mauritius, 2012c, 2015a.

Note: *Indicates figures after 2011 adjusted by Statistics Mauritius, after the census of 2011.

Since 2006, “net increase in migration” has been negative; it peaked in 2011 after reaching a figure of 3,068, and declined thereafter despite remaining negative. This trend contributed to a decline in the overall population by offsetting the latter’s natural increase. A fall in the “natural increase in population” between 2011 and 2014 can also be observed.

During the 1960s, when Mauritius was about to be granted independence as a British colony, it was estimated that some 30,237 Mauritians migrated to the United Kingdom, France and Australia between 1961 and 1972 (Dinan and Dinan, 2014). This figure subsequently rose to 36,178 between 1973 and 1982. Another round of migration was observed in the late 1970s and the beginning of the 1980s. The migratory trends that

occurred during the late 1960s and early 1980s have led to a Mauritian diaspora estimated in 2000 around 9 per cent of the then population of the Republic of Mauritius at 1.2 million (Dinan and Dinan, 2014). The Organisation for Economic Co-operation and Development (2005) reported that there were 29,674; 26,481; 16,557 and 6,465 Mauritius-born people were found to be living in France, the United Kingdom, Australia and Canada, respectively.

As aforementioned, the migration process over different phases of colonization has led to Mauritius acquiring a plural society. Leuprecht (2009) compares the dynamics of migration of Mauritius with that of the Fiji and highlights an important element with respect to political stability of Mauritius that has not led to any significant emigration of the majority group. Contrarily, in Fiji, military coups have encouraged an exodus of people of Indian origin that has led to an upheaval in the ethnic balance (proportion of people of Indian origins, who came as migrant workers, as opposed to the natives) after these coups.

1.2.b. Internal and international migration

According to a study by the International Monetary Fund (IMF) (Svirydzenka and Petri, 2014), ever since the global financial crisis in 2007, the Mauritian economy has performed below its yearly average of 4.5 per cent over 20 years. It is further reported in this study that the Mauritian economy's growth rate was only 3.2 per cent as compared to that of sub-Saharan Africa, amounting to 4.7 per cent in 2013 and would remain below it for the years 2014, 2015 and 2016. Mauritius is currently facing acute unemployment among the highly educated workers due to the non-performance of several sectors of the economy following the economic crisis, in addition to the changing structure and exigencies of the labour market. Consequently, there is a wave of emigration sweeping over, urging Mauritians to migrate to other countries namely Canada, France and Australia, as earlier indicated. In this respect, it is worth noting that the World Bank in 2000 reported that 56.2 per cent of emigration pertained to people who have been educated at least up to the tertiary level. According to the Ministry of Finance and Economic Development (MOFED) (2014), the Government is aware of the high rate of unemployment among the youth. Such a document indicates that most of those who were unemployed have low educational attainment; in particular, 51 per cent have not completed secondary level education.

It was also observed that among those who are unemployed, females had better qualifications than males. In fact, 25 per cent of them were university graduates as opposed to their male counterparts, among whom there were 16 per cent graduates. In order to promote employability of the youth and reduce the problem of brain drain, the Government has introduced graduate skills programmes in various areas. This would enhance work-based learning and experience, on-the-job training and address skills mismatch. In addition, the Government will promote cooperation with African countries that often have a deficit in skills needed to accentuate Africa's development. More opportunities for collaboration are suggested, and this would assist in reducing local unemployment.

According to IOM (2014), over the period 2006–2011, 94,218 people changed their place of residence in the Republic of Mauritius. This represented 8.1 per cent of the Republic's population. Out of this figure, 89,808 changed residence within the island of Mauritius, whereas 2,232 changed residence within the island of Rodrigues. Moreover, 1,116 migrated from Rodrigues to Mauritius and 1,062 migrated from Mauritius to Rodrigues. In terms of age, it was reported that the most mobile cohort of migrants were in the age group 16–29.

The economic progress of Mauritius has necessitated in recent years the recruitment of expatriate workers, high-skilled and low-skilled altogether. The low-skilled (manual) workers have been contracted to work especially in the construction and the manufacturing sectors and come mostly from China, Bangladesh, India and Madagascar. On the other hand, the high-skilled workers, from France, the United Kingdom and India mostly, operate in the information and communications technology, and financial services sectors. Based on published figures by Statistics Mauritius (2013a and 2015e), there were 28,383 foreign workers in 2014 operating in large enterprises in Mauritius, while in 2012, this figure stood at 23,477. The estimate for 2015 was 29,025, and out of which 80 per cent were employed in large scale export-oriented firms.

Lincoln (2012) pointed out that given their limited bargaining situation, low wage rate and willingness to work at odd hours, migrant manual workers are generally preferred to Mauritian citizens, especially in the textile and construction sectors. Among all work permits issued in 2010, 16.1 per cent pertained to the construction sector, while 76 per cent were related to the manufacturing sector. Based on Statistics Mauritius (2005), these figures stood at 6.6 per cent and 79.2 per cent respectively, thereby indicating a rising trend for work permits issued within the construction sector. Moreover, in terms of country of origin (refer to Table 4), 35.4 per cent came from India, 26.3 per cent from Bangladesh, 20.8 per cent from China and 6.5 per cent from Sri Lanka, while 10 per cent were from other countries. The highest number of work permits issued for female workers came from Bangladesh (17.3%), followed by China (10.6%) within the textile sector. In addition to work permits, occupational permits⁴ were also issued and mostly to professionals (67.4%) which were essentially issued to French citizens to the tune of 37.4 per cent out of 2,755 permits issued in 2008. Figures in both tables show that male workers continue to outnumber their female counterparts.

4 Occupational permits are provided to professional and highly skilled workers for a particular or specific job.

Table 4: Foreign workers employed in large establishments, * March 2011–March 2014

Industry	2011			2012			2013			2014		
	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes
Total	12,756	9,569	22,325	14,077	9,400	23,477	16,070	9,309	25,379	18,611	9,772	28,383
Export-oriented enterprises	9,231	9,013	18,244	9,601	8,645	18,246	11,654	8,692	20,346	13,211	9,127	22,338

Source: Statistics Mauritius, 2013a and 2015e.

Notes: *Large establishments as mentioned here refer to an enterprise with more than 10 employees.

For the year 2015, it was estimated that the total number of expatriate workers would rise to 29,025.

Table 5: Work permits issued for manual workers by country of origin, 2005–2010

Year	Country										Total
	Bangladesh		China		India		Sri Lanka		Others		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
2005	762	865	2,096	6,427	8,794	337	297	1,417	2,282	743	24,020
2006	2,415	1,221	2,500	6,824	9,678	292	402	1,921	2,475	753	28,481
2007	4,904	1,766	3,577	6,937	11,185	297	536	2,580	2,893	858	35,533
2008	5,828	2,417	2,639	5,310	9,424	230	551	2,606	2,131	733	31,869
2009	778	3,290	2,658	3,839	10,682	243	607	1,840	1,900	837	26,674
2010	3,063	5,856	3,442	3,586	11,719	265	591	1,596	2,533	1,164	33,815

Source: Lincoln, 2012.

Migrant workers generally benefit from the same rights as local workers as stipulated in Government of Mauritius, 2012a, their working conditions, including medical, health and safety and accommodation, should not be less favourable compared to Mauritian workers and they also have equal right to trade unions. However, they do not acquire the right to citizenship. Once their contracts (normally three years) are over, they are urged to leave the country. Otherwise, they may be treated as illegal migrant workers and would be deported. Most of the time, they live together or in the vicinity of their workplace. Given their short-term contractual appointment, they tend to have a modest life and perform a lot of overtime work, especially in the textile sector. Such workers try to mobilize the maximum amount of savings that they will take back home (Lincoln, 2012). Employers are compelled by law to provide all the basic facilities to migrant workers so that they could work and live decently. Since hospitals provide services free of charge to all, migrant workers do as well benefit from such facilities.

The study by Lincoln (2012) illustrates a further type of migrants, particularly in the real estate sector, who could acquire the right to residency under specific conditions. Over the last five years, there have been huge investments made by South African nationals in Mauritius. In addition to property development, these investors would acquire Mauritian citizenship pending upon the amount of investment made by them in the real estate sector. An investor, whose company's turnover has exceeded about USD 500,000 (or MUR 15 million) annually per shareholder over the past three years of operation in the country, is eligible to permanent residency (Board of Investment, n.d.).

In fact, a survey undertaken by Gopaul (2013) uncovers several problems faced by migrant manual workers. The safety and health standards where they live are often compromised, as sometimes they are packed in one room for living. Communication is a barrier too, as many migrant manual workers cannot understand the local dialect nor can they communicate in a common foreign language. The study by Gopaul (2013) also indicated that the conditions of migrant workers may not be necessarily satisfactory as compared to the local workers. Their work and pay conditions differ quite significantly. Moreover, these workers lack social protection and find it difficult to adjust to the Mauritian lifestyle. Differences in working conditions could be explained by the fact that the Government has not been actively involved in the recruitment and management of foreign

labour until recently. The Government of Mauritius (2012a), in line with ILO norms, has approved a framework that provides proper guidance on the recruitment and treatment of foreign workers in Mauritius. Lack of enforcement of existing labour laws towards international workers and the unruly employers may explain the unfavourable conditions in which foreign workers operate in Mauritius.

According to the Government of Mauritius (2012a), the working conditions of migrant workers are often left to be desired and will need major improvements through amendments to labour laws. The ILO has urged for the implementation of an action plan to improve the working and living conditions of expatriate workers in Mauritius. Some of the recommendations proposed are to reduce the discrimination in work and pay conditions and adopt measures that would integrate migrant workers within the labour market framework. The action plan will also identify and address all forms of disparities in their working schemes so as to improve their status. Trade unions, as well as the Mauritius Employers Federation and Ministry of Health and Quality of Life, will be the responsible parties to ensure that progress is made to these effects. On the other hand, the Government is trying to put in place a hybrid system⁵ of social protection for Mauritian workers who are working in countries, such as Canada and France. This system will benefit the workers, as well as their family members and held to regularize social security payments to retired citizens who have worked overseas.

Svirydzhenka and Petri's (2014) country paper broadens the discussion on foreign labour and the recruitment of migrant workers given that by 2025, Mauritius will suffer from a shortage of workforce, as the active population level is actually on the decline. Such trend would thus necessitate the need to recruit foreign workers to make up the ultimate deficit in the working population. Currently, the share of foreign workers to the overall labour force has risen from 0.25 in 1990 to 4.0 per cent in 2009, and this figure keeps rising rapidly. Moreover, the IMF study (Svirydzhenka and Petri, 2014) highlights that despite the increase in the tertiary enrolment rate, Mauritius is still far behind the South Asian tigers, such as Singapore; Hong Kong, China; and the Republic of Korea, where the tertiary level enrolment rates are much higher. Such trends indicate the ultimate shortage in the skilled labour force that the country will

⁵ This relates to a system that involves the Governments of both the host and recipient countries (de facto, Mauritius in this case) in deciding on the structure of retirement pension of migrant workers.

need to fill up in the near future. In the same vein, the Government has recently advised the Mauritian population to increase its fertility rate.

I.2.c. Development-induced migration

The net migration of the people of the Republic of Mauritius has varied across the different districts over the past decade. Table 6 illustrates this evolution. A high number of people have left Port Louis, the capital city, to settle in other districts mostly in Pamplemousses, followed by Plaines Wilhems and Black River. Indeed, the highest number of people who have migrated from one district to another is from Port Louis, followed by Savanne and Grand Port. There are more people who have migrated from Rodrigues to Mauritius than vice versa and have settled mostly in Port Louis, followed by Pamplemousses and Black River. It is interesting to observe that people who have migrated from Rodrigues have moved to similar districts as those who have migrated out of Port Louis, namely to Pamplemousses and Black River. The net migration out of Port Louis, being the highest among all districts, warrants further investigation but could possibly be explained by multiple factors. While it is difficult to know more about the profile of the people who have left the capital city, there may be different drivers for such internal migration process. One plausible argument could be the difficulty to secure employment in Port Louis itself. The demand for certain low skills, for instance, those who have left Port Louis to settle in Black River and Pamplemousses might find more opportunities for jobs within the construction industry. The latter may be associated with land democratization and real estate development with the conversion of agricultural land for residential purposes along with significant coastal development. Moreover, the possibility to acquire land and benefit from government support might be easier in these districts than in the capital city, characterized by high population density and pockets of poverty.⁶ The high population density, the increase in pollution and other adverse demographic factors related to urbanization might have driven people out of the capital city, for instance to settle elsewhere as well.

⁶ See, for instance, Giles and Mu (2014) explaining similar tendencies across different villages in China.

Table 6: Net migration between districts of migrants 5 years of age and over

District of destination (to)	District of origin (from)										Rodrigues and Outer Islands
	Total	Port-Louis	Pamplemousses	R. du Rempart	Flacq	Grand-Port	Savanne	Plaines Wilhems	Moka	Black River	
Mauritius	–	5,272	-1,629	-315	186	416	938	-2,050	340	-3,502	344
Port Louis District	-5,272	–	-1,929	-50	-26	23	-4	-1,578	-395	-1,395	82
Pamplemousses District	1,629	1,929	–	-244	-29	7	50	-61	50	-150	77
Rivière du Rempart District	315	50	244	–	121	-14	15	-76	36	-72	11
Flacq District	-186	26	29	-121	–	107	15	-274	51	-52	33
Grand Port District	-416	-23	-7	14	-107	–	265	-495	3	-63	-3
Savanne District	-938	4	-50	-15	-15	-265	–	-515	-31	-49	-2
Plaines Wilhems District	2,050	1,578	61	76	274	495	515	–	468	-1,478	61
Moka District	-340	395	-50	-36	-51	-3	31	-468	–	-179	21
Black River District	3,502	1,395	150	72	52	63	49	1,478	179	–	64
Rodrigues and Outer Islands	-344	-82	-77	-11	-33	3	2	-61	-21	-64	–

Source: Statistics Mauritius, 2000b.

