MINISTRY OF AGRO-INDUSTRY AND FOOD SECURITY

Fifth National Report on the Convention on Biological Diversity

Republic of Mauritius

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List of Abbreviations and Acronyms

ARDA	Association Réunionnaise de Développement de l'Aquaculture
ASCLME	Agulhas and Somali Current Large Marine Ecosystems Project
AREU	Agricultural Research Extension Unit
BOI	Board of Investment
CBD	Convention on Biological Diversity
CBO	Community Based Organisation
CMA	Conservation Management Area
COP	Conference of Parties
CSR	Corporate Social Responsibility
CWR	Crop Wild Relatives
DRR	Disaster Risk Reduction
EEZ	Exclusive Economic Zone
EPA	Environment Protection Act 2002
EIA	Environmental Impact Assessment
FADs	Fish Aggregation Devices
ESA	Environmentally Sensitive Areas
FARC	Food and Agricultural Research Council
FNR	Fifth National Report
FS	Forestry Services
GEF	Global Environment Facility
GMO	Genetically Modified Organism
IAEA	International Atomic Energy Agency
IAS	Invasive Alien Species
ICZM	Integrated Coastal Zone Management
IPGRI	International Plant Genetic Resources Institute
IPM	Integrated Pest Management
IOSEA	Habitats of the Indian Ocean and South-East Asia
IRS	Integrated Resort Schemes
IUCN	International Union for Conservation of Nature
LMO	Living Modified Organisms
MCIA	Mauritius Cane Industry Authority
MDG	Millennium Development Goal
MEO	Mauritius Environment Outlook Report
MID	Maurice Ile Durable
MAIFS	Ministry of Agro-Industry and Food Security
MESDDBM	Ministry of Environment, Sustainable Development, Disaster and Beach Management
MEPU	Ministry of Energy and Public Utilities
MOEMRFSOI	Ministry of Ocean Economy, Marine Resources, Fisheries, Shipping and Outer Island
MGE	Ministry of Gender Equality, Child Development and Family Welfare
MHL	Ministry of Housing and Lands
MTEC	Ministry of Tourism and External Communications
MMS	Mauritius Meteorological Services
MOI	Mauritius Oceanography Institute
MPA	Marine Protected Area
MRC	Mauritius Research Council
MSIRI	Mauritius Sugarcane Industry Research Institute
Mus$	Millions of US$

NAPRO	National Agricultural Products Regulatory Office
NBSAP	National Biodiversity Strategy and Action Plan
NCCAP	National Climate Change Action Plan
NCCAPF	National Climate Change Adaptation Policy Framework
NDS	National Development Strategy
NEP	National Environmental Policy
NES	National Environmental Strategy
NGO	Non-governmental Organisation
NIASSAP	National Invasive Alien Species Strategy and Action Plan
NPCS	National Parks and Conservation Services
NPPO	National Plant Protection Office
PA	Protected Area
PAN	Protected Area Network
PGR	Plant Genetic resources Unit
RRA	Rodrigues Regional Assembly
Rs	Mauritian Rupees
RTREBS	Rivulet Terre Rouge Estuary Bird Sanctuary
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SEMPA	South East Marine Protected Area
SIDS	Small Island Developing State
SST	Sea Surface Temperature
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNDP CO	United Nations Development Programme Country Office
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
UoM	University of Mauritius

Executive Summary

The Republic of Mauritius has prepared the Fifth National Report on the national implementation of the Convention on Biological Diversity (CBD) as required by Article 6 of the Convention and in accordance with Article 26 of the Convention and decision X/10 of the Conference of the Parties. The Fifth National Report (FNR) provides a key source of information for the review of the implementation of the Strategic Plan for Biodiversity 2011-2020, and Mauritius progress towards the implementation of the three objectives of the Convention (i) Conservation of biodiversity, (ii) Sustainable use of the components of biodiversity and (iii) Fair and equitable sharing of the benefits deriving from the utilization of genetic resources.

The FNR process has involved meetings, thematic area working groups (stock taking exercise), gathering and compilation of information from participating bodies across the public sector, parastatal bodies, private sector and NGOs.

The report covers geographically mainland Mauritius together with the Outer Islands Rodrigues in the period of 2010-2013. It aims to:

1. Update the status, trends and threats and implications for human well-being.
2. Outline the National Biodiversity Strategy and Action Plan (NBSAP), its implementation, and the mainstreaming of biodiversity.
3. Assess the progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals (MDG).

Biodiversity is of high importance to the Republic of Mauritius. Apart from the essential role forests, agriculture, inland water, wetlands, coastal, and marine biodiversity play in providing important ecosystem services (provisioning, regulating, supporting and cultural); they represent a key component of mitigation and adaptation measures for climate change impacts, disaster risk reduction, economy and human well-being. Although biodiversity has not yet been valuated some experiments have already been carried out in 2012 (ASCLME, 2012a & 2012b; Sultan, 2012) and in 2013 (Sookun and Weber, 2013).

As a Small Island Developing State (SIDS), the country faces several challenges that impact its biodiversity: small size, high population density, limited resources, dependence on international trade, highly vulnerable to natural as well as environmental (global warming, sea level rise, etc.) disasters, and contribute the least to global climate change and sea level rise.

Update on the status, trends and threats and implications for human well-being

***Forest/terrestrial biodiversity*.**

The forest in Mauritius covers around 25 % of its land area (Forestry Services, 2014, Mauritius) of which 2 % is native forest. In Rodrigues, the planted forest cover is estimated around 30 % of Rodrigues land area (Forestry Services, Rodrigues). The flora and fauna of Mauritius has a relatively high level of diversity and endemism as a result of the island's location, age, isolation and varied topography. Mauritius has 691 species of which 273 are single island endemics and another 150 are Mascarene endemics, Rodrigues has 150 species, of which 47 are single island endemics, and 72 are Mascarene endemics (Baider et al., 2010). In Mauritius, the only native mammals are bats, and to date, 9 endemic bird and 11 endemic reptile species.

Mauritius mainland forest area and Protected Areas (PA) spatial extent remain unchanged since 2010. Restoration of native forests has been multiplied by 2.5 since 2010 (PAN project, NPCS, FS) in Mauritius. Positive trends have been registered for endemic species of which 5 fauna species

(4 birds and 1 bat) have been down listed the last four years on IUCN Red List of Threatened Species from Critically Endangered to Endangered (*Psittacula eques, Foudia rubra*), Endangered to Vulnerable (*Pteropus niger*), Vulnerable to Near Threatened (*Foudia flavicans, Acrocephalus rodericanus*). Two species the Mauritius kestrel (*Falco punctatus*) and the Mauritius cuckoo-shrike (*Coracina typical*) have registered population decline from 2002 to 2013. Knowledge has increased for some species such as reptiles, but several gaps still exist for other species such as insects' biodiversity in terms of scientific baselines, expertise and capacity building.

However, pressures from human activities and natural factors have highly modified Mauritius ecosystems. The major threats to terrestrial biodiversity are the loss and the degradation of habitats biodiversity posing the risk of loss of species. Development in general, combined with the introduction of invasive species of plants and animals, has had a disastrous effect on the native flora and fauna, habitat destruction and modification, pollution, pests and diseases, climate change, and possible natural disasters. As a result, the Republic of Mauritius is part of one of the world's biodiversity hotspots.

The forests of the Republic of Mauritius are small in area but perform vital functions, the most important of them being soil and water conservation. The roles of forests in reducing soil erosion, carbon sequestration, conservation of biodiversity & genetic resources (pollination), and providing recreation and ecotourism activities are now widely recognized and valued. Consequently, conservation, protection and development of the remaining native forests through sustainable management are priority objectives of the overall national policy. In fact, the forests of the Republic of Mauritius are now managed more for these environmental functions rather than for the production of timber.

Agricultural Biodiversity and Biotechnology. In Mauritius agro-biodiversity is directly linked to food security and broadly categorized into two main groups: sugar and non-sugar (i.e. vegetables, fruit, medicinal plants and livestock) while in Rodrigues it is categorized into fruits and food crops.

From 2009 to 2013, general trends for the Republic of Mauritius agricultural production show a slowdown. In Mauritius, these trends are closely dependent on the government policies. For sugar cane, which mainly result from EU sugar reform and the drastic reduction in sugar price since 2006, these trends reflect a reduction of area, moving out of sugar cane production for small-scale farmers through abandonment, conversion from sugar cane to other agricultural uses (food crops and fruits), and conversion of land to non-agricultural uses (such as Integrated Resort Schemes (IRS) and residential and infrastructure projects). Livestock productions remain stable showing an increase in goat production linked to an increased demand from Mauritius. Livestock's trends in Mauritius are linked to livestock disease, increased costs of inputs (especially feed), marketing problems, land availability, fodder, and consumption decrease. It has resulted in a reduction of small-size breeders for the benefit of medium and large size breeders. The government and the Maurice Ile Durable (MID) Strategy and Action Plan encourage sustainable farming practices (bio-fertilizers, rainwater harvesting). The Republic of Mauritius ratified the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits in 2013.

The major threat to agricultural biodiversity is the loss of genetic resources as emphasis is being placed on a relatively small number of imported higher yielding crop varieties and animal breeds, and that field station lands with important genetic resources are being released for development. Direct drivers of agro biodiversity loss include habitat destruction via conversion of agricultural land to other uses; possible negative impacts of biotechnology and bioenergy crops; natural calamities associated with climate change such as droughts in Rodrigues; and introduction of invasive alien species, pests and diseases. Indirect drivers of agro-biodiversity loss are international trade policies and land increase demand for food. Furthermore, limited land area and capacity, incomplete inventories and research, lack of inter-institutional communication and collaboration are also jeopardising agro-biodiversity. Similarly, the introduction of Living Modified Organisms

(LMO) in the future could contribute to genetic erosion and loss of traditional crops.

Inland Freshwater, Coastal and Marine biodiversity. Since the Fourth National Report on the CBD (Republic of Mauritius, 2010), no additional information has been registered on the status of inland freshwater biodiversity due to a lack of data (last study done in 2003, ARDA). Since 2012, studies on reservoirs' and rivers' micro-algae biodiversity are being carried out for water quality (CWA, MEPU), 40 to 50 species have been identified. In Mauritius, loss of biodiversity including loss of mangroves and wetlands is the major threat to freshwater resources, while in Rodrigues mangroves are becoming well-established and are increasing. Wetlands form an integral component of biodiversity and provide many ecosystem services that benefit both people and wildlife such as habitat for a wide diversity of flora and fauna species; water storage, flood control, sediment and nutrient retention, carbon sink, shoreline stabilization; and aesthetic and educational values.
The latest status of coastal and marine biodiversity is reported in the National Marine Ecosystem Diagnostic Analysis (ASCLME, 2012a) that has been done in 2012. Total fish catch has decreased from 19,690 tonnes in 1993 to 5,270 tonnes in 2011, which represents a decline of 30 %. To conserve marine biodiversity, a system of Marine Protected Areas comprising fishing reserves, marine parks and marine reserves, has been established in the waters around Mauritius and Rodrigues. The Republic of Mauritius has, so far, proclaimed 6 Fishing Reserves and 2 Marine Parks as well as 5 Fisheries Reserved Areas, 4 Marine Reserves and a multiple-use Marine Protected Area in Rodrigues. Rodrigues registered a significant increase in octopus landings as well as in their increase in size and weight since 2012. These trends are related to the development of the Marine Reserves in Rodrigues originally identified by the fishermen communities and the implementation of regulations (2012) on seasonal octopus closure. In parallel, a sensitisation campaign was launched across the island associated with the development of alternative activities during the closure period to ensure proper understanding of the motivations that led to this management decision (IOC, 2012; Shoals Rodrigues, RRA).

Habitat loss and degradation are the major threats to these ecosystems. Despite their significance to Mauritius, marine and coastal ecosystems such as mangroves, seagrass beds and coral reefs face a wide array of threats – mainly due to human causes (over-exploitation of resources, erosion, siltation and pollution, coastal development) and invasive alien species. In addition, the impacts of climate change are heavily affecting these ecosystems.

Marine and coastal biodiversity provide Mauritian with a multitude of valuable goods and services. These ecosystem services range from food, medicine, climate regulation and coastal protection to cultural services such as recreational and spiritual benefits. ASCLME study (2012) has estimated the total value for goods and services produced by ecosystems provisioning, regulation, cultural and supporting services for Mauritius between 31,209 - 31,225 Mus$.

National Biodiversity Strategy and Action Plan (NBSAP) implementation and mainstreaming of biodiversity

The NBSAP 2006 – 2015 has been partially implemented. Since the Fourth National report many activities have been carried out mainly through projects implementation and have been met with varying degrees of success. Successes concern the positive trends registered for the threatened species conservation, restoration of native forest areas and the implementation of the octopus closure regulation in Rodrigues. However the NBSAP implementation faces key constraints and challenges. The major challenges are institutional (the process has not fully been institutionalised and sustained), fragmentation of responsibilities among various ministries and institutions (water resources for example), shortage in staff and capacities, base-line data sets, scientific data sharing and long-term monitoring mechanisms to inform decision-making. Thematic issues have been

raised related to the lack of (i) inland watershed biodiversity, (ii) outer islands and the Exclusive Economic Zone (EEZ) geographical cover, and (iii) climate change impact on biodiversity.

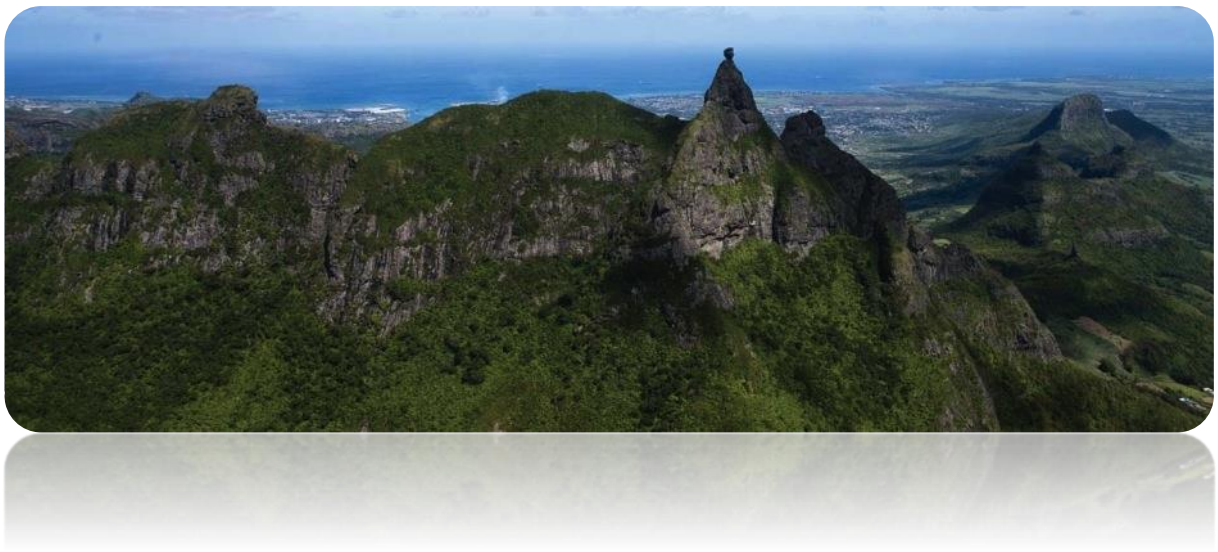
The Republic of Mauritius with the MID strategy mainstreams biodiversity. Mauritius has adopted a number of policies and strategies for conservation and sustainable use of biodiversity. Legislations/regulations have been revised and are in the process of adoption: the Wildlife and National Parks Act (1993) and its associated regulations has been amended and the new legislation will be known as the 'Native Terrestrial Biodiversity and National Parks Bill (20xx)' and the 'Native Terrestrial Biodiversity and National Parks Regulation 20xx'; a draft Wetland Bill document is under review. Strategies comprise the MID in 2013, the National Invasive Alien Species Strategy and Action Plan (NIASSAP 2009-2018; Republic of Mauritius, 2009), the National Climate Change Adaptation Policy Framework Report (Republic of Mauritius, 2013c) and the Disaster Risk Reduction (Republic of Mauritius, 2012) Strategic Framework and Action Plan (2012). These processes are supported by a number of programs and projects. Although, the mainstreaming of the biodiversity at government level is taking place, the need for a synergetic and dynamic biodiversity coordination mechanism and process has been raised among stakeholders.

Progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals

The NBSAP implementation contributes to different extents in terms of habitat loss, fragmentation and degradation; sustainable fisheries, agriculture, aquaculture; water pollution, IAS, vulnerable ecosystems, protected areas, species, genetic diversity, and to some extent to science and research towards the 2020 Aichi Biodiversity Targets and the Millennium Development Goals. The NBSAP update will start in 2015. Although the NBSAP does not refer directly to biodiversity awareness, mainstreaming and incentives, work has been achieved in these areas or they are addressed through experimental studies and actions.

Future priorities include the implementing of a sustainable national biodiversity coordination mechanism; building ecological resilience at landscape scale by protecting habitats and reducing existing pressures; increasing connectivity by establishing conservation linkages across the landscape and therefore facilitating the adaptation of species to climate change; mainstreaming biodiversity issues in the government, business, scientific and education sectors thus ensuring that biodiversity is not discounted in development process and government and industry decisions; establishing base-line data sets and long-term monitoring mechanisms to inform decision-making, and information exchange; developing a scientific data and publication exchange mechanism to improve the CBD reporting and exchange mechanisms, including the Clearing House Mechanism (CHM); and developing a financial resources mobilisation strategy. In terms of capacity building, the priorities include the development of technical, support to targeted research and core activities capacities.

Chapter 1. An update on biodiversity status, trends, threats and implications for human well-being



1.1. Introduction

The Republic of Mauritius consists of two main islands, Mauritius (1,865 km^2) and Rodrigues (109 km^2) and outer islands, namely St Brandon, Agalega, Chagos Archipelago including Diego Garcia; Tromelin, and Cargados Carjajos (Mauritius Constitution, 1968). 49 offshore islets surround Mauritius while eighteen islets lie in the lagoon of Rodrigues. Mauritius' total land area is 2,040 km^2. It has an Exclusive Economic Zone (EEZ) of over 2.3 million km^2, of which 99 % is still unexplored. Its ocean territory extends from the coast of Mauritius, Rodrigues, St Brandon (Cargados Carajos Shoals), Agalega, Tromelin and Chagos Archipelago (MID, 2013a).

Mauritius, Rodrigues and Reunion form the Mascarene Archipelago, which is located in the western Indian Ocean. These islands were never connected to a continental landmass and this isolation, and the age of the islands (Mauritius > 8.9 million years), allowed some of the richest and most extraordinary terrestrial biodiversity to evolve, giving rise to a high percentage of endemic species. The native biodiversity of Mauritius is unique and diverse.

Mauritius is densely populated and there is considerable pressure on agricultural land and forests. The proportion of land covered by forests has decreased from around 31 % in 1995 to 25.5 % in 2011. About 43 % of the land area is covered by agriculture and approximately 28 % by built up areas. High quality land is scarce and is sought after by a variety of competing users for urban and infrastructural expansion and to support the agricultural, industrial, and tourism sectors. These pressures, along with unsustainable practices, have led to overuse and degradation, especially in Environmentally Sensitive Areas (ESA) such as wetlands and mountain slopes (MID, 2013).

However, general trends show positive government efforts to maintain biodiversity and that the Republic of Mauritius is on track in its biodiversity mainstreaming and conservation programmes.

1.2. Forest/terrestrial biodiversity

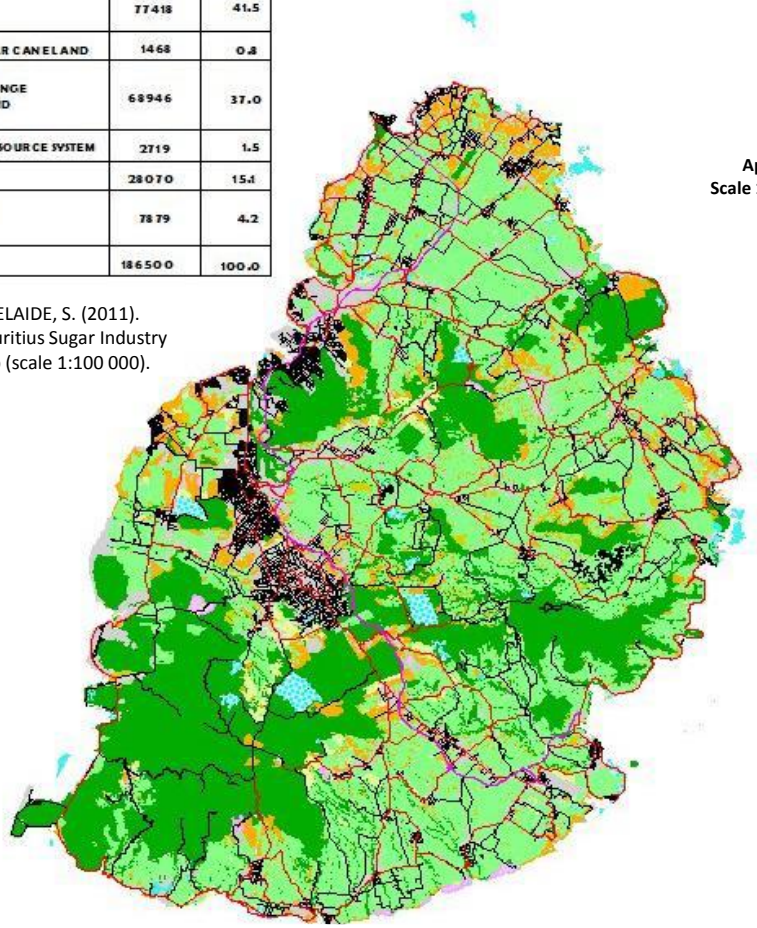
1.2.1. Forest biodiversity

In 2013, the total extent of forest cover in Mauritius mainland (Figure 1) is estimated at 47,108 hectares representing about 25 % of the total land area. The forest cover is composed of planted forests, native forests[1] (2 %), and shrub-land (14 %). 1 % of the native forest is considered to be of good quality while 9 % of this area is highly degraded.

Figure 1. Mauritius land use map, 2010 (source: MSIRI)

LEGEND	MAJOR LAND USE	AREA (Ha)	% TOTAL
SUGAR CANE OTHER CROPS LIVESTOCK PRODUCTION (POULTRY, FODDER)	AGRICULTURE	77418	41.5
ABANDONED SUGAR CANE LAND	ABANDONED SUGAR CANE LAND	1468	0.8
RESERVES (MOUNTAIN & RIVER) WASTE LAND ROCK HEAP LEISURE (BEACH, PUBLIC GARDEN,ETC)	FOREST, SHRUB, RANGE AND GRAZING LAND	68946	37.0
WATER BODY & MARSH	INLAND WATER RESOURCE SYSTEM	2719	1.5
BUILT-UP AREA	BUILT-UP AREA	28070	15.1
HIGHWAY MAIN ROAD SECONDARY ROAD/PIVOT PARKING	INFRASTRUCTURE	7879	4.2
TOTAL AREA (Ha)		186500	100.0

Source:
CHUNG TZE CHEONG, M., RAMASAMY, S. and ADELAIDE, S. (2011). **The 2010 Land use map of Mauritius**. Reduit: Mauritius Sugar Industry Research Institute. 22 p.: 7 tbls, 1 fig., and 1 map (scale 1:100 000). (*MSIRI Occasional Paper No. 41*).



Mauritius forestland categories (public 47 % and private 53 %) show marginal changes from 2010 to 2013 (Table 1). In 2013, the extent of reasonable quality native forest (>50 % of plant canopy cover) was estimated at around 2,600 ha. The Forestry Services (FS) observed that the pattern of forest distribution is changing. These changes might be attributed to climate change issues but in-depth studies need to be carried out.

[1] List of native plants: http://forestry.gov.mu/English/Pages/List-of-Native-Plants.aspx

Table 1. Mauritius forestland categories (FS, MAIFS, Republic of Mauritius 2011a (MEO), Digest of Environment Statistics 2013, Statistics Mauritius)

	Area (hectares)		% of total land area		Trends
	2010	**2013**	**2010**	**2013**	**%**
Forests lands	**47,159**	**47,108**	**25.3 %**	**25.3 %**	**- 0.1**
State owned	22,159	22,108	11.9 %	11.9 %	- 0.2
Plantations	11,916	11,867	6.4 %	6.4 %	- 0.3
PA and Nature reserves	8,254	8,279	4.4 %	4.4 %	0.3
Other Forest Land	1,358	1,332	0.7 %	0.7 %	- 2
Pas Geometriques	631	631	0.3 %	0.3 %	0
Privately owned lands	25,000	25,000	13.4 %	13.4 %	0
Reserves (land PA)	6,553	6,553	3.5 %	3.5 %	0
Other	18,447	18,447	9.9 %	9.9 %	0

In Rodrigues, the total extent of planted forest cover is estimated approximately around 30 % of the total land area (Forestry division personal communication, Rodrigues). Invasive alien woody species (*Acacia nilotica*) dominate all forest areas on Rodrigues and, with the exception of intensively restored areas in the nature reserves, no contiguous areas of native forest exist (MWF). Invasion of *Acacia nilotica* is mostly through faeces of grazing animals being given there is an extensive grazing system on the island. It covers about 20 % of the total forest cover. Elements of the original biodiversity remain in some forest fragments. In Rodrigues the endemic bois papaye *Badula balfouriana*, with only five remaining individuals in the wild, is being propagated in the MWF Solitude Nursery.

Main threats to forest biodiversity are Invasive Alien Species (IAS) and limited monitoring of the IAS on forest lands, limited land availability and habitat fragmentation, pests and loss of interactions. Mauritius and Rodrigues have lost the majority of their endemic vertebrate species among which were important browsers like land tortoises, pollinators and seed disseminating frugivores. Such losses are expected to have adverse effects on the native plant communities by reducing habitat heterogeneity (e.g. due to loss of browsers), reducing reproductive success (e.g. through lowered pollination levels) and reducing individuals' establishment and survival (e.g. through poor dissemination from mother plants).

