



**MINISTRY OF ENVIRONMENT AND SUSTAINABLE  
DEVELOPMENT**

**Fourth National Report on the  
Convention on Biological Diversity  
—  
Republic of Mauritius**

**August 2010**



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## List of Abbreviations and Acronyms

<b>AREU</b>	Agricultural Research Extension Unit
<b>CBD</b>	Convention on Biological Diversity
<b>CBO</b>	Community Based Organisation
<b>CMA</b>	Conservation Management Area
<b>CoP</b>	Conference of Parties
<b>EPA</b>	Environment Protection Act 2002
<b>EIA</b>	Environmental Impact Assessment
<b>ESA</b>	Environmentally Sensitive Area
<b>FS</b>	Forestry Services
<b>FARC</b>	Food and Agricultural Research Council
<b>GEF</b>	Global Environment Facility
<b>GMO</b>	Genetically Modified Organism
<b>ICZM</b>	Integrated Coastal Zone Management
<b>IPM</b>	Integrated Pest Management
<b>IUCN</b>	International Union for Conservation of Nature
<b>MDG</b>	Millennium Development Goal
<b>MoAIFS</b>	Ministry of Agro Industry and Food Security
<b>MoE</b>	Ministry of Environment and Sustainable Development
<b>MoHL</b>	Ministry of Housing and Lands
<b>MPA</b>	Marine Protected Area
<b>MSIRI</b>	Mauritius Sugar Industry Research Institute
<b>NBSAP</b>	National Biodiversity Strategy and Action Plan
<b>NDS</b>	National Development Strategy
<b>NEP</b>	National Environmental Policy
<b>NES</b>	National Environmental Strategy
<b>NGO</b>	Non-Governmental Organisation
<b>NPCS</b>	National Parks and Conservation Service
<b>NRCC</b>	National Report Coordination Committee
<b>PAN</b>	Protected Area Network
<b>RRA</b>	Rodrigues Regional Assembly
<b>SBSTTA</b>	Subsidiary Body on Scientific, Technical and Technological Advice
<b>SST</b>	Sea Surface Temperature
<b>UNDP Co</b>	United Nations Development Programme Country Office
<b>UNEP</b>	United Nations Environment Programme
<b>UOM</b>	University of Mauritius

## **Executive Summary**

### ***Participatory process in the preparation of the Fourth National Report***

The preparation of the report was carried out through a thorough participatory process involving the relevant stakeholders from the public and private sectors, statutory bodies, research organisations, academics and NGOs.

Three thematic working groups were established as follows:

Group 1: Forest and Terrestrial Biodiversity

Group 2: Agrobiodiversity and Biotechnology

Group 3: Inland Water, Marine and Coastal Aquatic Biodiversity

Each group was facilitated by a local resource person/ team leader. A number of meetings/ working sessions were carried out in each of the working group.

A national consultant was hired to consolidate the inputs from the three groups. Further consultations were also held with the National CBD Focal point, the SBSTTA Focal Point and the three resource persons. This process culminated in the preparation of a draft Fourth National Report.

The draft report was circulated to all relevant stakeholders including the Secretariat and UNDP CO for views and comments. Finally, the report was finalized by incorporating views and suggestions received.

A ‘National Report Coordination Committee’ (NRCC) was set up to steer the whole preparation process. The meetings of the NRCC were chaired by the representative of the Ministry of Environment and Sustainable Development.

### ***Key Findings***

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 been identified as a Centre of Plant Diversity by IUCN while the Mascarenes region comprising of Mauritius (including Rodrigues) and France (Réunion) have been included in the list of Indian Ocean islands biodiversity hotspot.

As at to date, the extent of reasonable quality native forest (i.e., with more than 50% native plant canopy cover) is currently estimated at around 2,600 ha, representing less than 2% of the total area of the island. The remaining native terrestrial biodiversity is primarily confined to marginal lands of low suitability to agriculture and urban development such as steep mountain and valley slopes or to marshy and rocky soils where the land is largely undevelopable.

A general status of biodiversity in Mauritius is as follows:

#### ***Flora and Fauna***

- 685 species of indigenous flowering plant have been recorded in Mauritius, of which 267 are endemic (Mauritius has six endemic plant genera), and 150 endemic to the Mascarene Archipelago.

- 89 % of the Mauritius endemic flora is considered threatened (Mauritius has one of the most threatened island floras in the world). 61 of the country's indigenous species are already classified as extinct. 141 of the flowering Mascarene endemic plant species are classified as Critically Endangered (89 taxa are represented by 10 or fewer known individuals in the wild and 5 taxa are represented by only a single known individual), 55 species are Endangered and 98 are classified as Vulnerable.
- Rodrigues has three endemic genera of plants with 133 indigenous plant species. 123 species remain, including 37 endemics. Nine of the endemic species 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*).
- 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.
- 24 out of the 52 native species of vertebrates that were known to have occurred on Mauritius and the adjacent islets, are now extinct, including the Dodo (*Raphus cucullatus*), a giant parrot (*Lophopsittacus mauritianus*) and two species of giant tortoise (*Cylindropsis* spp.)
- Of the three species of fruit bat (*Pteropus niger*, *P. subniger* and *P. rodricensis*) known to have occurred, only one (the Mauritian fruit bat, *P. niger*) remains in Mauritius and is still locally common, but *P. subniger* is extinct. *P. rodricensis* still occurs on Rodrigues.
- Out of 30 species of land birds known/ stated to have been present on Mauritius, 12 of these have escaped extinction. Of these 12, 9 are threatened.
- Of the 17 native reptile species known/ stated to have once inhabited mainland Mauritius, only 12 remain, 11 of which are endemic. Seven of these are restricted to remnant populations on the northern offshore islets. The burrowing boa (*Bolyeria multicaarinata*) was last seen in 1975 and it is probably extinct.
- There are 39 native species of butterfly, of which five are endemic, and 125 known native species of land snail of which 43 are already extinct.

#### \Coastal and Marine Biodiversity

- To date, some 1700 marine species have been recorded around Mauritius including 786 fish of which about 5% are of commercial value (42 species). Seven species of shrimps of the genus Peneid can be found near Mauritian shores and two species inhabit deeper waters. There is one endemic species of oyster (*Crassostrea edulis*).
- Taxonomic studies have been made on forty-nine amphipod (Crustacea) species, 26 melitids and 23 corophiideans. Among these, nineteen new species have been recorded and described and twelve species are new records for the island. A high degree of endemism (38%) is recorded in the melitid and corophiideans of Mauritius.

- 2 species of marine turtles namely *Chelonia midas* and *Eretmochelys imbricata* are found in Mauritius waters.
- In Rodrigues, taxonomic studies and checklists have been published for marine algae, corals, crustaceans (amphipods and isopods), molluscs, echinoderms and coastal fishes.
  - 160 species of coral identified including an endemic species, *Acropora rodriguensis*
  - 494 fish species recorded, 9 new fish species recorded, out of which 2 are endemic species *Pomacentrus rodriguensis* and the dottyback, *Chlidichthys foudioides*.
  - 109 species of bivalve and 74 species of echinoderms
  - Coral reefs in Rodrigues are relatively healthy with up to 70% live coral cover recorded on the reef slopes, with low dead coral and macro-algal cover

#### *Ecosystem conservation, protection and management*

- 12 legally proclaimed protected areas on the mainland - one *National Park*, seven *Nature Reserves*, four reserves (three forest reserves and one bird sanctuary) - covering a total area of 7,292 ha.
- 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).
- 8 Islets National Park, 7 Nature Reserves and one *Ancient Monument* - covering a total area of 735 ha. The Ile aux Aigrettes Nature Reserve is leased for conservation management purposes to the Mauritian Wildlife Foundation (MWF), one of the active NGOs. Two islets (Flat and Gabriel islands) are leased for tourism activities to a state and private companies respectively.
- The Forestry Service and the Mauritian Wildlife Foundation (MWF) have jointly undertaken significant work in the restoration of Grande Montagne and Anse Quitor reserves where about 80,000 native plants have been planted. There is a private project by Francois Leguat Ltd to recreate 20 hectares of original forest at Anse Quitor. 35,000 native and endemic plants have been planted.
- 6,553 ha of privately owned or administered land is classified as *Mountain Reserve* or *River Reserve* in terms of the Forest and Reserves Act of 1983 and many of these areas have been deforested and/or are void of native plants.
- 635 ha of undeveloped land within the *Pas Géométriques* areas acting as a physical buffer to coastal developments.
- 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.)
- As at December 2009, some 92 endemic gardens have been created in primary and secondary educational institutions
- Marine Protected Areas

- Marine Protected Areas for mainland Mauritius cover an extent of 7 190 hectares, including six fishing reserves and two marine parks. The Blue Bay Marine Parks has been listed as the second Ramsar site.
- In Rodrigues, a high percentage of the marine ecosystem is still in pristine state. Among measures being implemented to mitigate factors affecting the marine environment, is the setting up of a marine protected area in Rodrigues, under the South East Marine Protected Area (SEMPA), funded by UNDP/GEF/RRA under the project “Partnerships in Mauritius and Rodrigues for Marine Protected Areas.” The project covers a total area of 43 km<sup>2</sup>.
- There are 5 designated marine reserves covering an area of 16 km<sup>2</sup>. 4 new marine reserves in the north of the island at Grand Bassin (14.1km<sup>2</sup>), Passe Demi (7.2km<sup>2</sup>), Passe Cabri (1.5km<sup>2</sup>) and Riviere Banane (1.5km<sup>2</sup>) have been identified following consultations with fishing communities. Same have now been agreed by the Rodrigues Regional Assembly and management regulations have been drafted.
- The lagoon and sea (up to an extent of 1 km from the HWM line) surrounding the 8 declared Islet National Parks also form part of the Islet National Park. This accounts for an area about 36 km<sup>2</sup>.

### *Threats*

The main threats to biodiversity under the various thematic areas are, firstly, potential loss of biodiversity and secondly, degradation/ loss of habitat. Key drivers identified are land clearing for development and others purposes (mainly in privately owned land), invasive alien species, habitat modification for deer ranching, pollution from land based sources and activities (mainly non point sources), and adverse impacts of climate change. Climate change is gaining prominence as the impacts are increasingly understood.

### *Implementation of the National Biodiversity Strategy and Action Plan (NBSAP)*

Conservation, protection and management of threatened native biodiversity as well as offshore islets management have been achieved through effective collaboration and partnerships by the relevant government departments, private sector organizations, academic institutions, research organizations, statutory bodies, CBOs and NGOs. The NBSAP for the Republic Mauritius was completed and approved by the government of Mauritius through the Cabinet of Ministers in December 2006. The Cabinet also approved the setting up of a steering committee under the chairmanship of the Permanent Secretary of the Ministry of Agro Industry and Food Security to steer and monitor the implementation of the NBSAP. NBSAP also reflects on the relevant CBD COP decisions, the 2010 Biodiversity targets and the Millennium Development Goals (MDG). Targets have been set for the year 2015 and implementation is underway. However, measures in the NBSAP have met with varying degrees of success.

The key constraints and challenges noted are

- Shortage of staff and turnover of staff
- Technology transfer (need for latest state of art technologies)
- Capacity building
- Impacts of climate change (both extreme events and slow onset), and

- Funding

The above-referred challenges coupled with external socio- economic factors inherent to a SIDS have rendered the current strategy for biodiversity management weak in thematic area such as agrobiodiversity.

### ***Future Priorities***

Biodiversity conservation, protection and management remain one of the key priorities for the Government of Mauritius. Future priority measures include, *inter alia*,

1. Continue with implementation identified in the NBSAP and achievement of the targets set,
2. Implementation of the National Invasive Alien Species Control Strategy and Action Plan (2010-2019),
3. Management of Environmentally Sensitive Areas (ESAs) in collaboration and partnerships with competent organizations including Research organization, academics, NGOs and CBOs,
4. Development of legislative framework for protection of ESAs,
5. Enhance Integrated Coastal Zone Management.
6. Strengthening conservation of marine biodiversity through establishment of MPAs.
7. Strengthening conservation and management of agricultural biodiversity,
8. Enhance Monitoring Programme to establish trend with regard to impacts of climate change, and
9. Climate proofing biodiversity conservation, management and sustainable use.

# Chapter I: *Overview of Status and Threats*

## 1.1 Introduction

The Republic of Mauritius has a total land area of 2045 km<sup>2</sup>, length of coastline of 496 km, 16 840 km<sup>2</sup> of territorial sea, and 1.9 million km<sup>2</sup> of Exclusive Economic Zone. It consists of two main islands, Mauritius (1865 km<sup>2</sup>) and Rodrigues (109 km<sup>2</sup>) and two groups of outer islands, namely the St Brandon Archipelago (3 km<sup>2</sup>) and Agalega (c. 21 km<sup>2</sup>). 49 offshore islets surround Mauritius while eighteen islets lie in the lagoon of Rodrigues.

The systematic management and conservation of the threatened native biodiversity and its offshore islets started in the early 1940s, and as at to date considerable progress has been achieved through effective collaboration and partnerships with relevant government departments, private sector organizations, academic institutions, research organizations, statutory bodies, CBOs and NGOs.

## 1.2 Status of Biodiversity

Biogeographically, Mauritius including Rodrigues forms part of the Mascarene Archipelago, along with Reunion Island (France) found in the Indian Ocean. All three are of volcanic origin and share many similarities in terms of their biodiversity.

Around 39% of all higher plants, 80% of non-marine birds, 80% of reptiles and 40% of the bat species are endemic to the island. Much of the indigenous animals' species has disappeared from Mauritius over the past 400 years of human settlement as a result of the introduction of invasive alien species, and land transformation.

### 1.2.1 Forest/ terrestrial biodiversity

#### A. Status

The flora and fauna of Mauritius has a relatively high level of diversity and endemism due to the island's location, age, isolation and varied topography. Mauritius has been identified as a Centre of Plant Diversity by IUCN and the Mascarenes (Mauritius, La Réunion and Rodrigues) have been included in the Madagascar and Indian Ocean islands biodiversity hotspot.

The status of the flora is the following:

- The extent of reasonable quality native forest (i.e., that with more than 50% native plant canopy cover) is currently estimated at around 2,600 ha, representing less than 2% of the total area of the island. The remaining native terrestrial biodiversity is primarily confined to marginal lands of low suitability to agriculture and urban development such as steep mountain and valley slopes or to marshy and rocky soils where the land is largely undevelopable. Such areas occur mainly in and around the Black River Gorges National Park in the South West, followed by the Bambous Mountain Range in the South East and the Moka-Port Louis Ranges in the North West. A few isolated mountain peaks also harbour remnants of native forest, for example, Corps de Garde, Trois Mamelles and Le Morne Brabant.

- 15 vegetation types (based on vegetation structure and physiognomy) have been classified, ranging from marsh communities to scrub associations to forest communities
- 685 species of indigenous flowering plant have been recorded in Mauritius, of which 267 are endemic (Mauritius has six endemic plant genera), and 150 endemic to the Mascarene Archipelago (refer to *Table 1*)
- 89 % of the Mauritius endemic flora is considered threatened (Mauritius has one of the most threatened island floras in the world). 61 of the country's indigenous species are already classified as extinct. 141 of the flowering Mascarene endemic plant species are classified as Critically Endangered (89 taxa are represented by 10 or fewer known individuals in the wild and 5 taxa are represented by only a single known individual), 55 species are Endangered and 98 are classified as Vulnerable.
- 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
- Rodrigues has three endemic genera of plants with 133 indigenous plant species have been recorded (Wiehe 1949, Cadet 1975). 123 species remain, including 37 endemics (Strahm 1989). Nine of the endemic species 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*).