1.2.d. Relocation

As far back as the extreme event of 2007, whereby the southern part of the island was flooded, including villages, the Government has been considering the option of potentially relocating at that time some 300 inhabitants of Rivière des Galets. Actually, the passage of an extra tropical cyclone in May 2007 generated 10 m offshore swells within a period of 18 s and travelling at 50 km/h caused extensive flooding in that part of the island (Adaptation Fund Board (AFB), 2012). Since then, many studies have been carried out to look into the possibility of addressing vulnerability of this village to natural hazards, in particular, storm surges and sea-level rise. With the help of technicians from the Ministry of Housing and Lands, the cost of relocating some 100–150 people of Rivière des Galets to a safer location, so called green field site, was calculated at USD 9.3 million (AFB, 2012).

The option of relocation appears to be the most cost-effective way to solve the coastal vulnerability problems in a sustained manner based on the following observations made at Rivière des Galets:

- (a) Clearly observed/measured changes at the site due to climate change effects in the coastal zone;
- (b) Perceived increase in the rate of change and degree of vulnerability in the last 10 years, relative to other sites (therefore increasing concern);
- (c) Evident risk of damage to housing and infrastructure;
- (d) Possibility of disruption of, or constraints to, normal quality of life and peace of mind, due to ongoing risks;
- (e) Risk of loss of jobs due to unrestrained changes at the coastal site; and
- (f) Evident risk of loss of human lives.

In fact, an interview was conducted by the Ministry of Environment and Sustainable Development (MOESD, 2012)⁷ under the AFB in connection with the potential relocation of inhabitants of Rivière des Galets. This was more of a perception survey adopted by the parent ministry, which

⁷ This ministry has now been revamped since 2014 as the Ministry of Environment, Sustainable Development, and Disaster and Beach Management.

indicated that 49 per cent, so about half, of them agreed to be relocated without any conditionality, while 43 per cent, or 2 out of 5, agreed to be relocated subject to specific conditions be fulfilled to their satisfaction and the remaining 8 per cent did not want to be relocated. Of those who would wish to be relocated, they have indicated that they require financial support for the purchase of land and construction of a house in concrete and would wish to be relocated close to their relatives and current neighbours. This study corroborates the findings of IOM (2011a) discussed below and also mentions about the lack of motivation of the senior citizens to be relocated. By and large, relocation remains logistically challenging.

An IOM (2011a) study illustrates the varying impacts – direct and indirect – on sustainable livelihoods. In the exposed region of the south-west of the island at Rivière des Galets – highly vulnerable to sea-level rise, storm surges and flooding – the study reported that senior citizens are unwilling to move to a more secured place as opposed to those of younger generations. The inhabitants of Rivière des Galets who were interviewed reported that they are neither trained for any evacuation, nor have they been made aware by government officials of the possibility of any potential relocation. Moreover, should they be relocated, they would like to be compensated or financially supported. Fishers in this region have also expressed their concern with respect to threatened livelihoods. Indeed, they have observed a decline in fish catch and an increase in the frequency of bad weather, obstructing them from fishing in the high seas. Some respondents have also enumerated the problems associated with growing their crop. The same study has analysed another village at Petit Sable, in the south-east of the island, whereby it was found that the onion plantations are also at risk due to saltwater intrusion in the fields. Affected planters averred that there were insufficient compensation schemes from the Government for the damages caused by extreme weather events to their businesses. Another case of relocation linked to climatic influences is that of Quatre Soeurs, where 11 households have to be relocated to Camp Ithier. This was due to landslides occurring in this region after heavy falls and whereby houses, located at the foot of hills and mountains, are threatened of cracking and collapse.

I.2.e. Migration from Rodrigues to Mauritius

As aforementioned, 1,116 people migrated from Rodrigues to Mauritius, while 1,062 migrated from Mauritius to Rodrigues. As shown in Table 4, 344 in 2011 left Rodrigues to settle in Mauritius. IOM (2011a) has assessed different aspects of migration related to environmental degradation and climate change in the Republic of Mauritius. The study – which includes Rodrigues and Agaléga, besides five other places in Mauritius – presents the various challenges that characterize such migration conditional on demographic, geographic, cultural, occupational, social as well as economic factors. There is substantial evidence that Rodriguans are settling in the main island Mauritius for several reasons, one of which is degradation of the fisheries resources. In this study, IOM (2011a) sampled Tranquebar as a suburban area in the region of Port Louis, and occupied for over 30 years by people coming from Rodrigues Island. The unfavourable economic conditions in Rodrigues, as opposed to the better job opportunities in Mauritius have motivated the Rodriguans to come and settle in the main land (IOM, 2011a).

Some of the major difficulties highlighted in this study regarding the migration of Rodriguans to Mauritius are as follows:

- Lack of information and support for resettlement in Mauritius;
- Absence of land use monitoring policy in favour of Rodriguans in Mauritius;
- Limited information regarding the possibility for Rodriguans to serve as migrant workers in countries within the region, namely Southern African Development Community (SADC);
- No clear policy and guidance with respect to international migration in general and Rodriguans' in particular; and
- So far, the study notes that there has not been any forced migration.

Further studies on why people from Rodrigues migrate to Mauritius have been studied by IOM (2011b, 2012) and uncovered that such migration could be explained essentially by economic reasons. Drivers, such as the environment and sociological factors, might influence this migration, but this would depend on the background of the people whether they are from a particular region or socioeconomic group. In fact, the study undertaken by IOM (2011b) on migrant fishers from Rodrigues

to Mauritius revealed that the latter have migrated due to two main drivers – one being economic and the other being environmental. In fact, 57 per cent of the interviewees indicated that they came to Mauritius for economic reasons, while 31.6 per cent attributed this to environmental factors. The latter are associated, particularly to a constant decline in fisheries resources resulting in declining fish catch and constituting a threat to their livelihoods. These migrant fishers have been settling in regions that are economically disadvantaged. Most of them perform manual jobs, and that too, on an occasional basis. Their limited level of education impacts negatively on their prospects to secure a better job other than working as helpers, masons and drivers, among others.

Moreover, contrary to the existing tradition in Rodrigues, where people have a closely-knitted social fabric and are mutually helpful to one another, they are confined to their own communities with little scope to develop a good social network in Mauritius. On the other hand, the study by IOM (2012) on migrant workers from Rodrigues to Mauritius focused on the socioeconomic and health characteristics of these migrants. It also highlighted that migration of people from Rodrigues to Mauritius started as early as the 1970s but accentuated in the mid-2000s. Among the drivers of this migration, the most important one is economic, followed by social and to some extent, environmental. The limited scope for employment and agriculturally locked-up economy has urged people to look for better prospects during the recent years. The low income from fishing claimed by certain migrants, the vulnerability of the agricultural sector in Rodrigues to natural hazards and the limited educational landscape of the island have all been driving elements. The IOM (2012) study reflects the aspirations of the youth who would like to live a much more comfortable life than their parents with successful educational achievement, a more vibrant social life comparable to what exists in Mauritius and to work in non-traditional sectors, such as information and communications technology and services sectors.

1.2.f. Role of remittances

A large proportion of those Mauritians who migrate are students who went to study abroad. The IOM report (2014) indicated that the emigration rate of Mauritians holding at least a first degree is more than 50 per cent. In 2011/2012, there were 3,007 Mauritians studying abroad as compared to 3,500 one year before and 802 in 2000/2001.

Table 7 relates to the remittances of Mauritian citizens (exclusively as defined by World Bank, 2011), as well as the outflow of remittances from expatriates, students and other emigrants, to their country of origin.

Table 7: Inflows and outflows of remittances of Mauritius, 2003–2012
(millions USD)

Year	Inflow	Outflow
2003	215.0	10.0
2004	215.0	11.0
2005	215.0	11.0
2006	215.0	13.0
2007	215.0	12.0
2008	215.0	14.1
2009	211.2	12.2
2010	226.4	13.3
2011	249.0	11.3
2012	246.6	N/A

Source: World Bank, 2011, 2014.

Regarding remittances from Rodriguan workers settled in mainland Mauritius, the IOM (2011b) study revealed that few among them (31.5%) send remittances to their families who were left behind in Rodrigues. Of those who managed to work, one out of three was found to be able to remit money back home to contribute towards the purchase of land or a house, to support children's education or to reimburse a loan. The low remittances by migrants from Rodrigues could be explained essentially by the low income they generally derive from the jobs they perform in Mauritius. Among the higher income earners, it was reported that since most members of a family would have been settled on the mainland, there was little reason for them to send any remittance home.

II



KEY CHALLENGES: THE MIGRATION, ENVIRONMENT AND CLIMATE CHANGE NEXUS

II. KEY CHALLENGES: THE MIGRATION, ENVIRONMENT AND CLIMATE CHANGE NEXUS

II.1. Sudden-onset events and its effects on migration patterns

A number of studies exist with respect to migration and adaptation strategies for SIS, namely King and Smithers (2009), Bautista and Salcedo (2008), Vang (2008), Ranoivoson (2008) and the Government of Mauritius (1999b), among others. Migration “relates to the movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification” (IOM, 2011b). Planned relocations are generally undertaken by the Government, providing the financial incentives and logistical facilities to facilitate relocation as it has been the case in Maldives and Papua New Guinea (King and Smithers, 2009). Islands, such as the Maldives in the Indian Ocean and Tuvalu and Kiribati in the Pacific Ocean, are low lying and highly exposed to sea-level rise. The tsunami of 2004 particularly provided the evidence of the damages that sea-level rises could do to the people of Maldives and has accentuated the relocation of people from unsecured to secured islands. However, King and Smithers (2009) also emphasized the role of migration to other more secured places as the migrants do remit money to their families left behind.

Barnett and Chamberlain (2010) have indicated the possibilities of migration as a solution to climate change in Bangladesh and the Pacific, being disaster-prone regions. De Haan (2000, 2006), Dinar et al. (2008) and Waddington and Sabates-Wheeler (2003) have highlighted the role of migration whenever livelihoods are at stake. The outmigration in the Pacific islands is not totally something new and might increase further due to climate change. Here, it is worth noting the case of Tulun (Carteret) islanders in Papua New Guinea whereby relocation started as far back

as 1984 due to extreme weather events, causing land erosion, rise in population and hence threats to livelihoods (King and Smithers, 2009). Such resettlement was made possible with the Government's strategy for relocation and financial support. The authors also emphasized the complexity related to resettlement and the expectations of the communities moving to a new area.

Application of climate-resilient and disaster management strategies had been undertaken as well by several SIS to address the consequences of extreme weather events and their physical impacts on the environment and livelihoods. In the Philippines, for instance, Bautista and Salcedo (2008) highlighted that public education is being used as a major instrument to raise awareness of the dangers of climate change associated with floods, storm surges and tropical cyclones. Besides education, Global Positioning System (GPS) is used to establish flooding and landslides maps. With the collaboration of local authorities, these maps are used to design evacuation plans during a natural catastrophe. Vang (2008) discussed that in the Pacific islands, there is much being done by the Government to improve the efficiency and effectiveness of the cyclone tracking system. In Sri Lanka, to address landslides – which are very common in the country and which cause serious damages to private and public infrastructure – soil-engineering methods are being implemented. Ranoivoson (2008) explained how coral transplantation is being undertaken in Madagascar to replenish coral reefs often damaged by storms and heat. Such method has helped to improve marine biodiversity, in particular, fish biodiversity. Such an initiative helps to ensure sustainable livelihoods of fishers and communities that depend on the sea for a living. UNFCCC (2009) highlighted the case of Timor islands whereby the inhabitants have developed their own variety of staple food and crops to better adapt to the erratic rainfall patterns observed in recent years, as well as the frequent occurrence of tropical cyclones. In this way, they have shown the ability of a population to adapt to climate change and ensure sustainable livelihoods.

II.1.a. Tropical cyclones

Mauritius is highly exposed to very intense tropical cyclones that can generate gusts of wind exceeding 250 km/h accompanied by torrential rains as shown in Table 8. Such tropical cyclones are also responsible for wave surges that threaten the lives of people, cause severe damages to

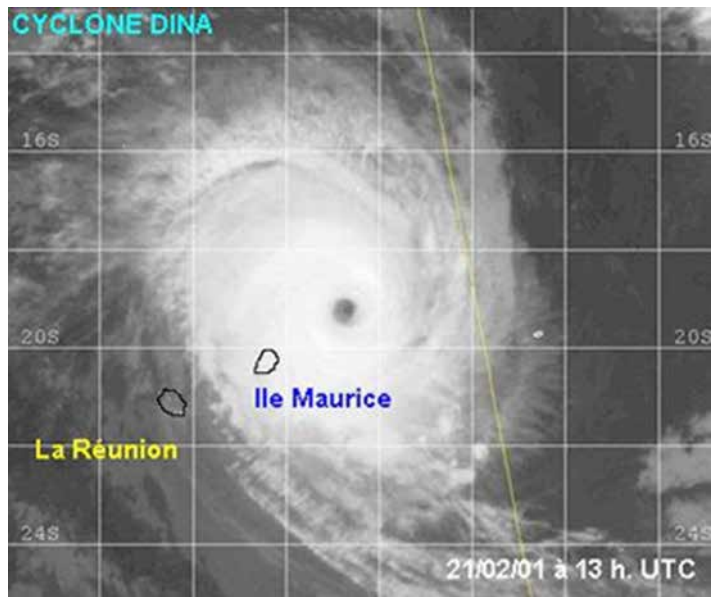
public and private infrastructure, agriculture and farming, and lead to beach erosion, among others.