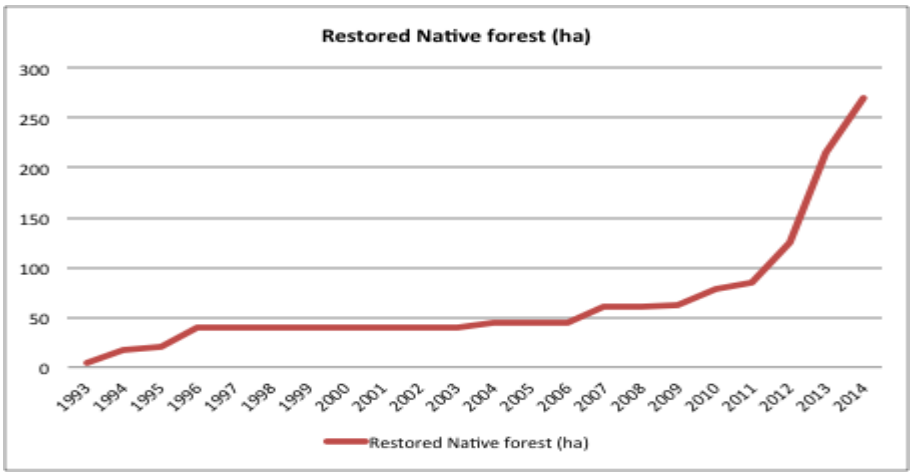
The Forestry Services are shifting to the FAO classification for forest categories, but observed a gap for the shrub-land category. In addition gaps are observed in the knowledge of Mauritius natural forest cover as well as of the pests and diseases affecting the forest, and of climate change impacts.

The priority now for Mauritius and Rodrigues is the restoration of endemic forests (9 % of highly degraded forest in Mauritius) by weeding all invasive alien species. In Mauritius, the sites selected for restoration are found in the national parks, nature reserves and other state land forests. About 242 ha (2013) of native forests are in the process toward restoration into Conservation Management Areas (CMA). Most of these plots are concentrated in key biodiversity sites on public and private lands. In 2009, approximately 50 % of the state plantation areas (some 6,000 ha of exotic plantations) have been set aside for protection of ecosystem services (water catchments, soil protection, etc.). In 2014, public private partnerships (PPP) have been initiated (Vallée de Ferney, Ebony forest). IAS threat is encountered in forest areas by native forest restoration. The surface of restored forest areas has been multiplied by 2.5 since 2010 (Figure 2). Restoration according to previous methodology used by government agency for initial weeding, using a contract strategy with intermediary bodies, was costly (+/- USD 10,000 per ha), therefore NPCS supports directly

community work by recruiting local labourers on contract under NPCS supervision and control on the weeding operation. This strategy has considerably reduced the cost of weeding to about USD 3,000 per ha. It also permits to raise awareness among local communities on native forests biodiversity conservation and its positive impacts on livelihood.

In Rodrigues, plant conservation programmes are implemented through community forests, private sector initiative and botanical garden.

Figure 2. Restored Native Forest areas in hectare (source: PAN project, NPCS, FS)



In Mauritius, the Vallee de Ferney Conservation Trust represents a public-private partnership between the Government of Mauritius and CIEL group that came into existence in 2006. The Trust is dedicated to the restoration and protection of the natural habitats contained within the reserve, acting with the cooperation and approval of the National Parks and Conservation Service. Vallee de Ferney is also set to become a reference for raising community awareness and providing out-of-classroom educational experience with regards to biodiversity conservation and environmental protection. Ferney reserve encloses 200 hectares of rainforest, which is home to more than a 100 plant species, as well as numerous vertebrate and invertebrate species (Vallée de Ferney website, http://www.valleedeferney.com/).

In Rodrigues, the private sector initiative takes place through ecotourism activities (Tortoise Park) cumulated with conservation processes. *Foetidia Rodriguesiana* is propagated through tortoises.

The forests of the Republic of Mauritius are small in area but perform vital functions, the most important of them being soil and water conservation. Where water is scarce, all activities, be they agriculture, tourism or manufacturing, are seriously affected. The environmental function of forests far outweighs their direct economic function in SIDS. The roles of forests in reducing soil erosion, carbon sequestration, conservation of biodiversity & genetic resources (pollination), and providing recreation and ecotourism activities are now widely recognized and valued. Consequently, conservation, protection and development of the remaining native forests through sustainable management are priority objectives of the overall national policy of Mauritius. In fact, the forests of the Republic of Mauritius are now managed more for these environmental functions rather than for the production of timber (FS, MAIFS).

1.2.2. Protected areas

Mauritius' target is to place 10 % of Mauritian terrestrial area within a Protected Area Network by 2015. In 2014, PA represent 7.6 % of Mauritius total mainland surface (Table 2, NPCS, Digest of Environment Statistics 2013, Statistics Mauritius), the surface remains unchanged since 2009.

Table 2. Status of protected areas in 2014

Name	Conservation status	Area (ha)
Formal State Protected areas – mainland		
Black River Gorges (management plan under review 2014)	***National Park***	6,574.00
Bras D'Eau (management Plan under process)		497.20
Perrier	***Nature Reserve***	1.44
Les Mares		5.10
Gouly Pere		10.95
Cabinet		17.73
Bois Sec		5.91
Pouce		68.80
Corps de Garde		90.33
Rivulet Terre Rouge Estuary Bird Sanctuary	***Ramsar Site: Wetlands of International Importance***	26.00
Pointe D'Esny		20.00
Vallée D'Osterlog Endemic Garden Foundation	***National Protected Area***	275
TOTAL – MAINLAND		**7,592.5 ha**
Formal State Protected areas – offshore islets		
Pigeon Rock	***Islets National Park***	0.63
Ile D'Ambre		128.00
Rocher des Oiseaux		0.10
Ile aux Fous		0.30
Ile aux Vacoas		1.36
Ile aux Fouquets		2.49
Ilot Flamants		0.80
Ile aux Oiseaux		0.70
Round Island	***Nature Reserves***	168.84
Ile aux Serpents		31.66
Flat Island		253.00
Gabriel Island		42.20
Gunner's Quoin		75.98
Ilot Mariannes		1.98
Ile aux Aigrettes		24.96
Ile de la Passe	***Ancient Monument***	*2.19*
TOTAL – OFFSHORE ISLETS		**735.2 ha**
Pas Géométriques		
Plantations – varied	***Pas Géométriques***	226
Leased for grazing and tree planting		230
Unplanted, protective or to be planted		179
TOTAL – PAS GEOMETRIQUE		**635 ha**
Privately owned/managed conservation areas		
Varied	*Mountain Reserve*	3,800
Varied	*River Reserve*	2,740
Mondrain	*'Private Reserve'*	5
Emile Series		8
TOTAL – PRIVATELY OWNED/MANAGED CONSERVATION AREAS		**6,553 ha**

In the last 4 years, 3 reserves have been converted and merged into the Bras D'Eau national park; Pointe D'Esny has been nominated as a Wetland of International Importance Ramsar site (NPCS). Action ahead initiated to nominate another National Ramsar Site (Midland Dam) in 2014.

Mauritius has two properties inscribed on the World Heritage Cultural List: Aapravasi Ghat (2006) and Le Morne Cultural Landscape (2008); and, one property considered to be a natural heritage of outstanding universal value submitted on the Tentative List in 2006: the Black River Georges National Park.

In Rodrigues, Grande Montagne (14 ha), Anse Quitor (10 ha) and two islets, Ile aux Sables (8 ha) and Ile aux Cocos (14.4 ha) have all been declared Nature Reserves (under the Forest and Reserves Act 1983). Work is under progress to increase the land area under protected area.

The threats to PA are IAS, land conversion and habitat fragmentation, and impact of climate change. The current PA system of Mauritius does not follow the IUCN definition, work in on-going under the PAN project to formalise the definition of what constitutes a 'protected area' in Mauritius. In Rodrigues, the major threats are land development and stray animals that disperse IAS seeds.

PAN implications for human well-being are the mitigation of natural hazards, the safety and satisfaction of PA visitors, food security and human-health in addition to the ecosystem services they provide (water and soil conservation, soil erosion, carbon sequestration, conservation of biodiversity & genetic resources).

1.2.3. Species

There are 691 native flowering plants species of which 273 are endemic (150 endemic to the Mascarene Archipelago) in Mauritius and 150 native flowering plants species of which 47 are endemic (72 endemic to the Mascarene Archipelago) in Rodrigues (Baider et al., 2010). The only native mammals are bats (fruit bats and tomb bats) and to-date nine endemic species of land bird and eleven endemic reptile species exist on the island. Table 3 shows the native and endemic terrestrial species diversity in selected groups in Mauritius and Rodrigues.

Table 3. Native and endemic terrestrial species diversity in selected groups in Mauritius (Mau) and Rodrigues (Rod), with respective total number of extinctions (percentages are given in brackets; Florens, 2013)

	Total Native		Total Endemic		Total Extinct		Endemic Extinct	
	Mau	Rod	Mau	Rod	Mau	Rod	Mau	Rod
Angiosperms[1]	691	150	273 (39.5%)	47 (31.3%)	61 (8.8%)	17 (11.3%)	30 (11.0%)	10 (21.3%)
Mammals[2]	5	2	1* (20.0%)	0	2 (40.0%)	1 (50.0%)	0	0
Land birds[2,3]	28	14	19 (67.9%)	13 (92.9%)	16 (57.1%)	11 (78.6%)	12 (63.2%)	11 (84.6%)
Reptiles[2**]	17	8	16 (94.1%)	8 (100.0%)	5 (29.4%)	8 (100.0%)	5 (31.3%)	8 (100.0%)
Butterflies[4]	30	10	5 (16.7%)	0	4 (13.3%)	1 (10.0%)	1 (20.0%)	0
Snails[5]	125	30	81 (64.8%)	16 (53.3%)	43 (34.4%)	7 (23.3%)	36 (44.4)%	5 (31.3%)

[1] Baider *et al*. 2010; [2] Cheke and Hume 2008, [3] Hume 2011; [4] Williams 2007; [5] Griffiths and Florens 2006;
* Goodman *et al*. 2008
** one species of gecko survives on Rodrigues but it was first recorded after 1884 and is believed to be cryptogenic

1.2.3.1. Flora

Mauritius has 691 species of which 273 are single island endemics and another 150 are Mascarene endemics, Rodrigues has 150 species, of which 47 are single island endemics, and 72 are Mascarene endemics (Baider et al., 2010). Nine of the endemic species in Rodrigues are comprised of less than 10 mature individuals in the wild, including three species, which are known from just a

single individual (*Ramosmania rodriguesii*, *Dombeya rodriguesiana* and *Gouania leguatii*, MWF 2012). Of its native flowering plants 39 % are unique to Rodrigues and 54 % unique to the Mascarenes (Mauritius, La Réunion and Rodrigues). Other species groups show similar levels of endemism.

61 of the country's native species are already classified as extinct, 141 of the flowering Mascarene endemic plant species are classified as Critically Endangered, 55 species are endangered and 98 are classified as Vulnerable (NPCS unpublished report). While in 2012, 192 native plants species were classified as Critically Endangered as per International Union for Conservation of Nature criteria (IUCN) of which 43 have been successfully propagated (NPCS, Digest of Environment Statistics 2013, Statistics Mauritius).

There are about 200 species, subspecies and varieties of pteridophytes, of which 13 species are endemic and 40 are extinct. There are 207 taxa lower plants consisting of 89 genera of mosses and 59 genera of hepatics.

The main threats affecting plant diversity are genetic erosion, small population sizes and fragmentation, invasive alien species (destruction of the linkage between flora and fauna) and climate change (NPCS).

However, certain damaging invasive species that are present in Mauritius such as monkeys and red whiskered bulbuls (*Pycnonotus jocosus*) for example have not been introduced to Rodrigues. The physical isolation of Rodrigues presents opportunities for invasive species prevention and management. However, the fact that it is politically part of the Republic of Mauritius makes the imposition of the necessary biosecurity measures a challenge. Similar biosecurity challenges and opportunities exist for the islets around Mauritius and Rodrigues and the Outer Islands that are part of the Republic of Mauritius. Consequently habitat restoration is a priority in Mauritius and Rodrigues. All islands have recently greatly advanced some aspects of plant conservation, while gaps are also apparent. Advances include conservation strategies, ex situ conservation. Gaps include lack of government support (Mauritius, Rodrigues) and of local scientific expertise (Baider et al., 2010).

1.2.3.2. Fauna

Figure 3. Lesser night gecko, Ile Marianne (© Mootoocurpen, Cole et al. 2013)

Of the 17 reptile species that used to be found in Mauritius, only 12 remain of which 11 endemic species (Figure 3), and 7 of these are restricted to offshore islets where they escaped extinction from rats. Moreover, five of these species are restricted to Round Island.

Figure 4 shows the distribution of the reptile species detected in Rodrigues including non-native species (NPCS; Cole et al, 2013).

Two endemic and endangered birds species are specific to Rodrigues: the Yellow Rodrigues Fody (*Foudia flavicans*) and the Rodrigues warbler (*Acrocephalus rodericanus*)

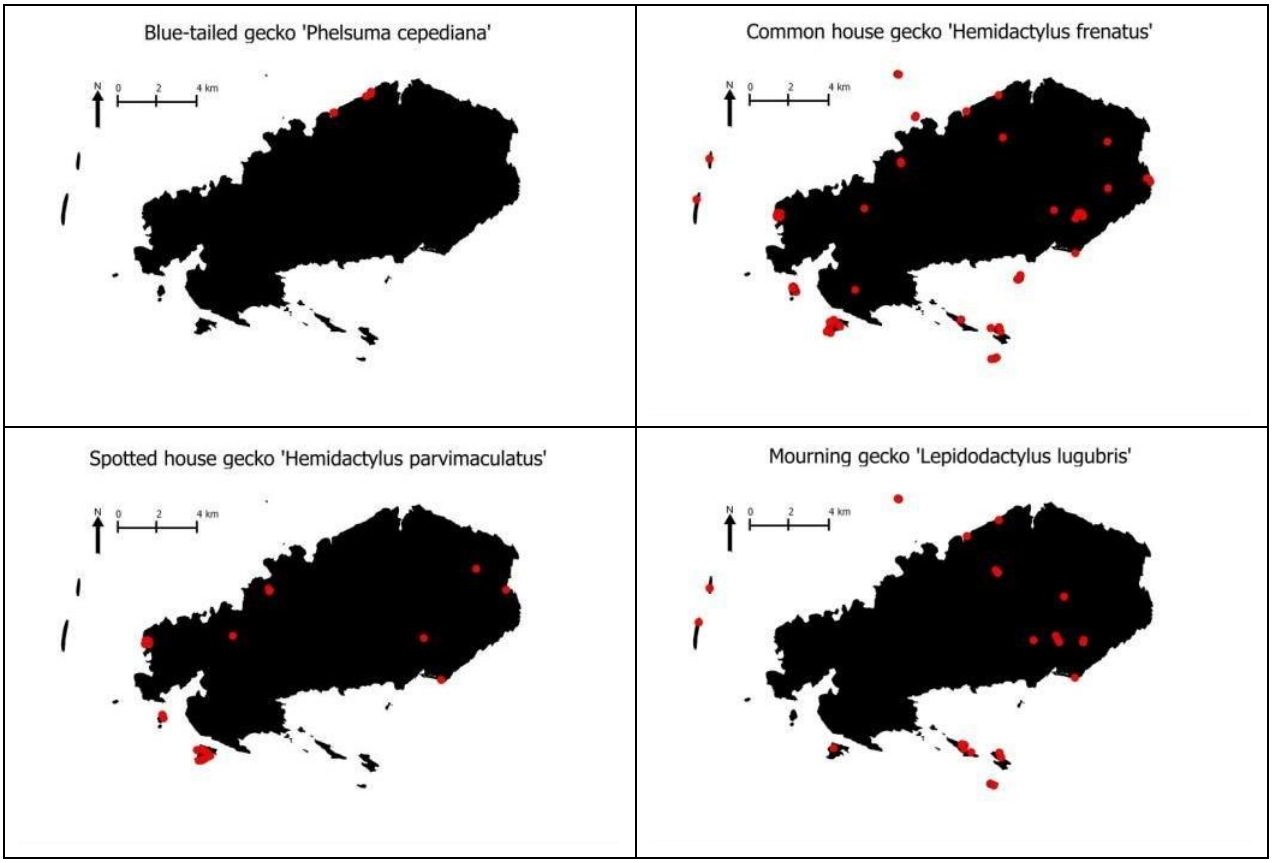
As mentioned before, bats are the only native mammal in Mauritius and Rodrigues. Two species of fruit bat currently occur in the Republic of Mauritius: *Pteropus niger* in Mauritius and *Pteropus rodricensis* in Rodrigues.

There are 40 native butterflies from 32 genera and 5 families species with substantial endemism[2] and 125 known native land snails' species of which 43 are already extinct. However to date, there is no conservation strategy for any invertebrate group and there is a need to reinforce experts in this field area in NPCS.

Positive trends have been registered for endemic species of which 5 fauna species (4 birds and 1 bat, Table 4) have been down listed the last four years on IUCN Red List of Threatened Species from Critically Endangered to Endangered (Mauritius echo parakeet (*Psittacula eques)*, Mauritius fody (*Foudia rubra*)), Endangered to Vulnerable (Mauritius fruit bat (*Pteropus niger*)), and Vulnerable to Near Threatened (Rodrigues fody (*Foudia flavicans),* Rodrigues warbler *(Acrocephalus rodericanus)*). Negative trends have been registered for two bird species: Mauritius kestrel (*Falco punctatus*) and Mauritius cuckoo-shrike (*Coracina typical*) from 2002 to 2013. In 2010, largely due to the habitat restoration work, the population of Rodrigues Warbler has increased from 30 individuals in 1970s to 4,000 individuals in 2010 (MWF).

In Rodrigues, the protection and monitoring of fauna species concerns the Rodrigues fruit bat (*Pteropus rodricensis*), and two endemic and endangered birds species: the Yellow Rodrigues Fody (*Foudia flavicans*) and the Rodrigues warbler (*Acrocephalus rodericanus*). Positive trends have been registered for these 3 species (Table 4). The major threats to these species in order of importance are cyclones, habitat loss and IAS.

Figure 4. The distribution of each reptile species detected in Rodrigues (source: NPCS, Cole et al, 2013)



[2] William J. R. (2007). Butterflies of Mauritius. Bioculture Press, Mauritius cited by Florens et al, 2010.

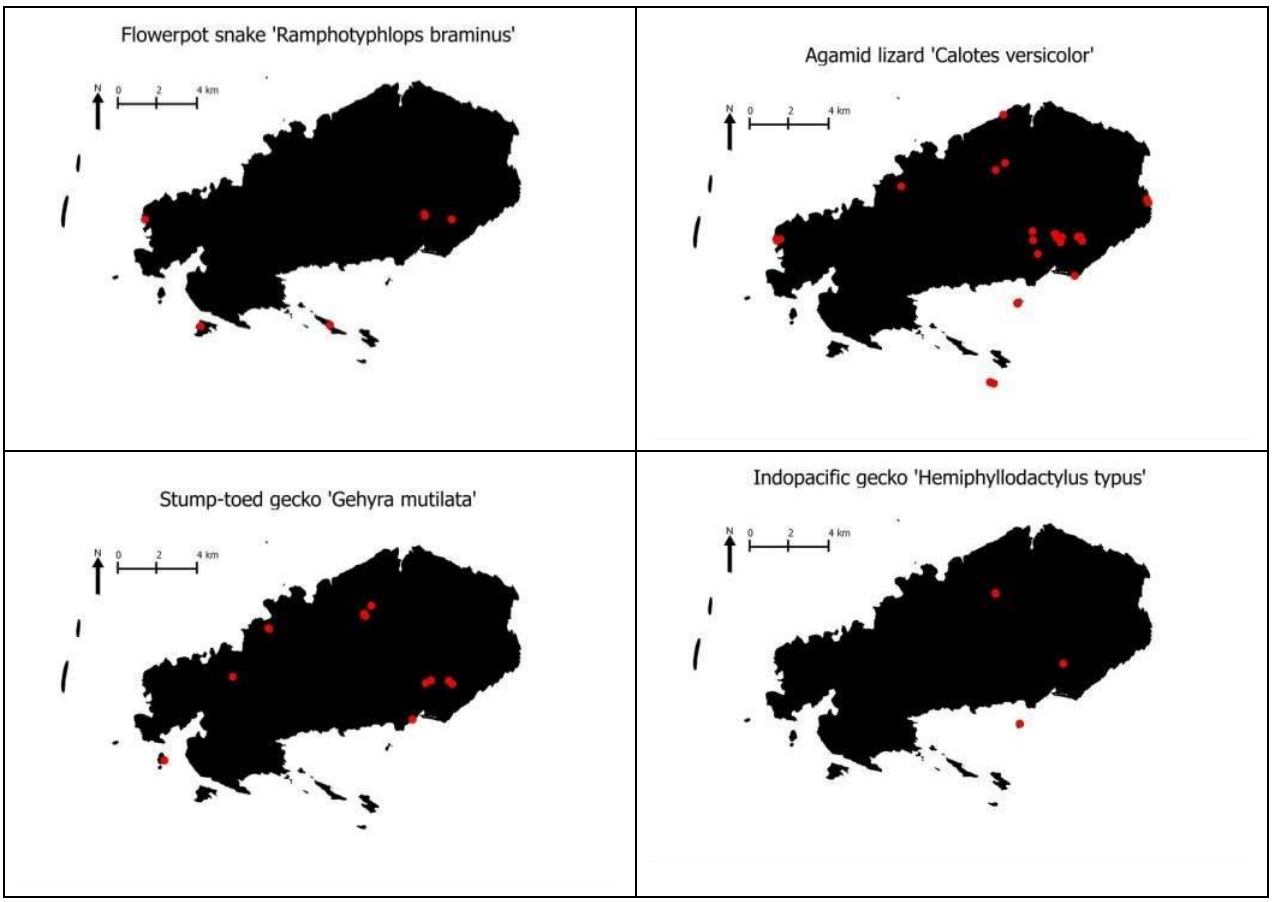


Table 4. Evolution of some population of endemic species 2009-2012/2013

Species	2000	2009	2012 / 2013	Trends 2009 to 2012
Near Threatened				
Rodrigues warbler *(Acrocephalus rodericanus)*	*150 individuals in 1999*	*3,000 individuals (Steward, 2010)*	*4,000 individuals*	*Increase*
	IUCN status: Endangered in 2012, down listed to Near Threatened in 2013			
Vulnerable				
Mauritius kestrel *(Falco punctatus)*	*700 individuals*	*+/- 600 individuals*	*362 individuals*	*Decrease*
Mauritius cuckoo-shrike *(Coracina typical)*	*300-350 pairs*	*>350 pairs*[1]	*225-300 pairs*	*Decrease*
Mauritius black bulbul *(Hypsipetes olivaceus)*	*225-340 pairs*	*225-340 pairs*	*800 to 1000 individuals*	*Increase*
Mauritius fruit bat *(Pteropus niger)*	*10,000*	*26,000*	*52,250 ind. in 2012 92,000 ind. 2013*	*Increase*
	IUCN status: Endangered in 2012, down listed to Vulnerable in 2013			
Endangered				
Pink pigeon *(Nesoenas mayeri)*	*400 individuals*	*+/- 400 individuals*	*400 to 450 individuals*	*Stable*
Mauritius echo parakeet ***(****Psittacula eques****)***	*120 individuals*	*+/- 440 individuals*	*600 individuals*	*Increase*
	IUCN status: in 2007 down listed Critically Endangered to Endangered			

Rodrigues fody *(Foudia flavicans)*	*900 individuals In 1999*	*8,000 individuals in 2010*	*Survey scheduled in 2020*	-
	IUCN Status: Vulnerable in 2012, since 2013 Near Threatened			
Mauritius fody *(Foudia rubra)*	*105-125 pairs*	*Black River Gorges National Park population stable at 105-125 pairs, about 160-170 individuals on Ile aux Aigrettes*	*420 individuals*	*Stable*
	IUCN status: Critically Endangered in 1994, down listed to Endangered in 2009			
Rodrigues fruit bat *(Peropus rodricensis)*	*70<>100 individuals in 1970*	*no data*	*10,000<>15,000 individuals*	*Increase*
Guenther's gecko *(Phelsuma guentheri)*			*4,000-6,000 individuals on Round Island*	
Critically Endangered				
Mauritius olive white-eye *(Zosterops chloronothos)*	*<100 pairs*	*<100 pairs in Black River Gorges National Park and surrounding areas. 20 individuals on Ile aux Aigrettes*	*35 individuals on Ile aux Aigrettes*	*Increase*
Least Concern				
Mauritius paradise flycatcher *(Erpsiphone bourbonnensis desolata)*	*250 pairs*	*>250 pairs some increases noted*	*800 individuals*	*Increase*
1. No new surveys conducted, but thought to have increased; *Sources*: NPCS, Mauritius Environment Outlook Report 2011; Steward (2010), Mauritian Wildlife Foundation (Annual report 2011-2012) and 4th National Report on the Convention on Biological Diversity, 2010; IUCN Red Lists.				

1.3. Agricultural biodiversity and biotechnology

1.3.1. Introduction

In Mauritius agro-biodiversity is directly linked to food security and broadly categorized into two main groups: sugar and non-sugar (i.e. vegetables, fruit, ornamentals, medicinal plants and livestock). The major threat to agricultural biodiversity is the loss of genetic resources (gradual loss of local land races) as emphasis is being placed on a relatively small number of imported higher yielding crop varieties and animal breeds, and that the Ministry field stations with important genetic

resources are being released for commercial production. These field stations contain valuable species and varieties and their release for development, may lead to the loss of valuable genetic resources. Other threats to agro-biodiversity are the effect of international trade policies, climate change, change in demand for quality food, reduction of pollinators, and limited resources. Similarly, the introduction of LMOs in the future could contribute to genetic erosion and loss of traditional crops if procedures for risk assessment and risk management are not followed correctly. Furthermore, limited land area and capacity, incomplete inventories and research, lack of inter-institutional communication and collaboration are also jeopardising agro-biodiversity.

In contrast to the overall economic transformation of Mauritius, the economy of Rodrigues has lagged behind and has remained predominantly agrarian. Crop farming, livestock rearing and lagoon fishing are the main economic activities on the island. Rodrigues is characterised by a drier climate and frequently faces droughts, which affect agricultural production.