The status of the fauna is the following:

- 24 out of the 52 native species of vertebrates that were known to have occurred on Mauritius and the adjacent islets, are now extinct, including the Dodo (*Raphus cucullatus*), a giant parrot (*Lophopsittacus mauritianus*) and two species of giant tortoise (*Cylindropsis* spp.)
- The only native mammal is bats. Of the three species of fruit bat (*Pteropus niger*, *P. subniger* and *P. rodricensis*) known to have occurred, only one (the Mauritian fruit bat, *P. niger*) remains in Mauritius and is still locally common, but *P. subniger* is extinct. *P. rodricensis* still occurs on Rodrigues. There is one endemic insectivorous bat species (*Taphozous mauritianus*) and one native also found on Reunion (*Mormopterus acetabulosus*).
- Out of 30 species of land birds known/ stated to have been present on Mauritius, 12 of these have escaped extinction. Of these 12, 9 are threatened.
- Of the 17 native reptile species known/ stated to have once inhabited mainland Mauritius, only 12 remain, 11 of which are endemic. Seven of these are restricted to remnant populations on the northern offshore islets. The burrowing boa (*Bolyeria multicaarinata*) was last seen in 1975 and it is probably extinct.
- There are 39 native species of butterfly, of which five are endemic, and 125 known native species of land snail of which 43 are already extinct. Of the invertebrate fauna, only butterflies, ants (Fisher *et al.* in 2005 – <http://www.antweb.org/mauritius.jsp>),

[butterflies \(Lepidoptera\)](#), Hymenoptera, Homoptera, Noctuidae, Gryllacrididae, Buprestidae, and some insect genera (e.g. *Cratopus*, *Syzygopsis*) and land snails have been studied.

**Table 1: Native diversity of selected groups in Mauritius, including the number of extinctions (numbers in brackets indicate the number of endemic species).**

	Number of native species	% species endemic	Number of extinct species	Number of extant species
<b>Angiosperms<sup>1</sup></b>	685 (267)	39%	61 (42)	624 (225)
<b>Mammals<sup>2</sup></b>	5 (2)	40%	2 (1)	3 (1)
<b>Birds<sup>2</sup></b>	30 (24)	80%	18 (15)	12 (9)
<b>Reptiles<sup>2</sup></b>	17 (16)	94%	5 (5)	12 (11)
<b>Butterflies<sup>3</sup></b>	37 (5)	14%	4 (1)	33 (4)
<b>Snails<sup>4</sup></b>	125 (81)	65%	43 (36)	82 (45)

1. Baider unpl.; 2. Cheke & Hume 2008; 3. Williams 2007; 4. Griffiths & Florens 2006.  
Updated from NBSAP (2006-2015)

The status of the protected areas is the following:

- 12 legally proclaimed protected areas on the mainland - one *National Park*, seven *Nature Reserves*, four reserves (three forest reserves and one bird sanctuary) - covering a total area of 7,292 ha.
- 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).
- 8 Islets National Park, 7 Nature Reserves and one *Ancient Monument* - covering a total area of 735 ha (refer to **Table 2**). The Ile aux Aigrettes Nature Reserve is leased for conservation management purposes to the Mauritian Wildlife Foundation (MWF), one of the active NGOs. Two islets (Flat and Gabriel islands) are leased for tourism activities to a state and private companies respectively.
- The Forestry Service and the Mauritian Wildlife Foundation (MWF) have jointly undertaken significant work in the restoration of Grande Montagne and Anse Quitor reserves where about 80,000 native plants have been planted to date. There is a private project by Francois Leguat Ltd to recreate 20 hectares of original forest at Anse Quitor. So far 35,000 native and endemic plants have been planted.
- 6,553 ha of privately owned or administered land is classified as *Mountain Reserve* or *River Reserve* in terms of the Forest and Reserves Act of 1983 and many of these areas have been deforested and/or are void of native plants.
- 635 ha of undeveloped land within the *Pas Géométriques* areas acting as a physical buffer to coastal developments.
- 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.)

- As at 2009, some 92 endemic gardens have been created in primary and secondary educational institutions

**Table 2: Current status and size of the terrestrial conservation areas of the mainland and offshore islets of Mauritius**

Name	Conservation status	Area (ha)
<b>Formal State Protected areas – mainland</b>		
<i>Black River Gorges</i>	National Park	6,574.00
<i>Perrier</i>	Nature Reserve	1.44
<i>Les Mares</i>		5.10
<i>Gouly Pere</i>		10.95
<i>Cabinet</i>		17.73
<i>Bois Sec</i>		5.91
<i>Pouce</i>		68.80
<i>Corps de Garde</i>		90.33
<i>Mare Sarcelles</i>		Reserve
<i>Bras d'Eau</i>	452.00	
<i>Poste La Fayette</i>	20.00	
<i>Rivulet Terre Rouge Estuary Bird Sanctuary</i>	Reserve	26.00
<b>TOTAL – MAINLAND</b>		<b>7,292 ha</b>
<b>Formal State Protected areas – offshore islets</b>		
<i>Pigeon Rock</i>	Islets National Park	0.63
<i>Ile D'Ambre</i>		128.00
<i>Rocher des Oiseaux</i>		0.10
<i>Ile aux Fous</i>		0.30
<i>Ile aux Vacoas</i>		1.36
<i>Ile aux Fouquets</i>		2.49
<i>Ilot Flamants</i>		0.80
<i>Ile aux Oiseaux</i>		0.70
<i>Round Island</i>	Nature Reserves	168.84
<i>Ile aux Serpents</i>		31.66
<i>Flat Island</i>		253.00
<i>Gabriel Island</i>		42.20
<i>Gunner's Quoin</i>		75.98
<i>Ilot Mariannes</i>		1.98
<i>Ile aux Aigrettes</i>		24.96
<i>Ile de la Passe</i>	Ancient Monument	2.19
<b>TOTAL – OFFSHORE ISLETS</b>		<b>735 ha</b>
<b>Pas Géométriques</b>		
<i>Plantations – varied</i>	Pas Géométriques	226
<i>Leased for grazing and tree planting</i>		230
<i>Unplanted, protective or to be planted</i>		179
<b>TOTAL – PAS GEOMETRIQUE</b>		<b>635 ha</b>
<b>Privately owned/managed conservation areas</b>		
<i>Varied</i>	Mountain Reserve	3,800
<i>Varied</i>	River Reserve	2,740
<i>Mondrain</i>	'Private Reserve'	5
<i>Emile Series</i>		8
<b>TOTAL – PRIVATELY OWNED/MANAGED CONSERVATION AREAS</b>		<b>6,553 ha</b>

Source: NBSAP (2006-2015) <http://agriculture.gov.mu>

## **B THREATS**

The key threats to the forest/terrestrial biodiversity of Mauritius and the offshore islets are loss of biodiversity and degradation of habitat. The drivers are summarized as follows:

### 1 Land conversion and habitat fragmentation

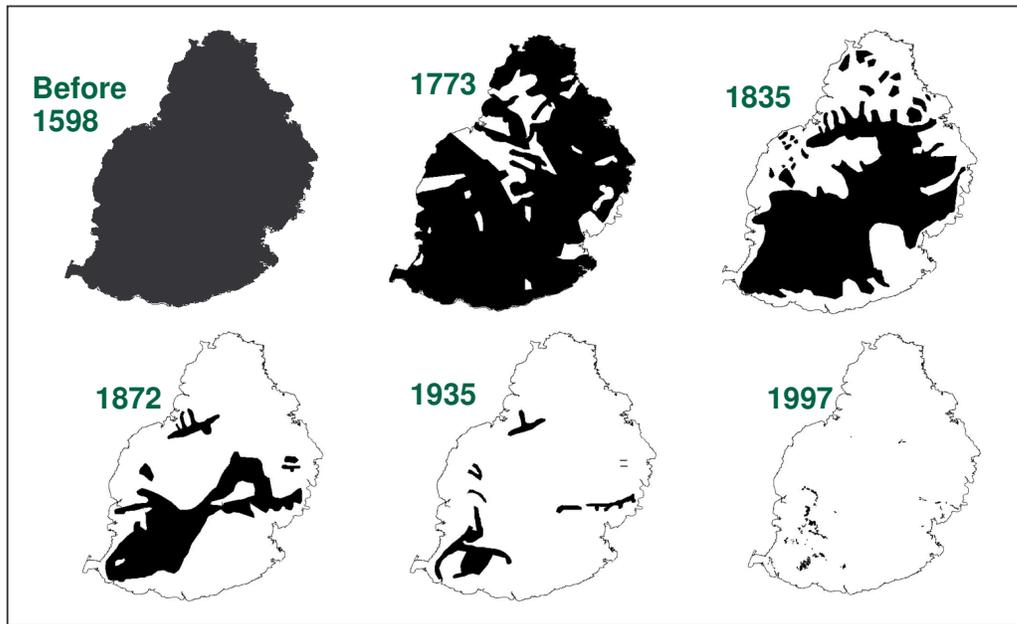
Forest clearance for agriculture and settlement began with the colonisation of the island in 1638, although selective logging for ebony (*Diospyros tessellaria*) started in 1598. Most of the forest cover had been lost by 1935, and the last major project of forest clearance occurred in the 1970s following a World Bank Funded scheme to replace native upland forest with plantation forestry based on pine (**Figure 1**). Further to these losses, habitat destruction and fragmentation continues on account of

- a. Gradual conversion of forest land to enlarge pasture areas for deer grazing.
- b. Demand for high quality land for development, particularly in prime coastal areas (including wetlands) where land is very scarce. Large private infrastructure and residential projects development are likely to pose serious threats to the integrity of the remaining lowland habitats. The National Development Strategy (2004) states that over the next 20 years, a further 15,000 ha of land may need to be released from the agricultural and forestry (**including native forests**) sectors to meet the projected needs for development of housing and social amenities.

The result of this fragmentation is that previously large contiguous populations of native species have now been reduced into small, and for most cases severely isolated populations. Despite some high profile conservation success stories like the Mauritius Kestrel, Pink Pigeon and Echo Parakeet and Mauritius Fody, the combination of extensive habitat destruction and fragmentation, and impact of invasive species is contributing toward a general decline, or local extinction, of many native species.

In 2005, the halting by the government of part of the construction of the link of the South Eastern Highway Project which was meant to cross the valley of Ferney, an area of native forest home to a diverse native flora of at least 140 species of fern and higher plants and several native animal species including at least ten vertebrate species and the best population of Mauritius Kestrel (*Falco punctatus*) was saved. Following cessation/modification of the development work, the government of Mauritius entered into a private-partnership scheme with the private land owners (Ciel Group), creating the Vallee de Ferney Conservation Trust. The Trust now employs a Conservation Coordinator and aims at using local and international funding for weeding and restoration of some 200 hectares of native forest under its hold.

*Figure 1 : The fragmentation of native forest on the mainland island of Mauritius*



Source: NBSAP (2006-2015), adapted from Vaughan and Wiehe, 1937 and Page and D'Argent, 1997

## 2 Invasive alien species

Invasive alien species is considered the most serious threat to Mauritian native terrestrial biodiversity. There are dozens of aggressive invasive alien weeds threatening Mauritian biodiversity. Among the main invasive woody species are three forest trees (*Ligustrum robustum* var. *walkeri*, *Litsea monopetala*, *Tabebuia pallida*), four fruit trees and spice plants (*Flacouria indica*, *Psidium cattleianum*, *Schinus terebrinthifolius*, *Syzygium jambos*), six ornamentals (*Ardisia crenata*, *Hiptage benghalensis*, *Homolanthus populifolius*, *Lantana camara*, *Livistona chinensis*, *Ravenala madagascariensis*), one fodder plant (*Luecaena leucocephala*) and two accidental introductions (*Clidemia hirta*, *Rubus alceifolius*). Strawberry guava (*P. cattleianum*, Myrtaceae), a native of Brazil, in Mauritius can reach densities of up to about seven million stems at or above 1.3m high per km<sup>2</sup> (Ramlugun, 2003). The negative effect of competition for light, water and minerals with native plants is massive, leading to major reduction in reproductive output, increased mortality and reduced growth rate as documented for Tambalacoque (*Sideroxylon grandiflorum*, Sapotaceae), (Baider and Florens, 2006), contributing further to the gradual replacement of native communities by alien plants which in turn constitute poor habitats for most native animals.

Many invasive alien animals also present a major threat to both native fauna and flora. At least 21 introduced species of mammals, reptiles and molluscs are naturalized in Mauritius. The Pink Pigeons (*Nesoenas mayeri*) are constantly at risk of predation by feral cats (*Felis catus*); and rats (*Rattus rattus* and *Rattus norvegicus*) have been documented to destroy up to 60% of the seed crop of Bois Colophane (*Canarium paniculatum*, Burseraceae) (Auchoybur, 2003) doubtless contributing to the poor regeneration of the tree despite *in-situ* conservation management. Monkeys (*Macaca fascicularis*), rats, pigs (*Sus scrofa*), and Rusa deer are directly detrimental to the native vegetation, and are either indirectly or, together with the lesser Indian mongoose (*Herpestes auropunctatus*). Predation by rats, tenrecs (*Tenrec ecaudatus*), for example, appears to pose a serious threat to the survival of endemic snails.

Very little information exists on the impact of insect pests and diseases on Mauritian biodiversity, but it is likely that their effect on ecosystem degradation has been underestimated as shown by one study of Kaiser *et al.* (2007) who report how coffee plantations increased pest load on endemic plants in nearby natural areas. Insect introductions to Mauritius accelerated considerably in the late 20<sup>th</sup> century in line with increased international traffic. Of the 22 significant pests to have entered Mauritius, 14 arrived after 1975. No reliable information exists on the effect of such pest species on native biodiversity. Pink pigeons for example are known to be very prone to three serious pathogens like *Trichomonas*, a protozoan transmitted directly or via contaminated food or drinking water; *Leucocytozoon marchouxi* a protozoan transmitted by blackfly (Simuliids); and avian pox, a virus spread by contact, contaminated surfaces or insect vectors notably mosquitoes. Psittacine beak and feather disease is causing a problem for the recovery programme of the Echo Parakeet.

Fire-degraded mountain slopes occupy the western rain shadow side of mountains of north-western Mauritius. These slopes were certainly previously covered with natural forests. However, with the removal of the native forests for wood and regular outbreaks of fire (recorded to be annual in some of the areas around Port Louis since 1770's), grassland composed of invasive alien species tend to predominate. The dominance of alien grasses precipitated the opportunistic grazing by livestock on these dry slopes, perpetuating the dominance of grass species and inhibiting the recovery of native forest species, though in some areas the invasive alien liana *Hyptage benghalensis* forms impenetrable shrubland. Many of these slopes lie fallow and unused for grazing and a number of fire-adapted woody invasive species have subsequently encroached into these grassland areas.

### 3 Habitat modification for deer ranching

The introduced Rusa deer from Java (*Cervus timorensis russa*) is reared on extensive farms and estates for hunting purposes. The meat is used exclusively for the local market and trophy horns for the local and foreign hunting fraternity. It is estimated that there are about 70,000 heads on some 25,000 ha (15,000 ha in private ownership and 10,000 ha in state-lease land ownership) of semi-natural forest areas at a stocking rate of ~2.8 deer/ha. Deer ranching in the privately owned land remains largely unregulated/ poorly enforced, with large proportions of native forest habitats transformed to pasture lands. All privately owned mountain and river reserves have legal protection under the Forest and Reserves Act (1983) but nevertheless they are heavily impacted by Rusa deer and other invading plant and animal species.

### 4 Hunting and harvesting

Direct exploitation of certain species has pushed them towards extinction. The Dutch colonised Mauritius mainly for its ebony (*Diospyros tessellaria*), which was highly prized, but the species remains common. Several other native species were also exploited for their wood or for medicinal uses in the past, but their rarity today had ceased most of this kind of activity. Most species of Mauritian palms were exploited for their edible hearts and are all now highly threatened, including a species with only one individual remaining. The four endemic species of giant tortoise (two each on Mauritius and Rodrigues) are all extinct were heavily exploited for their meat, contributing to their extinction, as well many of the large birds and bats. Fruit bats are still being illegally killed since they are perceived as a danger to orchards in Mauritius, and legal culling if the species reach pest proportion is being addressed under the revision of the Wildlife and National Park Act (and such concept will be extended to any native species).