Table 8: Worst tropical cyclones in Mauritius, 1960–2012

Name and year of cyclone	Maximum gust recorded in km/h	Maximum rainfall recorded in km/h
Alix (January 1960)	200	645
Carol (February 1960)	256	508
Jenny (February 1962)	235	185
Danielle (January 1964)	216	795
Gervaise (February 1975)	280	533
Claudette (December 1979)	221	300
Hollanda (February 1994)	216	494
Dina (January 2002)	228	711

Source: MMS, 2014 and Padya, 1989.

Figure 3: Satellite picture of intense cyclone Dina approaching Mauritius on 21 January 2002



Source: National Aeronautics and Space Administration (ReliefWeb, 2002).

Figure 3 shows intense cyclone Dina approaching Mauritius and which severely affected the island of Rodrigues. As indicated in Table 8, Dina cast off 711 mm of rain and blew gusts to the order of 228 km/h, passing some 50 km off the north coast of Mauritius. It had a diameter of about 800 km.

Table 8 further illustrates how intense and dangerous tropical cyclones could be based on wind speed and amount of rains dumped during their passage over or close to the island of Mauritius. An assessment made by Padya (1989) considered that cyclones Alix and Carol were both in fact responsible for reducing sugar production by 50 per cent in 1960, while 40 people were reported dead after the passage of cyclone Carol in February 1960. With the advent of a formal cyclone warning system in 1960 and progress in media and modern information technology, the number of deaths has been reduced significantly. Indeed, only five deaths were reported during cyclone Gervaise in 1975, two during cyclone Hollanda and none during cyclone Dina. It has also to be borne in mind that while more information exists today with respect to weather and cyclone forecasting and tracking, Mauritians have invested a lot in improving their housing structure. According to Statistics Mauritius (2012a), in 2011, 92 per cent of the residential buildings were made completely of concrete, while the rest comprises of buildings made up of a mix of concrete, iron sheets and wood.

II.1.b. Storm surges

Sobhee et al. (2013) have analysed the vulnerability of coastal communities, based on a survey of four coastal villages: Pointe aux Piments, Rivière des Galets, Case Noyale and Quatre Soeurs. These four villages differ quite significantly in terms of their demographic, as well as economic profile. But, by and large, these villages correspond to communities of fishers, planters and agriculturists, as well as low-income people, often threatened by extreme weather events. The method of Sustainable Livelihoods (DFID, 1999) was adopted to assess the extent to which people's livelihoods are vulnerable to environmental disasters and change. Such a method assesses vulnerability by evaluating the different forms of capital of people, namely human capital, social capital, financial capital, physical capital, natural capital and institutional capital. This study encompasses gender differences and their implications under climate change threats and has found that there are several inhabitants from the four villages studied who are found to be exposed to different forms

of vulnerability. While some people have their lives exposed due to poor housing structures, others are potentially at risk due to coastal flooding in view of the location of their residence and sea-level rise. Furthermore, there are farmers, planters and fishers who would become gradually more vulnerable in terms of threats to sustaining their livelihoods over the long run. Among the different recommendations made in the report, there is mention of a preparedness plan that should be established by the Government in consultation with different stakeholders to better address natural catastrophes. There is also the need to empower communities at risk through capacity-building and awareness campaigns of the dangers of climate change and how to develop resilience to extreme weather events. Of significant importance, among the recommendations, is the provision to relocate certain communities especially in the region of Case Noyale and Rivière des Galets. The latter are currently living too close to the shore, and their houses might be easily swept away, particularly during storm surges. Those who were found to squat State lands are living in highly precarious conditions.

II.1.c. Floods and flash floods

It has been reported by the Mauritius Meteorological Services (MMS) (2014) that the long-term annual mean of rainfall (1971–2000) for the whole island of Mauritius was 2,010 mm and revised to 2,003 mm for the period 1981–2010 (Statistics Mauritius, 2015d). The island gets most of its rain during summer (November to May), i.e. mean annual of 1,344 mm or 67 per cent of the overall annual mean, while the winter average remains at 666 mm. Variations in rainfall amounts are quite significant from 4,000 mm on the Central Plateau to 800 mm along the coast (Government of Mauritius, 2010). In addition, rainfall variability has risen together with an increased occurrence of high-intensity rainfall events. This condition favours flash floods and consequently run off to the detriment of recharge of aquifers. According to past technical reports of the MMS, episodes of droughts are becoming quite frequent over the years with remarkable deficiency in rainfall noted in the years 1983/1984, 1998/1999 and 2011/2012.

Long-term time series of rainfall amount over the past century (1905 to 2008) show a decreasing trend in annual rainfall over Mauritius. It has been observed that there has been a decrease in annual rainfall by around 8 per cent when compared to the 1950's Meteorological Services (MMS, 2014). Projections indicate that by 2050, the utilizable water resources

will decrease by up to 13 per cent (Government of Mauritius, 2010). Decline in rainfall is also attributed to the following: (a) longer period of transition from winter to summer; (b) lengthening of the intermediate dry season; and (c) a shift in the start of summer rains (MMS, 2014).

Table 9: Mean annual precipitation in millimetres for Mauritius, 2007–2014

Year	Mean annual precipitation by region (mm)				
	North	South	East	West	Centre
2007	1,095	2,375	2,436	1,028	2,744
2008	1,646	2,942	3,001	1,155	3,044
2009	1,692	2,827	3,153	1,207	2,965
2010	1,061	2,400	2,757	610	2,154
2011	1,439	2,210	2,797	1,051	2,227
2014	1,264	2,607	2,759	906	2,833

Source: Statistics Mauritius, 2012a, 2015d.

Table 10: Rainfall for islands of Mauritius and Rodrigues, 2011–2014 (mm)

Month	Mauritius				Rodrigues			
	2011	2012	2013	2014	2011	2012	2013	2014
January	304	88	258	419	90	213	70	44
February	330	210	486	184	85	227	218	62
March	373	343	355	270	109	86	90	304
April	58	249	214	247	43	50	144	113
May	114	186	54	127	73	80	40	76
June	151	178	75	61	69	21	44	105
July	93	161	65	126	65	105	13	174
August	172	82	110	116	99	37	93	56
September	44	54	37	54	9	41	68	36
October	51	42	138	64	71	11	90	22
November	71	68	233	89	18	34	30	74
December	184	120	101	336	103	137	80	78
Total for the year	1,945	1,781	2,126	2,093	834	1,042	980	1,144

Source: Statistics Mauritius, 2012a, 2015c.

**Box 1: The flash flood of 30 March 2013 affecting Port Louis,
the capital city of Mauritius**

On 30 March 2013, Port Louis experienced one of the worst natural disasters in its history when 152 mm of rain fell within three hours. This led to water accumulation and inundation, whereby 11 people lost their lives. This date is sadly remembered as Black Saturday. In February of the same year, Port Louis experienced water accumulation especially on the main road linking the capital to the south and north. But this was just a prelude, and there was no loss of lives. However, the event of 30 March was an unprecedented one, and before the rescue could come, the entire capital was under water. Several damages were observed to public and private infrastructure, as well as damages to vehicles that were caught trapped by the floods. The picture below clearly shows the amplitude of the event.

The media started questioning the ability of the road infrastructure network to respond to such heavy falls. The press reported that the major drains that are supposed to carry away excess water especially during heavy rains were blocked while there was poor maintenance of canals and rivers that run into Port Louis. However, it was also found that the city centre is a densely built-up area that may not sustain such heavy rains within a short span of time.

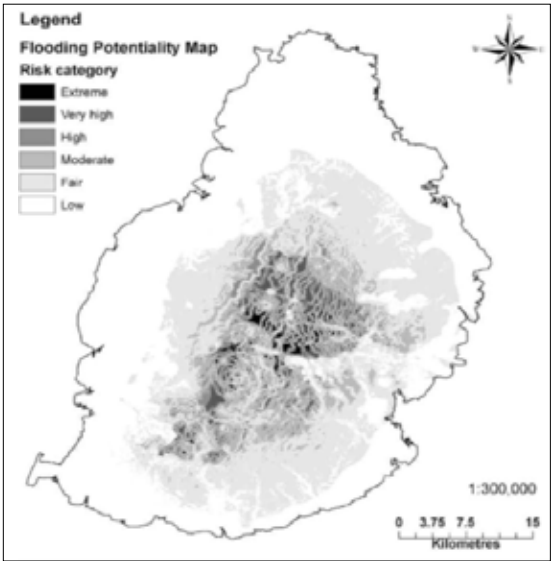


Source: Desai Associates, 2013.

Due to its land topography, rainfall, on average, is lower for the island of Rodrigues than that of Mauritius, as the former has a relief that is much lower (just over 200 m) than that of the latter (just over 600 m) and does not have a central plateau (but central ridge instead), which very much influence the amount of rainfall. Based on the long-term mean, of 2,010 mm of rain annually for Mauritius, and from Table 10, it can be said that for the years 2011 and 2012, the amount of rainfall obtained was below average, while for years 2013 and 2014, it was above average.

Flash floods have also been observed recently and are becoming quite frequent with significant little rain being dumped in very short period of time (Government of Mauritius, 2013c). In March 2013, an unprecedented flash flood occurred in Port Louis after 152 mm of rain fell in less than three hours and killing 11 people on a single day (Government of Mauritius, 2013c, 2013b). Box 1 provides more information on 30 March 2013 flash flood that struck Port Louis. Moreover, flooding is also observed in Mauritius during the passage of tropical cyclone over or close to the island. Thunderstorms experienced during the months of November to April also contribute to flooding in specific areas of the island (Rughooputh, 2008).

Figure 4: Flooding map



Source: Nigel and Rughooputh, 2008.

II.1.d. Landslides

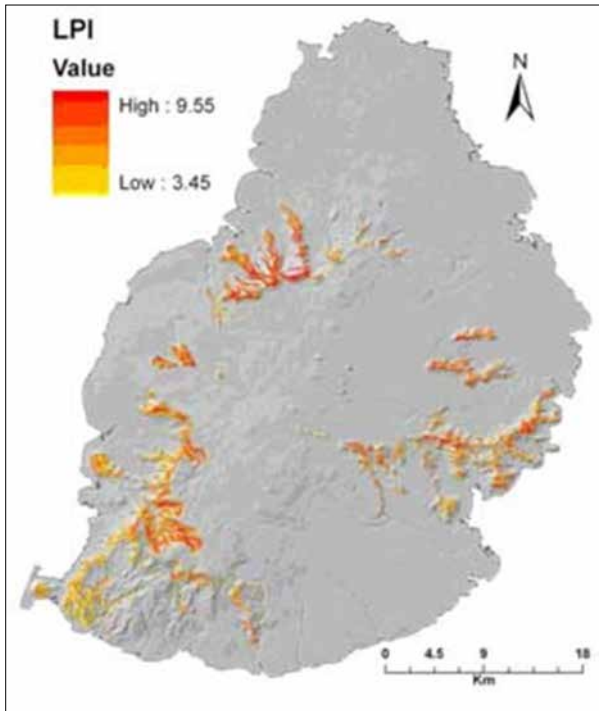
Mauritius is prone to experience heavy showers during summer especially when tropical cyclones pass over or near the island, causing risks of flooding and landslides in different regions of the island. In fact, GPS maps have been developed to portray the various areas within the island that could potentially be flooded and/or that are susceptible to landslides. Rughooputh (2008) has explained through these maps the dangers linked to heavy rains and the island's topography. Such maps are no doubt essential for the Government to develop and implement evacuation and relocation plans. On the other hand, Figure 5 shows a landslide map for the island of Mauritius. Landslides are common in areas that are located on the sloppy landscapes especially at the foot of mountains, such as Quatre Soeurs, Chitrakoot, La Butte, Montagne Ory and Nouvelle Découverte, among others. These places are highly prone to such natural hazards and have been severely affected in the past. Figure 5 indicates that flooding is likely to occur on high grounds and on the windward side of the island. The threats could be more pronounced in areas of high population density and massive built-up areas. Poorly constructed infrastructures that do not make provision for drains and canals are highly prone to flooding. The Government has announced that 11 families will be relocated from Quatre Soeurs to Camp Ithier in the region of Flacq due to the severe damages being caused to their housing structures by landslides. The picture below is taken from that region, showing the threats to public infrastructure as well as private property.



Damages due to landslide in the region of Quatre Soeurs.

Source: L'Express, 2014.

Figure 5: Landslides potentiality map



Source: Nigel and Rughooputh, 2008.