Mauritius ratified the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits in 2013.

1.3.2. Overview of the agricultural sector

1.3.2.1. Sugar cane

The sugar cane sector (Table 5) in general is characterised by decrease a in area under cultivation from 2010 to 2013, while the average extraction rate has been marked by a slight increase.

Table 5. Sugar cane evolution from 2010 to 2013 (Digest of agricultural statistics 2011 and 2013, Statistics Mauritius)

Sugar cane sector	2010	2011	2012	2013	Trends (%) 2010 - 2013
Area under sugar cane cultivation (ha)	62,100	59,724	57,160	56,391	- 9.2
Cane yield per hectare (tonnes)	74.4	74.6	72.9	71.4	- 4
Production of cane (tonnes)	4,365,833	4,230,174	3,947,285	3,815,782	- 12.6
Average extraction rate (%)	10.37 %	10.30 %	10.38 %	10.62 %	**+ 2.4**

1.3.2.2. Non-sugar cane

Tea. From 2010 to 2013, the area under tea cultivation decreased by 3.7 % (Table 6), while the production of green tea leaves and black tea went up. This reduction is mainly due to the high cost of production and competition from Kenya, Tanzania and type of tea (emphasis made on special flavoured tea).

Tobacco. The area under tobacco cultivation harvested from 2010 to 2013 has importantly decreased to nil (Table 6).

Food crops. The area under harvested food crops increased by 8.2 % from 2010 to 2013 (Table 6). The production of food crops increased by 2.9 % from 2010 to 2013. The decrease observed from 2012 to 2013 can mainly be explained by decreases of 19.5 % and 14.8 % in the production of potato and tomato respectively due to unfavourable climatic conditions. From 2012 to 2013, the other changes were noted in the production of the main food crops: cabbage (+7.1 %), calabash (-1.6 %), carrot (+10.4 %), chouchou (-15.7 %), onion (+9.5 %), paddy rice (-22.3 %), pumpkin (+11.9 %), and pineapple (+13.0 %). From 2010 to 2011, the following changes were noted in the production of the main food crops: brinjal (+19.3 %), cabbage (+7.0 %), calabash (+3.5 %), carrot (-2.7 %), cauliflower (+24.6 %), chouchou (-8.8 %), cucumber (-18.9 %), ginger (-44.9 %), groundnut (-10.3 %), onion (-9.6 %), potato (-0.7 %), pumpkin (+0.5 %), tomato (-8.0 %) and pineapple (+67.3 %).

Table 6. Non-sugar cane products evolution from 2010 to 2013 (NAPRO, Digest of agricultural statistics 2011 and 2013, Statistics Mauritius)

Non sugar cane sectors	2010		2011		2012		2013		Trends (%) 2010 - 2013	
	Mau.	Rod.	Mau.	Rod.	Mau.	Rod.	Mau.	Rod.	Mau.	Rod.
Tea										
Area under tea cultivation (ha)	698	-	684	-	669		672	-	-3.7	
Production of green tea leaves (tonnes)	7,370	-	8,975	-	7,947		7,524	-	2,1	
Production of black tea (tonnes)	1,467	-	1,787	-	1,577		1,525	-	4	
Tobacco										
Area under tobacco cultivation harvested (ha)	213	-	222	-	173	-	0	-	-100	
Food crops										
Area under harvested food crops (hectares)	7,570	519.5	7,484	521	8,124	427	8,189	443	8.2	-14.7
Production of food crops (tonnes)	114,844	3,698	115,934	3,736	121,106	2,960	118,121	2,607	2.9	-29.5

1.3.2.3. Livestock.

Livestock by type as at December 2013 was as follows: cattle (7,240), goat (25,702), sheep (2,510) and pigs (15,961). The production of beef from live cattle declined by 2.0 % from 1,986 tonnes in 2012 to 1,946 tonnes in 2013. Local beef production (including live cattle from Rodrigues), which represented only 4.6 % of total beef production, decreased by 50.0 % from 180 tonnes to 90 tonnes. In 2013, the production of goat meat and mutton was 46 tonnes, 9.8 % lower than the 2012 figure of 51 tonnes. The share of local production, inclusive of imports from Rodrigues, was 71.3 %. Production of pork decreased by 5.8 % from 653 tonnes in 2012 to 615 tonnes in 2013 (Statistics Mauritius, 2014).

The number of livestock by type as at June 2011 was as follows: cattle (6,596, beef production declined by 7.8 % from 2,194 tonnes in 2010 to 2,023 tonnes in 2011), goat (28,176), and sheep (1,931; goat meat production 8.8 % lower than the 2010) and pigs (23,285).

1.3.2.4. Impact on agro-biodiversity.

From 2009 to 2013, general trends for Mauritius agriculture production show a reduction in areas under cultivation and an increase in productivity. These trends are closely dependent on the government policies and international trends.

Sugar cane production uses roughly 85 % of all agricultural land and the industry employs over half of all agricultural workers. While its absolute importance has declined in recent years (as the production of food crops has increased), it remains the most important agricultural crop in Mauritius from an economic, social and land-use perspective. The trends reflect a reduction of area, moving out of sugar cane production for small-scale farmers through land abandonment, conversion from sugar cane to other agricultural uses (pineapple production), and conversion of land to non-agricultural uses (such as integrated resort schemes (IRS) and residential and infrastructure projects). These trends are mainly a result of EU sugar reform and the drastic reduction in sugar price since 2006. The cultivation of sugar cane for sugar production is no longer sustainable on marginal lands due to high cost of labour, inputs and transport.

For livestock these trends are linked to livestock disease, increased costs of inputs (especially feed), marketing problems, land availability, fodder and consumption decrease. It has resulted in a decrease of small-size breeders for the benefit of medium and large size breeders. The impact on agro-biodiversity would be a loss of biodiversity. With climate change, increase demand for quality

food and limited land resources, recourse is made to improved crop varieties and breed to improve productivity. Very often the local land races cross-pollinate with the new varieties thus resulting in a gradual degeneration of the local land races b and their gradual displacement.

The general trends for Rodrigues show a reduction of food crops and fruits production mainly due to droughts associated with a growth of fruits importation, agricultural land converted into non-agricultural land (residential), and it is believed to overpopulation of bats (fruits damages). Livestock productions remain stable showing an increase in goat production linked to an increased demand from Mauritius (Commission for Agriculture, Rodrigues).

For Mauritius, the main threat to agro-biodiversity is loss of biodiversity driven by economic and social factors. From a genetic perspective, decrease of the sugar cane sector should not be a threat to agro-biodiversity as long as new genetic variation is created each year, and a wide array of varieties are exploited commercially in the various agro-climatic zones and soil type. In Rodrigues, the major threats to agro-biodiversity are droughts and biosecurity. For the latter, Fig (*Ficus benghalensis*) has been imported for reforestation purposes in the 1970s, which brought water-hungry exotics that transpired vast quantities of the island's runoff back into the atmosphere.

1.3.3. Genetic resources

A number of varieties from gene pool is used in breeding programmes. One pea, one bean and one onion variety is used in conventional breeding programme. F6, F7 and F9 generation reached for pea, bean and onion respectively. One *colocasia* accession is used in mutation breeding. A potato breeding programme is also on-going. 10 progenies are at Generation 5 stage and 7 progenies at generation 2 stages.

Decoding genetic diversity to characterise local chilli varieties by morphological and molecular tools. The Food and Agricultural Research and Extension Institute (FAREI) is responsible for the morphological and molecular characterisation. Morphological characteristics are carried out using the descriptors for Capsicum (IPGRI) and both the quantitative and qualitative traits are assessed. Twenty-one varieties collected throughout the island have been evaluated for plant height, leaf and fruit characteristics.

1.3.3.1. Status of food crops.

Food crops collection includes Rodrigues' varieties. A total number of 686 (+316 additional from 2012 - 2014) varieties of different crops have been introduced and evaluated by the FAREI (Table 7) since 1998 and farmers are encouraged to grow selected varieties identified based on their consumer acceptability, yield performance and tolerance to pests and diseases (68 varieties have been recommended to growers). The adoption of high yielding hybrid crop varieties gradually displaces landraces adapted over decades of cultivation and selection, and narrows the genetic base within species, which is indeed determinant to food security and genetic erosion.

Table 7. List of Fruit accessions[3]

Scientific Name	Common Name	# of Accessions	Site
Ananas comosus	Pineapple	3	Pamplemousses ES
Fragaria ananassa	Strawberry	3	Wooton CRS
Litchi chinensis	Litchi	14	Reduit CRS, Pamplemousses, Curepipe ES, Barkly

[3] Horticulture list is available at the MAIF and FAREI

			ES
Dimocarpus longana	Longan	3	Reduit CRS, Pamplemousses
Mangifera indica	Mango	66	Roches Brunes SPC, Plaisance ES, Richelieu CRS, Labourdonnais, Barkly ES
***Musa* spp.**	Banana	42	Pamplemousses ES, Reduit CRS, Wooton ES
Psidium guajava	Guava	6	Reduit CRS, Pamplemousses ES
Cocos nucifera	Coconut	10	Pamplemousses ES
Persea americana	Avocado	9	Reduit CRS
Passiflora edulis	Passionfruit	5	Pamplemousses ES
Artocarpus heterophyllus	Jackfruit	3	Pamplemousses ES
Artocarpus altilis	Breadfruit	3	Pamplemousses ES, Barkly ES, Plaisance ES
Tamarindus indica	Tamarind	2	Pamplemousses ES
Hylocereus undatus	Pitaya	14	Pamplemousses ES, Reduit CRS
Annona spp.	Atemoya	4	Reduit CRS, Pamplemoussses ES
Annona squamosa	Ate	3	Pamplemousses ES
Averrhoa carambola	Starfruit	2	Pamplemousses ES
Citrus spp.	Agrumes	30	Barkly ES, Reduit CRS, Labourdonnais
Spondias cytherea	Hog Plum	2	Pamplemousses ES
Zizyphus jujuba	Jujube	4	Labourdonnais

Crop Improvement Programme at the FAREI: characterisation and utilization, breeding and improvement works are underway on the following:

- Onion (Allium cepa), garlic (Allium sativum), potato, pea (Pisum sativum), snap bean (Phaseolus vulgaris), tomato (Solanum lycopersicum), cauliflower (Brassica oleracea botrytis), cucumber (Cucumis sativus), colocasia (Colocasia esculenta var esculenta), cassava (Manihot esculenta), and Oyster Mushroom –Pleurotus strain
- Two locally bred onion varieties were released for commercial cultivation in 2007 and are produced by local onion producers under the Quality Declared Seed guidelines.
- Litchi germplasm characterised using phonological and morphological characteristics and molecular markers. Fourteen litchi genotypes exist in the germplasm pool at Reduit CRS.
- Morphological and molecular characterisation of 28 banana varieties existing in the germplasm pool at Pamplemousses ES has been initiated. A mutation-breeding programme on banana has started since 2008. One promising mutant is presently under evaluation.
- About 20 species of tropical exotics have been collected and characterised for use in breeding (*Heliconia* and *Alpinia* spp.)
- Some 30 orchid species have been collected and characterised for use in breeding programme
- Five anthurium varieties namely *Ceres* (Acropolis X Cumbia), *Achilles* (Midori X Cumbia), *Luna* (Anneke X Altiplano), *Icarus* (Anneke X Altiplano) and *Juno* (Anneke X Altiplano) were released in 2006. Another number of lines of potential interest are in their final year of evaluation.
- 2 strains of Pleurotus mushroom (CC 200 and CC 201) were recommended in the last 3 years.
- 10 varieties of colocasia (*Colocasia esculenta var. esculenta*) were introduced from Fiji in 2013

1.3.3.2. Ex-situ Conservation.

The cultivated *Saccharum* species, *S. officinarum, S. sinense, S. barberi*, and the wild *Saccharum* species *S. spontaneum, S. robustum* as well as associated genera, *Erianthus, Miscanthus, Narenga, Sclerostachya* constitute the basic genetic resources of sugarcane. The MSIRI holds a sizeable collection of accessions (2340), which have either directly or indirectly contributed to produce new varieties. These clones are conserved exclusively by vegetative means.

There are 471 of crop seed accessions in the seed gene bank (manned by the Plant Genetic Resources Unit (PGR) of the Ministry of Agro Industry and Food Security) consisting amongst others of the following genera: *Amaranthus, Allium, Brassica, Cucurbita, Lycopersicon, Phaseolus, Solanum, Abelmoschu*s and *Vigna*.

104 accessions of vegetatively propagated crop are conserved as ex situ accessions in the field gene bank of the Plant Genetic Resources Unit. These include *Ipomea batatas, Musa spp, Manihot esculenta, Colocasia spp* amongst others.

Some wild relatives of the cultivated species of *Lycopersicon spp, Canjanus spp, Cucumis spp and Solanum spp* are conserved in the seed genebank.

Another wild species called "lentille creole" (*Vigna glabra*) is considered to be among the rare species. The seeds are stored in the Vigna collection at the, Université Agricole de Gembloux, Belgium. It is extensively used in the breeding of bean against *Fusarium* wilt. Three wild coffee species are native to Mauritius are *Coffea macrocarpa*, *C. myrtifolia* and *C. mauritiana*. The last two species are endemic to Mauritius. The content of caffeine in *C. mauritiana* is quite low. The three *Coffea* species are conserved *in situ* in the protected areas of the Natural Park and Conservation Service.

For potato, a germplasm consisting of 5 locally developed clones are being maintained.

1.3.3.3. Status of farm animal genetic resources conservation.

A summary of various breeds for different species is given below in Table 8 together with the main production systems with which they are associated.

Table 8. Breeds and Production Systems by species in Mauritius (Source: Animal Production Division of the Ministry of Agro-Industry)

Species	Breeds	Systems
Cattle	Creole	Backyard
	Friesian	Backyard, intensive
	Jersey	Backyard, intensive
	Braford	Semi-intensive beef fattening
Goats	Local	Backyard
	Boer	Commercial intensive systems
Pigs	Large White	Backyard & Commercial intensive systems
	Landrace	Backyard & Commercial intensive systems
Chicken	Commercial hybrids	Predominantly intensive systems
	Local chicken	Backyard range systems
Deer	Rusa sp	Extensive/range & Intensive/feedlot system

The Rusa deer (*Cervus timorensis russa*) has been gaining increasing importance as a source of meat. Its population increased from an estimated 45,000 in 1988 to reach 55,000 in 1990 and stabilised around 70,000 in 2013. MAIFS has imported Angus for fattening purposes.

In the pig sector, due to shortage of piglets on the market, a total of 55 breeding pigs (5 boars and 50 gilts) aged 6 weeks (~Rs15000 each) were imported by plane from Reunion Island on

18/10/2013. Breeds were of Large White (10 females and 2 males), Land Race (10 females and 2 males), Duroc (1 male and 5 females) and Mascarine, a cross of Large White, Landrace and Duroc (25 females). The above animals were quarantined at former National Federation of Young Farmers' club Belle Mare till 20/11/2013. Distribution of pig was effected on 20/11/2013. The Mauritius Pig Marketing, the Cooperative Federation (30 gilts and 3 boars) and the Federation Cooperatives des Eleveurs Porcines (20 gilts and 2 boars) earmarked the list of beneficiaries. In 2009, 3 200 were imported because of the African Swine Fever.

Aadicon Biotechnologies' has imported a stock of 97 bulls and 25 cows (Holstein and Jersey) and 30 goats (Boer) for production of semen.

Recently, the Mauritius Meat Authority has imported 57 pregnant dairy heifers of Holstein/Friesian breed and 58 goats of Boer breed and 51 sheep of Dorper breed from South Africa. These have been made available for sale as breeding stock to livestock farmers across the island.

The Creole cattle and local goats have been characterised on phenotype. A nucleus of Creole cattle and local goats is being conserved for eventual use in breeding programmes. Under the conservation of farm animal genetic resources, a new nucleus of Creole cattle has been set up at Richelieu Open Prison farm of the Prisons Department and one for local goats at Belle Mare station of FAREI. They complement the ones, which already exist at Curepipe Livestock Research Station. A total of 68 Creole cattle (22 adult cows) and 52 local goats (43 adult does) are being kept in those herds. 37 Creole cattle and 11 local goats are being monitored at Curepipe Livestock Research Station for determination of productive and reproductive parameters. Aadicon is presently using semen for Artificial Insemination along with imported semen of Friesian and Jersey breeds.

The MAIFS is putting much emphasis on milk production. In this respect, around 900 heads of dairy cattle of improved breeds (Friesian/Holstein and Jersey) were imported in 2008. With the likely increase in importation in future, it is feared that the population of Creole cattle (which is classified by as being Critically Endangered) will further decrease on-farm. Presently, a national census is being carried out to determine the population of crops and livestock in Mauritius.

The Curepipe Livestock Research Station is the only government station on the island for research on cattle (Creole, Friesian and their crosses), goats (Local, Boer, and Boer crosses), sheep (Dorper and Dorper crosses) and rabbit (New Zealand white, Californian white crosses and Black Beveren crosses).

1.3.3.4. Introduction of predators and parasitoids for pest control

In November 2013, FAREI introduced *Acerophagus papaya*, a parasitoid from India for the control of the new pest papaya mealy bug, which causes significant damage to papaya trees in backyards and orchards. The mass rearing and release of the parasitoids has started in 2014. Accidentally introduced insect pests since 2010 are described in Table 9.

Table 9. Accidentally introduced insect pests since 2010

Year of introduction	Species	Order	Family	Common name
2010	*Leptocybe invasa* Fisher & LaSalle	Hymenoptera	Eulophidae	Blue gum chalcid
2011	*Amrasca biguttula* Ishida	Hemiptera	Cicadellidae	Okra leafhopper
2013	*Paracoccus marginatus* Williams & Granara de Willink	Homoptera	Pseudococcidae	Papaya mealybug
2013	*Planococcus kenyae* Le Pelley	Homoptera	Pseudococcidae	Coffee mealybug
2013	*Phenacoccus solenopsis* Tinsley	Homoptera	Pseudococcidae	Solenopsis mealybug
2014	*Maconellicoccus hirsutus* Green	Homoptera	Pseudococcidae	Pink hibiscus mealybug (PHM)

1.3.3.5. Fodder research and development.

A database of productivity and nutritional potential of different fodder species is being established. Amongst the species evaluated, Calliandra (*Calliandra calothyrsus*) has shown promising results and its field propagation is well under way. The Calliandra was introduced as a possible substitute for acacia (*Leucaena leucocephala*) which was widely used as fodder for livestock in the past but whose usage has decreased drastically due to an infestation by psyllids.

The following species are being maintained at Curepipe LRS and Richelieu RS: Elephant grass: *Pennisetum purpureum*; Guatemala grass (*Trypsacum laxum*); Herbe d'Argent (*Ischaemu maristatum*); Kikuyu (*Pennisetum clandestinum*); Lucerne (*Medicago sativa*); Pangola (*Digitaria decumbens*); Rhodes grass (*Chloris gayana*); Setaria (*Setaria sphacelata*); Sweet potato (*Ipomea batatas*); Brachiaria (*Brachiaria brizantha and Brachiaria ruziziensis*); Fatak Malgache (*Panicum maximum*); Herbe bourrique (*Stenotaphrum dimidiatum*); Mulberry (*Morus alba*); Siratro (*Macroptilium atropurpureum*); Rufa grass (*Hyparrhenia rufa*); Sugarcane (*Saccharum officinarum*); Desmodium (*Desmodium intortum*); Gliricidia (*Gliricidia sepium*) and Fatak (*Arundo donax*).

Fodder species that have been introduced and are being evaluated are: Lucerne (*Medicago sativa*); Calliandra (*Calliandra calothyrsus*); Cratylia (*Cratylia argentea*); Sorghum (*Sorghum bicolor*); Rye grass (*Lolium perenne*); Mucuna (*Mucuna pruriens*);Desmodium (*Desmodium sp*.); Oats (*Avena sativa*) and maize (*Zea mays*).

1.3.3.6. Status for application of biotechnology is the following:

- Processing of dairy products such as yoghurts, in brewing and transformation of molasses into alcohol amongst others.
- In 1999, a pilot study on 'National Biosafety Framework' with the support of the UNEP / GEF.
- The GMO Act was partly proclaimed in 2004 to address Genetically Modified Organisms (GMO) issues, but now needs full proclamation to include operational mechanisms (Regulations & Biosafety Office).
- A project "The Implementation of the National Biosafety Framework for Mauritius" funded by UNEP / GEF and Government of Mauritius was completed (2007-2011).
- There is also an active National Biosafety Committee.
- There are six institutions that use biotechnological tools in production and implementing their research and development programme (Table 10). These are (i) Agricultural Services of MAIFS, (ii) MSIRI, (iii) FAREI, (iv) University of Mauritius (UoM), (v) Microlab and Aadicon Biotechnologies Limited (private enterprises). UoM is involved both in teaching/training and in carrying out research pertaining to biotechnology.

Table 10. List of institutions and activities involved in biotechnology

Barkly Experimental Station, (MAIFS)	Banana, Anthurium, Orchids, Gerbera, Pineapple and Strawberries (micro propagation)
Division of Veterinary Services	Disease diagnosis, Vaccines production
FAREI (Ex FARC&/AREU)	Banana, Anthurium, Gerbera,Potato and Colocasia (micro propagation and molecular characterisation) Fodder (Calliandra) Feed analysis using degradability studies
UoM	Tissue culture of orchids, asparagus, endemic plants and medicinal plants (Research)
MSIRI	Sugar cane: 1. Tissue culture (micropropagation and disease elimination); 2. Molecular breeding (genetic mapping, QTL mapping, comparative mapping, next generation sequencing, DNASeq, RNASeq, DNA fingerprinting, marker assisted-selection;

	3. Molecular diagnostics; 4. DNA barcoding for insect pests; 5. Bio-pesticides production; 6. Bio-plastic production; 7. New products from sugar; 8. Genetic transformation.
Microlab Co. (Private Enterprise)	Anthurium (micro propagation)
Aadicon Biotechnologies Limited	Production of bio-fertilisers and production of frozen semen

Tissue culture techniques are used in a number of institutions for the rapid multiplication of a wide range of plant species.

Molecular techniques, based on serological tests using monoclonal and recombinant antibodies and nucleic acid sequence based techniques are used for the diagnosis of plant and animal diseases.

The techniques are: (i) Polymerase chain reaction (PCR), (ii) Reverse transcriptase PCR (RT-PCR), (iii) Random Amplified Polymorphic DNA (RAPD), (iv) Immuno-capture PCR and (v) Real-Time PCR. These techniques are applied by the MSIRI, FAREI, Agricultural Services and UoM for disease diagnosis, epidemiological studies, clean seed production and for studying genetic variability among strains of pathogens. An elaborate programme on biotechnology had been prepared by FARC where emphasis had been placed on problems facing modern agricultural practices.

In the Veterinary Section of the MAIFS, vaccines against 'Newcastle' disease and fowl pox are prepared using imported seed vaccines in the laboratory.

The Food Technology Laboratory of the MAIFS is also building its capacity in terms of equipment and training of staff to detect and assess GMOs.

- Research on antioxidants and secondary metabolites from medicinal plants is undertaken at the UoM.
- For safeguarding endangered species, *in vitro* tissue culture including embryo culture is also being used. Five tree wood species are being assessed for propagation and three indigenous orchids were micro propagated for the Forestry Services and have been returned to NPCS.
- Trials on embryo culture for the unique palm *Hyophorbe amaricaulis* were successful and 3 plantlets were obtained in vitro but did not survive the acclimatisation phase.

1.3.4. Sustainable farming practices

1.3.4.1. Organic products.

Several studies have been undertaken at the Faculty of Agriculture, University of Mauritius (UOM) to determine the potential market for organic foods, and results have shown that airlines, hotels, supermarkets, private clinics, health shops, as well as a significant number of the general public interviewed expressed their eagerness to buy organic produce cultivated in Mauritius, even at slightly higher prices. Research on organic practices as well as for Sustainable Agriculture have been conducted at the Faculty of Agriculture (UOM), which has demonstrated the success of a number of techniques for soil health and fertility management, and for integrated pest management, using non-chemical methods and natural plant-based chemicals that are permitted in organic production. Innovative approaches using natural compounds of marine origin are also being investigated. The effect of these methods on agro-biodiversity, such as beneficial organisms released for biological control, has also been studied.

There is no legal framework to support organic production, and the cost of certification from accredited organic certifier from neighbouring countries is high. The interest for shifting from conventional farming to organic is limited to a few farmers given the limited incentives, absence of standards, limited technical support and organic inputs. The demand for organic products is

increasing but very limited local organic production to meet the demand. Le Vélo Vert (NGO) involved in organic products, will carry out a street study on Mauritian population perception of organic food in December 2014 in collaboration with the Wageningen University in Netherlands. With respect to pest control, FAREI has tested a recommended a range of bio-pesticides (natural or microorganism based pesticides) and has also introduced, multiply and release parasitoids or predators for biological control of pest of economic importance (FAREI, AREU, MAIFS).

In Rodrigues, organic farming is encouraged but faces a number of issues such as droughts, fruit bats, pests, stray animals, erosion associated with issues of cost and availability of products and market, water for irrigation, capacities (training), number of staff and population mind-sets.

1.3.4.2. Bio-fertilisers and organic soil conditioner.

In 2013, the MAIFS has launched a compost purchase scheme to promote use of compost as a partial substitute to mineral fertilizers for small-scale planters (<10 ha). A range of imported bio-fertilisers comprising of beneficial living microorganism with the capacity to fix atmospheric nitrogen, mobilise K or soublise P are also marketed locally. There is a positive trend in the use of bio-fertilisers but there is a legal vacuum.

Economic growth, export oriented policies and freight rebate scheme have encourage the conversion of sugar cane land to pineapple production, whereby the plastic mulch used are burned, due to absence of a recycling facilities on the island. This technique has an impact on soil fauna and agro-system biodiversity (killing frogs, pollinators).

The Faculty of Agriculture (UOM) has conducted a large number of studies on the use of green manures, bio-fertilisers and various soil amendments and conditioners for enhancing soil health and fertility and reducing use of synthetic fertilisers.