Direct exploitation of native species has now largely ceased although certain plant species are still being taken from the wild for handicraft and medicinal purposes and for horticulture, and endemic reptiles are occasionally caught for the international pet trade. Small quantities of endemic hardwoods are also still being exploited in certain areas.

## 1.2.2 Agricultural Biodiversity and Biotechnology

### A. Status

The majority of food crops cultivated and animals reared in Mauritius have been introduced over the last 4 centuries. These have undergone crossing, natural or induced, producing hardier cultivars and breeds. Agro-biodiversity is broadly categorized into sugarcane and non sugar sector (that is, vegetables, fruit, medicinal plants and livestock).

The share of agriculture in the economy has continued to decrease from 5.6% in 2006, 4.9 % in 2007 to 4.4 % in 2008. The area of sugar cane harvested has been decreasing as well from 64,260 hectares in 2007 to 62,024 in 2008, though yield of sugar increased from 435,972 tonnes to 542,062.

Status of the sugarcane is the following:

- The Mauritius Sugar Research Institute (MSIRI) maintains a collection of about 2200 genotype of sugar cane, which includes the basic *Saccharum* spp. and allied genera, early generations of inter-specific hybrids, commercial type hybrids, developed locally (38%) and imported from other breeding stations (31%).
- About 1800 to 2000 crosses from around 400 genetic combinations are made each year and about 66 000 new varieties are produced annually for evaluation. The evaluation and characterization of the germplasm are activities that are integrated in the breeding programme. Information on the agronomic, morphological, genomics and pest reaction of the clones are kept in relational databases and retrieved for use in breeding work.

Status for other food crops is the following:

- A total number of 686 varieties of different crops have been introduced and evaluated by the Agricultural Research and Extension Unit (AREU) since 1998 and farmers are encouraged to grow selected varieties. This practice tends to displace 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.
- Crop Improvement Programme at the AREU- characterisation and utilization, breeding and improvement works are underway on the following:
  - Onion (*Allium cepa*), garlic (*Allium sativum*), pea (*Pisum sativum*), snap bean (*Phaseolus vulgaris*), tomato (*Solanum lycopersicum*), cauliflower (*Brassica oleracea botrytis*), cucumber (*Cucumis sativus*), colocasia (*Colocasia esculenta var esculenta*), and cassava (*Manihot esculenta*)

- Litchi germplasm characterised using phenological, morphological characteristics and molecular markers. Fourteen litchi genotypes were identified in the local germplasm pool in 2007
  - 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.
  - 15 varieties introduced of tobacco (*var.*) and 3 were recommended over the last five years.
- 'Decoding genetic diversity to characterise local chilli varieties by morphological and molecular tools'. The morphological and molecular characterisation is undertaken by AREU and UoM respectively. 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.
  - *Ex-situ* Conservation
    - There are 452 accessions in the 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*, Cucurbitaceae, *Lycopersicon*, *Phaseolus*, Solanaceae, and *Vigna*.
    - Some wild relatives of the cultivated species that are found in the genebank are:
      - a. tomato- *Lycopersicon esculentum*
      - b. pigeon pea - *Cajanus cajan*
      - c. wild cucumber – *Cucumis sativa*
      - d. Potato - *Solanum tuberosum*
      - e. Eggplants: *Solanum melongena*
    - Another wild species of pea 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. These species of plants are collected, multiplied and conserved in the gene bank.
    - Some species are still new for the local production and at times for export with special mention of litchi and pineapple. It should be recalled that the Victoria pineapple was bred in the Mascarenes Islands and it is produced only by Mauritius, Reunion, Madagascar and South Africa for its typical acid taste.

For potato, a germplasm comprising of 120 imported clones and another 20 locally developed clones are maintained.

- A collection of 17 aromatic/ medicinal plants are as follows: mint (6 accessions), thyme (3 accessions), ayapana, baume du perou, citronelle, herbe boileau, vetiver, sage, curry leaf, garlic chives, rosemary, soulefaf, lilas de Perse, faux orthosiphon, local sasil (tulsi), curled and flat parsley, lemon balm is being maintained on AREU's station and they are being characterised and assessed for their potential as dried herbs and health aromatherapy.
- Fruit species collection comprises of both local and introduced varieties of mango, papaya, litchi, pineapple, banana, citrus and avocado

Status of farm animal genetic resources conservation is the following:

- A summary of various breeds for different species is given below in **Table 3** together with the main production systems with which they are associated.

**Table 3 : Breeds and Production Systems by species in Mauritius**

Species	Breeds	Systems
Cattle	Creole	Backyard
	Friesian	Backyard, intensive
	Mixed Zebu breeds	Intensive systems for 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

Source: Animal Production Division (APD) of the Ministry of Agro Industry

The Rusa deer 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 2008.

- 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. 37 Creole cattle and 11 local goats are being monitored at Curepipe Livestock Research Station for determination of productive and reproductive parameters. The semen of two Creole bulls is presently being used for Artificial Insemination by the Division of Veterinary Service of the Ministry of Agro-Industry, Food Production and Security along with imported semen of Friesian breed.
- The Ministry of Agro Industry Food Security 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 census is being carried out to determine the population of Creole cattle and local goats in Mauritius.

- The Curepipe Livestock Research Station is the only station on the island for research on cattle (Creole, Friesian and their crosses), goats (Local, Boer, and Boer crosses), sheep (Charmoise, Dorper and Dorper crosses) and rabbit (New Zealand white, Californian white crosses and Black Beveren crosses).
- Indigenous chicken known as “local chicken” in Mauritius and “Rodriguan chicken” in Rodrigues are, presumably, a mixture of Rhodes Island Red, Australorp and Naked neck introduced on the islands 2-3 centuries ago by early settlers. A study, funded by the IAEA, was carried out from 1999 to 2001 with the objectives of characterising family poultry production and identifying major problems faced by smallholder poultry farmers rearing local chicken.

A survey was carried out and it provided baseline information on the health and management of family poultry production. The results of the survey also provided the basis for proposing future interventions for improving production local chicken for both Mauritius and Rodrigues. The results of these studies were published in IAEA-TECDOC (2002) and Proceedings of sixth meeting of Agricultural Scientist (2003).

- Fodder research and development
  - A fodder research and development programme was set up by AREU in 2007 to: (a) set up and maintain a germplasm collection, (b) evaluate different fodder species, (c) introduce and evaluate new fodder species and (d) evaluation of the conservation properties of different fodder species.
  - The following species are being maintained at Curepipe LRS and Richelieu RS: Elephant grass: *Pennisetum purpureum*; Guatemala grass (*Trypsacum laxum*); Herbe d'Argent (*Ischaemum aristatum*); Kikuyu (*Pennisetum clandestinum*); Lucerne (*Medicago sativa*); Pangola (*Digitaria decumbens*); Rhodes grass (*Chloris gayana*); Setaria (*Setaria sphacelata*); Sweet potato (*Ipomea batatas*); Brachiaria brizantha (*Brachiaria brizantha*); Brachiaria ruziziensis (*Brachiaria ruziziensis*); Fatak Malgache (l'herbe fatak) (*Panicum maximum*); Herbe bourrique (*Stenotaphrum dimidiatum*); Mulberry (*Morus alba*); Siratro (*Macroptilium atropurpureum*); Rufa grass (*Hyparrhenia rufa*) and Sugarcane (*Saccharum officinarum*)
  - Fodder species that have been introduced and have been / are being evaluated are: Lucerne (*Medicago sativa*); Calliandra (*Calliandra calothyrsus*); Cratylia (*Cratylia argentea*); Sorghum (*Sorghum bicolor*); Rye grass (*Lolium perenne*) and Mucuna (*Mucuna pruriens*)

Status for application of biotechnology is the following:

- It has been applied in Mauritius for many years in processing of dairy products such as yoghurts, in brewing and transformation of molasses into alcohol amongst others.
- Mauritius carried out a study on ‘National Biosafety Framework’ with the support of the UNEP and GEF. A GMO Act was proclaimed in 2004 to address Genetically

Modified Organisms (GMO), but needs to include operational mechanisms. A project is ongoing for "The Implementation of the National Biosafety Framework for Mauritius", funded by UNEP / GEF and Government of Mauritius. There is also an active National Biosafety Committee

- There are five institutions that use biotechnological tools in production and implementing their research and development programme. These are (i) Agricultural Services of MoAIFS, (ii) MSIRI, (iii) FARC/AREU, (iv) University of Mauritius (UoM) and (v) Microlab (private enterprise). UoM is involved both in teaching/training and in carrying out research pertaining to biotechnology.
- It assists in genome mapping, marker assisted selection fingerprinting of cultivars and diversity studies. In recent years, different marker systems such as Amplified Fragment Length Polymorphisms (AFLPs) and Simple Sequence Repeats (SSRs) or microsatellites have been developed and applied to sugarcane.
- Tissue culture techniques are used in a number of institutions for the rapid multiplication of a wide range of plant species. These include:

<i>Barkly Experimental Station, (MoAIFS)</i>	Banana, Anthurium, Orchids, Gerbera, Pineapple and Strawberries
<i>FARC/AREU</i>	Banana, Anthurium and Gerbera
<i>UoM</i>	Tissue culture of orchids, asparagus, endemic plants and medicinal plants
<i>MSIRI</i>	Sugar cane and potato. The MSIRI produces tissue culture plantlets of sugarcane annually that are used to establish nurseries from which cuttings are supplied to growers. MSIRI also produces potato plantlets of clones that have been selected locally for minituber production for the seed multiplication programme
<i>Microlab Co. (Private Enterprise):</i>	Anthurium

- 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
- v. Real-Time PCR

These techniques are applied by the MSIRI, AREU, 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 MoAIFS, vaccines against 'Newcastle' disease and fowl pox are prepared using imported seed vaccines in the laboratory.

The Food Technology Laboratory of the MoAIFS 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. Experiment on embryo culture for the unique palm *Hyophorbe amaricaulis* was at an advanced stage of success.

## **B. Threats**

The key threat in the agricultural biodiversity is considered to be the loss of PGR as a result of

- Increase in use of modern agriculture and adoption of novel improved varieties. Traditional knowledge and varieties are rapidly fading out. Many species that were plentiful are now few in numbers and some are even considered to be threatened.
- Climate Change impact causing a change in production process and more reliance
- 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.

### **1.2.3 Inland Freshwater, Coastal and Marine biodiversity**

#### **A. Inland Water Biodiversity**

The freshwater biodiversity of Mauritius is mainly contained within some 90 rivers and rivulets for Mauritius and 43 for Rodrigues (Map of Mauritius and Rodrigues Y682 (DOS 529) of 1983)), several human-made reservoirs like La Ferme and Mare aux Vacoas, natural lakes such as Bassin Blanc Crater lake, as well as ponds and marshy areas. The inventory is still incomplete.

The status of inland biodiversity is the following:

- The first inventory of freshwater fish and macrocrustaceans was carried out in 2003 by "Association Réunionnaise de Développement de l'Aquaculture" (ARDA). No further studies (as recommended) have been carried out with the exception of

wetlands under the Environmentally Sensitive Areas study (2009) commissioned by the Ministry of Environment.

- The freshwater vertebrate fauna of Mauritius is markedly low in diversity and endemism. Of the 18 fish species found, 5 are introduced including 4 Poeciliidae (*Genera Gambusia, Poecilia and Xiphophorus*) and 1 Cichlidae (*Oreochromis niloticus*). None of the 13 native fish species is endemic to Mauritius. However, 2 are Mascarene endemics and another 2 are endemic to the Mascarene-Madagascar region. The others are of much wider distribution; 5 are Indo-African and 4 are Indo-Pacific species.
  
- For the invertebrates
  - 3 out of 10 species of macrocrustaceans belonging to two families (the Atyidae, with six *Caridina* spp. and one *Atyoida*) and the Palaemonidae (with two *Macrobrachium* and one *Palaemon*) are endemic to Mauritius. 1 of the remaining 7 species is endemic to the Mascarenes while the rest are of Indo-Pacific distribution. Most of these species occur at higher densities than in corresponding habitats on Réunion, which bodes well for their future. However, the edible ‘Camaron’ (*Macrobrachium lar*) is now rather rare as a result of its exploitation.
  
  - 18 species of freshwater and one of brackish water snails are known from Mauritius. This includes seven introduced and one cryptogenic species. Only one of the ten native species (the planorbid *Gyraulus mauritianus*) may be endemic to Mauritius. Overall, the native aquatic non-marine malacofauna is dominated by the Neritidae (five species) followed by the Thiaridae (two species).
  
  - Rodrigues has a poorer freshwater malacofauna consisting of six native species of which one (*Afrogyrus rodriguezensis*) is endemic to the island. Three freshwater snails species have been introduced and are now naturalised in Rodrigues’ rivers.
  
- For the native higher plant diversity
  - There are currently nine surviving endemic vacoas species (*Pandanus* spp.) with half of them maintaining world populations estimated at 200 or less, including *P. palustris* with only about 30 known individuals, out of the ten known to grow in marshes and streams or to be restricted to wet places very close to rivers (Bossier & Guého, 2003).
  
  - According to the Flore des Mascareignes (1974-2003), there are also an additional 24 native higher plant species from 14 families that are strongly associated with freshwater ecosystems. These include eight submerged aquatic species examples being *Utricularia gibba* and *U. stellaris*, the only native carnivorous plants of Mauritius; two floating aquatics, *Lemna perpusilla* and *Spirodela punctata* and 14 species that are rooted under water but have aerial shoots. 3 Of the 24 species being referred are endemic to Mauritius, including one, which appears to be extinct (*Eriocaulon johnstoni*).

## B. Coastal and Marine Biodiversity

Fisheries, coral reefs, mangroves, seaweeds, and sea grasses make up the major living resources within the coastal and marine areas while the non-living resources include sand, lagoons for recreation and common salt. Unexploited resources include substrate manganese nodules, tidal movements and solar radiation

Main economic activities in the coastal zone are tourism and fisheries. In 2008, tourism contributed 8.7% to the GDP and represents a source of earning for about 45,000 individuals from direct and indirect employment. The fisheries sector contributed 1.3% to the GDP and provides livelihood for about 2020 registered artisanal fishermen and some 320 fishers working on fishing banks (MoFR, 2009). Export of fish and fish products accounted for US\$ 267 million in 2008 (CSO 2008). Artisanal fishing in Mauritius is marketed but used at subsistence levels in Agalega and Saint Brandon. The maximum sustainable yield (MSY) is estimated at 1700 t. In 2009, artisanal fishing catch reached 820 t (MoFR, 2009). Fish catch comprises of about 42 spp. of fish and seven crustacean.