Technical assistance has been secured from the Government of Japan through the Japan International Cooperation Agency (JICA) for the implementation of the project “Capacity Development on Landslide Management in the Republic of Mauritius”. The project was implemented by the Ministry of Public Infrastructure and Land Transport (MPI). The objectives of the project (2012–2015) were as follows: (a) formulation of a landslide management plan to establish a landslide monitoring system; (b) implementation of the feasibility study and pilot project to examine, carry out and learn specific approaches; and (c) improvement of landslide management skills at the Repair and Rehabilitation Unit/ Landslide Management Unit of the MPI and other related institutions. Since the inception of the Landslide Management Project, the JICA expert team has identified 37 sites potentially at risk to landslides in Mauritius and have been classified in accordance with the types of site-specific

occurrences and the degree of risks. Chitrakoot, Quatre Soeurs, Vallée Pitot and La Butte were the highest priority areas because of the current landslide activity, the hazard risk potential, and the scale of landslide. Necessary countermeasures were implemented there.

Stakeholder meetings for residents were also held. Staff of the MPI and the Japanese experts visited each priority site to explain to residents the background and objectives of the project, as well as the outline of each survey and the monitoring methods. Moreover, three technical transfer seminars have been held with the objectives of roping in relevant stakeholders in the technical transfer process and enhancing as well as reinforcing local institutional competencies in the field of landslide management.

II.2. Slow-onset processes and their effects on migration patterns

II.2.a. Sea-level rise

The *Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC, 2014) forecasts that sea level will rise between 52 and 98 cm by 2100 for Representative Concentration Pathway (RCP 8.5), i.e. in the scenario where emissions continue to rise throughout the twenty-first century. Based on a long-term average of tidal gauge records from 1950 to 2001, there is evidence that the sea level has risen by 1.5 mm per year (meaning by 7.8 cm) at Port Louis, Mauritius and by 1.3 mm per year (i.e. by 6.7 cm) at Port Mathurin in Rodrigues (Church, White and Hunter, 2006). Such tendency would result in beach erosion, loss of bays and severe damages to built-up areas around the coast. Mauritius may thus lose its beautiful coastal landscape in only a few years (MOESD, 2013a and UNFCCC, 2014). The Initial National Communication (INC) of the Republic of Mauritius (Government of Mauritius, 1999a) indicates that sea-level rise will have serious implications for Mauritius and, in particular, for specific coastal zones. The report mentions about the potential losses of land, the coastline and coastal infrastructure. Areas that are most at risk with respect to landmass losses are located in the south-west, north and the estuary at the rivulet of Terre Rouge. In addition, public beaches that are most threatened by erosion caused by sea-level rise are Flic-en-Flac, Le Morne, Riambel, Pointe d'Esny, Cap Malheureux and Grand Bay. Besides, the coastline is receding in certain places by 1 m per year and the risk of salinization of the soil and low agricultural land cannot

be undermined. All in all, the rise in sea level would have a negative impact on public and private infrastructure. About 12–25 km of roads are at risk while there are about 6,000 people who would be concerned by this phenomenon. The Government of Mauritius (1999b) and the Mauritius Africa Adaptation Programme project document (UNDP, 2009) also emphasized the threat to the aesthetic beauty of the island that may affect the tourism sector in the long run and the need for effective coastal zone management that would have to be climate change-oriented.

According to the *Disaster Risk Reduction Strategic Framework and Action Plan – Synthesis Report* (Government of Mauritius, 2012b), the coastal zones potentially at risks due to inundation hazard on mainland Mauritius are shoreline areas:

- Between Pointe aux Cannoniers and Cap Malheureux;
- Between Mon Choisy and Baie de l'Arseanal;
- Between Cap Malheureux and Poudre d'Or;
- From Baie du Trombeau to Baie de la Grande Rivière;
- From Flic en Flac to Baie de la Petite Rivière Noire;
- In Pointe aux Roches, Pomponnette, Riambel and Mahebourg; and
- At Trou d'Eau Douce, Poste de Flacq and Roches Noires.

In total, some 12.2 km² of built-up land and around 11.8 km² of expansion areas are exposed to high or very high hazards of inundation on Mauritius Island. Same applies for around 60 (80) km of primary (secondary) roads. The exposure is relatively lower on Rodrigues Island, with 0.56 km² of built-up areas being exposed to higher hazard levels. Some 22 (23) km of primary (secondary) roads are exposed to inundation hazard. Considering the sea-level rise increase scenarios (from 2.5 to 6 m above sea level), the population exposed to inundation ranges from 22,800 to 63,400 people in Mauritius, while in Rodrigues exposed population ranges from 800 to 1,800 people (Government of Mauritius, 2012b).

II.2.b. Increasing temperature

According to MMS (2014), the mean summer temperature is 24.7°C, while that of winter is 20.4°C. The hottest months are January and February when the daily average temperature may reach 29.2°C, while the coolest months are July and August when the average daily temperature may attain 16.4°C. According to climate change predictors based on various IPCC reports, the average temperature for Mauritius is expected to rise between 1 to 2°C by 2060–2070 and sea-level rise of up to 98 cm by 2100. It has to be highlighted that temperature in recent years has been rising by 0.15°C per decade compared to long-term mean (MMS, 2014). Table 11 shows the average minimum and maximum temperature recorded in Mauritius and Rodrigues in 2014.

Table 11: Average temperature recorded in Mauritius and Rodrigues, 2014 (°C)

Month	Mauritius		Rodrigues	
	Minimum	Maximum	Minimum	Maximum
January	23.3	30.0	25.0	30.4
February	23.2	30.4	25.1	31.1
March	22.6	30.1	24.7	30.2
April	21.5	29.0	24.2	29.5
May	19.5	27.5	22.7	28.4
June	18.7	26.1	21.6	26.9
July	18.6	25.3	21.0	26.4
August	17.7	25.4	20.0	25.3
September	20.1	26.3	20.4	26.1
October	21.4	28.3	22.0	27.4
November	22.6	29.5	23.3	28.7
December	22.8	30.1	24.3	29.8

Source: Statistics Mauritius, 2012a, 2014d.

As it can be observed, the average temperature for Rodrigues is normally higher than that of Mauritius for both winter and summer months.

Table 12: Average maximum summer temperature at Vacoas, 1971–2012 (°C)

Year	Temperature
1971	27.7
1981	28.0
1991	28.5
2001	28.4
2012	31.6

Source: Statistics Mauritius, 2012a, 2014d.

Table 12 relates to the evolution of the average temperature essentially recorded at Vacoas, where the headquarters of the MMS is located on the Central Plateau, in over 40 years during summer. From 1971 to 2012, it can be seen that there has been an increase of the average summer temperature at Vacoas over the past few decades. The mean summer temperature of the island is 24.7°C and throughout 1971 to 2012, the values recorded at Vacoas have overshoot this mean.

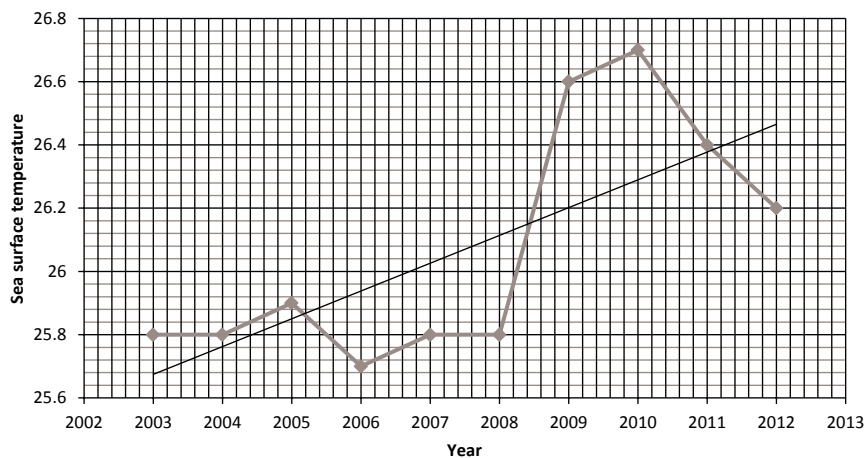
Analyses of temperature recorded at Mauritius and its outer islands show a definite warming trend. Average temperature at Vacoas and Plaisance during the last 10 years (1998–2008) was higher than that of the decade 1951–1960 by 0.74 and 1.1°C, respectively (Government of Mauritius, 2009).

II.2.c. Ocean acidification and temperature anomalies

When the pH level of water falls below 6.5, it is considered to be acidic. This may have major impacts on calcifying organisms, such as corals, clams and coralline algae. Moreover, the increasing sea surface temperature due to global warming may impact on corals and lead to massive coral bleaching and eventual mortality. In Mauritius, there has been numerous reports of coral bleaching that increased in extent and intensity, from 10 per cent in 1998 to nearly 50 per cent in 2009 (Moothien Pillay et al., 2012). The MOESD (2013c) reported that only 40 per cent of live coral cover remained in Mauritius lagoon and 30 per cent off-lagoon. The Mauritius Oceanography Institute (2011) reported above normal sea surface temperature all over the South-West Indian Ocean (excluding the Mozambique Channel and the Seychelles region). In addition, a temperature of 0.5°C higher than the normal has been

observed around the Mascarene Islands, which include Mauritius, Reunion and Rodrigues. Sedimentation in the lagoon may also amplify the problems, especially during the passage of tropical cyclones that carry away toxic wastes and detritus from inland into the lagoons. The land topography and the high number of rivers and rivulets actually explain the run-offs causing eutrophication of the sea water around the coastline. Studies by Sobhee (2004, 2006) have already shown the environmental stress in the lagoons around the island of Mauritius, in particular overall decline in fish stocks and fish biodiversity due to human factors. In Figure 6, sea-surface temperature is plotted over years 2002–2012. The graph shows an increase in temperature over the period shown with a peak attained in the year 2010. To capture the trend, a regression line is fitted, represented by the straight line, where a continuous rise is depicted.

Figure 6: Sea surface temperature, 2002–2012



Source: Author’s own elaboration based on Statistics Mauritius, 2012c.

II.2.d. Salinization

Given the island’s relief, sea-level rise and storm surges may lead to the salinization of the underground water stocks and aquifers found in coastal areas. Saltwater intrusion may also affect crops and reduce yield of coastal agricultural lands. Many of the plantations located in regions, such as Case Noyale, Rivière des Galets, Quatre Soeurs and Deux Frères are prone to the intrusion of saline water. Inhabitants and especially

planters of Quatre Soeurs reported that saltwater intrusion affected soil water quality, which in turn led to a reduction in onion yield (Sobhee et al., 2013). As reported earlier by the Government of Mauritius (1999a, 2012c), water salinity could prove to be a threat to soil quality and underground freshwater resources in low-lying land topography.

II.2.e. Land and forest degradation

The MOESD (2013c) reported that Mauritius has only 2 per cent of the native forest cover that used to exist prior to human settlements, and this figure stands at 1 per cent for the island of Rodrigues. From 1995 to 2012, the proportion of land under forest cover has dropped from 30.6 per cent to 25.3 per cent (Statistics Mauritius, 2012c). The rise in the demand for private and public infrastructure, conversion of forests into agricultural and farming lands, among others, have led to the substantial reduction of forest cover over the past few centuries. In addition to the rise in built-up areas, there has been the introduction of alien species of animals and plants that have, to a large extent, been responsible for the destruction of native forest and endemic plants. However, according to the Physical Development Plan of the Ministry of Housing and Lands (MOESD, 2013c), it is stipulated that the Government's development strategies will address environmental sustainability and social equity. This would imply therefore that economic progress should not compromise the natural environment while being in conformity with a more equitable society. Table 13 illustrates the breakdown in land use for Mauritius over the past decade from 1995 to 2005.

Table 13: Land use in Mauritius, 1995–2005

Land use	2005		Change since 1995	
	Hectares	%	Hectares	%
Sugar cane plantations	72,000	38.6	-4,840	-6.3
Tea plantations	674	0.4	-2,986	-81.6
Other agricultural activities	8,000	4.3	2,000	33.3
Total agricultural land	80,674	–	-5,826	–
Forests, scrubs and grazing lands	47,200	25.3	-9,800	-17.2
Infrastructure	4,500	2.3	500	12.5
Inland water resource systems	2,900	1.6	300	11.5
Built-up areas	46,500	24.9	10,100	27.7
Abandoned cane fields	4,726	2.5	–	–
Grand total	186,500	100		

Source: Statistics Mauritius, 2012c.

Table 14: Forest – Land cover as a percentage of total land area, 2003–2014

Nomenclature/Year	2003 (as a %)	2014 (as a %)
Forest lands	30.4	25.3
Of which: State-owned land	11.8	11.9
Plantations	6.6	6.3
Land protected areas and natural reserves	4.0	4.4
Other forest land	1.0	0.7
Pas Géométriques*	0.3	0.3
Of which: Privately owned land	18.5	13.4
Reserves (Land protected areas)	3.5	3.5
Others	15.0	9.9

Source: Statistics Mauritius, 2012a, 2014c.

Note: *This refers to a reserve area marked to demarcate the end/start of public domain and is usually located between a public beach and privately owned lands. In other words, this refers to the public beach on which no private construction is permitted. Such provision was introduced under the French administration of Mauritius in the eighteenth century.

It is also worth mentioning in the Mauritian context that forest destruction is also caused by outbreak of fire, passage of a tropical cyclone on or very close to the island and the spread of diseases and pests altogether. The Forestry Department in 2006 (Ministry of Agro Industry and Fisheries (MOAIF), 2006) asserted that 256 ha of forest were damaged by tropical cyclones over the period 1998–2004, while fire (normally caused by fire from sugar cane fields spreading to adjacent forests) was responsible for the destruction of 100 ha of forest between 1998 and 2002.