Currently, the Mauritius Research Council (MRC) is liaising with a number of institutions to fine-tune the transformation of local seaweeds into plant growth promoter/bio-fertiliser products in Mauritius and Rodrigues. Furthermore two seaweeds of high potential for plant growth promoter manufacture have been identified. Four experimental seaweed farms have been set up in Mauritius and Rodrigues since November 2011. It is anticipated that this new industry will alleviate the problems of increasing fertiliser prices and the high costs of pig feed that agricultural community is facing[4].

1.3.4.3. Rainwater harvesting.

Since 2013, the MAIFS has launched a new Rainwater harvesting scheme - to encourage planters and livestock breeders in sustainable use to capture and store rainwater - grant up to 40 % cost of project up to a maximum of Rs 80,000. Up to March 2014, out of 28 applicants 13 farmers have benefited from this scheme. Farmers growing crops on river reserve are recommended not to use chemical fertilisers and pesticides. Farmers require an abstraction permit to extract freshwater from river and streams for irrigation, but this is not well enforced.

Rodrigues rainwater structures are managed by the agricultural services and are a common good. A financial support programme for rainwater harvesting targeting low-income population and sensitisation programmes sustains this action.

1.3.4.4. Bats and fruit production.

FAREI undertook survey in fruit orchard and backyard to estimate fruit damage due to bats (Table 11). Pruning of fruit trees to manage trees height in orchards and the use of bird nets are

[4] http://www.mrc.org.mu/in-house_projects/_development_of_seaweed_farming_and_processing_industry

recommended for control of fruit damage by bats. Since 2009, the MAIFS put up a Fruit Protection Scheme for purchase of bird net for reduction of fruit loss due to bat damage. From 2009 up to December 2013, 1,987 planters have benefited from the scheme and around Rs 16M disbursed. Significant increase in number of fruit farmers and household benefiting from the Fruit Protection Scheme for purchase of bird net from 173 beneficiaries in 2009 to 852 in 2013.

Table 11. Fruit damage by bats (Source: Entomology Division, FAREI)

Year	Litchi[5]	Mango
2009	5-42 %	35 %
2010	4-23 %	27-31 %
2011	31-81 %	22-35 %
2012	5-78 %	15-25 %
2013	5-53 %	24-32 %

For Mauritius, the major threats in the agricultural biodiversity are considered to be the loss of PGR and biodiversity as a result of:

- Increase in use of agrochemicals under intensive production systems and increase in adoption of improved hybrid crop varieties.
- Traditional knowledge and varieties are rapidly fading out.
- Land development that threatened perennial species such as mango, whose diversity is unique.
- Climate Change impacts such as drought, temperature rise and high intensity rainfall leading to flash flood affecting crop productivity and farmers livelihood.
- Release of field station lands to private individuals may jeopardise PGR activities (selection exercises, regeneration, multiplication, characterisation of accessions, rescue of important germplasm, undue crossing). The key stations contain valuable species and varieties and their release for other development, may lead to the extinction of these valuable germplasm.
- Bio-energy new trends but risk of IAS importation for this activity.

For Rodrigues, the major threat is considered to be the loss of agro-biodiversity as a result of the lack of water, pest and diseases, genetic erosion of varieties and breeds, over-population of bats.

[5] Most of the trees in the litchi orchard are pruned and managed and partly covered with birdnet

1.4. Inland Freshwater, Coastal and Marine Biodiversity

1.4.1. Inland freshwater biodiversity

1.4.1.1. Rivers biodiversity

The island of Mauritius is divided into 25 major river basins and 21 minor ones with catchment areas varying from 3.9 to 173 km2. Almost all major rivers are perennial with most of the streams having their sources in the central plateau. Flows in streams and rivers vary from a few litres per second to more than 500 m3/s during floods.

The freshwater biodiversity of Mauritius is contained within 92 rivers and 232 rivulets, several manmade reservoirs, natural lakes and marshy areas. The island of Rodrigues has been divided into 20 major river basins and 10 minor ones, which have been for the most part that has dried up.

The latest inventory of fishes and macro-crustaceous was carried out in 2003 by the Association Réunionnaise de Développement de l'Aquaculture (ARDA). Following this survey, 18 species of fish and 10 crustacean species were recorded in the main rivers of Mauritius. Three endemic crustacean species were also inventoried: *Cardina mauritii, Cardina spathulorostris* and *Cardina richtersi* (petite chevrette). However, most of those species are few in number.

Many of the watercourses in Mauritius become overgrown with invasive plant species. The Mauritian Wildlife Foundation also conducted a survey on existing vegetation along riverbanks and riversides (January-February 2004). It was found that watercourses and riversides have become degraded by invasive alien species, which have infested about 95 % of riverbanks. Freshwater resources are threatened by dumping of solid wastes in rivers, heavy use of agrochemicals in nearby agricultural fields, sewage disposal, and backfilling of coastal wetlands (in Grand Baie alone, there has been a 23 % reduction in wetlands since the year 2000, Republic of Mauritius 2011a). Climate change is expected to further exacerbate the situation due to decreasing rainfall and rising temperatures (MID, 2011).

1.4.1.2. Wetlands biodiversity

There are 203 coastal wetlands in Mauritius and Rodrigues (Technical Report on Freshwater Wetlands, 2010; ESA, 2009; Figure 5). Wetlands are classified as (a) Natural Wetlands such as Coastal Marshland including tidal mudflats located along the coastline, Freshwater Marshland (inland) and Marine Wetlands; (b) Manmade Wetland such as Reservoirs and Dams.

Natural freshwater wetlands form an integral component of biodiversity and provide many ecosystem services that benefit both people and wildlife such as shelter for a wide diversity of flora and fauna species; water storage, flood control, sediment and nutrient retention, carbon sink, shoreline stabilization; and aesthetic and educational values.

Biodiversity is generally higher in larger, unfragmented wetlands and lower in wetlands with degraded margins. Urban wetlands are smaller and more likely to be fragmented than those adjoining other land uses such as grazing and agriculture. On going wetland decline in Mauritius not only contributes to the loss of local biodiversity but reduces the larger ecosystem role these habitats play in regulating surface water and protecting adjacent marine habitats (Laurance et al., 2012). In Rodrigues, although the mangrove planting programme undertaken since

the mid-80' has met with variable success in the different sites (Perry & Berkeley, 2009), the general trends show an increase in mangrove.

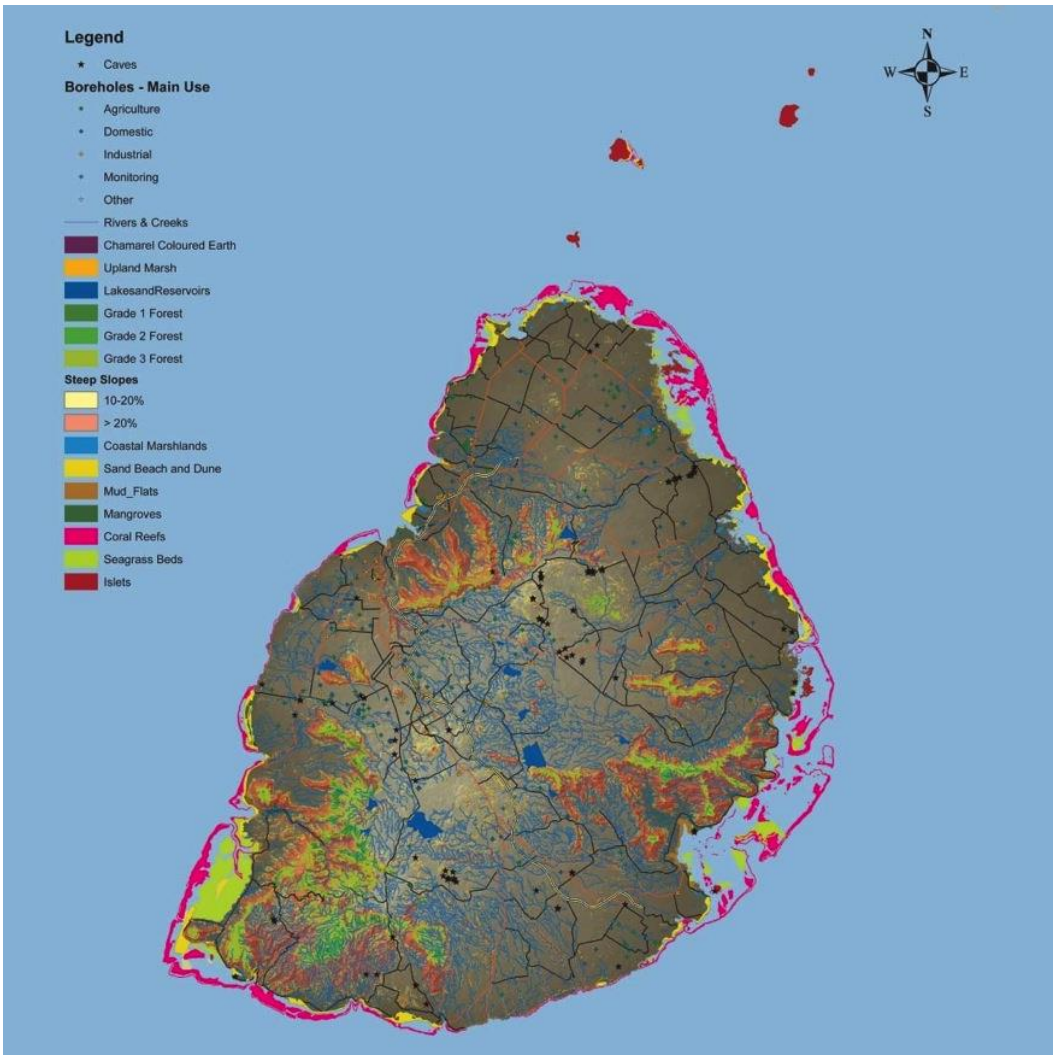
Mauritius has designated its third Wetland of International Importance, the Pointe d'Esny Wetland (22 hectares, 20°25'36"S 057°43'11"E) in the south-eastern district of Grand Port in 2011 (Blue Bay Marine Park (2008), Rivulet Terre Rouge Estuary Bird Sanctuary (RTREBS, 2001)). Rare species such as *Sesuvium ayresii* are protected and conserved in RTREBS. The most common migratory birds observed in RTREBS are the common sandpiper, and common tern (NPCS, 2013).

Since 2012, studies on reservoirs (manmade wetlands) and rivers micro algae are carried out for water quality. 40 to 50 species have been identified. Results of the studies will be available in 2015 (MEPU).

The main pressures on lakes and reservoirs are attached to long-term changes to precipitation patterns in response to climate change and increased use of freshwater resources and site facilities by an expanding resident and tourist population.

Freshwater biodiversity responsibility is fragmented among various stakeholders. Fresh water wetlands biodiversity is under NPCS responsibility, while rivers biodiversity has been identified as a gap. CWA, WRU, MESDDBM, MEPU, MHL are involved with regard to freshwater quality in Mauritius. Regular analyses are carried out by these institutions to assess the quality of groundwater (from boreholes), surface water (from rivers) and treated effluents (discharged from the treatment plants). Water quality tests generally show compliance to satisfactory level.

Figure 5. Demarcation and inventory of wetlands in Mauritius (ESA, 2009)



Lakes and Reservoirs provide water storage, which underpins freshwater supplies to the country. These stores contribute to meeting present and future freshwater needs attached to human consumption (domestic and tourism-related), industrial (mainly textile) and agriculture, mainly as irrigation. Hydropower - four of the eleven reservoirs are utilised in generating electricity.

The position of volcanic lakes at the top of the watershed has left them less exposed to the long history of natural habitat conversion, which has affected most of the lowland areas. Consequently, significant remnants of native forest and endemic plant and animal populations can be found adjacent to these features.

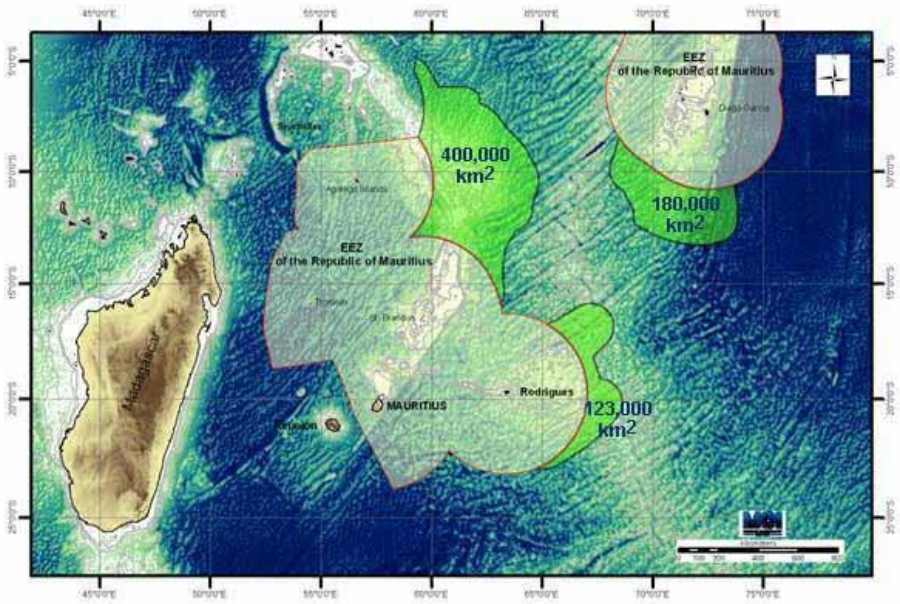
Additional values are delivered via recreational opportunities, such as fishing, hiking and cycling. Grand Bassin represents one of the most significant cultural landmarks in Mauritius, yielding significant value to Mauritians. It is also becoming of increasing tourist importance. Artificial lakes and reservoirs can also provide habitat benefits, particularly to migratory waterfowl.

Source: ESA, 2009

1.4.2. Coastal and marine biodiversity

Mauritius EEZ (figure 6) covers over 2.3 million km^2 (including 400 000 km^2 which is co-managed with the Seychelles) of which 99 % is still unexplored and under researched (MOEMRFSOI). Its ocean territory extends from the coast of Mauritius, Rodrigues, St Brandon (Cargados Carajos Shoals), Agalega, Tromelin and Chagos Archipelago (Republic of Mauritius, 2013a). The Mauritius National Marine Ecosystem Diagnostic Analysis (ASCLME, 2012a) is the latest comprehensive study that has been undertaken and is the main source of information for the coastal and marine biodiversity. It was undertaken as a collaborative effort among various Mauritian institutions (Mauritius Oceanography Institute, Mauritius Meteorological Services, Ministry of Fisheries).

Figure 6. Republic of Mauritius and its EEZ (source: Republic of Mauritius, 2011b)



1.4.2.1. Coastal biodiversity.

Mainland Mauritius has a coastline of 322 km and is surrounded by 150 km of protective coral reefs, covering a lagoon area of around 243 km^2. The coastal zone[6] consists of sandy beaches, coastal dunes, rocky shores, near shore wetlands and mangroves, lagoon corals, fringing coral reefs and all their associated marine life. All these marine ecosystem components are interconnected. The main critical ecosystems include mangroves, seagrass beds and coral reefs.

Mangrove wetlands provide a natural buffer controlling surface water runoff to the lagoon by neutralizing pollutants, nutrients and sediments, which might damage the lagoon ecosystem. Mangroves also provide a habitat for juvenile fish and invertebrates and the fringing coral reef protects the coastline from the waves coming from the open ocean (ASCLME, 2012a). Two species of mangrove, *Rhizophora mucronata* and *Bruguiera gymnorhiza* grow around Mauritius.

Wetland biodiversity is on average higher in the open water *Acrostichum* - dominated wetlands and vegetated wetlands dominated with *Typha* and *Acrostichum* than the open water and vegetated wetlands that supported grass communities (ASCLME, 2012a). Watersheds and wetlands are amongst Environmentally Sensitive Areas (Figure 6; ESAs, 2009; Appendix 2).

Wetlands areas are decreasing and degrading. Backfilling of wetlands for construction is affecting 90 % of all wetlands and resulting in a reduction of biological habitats (Republic of Mauritius 2011a). A comparison of wetland area in Grand Baie over time revealed an estimated 23% decrease from 2000 to 2008 due to backfilling and increased urbanisation. Flooding in Grand Baie and Flic en Flac has been exacerbated by backfilling of wetlands (Republic of Mauritius 2011a; MESDDBM, 2010).

The main pressure on the mangrove plants around Mauritius is coastal development.

Rodrigues has a coral reef platform that forms an almost continuous rim, 90 km long and from 50 to 10,000 metres wide which encloses a lagoon of 240 km^2. Mangroves in Rodrigues are thriving well and not under any specific pressure (ESA, 2009). Wetlands are very sensitive to interference by human activities like general building and settlement developments, irrigation projects, agricultural land conversion, reclamation projects, river and spring diversions or ground water extraction.

The algal flora is rich with over 160 genera of marine algae have been identify in coastal water (ASCLME, 2012a). Over 36 species of seaweeds have been identified in Mauritian waters, including *Enteromorpha*, Ulva, *Sargassum*, *Caulerpa* spp., *Padina* and *Halimeda*. Macrofauna consists of 10 major faunal groups consisting of polychaetes 52 %, pelecypods 13.8 %, isopods 12.3 %, ophiuroids 5.8 %, tanaidaceans 5.2 %, amphipods 4.9 %, gatropods 2.3 %, branchiopods 1.5 %, echiurid worms 1.2 %, and sipunculids 0.7 %. Polychaetes are the most important macrobenthic group with 100 % prevalence, followed by peracarid crustaceans and mollusks. Among crustaceans, the isopods are more frequent than either amphipods or tanaidaceans.

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[6] The Environment Protection Act of 2002 (Republic of Mauritius, 2007), which replaced the 1991 act, defined coastal zones as follows: "coastal zone"

(a) means any area which is situated within 1 kilometre or such other distance as may be prescribed from the high water mark, extending either side into the sea or inland;

(b) includes -

(i) coral reefs, reef lagoons, beaches, wetlands, hinterlands and all islets within the territorial waters of Mauritius and Rodrigues;

(ii) any estuary or mouth of a river and that part of a river, stream or canal which lies within 1 kilometre from the outermost point of its bank on the sea at high tide;

(iii) the islands of Agalega and Saint Brandon, and other outer islets.

Rodrigues has 493 fish species, 175 gastropod species, 104 species of algae, 109 bivalve species, 138 coral species, 74 species of echinoderms and 41 bryozoan species. For many of the taxa considered, Rodrigues appears to be less diverse with the notable absence of certain species common elsewhere in the area.

The MRC has invested substantially in researching avenues for seaweed farming and the development of seaweed derived products both in Mauritius and in Rodrigues. The scientific and marketing research conducted in the prefeasibility phase have both proved to be quite successful and shown that local seaweed resources can be used for a wide range of applications including human consumption, cosmetics, medical and pharmaceutical uses, plant growth promoter/bio-fertiliser, and animal feed formulation.

In Mauritius the main pressures on the seagrass beds, which tend to retreat, come from the tourism development in regions where large meadows exists whereby areas under seagrass are being cleaned so as to provide a more appealing lagoon to the tourists. Overfishing, scenic fishing and other human disturbances are also affecting the seagrass beds. Seagrasses in Rodrigues are not being impacted directly but overfishing of fish and other organisms living in the meadows are indirectly impacting on the seagrass. In Rodrigues the major threat to seagrass meadows are eutrophication of nearshore habitats due to domestic and agricultural runoff and throughflow of nutrients from coastal areas, input of terrigenous sediment by erosion and overfishing in the lagoon.

Seagrass beds are rated the 3rd most valuable ecosystem globally (on a per hectare basis), only preceded by estuaries and wetlands. The habitat complexity within seagrass meadows enhances the diversity and abundance of animals. Seagrasses on reef flats and near estuaries are also nutrient sinks, buffering or filtering nutrient and chemical inputs to the marine environment. They also stabilise coastal sediments and act as a potentially important carbon sink as organic matter created by seagrass decay and discharged by rivers and creeks is trapped within the sediments. Seagrass meadows provide food and shelter for many organisms, and are a nursery ground for commercially important prawn and fish species. The high primary production rates of seagrasses are closely linked to the high production rates of associated fisheries. These plants support numerous herbivore- and detritivore- based food chains and are considered very productive pastures of the sea. The associated economic values of seagrass meadows are very large, although not always easy to quantify.

Source: ESA study, 2009

1.4.2.2. Coral reefs.

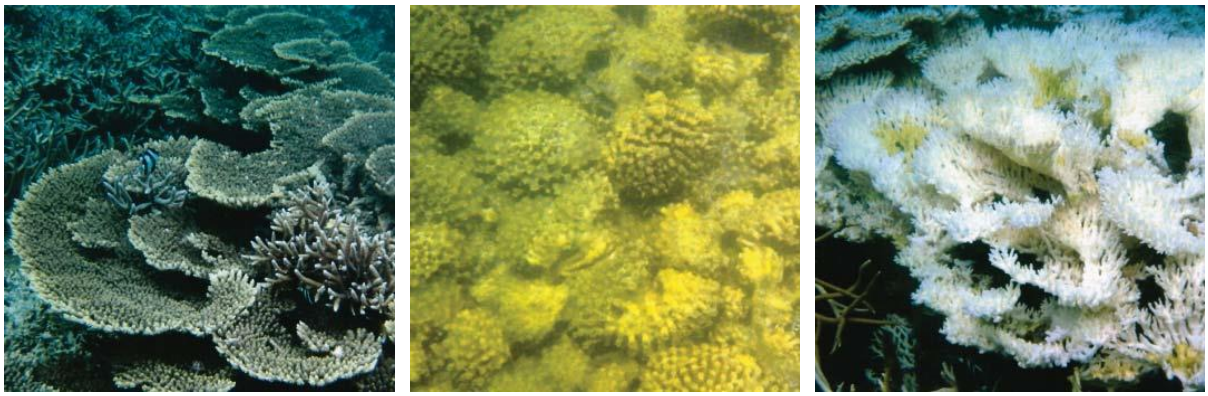
There are five types of reef around Mauritius: fringing reefs, patch reefs, atolls, reef flats and barrier reefs. Fringing reefs occur in shallow waters near to land, extending to depths of 15 - 45 meters. The fringing coral reefs encircle Mauritius and protect it from the sea. Patch reefs are found in relatively shallow waters around Mauritius where the underlying seabed has been close enough to the surface for corals to grow. Atolls start as fringing reefs around volcanic islands, forming atolls as the island gradually submerges. The Mauritian offshore islands of the St. Brandon archipelago include a group of 22 atolls. Reef flats are formed as the fringing reef pushes steadily seaward leaving behind limestone areas that are eroded almost flat by the sea. Reef flats do not occur around the island of Mauritius but are significant around Rodrigues. Barrier reefs are usually found far from the main shoreline and are separated from the shore by broad and deep waters. These occur in the south east of the island.

A total of 159 species of scleractinian corals (hard corals; Moothien Pillay et al, 2002), 1,656 species and 290 families of marine species have so far been recorded from the waters of Mauritius.

The coral reef habitats around Mauritius and Rodrigues are being degraded. In Mauritius, coastal development, sedimentation, marine pollution, anchor damage and pollution from inland activities are the main drivers of this degradation. In Rodrigues overfishing, bad fishing practices (anchoring, use of driving poles, breaking corals to scare fish into nets, wading on reefs to look for

invertabrates) climate change and, terrigenous sediment input are the major threats. The main natural and main induced threats to coral reefs are tropical cyclones, climate change and predators such as the Crown of thorn starfish and drupella snails. For the past few decades, there has been an increase in both extent and severity of bleaching (Figure 7) around the island due to warm-water anomalies, which has led to the degradation of the Mauritian reef (Moothien Pillay et al., 2002 and 2012; McClanahan et al., 2005). Reefs of the Mauritius lagoon have lost more than 50 % - 60 % of their coral cover (McClanahan et al., 2005, Moothien Pillay et al., 2012). Anchors and use of nets are also responsible for localised damage to corals. Reduction in coral reef habitats is posing a serious threat to biological diversity. Safeguarding the reefs is therefore a priority.

Figure 7. Coral stages (source: Republic of Mauritius 2011a (MEO))



Healthy Coral Reef *After an algal bloom (dead corals)* *Totally bleached corals*

Courtesy: Ministry of Fisheries and Rodrigues, Fisheries Division

In response to the on-going reef degradation in Mauritius, the Mauritius Oceanography Institute implemented a pilot coral farming project in 2008 for culturing corals under controlled conditions in land based nurseries. Culture techniques were developed for the *ex-situ* propagation of various coral species including fast-growing species, bleaching resistant species/strains and threatened species for conservation initiatives and rehabilitation of degraded lagoons of Mauritius.

In parallel scientific monitoring of the marine environment was undertaken for the identification of resilient coral species and of appropriate sites to implement small-scale reef rehabilitation. Reef rehabilitation is essential to enhance its ecosystem functions such as increased habitat for increased fish and coral recruitment. Hence, for *t*he past six years, fifteen permanent coral reef monitoring stations and an *in-situ* temperature network were established in-shore and off-shore at different sites around the island (Figure 8).

Figure 8. Location where permanent stations have been deployed by the MOI (GRSE: Grand River South-East and TAB: Trou aux Biches) (Source: Google Earth®, 2010)

As from 2011, a small-scale reef rehabilitation project was implemented by the MOI. Locally adapted multi-layered rope nurseries were set up at Albion, Flic en Flac and eventually at Trou aux Biches in 2013 in collaboration with the NGO, ELI-Africa (Table 12) for *in-situ* mass propagation of eighteen selected coral species (including fast-growing and bleaching resistant species/strains) prior to transplantation to either locally-adapted artificial reef rehabilitation modules or on natural substrates. Coral fragments were grown in rope nurseries for a period varying from eight to twelve months before their eventual transplantation to selected recipient reef sites. To date, nursery-grown coral colonies from the nurseries have been used to rehabilitate small degraded areas of 350 m^2, 300 m^2 and 150 m^2 at Albion, Flic en Flac and Trou aux Biches respectively (Table 12).