The status of the coastal and marine biodiversity is the following:

- To date, only 1700 marine species have been recorded around Mauritius including 786 fish of which about 5% are of commercial value (42 species). Seven species of shrimps of the genus *Peneid* can be found near Mauritian shores and two species inhabit deeper waters. There is one endemic species of oyster (*Crassostrea edulis*).
- Taxonomic studies have been made on forty-nine amphipod (Crustacea) species, 26 melitids and 23 corophiideans, in a study carried out by the University of Mauritius (Appadoo, 2005). Among these, nineteen new species have been recorded and described and twelve species are new records for the island. A high degree of endemism (38%) is recorded in the melitid and corophiideans of Mauritius.
- 17 species of marine mammals are recorded to live in or to cross Mauritian waters. In addition, very occasionally stranded seals may find themselves within Mauritian waters.
- 2 species of marine turtles namely *Chelonia midas* and *Eretmochelys imbricata* are found in Mauritius waters.
- Sea cows once common in Mauritian lagoons are not sighted.
- In Rodrigues, taxonomic studies and checklists have been published for marine algae, corals, crustaceans (amphipods and isopods), molluscs, echinoderms and coastal fishes (Oliver & Holmes, 2004).
  - 160 species of coral identified including an endemic species, *Acropora rodriguensis*
  - 494 fish species recorded, 9 new fish species recorded, out of which 2 are endemic species *Pomacentrus rodriguensis* and the dottyback, *Chlidichthys foudioides*.
  - 109 species of bivalve and 74 species of echinoderms
  - Coral reefs in Rodrigues are relatively healthy with up to 70% live coral cover recorded on the reef slopes, with low dead coral and macro-algal cover
- Marine Protected Areas

- Marine Protected Areas for mainland Mauritius cover an extent of 7 190 hectares, including six fishing reserves and two marine parks.
- In Rodrigues, a high percentage of the marine ecosystem is still in pristine state. Among measures being implemented to mitigate factors affecting the marine environment, is the setting up of a marine protected area in Rodrigues, under the South East Marine Protected Area (SEMPA), funded by UNDP/GEF/RRA under the project “Partnerships in Mauritius and Rodrigues for Marine Protected Areas.” The project covers a total area of 43 km<sup>2</sup> where users are key stakeholders, participating in the decision making process through an innovative co-management approach. Presently various activities are underway in the project namely ranging from awareness-raising of marine resources to demarcation of the MPA boundaries.
- There are 5 designated marine reserves covering an area of 16 km<sup>2</sup>. 4 new marine reserves in the north of the island at Grand Bassin (14.1km<sup>2</sup>), Passe Demi (7.2km<sup>2</sup>), Passe Cabri (1.5km<sup>2</sup>) and Riviere Banane (1.5km<sup>2</sup>) have been identified following consultations with fishing communities. Same have now been agreed by the Rodrigues Regional Assembly and management regulations have been drafted.
- Long term monitoring of coral ecosystem, benthos and fish population are carried out around Mauritius at eight established sites and the two marine parks. Physico-chemical parameters are monitored at 23 sites.
- The lagoon and sea (up to an extent of 1 km from the HWM line) surrounding the 8 declared Islet National Parks also form part of the Islet National Park. This accounts for an area about 36 km<sup>2</sup>.

### C. Threats

Key threats to this thematic area are loss of biodiversity and loss/ degradation of habitat. The drivers include:

- Degradation of habitats (deforestation/ land degradation and siltation of lagoon, filling of marshy areas and wetlands, sand and coral mining, over exploitation of resources, pressure for development amongst others)
- Pollution from land based sources and activities mainly discharge of domestic, agricultural and industrial waste water discharge (liquid and solid from non-point sources)
- Climate change (global warming and sea level rise)
- Aliens invasive species introductions (accidental and sometimes deliberate)

#### 1 Degradation of habitats

##### a. Mangroves

Mauritius lost 30% of its mangrove cover in 7 years (1987-1994, from 20 km<sup>2</sup> to 14km<sup>2</sup>). Through the years, the extent of mangroves cover has significantly decreased through illegal cutting for firewood, construction purposes and for providing passage for boats. There are two species - *Rhizophora mucronata* and *Bruguiera gymnorhiza*. Since the mid 1990's, a mangrove restoration programme was initiated and is ongoing. Over the past 15 years, 23 hectares have been restored with some 230 000 seedlings.

## b. Wetlands

Much of the wetlands at Grand Baie, Pereybere, Tombeau Bay, and Flic en Flac have been reclaimed for commercial and residential development. Estimates given in recent studies undertaken by the Ministry of Environment indicate that 20% of wetland had been filled in the Northern tourist zone of Mauritius and up to 50% in Flic en Flac region. Half of remaining wetlands (marshes and mangroves) are under pressure mainly in North; South-West and Belle Mare tourist zones (NES 1999). The ESA Study commissioned in 2009, identified some 203 coastal marshlands in Mauritius of which approximately half were habitat fragments of once-contiguous wetlands.

Continued urbanisation and expansion of residential housing was identified as the key contemporary threat to Mauritian wetlands, exacerbating earlier losses of wetlands from centuries of farming in the lowlands. The process of backfilling and fragmenting wetlands has markedly reduced the area of wetlands within most major Defined Settlement Boundaries and disturbed most wetland edges. The construction of homes in these low-lying areas has also increased the risk of flooding to houses and infrastructure.

## c. Lagoon sand mining

Lagoon sand mining which was causing substantial damage to the marine ecosystem while exacerbating erosion problems, has been banned in September 2001 in Mauritius whilst in Rodrigues, there is a controlled extraction (as alternative to coral sand being very costly and limited). Those workers engaged in this activity were compensated and many, like the 96 ex-sand miners in 2002, have been given training in FAD fishery (MoFS, 2004). Lagoon sand itself has been largely substituted by rock sand.

Monitoring of ex sand mining sites have shown recuperation and colonization of the seabed by seagrass; new recruits of corals have been encountered and an increase in fish abundance has also noted (Fisheries Division Draft Annual Report 2008)

## 2 Pollution from land based sources and activities

### a. Siltation of lagoon

In Rodrigues, sedimentation as a result of soil erosion and run-off is a serious problem, particularly following periods of heavy rainfall. All bays to the east of Port Mathurin are subjected to heavy siltation and channels around the island contain a large amount of terrigenous material and have reduced in depth over the past years. High levels of sedimentation which occur after heavy rainfall smother coral colonies, resulting in reduced growth and reproduction and eventual death. High sediment areas such as Baie Topaze and Baie aux Huîtres also have very low numbers of fish and invertebrates.

The situation is similar in Mauritius, especially after flash flood and heavy downpour during which load of top soil is washed into the lagoon through the streams.

### b. Inadequate sewerage system in some of the coastal areas

At certain location, the absence of appropriate sewerage system near the seaside seems to contribute towards increase in lagoon nutrient causing eutrophication, leading to local population decline of some marine species, and sometimes to severe damage to coral

reefs. Several project works pertaining to waste water collection, treatment and also discharge through long sea outfall are being implemented in the coastal areas such as Grand Baie and Baie du Tombeau areas while others are planned in the near future for the popular coastal zone like Flic en Flac. The National Sewerage Master Plan of 1994 is being implemented and it is expected that about 50% of household in Mauritius will be connected to public sewerage system by the year 2012.

### 3 Climate Change and Sea Level Rise

#### a. Coral bleaching and loss of biodiversity

The following episodes of coral bleaching events have been recorded in Mauritius

**1998:** Coral bleaching was observed in the lagoonal waters of Mauritius since February 1998. Surveys carried out at 4 selected sites around the island revealed different extents of bleaching. The highest percentage of complete bleaching was 21.6% at Le Bouchon in the south while the highest percentage of partial bleaching was 55.7 % at Ile aux Benitiers in the South-west. However the weighted average of complete bleaching was less than 5% for all surveyed sites. The same sites were resurveyed 9-12 months later, when no sign of coral bleaching was reported. The surveys showed that most of the corals have recovered except for about 10% which had been irreversibly affected. Seawater temperature persistently higher than normal (>30°C) might have been the main cause of coral bleaching.

Coral bleaching was also observed in the Balaclava and Blue Bay Marine Parks. The bleaching process started in late February 1998. 39% and 31% of live corals were affected by bleaching in the lagoons of Balaclava and Blue Bay marine parks respectively. Massive corals were bleached to an extent of 43.9% whilst bleaching of other coral forms was less than 5%. Partial bleaching was most pronounced in digitate *Acropora* (77.9%), followed by submassive corals (51.9%), tabular *Acropora* (32%) and foliose coral (30%).

**2003:** Coral bleaching was observed in the lagoonal patch reefs, reef flats and reef slopes. Coral bleaching was observed at four sites viz: Ile aux Benitiers, Belle Mare, Poudre d'Or and Albion and the % of completely bleached corals at these sites were 56, 11, 22 and 2 while that of partially bleached corals were 8, 27, 17 and 16% respectively. Branching and tabular corals were mostly affected in the back reef while massive corals were affected in the fore reef. In 2003, bleaching of corals was observed by late February and by June 95% of the bleached corals had recovered while 2% were recovering and 3% had died.

**2009:** With the rise in SST above the normal range of 29 °C, coral bleaching was observed in many areas at different depths. Surveys were carried out at four sites namely at Belle Mare (East), Bel Ombre (South), Ile aux Benitiers (West) and in Anse la Raie (North).

In February 2009, during the survey in the lagoon of Belle Mare which has a usual high coral cover, it was observed that at Station 1 had 29% of totally bleached corals followed by 19% of partly bleached corals while Station 2 recorded 33% totally bleached corals and 10% partly bleached corals. The SST was 30.5°C at the time of the survey. It should be noted that these stations had experienced coral bleaching in 2003 and 2004 but had recuperated.

In February 2009, the Anse la Raie back reef station, showed 4% of partly bleached corals and 6% of totally bleached corals while corals at the shore reef station were completely covered by algal growth. The SST recorded was above 30 °C.

In March 2009, the fore reef of Ile aux Benitiers (5-8m depth) was surveyed using the Manta tow method to assess the bleaching event. It was observed that the average coral cover was about 30% with partly bleached massive *Porites*. The SST was 29 °C. The survey effected in April 2009 in the Bel Ombre shore reef showed 15% of partly bleached corals and 2% of totally bleached corals. The SST was 30 °C.

In Aug-September 2009, follow-up surveys were carried out to note the recuperation of the bleached corals. During the survey the sea surface temperature was 23-24 °C. The percentage of abiotic component has increased due to the mortality of corals. At all the stations, the species *Pocillopora damicornis* did not bleach and can be considered as very resistant.

It has been observed that most of the corals have recovered from the bleaching at the surveyed sites except at Bel Ombre where the branching corals are still partly bleached. This is not a healthy situation and will eventually cause the mortality of these corals.

#### b. Decline in Fish Catch

Data collected at fish landing stations around Mauritius have shown a gradual decline in the overall landings for artisanal fishery. However, being given the long time overexploitaion of our lagoonal resources, it cannot be attributed directly as an effect of climate change. However, small scale fishers are particularly vulnerable to impacts of climate change. Some may see the disappearance of their target species and some may experience an increase in their landings of some species of commercial values.

In January 2009, cases of fish mortality were reported in the lagoon of Poudre d'Or. Results of underwater surveys showed that a sudden rise in the sea-surface temperature (SST), (the temperature recorded in this area was 31.5o C) had resulted in a micro-algal bloom which could have been the main cause of fish mortality. In certain areas of the lagoon it was observed that the coral reef patches which until recently were in a healthy state have also been affected to a large extent as the microalgae had made a slimy coating on the corals thus smothering them.

Fish mortalities have been recorded at the around Mauritius are shown on the Map given at Figure 2.

During the 1997 – 2008 decade two major anomalous events related to the Indian Ocean Dipole (IOD) events reduced the catch rates of the purse seines fleets in the Western Indian Ocean (WIO). During these events, the WIO had above average SST, a deeper than average thermocline and low chlorophyll concentrations. These factors are believed to produce unfavourable conditions for tunas in the surface layers. The most recent IOD event (2006-2007) did not reach the magnitude of that of 1997-1998 but purse seine catches declined sharply. Between the two major events, there was enhanced biological productivity (peaked in 2003-2004) which resulted in favourable conditions for tuna and thus corresponded in high catches of tunas.

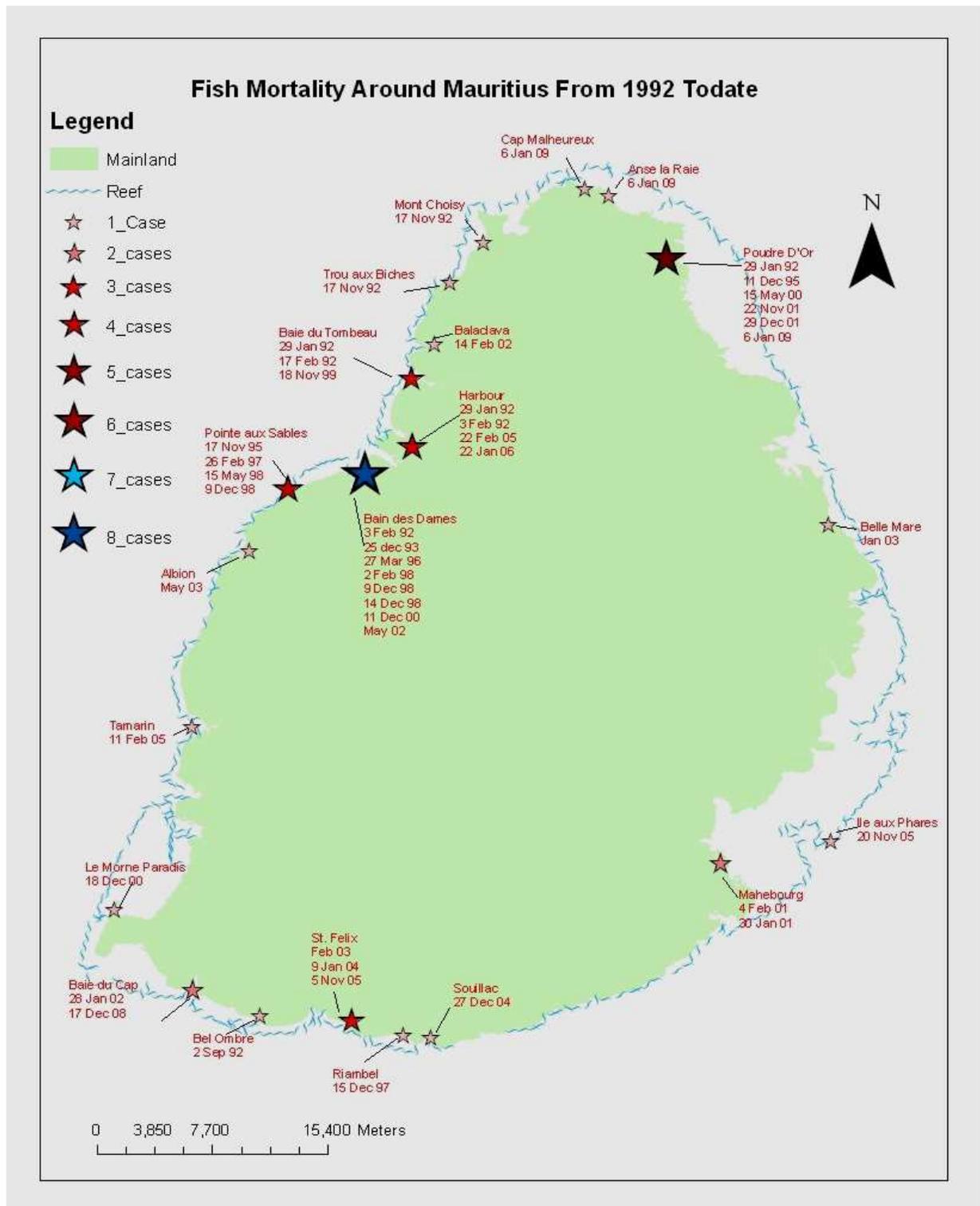


Figure 2: Reported cases of fish mortalities (cause: High SST)

### 1.2.4 Summary of Threats to Biodiversity in Mauritius

The Table 4 given below provides a summary of the threats to the native biodiversity in Mauritius.

**Table 4: Summary of threats to Biodiversity in Mauritius**

Biome/Ecosystem type	Threats	Drivers of threats							Implications
		Direct drivers				Indirect drivers			
		Habitat degradation	Invasive Alien Species	Pollution	Climate Change	Demographic change	Socio-Political Factors	Funding, capacity, knowhow limitations and other factors	
Forests 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 ecosystems	Degradation/ Loss of Habitat with potential loss of species	↗	→	→	↑	↑	→	→	Impacts on ecosystem good and services, local livelihoods affected. Sustainable development compromised

↑ : Increase
↗ : Moderate increase
↘ : Moderate decrease
→ : Unchanged/ under control

## **Chapter II. Current Status of NBSAP for the Republic of Mauritius**

### **2.1 The NBSAP Process in Mauritius**

The National Biodiversity Strategy and Action Plan (NBSAP) for the Republic Mauritius was completed and approved by the government of Mauritius through the Cabinet of Ministers in December 2006. The Cabinet also approved the setting up of a steering committee under the chairmanship of the Permanent Secretary of the Ministry of Agro Industry, Food Production and Security to guide and monitor the implementation of the NBSAP.