II.2.f. Loss of biodiversity

Both the flora and fauna of the island have suffered extensive damages due to rising human settlements, increase in built-up areas, destruction of forests and the introduction of invasive alien animals (such as deer, pigs, monkeys, mongooses, among others) and plants by the earlier settlers and colonizers. The disappearance of the dodo⁸ in the fifteenth century bears testimony to the extent of damages done by earlier settlers and administrators. All along, the giant turtles of Aldabra, the giant lizards and the Mauritian parakeet have had a similar end. In Rodrigues, the solitary bird was also decimated due to human settlements. In Table 15, the current status of threatened and endangered species of animals and plants is revealed. In fact, Mauritius is the third country in the world to have the most threatened plant species after Hawaii and the Canary islands (MOESD, 2013a).

Out of the 671 plant species that have been identified as being native species, 38 are “presumed extinct”, 5 are “extinct in the wild” and 141 are “critically endangered”. Moreover, 79 species are represented by less than 10 individuals in the wild, while several of them by a single individual (MOAIF, 2008). Regarding the fauna, there are 9 endemic bird species and 11 endemic reptile species that still exist today. Endemic species of birds and animals have been made extinct because of the invasive alien species of animals introduced by the earliest settlers in the island. Currently, there are two marine park areas, seven fish reserves and one wetland that have also been declared as the Ramsar site at the Terre Rouge Estuary. In addition, the size and location of these are given in Table 16.

8 The dodo was a huge unique bird living in Mauritius, now extinct, and which was found in great numbers over the island at the time when it was discovered by the first European sailors. As it could not fly, and laid only one egg a year, it soon became extinct as the island became populated around 1680 (see for instance Staub (2000) on the morphology of this bird).

Table 15: Threatened plant species in Mauritius indicative of biodiversity loss

Category	Mauritius endemics	Mascarene endemics	Native species	Total
Presumed extinct	27	11	0	38
Extinct in the wild	5	0	0	5
Critically endangered	113	28	0	141
Endangered	46	9	0	55
Vulnerable	81	17	0	98
Least concern	2	3	0	5
Data deficient	8	3	0	11
Not assessed	24	73	221	318
Total	306	144	221	671

Source: MOAIF, 2008.

Table 16: Marine protected areas in 2014 – Island of Mauritius in hectares

Classification and location	Surface area in hectares
Marine parks:	838
Blue Bay	(353)
Balaclava	(485)
Fish reserves:	6,352
Port Louis	(331)
Poudre d'Or	(2,542)
Poste Lafayette	(280)
Trou d'Eau Douce	(574)
Grand Port (Zone A)	(1,716)
Grand Port (Zone B)	(112)
Black River	(797)
Wetland:	48
Rivulet Terre Rouge Estuary Bird Sanctuary	(26)
Pte D'Esny Wetland Ramsar Site	(22)
Total	7,238

Source: Statistics Mauritius, 2014.

With reference to marine biodiversity loss, Sobhee (2004) reported that in addition to the decline in fish catch, there is a corresponding decline in fisheries biodiversity based on the computation of the Shannon's index, a biodiversity index, calculated from data provided by Albion Fisheries Research Centre. Furthermore, this declining trend was observed over more than the past two decades. Further discussion on this issue will be addressed in the following section.

II.2.g. Coastal erosion

Being an island, Mauritius is highly susceptible to coastal erosion, which is largely driven by two major factors: man-made and natural. The man-made drivers pertain to intensive coastal development related to hotel construction and its rapid expansion in recent years. Besides, the effects of sea-level rise and tropical cyclones cannot be underrated. Cyclones that pass very close or over the island occasionally cause phenomenal waves that contribute to significant erosion of the coastline. According to the INC for Mauritius (Government of Mauritius, 1999a), coastal segments where marked erosion have been identified in the region of Flic-en-Flac, Le Morne, Riambel, Pointe d'Esny, Cap Malheureux and Grand Bay are highly susceptible to coastal erosion.

Under the project for "Capacity Development on Coastal Protection and Rehabilitation in the Republic of Mauritius" the Final Report (June 2015) states that in relation to the mainland Mauritius, there are 67 km of sandy beach, out of which 17 per cent (representing 11.34 km) of the coast has been eroded, 23 per cent of the coast has been accreting and 59 per cent is stable. The causes of coastal changes are cyclones and the degradation of corals and seagrass on the erosion side, and the growth of corals contributing to sand accretion.

II.2.h. Declining soil fertility

The overgrazing of land in the island of Rodrigues and soil erosion especially due to high run-off whereby the topsoil is carried away into the lagoon contribute to the decline in soil fertility (MOAIF, 2006). In addition, the fact that there is no application of inputs by planters to improve the soil quality explains the rapid decline in soil fertility. Agriculture is also practised for the purpose of subsistence, hence the unwillingness to invest much in inputs that would have otherwise improve significantly the soil quality. Hence, overgrazing of land and severe deforestation in the island of Rodrigues exacerbate the problem of soil erosion and

decline in the quality of soil (MOAIF, 2006). In Mauritius, soil quality has always been a major source of concern for planters keen to boost up their agricultural yield. In 2012, the equivalence of 52,739 tons of fertilizers was imported (Statistics Mauritius, 2012a).

II.3. Vulnerability mapping

II.3.a. Geographically

This section tries to map the vulnerability of certain specific communities that could be potentially at risk as and when extreme weather events (flooding, landslides, tropical cyclones, droughts and sea-level rise) take place. The purpose of this exercise is to give an idea of the nature of the threats and why such communities might be concerned from short to long term. The socioeconomic characteristics as well as the location of each community are factored in to do this mapping exercise. The first table below illustrates the overall status of the development of a village measured in terms of the Regional Development Index (RDI)⁹ and its ranking with all other places in Mauritius. The population size is also indicated for the purpose of comparison.

Table 17: Level and ranking of overall development and population size of some areas at risks

Region/Village	RDI	Rank out of 145 Village Council Areas	Size of population
Le Morne (South-west)	0.46	145	1,300
Rodrigues	0.56	144	40,434
Case Noyale (South-west)	0.57	143	1,703
Quatre Soeurs (South-east)	0.66	127	3,317
Chamarel (South-west)	0.65	136	783
Post de Flacq (East)	0.66	130	8,454
Port Louis (Ward IV) – Capital city	0.77	56	18,443
Cap Malheureux (North)	0.75	82	5,070

Source: Statistics Mauritius, 2012c.

⁹ Computed by Statistics Mauritius, the Regional Development Index (RDI) is an adapted variant of the Human Development Index as computed by the United Nations Development Programme to capture specificities of Mauritius regarding socioeconomic evolution of a locality. Hence, this measure tracks the relative development of small areas of the country while encompassing the following aggregates: (a) housing and living conditions; (b) literacy and education; and (c) employment. The RDI ranges between 0 (least developed) and 1 (most developed) for 144 regions of the island of Mauritius and including Rodrigues.

Table 18: Vulnerability of some communities to climate change

Region/Village	% of houses in concrete	% of right of ownership	% of literacy level	% of employment level	Potential threats due to climate change
Le Morne (South-west)	43.3	97.0	81.3	87.0	Sea-level rise, wave surge, drought and landslides
Rodrigues	69.2	94.0	78.7	88.4	Sea-level rise, wave surge, water stress
Case Noyale (South-west)	68.9	90.0	74.0	93.0	Sea-level rise, wave surge, drought
Quatre Soeurs (South-east)	67.1	99.0	77.5	90.0	Sea-level rise, saltwater intrusion, landslides
Chamarel (South-west)	66.7	100.0	82.1	91.5	Floods, landslides and water stress
Post de Flacq (East)	62.0	95.0	83.0	91.0	Sea-level rise, beach erosion and wave surge
Port Louis (Ward IV) – Capital city	73.3	75.0	94.0	92.0	Flooding High temperature
Cap Malheureux (North)	79.0	91.0	88.2	94.0	Storm surge, water stress, flooding

Source: Statistics Mauritius, 2011b and author's assessment of climate change threats from landslides and flooding maps, as well as per local observations.

Note: Port Louis Ward IV includes Tranquebar, the Champ de Mars and part of Vallée Pitot.

Both tables show the relative development status of some villages and one suburban area (Ward IV – Port Louis) that could be easily exposed to extreme weather conditions. The vulnerability is not only captured by the building structure but by the level of education in each village/suburban area as well. While the literacy rate is generally above average in all communities shown, it is worthy to note that the population of people above 18 years with an education level greater than School Certificate is below 20 per cent. Le Morne village has the lowest RDI in the Republic of Mauritius as indicated in Table 17. Furthermore, despite the fact that there are a high proportion of people found to be employed, many of them are registered fishers, farmers and manual workers deriving a relative low income. Their low income and dependence on the environment for a living may easily be jeopardized by weather patterns. In fact, Sobhee (2004) has shown that high-income inequality and low educational attainment would simply lead to greater environmental degradation and lower fish catch as such. Rising inequality (measured in terms of Gini coefficient) over the past few years from 0.37 in 2001 to 0.41 in 2012 (Statistics Mauritius, 2015c) would simply exacerbate the financial constraints of poor households more so when they depend on the natural capital for a living. All in all, these people are highly exposed to tropical cyclones, storm surges, saltwater intrusion, beach erosion and water stress, given their location and the island's topography. Next to Le Morne village is Rodrigues, in terms of ranking as most vulnerable communities based on the RDI. With a population of 40,434, it is bound that there are many poor families who also work in the informal sector and essentially deriving an income from a nature-based activity. The island is highly exposed to extreme weather events, and the fact that 69.2 per cent of the houses are made of concrete indicates that an important number of Rodriguans are exposed to tropical cyclones and related calamities.

II.3.b. Types of livelihood affected (and co-stressors)

UNDP (2014) and the Government of Mauritius (2013a) have emphasized the fact that climate change has very serious implications for the economic sectors of the Republic of Mauritius, as well as on people's livelihoods. Currently, it is observed that tropical cyclones, heavy rainfalls, drought periods and increase in air temperature have all varying impacts

on the output and income of production as well as services sectors. In a nutshell, the following impacts are usually felt and observed:

- Reduction of agricultural output and income;
- Reduction in livestock;
- Landslides;
- Marine pollution and dislocation of fish stocks;
- Threats to water resources;
- Changes in coastal morphology;
- Threats to private and public infrastructure;
- Increasing health hazards (skin disorders, asthma, water and vector-borne diseases, among others); and
- Water shortages.

The agricultural sector, which also includes farming and the fisheries, is bound to be affected through changing rainfall patterns resulting into droughts and floods in alternate years. Whether it is sugar cane plantations or non-sugar cane crops, lack of and excessive rainwater may cause serious damages resulting in loss of output as well as income. The passage of tropical cyclones also leads to severe damages to crops (sugar and non-sugar), thereby leading to enormous losses of income for farmers and decline in GDP and foreign currency. The penetration of sea water in certain low-lying parts of the island especially fields may lead to significant destruction of crop and loss of investment by planters. Such examples are found in Quatre Soeurs, Rivière des Gallets and Petit Sable. The possibility of saltwater intrusion is as well one of the consequences that has been highlighted by UNDP (2014) and the Government of Mauritius (1999a) with the expected sea-level rise. The latter may well lead to contamination of the underground water resources and destroy crops grown along the coastal line. In addition, the Government of Mauritius (1999a) clearly mentioned about the serious implications for sustainable livelihoods of different communities of the island of Mauritius due to anticipated damages to agriculture and farming. The losses of land and coastal erosion will threaten some more than 1,000 houses or 0.6 per cent of the population.

As highlighted earlier, one of the predictions of climate change is the increase in sea surface temperature that will impact marine ecosystems leading to loss of habitats and ecosystem services. Climate-induced

coral bleaching occurred in 1998/1999 due to elevated sea surface temperature, where 10 per cent of corals were affected (Bhagooli, 2012 and Moothien Pillay et al., 2012). Increasing episodes of higher sea surface temperatures will thus amplify the extent of coral bleaching, though the Government of Mauritius (1999a) indicated that there is occasional coral bleaching in the lagoons of Mauritius caused primarily by deposited sediments related to human activity.

Mauritius has a coastline of 322 km and a coral reef length of 150 km, which encloses a lagoon area of 243 km². The area of coral reef is about 300 km². The shoreline has a varied geomorphology, dominated by sandy beaches and other sensitive ecosystems that include marine protected areas (7,216 ha) and mangrove forests.

Coral reef has important functions for coastal conservation from being a source of beach sand to dissipating wave energy. The live coral cover was monitored at 44 points by the spot check method. The mean coverage was 27 per cent. The long-term changes of the coverage have been monitored by the Albion Fisheries Research Centre from 1998. The results show that the coverage have decreased continuously from 50 per cent to under 20 per cent and at the back and fore reef, it dropped to 10 per cent or 20 per cent due to the increase of sea surface temperature in 2009 (Government of Mauritius, 2015a).

Sobhee (2004) has analysed the impact of income inequality on the evolution of fish catch in Mauritius using time series analysis while assessing environmental degradation in the coastal zone. The author found that higher income inequality leads to more environmental degradation tracked by the decline in fish catch. Moreover, low educational attainment in the coastal areas and lack of job opportunities contribute to the decline in fish catch. In another study, Sobhee (2006) found that fisheries biodiversity was on the decline. The study computed an index of biodiversity over more than two decades of different fish variety caught in the lagoons of Mauritius. Table 19 below summarizes the decline in fish catch and value added over the last decade.