Table 12. Small scale reef rehabilitation in Mauritius

Sites	Project Timeframe	Approx. no of coral fragments cultured	No. of locally adapted rope nursery units deployed	Approx. area rehabilitated (m^2)
Albion	2012-2014	8000	25 (experimental)	350
Flic en Flac	2012-2014	6500	6	300
Trou aux Biches	2013-2014	3000	4	150

The Ministry of Fisheries has also been undertaking reef rehabilitation at selected degraded reef sites since 2008. Coral fragments are fixed to coral farming tables which provide at the same time shelter to fish and other marine organisms, acting hence as a self-sustaining marine system. Under the Africa Climate Change Adaptation Programme, the Ministry also acquired a funding of MUR 1.2 million and carried out coral farming at five sites in Mauritius and Rodrigues in 2012.

The second way to rehabilitate coral reefs is via direct restoration of damaged coral habitats, by attaching coral nubbins directly to the substrate using either with nails and cable ties for attachment to limestone pavements, or cable ties for attachment to recently deceased coral colonies. Nubbins are collected from areas suffering severe fragmentation as a result of fisheries related damage to reefs. These two techniques have successfully been applied in Rodrigues within the Anse Aux

Anglais Marine Reserve and at other northern and eastern lagoon sites. Success rates are above generally above 70%

The major threats to coastal biodiversity are coastal erosion, which accounts for 45-50 % of the erosion in Mauritius (ICZM, MOSD); natural hazards (storms, cyclones, tidal surges), climate change (increase in sea temperature), overfishing Coastal erosion is a crucial issue and contributes substantially to shoreline changes and to exacerbating poverty in coastal zones.

Mauritius has an extremely rich coastal zone consisting of near shore wetlands and mangroves, lagoon coral, fringing coral reef and all their associated marine life. Mauritius being a small island state depends largely on this coastal ecosystem for its tourism industry. Most of the hotels are coastal based. Moreover, the fishermen population residing in the coastal area get their daily livelihood from fishing activities. The good health of this coastal ecosystem is also very important as it provides leisure activities to the population and tourists who visit the country.

All these marine ecosystem components are interrelated: wetlands provide a natural buffer, controlling surface water run off to the lagoon by neutralising pollutants, nutrients and sediments which might damage the lagoon ecosystem; mangroves provide a habitat for juvenile fish; invertebrates; and the fringing coral reef protects the coastline of Mauritius from the waves coming from the open ocean and is pivotal to the ecology of tropical oceans.

Coral reefs have more than simply existence value, and are important not only for the diverse life they and their affiliated ecosystems support, but to the human population as well. Reef-associated plants and animals provide people with a number of valuable products, such as: seafood, new medicines, other economic goods, live fish and corals used in aquariums; recreational value; coastal protection.

Source: ASCLME, 2012a

1.4.2.3. Marine biodiversity (ASCLME, 2012a)

The distribution of benthic fauna in waters around Mauritius has not been extensively studied. However, several species of crabs, shrimps, lobsters, molluscs, octopus and sea cucumbers are abundant (decline observed in Rodrigues) and are of commercial value. Four species of crabs and five species of Penaeid shrimps as well as two species of deepwater shrimps have been identified in Mauritius and are currently being fished. Two species of lobsters are fished around Mauritius and St. Brandon. Other marine invertebrates comprise polychaetes (52 %), bivalves (13.7 %) and isopods (12.3 %). Among other groups, amphipods are important. Among crustaceans, the isopods are more frequent than either amphipods or tanaidaceans.

Out of 340 species of fish, which have been identified in the waters of Mauritius, 42 are of economic importance within the inshore area, with a different composition and relative abundance in the near shore waters of each island within the Republic. The effect of over-fishing of *Lethrinids* is apparent on the fringing reefs of Mauritius with a population explosion of sea urchins *Diadema* sp. and *Echinometra* spp. A recent DNA based assessment of commercial fish diversity of Mauritius by the MOI has shown the number of commercial fish species to be 149, out of which 42 are new records to Mauritius and 3 may be potentially new species.

Fishery resources have been traditionally exploited in lagoons and offshore areas around Mauritius, Rodrigues, St. Brandon, Chagos Archipelago and other outer islands. There are four main types of fisheries in Mauritius namely; (i) artisanal fishery; (ii) sport fishery; (iii) banks fishery, and (iv) tuna fisheries. Artisanal fishing provides employment and livelihood to some 2,200 fishermen and their families. Main families of fish that are caught are Lethrinids, Siganids, mullets, Scarids and groupers. Reef and demersal fish stocks are over-exploited and no substantial increase in fish

production in these areas is expected in future. The total catch of this fishery is estimated at 400 tonnes per year, consisting mainly of bill-fishes and tunas. The banks fishery consisting of mainly Lethrinids (90 %) catches around 3,000 tonnes annually. The tuna fishery is split into the Fish Aggregation Devices (FADs) and the offshore industrial tuna fishery. Tuna and tuna-like species are caught by local fishermen off-lagoon and around FADs. The total landings from FADs and sport fishermen are estimated at around 650 tonnes annually. Species caught are big eye tuna, skipjack, yellow fin tuna, dorado, wahoo and sharks. Industrial tuna fishing is carried out mainly by long-liners and purse-seiners mostly licensed foreign fishing vessels that catch about 10,000 tonnes yearly in the EEZ of Mauritius. The species caught are mainly the skipjack tuna and yellow fin tunas. Other fisheries resources include the deep-water shrimp with an estimated Mean Sustainable Yield (MSY) of 200 tonnes. Total fish catch has declined from 19,690 tonnes in 1993 to 5,270 tonnes in 2011. Figure 9 and Table 13 illustrate some of these results. The potential for aquaculture is estimated to be 29,000 tonnes of fish in the medium term and about 39,000 tonnes of fish in the long term, on annual basis.

Figure 9. Proportion of fish catch (Artisanal and Bank) over the maximum allowable threshold, 1990, 2000, 2010 & 2012 (source: Mauritius Statistic; Republic of Mauritius, 2013b)

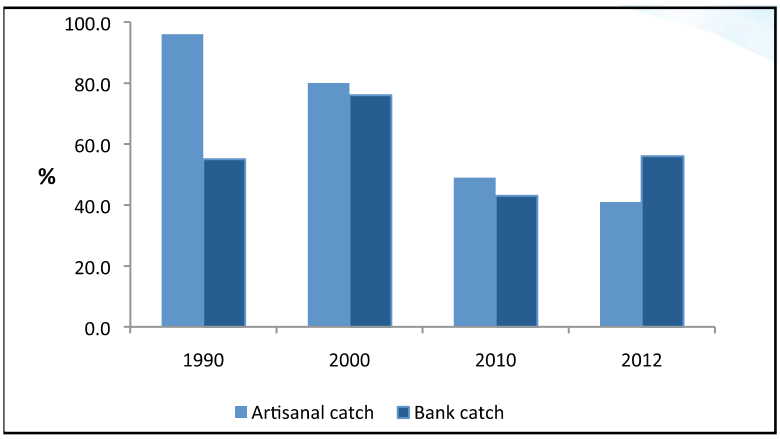


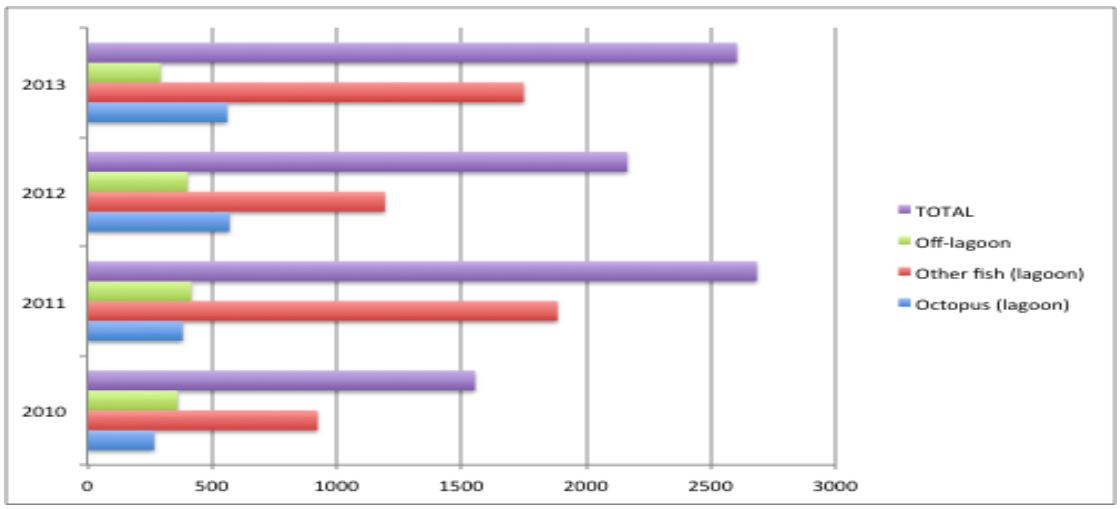
Table 13. Production of fish (in wet weight equivalent, tonnes) - Island of Mauritius, 2004 – 2013 (Digest of environmental statistics 2013, Statistics Mauritius)

	2004	2005	2006	2007	2008	2009	2010	2011	2012 [1]	2013 [2]
High seas [3]	**7,000**	**6,711**	**6,259**	**4,060**	**3,614**	**4,115**	**3,214**	**2,663**	**2,383**	**3,625**
Local vessels	7,000	6,711	6,259	4,060	3,614	4,115	3,214	2,663	2,383	3,625
Coastal Fishing	**1,993**	**1,897**	**2,114**	**1,754**	**1,808**	**2,161**	**2,112**	**2,100**	**1,888**	**1,749**
Lagoon and off lagoon	1,043	947	1,164	804	858	1,211	1,162	1,150	938	799
Sport fishing	650	650	650	650	650	650	650	650	650	650
Amateur fishing	300	300	300	300	300	300	300	300	300	300
Ponds and Barachois	**437**	**374**	**472**	**563**	**238**	**430**	**561**	**520**	**509**	**421**
Total production	**9,430**	**8,982**	**8,845**	**6,377**	**5,660**	**6,706**	**5,887**	**5,283**	**4,780**	**5,795**

[1] Revised
[2] Provisional
[3] includes fish caught for the canning industry
Source: Ministry of Fisheries

For Rodrigues (Figure 10), the total fish catch increased between 2010 and 2013 up to 68 % of which fish caught in the lagoon made up to 94 % while off-lagoon fishing decreased by 19 %. The increase in total fish catch over the last four years may be attributable, in part, to overfishing in the lagoon and to a significant increase in octopus population as well as their increase in size and weight since 2012. These trends are related to the development of the Marine Reserves in Rodrigues originally identified by the fisher communities and the implementation of regulations[7] on seasonal octopus closure. Parallel to these developments, a sensitisation campaign was launched across the island associated with the development of alternative activities during the closure period to ensure proper understanding of the motivations that led to this management decision (IOC, 2012; Shoals Rodrigues, RRA).

Figure 10. Fish caught (metric tonnes) in and off lagoon from 2010 to 2013 (Statistics Mauritius, Fisheries department, Rodrigues)



1.4.2.4. Species

Marine mammals found in Mauritius EEZ include dolphins, whales, seals, sea lions and dugongs. Mammals are distributed between residency, migratory and occasional species. Dugongs, once common in the lagoons of Mauritius are extinct due to intense hunting pressure and predation. Seventeen marine mammal species have been recorded in Mauritian waters, mostly as they migrate to and from Antarctica to warm tropical waters for calving. Dolphins are encountered more frequently than whales, although the breeding and nursery grounds of the dolphins have not yet been located. Whale watching is becoming a very popular tourist attraction in Mauritius. The marine mammals are protected species under the Fisheries and Marine Resources Act (Action plan for stranded mammals coordinated by the MOEMRFSOI).

There are two species of marine turtles in Mauritius, which are commonly encountered in shallow coastal waters. These are the hawksbill Eretmochelys imbricate and the green *Chelonia mydas*. The population trends on both the species are not known but they are believed to be declining. The nesting beaches for green and hawksbill turtles are found around St. Brandon, Agalega and the Mascarene. The peak nesting period is in summer. The foraging and feeding areas take place in

[7] Rodrigues Regional Assembly (Octopus Closed Season) Regulations 2012. Regulations made by the Rodrigues Regional Assembly under Sections 26(1), 31, and item (16) of the Fourth Schedule of the Rodrigues Regional Assembly Act 2001.

seagrass beds and coral reefs around Mauritius, Agalega and St Brandon. The sea turtles are migratory species foraging in one area and nesting in another. The hawksbill has traditionally been exploited for meat, its shell and eggs and the green turtle is exploited for meat, eggs, fat and leather. The marine turtles are protected species under the Fisheries and Marine Resources Act.

Information on seabirds and shoreline birds of Mauritius is very limited. The Rivulet Terre Rouge Bird Sanctuary located in the Northeast of the islands, near the Port Louis Harbour is a tidal mudflat that is used as wintering areas by migrating shorebirds. Around 100 - 1000 migratory birds visit this site each year representing 11 regular species and 4 - 5 vagrant species (Bird survey count 1997, NPCS unpublished). The islets of Mauritius, namely Flat Island, Gunners Quoin and Round Island are bird sites and several species of birds have been identified in these islands. Work is on-going under NPCS and MWF in these islets for Round Island Petrel, Bulwer's Petrel, Wedge-tailed shearwater, red-tailed Tropicbird, and White-tailed Tropicbird.

In Rodrigues, sea birds are regularly monitored by the MWF staff on the Ile aux Cocos and Ile aux Sables reserves. Species monitored are the Lesser Noddy (*Anous tenuirostris)*, Lesser Noddy (*Anous stolidus*), Fairy Tern (*Gygis alba*), Sooty Tern (*Sterna fuscata*) and Roseate Tern (*Sterna dougalli*).

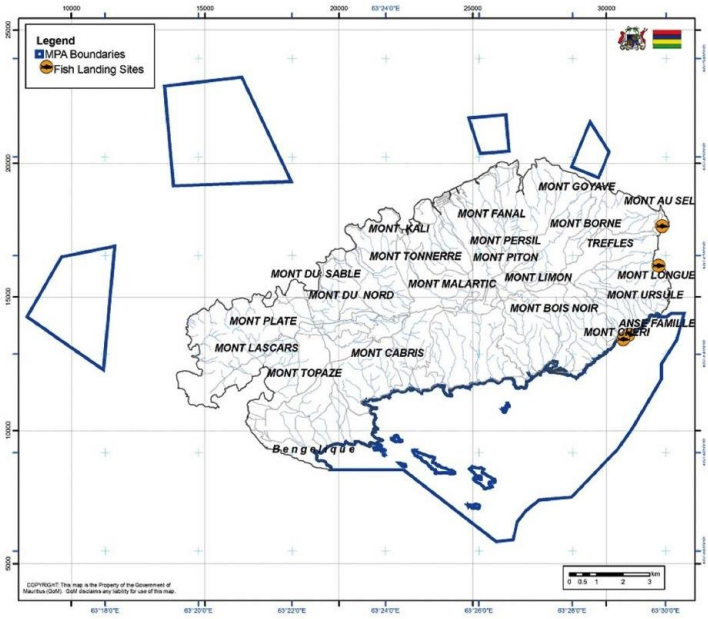
1.4.2.5. Marine Protected Areas.

To conserve marine biodiversity, a system of Marine Protected Areas comprising fishing reserves, marine parks and marine reserves, has been established in the waters around Mauritius and Rodrigues. The Republic of Mauritius has, so far, proclaimed 6 Fishing Reserves and 2 Marine Parks namely Balaclava (485 ha) and Blue Bay (353 ha) as well as 5 Fisheries Reserved Areas (MOEMRFSOI, MID, 2013), 4 Marine Reserves (Rivière Banane, Anse aux Anglais, Grand Bassin, Passe Demie) and a multiple-use Marine Protected Area in the south east of Rodrigues (SEMPA).

The Blue Bay Marine Park is known for its diverse and rich fauna and flora especially the corals, mainly for a brain coral of diameter 6 - 7 metres. 108 species (33 genus) of coral, 233 fish species, and 201 species of molluscs were inventoried in 2012. A Blue Bay Marine Park visitor centre will be launched (MOEMRFSOI), another centre in Balaclava Marine Park will be developed in 2015.

In Rodrigues, the South East Marine Protected Area (SEMPA), gazetted in 2009, is implemented in the Southern part of Rodrigues lagoon. It covers a sea surface area of about 43 km^2 stretches from the shoreline to the 20m isobath. It is composed of a variety of habitats including off-lagoon waters, reef slopes, reef flats, channel reefs, back reef areas and seagrass beds. The SEMPA zoning has been successfully (Castro-de-la-Mata, 2012) and is properly maintained. Its area has been sub-divided into several multiple use zones and key planning documents have been drafted for successful management including several studies and the development of SEMPA's Management Plan. The latter however has not yet been implemented. SEMPA was designed to be a showcase of participatory MPA management. Important global benefits were generated through the creation of SEMPA and its strengthened management through participatory approaches. A main challenge in SEMPA is the lack of local capacity in MPA management. The RRA has publicly subscribed to these goals (Castro-de-la-Mata, 2012). The 4 Marine Reserves gazetted in 2007, are set in the northern and north-western sectors of lagoon (Figure 11) and occupy ~20 km^2. All four reserves were demarcated in 2009 and 2010; however, all demarcation buoys are presently lost, due to failure, bad weather and vandalism. A management plan was drafted in 2011 by a Technical Sub-Committee composed of various stakeholders including fishers, NGO officers, tour operators, MPA officers and fisheries protection officers, and compiled by a team of international scientists. The main challenge for the northern reserves is the lack of local capacity and workforce to implement the management plan.

Figure 11. Location of the Marine Protected Areas for Rodrigues (source: Republic of Mauritius, 2011a)



1.4.3. Threats

The major threats to marine and coastal biodiversity are habitat destruction and fragmentation (Table 14). The drivers are overexploitation of fisheries resources and destructive fishing techniques, coastal development, pollution, coastal and bio-erosion, invasive alien species and climate change.

1.4.3.1. Exotic and invasive species

In the Mauritius EEZ, no marine invasive species have been recorded in the Global Invasive Species Database. However, *Caulerpa taxifolia*, which is known to occur at some sites in the lagoon of Mauritius, is an invasive marine algae that forms dense monoculture that prevents the establishment of native seaweeds and excludes almost all marine life. This affects the livelihoods of the fishermen. It is usually introduced via wastewater effluents (ASCLME, 2012a).

1.4.3.2. Coastal development

On Wetlands there are unsustainable patterns of development such as backfilling of wetlands for construction (about 90 % of all wetlands have been destroyed this way), the absence of drains and sewer network are putting pressure on the coastal zone (Republic of Mauritius 2011a). Some 7 km of beach have been affected by erosion, and are being further degraded by hard structures constructed on the beach (MID, 2011). As a result, the natural functions of wetlands, that is water drainage and filtering of toxic substances, have been impaired.

Currently there is not yet legislation for the protection of wetlands. Development on wetlands warrants an Environmental Impact Assessment (EIA) and Environmentally Sensitive Areas (ESAs) are protected in the Outline Planning Schemes. It is noteworthy that the Draft Environmentally Sensitive Areas Conservation and Management Act (2009, Draft ESA Act) submitted as part of the ESA Study proposes a number of uniform rules for the valuation of lands, enforcement of easements, and the development of other types of incentives for conserving and managing ESAs. It was also highlighted that there is no existing management plans for caves, which according to Ramsar Convention falls under the Wetlands (MID, 2011).

Marine biodiversity is threatened by habitats destruction, soil runoff and erosion result in excess nutrients from fertilizers and domestic sewage, which then leads to harmful algae blooms that block

sunlight and deplete the water of oxygen. It also causes silt to build-up on coral reefs, which blocks sunlight necessary for coral to grow.

1.4.3.3. Pollution.

The coastal areas and waters are the ultimate recipients for environmental degradation and pollution released to the atmosphere, land and water. The threat of contamination of oligotrophic waters in Mauritius and deterioration in water quality by eutrophication and industrial wastes, in particular, metal pollution have caused a decline coverage of live corals to 10-30% in coastal lagoons around Mauritius in 2012 and exceeding the Redfield ratio for nutrients. Recent eutrophication in several Mauritius lagoons has highlighted the need for a greater understanding of nutrient sources to lagoon waters. Submarine groundwater discharge (SGD) into the marine environment is one possible transport mechanism for excess terrestrial nutrients to reach the sea (Ramessur, 2013).

1.4.3.4. Climate change

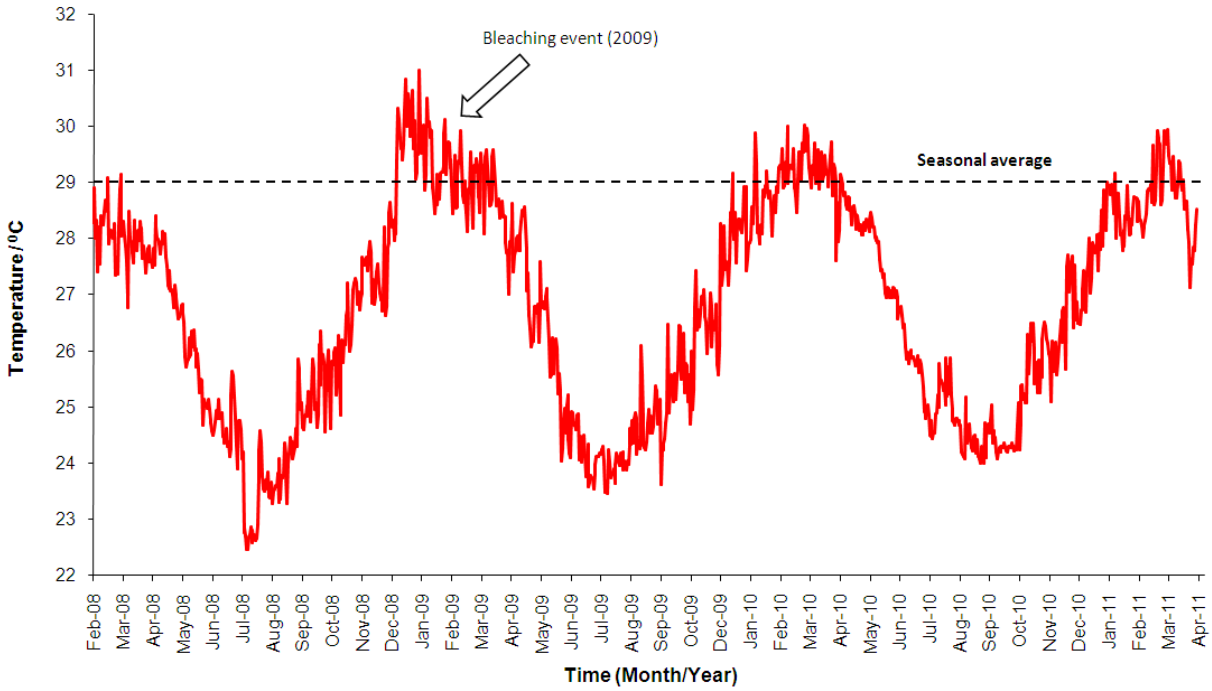
Climate change is the major threat to MPA. As describe in the Blue Bay Marine Park Habitat mapping and biodiversity inventory of Blue Bay Marine Park (PARETO, 2012): '*global threats overlap local threats and are major pressure on the marine environment*.' Thus, reducing local threat to increase ecosystem resilience to climate change could decrease its impact.

Mauritius is one of the Western Indian Ocean states being impacted by global climate change. Mauritius has experienced a very slow fall in sea level (- 0.10 mm/yr) from 1986 to 2003. In Rodrigues, sea level has declined at a rate of - 0.32 mm/yr during the same period. However, during the last few years an accelerated sea level rise at a rate of between 1.2 and 3mm/yr has been observed. This is a matter of serious concern since it has led to the intensification of coastal erosion leading to destruction of coastal infrastructure and settlement. The continuing sea level rise is expected to worsen the problem of coastal erosion, which is being accelerated due to ill-planned and ill-designed coastal development. Hard engineering approaches (e.g. construction of sea walls and groynes) for controlling coastal erosion have not been successful in Mauritius (ASCLME, 2012a).

Climate change and sea level rise are global problems that are also impacting on the coastal zone of Mauritius. Sea level rise is monitored at Trou Fanfaron-Port Louis since 1987 and between 1998 and 2007, local mean sea level rose by 2.1 mm per year. Overall, mean sea level rise for Mauritius during the past decade has been around 1.2 mm (Meteorological Services, 2009). It is expected that sea level rise will lead to saline intrusion and inundation of certain low-lying coastal areas, thereby affecting livelihoods, coastal wetlands and mangroves. In May 2007, inhabitants of Rivière des Galets village were affected by a storm surge, which flooded their houses. It is expected that coastal erosion will become more serious with sea level rise. In January 2009, cases of fish mortality were recorded in the region of Poudre d'Or. Surveys indicated that a sudden rise in seawater temperature (up to 31.5°C) resulted in a micro algal bloom, which could have been the main cause of fish mortality.

Coral reefs are being impacted by global climate change and increase in sea surface temperatures. Since 1998, temperature induced coral bleaching has been reported from Mauritian waters (Moothien Pillay *et al*., 2002) with subsequent bleaching episodes occurring in 2004 (McClanahan *et al.*, 2005) and 2009 (MOI, unpublished data) causing a major loss of live corals in the lagoons around the island (Figure 12).

Figure 12. Average sea water temperature (^{0}C) recorded during day-time in the lagoon of Albion from Feb-08 to Apr-11 (*in-situ* data recorded by HOBO® Pendant Light/Temperature logger at interval of 15 mins) (Source data: MOI)



1.4.4. Impact of coastal and marine biodiversity on well-being

Marine and coastal biodiversity provide Mauritian with a multitude of valuable goods and services. These ecosystem services range from food, medicine, climate regulation and coastal protection to cultural services such as recreational and spiritual benefits.

The National Marine Ecosystem Diagnostic Analysis has estimated the coastal and marine ecosystem services in 2012 (ASCLME, 2012b & Island States CBA Preliminary Report). The total value for goods and services produced by ecosystems provisioning, regulation, cultural and supporting services for Mauritius is estimated between 31,209 - 31,225 Mus$.