It was prepared through a fully inclusive and participatory process with relevant partners and stakeholders involved. The coordination was carried by the National Parks and Conservation Service of the Ministry of Agro Industry under the UNEP/ GEF/1200-96-58 project. A Country Study Report was prepared on basis of sectoral assessments. The findings guided the formulation of the strategy component of the NBSAP. The strategy document was finalised through a series of local, thematic and national workshops in November 2005. This NBSAP also reflects on the relevant CBD COP decisions, the 2010 Biodiversity targets and the Millennium Development Goals (MDG). The report structure, with separate sections for Mauritius and Rodrigues, was refined to three thematic areas, namely, Forest and terrestrial Biodiversity; freshwater, coastal and marine biodiversity; and agricultural biodiversity, biotechnology and biosafety.

The Strategy document lays out an agreed structure and process for the coordination and implementation of the NBSAP designed to build and maintain stakeholder participation and implementation. The document is set out in a strategic and modified logical framework and incorporates consideration of ongoing initiatives such as the National Capacity Self-Assessment (NCSA) and Biosafety Framework.

### **2.2 Vision and Strategic Objectives**

The Vision of the Mauritius NBSAP read as, *“That people in Mauritius enjoy a healthy environment and an enhanced quality of life, through the effective conservation and sustainable use of biodiversity in line with national and international commitments, while respecting local values.”* The Mission Statement states that *“Mauritius will continue to work towards achieving a significant reduction in the rate of biodiversity loss by 2015.”*

There are five Strategic Objectives set in the NBSAP, namely, (i) to establish a representative and viable Protected Area Network (PAN), (ii) to manage key components of the biodiversity, (iii) to enable sustainable use of biodiversity, (iv) to maintain ecosystem services and (v) to manage biotechnology and its products.

The strategy has a 10-year duration 2006-2015 with an independent mid term review during year five. This will provide the basis for a consultative revision of the BSAP so as to enable an adaptive management approach and the optimal attainment of goals and objectives.

### **2.3 Progress in the implementation of the NBSAP**

The status of implementation of the activities are given in the **Table 5** below

**Table 5: Status of implementation of the NBSAP for the Republic of Mauritius**

Strategic Objective (SO)	Work Programme	Objective	Activities	Status (December 2009)
<b>SO 1: Establish a representative and viable Protected Area Network (PAN)</b>	1a. Terrestrial Protected Area Network	To place 10% of Mauritian terrestrial area within a PAN by 2015	<p>Define major habitat types using available models (e.g. Reunion island model).</p> <p>Identify biodiversity hotspots and other priority areas (e.g. caves).</p> <p>Re-evaluate status of forestlands (private &amp; state) using best available sources</p> <p>Establish a forum involving all stakeholders to discuss implementation of the objective.</p> <p>To identify incentives where appropriate</p> <p>Select areas for inclusion in PAN based on findings of above activities.</p> <p>Designate and demarcate</p> <p>Amend existing legislation with reference to IUCN categories.</p> <p>Select priority areas for implementation of intensive management</p> <p>Improve methods of restoration through adaptive management.</p> <p>Actively manage 1000 ha of forest</p>	<p>In 2008/2009 a full sized project (FSP), ‘Expanding Coverage and Strengthening management effectiveness and the Terrestrial Protected Area Network-PAN on the island of Mauritius’ was developed for the Republic of Mauritius to the tune of USD 11 747 000. GEF has already approved the project. Implementation has just started and will span over 5 years.</p> <p>The FSP was developed through a PPG of 150,000 USD was secured from GEF through UNDP.</p> <p>The proposed project will achieve its objectives (Systemic framework for PA expansion improved; PA institutional framework strengthened and Operational know-how in place to contain threats) through the following outputs:</p> <ol style="list-style-type: none"> <li>1. Enabling national policy for a representative system of protected areas is formulated</li> <li>2. Legislative and regulatory framework for the PAN is updated and reformed</li> <li>3. Rationale for PA expansion in place, and conservation stewardship strategy and tools established to guide implementation</li> <li>4. Business-oriented financial and business plan prepared for PAN</li> <li>5. Awareness of the need to conserve native biodiversity is improved</li> <li>6. Management and governance options for the PAN reviewed.</li> <li>7. Strategic planning for PA institutions completed</li> <li>8. Financial sustainability of PA institutions improved</li> <li>9. Conservation stewardship unit established and pilot programme implemented</li> <li>10. Skills and competencies of PA staff improved</li> <li>11. Integrated management plan prepared for Black River Gorges National Park</li> </ol>

				<p>12. Cost-effective IAS control measures, and ecosystem restoration techniques, developed and tested</p> <p>13. Enforcement and compliance capability improved</p> <p>14. Information management system for recording, exchanging and disseminating information in place</p>
	1b. Inland Waters Programme	Identify key areas of inland water ecosystems for management and incorporation into PAN.	<p>Undertake a rapid assessment of inland waters to identify biodiversity hotspot areas.</p> <p>Identify priority areas for management and/or incorporation into the PAN</p> <p>Enable/facilitate/undertake comprehensive baseline survey of biodiversity.</p> <p>Identify / establish the responsible agency for the management of freshwater systems</p>	<p>A first inventory of freshwater fish and macrocrustaceans was carried out in 2003 by “Association Réunionnaise de Développement de l’Aquaculture” (ARDA) in the principal rivers of Mauritius.</p> <p>The ecology of wetlands was also assessed as part of the Environmentally Sensitive Areas study commissioned by the Ministry of Environment in 2007/9.</p> <p>The Water Resources Unit of the Ministry of Energy and Public Utilities has the overall responsibility for the management of freshwater ecosystems.</p>
	1c. MPA Network	To develop and maintain a representative MPA network	<p>Undertake gap analysis of habitats in existing marine protected areas.</p> <p>Identify priority representative habitat areas for inclusion in PAN.</p> <p>Establish a sensitive areas atlas of marine areas.</p> <p>Identify sites that can be declared and managed as marine PAs</p> <p>Declare and demarcate PAN.</p>	<p>Measures for a more effective protection, conservation and management of Marine Protected Areas are now prescribed in the Regulations promulgated under the Fisheries and Marine Resources Act 2007.</p> <p>Already identified</p> <p>The management of the two marine parks of Mauritius, the Blue Bay Marine Park (353 ha) and the Balaclava Marine Park (485 ha) has been continuously reviewed and strengthened, particularly through the essential tools provided under the Regulations.</p> <p>The Regulations are cited as the Fisheries and Marine Resources (Marine Protected Areas-) Regulations.</p> <p>The Network of Marine Protected Areas for countries of the Indian Ocean, a project of the Indian Ocean Commission and implemented by WWF for Nature. Over its duration 2006 -2010, four main components are being implemented:</p>

				<ul style="list-style-type: none"> <li>(a) Development of a regional strategy for biodiversity and marine resources management through eco-regional analysis</li> <li>(b) Creation of new marine protected areas and supporting existing ones</li> <li>(c) Development of a regional forum of MPA managers</li> <li>(d) Development of an awareness and communication programme</li> </ul> <p>A biological inventory of the Balaclava Marine Park was carried out in 2009.</p> <p>The setting up of a marine protected area in Rodrigues, under the South East Marine Protected Area (SEMPA)– is being funded by UNDP/GEF/RRA under the project “Partnerships in Mauritius and Rodrigues for Marine Protected Areas.” The project covers a total area of 43 km<sup>2</sup> where users are key stakeholders–, participating in the decision making process through an innovative co-management approach.</p>
	1d. Adaptive Management of Protected Area Network	To develop costed and scheduled management plans, for each PA, that enables adaptive management.	<p>Develop management plans for each area through stakeholder consultation utilising a logical framework approach.</p> <p>Investigate usage potential in particular modes of non-consumptive use.</p>	<p>Strategic plan was developed for 16 islets of conservation importance. Management plans with logical framework were produce for 18 offshore islets of Mauritius and Rodrigues. The development of these plans was effected through a highly consultative process. Some plans are still awaiting approval from the Government</p> <p>Two islets Nature Reserves have been leased to private companies for a period of seven years each with 50 conditions attached in their lease agreements including conservation oriented activities , though not being fully implemented</p>
<b>SO 2: Manage key components of Biodiversity</b>	2a. Invasive Alien Species	To develop and implement a comprehensive national IAS Strategy and Action Plan (NIASSAP)	Develop a national strategy and action plan through stakeholder consultation utilising the GISP model and other relevant strategies.	<p>National Invasive Alien Species Committee (NIASC) in August 2003 under the aegis of the National Parks and Conservation Service (NPCS)</p> <p>The National Invasive Alien Species Control Strategy and Action</p>

			Review and modify, as appropriate, national IAS committee membership.	Plan (2010-2019) for the Republic of Mauritius was approved by Cabinet in January 2010.
	2b. Flowering Plants and Ferns	To enhance conservation of native flowering plants and ferns	<p>Assess the conservation status of species and identify threatened and endangered species as per IUCN criteria.</p> <p>To secure all endangered species in ex-situ collections and in-situ managed areas.</p> <p>To protect all threatened species at a national level and under the Wildlife and National Parks Act.</p> <p>To encourage public awareness and use of native plants (instead of exotics) in landscaping.</p>	<p>Preliminary assessment of the threatened status of Mascarene endemic plants species reviewed was conducted.</p> <p>Most endangered Mascarene threatened angiosperm species are incorporated into <i>ex-situ</i> collections (mainly in seed bank) and <i>in-situ</i> management areas.</p> <p>The revision of the Wildlife and National Parks Act proposed to have both threatened angiosperm and ferns native species protected by law.</p> <p>Ongoing through free counseling and free plants provided through national campaigns.</p>
	2c. Birds	<p>(i) to review and enhance the conservation of endemic birds</p> <p>(ii) To protect seabird colonies</p> <p>(iii) To protect migratory birds</p>	<p>Assess conservation status of endemic birds.</p> <p>Establish monitoring programmes as appropriate.</p> <p>Determine conservation priorities. Develop and implement conservation plans for threatened species (habitat emphasis)</p> <p>Carry out rat eradication on St Brandon.</p> <p>Identify introduced predators on outer islands and consider control measures (x-ref WP 2a).</p>	<p>In the last year the most successful captive breeding and release programme was the Echo parakeet, that led to its downgrading on the Red List from CR to EN. The greatest threat at present is the Psittacene Beak and Feather Disease which causes heavy mortality in chicks and young birds, but. Several studies have been initiated by the MWF in collaboration with the Durrell Institute of Conservation and Ecology, DICE (UK) and the International Zoo Veterinary Group, IZVG, UK.</p> <p>The same downgrading (as for the Echo Parakeet) on the IUCN Red List was done for the Mauritian Fody in 2009.</p> <p>One new sub-population of Pink Pigeon, was established at the Lower Black River Gorges National Park.</p> <p>Develop and implement conservation plans for threatened species (habitat emphasis) – under implementation.</p> <p>A new schedule on the forthcoming new W&amp;NP Act includes migratory species of birds.</p>

			<p>Review protected species listings modify as appropriate.</p> <p>Review obligations under the African-Eurasian Waterbird Agreement (AEWA) and develop and commence implementation of an action plan.</p> <p>Review obligations under the Ramsar Convention and develop and commence implementation of an action plan.</p>	<p>Underway.</p> <p>Proclamation of RTREBS as a RAMSAR site, as well as Blue Bay Marine Park. Application for a third RAMSAR Site at Pointe d'Esny has been submitted to the Ramsar Secretariat.</p>
	2d. Bats	To enhance conservation of bat species	<p>Assess abundance and distribution of fruit bats and micro-bats.</p> <p>Establish and implement population monitoring protocols.</p> <p>Carry out research on the ecology of fruit bats, including movement and feeding habits.</p> <p>Quantify the economic loss to crops by fruit bat through time (2 year study).</p>	<p>Abundance and distribution of fruit bats and was assessed by NPCS/MWF carried out national surveys to estimate the population of fruit bat using both Evening Dispersal Count (EDC) and Disturbance methods. with 40 major roosting sites were surveyed and a total of about 22,000 to 25,000 bats were estimated/counted.</p> <p>A study in 2008 revealed that one of the micro-bats species is endemic to Mauritius</p> <p>The study has confirmed fluctuations in roost due to seasonal and annual factors. Approaches towards establishment of protocol being refined</p> <p>Research not yet initiated</p> <p>During the past 5-10 years, there has been general outcry by local fruit growers and exporters about considerable damages caused by <i>Pteropus niger</i> to fruit crops of litchis, mangoes and longane. The perceived problem was quantified by Agricultural Research and Extension Unit and quoted damages (unverified) between 30-80%. In 2007 scientific estimation brought down damages to 2 to 17% in orchards where most likely bats were repelled using rudimentary control measures (flag, light, smoke, sound and even gun) as</p>

			<p>Investigate ways to reduce conflict between fruit farmers and fruit bats.</p> <p>Assess that possibility of reintroduction of the Rodrigues fruit bat.</p>	<p>mentioned in the study of AREU as per report AREU/C/32/52 of 17 Sept 07.</p> <p>A campaign on the sensitisation of fruit growers on the use of bird nets to protect their fruit crop started in November 2009. Some 152 people have already benefited from the scheme for the purchase of nets. The Mauritian Government has put aside a sum of Rs 15 M for this purpose. An ultrasonic device to repel bats was tested by AREU and proved to be ineffective.</p> <p>Not yet implemented</p>
	2e. Reptiles	To review and enhance the conservation of reptiles	<p>Assess abundance and distribution of native reptiles</p> <p>Carry out research on the ecology of the species as appropriate.</p> <p>Maintain key islets free of alien predators</p> <p>Implement a reptile translocation in line, as appropriate, with IUCN guidelines</p> <p>Implement IOSEA action plan as appropriate in Mauritian circumstances.</p>	<p>Ongoing at the level of NPCS and Mauritian Wildlife Foundation</p> <p>Surveys on islets have led to discoveries of a new population of <i>Nactus coindmirensis</i> (Flat Island). Ecology of <i>Nactus</i> spp. better known through Freeman (2003) and Cole (2005), food web of Round island reptiles (Zuel 2009), Orange tailed skink better understood through Msc project, It is now known that <i>Phelsuma cepediana</i> is made up of three genetic clades (Austin et al 2004).</p> <p>Monitoring activities to detect the presence of pests are being carried on regular basis ( every 3 months)</p> <p>Refer to project under Darwin Initiative ( please refer to page 43) A turtle nest in the south of Mauritius was monitored and protected. Further projects (both local and regional) are in the pipeline under the South West Indian Ocean Fisheries Project.</p>
	2f. Research Priorities	To identify additional research priorities	<p>Undertake gap assessment of existing knowledge of native biodiversity.</p> <p>Identify key species and groups of particular importance to the conservation and sustainable use of biodiversity.</p>	<p>Gap assessment made under the NCSA study.</p> <p>Done at the level of the Conservation, research and academics organizations</p>

			Carry out inventories of these groups. Identify topics of priority for conservation research.	Ongoing
			Determine suitable conservation measures.	Ongoing
	2g. Agrobiodiversity	To have 70% of local agro-biodiversity under ex-situ protection and document knowledge on native agro-biodiversity (including cultivated medicinal plants).	Undertake stocktaking and characterisation of local plant and animal agro-biodiversity.  Develop a national strategy for conservation of agrobiodiversity and medicinal plants.  Develop ex-situ livestock facilities. Carry out survey of literature & grey literature.  Interview traditional farmers and herbalists.  Document and make available traditional knowledge.	Ongoing (AREU programme)  A non Sugar Sector Strategy Plan developed and adopted. Includes conservation of agrobiodiversity and medicinal plants  Ongoing  To be undertaken  Documentation started and several documents / books already published on medicinal plants. Need to be continued for agrobiodiversity
<b>SO 3: Enable sustainable use of Biodiversity</b>	3a. Ecotourism development	Develop an ecotourism strategy	Establish a representative and equitable stakeholder committee  Review progress to date in the elaboration of an enabling framework for the development of sound ecotourism.  Develop a comprehensive ecotourism strategy, building upon existing sound initiatives, through stakeholder consultation utilising a logical framework approach.	Tourism Development Plan was developed in 2002.  Contrary to mainland Africa, tourism in Mauritius depends to a large extent on the health of the coastal and marine ecosystem.  Policy, regulatory and other measures are in place to management, conserve and protect the coastal and marine resources, cultural and historical sites, botanical gardens, natural parks, marine protected areas, diving sites, under water activities, ex-sugar and tea factories building converted into tourist attraction points.