Table 19: Fish production in metric tons, 2003 to 2014

Nature of fishing/year	2003	2006	2009	2012	2014
Artisanal	1,166	950	820	705	459
Total (Artisanal and offshore)	9,709	8,634	6,639	4,781	12,617*

Source: Statistics Mauritius, 2012c, 2014.

Note: *Includes fish caught for the canning industry and provisional estimate.

Decline in fish catch is associated with lower value added of the fisheries sector towards the national economy, for instance, the value added from fishing activities declined from MUR 375.8 million in the year 2000 to MUR 341.1 million in 2011 and declined further in 2012 to MUR 301.7 million. Such decline will no doubt constitute a threat to the livelihoods of fishing communities, as well as those businesses that are indirectly linked to such activities, namely hotels, restaurants and fish sellers among others.

Regarding the agricultural sector, a study by Sultan (2012) evaluates the relationship between agricultural outputs and inputs utilized by farmers in different regions of the island of Mauritius. In particular, the yield of cultivated land is analysed in relation to different agricultural inputs including climatological variables, such as rainfall, air temperature, land humidity and wind speed among others. His study revealed the losses in terms of output and revenue due to temperature and rainfall variations impacting severely the low-income planters and small-sized farms. The author also found that farmers have little knowledge of the implications of climate change for their yields and crop patterns. Also, Sultan (2012) recommended that an action plan should be put in place to empower the farming communities, especially the small-sized farms, to better address damages caused by extreme weather events as and when they occur.

In the agricultural sector, the Agricultural Productions Systems Simulator model predicts cane yield reductions of 34 to 48 per cent and sugar yield reductions of 47 to 65 per cent with a 10 to 20 per cent decrease in rainfall and a 2°C increase in temperature. Extreme weather events such as cyclones and drought have also been shown to reduce cane productivity and sugar extraction rate depending on the timing, severity and duration of the extreme event, as well as some carry-over effects. Climate change is also expected to change sugar cane phenology, with

higher vegetative growth to the detriment of sucrose accumulation, under conditions of increased mean temperatures and a narrowing of the day and night temperature amplitudes (Facknath, Lalljee and Boodia, 2014). The implications of climate change for Rodrigues has also been analysed by Marshall et al. (2010), as a case study based on a survey carried out at Rivière Banane. The findings relate to economic and environmental problems that currently exist in the island, and these are going to be amplified with climate change. While the inhabitants have very few opportunities other than depending on the fisheries resources, the findings also revealed a decline in fish catch and increasingly bad weather conditions over the recent past. Reef degradation has also been observed in this part of the island. The inhabitants have realized that the marine resources should be protected to boost up yield from fishing. Under worsening climate change scenarios, increasing dependence on fishing activity would simply jeopardize the livelihoods of the communities at Rivière Banane. This case study supplements insights highlighted earlier by IOM, indicating the vulnerability of Rodriguans to sustain their livelihoods due to environmental degradation and unfavourable weather events.

The economy of Rodrigues is predominantly based on subsistence type of agriculture, with animal rearing and lagoon fishing. Rodriguans are also as well involved in handicrafts productions such as hats and bags made of jute and other local plants (*Pandanus* or others). Tourism is an important sector for Rodrigues with more than 55,000 tourism arrivals per year. Manufacture remains limited.

There is an important environmental degradation on Rodrigues mainly due to the following:

- Overgrazing as pastures are publicly owned and access is free;
- Soil erosion resulting from unsustainable agriculture practices because of the land tenure, which is mostly publicly owned and gives no security for private investment in sustainable farming practices such as terracing;
- An important deforestation; and
- The spread of invasive species such like *piquant loulou* (Government of Mauritius, 2015b).

Climate change impacts exacerbate the critical environmental socioeconomic situation of Rodrigues. The key sectors already impacted upon are the following: (a) infrastructures that support the livelihood of communities (strategic infrastructure, tourism infrastructure); (b) water resources; (c) coastal areas; (d) fisheries; (e) agriculture; (f) human health; and (g) marine and terrestrial biodiversity.

With predicted increase in cyclonic disturbances and storm surges, coastal areas of Rodrigues looks extremely vulnerable; elevated sea levels will be experienced more frequently in many coastal locations in the future, with low-lying areas particularly vulnerable to flooding. Individually or in combination, the inland flood, coastal inundation and landslide hazards affect a large proportion of Rodrigues and a number of infrastructures are exposed to these risks (Government of Mauritius, 2012b).

On Rodrigues, regarding inland flooding, some 0.4 km² of build-up land and 0.5–0.6 km² of agricultural land, 4.5 km of primary road and 13–16 km of secondary roads are exposed to floods. Concerning coastal inundation, some 0.4 km² of build-up land and 0.5–0.6 km² of agricultural land, 4.5 km of primary road and 13–16 km of secondary roads are exposed to floods (Government of Mauritius, 2012c).

II.3.c. Internal migration and displacement dynamics

Internal migration is basically characterized by studies of Rodriguans coming to Mauritius. There is actually a lack of information and research on internal migration within Mauritius, people moving across districts, as well as Mauritians going to settle in Rodrigues.

Studies carried out on Rodriguans coming to settle in the island of Mauritius by IOM (2011a, 2011b, 2012) have revealed that among other drivers, the degradation of the environment in Rodrigues has encouraged people to migrate to Mauritius. Among the migrants, there were fishers who clearly indicated that the decline in fish catch and the increasing bad weather conditions have urged them to seek better employment opportunities and settle in Mauritius.

However, these studies show that migrants from Rodrigues tend to settle in economically disadvantaged areas, for instance in Tranquebar

or Roche Bois. Their living conditions are very often mentioned in these studies as being precarious. From Statistics Mauritius (2000b), it can be observed that out of the 1,242 people who migrated from Rodrigues and the Outer Islands, 253 (20.4%) went to settle in Port Louis, 218 (17.5%) in Pamplemousses, 351 (28.2%) in Plaines Wilhems, 150 (12.1%) in Black River and the rest (21.8%) in other districts.

From the previous census conducted in 2000 by Statistics Mauritius (2000b), the net migration of 5,272 people from Port Louis district to the other districts of the island shows that more people have left the capital city, and that among the 10,192 people who left, 32.3 per cent settled in Pamplemousses, 29.4 per cent in Plaines Wilhems, 18.7 per cent in Black River and the rest (19.6%) settled in the other remaining districts including Rodrigues and the Outer Islands. The positive net migration out of Port Louis needs further investigation as it would seem that urbanization compounded with high population density might have driven people out of the capital city.

II.4. Potential effects of (environmental) migration on vulnerability

II.4.a. Environmental degradation and human security

Studies by IOM (2011a, 2011b, 2012) clearly reveal the precarious conditions in which migrants from Rodrigues are staying in areas where they have settled down. These areas often compromise sanitation conditions; poor treatment of waste and waste water easily gives rise to the proliferation of diseases. Since they all live in an area of high density, for instance at Tranquebar and Roche Bois, the propagation of any water-borne disease such as the Chikungunya or malaria may take a bad turn.¹⁰ Plagued with their financial difficulties, these people have also become the victims of substance abuse and degraded social norms.

According to the IOM (2011a) study, in their initial years of settlement, Rodriguan migrants have to face few challenges to adapt to local Mauritian conditions and living standards. They have to change houses quite often (on average two to four times a year) before actually settling down. Altogether, low-income migrants from Rodrigues have very poor

¹⁰ Government of Mauritius (2013a) indicated the high risks associated with the proliferation of water-borne diseases in the capital city as experienced in 2005 and 2006.

housing conditions that increase their exposure to extreme weather conditions. Made mostly of wood and iron, the houses can easily be blown down during the passage of a tropical cyclone.

Owing to financial constraints, the migrant parents cannot afford to pay for the education of their children. This means that the next generations of these migrants are already highly vulnerable to secure a job and have a decent life.

II.4.b. Urbanization and migration flows

As reported in Table 20 below, 41.7 per cent of Mauritians live in the urban areas and the intercensal change indicates that the population of the urban regions has fallen by 0.07 per cent, while that of the rural regions has experienced an annual increase of 0.77 per cent. Among the urban cities, Port Louis has experienced the highest reduction in its population annually between the two censuses. On the other hand, Vacoas-Phoenix has been an exception in showing a positive expansion rate among all urban areas.

Table 20: Evolution of rural and urban population – Island of Mauritius

Population/Gender	Both sexes	Male	Female	Intercensal change	
				Total	Annual average
Urban:	499,349	244,688	254,661	-3,696	-0.07
Port Louis	137,608	68,370	69,238	-6,695	-0.43
Beau Bassin/ Rose Hill	103,098	51,114	51,984	-774	-0.07
Quatre Bornes	75,613	36,870	38,743	-271	-0.03
Vacoas-Phoenix	105,559	50,963	54,596	5,493	0.48
Curepipe	77,451	37,371	40,100	-1,449	-0.17
Rural	697,034	346,256	350,778	57,010	0.77
Whole Island	1,196,383	590,944	605,439	53,314	0.41

Source: Statistics Mauritius, 2012d.

III

TOOLKIT FOR POLICYMAKERS

Rock revetment to protect against beach erosion and wave surges.
© MOESDDBM

III. TOOLKIT FOR POLICYMAKERS

III.1. Existing policy framework

The key organization that addresses issues pertaining to the environment, environmental protection, sustainable development, natural resources management and climate change is the Ministry of Environment, Sustainable Development, and Disaster and Beach Management. The main legislative framework relates to the Environment Protection Act of 2002, and it has been enlarged to encompass sustainable development as from 2010.

The *National Report of the Republic of Mauritius* (Government of Mauritius, 2013a) clearly spells out the various concerns with respect to environmental challenges, as well as emerging and pertinent issues with respect to climate change. This report elaborates the government programme in relation to climate change for the period 2010–2015 enshrined in the programme as an overarching policy cutting across the different ministries as a major objective to be addressed by all of them. This document supplements the existing National Climate Change Adaptation Policy Framework of the Republic of Mauritius (MOESD, 2012) that elaborates the various sectoral challenges pertaining to water, coastal zone management and tourism, agricultural practices and terrestrial ecosystem, promoting biodiversity and disaster management among others. Environmental sensitive and flooding maps have also been developed in order to better manage risks associated with extreme weather as and when climatologic or environmental events occur. A National Disaster Risk Reduction and Management Centre has already been established at the line barracks in Port Louis, while one exclusively for Rodrigues is in the process of being implemented to ensure more effective and timely intervention of local authorities as and when the Republic is threatened by a natural catastrophe (MOESD, 2013c).

The Government, through the continued support and complementary efforts being done by the MOESD, has been addressing key and daunting sustainable development policy challenges (see for instance Government of Mauritius, 2013c). Some of the major related initiatives that are also in connection to climate change are reforms on institutional laws and

environmental legislation, research and development, public health, renewable energy and resources mobilization. These initiatives all in all address the vulnerability of the island as a SIDS and encompass a vision that would as well take on board equity and poverty besides socioeconomic issues related to food security, cultural development, land reforms, integrated resource management, capacity-building and further prospects for societal progress from a sustainable development perspective. It is worth noting that the National Development Unit is currently undertaking massive investment in revisiting dated public infrastructure throughout the island especially in flood-prone areas to reduce the risks of flooding during the stormy season.

Regarding poverty reduction within the context of climate change and sustainable livelihoods, under the aegis of the Ministry of Social Integration and Economic Empowerment, the National Empowerment Foundation (NEF) (Government of Mauritius, 2013c) has identified some 10,000 families living below the threshold poverty. Continuous efforts are being made to provide housing facilities to many of the people who cannot afford a house and live under precarious conditions highly exposed to extreme weather events. In addition, the Government is considering redeploying fishers who have been experiencing declining fish catch and facing difficulties to go out at sea due to bad weather conditions. Moreover, under the Finance Act of 2009, private companies have to contribute 2 per cent of their annual profits towards corporate social responsibility (CSR). The CSR fund is used for poverty alleviation, environmental protection, promoting the welfare of children and women, as well as community empowerment (Government of Mauritius, 2013c).

Concerning Rodrigues, similarly, the Government has put on its agenda programmes that will ensure more effective management of water resources in Rodrigues. Water remains the most pressing concern of the island from harnessing, storage to distribution (Government of Mauritius, 2012c). All along, there is also a proposed action plan to make optimal use of land within a context of sustainable land use, property development and enhancement of agricultural productivity (Government of Mauritius, 2013a). As Rodrigues was badly affected by the tsunami of 2004, it has been proposed that there should be an optimal protection of coastal areas to reduce coastal erosion, encourage beach nourishment and address sea-level rise.

Recently, the Government is working on a 10-year Economic and Social Transformation Plan that will target Mauritius to reach the high-income economy status by 2020, hence increasing GDP per capita from its current level of USD 9,187 to USD 13,000. This will require the efforts of both public and private sector investment to promote human and physical capital and making growth inclusive as well as sustainable.

However, the *National Report* of 2013 recognizes the need to establish an effective framework with respect to migration and climate change.