Table 14. Summary of threats to Biodiversity in Mauritius

Biome / Ecosystem type	Threats	Drivers of threats							Implications
		Direct drivers				Indirect drivers			
		Habitat degradation	IAS	Pollution	Climate Change	Demographic change	Socio-Political Factors	Funding, capacity, knowhow limitations & other factors	
Forest and terrestrial	Reduction/ loss in habitat posing the risk of loss of species	↗	↗	↘	↑	↗	→	→	Ecosystems integrity and functioning affected. May affect inland tourism activities.
Agricultural	Loss of PGR	↗	↗	↘	↑	→	↗	↗	Loss of traditional knowledge and loss of important genetic resources. Add risks to food security which is a growing concern.
Inland waters, marine & coastal	Degradation/ Loss of Habitat with potential loss of species	↗	↗	→	↑	↑	→	→	Impacts on ecosystem good and services, local livelihoods affected.

↑ : Increase

↗ : Moderate increase

↘ : Moderate decrease

→ : Unchanged / under control

Chapter 2. Mauritius national biodiversity strategy and action plan, its implementation, and the mainstreaming of biodiversity

2.1. Mauritius biodiversity targets and NBSAP updating progress

Mauritius NBSAP 2006 – 2015 was prepared in order to meet the country's obligations under the Convention on Biological Diversity (article 6a) and provide a strategic approach for biodiversity management in Mauritius for the coming decade (2006 –2015). The current document does not incorporate the Aichi Targets. However, Mauritius biodiversity strategic objectives and programmes of work are in line with the 2020 Aichi Targets for Target 5, Targets 6, Targets 7, Targets 8, Targets 9, Targets 10, Targets 11, Targets 12, Targets 13, and partially Targets 14, Targets 18 and Targets 19.

The challenges encountered in the Convention implementation and mentioned further in this chapter coupled with external factors inherent to a SIDS have rendered the current strategy for and practices within biodiversity management weak. The following elements of the CBD Strategic Plan's Aichi Targets need to be further improved and developed in the revised NBSAP: Target 1, Target 2, Target 3, Target 11, Target 14, Target 16, and Target 20.

An updating process of the NBSAP in line with the CBD Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets will start in 2015. This process will follow the steps suggested in the national biodiversity planning guidelines prepared by the World Resources Institute (WRI), IUCN and UNEP and recommended to Parties by the Conference of the Parties (COP) in 1995. It is a seven-step biodiversity planning process that is a cyclical and adaptive process, and builds in feedback mechanisms. It will build on the Fifth National Report, stock taking outcomes and key case studies (Ecosystem Valuation in Mauritius; Advances in cross-sectoral Mainstreaming of Biodiversity in Mauritius; Challenges and Opportunities linked to Ecosystem-Based Adaptation and Resilience within Mauritius' protected area network).

The strategy updating process has as objective to align Mauritius NBSAP with Maurice Ile Durable Strategy and Action Plan (MID, 2013) best-case scenario targets 2030 in a manner that is in line with the global guidance contained in the CBD. It includes the incorporation of ecosystem approach to mainstream biodiversity, coordination mechanisms based on the (i) development of synergies and coordination amongst Rio conventions and biodiversity related conventions; (ii) implementation of monitoring and evaluation processes; (iii) development of financial resources mobilisation strategy; (iv) convention reporting and exchange mechanisms, including the Clearing House Mechanism (CHM) of the CBD.

2.2. Mauritius NBSAP implementation and biodiversity mainstreaming

2.2.1. Progress in the implementation of the NBSAP and biodiversity mainstreaming

Since the Fourth National Report on the CBD, Mauritius has taken a number of actions to support the Convention implementation. Policies and strategies for the conservation and sustainable use of biodiversity have been adopted and are at various stages of implementation. Part of the NBSAP has been implemented as shown in the Tables 16 and 17 despite gaps and challenges encountered.

The Republic of Mauritius took several actions to implement the NBSAP. These actions concern the revision of legislations and regulations, national strategies, and the implementation of programmes and projects. The Republic of Mauritius government commitments to biodiversity conservation and sustainable use are a continuum of the key policies and strategies, legal/regulatory frameworks, and tools (national budget including biodiversity) and processes to

mainstream/integrate biodiversity conservation and sustainable use described in the Fourth National Report (2010).

2.2.1.1. Strategies

Mauritius has made progresses in developing environmental policies and strategies in most sectors to ensure environmental protection and has adopted a number of policies and strategies for conservation and sustainable use of biodiversity. These include:

- Maurice Ile Durable (MID) Policy, Strategy and Action Plan (2013): there is strong political commitment at the national level to advance sustainable development through the adoption of the new long-term vision of Maurice Ile Durable (MID), whose main objective is to make Mauritius a model of sustainable development, particularly in the context of SIDS. The National MID Vision frames sustainable development and green economic growth in the context of five 'E' (Energy, Environment, Employment/Economy, Education, Equity). Each 'E' has a goal, for Environment it is to ensure sound environmental management and sustainability of Mauritius ecosystem services. The MID strategy includes two environment targets:

- Reduce the ecological footprint to be in the upper quartile of performance of similar income nations by 2020.
- Meet the environmental sustainability targets of the Millennium Development Goals.

MID Policy, Strategy and Action Plan target for biodiversity conservation are represented in Table 15.

Table 15. MID Policy, Strategy and Action Plan target for Environment

Environment						
Policy Code	**Policy**	**Proposed Strategy**	**Action**	**Link to Concept Plan**	**Priority**	**Implementing Agencies**
B9	**Biodiversity Conservation:**To conserve the natural assets of the Republic by adopting the ecosystem approach.	To monitor and manage the use of terrestrial and marine biodiversity to ensure that they continue to provide ecosystem services in a sustainable way.	To protect existing and increase indigenous forest cover.	Cleaner, greener, pollution free Mauritius	Short	Ministry of Agro-Industry and Food Security Ministry of Fisheries Prime Minister's Office (Mauritius Oceanography Institute) NPCS
			To create Conservation Management Areas (starting in Black River Gorges National Park and Gunner's Quoin Islet).			
			To save the endemic endangered reptiles of the Mauritian offshore islets from extinction.			
			To protect the coastal zone and marine ecosystem, focusing initially on rehabilitation of damaged coral reef system through coral farming.			
			To create sand banks for beach nourishment.			
			To promote mangrove protection and propagation.			

A MID Fund has also been instituted to fund sustainable development projects such as conservation of local natural resources, use of local sources of renewable energy, energy efficiency and conservation, promotion of resource use efficiency, waste recycling and Research and Development (R&D) pertaining to environmental sustainability. Various projects such as the native forests restoration projects, the solar water heater grant scheme, the installation of photo-voltaic panels in public and private schools, the rain water harvesting scheme for market and fairs for local authorities, the water saving campaign for heavy water users, the promotion of the household composting scheme, and the carbon footprint project have been implemented.

- National Climate Change Adaptation Policy Framework Report (Republic of Mauritius, 2013c)[8] has been developed to foster the development of policies, strategies, plans and processes to avoid, minimize and adapt to the negative impacts of climate change on the key sectors namely: water,

[8] http://environment.govmu.org/English/Climate_Change/Pages/Climate-Change.aspx

agriculture, fisheries and tourism and also to avoid or reduce damage to human settlements and infrastructure and loss of lives caused by climate change.

- DRR Strategic Framework and Action Plan (2012) including Risk Maps in relation to inland flooding, landslide and coastal inundation for the Republic of Mauritius has been developed under the AAP. These will contribute to designing robust disaster risk reduction and policies and management practices for the decades to come. It is wise to look ahead, learn about and prepare to what the future holds for the Mauritian community so as to build disaster-resilient architecture and have an up-to-date early warning system so as to enhance the country's preparedness in the face of disasters (MESDDBM).

- Technology Action Plan for an enhanced Climate Change Adaptation and Mitigation. Technology Action Plans to implement feasible technologies that reduce greenhouse gas emissions and support adaptation to climate change that are consistent with national development priorities has been completed. 12 technologies have been prioritized following a thorough assessment from an initial list of 128 technologies for enhanced climate change mitigation in the Energy sector and adaptation in the Agriculture, Water and Coastal Zone sectors (MESDDBM).

- Work is on-going for an ecotourism strategy: guidelines for Ecotourism Development on Freehold Land are being reviewed and Mauritian Standard for sustainable tourism requirements MS165:2014 and an Eco Label Grant Scheme for Operator in Tourism Sector will be launched in October 2014 with MID. These actions are completed by a set of guidelines for more responsible and environmentally friendly operations of tourism activities on coastal and marine resources to protect marine ecosystem,

- A Protected Areas Network Strategy document is currently being developed and will be completed in 2015.

Health, gender and environment are important across the policy framework. Strategies and action plans have been formulated with regards to enabling activities for climate change adaptation in these sectors also include research and development and the need for continuous monitoring and evaluation. The ministries of Fisheries, Environment and Sustainable Development have developed Gender policies and each ministry has a dedicated gender cell.

2.2.1.2. Legislations and regulations

- The Wildlife and National Parks Act (1993) and its associated regulations has been amended and the new legislation will be known as the 'Native Terrestrial Biodiversity and National Parks Bill (20xx)' and the 'Native Terrestrial Biodiversity and National Parks Regulation 20xx'
- A draft Wetland Bill document is under review. The National Ramsar Committee established in 2004 has worked on the preparation of the Wetlands Bill.
- Regulations for the collection of sea cucumbers were proclaimed in September 2008 and a moratorium has been put forth from 1 March 2012 to 29 February 2016 to allow the sea cucumber population to recuperate.
- Tourism Authority (Dolphin and Whale Watching) Regulations 2012 GN No. 154 of 2012 Government Gazette of Mauritius No. 87 of 1 September 2012 (MTEC)
- Rodrigues Regional Assembly (Octopus Closed Season) Regulations 2012. Regulations made by the Rodrigues Regional Assembly under Sections 26(1), 31, and item (16) of the Fourth Schedule of the Rodrigues Regional Assembly Act 2001.
- The Government of Mauritius has established a policy with the overall objective of mandating registered companies to pay 2 % of their book profit towards programmes that contribute to the social and environmental development of the country. This new legislation was introduced in 2009 and amended in 2011 and requires businesses in Mauritius to donate 2 % of their pre-tax profit to approved projects that contribute to the social and environmental development of the country.

- A Climate Change Bill has been drafted to establish the legal framework and mechanism towards making Mauritius climate change-resilient and adopt a low-carbon economy in line with the overarching Government objectives of developing a green economy. The Bill will support and facilitate the development and implementation of policies, strategies and programmes to address climate change adaptation and greenhouse gas emission reduction. A Workshop on Climate Resilient Legislation was held from 22 – 24 August 2012 for the Capacity Building of key stakeholders on drafting of legislation and the validation of the content of the proposed Climate Change Bill.

2.2.1.4. Conventions and Protocol

Mauritius has ratified the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits in 2013.

2.2.1.5. Projects and Studies

Main projects and studies for terrestrial biodiversity and sustainable use

- Projects and programmes for the conservation of terrestrial biodiversity include the creation and management of nature reserves, national park and botanical gardens, propagation of endangered plant species, reforestation, species recovery for critically endangered birds and translocation of reptiles. Mauritius has so far saved 3 endemic bird species (Kestrel, Pink pigeon and Echo parakeet) from the brink of extinction, proclaimed 3 Ramsar sites of international importance, 10 national parks, and will be rehabilitating 400 ha of invaded forests into native forests under the Protected Area Network Project.
- *Protected Area Network project*. Expanding Coverage and Strengthening management effectiveness and the Terrestrial Protected Area Network-PAN on the island of Mauritius" (2009).
- Capacity building for Sustainable Land Management in Mauritius (including Rodrigues) 2009-2013. The objective of this project is to help develop SLM capacities within relevant government institutions and civil society, as well as in user groups, in Mauritius and Rodrigues. The project offered various training opportunities to various government institutions and civil society groups As a direct result, the Forest Land Information System was established within the Forest Service department to monitor land-use and land-cover change, and training provided to technical personnel to support the system. In addition, the SLM Practice Guide for Mauritius and Rodrigues was published as part of the SLM knowledge-sharing and mainstreaming activities by the project.

Main projects and studies for coastal and marine biodiversity

- *Coral Farming (2011).* Since reefs are constantly threatened by rising seawater temperature and ocean acidification, coral culture has an important role to play in rehabilitating degraded reefs hence enhancing the ecosystem services they provide for tourism, fisheries and coastline protection. Land-based coral farming can be used to create sanctuaries for maintaining biodiversity and genetic resources and for propagating threatened species to prevent local extinction. The culture of corals for conservation initiatives could be made self-sustainable through commercialisation. It could be beneficial to countries already involved in harvest of corals from the wild for the international trade. The coral farming project which started in 2011, builds on results obtained during the pilot phase and is focussing on (1) culture of coral species which are in high demand for the aquarium market (2) propagation of threatened species to prevent local extinction (3) mass culture of corals, including bleaching resistant species and strains for rehabilitating degraded sites (4) creation of a coral sanctuary/bank for preserving biodiversity and genetic resources and (5) collaboration with the private sector to create land-based coral farms and coral gardens for hotel resorts (http://moi.govmu.org/research_projects.htm).

- *Assessment of Marine Living Resources in the EEZ of Mauritius using DNA-based approach* (http://moi.govmu.org/research_projects.htm). Worldwide, marine species are under threat from exploitation, habitat loss, invasive species, pollutants, diseases and climate change. It is widely speculated that species loss will occur at a higher rate than the documentation of the diversity. In particular, commercially exploited species such as non-target or high value species are relatively more vulnerable to extinction. In Mauritius, degradation of coastal habitats and over-exploitation of marine living resources could be a real threat to the persistence of species. In 2010, the Mauritius Oceanography Institute initiated a project to establish an inventory of marine species of commercial importance by combining traditional taxonomic identification tools and DNA-based approach. To date, 189 commercial fish species have been inventoried, out of which, 42 are new records to Mauritius and 3 may be potentially new species. Additionally 9 species of holothurians have been identified. Subsequently, the diversity of other group of organisms such as mollusks, crustaceans and soft corals will be undertaken. The morphological and genetic data generated from this study are continuously being uploaded on the publicly accessible Mauritius Oceanography Institute's online marine diversity and genetic data bank (www.mdgdb.com). The information gathered from this project will be valuable for the sustainable use and conservation of marine living resources in the waters of Mauritius.
- *Seaweed Farming Project in Rodrigues (2011)*, which is an experimental farm showcasing 3 seaweed cultivation methods with 2 species of seaweeds (*Gracilaria salicornia* and *Hypnea* spp.). The farm in Petite Butte is being monitored by the personnel of Rodrigues Office in collaboration with the South East Marine Protected Area and the Fisheries and Research Training Unit.
- *Partnerships for Marine Protected Areas in Mauritius and Rodrigues* (ended in 2012). Project implemented by the Republic of Mauritius to protect marine biodiversity through the establishment of collaborative management approaches to its Marine Protected Areas (MPAs).
- Marine ecosystems conservation and restoration (IOC/FGEF).
- Study on Environmentally Sensitive Areas (2009).
- Biodiversity is considered at regional level at IOC level with European Union funds within the Biodiversity Project, which began its operations in 2014. Its objective is to raise awareness of the peoples of the region and build up the capacity of national and local policy makers, communities, private operators, with the support of non-governmental organizations. Other projects on Invasive Alien Species are supported by IUCN.
- 3 studies have done experimental valuation of ecosystem services:

▪ ASCLME (2012). National Marine Ecosystem Diagnostic Analysis. Mauritus. Contribution to the Agulhas and Somali Current Large Marine Ecosystems Project (supported by UNDP with GEF grant financing).
▪ R. Sultan (2012) An economic valuation of the marine and coastal ecosystem in Mauritius. Western Indian Ocean Marine Highway Development and Coastal Contamination Prevention Project, Indian Ocean Commission and Ministry of Environment and Sustainable Development, Mauritius.
▪ Sookun A. and Weber J.L. (2013). Experimental ecosystems natural capital accounts. Mauritius case study. Methodology and preliminary results 2000-2010. Second Expert Group Meeting on Biodiversity for Poverty Eradication and Development, Convention on Biological Diversity, 4 – 6 December 2013, Chennai, India.

Mauritius country's institutional architecture and legal framework for environmental governance is anchored in the concept of sustainable development and incorporates the relevant recommendations of major UN Conferences on environment. Ecosystem approach, biodiversity inclusive Environmental Impact Assessment (ESA) are the main tools used by each sector.

However, synergies with the United Nations Framework Convention on Climate Change (UNFCCC) the United Nations Convention to Combat Desertification (UNCCD) and other relevant

conventions need to be reinforced to achieve the implementation of the Convention on Biological Diversity at national level.

2.2.3. Challenges and gaps to implementation of NBSAP and effectiveness of current strategy

As it has been mentioned, some part of the NBSAP has been implemented. Many activities have been carried out since the Fourth National Report on CBD and have been met with varying degrees of success. Successes, challenges and gaps have been identified.

Successes concern the positive trends registered for 4 birds (*Psittacula eques*, *Foudia rubra*, *Foudia flavicans*, *Acrocephalus rodericanus*) and 1 bat (*Pteropus niger*) species conservation, increase of native forest areas restoration, protected areas network, genetic resources conservation and progress made toward sustainable use of natural resources (fisheries, agriculture).

A major success is the implementation of regulations on seasonal octopus closure in Rodrigues, which was accompanied by a sensitisation campaign across the island and associated with the development of alternative activities during the closure period to ensure proper understanding of the motivations that led to this management decision (IOC, 2012; Shoals Rodrigues, RRA). The result is a significant increase in octopus population as well as their increase in size and weight since 2012.

2.2.3.1. Gaps to implementation of NBSAP and effectiveness of current strategy comprise:

- Institutional NBSAP coordination process for implementation, monitoring and evaluation has not fully been institutionalised and sustained. The CBD implementation responsibility was until 2012 under the MESDDBM, since the NFP has been transferred to the NPCS under the overall responsibility of the MAIFS.
- Fragmentation in the responsibilities among various ministries and institutions in the implementation of the NBSAP. For example inland water biodiversity has been identified as a gap, it encompasses freshwater (rivers and reservoirs), wetlands. Thus the Wildlife and National Parks Act 1993 regulates the protection and management of the following crustaceans: 'camarons' and 'shrimps'; FS are in charge of banks protection while the Fisheries and Marine Resources Act 2007 provides for the protection of aquatic ecosystems, and CWA and Water Resources Unit of the MEPU are in charge of water quality.
- Inadequate information and knowledge sharing. Serious gap in information flows: sharing and dissemination of scientific knowledge amongst institutions and organisations have been identified.
- Serious gap in large-scale investigations on identifying, inventorying and characterising local terrestrial and marine flora and fauna species including microorganisms, benthic fauna and entomology, habitats; baseline studies, in research studies on past and diseases, impact of climate change, database and monitoring mechanisms.
- Insufficient staff numbers, shortage of qualified and experienced staff both technical and in the executing agencies with responsibility for enforcement.
- Capacities building gaps have been identified in technical and scientific areas and in core activities; these have been listed in the National Self-Capacity Assessment (Ministry of Finance and Economic Development and Ministry of Environment and National Development Unit, 2005), which is still up to date.
- Thematic issues have been raised related to the lack of (i) inland watershed, rivers, estuaries and terrestrial coastal systems biodiversity (ii) outer islands and the Exclusive Economic Zone (EEZ) geographical cover, and (iii) climate change impact on biodiversity.

2.2.3.2. Challenges to implementation of NBSAP and effectiveness of current strategy comprise:

- Harmonisation of institutional mandates in the area of terrestrial biodiversity conservation.
- Implementation and sustainability of a national biodiversity coordination structure.
- Communication between scientific/technical and non-scientific/technical people, networking, information sharing, publication.
- Sustainability of mechanisms developed (NBSAP coordination committee) and funding mechanisms (environment fund).

Table 16. Status of implementation of the NBSAP for Mauritius

Strategic Objective (SO)	Work Programme *Objective*	NBSAP Results/Target 2015	Achievements
Strategic Objective 1 **Establish a representative and viable Protected Area Network (PAN)**	**1a. Terrestrial Protected Area Network**		
	To place 10% of Mauritian terrestrial area within a PAN by 2015	New paradigm for Protected Area (PA) management, which fosters (including incentives) private sector involvement in the ownership, and/or management of protected areas (PAs).	100 % done: 2 MoU signed PPP for restoration, survey done (400000 Rs to restore at 5 ha per private area). PPP with le Vallée de Feney.
		Viable and representative PAN consisting of at least 10% of land mass established.	7.6 % of PA properly managed and protected
		Protected area law and categories provide for a comprehensive and graded range of protective and usage regimes.	40 % on-going work (consultant recruited and working): work in progress for a PAN strategy and action plan - expected by 2015. Native Terrestrial Biodiversity and National Parks bill at the State Office waiting for First reading. Last step before the being an Act. It includes CITES provision.
		At least 1000 Ha of priority areas are under intensive management by 2015.	24 % done. PAN project and 2 MID projects (in 2014, restoration of 5 ha of degraded native forest at Gunner's Quoin Islet; Restoration of 42 ha of degraded native forest at Plaine Raoul in the Black River gorges National Park).
	1b. Inland Waters Programme		
	Identify key areas of inland water ecosystems for management and incorporation into PAN.	Hot spot areas identified.	100 % done: Environmentally Sensitive Areas for Mauritius and Rodrigues study (ESA study, 2009).
		Priority areas incorporated into PAN.	PAN project on-going, priority areas being incorporated into PAN.
		Detailed research programme targeting management priorities on inland water biodiversity initiated.	Not done.
		Single agency identified/established and administering inland water biodiversity management.	Has not been achieved.

	1c. Marine Protected Area Network		
	To develop and maintain a representative MPA network	Habitat types lacking from PAN identified.	ICZM Framework has been developed and a study on ESA undertaken (identification of seagrass beds and mangrove ecosystems, gap analysis of coral communities, prioritisation of coastal wetlands) for the proper and rational management of coastal and marine resources. 8 PMA: 2 Marine Parks and 6 MPA management committee established in 2012 and management plans development on-going. Long term coral reef ecosystem monitoring program (including water quality) – status of the coral reef included in marine parks 16 sites.
		Key habitat areas identified and incorporated into sensitive area atlas.	100 % done for Integrated Coastal Zone Management. Africa Monitoring of the Environment for Sustainable Development (AMESD, 2009-2013, http://moi.gov.mu/amesd/news/view.php?id=41) project MOI with two main operational services that use satellite ocean observation data will be developed: (1) Support to Fisheries Resources Management and (2) Monitoring of Physical Oceanography Variables
		Representative PAN established and under operation (x-ref WP1d).	Under process depends on the PAN strategy, presently being worked out by PAN consultants
		Permanent buoys demarcate marine areas.	Done for the 2 Marine Parks. Different buoys represented (zoning done depending on the sensitiveness of the habitats). Work is on-going for the other MPA but is subject to lack of funding.
	1d. Adaptive Management of Protected Area Network		
	To develop costed and scheduled management plans, for each PA, that enables adaptive management.	Each Protected Area has a structured, time bound and targeted management plan that enables adaptive management.	2 national parks: one under revision and one on-going process. Management plans for islets done in 2008 awaiting approval; and management plan development for mainland nature reserves planned for 2015 (Forestry Service, MAIFS).
Strategic Objective 2: **Manage Key Components of Biodiversity**	**2a. Invasive Alien Species**		
	To develop and implement a comprehensive national IAS Strategy and Action Plan	Balanced, comprehensive IAS strategy developed in line with GISP guidance.	100 % done: National Invasive Alien Species Strategy for the Republic of Mauritius (2010 - 2019) adopted and supported by: 'Native Terrestrial Biodiversity and National Parks Bill (20xx)' at State Office includes CITES provision and control of wildlife population

		(threatened species protection against IAS) and 'native Terrestrial Biodiversity and National Parks Regulation 20xx' – will replace Wildlife and National Parks Act 1993 and Wildlife and National Parks regulations 1996.
	Action plan under implementation	Costing missing, in progress. Approximately 30 % of it implemented by PAN project.
2b. Flowering Plants and Ferns		
To enhance conservation of native flowering plants and ferns	Conservation status of species reviewed and identified.	Not yet finished, review of status of flowering plants started in 2014. New list of threaten plants has been worked out and will be incorporated in the new law for Mauritius and Rodrigues but not yet validated by IUCN (90 % done). No fern has been red-listed. Last one done in 2005 by National Threaten Plant committee.
	All endangered species incorporated into ex-situ collections and in-situ management areas.	> 60 % done
	All threatened species protected by law and incorporated into conservation initiatives (x-ref with WP 1a).	Will be finalized in 2015. National Invasive Alien Species Strategy and Action Plan (2010-2019) adopted in line with the Convention on Biological Diversity.
	Use of exotic species reduced.	National Plant Protection Office (NPPO), National invasive species committee advise on importation - controlled by law.
2c. Birds		
i) To review and enhance the conservation of endemic birds. *ii) To protect seabird colonies.* *iii) To protect migratory birds*	Conservation status of species determined and protected species list modified as appropriate.	100 % done as per Fauna section of this report.
	Species databases established.	100 % done (NPCS).
	Recovery programmes under implementation for priority species.	Restoration programs in progress.
	St Brandon rat free.	-
	Priorities for IAS management on outer islands determined.	Not done
	Implement AEWA action plan. Implement Ramsar action plan	30 % done, Ramsar committee in place. AEWA Rivulet Terre Rouge estuary bird sanctuary managed by NPCS according to AEWA principles.
2d. Bats		

	To enhance the conservation of bat species.	Conservation status and priorities of bat species determined.	100 % done
		Population databases established and trends through time elaborated.	100 % done
		Fruit bat ecology including range and feeding niche understood.	100 % Study done by MWF.
		Impact of Fruit bats on fruit production quantified.	100 % done: FAREI undertook survey in fruit orchard and backyard to estimate fruit damage due to bats. The percentage of fruit damage caused by bats recorded is up to 78 % in lychee, 45 % in mango and 100 % in long an in backyards and orchards (2013).
		Impact reduction techniques tested and viable options under implementation.	100 % done: bird net was found to be a viable option in preventing damage from bats. Pruning of fruit trees to manage trees height in orchards and the use of bird nets are recommended for control of fruit damage by bats. Since 2009, the MAIFS put up a Fruit Protection Scheme including incentives for purchase of bird net for reduction of fruit loss due to bat damage.
		Feasibility and practicality of re-introduction of Rodrigues fruit bat determined and decision made.	The breeding programme for the Rodrigues fruit bat has been successful but no attempts have been made yet to reintroduce captive-bred bats to the wild.
	2e. Reptiles		
	To review and enhance the conservation of reptiles.	Occurrence of and distribution of key populations mapped and priorities determined.	Reptile conservation project has been implemented it focused on the protection on 7 species. Mapping for the islet on all reptile population – on mainland still on-going.
		Ecology requirements of priority species understood.	100 % done
		New populations of key species established.	Ex-situ captive breeding programmes at Durell (UK) and in-situ captive rearing programmes on Ile aux Aigrettes to support establishment of new population key species. Priority species security enhanced by removing or reacting to emerging threats to island biodiversity and moving reptile species from one to two or more islands.
		IOSEA Action Plan under effective implementation	Legal basis: Under the Fisheries and Marine Resources Act 2007 (a) fishing of any species of turtles, turtle eggs or marine mammals is illegal under paragraph 16 (1) (c) except with the written approval of the

			Permanent Secretary (b) Paragraph 12 prohibits fishing with drift nets (c) Paragraph 22 (2) (a) prohibits import of turtle (dead or alive), turtle egg, or stuffed except with the written approval of the Permanent Secretary. Awareness campaign on the importance of the conservation of turtles. NGO and AFRC work together. Viewing the importance of the conservation of turtles, Government has provided a sum of Rs 600,000 in the 2013 budget of the MOEMRFSOI. Fisheries particularly for conservation of turtle. Vesselowners have been requested to abide by resolution of IOTC relating to turtles. (Source: Country Report Mauritius, 2012 – IOSEA Turtles)
	2f) Research Priorities		
	To identify additional research priorities.	Additional priorities for research and/or conservation identified.	IAS bio-control researches. Micro-organisms (terrestrial and marine) biodiversity. Include social science in particular behavioural research. Biodiversity valuation. Research on Climate Change for SIDS in connection with coastal communities – vulnerability. Develop applied research.
		Conservation/research projects determined.	Tortoise as analogue species providing the ecosystem service of habitat restoration through grazing (NPCS, 2013 – Cardiff University, UK). The ecology and management of reintroduced and wild populations of the critically endangered Mauritius Olive White Eye (NPCS, 2013 – Reading University, UK). Investigating the perceived role of Mauritius Fruit Bats and other frugivorous species in crop rising and an assessment of stakeholders attitude toward these species (NPCS, 2013 – Imperial College, UK).
	2g) Agro-biodiversity		
	To have 70% of local agro-biodiversity under ex-situ protection and document knowledge on native agro-biodiversity (including cultivated medicinal plants).	Listing and detailed characterisation of breeds and varieties.	List and detailed characterisation of breeds and varieties documented. Increase the local varieties and breeds of agro-biodiversity represented in ex-situ collections.
		National strategy under implementation.	
		At least 70 % of agro-biodiversity represented in ex-situ collections.	
		Traditional knowledge relating to local agro-biodiversity documented.	