			Establish ecotourism bureau to oversee Coordination and implementation of national strategy.	Mauritius has 2 sites listed as World Heritage sites, Le Morne and Appravasi Ghat.
	3b. Review of the Environment Protection Act	To better integrate issues of biodiversity concerns into the functioning of the EPA	<p>Investigate and implement methods to enhance public involvement in the EIA process.</p> <p>Investigate and implement means to ensure the impartiality of the EIA document.</p> <p>To set legal guidelines for the preparation of EIA.</p> <p>Consider additional activities for Inclusion of list of activities that require an EIA.</p>	<p>Part (IV) of the Environment Protection Act 2002 dealing with the applications for EIA makes provisions for a Section on Public Comments. The EIA is open for public inspection and comments by publication in the government gazette and two dailies. The EIA report is also posted on the website of the Ministry.</p> <p>Moreover, Section 19 (1) (b) of the EPA, the EIA report should include the particulars of the consultation held with the public in the area where the undertaking is located.</p> <p>The EPA 2002 provides for environmental stewardship, greater transparency and public participation in the EIA mechanism. A copy of the EIA report is circulated to the authorities concerned with a request to submit their views in writing within a prescribed time limit.</p> <p>The EA Division at the Ministry of Environment processes the application taking into consideration the views of the authorities concerned as well as any public comments received. The Director's review is referred to the EIA committee for examination. The EIA committee makes recommendations to the Minister for a decision which is thereafter communicated to the proponent by the Director.</p> <p>A Proponent's guide to EIA has been prepared to assist/guide the proponent and his consultants in the preparation of a comprehensive Some of the Sectoral Guidelines have also prepared looking into the trend of the projects received at the Ministry such as coastal hotel project, desalination plants, morcellement projects and stone crushing plants amongst others.</p> <p>As per the Section 17 of the EPA under Non-Listed Activity, the Minister may request the person carrying out or proposing to carry out the project or activity to submit a preliminary environmental</p>

				report or an application for an EIA licence in view of its nature, scope, scale and sensitive location, to have an impact on the environment.
	3c. Fisheries	Enable sustainable utilisation of fishery resources	<p>(i) Offshore fishery: Implement an obligatory independent observer system; Monitor by-catch and quota; Increase deployment of FADs for local fishing fleet.</p> <p>(ii) Lagoon fishery: Reduce fishing pressure; Restock the lagoon with native species; Investigate means of developing community stewardship of lagoon resources; Review legislation pertaining to shell and coral collection ; Ban import of corals, shells and shells products.</p> <p>(iii) Freshwater fishery: Investigate scope for sustainable use of camaron la rivièrè, chevrettes etc; Assess the present stocks Improve water quality in marginal freshwater systems Investigate potential for sustainable aquaculture</p> <p>(iv) Aquaculture/ mariculture: Promote sustainable mari/aquaculture. Mari/aquaculture developed in line with international guidelines and best practice</p>	<p>Undertaken/ ongoing by the Ministry of Fisheries . 21 FADs have been placed around Mauritius and 6 in Rodrigues. These are constantly being monitored.</p> <p>Artisanal fishery - Since 1996 management measures have been taken to discourage large nets and gill net fishing, and a buy-back policy has been put in place. In 1996, there were 32 large nets and 19 gill nets where as in 2009 there are 15 large nets and 5 gillnets. Cast net fishing has also been banned since 2000. Legislation reviewed. Shell and coral collection and even exports have been banned. The fishing of sea cucumber is regulated under the “ Fisheries and Marine Resources (Fishing of sea cucumbers) Regulations whereby a close season has been introduced. A 2 year Moratorium has been introduced in 2009.</p> <p>The AFRC is involved in the post larval production of <i>Macrobrachium rosenbergii</i>, fingerling production of the Red Tilapia, and breeding of three species of fresh water ornamental fish ( Gold fish, platties, mollies)</p> <p>Aquaculture Master Plan developed in 2007. It indicates a potential for an annual production of 29 000– 39 000 tonnes of farmed fish. A legal framework for fish farming in the sea is in place since July 2008 with a view to promote aquaculture development in Mauritius. The Fisheries and Marine Resources Act 2007 has been amended to allow for fish farming in the sea. The amended act makes provision for eight Fish Farming Zones.</p>

			<p>(v) Sports Fishing: Investigate the sustainability and scope for expansion of sport fishing.</p> <p>Consider feasibility of and incentives for catch and release programmes</p>	<p>To be undertaken</p> <p>Under consideration/ implementation</p>
	3d. Agrobiodiversity	To increase sustainable agriculture and encourage the use of local varieties and breeds	<p>Determine the potential market for and production of organic produce.</p> <p>Encourage organic farming practices and the use of local varieties and breeds.</p> <p>Use of ex-situ and in-situ genepool in breeding programme</p> <p>Raise awareness of health implications of excess use of agrochemicals.</p> <p>Rationalise the production and use of compost</p> <p>Facilitate utilisation of the ex-situ genepool to maintain in-situ populations.</p> <p>Develop mechanisms to harmonise freshwater conservation and agriculture.</p>	<p>Promoted by AREU</p> <p>Ongoing. Need capacity-building for high level training of breeders</p> <p>Extension Programme at AREU</p> <p>Compost plant is under construction for municipal waste</p> <p>Ongoing. Could become in jeopardy from the privatisation of PGR stations if alternative measures are not identified and implemented</p> <p>To be undertaken</p>
SO 4: Maintain Ecosystem Services	4a. Forest Management	Protect watersheds and soil by increasing forest cover	Maintain forests with regard to existing catchments and areas at high risk of erosion.	<p>Catchments areas and environmentally sensitive areas are excluded from the exploitation programme of the Forestry Service. However only hygienic operations are carried out, manually on these areas to enhance the growing stock.</p> <p>More over some 41200 plants of indigenous and exotic tree species have been distributed free of charge to mountain and river reserve owners under the National tree planting campaign Reserves programme to protect these areas from soil erosion by ensuring a</p>

			<p>Increase capacity to produce saplings of appropriate species.</p> <p>Extend forest cover by reforestation of strategically selected areas</p> <p>Replace exotic plantations used for ecosystem service protection with native species – up to 50%</p>	<p>constant vegetal cover.</p> <p>The number of saplings produced has been increased from 450,000 units to 500,000 units during the past 3 years through proper nursery management and planning, re-engineering production processes and light mechanization. The increase in production has been maintained despite a significant decrease in the labour force available.</p> <p>Annually some 2 ha of avenue plantation and state land are planted with tree species. 20 ha of degraded slope of signal mountain is being rehabilitated and reforested; the success is quite visible to date through proper protection against fire by creation and maintenance of fire breaks. The second phase will consist of incremental increase in the rehabilitation area against land degradation.</p> <p>The objective is mainly to reverse the trend of land degradation. The Forestry Service is also very active in increasing the tree cover through multi-pronged approach of trees outside forests; urban forestry, and highway plantation.</p> <p>10% of annual plantation is planted with indigenous/endemic plant species. Since 2006 some 25 ha have been planted with indigenous endemic species.</p>
	4b. Water quality	To reduce water pollution	<p>Monitor water quality in freshwater and marine systems.</p> <p>Enforce environmental standards as they pertain to pollution and water quality.</p> <p>Investigate and implement means to reduce and mitigate impacts of water pollution.</p>	<p>Monitoring programme established and ongoing both for fresh water and marine waters</p> <p>As per the Environment Protection Act 2002, Enforcing Agencies have been designated to enforce environmental standards pertaining to pollution of the media including water quality</p> <p>National Sewerage Master Plan prepared in 1994 and implementation underway. 50 % of the household connection to sewerage network by the year 2015 targeted. The main objectives</p>

			Protect wetlands	<p>are to improve sanitation and to halt and reverse the trend of environmental degradation</p> <p>ESA study for the demarcation of wetland completed. Wetland/ESA bill is under consideration.</p>
	4c Integrated Coastal Zone Management	To increase coastal protection	<p>Implementation of Baird Report recommendations on coastal erosion study around Mauritius.</p> <p>Establish a dispute resolution mechanism.</p> <p>Increase the area of coastal wetlands, mangroves, seagrasses and fringing coral reefs as protected areas.</p> <p>Identify sensitive areas and develop atlas for implementation under the Environment Protection Act.</p> <p>Review function of the ICZM Committee.</p> <p>Develop an ICZM plan for Mauritius and the outer islands</p>	<p>Implementation of recommendations at various sites underway</p> <p>An ESA bill preparation is under consideration</p> <p>GIS Maps have been prepared as part of the ESA and ICZM Framework Studies</p> <p>Committee set up under the National ICZM committee</p> <p>ICZM framework for Mauritius prepared</p>
SO 5: Manage Biotechnology and its Product	Cartagena Protocol on biosafety	To implement the Cartagena Protocol on biosafety	To implement the national biosafety framework.	<p>The implementation of "National Biosafety Framework in Mauritius", funded by UNEP/GEF ongoing</p> <p>National Biosafety Committee set up.</p> <p>Training held under the Biosafety Clearing House at the level of the Ministry of Agro Industry and the Food Technology Laboratory for detection of GMOs</p>

## 2.4 Challenges to Implementation of the NBSAP and effectiveness of Current Strategy

Biodiversity is considered as one of the national priorities for the Government of Mauritius. Conservation, protection and management of threatened native biodiversity as well as offshore islets management have been achieved through effective collaboration and partnerships by the relevant government departments, private sector organizations, academic institutions, research organizations, statutory bodies, CBOs and NGOs. However, measures have met with varying degrees of success. The key constraints and challenges observed are

- Shortage of staff
- Technology transfer (need for latest state of art technologies)
- Capacity building
- Impacts of climate change (both extreme events and slow onset), and
- Funding

The above-referred challenges coupled with external factors inherent to a SIDS have rendered the current strategy for biodiversity management weak e.g., conservation under the agrobiodiversity thematic area.

## 2.5 Successful Partnerships

### A. Ecosystems restoration and species recovery

- ✓ Efforts to conserve biodiversity in Mauritius began with establishing of small managed areas for the protection of endangered forest types and endangered plant species which was spearheaded by Vaughan and Wiehe (1941). A small plot in the Macchabé forest, in the south west of the island, was earmarked as an intensive study plot. The management of the Macchabé plot was the inspiration for the establishment of a series of weeded and fenced *Conservation Management Areas* (CMAs) in different parts of the upland forest that are representatives of some of the different ecotypes identified by Vaughan and Wiehe in 1937. The 1.44 ha Perrier Plot was established by the Forestry Service in 1969, and the 5 ha Mondrain Reserve by the Médine Sugar Estate (private sector) in 1979, but the major expansion of CMAs occurred from the 1980s onwards through the collaborative work of MWF and the National Parks and Conservation Service (NPCS). There are now about 66 ha of native forest that have been fenced and weeded, and most of these plots are in the Black River Gorges National Park (BRGNP). There are also areas in the BRGNP that are either only fenced or only weeded (e.g., Fixon and Machabe). There are also managed (weeded or weeded and fenced) plots within Nature Reserves (c. 6.0 ha. in six Nature Reserves). Managed plots can also be found outside Nature Reserves and within native forest (7 ha Mont Vert, 0.5 ha at Le Cabinet and 1 ha outside Perrier nature reserve). Managed areas on private land: the Mondrain mentioned above, as well, weeded plots in Chamarel (3.86 ha) and in the Bambous Mountain Range (Vallée de l'Est, 3.66 ha, Boulle and Ferney) being managed by Bioculture Mauritius Ltd, and the Vallee de Ferney Trust respectively.
- ✓ Research has shown that recovery from weeding has an immediate positive effect on the plants and the effect is amplified over time (Baider & Florens 2006; Florens 2008). However, restoration according to current methodology used by Government agencies is very expensive (~ US\$ 10,000 per ha) for initial weeding and fencing cost

US\$ 330 per running metre. Considering inherent problems with contractors coupled with the high cost involved, NPCS has tried to adopt new strategy to reduce the cost of initial weeding. In this context the Fixon CMA project was designed to recruit labourers (from local communities) on contract to work directly under NPCS supervision thus ensuring the total control on the weeding operation and meeting this organization's strategy to reduce cost. This project was designed to recruit 15 contract labourers to clear 8 ha of degraded forest, reducing the cost to about US\$ 4,500 per ha, which is about 50 to 60 % less. In a similar manner, labourers have been recruited on contract to restore 10 ha of highly degraded forest at Plateau Remousse under the UNEP/ GEF/WIOLaB demonstration project. The new system of recruiting labourers for initial weeding is showing to be of lesser cost plus the overall control on the weeding operation remains under the National Park staff. This scheme also increases the number of jobs and improving livelihood in the poorer communities while creating opportunities for developing ownership and stewardship by the local communities.

- ✓ Ecosystem restoration works have been complemented by rare species recovery programmes. Conservation work in Mauritius has a long history, with some of the 1<sup>st</sup> law against deforestation proclaimed under the French occupancy. In 1940-1950's a system of Nature Reserves were set up. It was followed by the species recovery programme for the Mauritius kestrel (*Falco punctatus*) in the early 1970s, along with preliminary conservation work on the Pink pigeon (*Nesoenas mayeri*) and Echo parakeet (*Psittacula eques echo*). Actions undertaken to build up bird populations from critically low levels included nest protection from predators, harvesting of eggs and hatchlings for captive rearing, captive breeding and reintroduction and supplementary feeding of released and wild birds, and disease management. Species recovery work has recently been expanded to some of Mauritius' rare passerines, e.g., the re-introduction of the Mauritius Fody (*Foudia rubra*) and Olive White-eye (*Zosterops chloronothos*) to Ile aux Aigrettes. Some of the rare endemic reptile species currently confined to Mauritius' offshore islets have also been reintroduced to other islets. A more coordinated and species recovery work for rare plants began in the early 1980s. Plant species recovery work included intensive searches for individual rare plants, management of these species in the wild through measures such as localised weeding, air-layering and bagging of fruit, rat and monkey control, nursery propagation, ex-situ conservation in field gene banks and seed banks, and reintroduction into CMAs.