Additionally, on 28 September 2015, Mauritius submitted its Intended Nationally Determined Contribution to the UNFCCC Secretariat, and specific reference has been reflected on the high vulnerability of Mauritius to the impacts of climate change and climate variability that are seriously impacting on the sustainable development of the country. Mauritius has, therefore, developed comprehensive action plans to adapt to these. However, the costs of such adaptation measures are so exorbitant that Mauritius can only achieve its targets if financial support in terms of grant and technical support from partners is made available to enable it to implement the plans to protect life and property and mitigate any propensity of migration of its population.

III.2. Policies in the process of being elaborated

Regarding migration and development, the *National Report of the Republic of Mauritius* (Government of Mauritius, 2013a) highlights the importance of migration within the context of climate change and regional integration. Two programmes of action have been identified as follows:

- (a) The Accelerated Programme for Economic Integration: This seeks to encourage greater mobility of labour in the region especially within the context of existing regional trading blocks such as the SADC and the Common Market for Eastern and Southern Africa. The objectives of this programme are, among others, to make up any mismatch of skills and labour market exigencies and shortages among Member States. Such a programme will thus promote labour productivity, trade and greater scope for economic advancement.

- (b) The Regional Multi-disciplinary Centre of Excellence: This is an entity that is currently based in Mauritius, which oversees the training needs and gaps across Member States in different areas. As such, different capacity-building exercises are proposed, such as climate change, investment prospects, macroeconomic management, trade and diplomacy, among others. These initiatives help to consolidate knowledge within the region and broaden the scope for greater trade relationships and economic success.

Similarly recent agreement with the ILO (Government of Mauritius, 2013a) provides avenues scope for establishing the necessary protocol in line with international practices to address migrant labour. Furthermore, collaboration with IOM – following a workshop done in 2013 in Port Louis with the Ministry of Labour, Industrial Relations and Employment – opens new avenues for regional collaboration and the implementation of an integrated approach towards migration within the development context of the Republic of Mauritius. Some grey areas that this research has identified especially in terms of information and data gaps relate to both internal and international migration. These could be considered as follows:

- (a) Current population database could be consolidated from surveys that encompass international migration. There is currently a paucity of data with respect to the exact number of people who are actually international migrants.
- (b) More information should be made available with respect to migration of people across districts basically capturing information related to the reasons or drivers of such migration, along with Mauritians who leave to settle in the island of Rodrigues and vice versa. The register-based census would actually be one way to better keep a record of the demographic evolution of the population or given community.
- (c) It is imperative to keep track of the movements of foreign workers in the island both those with and without residence permits. Such database would be useful to have an actual idea of the strength of foreign labour in addition to foreign workers brought to work in the informal sector.

Such an improvement would help to track migration of people for specific reasons, including climatic events. Moreover, this would feed well into climate change migration strategies in a holistic manner.

In addition to the existing recommendations made to address internal migration, it would be as well a major breakthrough if the regional aspects of migration are taken care when dealing with the economic development, migration and climate change issues. Based on regional agreement under the Indian Ocean Commission (IOM, 2013), there is further scope to broaden aspects of migration and climate change as priorities at the national level for Mauritius, Comoros, Seychelles and Madagascar. As it is, there is some collaboration regarding migration among the four countries. However, the policies adopted towards migration might be incoherent and not necessarily in line with economic development. Hence, it might definitely be an opportunity for such countries and their governments to be more participatory to develop consistent and coherent plans towards migration and economic development, especially as islands are threatened by extreme weather events.

Opportunities must be explored to find the best options to integrate migration and climate change within the policy sphere among the four countries. This would undoubtedly reinforce cooperation in the region and develop resilient plans against extreme weather. As such, there should be a proper regional database created to provide access to policymakers and researchers regarding the mobility of people, taking into account an inventory of the current situation and how could further progress be streamlined to strengthen regional cooperation towards migration. In this way, national and regional policies towards migration and climate change would have a more significant part to play in the economic development of the country and the region. MOFED (2014) has also highlighted the Government's wish to explore employment opportunities and seek areas of collaboration in regional labour markets to improve the employability of Mauritian youth graduates and reduce unemployment among the youth. This would, to a large extent, take a more holistic approach to migration and brain drain.

III.3. Policy options and research priorities: Some initial suggestions

There is little scope for certain categories of people who are dependent on the natural capital, such as farmers, fishers and planters to make a decent living as their livelihoods are constantly threatened by more recurrent extreme weather events. In addition to government strategies to mitigate the impacts of climate change on specific communities, through well-crafted national action plan, signed agreements with neighbouring countries on migration can offer more and sometimes better opportunities for sustained livelihoods. Such opportunities can benefit all parties concerned if all actions are well-planned and structured. The low proportion of remittances out of GDP in recent years (below 1% of GDP) can potentially be increased to play a more significant role in future economic development of Mauritius and within a climate change-inclusive growth context.

Mauritius could try to find out how specific government housing schemes can be designed exclusively or in collaboration with the private sector through the CSR Fund¹¹/arrangement to help coastal communities whose houses are very much exposed to extreme weather events. In particular, more thinking could be done with respect to squatters and economically disadvantaged communities both in coastal and urban areas exposed to natural hazards. The NEF, which is entrusted to provide the necessary support, financial, technical and otherwise, could become a major player to help those families and communities that are vulnerable to extreme weather events.

Long-run sustainable livelihood schemes must be integrated within the action plan of the Government with respect to internal migration across the islands. A special framework could be devised for those who have to migrate due to degradation of the natural capital under environmental and climate change. An action plan that emphasizes the restoration of degraded or potentially degraded natural capital over the long term is primordial to contain migration. Such restoration encompasses measures to reduce the impacts of disasters on exposed communities such as wall

11 Large establishments of the private sector are compelled by the Government to contribute 2 per cent of their annual profit to the CSR Fund, which in turn, could be used to finance activities carried out by NGOs towards poverty reduction, environmental protection and promotion of child welfare, among others.

buildings, beach nourishment, strengthening of public infrastructures among others. A reorganization of the public and private structures at risk need not be excluded. These are especially meant for those who do not wish to leave their place of origin.

According to the National Disaster Risk Reduction and Management (NDRRM) Act 2016, every local authority other than a village council, will have a Local Disaster Risk Reduction and Management Committee that will collaborate with the National Centre and the local community in respect of the area under its jurisdiction for any disaster risk reduction and management activity. The NDRRM Act empowers local authorities to devise contingency plans at their respective levels, based on preparedness and response to disasters. Additionally, drills have been conducted by the local authorities (Municipal Council of Quatre Bornes, District Council of Savanne and District Council of Flacq, among others) in collaboration with various stakeholders and the concerned local communities on emergency and evacuation plans.

Since flooding and landslides maps have established particular zones that could be potentially affected during extreme weather, there is an urgent need that the central and local governments come up with an integrated action plan to address infrastructural gaps, needs and quality for both private and public entities to minimize loss of lives, wreckages and financial losses in the immediate run. In the long term, the Government has to think in terms of an evacuation plan for people in Agaléga, especially due to its low-lying relief. There should be some careful thought done to establish a preparatory plan to relocate its inhabitants especially in the event of an unexpected natural calamity, such as a storm surge or a tsunami.

It is worth researching about the high outmigration of people from the capital city of Port Louis as it is unclear whether urbanization and possibly environment (climate-related) factors might be the drivers. In the same vein, the decline in urban to rural ratio for the island as a whole warrants investigation.

A concrete policy framework is also needed to take care of the needs and requirements of Rodriguan migrants and potential ones in Mauritius regarding employment opportunities, settlement facilities and land purchase schemes under extenuating environmental conditions. Such

scheme would help to streamline the migration process and prevent haphazard settlement. It may also assist families to lead a better and more decent life, especially if they come from a low-income background.

It is a matter of concern for the Government to try and restore the natural habitat and establish an effective protocol for relocation. It has also been found that many coastal communities might be at risk when it comes to sea-level rise, storm surges and flooding. The scope to restore the physical environment must be an option to enable people to adapt to these extreme events and be ready for any eventuality. Special climate change-oriented housing schemes might be needed to support those who are not necessarily owners of a house and might be living in undesirable and unsafe conditions while others may be squatting public property.

IV

CONCLUSION

IV. CONCLUSION

As a SIDS, Mauritius shares country-specific features as far as human settlements and climate change are concerned. It remains undeniably highly vulnerable to extreme weather events, sudden or gradual, that can indeed impact on economic performance, well-being, livelihoods and the physical environment. In fact, the *World Risk Report* (UNU, 2015) bears testimony to this fact by placing Mauritius among the most vulnerable countries to natural hazards. In particular, its rank of seventh among 15 most exposed countries to natural hazards, namely sea-level rise, cyclones and floods and its rank of thirteenth among 171 countries for disaster risk cannot be taken lightly. However, being aware of climate change challenges, the Government of Mauritius has initiated studies more than a decade ago to assess the impacts of increasing natural hazards on economic sectors, communities and the physical environment. Subsequently, it took constant action to develop adaptation and mitigation strategies while developing vulnerability maps of the island with respect to flooding risks, landslides and storm surges. These would be useful for much better planning and monitoring in the presence of threats posed by these natural hazards. As such, climate change is now well established on the agenda of the Government, and it remains a major matter of concern for policymakers. However, there are still some daunting tasks that are yet to be addressed, especially when taking into account IPCC's projections and threats of natural hazards to human settlements. Coastal communities, including island populations of Rodrigues, St Brandon and Agaléga, are far more exposed to the immediate impacts of extreme climatic events. While all people are concerned by climate change, a special attention is needed for those communities that are already economically vulnerable and whose livelihoods are dictated by weather patterns. If not assisted on time, they may end up as trapped communities. Relocation of specific communities at Rivière des Galets and Quatre Soeurs is currently under consideration. However, relocation remains an expensive option and most of the time logistically challenging.

This study has highlighted the opportunities and challenges that migration may encompass to mitigate the effects of climate change both in the short run and over the long term for the Republic of Mauritius. In the light of above country assessment, it is obvious that the Republic of Mauritius has several challenges, as well as opportunities with respect

to recent trends in migration. More so, when the migration profile of the country is multifaceted. It has been found that there is an increasing demand for international labour to work in the low-skilled sectors, while there is currently a high number of Mauritians, particularly those that study abroad who seek to migrate because of better job prospects and opportunities. Within Mauritius, there is a high mobility of people migrating across districts and to and from Rodrigues. In addition, as the population is becoming older, Mauritius will, in a decade or so, become a human capital-stressed economy. These migration dynamics need to be analysed in depth to design an integrated framework from the perspective of climate change inclusive growth performance.

In short, the case study of Mauritius has shown that there is scope to use migration for developing resilience against natural hazards, but this will necessitate the strong commitment of policymakers to adopt a comprehensive policy framework to achieve the most effective and timely outcomes.

BIBLIOGRAPHY

Adaptation Fund Board (AFB)

- 2012 Climate Change Adaptation Programme in the Coastal Zone of Mauritius. Adaptation Fund Board Secretariat, Washington, D.C.

Barnett, J. and N. Chamberlain

- 2010 Migration as climate change adaptation: Implications for the Pacific. In: *Climate Change and Migration, South Pacific Perspectives* (B. Burson, ed.). Institute of Policy Studies, Wellington, pp. 51–60.

Bautista, M.L.P. and J. Salcedo

- 2008 Collective Strengthening of Community Awareness: Philippines. In: *Sharing Innovative Experiences: Examples of Natural Disaster Mitigation in Small Island Developing States* – vol. 12. United Nations Development Programme (UNDP), New York.

Bhagooli, R.

- 2012 The Application of Bleaching Index as a Potential Tool for the Monitoring of Coral Health. *University of Mauritius Research Journal*, 18 (A):88–104.

Board of Investment – Mauritius

- n.d. Guidelines for Permanent Residence Permit. Board of Investment – Mauritius homepage. Available from www.investmauritius.com/work-live/prp.aspx

Church, J.A., N. White and J. Hunter

- 2006 Sea-level rise at tropical Pacific and Indian Ocean islands. *Global and Planetary Change*, 53:155–168.

de Haan, A.

- 2000 Migrants, livelihoods, and rights: The relevance of migration in development policies. *Social Development Working Paper 4*. Available from www.eldis.org/vfile/upload/1/document/0708/DOC7584.pdf

- 2006 *Migration in the Development Studies Literature: Has It Come Out of Its Marginality?*, Research Paper 2006/019. United Nations University (UNU)-WIDER. Available from www.wider.unu.edu/publication/migration-development-studies-literature

Department for International Development (DFID)

- 1999 Sustainable Livelihoods Guidance Sheets. Available from www.eldis.org/vfile/upload/1/document/0901/section2.pdf

Desai Associates

- 2013 Climate Change and Disaster Risk Management. *The Journal of the Institution of Engineers Mauritius*. Available from [www.iemauritius.com/upload/files/cc&drm_\(desai\).pdf](http://www.iemauritius.com/upload/files/cc&drm_(desai).pdf)

Dinan, P. and M. Dinan

- 2014 La saga des Départs: La Diaspora de 1960 à 2004. Available from <http://archive.is/lk5jP>

Dinar, A. et al.

- 2008 *Climate Change and Agriculture in Africa: Impact Assessment and Adaptation Strategies*. Centre for Environmental Economics and Policy in Africa, Earthscan, Oxon and New York.

Facknath, S., B. Lalljee and N. Boodia

- 2014 *A Comprehensive Scoping and Assessment Study of Climate Smart Agriculture Policies in Mauritius*. Food Agriculture, Natural Resources Policy Analysis Network, Pretoria.