Strategic Objective 3: Enable Sustainable Use of Biodiversity	**3a) Ecotourism Development**		
a	*Develop an ecotourism strategy*	Ecotourism committee established and operating.	100 % done: Mauritius Sector Strategy Plan (2009 - 2015) and its related Programme Budgeting (2009).
		Basis for ecotourism strategy determined by review of existing initiatives.	Proposed Guidelines for Ecotourism Development on Freehold Land and are being reviewed.
		Ecotourism strategy under implementation and administered by ecotourism bureau.	Mauritian Standard for sustainable tourism requirements MS165:2014 and an Eco Label will be launched in October 2014 with MID. Set of guidelines for more responsible and environmentally friendly operations of tourism activities on coastal and marine resources – eco-friendly more responsible to protect marine ecosystem. Dolphin watching law has been developed. Helmet diving underwater sea walk, jet ski, para sailing. ms165:2014 Sustainable Tourism Requirement – a Mauritian standard for the award of an eco-label for tourism sector. Lagoon zoning: swimming zone – buffer zones – snorkelling, blue flag. Ecotourism: guidelines are being reviewed.
	3b. Review the Environment Protection Act.		
	To better integrate issues of biodiversity concern into the functioning of the EPA.	Public involvement and input to EIA process is enhanced.	100 % done
		Process, legislation and implementation of EIAs reviewed and amended to enhance function.	
		Biodiversity and sensitive area considerations are better incorporated into EIA and development planning approaches.	
	3c) Fishing		
	Enable sustainable utilisation of fishery resources.		
	3c (i) Offshore fishery	Fishing controls are enhanced.	100 % done Fisheries master plan in place and implemented. Port State Control Unit in place to implement Regional and International Marine conservation management measures. National Plan of Action (NPOA - IUU) to combat illegal and unreported

			unregulated fishing.
		Fishery stocks and by-catch are better managed.	100 % done: measures have been taken to manage the fish stock and a set of conditions are implemented (quota system, limited entry, licencing of fishing vessels) Fishery monitoring centre, which harbours a monitoring vessel system has been regionalised amongst IOC member states (2014)
	3c (ii) Lagoon fishery	Fishing effort in the lagoon reduced. Fish populations show recovery.	100 % done: regulations for the removal of corals and shells have been promulgated in 2006. No permits for removal of shells and corals are issued except for scientific purposes. Aquaculture coral farming recent project: marine ranching juveniles collect, grow and realised The following management measures have been taken by the Fisheries Division to maintain a sustained fishery development and protection of the marine environment: • Banning of underwater fishing and of fishing with explosives. • A closed season for net fishing in the lagoon. • Regulations on undersized commercial fishes. • Fishing with cast nets has been banned since 2000. • Reduction of fishing pressures in the lagoon by encouraging artisanal fishers to fish off-lagoon. • Fishers were encouraged to surrender large and gill nets against payment of compensation. • Setting up of Fish Aggregating Devices (FAD) around Mauritius so as to relocate fishing effort to offshore areas. • Creation of a Fishermen Training and Extension Centre to train fishers to fish off-lagoon. • Grant of loan facilities at very low interest rates through the Development Bank of Mauritius to registered fishers for purchase of offshore boat. • Enforcement is effected through patrols by the Fisheries Protection Service in the lagoon and on land followed by legal proceedings. • Regulations for the collection of sea cucumbers were proclaimed in September 2008 and a moratorium has been put forth from 1 March 2012 to 29 February 2016 to allow the sea cucumber population to recuperate.
		New management regimes have community support.	100 % done: awareness and sensitisation is part of the activities of the Ministry. The fishermen are sensitised through the FiTEC. Pamphlets and posters on the protection and conservation of coral reefs are produced for distribution to the public.
		Shells and coral receive are better managed.	Nurseries set up. Coral farming nurseries have been set up in the lagoons at selected sites to rehabilitate degraded coral reefs areas and the project is

		on-going.
3c (iii) Freshwater fishery	Recommendations for management of freshwater fishery stocks.	No data
3c (iv) Aquaculture/Mariculture	Sustainable profitable small enterprises are developed in the fields of aquaculture and mariculture.	121 women have been trained in aquaculture for ornamental fish breeding techniques so that they can start their small aquarium business.
	Activities have minimal negative environmental impacts.	The Fisheries and Marine Resources Act 2007 regulates aquaculture activities, as amended in 2008. Fish farming is a scheduled activity under the EPA 2002 (amended). All marine fish farming projects have to comply with operational guidelines for responsible fish farming practices, and require an Environmental Impact Assessment (EIA) licence. Twenty aquaculture lease fish farming sites have been promulgated in the Fish Farming Regulations 2014 under the Fisheries and Marine Resources Act. All new projects need to pass through the Board of Investment (BOI). A pilot project on floating cage culture has been set up at Grand Gaube, Trou d'Eau Douce and Q. Soeurs in the lagoon and fishermen are participating in the project. Cages have been supplied by the Ministry of fisheries along with fingerlings for grow out. Marine Ranching is being carried out annually for the stocking of the lagoon with commercial species such as Seabream (*Rhabdosargus sarba*) and *Siganus* spp (rabbit fish). The Fisheries and Marine Resources (Aquatic Animal Farming) Regulations 2014 is being drafted by the Competent Authority-Sea food along with the MOEMRFSOI. Extension services are provided to private and small-scale farmers on both freshwater and seawater aquaculture projects.
3c (v) Sports Fishing	Sports fishery activities are sustainable and optimised.	-
3d) Agro-biodiversity		
To increase sustainable agriculture and encourage the use of local varieties and breeds	Demand for and supply of organic produce increased, particularly that of local varieties and breeds.	Several studies have been undertaken at the Faculty of Agriculture, University of Mauritius (UOM) to determine the potential market for organic foods, and results have shown that airlines, hotels, supermarkets, private clinics, health shops, as well as a significant number of the general public interviewed expressed their eagerness to buy organic produce cultivated in Mauritius, even at slightly higher prices.

		Incentive system in place to encourage organic and beneficial traditional farming practices and varieties/breeds.	100 % done. Incentive system in place.
		Biodiversity considerations incorporated into permit system for water access.	100 % done. Biodiversity considerations incorporated into permit system for water access. Report on needs assessment in CWR conservation and utilisation. Scientific personnel trained in technological tools for CWR conservation. National strategic plan on conservation of CWR prepared. Soil microbial status determined for agricultural zones.
Strategic Objective 4: Maintain Ecosystem Services	**4a) Forest management**		
	Protect watersheds and soils by increasing forest cover.	Existing core areas are protected.	Under progress.
		Nursery capacity adapted to new planting needs.	100 % done: PAN project, MWF, NPCS, FS. A modern shade house established Bras D'Eau and 2 in the pipeline. It includes identified coastal dry forest, endemic coffee, only location where *Eugenia bojeri* flowers classified as Critically Endangered species amongst others i.e. Vallée D'Osterlog.
		Forest cover increased and optimised by incorporating new priority areas.	Under progress: protected areas map, ESA map.
		Area of native woodland cover progressively increased to up to 50 % of total area.	24 % on-going restoration process (FS, PAN project).
	4b) Water Quality		
	To reduce water pollution	Database of ambient water quality.	Inland water microalgae monitoring programme (CWA, Water Unit, MEPU) started in 2012, 2013 to 2014 following watershed management approach. Is targeting management priorities in terms of water quality – currently waiting for extension. Results will be available in 2015.
		Law enforced more effectively and efficiently.	Environment Protection Act 2002
		Cases of point source and general water pollution reduced.	Regular analyses are carried out by these institutions to assess the quality of groundwater (from boreholes), surface water (from rivers) and treated effluents (discharged from the treatment plants). Water quality tests generally show compliance to satisfactory level.
		Wetlands receive higher protection	100 % done Pointe d'Esny designated in 2011 as a Ramsar Site, Wetlands of

			International Importance. ESA Policy Guidance contains in ESA report and outline schemes used by relevant ministries (MHL, MESDDBM, MAIFS).
	4c) Integrated Coastal Zone Management		
	To increase coastal protection.	Impacts and costs of coastal erosion reduced.	Integrated Coastal Zone Management (ICZM) Framework has been adopted by Government in 2010 for implementation. Its main activities are focused on the monitoring of coastal erosion, coastal protection works and development control around the coast and shoreline management, among others. In 2012, this Division carried out the protection and rehabilitation at nine eroded public beaches around Mauritius. Coastal protection and rehabilitation works comprising rock revetments have been completed for 2 sites, namely Poudre d'Or and Cap Malheureux in 2013. Similar works have started at two other sites – Quatre Soeurs and Grand River South East (MESDDBM).
		Dispute mechanism functioning providing stakeholders with recourse to appeal against development decisions.	In order to manage the coastal zone in an integrated and holistic manner, the Division is implementing the recommendations of the 'Development of an ICZM Framework for the Republic of Mauritius in close collaboration with various stakeholders.
		Coastal habitats receive greater protection under the law.	Activities relating to environmental disasters in the coastal zone namely tsunami and oil spills are developed under the ICZM division and the National ICZM Committee. In this regard, it has developed a National Oil Spill Contingency Plan and a Coastal Sensitivity Atlas for Oil Spill Response.
		ICZM policy and guidelines under implementation.	The ICZM plan has been developed by the MESDDBM under the ICZM division and the National ICZM Committee. Sound development practices are promoted in the coastal zone by strict adherence to Outline Planning Schemes and Planning Policy Guidance such as 'Integrated Resort Scheme' that requires that EIA incorporates inter alia ICZM policy and guidelines.
Strategic Objective 5: Manage Biotechnology and its Products	**5) The Cartagena Protocol on Biosafety**		
	To implement the Cartagena Protocol on Biosafety.	The legislative and administrative structure established to enable the effective implementation of the Cartagena Protocol on Biosafety.	Mauritian GMO Act 2004. A project "The Implementation of the National Biosafety Framework for Mauritius" funded by UNEP / GEF and Government of Mauritius was completed (2007-2011). There is also an active National Biosafety Committee.
		International commitments under the Cartagena Protocol are met.	-

Table 17. Status of implementation of the NBSAP for Rodrigues

Strategic Objective (SO)	Work Programme *Objective*	NBSAP Results/Target 2015	Achievements
Strategic Objective 1 **Establish a representative and viable Protected Area Network (PAN)**	**1a. Terrestrial Protected Area Network**		
	To place 10 % of Mauritian terrestrial area within a PAN by 2015	Priority areas of terrestrial habitat for inclusion in PAN identified.	100 % done: Environmentally Sensitive Areas for Mauritius and Rodrigues.
		PAN incorporates viable and representative components of Rodrigues' terrestrial environment.	PAN not yet implemented in Rodrigues.
		PAN is designated under the law and demarcated on the ground	
		At least 10 % of landmass is incorporated into PAN	
		500 Ha of priority habitat under intensive management	
	1b. Inland Waters Programme		
	Identify key areas of inland water ecosystems for management and incorporation into PAN.	Priority areas for management and/or inclusion into the PAN identified.	PAN not yet implemented in Rodrigues.
		Capacity for on-going monitored localised.	
		Inland waters biodiversity under enhanced and effective management regime.	
	1c. Marine Protected Area Network		
	To develop and maintain a representative marine protected area network.	PAN network is expanded to include representative components of marine habitats in and around the lagoon.	100 % done: project document available and project implemented to include different representative components of marine habitats around the lagoon.
		Mourouk marine park, incorporating Gombrani Island	100 % done: South East Marine Protected Area (SEMPA) boundary has

		and Mourouk Valley, is designated and demarcated	been gazetted in February 2009 (Rodrigues GN No. 2 of 2009, Government Gazette of Mauritius No. 18 of 28 February 2009) Gombrani island and Mourouk valley are not included) and the zoning plan gazetted in 2011. South Eastern Marine Protected Area 43.32 km^2 2009.
		PAN is managed within the context of Integrated Marine and Coastal Area Management (IMCAM).	Management plan developed under implementation.
		Status of fishery reserves reviewed and altered as appropriate.	2 of the 5 fisheries reserves have been converted into no take zones in SEMPA.
		Conservation status of mangrove systems determined.	Studies have been conducted: (i) sediments microfacies characteristics in 2008 (O'Leary et al., 2009); (ii) effect of mangrove canopy on sediment in fauna abundance, biomass and diversity in 2009.
	1d. Adaptive Management of Protected Area Network		
	To develop costed and scheduled management plans, for each PA, that enables adaptive management. *Investigate usage potential in particular modes of non-consumptive use.*	Each Protected Area has a structured, time bound and targeted management plan that enables adaptive management.	100 % done 2 management plans developed one for SEMPA and one for the 4 Marine Reserves.
Strategic Objective 2: **Manage Key Components of Biodiversity**	**2a. Invasive Alien Species**		
	To develop and implement a comprehensive national IAS Strategy and Action Plan (NIASSAP)	Balanced, comprehensive IAS strategy developed in line with GISP guidance.	National IAS Strategy developed but a representative Rodriguan stakeholder IAS committee not yet established.
		National IAS strategy and Action Plan recognises the distinct biogeographical context of Rodrigues and the need to exert internal controls to ensure the Biosecurity of Rodrigues.	100 % done: Rodrigues distinct biogeographical context recognised in the NIASSAP Rodrigues Regional Assembly (RRA) invited to establish a sub-committee to look over the management and control of IAS in Rodrigues.
		IAS impact on ecosystem services addressed.	Restoration and reforestation of the Grande Montagne Nature Reserve, Rodrigues (Biaza annual awards 2011: Best field conservation project). Anse Quitor: Anse Quitor is home to very rare endemic plants such as the

		Zanthoxylum paniculatum and *Gastonia rodriguesiana*. About 14 hectares of the 34 hectares native forest have already been restored and many rare plants of Rodrigues have been planted in this reserve. Restoration involves the identification of a plot, thinning of invasive alien species, planting of endemic seedlings, followed by continued weeding and monitoring of plant survival (MWF).
	Action plan under implementation	IAS committee not yet set up.
2b. Flowering Plants and Ferns		
To enhance conservation of native flowering plants and ferns	Status of flowering plants reviewed and threatened and endangered species identified1.	Technical committee not yet set up.
	Electronic database (GIS) of threatened plant species established.	Not done yet, preliminary work began with Missouri Botanical Garden personnel
	All critically endangered species and 60% of threatened species in ex-situ collections.	90 % achieved, collections in Kew Gardens, Chester Zoo, Brest Botanical Gardens and in Mauritius.
	60% of threatened species represented in-situ management areas.	90 % represented in Grande Montage, Anse Quitor, Ile aux Cocos, Ile aux Sables Nature Reserves
	1 coastal and 1 "uplands" in-situ gene bank (arboretum) established.	20 %: suitable areas for in-situ gene banks (arboretum) and establishment identified at Mourouk.
	All threatened species protected under the Wildlife and National Parks Act.	100 % done 'Native Terrestrial Biodiversity and National Parks Bill (20xx)' at State Office includes CITES provision and control of wildlife population (threatened species protection against IAS) and 'native Terrestrial Biodiversity and National Parks Regulation 20xx' – former Wildlife and National Parks Act 1993 and Wildlife and National Parks regulations 1996
2c. Birds		
To monitor and manage key bird species	Status of Rodriguan warbler, Rodriguan Fody and other priority species known.	80 % survey of Rodriguan fody and Rodrigues Warbler conducted and reports available. In 2010, population and habitat surveys on the Rodrigues warbler provided a good scientific base to continue with more monitoring work in the future. Largely due to the habitat restoration work, the population of Rodrigues warbler has increased from 30 individuals in 1970s to 4,000 individuals in 2010 (MWF). The Rodrigues fody *Foudia flavicans* declined dramatically to around 6 pairs in 1968, although the population is now increasing, with around 900 individuals counted in 1999 and 8,000 in 2010. This is one of the most

			successful recoveries in the history of avian restoration (MWF).
		Bird species database established. Bird species adaptively managed	Not done
	2d. Bats		
	To enhance the conservation of bat species.	Status of bat population known ecology of the species better understood.	50 % three complete population surveys were conducted in 2009 and four in 2010 at a number of roost locations, in order to estimate current bat numbers and to monitor the population. Regular bat surveys are also conducted at the Cascade Pigeon roost, which is one of the major roost sites on the island. From these surveys it has been found that the number of individuals now stands at around 9,000.
		Criteria for active management established	Not done
	2e. Reptiles		
	To review and enhance the conservation of reptiles.	Strategy and Action plan for terrestrial reptiles developed and under implementation.	30 % no Strategy and Action Plan available yet – on-going Surveys of the native gecko on Coco and Sable islands, Anse Quitor, Grand Montagne in 2012 (Cole & *al*, 2013).
		IOSEA action plan under implementation in Rodrigues	Not done
	2f. Invertebrates		
	To develop and implement strategies for native insects and snails respectively	Insect Strategy with targeted species action plans, as appropriate, developed and under implementation.	Not done
		Snail Strategy with targeted species action plans, as appropriate, developed and under implementation.	
	2g. Agrobiodiversity		
	To have 70% of local agro-biodiversity under ex-situ protection	Local varieties and breeds documented.	Local varieties and breeds are documented and conserved in ex-situ collections in Mauritius.
		At least 70% of local varieties and breeds of agrobiodiversity are conserved in ex-situ collections.	
		Traditional knowledge on each accession in ex-situ collection documented.	
	2h. Repatriation of Genetic Material		
	Identify/assess overseas holdings of Rodriguan genetic resources and	International ex-situ holdings of specimens and genetic material identified and access secured	Liaison with Kew Garden for repatriation of endemic plants of Rodrigues.

	specimens and secure access as required		
Strategic Objective 3: Enable Sustainable Use of Biodiversity	**3a) Ecotourism Development**		
a	*Develop an ecotourism strategy*	Ecotourism strategy finalised, approved and under implementation	Rodrigues Tourism Office set up in 2006 and still operational.
	3b. Review the Environment Protection Act.		
	To better integrate issues of biodiversity concern into the functioning of the EPA.	Biodiversity issues are better represented in final EIA documents.	100 % done
		Public input EIAs on large developments enhanced and maintained.	
		New process for the selection of EIA consultants that ensures independence from developers.	
		Activities requiring EIAs updated	
	3c. Traditional Use of Plants		
	To manage species of plant harvested for traditional use	Public awareness on protected plant species enhanced.	Not yet done
		Sustainable use of key plant species subject to traditional use enabled	
	3d. Fishing		
	3d (i) Lagoon fishery.		
	Enable sustainable utilisation of lagoon fishery resources	Protected area network strengthened and expanded (x-ref WP 1c).	No take zones established for SEMPA. Legislation exists for the collection and banning of marine shells.
		Stakeholders effectively involved in beneficial management regimes.	Reduction of Seine Net Licence from 17 to 5. Scheme of Bad Weather Allowance reviewed to zoning. Conversion of 300 lagoon fishermen through training into off lagoon fishermen. Construction of 11 off-lagoon fishing boats for off-lagoon fishing. Skipper training delivered to fishers to enhance ecotourism sector. Octopus closure regulation to regulate octopus fishery exploitation. (The Rodrigues Regional Assembly (Octopus Closed Season) Regulations 2012)
		Lagoon resources better managed and providing	Community Resource Observers who are fishers recruited for assisting in

		improved sustainable yields.	the surveillance of SEMPA zones have been established. Community Watchmen are involved in the surveillance of lagoon during octopus-closed season.
	3d (ii) Game fishing	Strategy developed, approved and under implementation.	Not yet done
		Game fishing industry continues to develop in sustainable manner.	
		Negative interactions between game fishers and artisanal fishers reduced.	
	3e. Agrobiodiversity and Sustainable Agriculture		
	Encourage the utilisation of native agro-biodiversity and increase the sustainability of agricultural practices	Usage of traditional varieties is increased and economically viable.	The Mauritius Research Council (MRC) is liaising with a number of institutions to fine-tune the transformation of local seaweeds into plant growth promoter/bio-fertiliser products in Mauritius and Rodrigues. Furthermore two seaweeds of high potential for plant growth promoter manufacture have been identified. Four experimental seaweed farms have been set up in Mauritius and Rodrigues since November 2011. It is anticipated that this new industry will alleviate the problems of increasing fertiliser prices and the high costs of pig feed that agricultural community is facing.
		Organic farming practices more widely utilised.	
Strategic Objective 4: Maintain Ecosystem Services	**4a. Forest management**		
	Protect watersheds and soils by increasing forest cover.	Equitable consultation mechanism between grazing and forestry interests established.	Not yet done
		Forestry policy and current livestock grazing practices harmonised enabling an extension of forestry cover in priority areas.	Not yet done
		Priority areas for erosion, catchments and biodiversity management (re)planted as appropriate.	30 % Recommendations available.
	4b) Water Quality		
	To reduce water pollution	Baseline established for water quality in freshwater sources and lagoon.	Began in SEMPA, discontinued in 2012
		Point sources for pollution identified and mitigated.	
		Adaptive management improves ambient water	

		quality.	
Strategic Objective 5: **Manage Biotechnology and its Products**	**5. The Cartagena Protocol on Biosafety**		
	To implement the Cartagena Protocol on Biosafety.	Public receives balanced information on the use of biotechnology.	-
		Societal choice with regard to the handling transfer and use of LMOs and their products in Rodrigues is determined.	
		Administrative and legislative framework is put in place in line with requirements specified under the National Biosafety Framework document and local circumstances.	

Chapter 3. Progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals

3.1. Progress towards the 2020 Aichi Biodiversity Targets

The lack of baseline studies and measurable targets hindered the quantification of the progress made towards the Aichi Target 2020. However, table 18 shows the efforts made by the Republic of Mauritius towards the CBD Strategic Goals and 2020 Aichi Biodiversity Targets. The table presents the Strategic Goals and the 2020 Aichi Targets, Mauritius NBSAP programmes of work, objectives.

The NBSAP implementation contributes to different extents in terms of habitat loss, fragmentation and degradation; sustainable fisheries, agriculture, aquaculture; water pollution, IAS, vulnerable ecosystems, Protected Areas, species, genetic diversity, and to some extend to science and research. The NBSAP revision will start in 2015. Although the NBSAP does not refer directly to biodiversity awareness, mainstreaming and incentives, work has been achieved in these areas or they are addressed through experimental studies and actions. Yet, Aichi Targets (1, 2, 3, 4, 11, 14, 16, 20) need further improvement.

3.2. Progress towards the achievement of the 2015 targets of the MDG

In the 2013 Millennium Development Goals Status Report (Republic of Mauritius, 2013b), the Government of Mauritius stated that the country was struggling to achieve target 7 B Reduce biodiversity losses for the Goal 7 Ensure Environmental Sustainability. The first trends show progress over the last four years as for the contribution of the NBSAP implementation towards the Millennium Goals. Although the terrestrial protected areas network and marine protected areas total area remained unchanged, management of these areas is reinforced in terms of management plans development (PA management plans either validated or under validation by the MOAIF) and implementation. In terms of species conservation, progress is made in the conservation of some endemic species. 4 birds and 1 bat have been down listed the last four years on IUCN Red List of Threatened Species from Critically Endangered to Endangered (*Psittacula eques*, *Foudia rubra*), Endangered to Vulnerable (*Pteropus niger*), Vulnerable to Near Threatened (*Foudia flavicans*), and Endangered to Near Threatened (*Acrocephalus rodericanus*). Negative trends have been registered for two bird species: Mauritius kestrel (*Falco punctatus*) and Mauritius cuckoo-shrike (*Coracina typical*) from 2002 to 2013. To improve and sustain the progress towards the achievement of target 7 B indicators will need to be developed and monitored in addition to the existing environment indicators (appendix 3).