Intensive management has helped saved 4 of 9 threatened Mauritian species (IUCN Red List, 2008) from probable extinction. The names of the 12 species of land birds that have escaped extinction are given in the **Table 6** below. The Mauritius kestrel, was once the rarest falcon in the world due to DDT poisoning with four birds known in 1974. The Echo Parakeet, the last surviving parrot in the Mascarenes, and also the rarest parrot in the world, with about 12 individuals known in 1987 due to nest predation by invasive species and habitat loss. The Pink Pigeon now numbers around 450 birds, compared to a population of c. 25 birds in the 1970s, with now five heavily managed populations, four in the Black River Gorges National Park and one population on Ile aux Aigrettes. Of the remaining forest bird species, the Mauritius grey white eye (*Zosterops mauritianus*), the Mascarene cave swiftlet (*Collocalia francica*) and the Mascarene Swallow (*Phedina borbonica*) are fairly common, while all others are threatened. A recovery programme was initiated in 2003 to establish a population of the Mauritius Fody (*Foudia rubra*) on Ile aux Aigrettes (a rat-free islet). There are now about 50 birds on the island, and individuals began to breed in 2004. None of the other species, Mauritius Cuckoo shrike (*Coracina typica*), Mauritius

black bulbul (*Hypsipetes olivaceus*), Mauritius olive white eye (*Zosterops chloronothos*), or Mascarene paradise flycatcher (*Terpsiphone bourbonensis* subsp. *desolata*) receive any active management.

**Table 6 Evolution of the population of endemic birds (1975-2009)**

Species	1975	2000	December 2009
Mauritius Kestrel	2**	700*I	c.600*
Pink Pigeon	18-20*	400*	c.450*
Mauritius Echo Parakeet	50*	120*	c.440*
Mauritius Cuckoo-Shrike	210-220*	300-350**	>350**no new surveys conducted, but thought to have increased
Mauritius Black Bulbul	200**	225-340**	225-340**, probably increasing
Mauritius Paradise Flycatcher	250**	250**	>250** some increases noted
Mauritius Grey White-Eye	34 000-68 000**	34 000-68 000**	ditto
Mauritius Olive White-Eye	350**	<100**	<100** in BRGNP and surrounding areas. 20* on Ile aux Aigrettes
Mauritius Fody	250**	105-125**	BRGNP population stable at 105-125**, but add c.160-170* (c.55-60**) on Ile aux Aigrettes

\* Individuals      \*\* Pairs

- ✓ *Plants* - The intensification of plant species recovery efforts by NPCS, MWF and FS has resulted in the propagation of large numbers of endangered plants of at least 100 species. Out of 500,000 plants produced annually by the Forestry Service nurseries, some 90,000 are indigenous/endemic. The nurseries are propagating some 132 species like *Syzygium guehooii*, *Trochetia parviflora*, *Pandanus iceryi*, amongst others.
- ✓ The project '*Flore des Mascareignes*', for describing all higher plant species and ferns in the Mascarenes (a collaboration between the Mauritius Herbarium, MSIRI, IRD/Museum national de Histoire naturelle, Paris and Royal Botanical Gardens, Kew initiated in 1974), is nearly completed and revealed more than 100 new species for the region. With an updated flora and increased number of field surveys, 4-6 new species have been found since 2002 (1 described already), 4 new plant records were added for Mauritius (2 orchids and 2 ferns), 2 species considered extinct in the wild were relocated and 13 native plant species thought extinct were also relocated.
- ✓ The Critically Endangered *Elaeocarpus bojeri* was propagated with collaboration of the Plant Genetic Resources unit of the Agricultural Services through grafting. International collaboration with the Royal Botanic Gardens, Kew 12 plants of *Cylindrocline lorencei* were repatriated to Mauritius and some were reintroduced in protected areas.

- ✓ In 2006, the NPCS in collaboration with the Mauritius Herbarium, MSIRI and Royal Botanic Gardens initiated the setting up of native seed bank facility in the country, with collection back up at the Millennium Seed Bank in the UK. Between 2006-2009, this project was funded by the Darwin Initiative (£ 60,000), the National Parks and Conservation Fund of the Government of Mauritius <sup>1</sup>(£ 66,000) and the Mauritius Herbarium (£ 1,000). Main achievements were creation of the seed bank facility in Mauritius and seed banking 55% of all Mascarene endemic species that are considered threatened (based on tentative assessment made in 2007 by the National Native Threatened Plants Committee). Stakeholders involved with plant conservation received training seed collection and propagation and two Mauritian were employed full time on the project. The project is ongoing (2009-2011), with funds from the Conservation Fund (£ 54,000), and Kew (to be announced in 2010) and it is aiming at increasing the number of species and collections per species, especially of common species for potential use in restoration project. Rodrigues, and may be other outer islands (Agalega and St Brandon), will have collection trips schedules for seed banking. A temporary seed bank facility will be set in Rodrigues, and staff from the FS and MWF will receive training.
  
- ✓ In 2006, the NPCS in collaboration with Durrell Wildlife Conservation Trust (DWCT) and MWF started a programme of translocation of reptiles from Round Island and other rodent free islets around Mauritius. Between 2006 and 2009, this project was funded by the Darwin Initiative (£ 180,000) and the Conservation Fund of the Government of Mauritius (£ 40,000).

Main achievements were 250 Telfair skink translocated to Ile aux Aigrettes and Gunners Quoin, Bojers skink from Ilot Vacoas were reintroduced on Ile aux Fouquets, Macabe (orange –tailed) skinks from Flat Island were introduced on Gunners Quoin. Staff from the NPCS and FS received training on translocation techniques and on Island Species Led action (ISLA). The project is ongoing (2009-2011), with funds from the Government of Mauritius (£ 85,000), DWCT (£ 100,000) and MWF (£ 8,000), aiming at translocating Gunthers gecko onto Ile aux Aigrettes, Bojers skink on Ile aux Fouquets and Ile de la Passe, *Nactus* from Ilot Vacoas and Round Island onto Ile aux Mariannes and captive breeding of *Nactus* gecko at Jersey Zoo (Durrell).

The **Table 7** given below provides a list of reptiles found on the northern islets. It includes five species found only on Round Island; the keel scaled boa (*Casarea dussumieri*), Telfair’s skink (*Leiopisma telfairii*), Gunther’s gecko (*Phelsuma guentheri*) and a night gecko (*Nactus durrelli*).

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<sup>1</sup> The National Parks and Conservation Fund is a fund established under section 25(1) of the Wildlife and National Parks Act (1993)

Table 7: Native reptile species found on the Northern islets

SPECIES		Round Island	Flat Island	Gabriel Island	Gunners Quoin	Pigeon Rock	Serpent Island
Latin name	Common name						
<i>Leiopisma telfairii</i>	Telfair's skink	+	Ex	/	Ex	/	/
<i>Gongylomorphus bojerii</i>	Bojer's skink	+	+	+	+	+	+
<i>Gongylomorphus fontenayi</i>	Orange tailed skink	/	+		/	/	/
<i>Cryptoblepharus boutonii</i>	Bouton's skink	+	+	+	+	/	/
<i>Phelsuma ornata</i>	Ornate day gecko	+	+	+	+	/	/
<i>Phelsuma guentheri</i>	Gunther's gecko	+	/	/	/	/	/
<i>Nactus serpensinsula durrelli</i>	Durrell's night gecko	+	/	/	/	/	/
<i>Nactus serpensinsula serpensinsula</i>	Serpent I. night gecko	/	/	/	/	/	+
<i>Nactus coindemirensis</i>	Lesser night gecko	/	/	/	+	+	/
<i>Casarea dussumieri</i>	Keel-scaled Boa	+	Ex	/	Ex	/	/
<i>Bolyeria multocarinata</i>	Burrowing Boa	Ex?	Ex	/	Ex	/	/

Ex = Extinct; / = Not recorded; + = present

Source: *Islets National Park Strategy Plan*, 2004

## B. Sustainable Agriculture

- ✓ AREU has developed a rapid composting technology through the application of efficient strains of cellulose decomposers and the use of natural and forced aeration. This composting technology are being transferred to growers for composting of seaweeds, farm animal wastes, farm residues after harvest, green wastes from markets, plant residues from greenhouses, nurseries and household. The nutrient value of various types of locally available composted organic wastes has been evaluated and the agronomic value has been assessed in the field on a range of food crops including carrot, cabbage, onion and chinese cabbage. Technologies have also been developed to enrich composted organic wastes (poultry manure, cattle manure and scum through addition of microbial consortia (biofertilisers) and the agronomic value of these enriched composted agri-wastes is being assessed on cabbage.

### ✓ Biofertilisers

In collaboration with a private foreign company, AREU has introduced biofertilisers. These are microorganisms that can 'fix' nutrients from the air, organic matter and soil to crops. On-farm trials are being conducted to assess the effect of a biofertiliser consortium comprising of four biofertilisers (azotobacter, azospirillum, phosphate solubiliser, potash mobiliser) and three biocontrol agents (*Pseudomonas fluorescens*, *Trichoderma viridae* and actinomycetes) on maize, beans, carrot, cabbage, squash,

potato and onion under local conditions. Trials are also being undertaken to evaluate *Azotobacter chroococcum* and Phosphate solubilising micro-organism as a substitute to N and P fertilizer respectively.

✓ Organic products for pest control

Thirty-two products (biopesticides, neem based compounds and products derived from plants and fatty acids) have been tested against major pests. Twenty-four products were found effective and seven have been commercialised

✓ Integrated Pest Management (IPM)

Since 1997, AREU has been conducting research to develop and implement IPM packages against key pests of priority crops.

**Crucifers:** An IPM package was developed against the diamond back moth, *Plutella xylostella*, a major pest of cabbage and cauliflower. It includes three IPM components (pest scouting, use of biopesticides and selective chemical insecticides, and releases of parasitoids). The farmers' participatory approach was used to implement the developed package at field level. There has been around 50 % reduction in insecticide application during the crop cycle of cabbage and cauliflower. Farmers are using mainly biopesticides instead of broad spectrum chemical insecticides. The larval parasitoid, *Cotesia plutellae*, is being released in farmers' fields. Research is now focussed on enhancement of released parasitoids in the field.

**Onion:** The leaf miner, *Liriomyza* spp. is a serious pest of onion and other cultivated crops. To reduce the excessive use of insecticides, an IPM package was developed based on the use of yellow sticky traps and selective use of insecticides. This package is now being used by individual farmers and even by groups of farmers in other crops susceptible to leaf miner attack on an area wide basis.

**Bean:** Control of pod borers (in particular *Maruca vitrata*) is a major constraint for farmers to produce pest free and pesticide free beans. A package (use of biopesticides and selective chemical insecticides) has been developed. The possible use of recently recorded egg parasitoid, *Trichogramma chilonis* is being investigated.

**Banana:** Two types of traps (cut pseudostem trap and synthetic pheromone trap) were found effective in luring the banana weevil, *Cosmopolites sordidus*. Growers are being sensitised on their use.

**Litchi:** a synthetic pheromone has been tested and found effective in luring adults of the litchi fruit borer, *Cryptophlebia peltastica*, a major pest of litchi fruits. At present, research is focused on the possible use of pheromone traps as a monitoring/control tool in litchi orchards.

## **Chapter III - Sectoral and Cross-sectoral Integration or Mainstreaming of Biodiversity Considerations**

### **3.1 Importance of Biodiversity in the Mauritian Economy**

Mauritius is a SIDS endowed with very limited resources, and on the other hand, a relatively high population density (644 persons/ km<sup>2</sup>).

Agriculture (mainly sugar cane which is on the decline due to the dismantling of the preferential trade agreement), manufacturing, tourism and financial services are the major economic drivers of the economy. The emerging sectors are tourism and financial services. The government has set as a target of 2 million tourists by year 2015, representing an increase in the annual tourist arrivals from the current level of 900,000. New growth sectors that have been identified include a land based oceanic industry and marine industry (sea food hub and aquaculture) amongst others.

Tourism sector remains one of the main locomotives driving the Mauritian economy. Maintaining a healthy environment including the terrestrial, coastal and marine resources which are most vital assets for Mauritius, remains among the highest priority. Conscious of this reality, successive governments have placed environment including natural resources management, high on their respective programmes.

Accordingly, Mauritius signed and ratified the UN Convention on Biological Diversity (CBD) in 1992. As a party to the CBD, Mauritius is committed to promote the three objectives of the convention which is conservation, sustainable use and fair and equitable sharing of the benefits out of utilization of genetic resources. Mauritius has also signed/ ratified/ acceded to a number of biodiversity related agreements. The relevant ones are:

- a. United Nation Framework Convention on climate change. Mauritius ratified the Convention in August 1992.
- b. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973
- c. Convention on Migratory Species
- d. Convention to Combat Drought and Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, 1995
- e. Convention on Wetlands of International Importance especially as water fowl habitats also known as the RAMSAR Convention. Mauritius ratified the Convention in 2001.
- f. The International Convention on Oil Pollution Preparedness Response and Cooperation was adopted on the 30<sup>th</sup> November 1990 in London. Mauritius acceded to the Convention in March 2000.
- g. Convention for the Protection, Management and Development of marine and coastal environment in the Eastern African Region and Related Protocol 1985. Mauritius acceded to the Convention in 2000.
- h. International Plant Protection Convention 1971
- i. Convention for the Protection of the World Cultural and Natural Heritage 1972
- j. IOSEA Turtle MOU
- k. Convention on Fishing and Conservation of the Living Resources of the High Seas 195 Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel) in 1989
- l. Cartagena Protocol in 2000

- m. African Convention on Conservation of Nature and Natural Resources 1968
- n. Stockholm Convention on Persistent Organic Pollutants 2001
- o. African Eurasian Water bird Agreement( AEWA)

### 3.2 Strategies and Plans with CBD Objectives integrated

In fulfillment to the requirements, obligations, decisions under the CBD, biodiversity conservation, management and sustainable use have been integrated in most development plans and strategies prepared over the last decades. Ecosystem Management Approach has also been recognized/ mainstreamed during recent policy review. The key policy documents and strategies are given below:

- a. First National Environmental Policy (1988)
- b. National Environment Action Plan 1 and the Environmental Investment programme 1 (1990)
- c. National Environmental Strategies (1998)
- d. Ten Years Fisheries Development Plan (1999)
- e. Climate Change Action Plan (1999)
- f. Tourism Development Plan (2002)
- g. National Development Strategies (2004)
- h. Islets National Park Strategic Plan (2004)
- i. National Action Programme to Combat Desertification (2004)
- j. The National Biodiversity Strategy and Action Plan (2006)
- k. National Environment Policy (2007)
- l. Environmentally Sensitive Areas Study (2009)
- m. National IAS Strategy and Action Plan (2010)
- n. Integrated Coastal Zone Management Framework (2010)
  
- o. A Non-Sugar Sector Strategic Plan 2003-2007 (2002), *A Sustained Programme for Agricultural diversification.*
- p. National Forest Policy (2006).  
[http://www.gov.mu/portal/goc/moa/file/forest\\_policy.pdf](http://www.gov.mu/portal/goc/moa/file/forest_policy.pdf)
- q. *Multi Annual Adaptation Strategy - Sugar Sector Action Plan 2006-2015 (2005):*  
<http://www.gov.mu/portal/sites/moa/site/download/Multi%20Annual%20Adaption%20Strategy.pdf>
- r. *Strategic Options in Crop & Livestock Sector 2007-2015 (2007):*  
<http://www.areu.mu/files/pub/areunssp.pdf>
- s. *'Sustainable Diversified Agri - Food Strategy for Mauritius 2008 - 2015. (2008)*  
<http://www.gov.mu/portal/goc/moa/file/bprintagriju08.pdf> '
- t. Food Security Strategic Plan 2008 - 2011. (2008)  
<http://www.gov.mu/portal/goc/moa/file/straplan.pdf>

#### National Environment Policy

Among the most recent policy document approved by the government and in which biodiversity has been mainstreamed is the National Environment Policy (NEP). The NEP was

been approved by Cabinet in 2007. It aims at establishing a clear policy framework and sets appropriate environmental objectives and strategies.