Giles, J. and R. Mu

- 2014 Village political economy, land tenure insecurity and the rural to urban migration decision: Evidence from China. Paper is funded by the Knowledge for Change Program; Policy Research working paper no. WPS 7080. World Bank Group, Washington, D.C. Available from <http://documents.worldbank.org/curated/en/241781468242974571/Village-political-economy-land-tenure-insecurity-and-the-rural-to-urban-migration-decision-evidence-from-China>

Gopaul, A.

- 2013 The Daily Poverty of Migrant Workers: The Hidden Side of the Mauritian Coin. Unpublished conference paper for the Third International Conference on International Trade and Investment, 4–6 September, Mauritius.

Government of Mauritius

- 1999a *Initial National Communication of the Republic of Mauritius under the United Nations Framework Convention on Climate Change* (April 1999). Available from <http://unfccc.int/resource/docs/natc/maunc1/>
- 1999b *National Environmental Strategies for the Republic of Mauritius: National Environmental Action Plan for the Next Decade*. Environmental Resources Management, Cavendish Square, London.
- 2009 *Climate Change Impacts on Mauritius. Meteorological Services*. Available from http://31.222.186.27/fileadmin/multimedia_francais/centre_medias/dossiers_techniques/downloads/200903_Climate_Change_impacts_on_Mauritius.pdf
- 2010 *Second National Communication of the Republic of Mauritius under the United Nations Framework Convention on Climate Change (UNFCCC)*. Available from <http://unfccc.int/resource/docs/natc/musnc2.pdf>
- 2012a *Decent Work Country Programme 2012–2014, Mauritius*. May 2012. Available from www.ilo.org/public/english/bureau/program/dwcp/download/mauritius12-14.pdf
- 2012b *Disaster Risk Reduction Strategic Framework and Action Plan – Synthesis Report*. Ministry of the Environment, Sustainable Development, and Disaster and Beach Management (MOESDDBM).
- 2012c *Mainstreaming Climate Change Adaptation in the Agriculture, Tourism and Fisheries Sectors of the Republic of Mauritius and in the Water Sector for Rodrigues – Synthesis Report*. Port Louis, Republic of Mauritius.
- 2013a *Third International Conference on Small Island Developing States – National Report of the Republic of Mauritius*. Government Printing Department, Port Louis.

- 2013b *Contingency Plan to Counter Infectious Diseases in Port Louis*. Government Information System (GIS). Available from <http://gis.govmu.org/English/Documents/News March 2013.pdf>
- 2013c *Eleven die in flash floods*. Government Information System (GIS) Newsletter. Available from <http://gis.govmu.org/English/Documents/News March 2013.pdf>
- 2015a *The Project for Capacity Development on Coastal Protection and Rehabilitation in the Republic of Mauritius – Final Report Summary*. Available from http://open_jicareport.jica.go.jp/pdf/12237327.pdf
- 2015b *Intended Nationally Determined Contribution for the Republic of Mauritius*. Available from www4.unfccc.int/ndcregistry/PublishedDocuments/Mauritius%20First/Final%20INDC%20for%20Mauritius%2028%20Sept%202015.pdf

Intergovernmental Panel on Climate Change (IPCC)

- 2014 *Sea Level Change*. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge and New York.

International Organization for Migration (IOM)

- 2011a *The Other Migrants Preparing for Change: Environmental Changes and Migration in the Republic of Mauritius – An Assessment Report*. IOM, Geneva. Available from https://publications.iom.int/system/files/pdf/the_other_migrants.pdf
- 2011b *Migrant Fishers from Rodrigues to Mauritius*. IOM, Geneva.
- 2012 *Assessing the Socioeconomic Vulnerability and Health Characteristics of Migrants from Rodrigues in Mauritius*. IOM, Geneva.
- 2013 *Migration et Développement: Integration de la Migration dans la Planification du Développement dans l'Indianoceanie*. Rapport Final de l'atelier, Hotel Le Labourdonnais, Port Louis, November 2013.
- 2014 *Migration in Mauritius: A Country Profile 2013*. IOM, Geneva. Available from https://publications.iom.int/system/files/pdf/mp_mauritius_26aug2014.pdf

King, D. and S. Smithers

- 2009 Climate change migration from low lying small island communities. In: *Climate Sense* (G. Asrar, ed.). World Meteorological Organization, Tudor Rose Publishing, Leicester, pp. 50–52.

Leuprecht, C.

- 2009 Migration as the Demographic Wild Card in Civil Conflict: Mauritius and Fiji – New Directions in Demographic Security. *Environmental Change and Security Program*, 13 (2008–2009):34–39. Available from www.wilsoncenter.org/sites/default/files/ECSPReport13_DemographicSecurity.pdf

L'Express

- 2014 Glissement de terrain à Quatre-Soeurs: onze familles veulent être relogées. *L'express.mu*, 11 September. Available from www.lexpress.mu/article/252209/glissement-terrain-quatre-soeurs-onze-familles-veulent-etre-relogees

Lincoln, D.

- 2012 *Migration and Development in Contemporary Mauritius*. Southern African Migration Programme (SAMP) Policy Brief No.27. Available from www.queensu.ca/samp/sampresources/samppublications/policybriefs/brief27.pdf

Marshall, N.A. et al.

- 2010 *A Framework for Social Adaptation to Climate Change – Sustaining Tropical Coastal Communities and Industries*. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland.

Mauritius Meteorological Services (MMS)

- 2014 Climate Change. Available from <http://metservice.intnet.mu/climate-services/climate-change.php>

Mauritius Oceanography Institute

- 2011 Monthly Physical Oceanography Bulletin (South West Indian Ocean), Quatre Bornes, Mauritius.

Ministry of Agro Industry and Fisheries (MOAIF)

- 2006 *National Forest Policy*. Forestry Service, Republic of Mauritius, Curepipe.
- 2008 *Annual Report of the National Parks and Conservation Service*. Government of Mauritius, Port Louis.

Ministry of Environment and Sustainable Development (MOESD)

- 2012 *National Climate Change Adaptation Policy Framework for the Republic of Mauritius*. Government of Mauritius, Port Louis.
- 2013a *Climate Change. Impacts of Climate Change on Small Island Developing States*. Accessed http://environment.govmu.org/English/Climate_Change/Pages/Climate-Change.aspx
- 2013b *Consolidated Report Following the Attitude Survey at Rivière des Galets*. Government of Mauritius, Port Louis.
- 2013c *Maurice Ile Durable Policy, Strategy and Action Plan*. Government Printing Department, Port Louis.

Ministry of Finance and Economic Development (MOFED)

- 2014 *Youth Employment Programme: Saving the Mauritian Youth from Unemployment Crisis*. Government of Mauritius, Port Louis.

Moothien Pillay, R. et al.

- 2011 Adapting coral culture climate change: the Mauritian experience. *Western Indian Ocean Journal of Marine Science*, 10(2):155–167.

Nigel, R. and S.D.D.V. Rughooputh

- 2008 A Water Accumulation Flooding Potentiality Index (WAFPI) for rating the risk of flooding – A case study of Mauritius Island. *University of Mauritius Research Journal*, 14:93–111. Available from www.ajol.info/index.php/umrj/article/viewFile/130890/120469

Organisation for Economic Co-operation and Development (OECD)

- 2005 *Objectif Développement: Migration, Transferts de Fonds et Développement (Objective Development: Migration, Remittances and Development)*. OECD, Paris.

Padya, B.M.

- 1989 *Weather and Climate of Mauritius*. Mahatma Gandhi Institute Press, Moka, Mauritius.

Ranaivoson, E.

- 2008 Restoring Coral Reefs: Madagascar. In: *Sharing Innovative Experiences: Examples of Natural Disaster Mitigation in Small Island Developing States* – vol. 12. UNDP, New York.

Recent Natural Disasters

- 2013 Flooding in Mauritius Capital Port Louis; 11 killed. Disaster Report.com, 31 March (last updated). Available from www.disaster-report.com/2013/03/flooding-in-mauritius-8-killed.html

ReliefWeb

- 2002 Mauritius – Tropical Cyclone Dina – Situation Report No. 1. Available from <http://reliefweb.int/report/mauritius/mauritius-tropical-cyclone-dina-ocha-situation-report-no-1>

Rughooputh, S.

- 2008 Integrating Disaster-management Information: Mauritius. In: *Sharing Innovative Experiences: Examples of Natural Disaster Mitigation in Small Island Developing States* – vol. 12. UNDP, New York.

Sobhee, S.K.

- 2004 Economic development, income inequality and environmental degradation of fisheries resources in Mauritius. *Environmental Management*, 34(1):150–157.
- 2006 Fisheries biodiversity conservation and sustainable tourism in Mauritius. *Ocean & Coastal Management*, 49:413–20.
- 2009 The economic success of Mauritius: Lessons and policy options for Africa. *Journal of Economic Policy Forum*, 12(1):29–42.

Sobhee, S.K. et al.

- 2013 *An Evaluation of the Vulnerability of Coastal Communities Due to Climate Change in the Island Economies – A Case Study of the Republic of Mauritius*. Mauritius Research Council and Government of Mauritius.

Statistics Mauritius

- 2000a Geographical and Migration Statistics, Vol. VI. Government of Mauritius, Port Louis.
- 2000b Five-Year Migration Streams to and from Each Geographical District. Government of Mauritius, Port Louis.
- 2005 *Digest of Labour Statistics 2004*. Government of Mauritius, Port Louis.
- 2009 *Poverty Analysis of Household Budget Survey of 2006/07*. Government of Mauritius, Port Louis.
- 2011a *Digest of Business Activity Statistics 2010*. Government of Mauritius, Port Louis.
- 2011b Relative Development Index. Government of Mauritius, Port Louis.
- 2012a *Mauritius in Figures 2011*. Government of Mauritius, Port Louis.
- 2012b *Annual Digest of Statistics 2011*. Government of Mauritius, Port Louis.
- 2012c *Digest of Environment Statistics 2011*. Government of Mauritius, Port Louis.
- 2012d *Digest of Demographic Statistics 2011*. Government of Mauritius, Port Louis.
- 2013a *Digest of Labour Statistics 2012*. Government of Mauritius, Port Louis.
- 2013b *Digest of Population Statistics 2012*. Government of Mauritius, Port Louis.
- 2014 *Digest of Agricultural Statistics 2013*. Government of Mauritius, Port Louis.
- 2015a *Population and Vital Statistics (Highlights) 2015*. Government of Mauritius, Port Louis.
- 2015b Labour Force, Employment and Unemployment (Highlights) 2015. Government of Mauritius, Port Louis.
- 2015c *Mauritius in Figures 2014*. Government of Mauritius, Port Louis.
- 2015d *Digest of Environment Statistics 2014*. Government of Mauritius, Port Louis.
- 2015e *Survey of Employment and Earnings 2014*. Government of Mauritius, Port Louis.

- Staub, F.
2000 New hypothesis on the dodo's true morphology from an ecological consideration of its available diet in: *Globalisation and the South-West Indian Ocean* (S.J.T. Evers and V.Y. Hookoomsing, eds.). International Institute for Asian Studies and University of Mauritius, The Netherlands and Mauritius, pp. 67–76.
- Subramanian, A. and D. Roy
2001 *Who Can Explain the Mauritian Miracle: Meade, Romer, Sachs, or Rodrik?*. International Monetary Fund (IMF) Working Paper No. 01/116. IMF, Washington, D.C. Available from www.imf.org/external/pubs/ft/wp/2001/wp01116.pdf
- Sultan, R.
2012 *Climate Change and agriculture in Mauritius – Impacts and vulnerability assessment, Mauritius Research Council*, Government of Mauritius, Ebene.
- Svirydzenka, K. and M. Petri
2014 *Mauritius: The Drivers of Growth – Can the Past be Extended?* IMF Working Paper No. 14/134. IMF, Washington, D.C. Available from www.imf.org/external/pubs/ft/wp/2014/wp14134.pdf
- United Nations Development Programme (UNDP)
2009 Africa Adaptation Programme (AAP) Project Document.
- United Nations Framework Convention on Climate Change (UNFCCC)
2009 Vulnerability and Adaptation to Climate Change in Small Island Developing States: Background paper for the expert meeting on adaptation for small island developing States. UNFCCC. Available from https://unfccc.int/files/adaptation/adverse_effects_and_response_measures_art_48/application/pdf/200702_sids_adaptation_bg.pdf
- United Nations University (UNU)
2015 *World Risk Report 2015*. Bündnis Entwicklung Hilft and UNU-EHS, Berlin.

Vang, K.

- 2008 Cyclone Tracking and Alert System: Pacific Islands. In: *Sharing Innovative Experiences: Examples of Natural Disaster Mitigation in Small Island Developing States* – vol. 12. UNDP, New York.

Waddington, H. and R. Sabates-Wheeler

- 2003 *How Does Poverty Affect Migration Choice? A Review of Literature*, Institute of Development Studies Working Paper T3. University of Sussex, Brighton.

World Bank

- 2011 Migration and Remittances Factbook 2011. The World Bank. Available from <http://data.worldbank.org/data-catalog/migration-and-remittances>
- 2014 Personal remittances received (USD). The World Bank. Available from <http://data.worldbank.org/data-catalog/migration-and-remittances>

ASSESSING THE EVIDENCE:

OPPORTUNITIES AND CHALLENGES
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AGAINST CLIMATE CHANGE IN THE

REPUBLIC OF MAURITIUS



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