3.3. Lessons learned from the implementation of the Convention in Mauritius

The main lessons learned from the implementation of the Convention in Mauritius are:

- Biodiversity importance is incorporated at the highest level through the MID strategy but its information is fragmented among institutions and organisations, therefore it is of foremost importance to strengthen Mauritius institutional mechanisms for the coordination, the implementation and the monitoring and evaluation of biodiversity conservation, sustainable use of natural resources and implication for human well-being.

- There is value in improving baseline data sets, particularly to help track and monitor progress against Mauritius national targets and help inform decision-making.
- National-scale measuring and accounting in relation to natural capital (including biodiversity) could be strengthen through Mauritius' involvement in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).
- A reinforcement of human resources in terms of capacity building (technic and economic) and number of staff sustained by biodiversity funding mechanism will ensure the implementation of the NBSAP.
- Lack of scientific knowledge sharing amongst the different institutions and access to information is a limit to the NBSAP implementation and to development of synergies amongst the biodiversity thematic areas.

3.4. Summary of future priorities and capacity building needs

The future priorities identified to address the gaps and challenges, to improve the implementation of the NBSAP at national and local level are listed below.

- Implementing a sustainable national biodiversity coordination mechanism. This approach would foster a democratised participation while at the same time it optimises the NBSAP implementation; the monitoring and evaluation of biodiversity conservation strategies (IAS, PAN expansion, Nagoya protocol), activities, and existing synergies. This mechanism also caters for participation by the RRA and also for the NBSAP implementation relevant for Rodrigues. It would function as an inter-institutional coordination committee, bringing together key participants (focal points, nominated lead and co-lead for the various sub thematic areas etc.) promoting inter-institutional exchanges to take place regularly, while synergies are generated at the level of implementation, including the line ministries and other actors. Such a mechanism will ensure biodiversity mainstreaming across sectors in Mauritius. Important to its success is an enabling environment, including appropriate legislation framework, delegation of authority, and leadership at the highest levels.
- Building ecological resilience at landscape scale by protecting habitats and reducing existing pressures.
- Increasing connectivity by establishing conservation linkages across the landscape and therefore facilitating the adaptation of species to climate change.
- Mainstreaming biodiversity issues in the government, business, scientific and education sectors thus ensuring that biodiversity is not discounted in development process and government and industry decisions.
- Establishing base-line data sets and long-term monitoring mechanisms to inform decision-making, and information exchange.
- Developing a financial resources mobilisation strategy.
- Developing a scientific data and publication exchange mechanism to improve the CBD reporting and exchange mechanisms, including the Clearing House Mechanism (CHM).

In terms of capacity building, the priorities include:

- *Technical capacities*: training of personnel in scientific methodology, taxonomy and biodiversity censuses; training on development of improved bio-control methods for already established IAS; pest and diseases; capacity enhancement at relevant organizations on CC impacts, deployment of latest technologies and in the identification of vulnerable areas and mitigation analysis; capacity enhancement in CC science: training of farmers on sustainable agricultural practices (high relevance for Rodrigues); capacity building in the development of strategies for controlling and/or mitigating land degradation, with inputs from foreign experts;

- *Support to targeted research* along with development of new models of partnership and cooperation in order to strengthen capacity building in the fields of scientific research and development, information collection and dissemination is essential to enable stakeholders to bridge the knowledge gaps as well as ensure sound implementation of relevant measures and activities in line with the requirement of the three Rio conventions.
- *Core activities capacities*: education and awareness rising; data management, information access and networking (include data collection, quality control and archiving); training and re-training.

Table 18. Aichi Targets and Mauritius NBSAP 2006-2015 work programmes and objectives

Aichi Targets	*Targets - Work programme*	**Progress towards 2020 Aichi Targets**
Strategic Goal A: ***Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society***		
	Not mentioned in the NBSAP 2006 - 2015	Sensitisation and Awareness Programmes on the value of biodiversity are undertaken by most of the stakeholders who work on biodiversity (FS, NPCS, MAIFS; MESDDBM; MOEMRFSOI, MoE, NGOs). To sensitise all target groups on the critical importance of biodiversity, the NPCS, the FS and the MESDDBM carry out regular public awareness programmes. For instance, at school level, nature/endemic corners have been created and talks are delivered. Furthermore, Visitors Centres and guided tours in nature parks also raise awareness on biodiversity. Recently, nature walks have been set up by the FS to offer scope for recreational, environmental education, and for raising awareness on the native fauna and flora and the importance of conservation of biodiversity. Blue Bay Marine Park visitor centre to be launched. By next year another centre Balaclava Marine Park 2015. A Climate Change Information Centre has been set up in July 2013. This Centre provides consolidated information on climate change, which is accessible to students, researchers, private sector organizations, NGOs, and to the general public. This Centre aims to become a regional Climate Change Information Hub for the Eastern African Region in the near future (MESDDBM). The CCIC has embarked on the MS ISO 9001:2008 implementation. Biodiversity is mainstreamed in education curricula at all levels (primary, secondary and tertiary levels). For primary education the National Curriculum Framework is currently under revision and biodiversity is integrated either directly or indirectly. Activities such as the ARGO project (UNESCO), Green Flag award, platform and network, MID Club are already carried out. In 2015 a new component will be launched for high school certificate and professional ICT and Global perspectives, its topics include Biodiversity, Sustainable Development and Climate Change (online – Cambridge UK). In Rodrigues, activities to promote biodiversity through awareness include swimming and snorkelling courses, first aid and life saving courses, practical knowledge development in lagoon and fish ecology sustainable fisheries, coastal dangers to fishers, education and sensitisation campaigns to general public and students, and marine Tourist Guide Training.
	Not mentioned in the NBSAP 2006 - 2015	Accounting of Mauritius natural capital and ecosystem services helps in assessing the impact of economic growth on environment and internalising the impact into a decision-making framework. It also provides indicators for the economy and society, which in turn helps in achieving the elements of a green economy. In 2012, the Indian Ocean Commission (IOC) supported the development of Ecosystem/Natural Capital accounts. The study 'Experimental Ecosystems Natural Capital Accounts. Mauritius case study. Methodology and preliminary results 2000-2010' done by Jean-Louis Weber. MID commission funds a second phase of the study. In 2012, National Marine Ecosystem Diagnostic Analysis. Mauritius. Contribution to the Agulhas and Somali Current Large Marine Ecosystems Project (supported by UNDP with GEF grant financing). However, these studies need to be deepened and integrated into a plan for integrating the value of biodiversity into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems (Target 2).

	Not mentioned in the NBSAP 2006 - 2015	Although, neither the NBSAP, nor the Fourth National Report touched upon the issue of incentives and harmful subsidies, these walk hand-in-hand with valuation of biodiversity, but it moves the agenda one step further, as it focuses on what needs to be done for effectively protecting the country's biodiversity from an economic and public finance point of view. ***2 positive incentives in the forestry sector in 2014***: PAN project has successfully initiated an innovative financing of forest ecosystem restoration (2013) by private sector partnership through the Corporate Sustainability and Green marketing process (CSR funding from the National CSR committee). 2 MoU signed with the Private Sector.
	Not mentioned in the NBSAP 2006 - 2015	Climate change is a major concern to Mauritius as an island state. This was recognised both in the NBSAP and in the Fourth National Report. Yet, the concept of resilience and sustainable production are still to be fully incorporated into the upgraded NBSAP.
Strategic Goal B: ***Reduce the direct pressures on biodiversity and promote sustainable use***		
Aichi Targets	***Targets - Work programme***	**Progress towards 2020 Aichi Targets**
	*To enhance conservation of native flowering plants and ferns.*	Strategic objective 2, programme 2b: In progress
	To review and enhance the conservation of endemic birds. *To protect seabird colonies.* *To protect migratory birds.*	Strategic objective 2, programme 2c: In progress Species databases established. Recovery programmes under implementation for priority species. AEWA Rivulet Terre Rouge estuary bird sanctuary managed by NPCS according to AEWA principles. 30 % of the Ramsar action plan implemented.
	To enhance the conservation of bat species.	Strategic objective 2, programme 2d: Achieved Conservation status and priorities of bat species determined and population databases have been established and trends through time elaborated. Fruit bat ecology including range and feeding niche are understood. Impact reduction techniques tested and viable options under implementation. Feasibility and practicality of re-introduction of Rodrigues fruit bat have been determined and decision made.
	To review and enhance the conservation of reptiles.	Strategic objective 2, programme 2e: In progress The occurrence of and distribution of key populations have been mapped and priorities determined; and the ecology requirements of priority species understood. New populations of key species have been established. IOSEA Action Plan under effective implementation

	*Enable sustainable utilisation of fishery resources.*	Strategic objective 3, programme 3c, (i), (ii), (iii), (iv), (v): In progress Fishing controls are enhanced and fishery stocks and by-catch are better managed. Fishing efforts in the lagoon have been reduced and fish populations show recovery. New management regimes have community support. Shells and coral receive are better managed.
	*Develop an ecotourism strategy.*	Strategic objective 3, programme 3a, 3d: In progress Ecotourism committee established and operating, and basis for ecotourism strategy has been determined by review of existing initiatives. Ecotourism strategy under implementation and administered by ecotourism bureau.
	To increase sustainable agriculture and encourage the use of local varieties and breeds.	Strategic Objective 3, 3d): In progress Demand for and supply of organic produce increased, particularly that of local varieties and breeds (no data yet but trends). An incentive system in place to encourage organic and beneficial traditional farming practices and varieties/breeds. Biodiversity considerations have been incorporated into permit system for water access.
	*To increase coastal protection.*	Strategic objective 4, programme 4c: In progress Impacts and costs of coastal erosion reduction are on-going activities (Integrated Coastal Zone Management (ICZM) Framework has been adopted by Government in 2010 for implementation). Dispute mechanism functioning providing stakeholders with recourse to appeal against development decisions are in place. Coastal habitats receive greater protection under the law: activities relating to environmental disasters in the coastal zone namely tsunami and oil spills are developed under the ICZM division and the National ICZM Committee. In this regard, it has developed a National Oil Spill Contingency Plan and a Coastal Sensitivity Atlas for Oil Spill Response.
	To reduce water pollution.	Strategic Objective 4, programme 4b: In progress Database of ambient water quality through microalgae monitoring programme (CWA, Water Unit, MEPU) started in 2012, 2013 to 2014 following watershed management approach. Wetlands receive higher protection: Pointe d'Esny designated in 2011 as a Ramsar Site, Wetlands of International Importance.
	*To develop and implement a comprehensive national IAS Strategy and Action Plan (NIASSAP).*	Strategic objective 2, programme 2a: In progress National Invasive Alien Species Strategy for the Republic of Mauritius (2010 - 2019) adopted and supported by the 'Native Terrestrial Biodiversity and National Parks Bill (20xx)' at State Office includes CITES provision and control of wildlife population (threatened species protection against IAS) and 'native Terrestrial Biodiversity and National Parks Regulation 20xx' – will replace Wildlife and National Parks Act 1993 and Wildlife and National Parks regulations 1996. Action plan under implementation.
	*Enable sustainable utilisation of fishery resources.*	Strategic objective 3., programme 3c, (i), (ii), (iii), (iv), (v): In progress Fishing controls are enhanced and fishery stocks and by-catch are better managed. Fishing effort in the lagoon reduced. Fish populations show recovery. New management regimes have community support. Shells and coral receive are better managed.
Strategic Goal C: ***To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity***		

	*To place 10 % of Mauritius terrestrial area within a PAN by 2015.*	Strategic objective 1., programme 1a, 1c: Mauritius: In progress; Rodrigues: under development in Rodrigues Viable and representative PAN consisting of at least 10 % of land mass established. A plan for fully implementing the Programme of Work on Protected Areas, including increased protection and landscape/seascape connectivity – the existing NBSAP does not adequately address issues related to the establishment of an effective protected area network as outlined in Target 11. Protected area law and categories provide for a comprehensive and graded range of protective and usage regimes. 300 Ha of priority areas on 1000 Ha expected for by 2020 are currently under intensive management.
	To develop and maintain a representative MPA network.	Strategic objective 1, programme 1c: In progress ICZM Framework has been developed and a study on ESA undertaken (identification of seagrass beds and mangrove ecosystems, gap analysis of coral communities, prioritisation of coastal wetlands) for the proper and rational management of coastal and marine resources. Key habitat areas identified and incorporated into sensitive area atlas (ESA, 2009). Permanent buoys demarcate marine areas: done for the 2 Marine Parks. Different buoys are represented (zoning done depending on the sensitiveness of the habitats). Work is on-going for the other MPA but is subject to lack of funding.
	*To develop costed and scheduled management plans, for each PA, that enables adaptive management.*	Strategic objective 1., programme 1d: In progress Each Protected Area has a structured, time bound and targeted management plan that enables adaptive management: 2 national parks: one under revision and one on-going process. Management plans for islets done; and management development for mainland nature reserves planned for 2015 (Forestry Service, MoAISF).
	*To have 70% of local agro-biodiversity under ex-situ protection and document knowledge on native agro-biodiversity (including cultivated medicinal plants).*	Strategic objective 2., programme 2g: In progress List and detailed characterisation of breeds and varieties documented. Increase the local varieties and breeds of agro-biodiversity represented in ex-situ collections.
Strategic Goal D: ***Enhance the benefits to all from biodiversity and ecosystem services***		
	*Protect watersheds and soils by increasing forest cover.*	Strategic objective 4., programme 4a: Under development Existing core areas are protected. Nursery capacity adapted to new planting needs. Forest cover increased and optimised by incorporating new priority areas.
	Not mentioned in the NBSAP 2006 - 2015	

	Not mentioned in the NBSAP 2006 - 2015	The NBSAP does not address the need to strengthen ecosystem resilience and linkage, and the contribution of biodiversity to carbon stocks, including the restoration of at least 15 per cent of degraded ecosystems. Both the NBSAP and the Fourth National Report identify the need to better account for, manage and plan for climate resilience and adaptation as a major priority. A plan to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity through strengthening ecosystem resilience to climate change and the development of a comprehensive plan for sustainable production.
Strategic Goal E: ***Enhance implementation through participatory planning, knowledge management and capacity building***		
		NBSAP updating process planned for 2015
	*To have 70% of local agro-biodiversity under ex-situ protection and document knowledge on native agro-biodiversity (including cultivated medicinal plants).*	Strategic objective 2., programme 2g: In progress List and detailed characterisation of breeds and varieties documented. Increase the local varieties and breeds of agro-biodiversity represented in ex-situ collections.
	*Additional priorities for research and/or conservation identified.* *Conservation/research projects determined.*	Strategic objective 2., programme 2e: In progress Additional priorities for research and/or conservation identified: IAS bio-control researches; micro-organisms (terrestrial and marine) biodiversity; include social science in particular behavioural research; biodiversity valuation; research on Climate Change for SIDS in connection with coastal communities – vulnerability, and develop applied research. Conservation/research projects determined.
	Not mentioned in the NBSAP 2006 - 2015	

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Appendices

Appendix A. Information concerning the reporting Party and preparation of the FNR

The biodiversity planning process is driven by the body responsible for national implementation of the CBD, which is now the MAIFS through the NPCS. The NPCS director is the CBD national focal point (NFP) and leads the current biodiversity planning process with the support of the UNDP/GEF NBSAP project Enabling Activity Coordinator (EAC) with the support of an international consultant.

The biodiversity planning process in Mauritius consists of two phases:

1. Preparation of the Fifth National Report on the Convention on Biological Diversity,
2. The national biodiversity strategy and action plans revision in line with the Strategic Plan for Biodiversity (2011-2020) and its Aichi Targets.

The NBSAP revision planning process will be built on the Fifth National Report preparation.

The Fifth National report on the CBD preparation

a. Preparatory process of the Fifth National reporting

The MAIFS has the overall responsibility for coordinating the preparation of the national report and its submission to the CBD on 3rd October 2014. The NPCS director who is as well the UNDP NBSAP National Project Director oversees the process with the EAC to ensure that the report does not solely reflect the work of a few experts or agencies but the whole national biodiversity status.

The UNDP NBSAP project's EAC is in charge of collecting, coordinating and compiling the information. To this end, the EAC collaborates with the former members of the National NBSAP committee, existing bodies (ministries, representatives of the different committees that exist), on-going programmes and projects (Climate Change Division inter-sectoral climate change monitoring programme, Protected Areas Network project), non-governmental organisations and private sectors to fill in any gaps.

The draft Fifth National report on CBD will be submitted to the CBD on 3rd October 2014 for the COP 12, therefore the short timeframe does not permit to hold a series of large working group sessions. Thus face-to-face meetings with each stakeholder are organised. Their objectives are (i) to introduce the Fifth National Report Preparation process, (ii) collect data and information, mainstream gender, raise issues on the biodiversity planning process and emerging threats to biodiversity and gaps; and (iii) evaluate the level of biodiversity mainstreaming.

b. Relevant organisations identification

The first task was to identify the relevant organisations and stakeholders who need to be involved in the completion of the report. All stakeholders are asked to identify 'missing' ones who should be invited to participate. This list is flexible and missing stakeholders can be included at any time.

The stakeholders identified to participate in the preparation process have been provided with the relevant information, including the reporting guidelines, supporting materials and Mauritius and Rodrigues action plans to be completed.

c. Preliminary calendar and set of milestones

The table below describes the preliminary calendar and set of milestones, based on an estimate of the successive stages of preparing the report, the methodology adopted (face-to-face meetings, circulation of views by email, telephone, etc.), resources available, and planned deadline for completion of the draft report.

Steps - main activities	Sub-activities	Means of verification	Timeline
Stakeholders identification		Stakeholders list	2 first weeks of September
Face-to-face meetings Information collection	Documents collection Documents analysis Meeting with stakeholders	Document list List of meetings and contact names	
Data compilation in the NBS Action plan framework	Compile Mauritius activities and 2013 biodiversity status	NBSAP for 2013 biodiversity status	
Data compilation towards the Aichi Targets	Compile data towards Aichi targets	NBSAP aligned with Aichi Targets	
Data compilation for the indicators	Compile existing indicators	NBS Action Plans for indicators reporting	
Draft report compilation	Compilation of all the information gathered into the fifth draft report Draft report		22nd September
Draft Fifth National Report to CBD including reporting to Strategic goals and Aichi targets and indicators	Compilation of the inputs, recommendations of the inception report	Draft report	30th September
Thematic working groups	Fifth National Report for Mauritius and Rodrigues addition and stocktaking exercise Fifth National Report validation	Stocktaking exercise draft Thematic working groups minutes List of participants	Second week of February 2015 in the context of the NBSAP revision process By end of February 2015
Finalisation of the FNR	Administrative procedures	Final Fifth National Report	March 2015

d. Identifying sources of information and data, including use of indicators and the National Clearing-House Mechanism

Information and data

The sources of information considered for the documentation review to ensure that the FNR on CBD comprehensively reflects the national situation are:

- The MID, NCCAPF, MOER 2011, NDS which considered biodiversity in their country environment studies and assessments and evaluations of some ecosystem services and biodiversity at various levels.

- Information held by government agencies, national focal points of other conventions, research and scientific institutions, non-governmental organisations and local communities.
- Ministries' department national annual reports, projects reports such as the Mauritius National Marine Ecosystem Diagnostic Analysis (MEDA report, ASCLME, 2012), parastatal institutions.
- Research papers and website research.

In parallel a template of the NBS Action plans for Mauritius and Rodrigues in excel format, indicating where information is required for each part and section have been sent to relevant stakeholders for completion. This approach has as objective to ease the data compilation.

National Clearing-House Mechanism (CHM)

Discussion about opportunity to create synergies and to improve the availability of biodiversity-related information for the biodiversity planning process as well as for future reporting have taken place and some options identified (for example synergies could be created with the MESDDBM Climate Change department via the Climate Change Information Centre, the Data Server for Research and Academic Purposes at the University of Mauritius and Agricultural Decision Support System). However, to establish this mechanism additional information collection and discussion is needed. The mechanism will be discussed in the light of these ongoing activities and opportunities that will raise during the NBSAP revision process and a professional hired to biodiversity (such as the Biodiversity Indicators Partnership, Global Biodiversity Information Facility and the World Conservation Monitoring Centre, the Global Environment Outlook portal, among other relevant ones).

a. Data analysis and compilation

To ensure the quality of the data used in the report, the most up-to-date data and information are compared to relevant historical data or information to analyse trends, threats and impact on ecosystem services and human well-being. In addition confirmation of the trends are obtain through experts' opinions and qualitative assessments when needed and available.

b. Compiling drafts and finalising the report through stakeholder consultations and Submission of the draft FNR

The data and information collected are compiled into a first draft and submitted to the Ministry of Agro-Industry and Food Security by the 22nd September.

It will be circulated to all participants prior to the validation beginning of 2015. A first draft fifth national report on the CBD has been submitted on 3rd October 2014 before the COP 12.

c. Outreach and communication

FNR. Once the FNR report is validated and the final version submitted to the CBD Secretariat a communication on the Mauritius biodiversity status, trends, threats and impact on ecosystem services and human well-being is planned. A communication plan for the Biodiversity day the 22nd of May will be developed to have a maximum reach on Mauritius population and organisations. Its objective is to support biodiversity mainstreaming and insist on biodiversity importance for Mauritius.

Appendix B. Areal estimates for the various ESA by type and sub-category, ESA 2009

Name	Extent (ha)	Sea Frontage (m) (Approx)
GRAND PORT		
Grand Sable	0.1	66
Pointe du Diable	0.2	71
Bois des Amourettes	1.0	275
Old Grand Port	0.2	59
Riviere des Creoles	0.4	257
Mahebourg Village	0.2	107
Remy Ollier Square	0.4	180
Blue Bay	4.8	400
La Cambuse	5.5	692
Le Bouchon	11.0	1475
Pont Naturel	0.8	163
Le Souffleur	2.1	180
Petit Sable	0.8	349
Petit Sable(Toilet Block & Parking Space)	0.4	No sea fontage
Bambous Virieux (Portion 1)	0.1	87
Bambous Virieux (Portion 2)	0.2	110
Bambous Virieux (Portion 3)	0.2	75
Grand Sable	0.1	15
Providence	0.2	131
P.G.Vieux Grand Port	0.1	76
P.G.Virginia	2.5	314
Total	**31.4**	
SAVANNE		
Terracine	6.1	1048
Gris Gris	3.8	220
Telfair	1.4	285
Near Souillac Cemetery	1.3	885
Surinam	0.3	100
Saint Felix	0.6	391
Saint Felix	6.6	819
Riviere des Galets	11.6	1530
Bel Ombre	6.5	579
P.G.Bel Ombre	0.1	73
Ruisseau des Creoles	0.9	667
Total	**39.4**	
BLACK RIVER		
La Prairie (Exclusive of B/R-S Coast Rd)	2.2	300
P.G L'Embrazure	4.7	1930
Le Morne Brabant(Pointe Sud Ouest)	10.9	1000
P.G Le Morne(Near Berjaya Hotel)	0.4	40
P.G Le Morne	5.3	500
P.G. Comptesse La Marque	13.1	1395
La Preneuse	0.5	83
La Preneuse	0.1	
Tamarin	2.2	410
Wolmar	1.3	50
Flic en Flac / Wolmar(Near Pearle Beach Hotel)	12.7	1795
Flic en Flac(opposite Manisha Hotel)	2.1	545
Flic en Flac(opposite Restaurent Ocean)	2.1	512
P.G Anna	0.4	105
P.G Albion	1.8	205
P.G. Mon Plaisir	2.1	250
Petit Verger	0.2	62
Petit Verger	0.2	50
Pointe Aux Sables	1.1	88
Pointe Aux Sables(Near Fisheries Post and Training Centre	0.3	68
P.G.Petite Case Noyale	0.2	36
P.G.Petite Case Noyale	1.0	462
P.G. LaPrairie	31.6	451
P.G. LaPrairie	63.5	510
P.G. Les Salines Koenig	20.9	141
P.G. Petite Case Noyale	0.2	282
Total	**181.2**	
PORT LOUIS		
G.R.N.W(Sable Noire)	1.1	337

Source: Beach Authority

Appendix C. Main Environment Indicators, 2004, 2012 and 2013

Main Environment Indicators, 2004, 2012 and 2013

Indicator	Units	2004	2012	2013 [1]
1. Forest area	ha	47,200	47,143	47,108
2. Total forest area as a % of total land area	%	25.3	25.3	25.3
3. Irrigated land	ha	21,417	19,459	19,170
4. Land Protected Areas	ha	13,973	14,879	14,879
5. Marine Protected Areas	ha	7,216	7,216	7,216
6. Threatened plant species (NPCS)[2]	%		88	88
7. Threatened animal species (NPCS)[2]	%		89	89
8. Fish production (freshweight equivalent)	tons	9,471	4,961	5,982
9. Mean catch per fisherman day	kg	4.2	5.9	5.0
10. Total carbon dioxide emission	Gg or Thousand Tonnes	2,795.7	3,745.1	3,836.9
11. Per capita carbon dioxide emission	tons	2.3	3.0	3.0
12. Mean annual rainfall	millimetres	2,271	1,609	2,049
13. Annual fresh water abstraction	Mm^3	725	582	608
14. Daily per capita domestic water consumption	litres	165	160	165
15. Daily per capita solid waste disposed at landfill	Kg	0.88	0.87	0.97
16. Total electricity generated	GWh	2,165	2,797	2,885
17. Electricity generated from renewable sources	%	27.4	20.3	20.6
18. Total primary energy requirement	ktoe	1,255.8	1,427.6	1,454.8
19. Primary energy requirement from renewable sources	%	22.0	15.6	15.0
20. Per capita primary energy requirement	toe	1.03	1.14	1.16
21. Per capita final energy consumption	toe	0.69	0.68	0.69
22. Energy intensity	toe per Rs 100,000 GDP at 2000 prices	0.88	0.74	0.73
Other Environment Statistics				
23. Length of coastline	km		322	
24. Length of protective coral reefs	km		150	
25. Area of protective coral reefs	km^2		300	
26. Exclusive Economic Zone (EEZ) - Republic of Mauritius	km^2		2.3 million	

[1] *Provisional*

[2] National Parks and Conservation Service