*Objectives of NEP are*

***(i) Conservation of Environmental Resources***

*To protect and conserve critical ecological systems and resources, and invaluable natural and man-made heritage which are essential for life-support, livelihoods, economic growth and a broad conception of human well being.*

***(ii) Intra-generational Equity***

*To ensure equitable access to environmental resources and quality for all sections of society, and in particular for poor communities as well as taking into consideration gender equity.*

***(iii) Inter-generational Equity***

*To ensure judicious use of environmental resources to meet the needs and aspirations of present and future generations*

***(iv) Integration of Environmental Concerns in Economic and Social Development***

*To integrate environmental concerns into policies, plans, programmes, and projects for economic and social development.*

***(v) Achieve Sustainable Production and Consumption patterns***

*To adopt sustainable production and consumption patterns, to ensure efficient use of energy and environmental resources and achieve a recycling-based society. To make optimum use of renewable energy sources such as bagasse, ethanol, solar and wind energy, biomass and agricultural wastes.*

***(vi) Achieve the “Garden Island” concept***

*To have a built up environment characterised by good landscaping and architectural designs.*

***(vii) Enhancement of Partnerships across Society***

*The cooperation and partnership across all sectors is crucial to meet sustainability challenges and to build an environmentally sustainable Mauritius for generation to come.*

***(viii) Development of Environmental Ethics in the Citizen***

*To inculcate environment stewardship in the society for the responsible care of the environment.*

(ix) **Promotion of policy dialogue**

*To develop a policy dialogue culture at all levels with stakeholders in order to ensure an effective participation of the citizen.*

**Conservation and sustainable use of Biodiversity**

The biodiversity shall be managed in such a way that it will ensure conservation of habitats and ecosystems, protection of native fauna and flora, enhance crop and animal production to meet food, health and other socio-economic needs of the growing population. Viable populations of naturally-occurring species will be maintained to ensure that biological diversity can continue to evolve.

**National targets**

- (i) A representative selection of habitats and ecosystems of the Republic of Mauritius shall be protected and managed for future generations
- (ii) Major disturbances such as infrastructure development shall be avoided in threatened habitats and ecosystems e.g. in Environmentally Sensitive Areas (ESAs) and in vulnerable ecosystems important ecological functions shall be maintained
- (iii) Harvesting and other use of living resources including biota shall not cause species to become extinct or endangered
- (iv) The introduction of alien species through human activity shall not damage or impair ecosystem functions
- (v) Populations of threatened species shall be maintained or restored to viable levels.
- (vi) Enhance community access to nature areas and nature parks
- (vii) Implement the National Biodiversity Strategy and Action Plan and the approved National Forestry Policy

**Strategies and Policy Instruments**

**The Government will:**

- Conserve and protect nature areas: Identify and document environmentally sensitive areas for land-use plans; continue to rehabilitate, enhance and manage native (indigenous & endemic) species.
- Promote public awareness and involve the public in nature conservation; document and update our biodiversity through regular biodiversity surveys; ensure that databases on biodiversity are readily accessible to users.
- Establish a Protected Area Network to manage ecosystems.
- Establish networking with local and international research institutions to exchange expertise and knowledge.
- Review the legal, economic and administrative policy instruments with a view to improving and coordinating the management of threatened, environmentally sensitive areas and private forests.
- To promote public/private partnership in biodiversity management.
- The obligations of biodiversity-related conventions, such as Ramsar, UNCCD and UNFCCC, shall be implemented through domestication of provisions into the local legislations to enable enforcement and compliance.
- Support the adoption of the Convention on Biodiversity guidelines, such as the one pertaining to biodiversity and tourism, by strengthening the national scientific and administrative knowledge base for its implementation.

*Extract from NEP 2007*

### 3.3 Legal/ Regulatory Framework relevant to Biodiversity in Mauritius

A number of legislations have been enacted with regard to the conservation, management and sustainable use of the natural resources in the Republic of Mauritius. Assessment studies undertaken in the context of the Second National Environment Strategies and UNEP GEF Western Indian Ocean Project entitled, “Addressing Land Based Sources and Activities in the WIO Region” (for the prevention of pollution to the coastal and marine environment from land based sources and activities) showed Mauritius has integrated the three objectives of CBD through a number of primary and secondary legislations. However, as ecosystem management falls under the responsibility of a number of institutions, certain degree of overlap and shortcomings have been noted in some cases. One typical example is the general management of Nature Reserves which falls under the purview of the Forestry Services while terrestrial biodiversity management is conferred upon the National Parks and Conservation Service through the Wildlife and National Park Act. Similarly, biodiversity management in fresh water bodies is still unclear.

Legislations relating to biodiversity conservation, protection, management as well as its sustainable use under the various thematic areas are the following:

- a. Wildlife and National Park Act 1993
- b. Fisheries and Marine Resources Act 2007
- c. Environment Protection Act 2002
- d. Maritime Zone Act 2005
- e. Female Sea Turtles (Prohibition of Import) Regulations 1950
- f. Fisheries (Gill Net Prohibitions) (Rodrigues) Regulations 1983
- g. Fisheries (Reserved Access) (Rodrigues) Regulations 1984
- h. Maritime Zones (Fishing licences) Regulations 1978
- i. Fisheries and Marine Resources (Toxic Fish) Regulations 2004
- j. Pleasure craft (restricted activity and speed limit) Regulations 1998
- k. GMO Act 2004
- l. Plant Protection Act 2006
- m. Blue Bay Marine Park – Proclamation 15/1997 (declared MPA in 2000 GN61/ 2000)
- n. Balaclava Marine Park – Proclamation 14/1997 (declared MPA in 2000 GN61/ 2000)
- o. Fisheries and Marine Resources (Vessel Monitoring system) Regulations 2005
- p. National Coast Guard Act 1998
- q. Fisheries (Reserved Areas) (Rodrigues) Regulations 1984
- r. Fisheries and Marine Resources ( Marine Protected Areas ) Regulations 2007
- s. Fisheries and Marine Resources ( Fishing of Sea Cucumbers) Regulations 2008
- t. Fisheries and Marine Resources ( Undersized Fish) Regulations 2006
- u. Fisheries and Marine Resources ( Removal of corals and shells) Regulations 2006
- v. The Beach Authority Act 2002
- w. The Tourism Act 2004
- x. Forest and Reserve Act 1983

- y. Rivers and Canals Act 1863
- z. Regulations related to collection of solid waste

### **3.4 Tools and Processes to mainstream/ integrate biodiversity conservation and sustainable use**

Biodiversity mainstreaming has been achieved through a number of tools and processes. The key ones are:

- a. National budgetary process: inclusion of provisions for funding conservation measures. Implementation is tracked through monitoring of pre-agreed performance indicators.
- b. Environmental Impact Assessment (EIA) for all major developments listed in the First Schedule of the Environment Protection Act 2002. Additionally, the Section 17 of the EPA 2002 gives power to the Minister to request for a Preliminary Environmental report or an application for an EIA Report EIA for any activity or development not listed in the first schedule and which is likely, by reason of its nature, scope, scale, and sensitive location, to have an impact on the environment.
- c. Environmental Information System developed with biodiversity indicators integrated
- d. Biodiversity conservation included in key policy documents, namely, the National Environment Policy, National Development Strategies, and Tourism Development Plan and so on.
- e. Physical Development Plans and Outline Scheme promoting ecosystem protection through its delineation. Planning Policy Guidances providing for siting for new development taking on board biodiversity considerations through provisions of setback
- f. Islets Management Plans promoting ecosystem management
- g. Stewardship and Corporate Social Responsibility supporting biodiversity related conservation initiatives
- j. Biodiversity related Training courses delivered at the University
- k. Partnership project, one example is the UNDP/ GEF Sustainable Land Management Project. Institutional Capacities enhanced through tailored training sessions. Under this project the following training programmes have been completed in Mauritius and Rodrigues
  - i) Geographical Information Systems
  - ii) Fire management
  - iii) Forest economics
  - iv) Sustainable agricultural production
  - v) Participating management of open pastures
  - vii) Remote sensing applications for sustainable land management
  - viii) Forest Land information systems
- l. Partnership arrangements with NGOs, Private Sectors and international organisations as part of Co-management approach in the management of Marine Protected Areas in Rodrigues
- m. Creation of School Endemic gardens or corners in primary and secondary schools

### 3.5 Institutions Mandated to deal with Biodiversity Related Matters

There are a number of institutions dealing with biodiversity related matters. Some are directly involved with the conservation, protection, management and sustainable use while others are involved indirectly through either formulation of policies, enforcement and so on taking on board biodiversity considerations.

Institution(s)	Relevant Functions
Ministry of Environment & Sustainable Development	Development of Policies, Integrated Coastal Zone Management, Issuing of EIA licence, EIS management, Education and Awareness raising, Pollution control. General coordination and National Focal Point for CBD
Ministry of Agro Industry and Food Security (Agricultural Services, Forestry Services, National Parks and Conservation Service, Agricultural Research Extension Unit, Food and Agriculture Research Council, SSRBG, Vallée d'Osterlog Endemic Garden )	Forest and terrestrial biodiversity conservation, protection and management. <i>In-situ</i> and <i>ex-situ</i> conservation works, research and development, all matters pertaining to terrestrial fauna and flora including offshore islets  Agricultural policy formulation, food crops and livestock management.  (Agro-biodiversity including plants used in agriculture and medicine, and domestic animals)
Ministry of Fisheries and Rodrigues (Rodrigues Regional Assembly, Albion Fisheries Research Centre, Fisheries Protection Service)	Research and conservation ; Enforcement of laws related to fisheries and marine resources, coastal ecosystem monitoring  Environmental management in Rodrigues, Management of fisheries and marine resources, management of marine parks and marine protected areas
Mauritius Oceanography Institute	Research and Development on Coastal and Marine Resources
Ministry of Housing & Lands	Physical Land use Planning of the island including coastal zone
Ministry of Tourism	Planning, management and control of tourism development, Zoning of lagoon, Installation of moored buoys
Ministry of Local Government	Solid waste management and public beaches management
Mauritius Police Force [National Coast Guard, Police de L'Environnement]	Enforcement of law relating to the protection of the maritime zones
University of Mauritius (Academic)	Training, Research and Development, , Crop Museum
Mauritius Institute of Education	Teacher Training, Curriculum development (include biodiversity and other environment concepts)
Mauritius Sugar Industry Research Institute (Research Organisation)	Research and Development in sugar cane and other related sectors, Herbarium
Mauritian Wildlife Foundation (NGO)	Terrestrial conservation works
Mauritius Marine Conservation Society (NGO)	Marine conservation works

### 3.6 Coordination of biodiversity related matters

Following a decision at the level of the cabinet of Ministers, a national committee has been set up under the aegis of the Ministry of Agro Industry and Food Security to oversee and coordinate the implementation of measures elaborated under the approved National Biodiversity Strategy and Action Plan. Matters pertaining to general environmental management, including ecosystem management are coordinated at the level of Ministry of Environment and Sustainable Development. Members in these two committees include institutions indicated above.

Additionally, a number of statutory committees have been established with specific mandate and functions. The key ones are listed below:

<b>Statutory Boards</b>	<b>Committees/</b>	<b>Key Functions</b>
Nature Reserve Board		Advise the Minister on all matters relating to Nature Reserves
Wildlife and National Parks advisory Council		Advise the Minister on any matter related to wildlife, national parks and other reserved land
National Ramsar Committee		Advise the Minister on all matters relating to wetlands
Beach Authority Board		Advise on Management of public beaches and conservation of ecosystem
Mauritius Oceanography Institute Board		Advise on Policy and Research on Ocean matters
Tourism Authority Board		Advise on measures in relation to use of lagoon for tourism development activities
Environment Coordination Committee		Policy and Coordination of environmental activities (including biodiversity) in Mauritius
Environmental Impact Assessment Committee		Assess and Advise Minister on issuance of EIA licence
Environment Liaison Officers Committee		Coordinate enforcement matters
Plant Genetic Resource Committee		To advise on PGR conservation matters
National Biosafety Committee		Advise on Biosafety matters

## **Chapter IV - Conclusions: Progress towards the 2010 Target and Implementation of the Strategic Plan**

### **4.1 Progress towards 2010 Targets**

<b>Goals and targets</b>	<b>Progress</b>
<b>Protect the components of biodiversity</b>	
<i>Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes</i>	
Target 1.1: At least 10% of each of the world's ecological regions effectively conserved.	<p>30 out of 41 designated areas are effectively conserved through ongoing conservation and management measures. The total area of conserved sites amounts to 221 km<sup>2</sup>, that is, 78 % of the legally proclaimed protected areas for biodiversity conservation. The protected areas comprise 59.8 % marine and 40.2 % terrestrial.</p> <p>These include the 2 marine parks and 6 Fishing Reserves in Mauritius (7190 ha); 1 marine park in Rodrigues (43 km<sup>2</sup>) and 5 Marine Reserve (16 km<sup>2</sup>), 2 terrestrial Nature Reserves (24 ha) and 2 (islet) Nature Reserves (22.4 ha); 1 Terrestrial National Park (6574 ha); 8 Islets National Park (land area 1.554 km<sup>2</sup>), 1 wetland (Ramsar site) (26 ha), 7 Nature Reserves (refer to <b>Table 2</b>) (598 ha), Ancient Monument site (2.19ha); 14 km<sup>2</sup> of mangrove, 29 ha of CMAs in other state land and private forest).</p>
Target 1.2: Areas of particular importance to biodiversity protected	283 km <sup>2</sup> of area of importance to biodiversity are legally protected. Please refer to progress indicated under target 1.1 and the Table 2

<u>Goals and targets</u>	<u>Progress</u>
<i>Goal 2. Promote the conservation of species diversity</i>	
<p>Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups.</p>	<p>4 Species of birds have been saved from extinction (Mauritius Kestrel, Mauritius Echo Parakeet, Pink Pigeon, and Mauritius Fody). Refer to success stories on the captive breeding and release of native species of birds, reptiles and flora given in the sub section on terrestrial/ forest biodiversity</p> <p>Additionally, an electronic database on marine organisms of all taxa in Mauritian waters by produced by the Mauritius Oceanography Institute</p> <p>Marine turtles – trade is prohibited under CITES and protected under the Fisheries &amp; Marine Resources Act</p> <p>Mangroves – protected species under the Fisheries &amp; Marine Resources Act</p> <p>Coral &amp; shells – removal is prohibited under the Fisheries &amp; Marine Resources Act</p> <p>Sea cucumber Regulation, Fish Catch quota established</p> <p>Prohibition of fishing by certain fishing gears, areas or during certain periods, prohibition of a specific species, size or gender of fish.</p> <p>Prohibition to fish any crab or lobster in the berried state or a turtle or a marine mammal.</p> <p>Prohibition of any activity likely to disturb the marine ecosystems and habitats.</p> <p>Prohibition of dynamites fishing.</p> <p>Sand mining activities have been phased out as from 1<sup>st</sup> October 2001, in order to rehabilitate the state of the lagoon.</p> <p>Reduction of the number of large nets, seine nets and gill nets under a buyback programme and training of fishers to other fisheries viz. FADs (Fish Aggregating Devices) fishery and swordfish fishery.</p> <p>Kindly refer to <b>Table 5</b> on the progress/ implementation of NBSAP</p>

<u>Goals and targets</u>	<u>Progress</u>
<p>Target 2.2: Status of threatened species improved.</p>	<p>Refer to success stories on the captive breeding and release of native species of birds, reptiles and flora given in the sub section on terrestrial/ forest biodiversity (chapter 1.2.1 B of the report)</p> <p>There is a field genebank for upland species targeting 20 species with less than 50 individuals (and usually much less) in the wild, capturing all genetic diversity of these species by taking cuttings (or if not possible seed) from each known wild individual, and developing a collection (replicated in another site) that contains all of these plants.</p> <p>There are four nurseries specifically to propagate native species, an arboretum where individuals of rare species are propagated and planted out (from a list of the most threatened plant species).</p> <p>So far the National Parks and Conservation Service and the Forestry Services of the Ministry of Agro Industry Food Security and the Mauritian Wildlife Foundation have successfully propagated at least 100 threatened species.</p> <p>Some critically endangered species have been included in restoration programmes, e.g. <i>Tectiphiala ferox</i>, <i>Trochetia parviflora</i>, <i>Psiadia arguta</i>, <i>Dictyosperma album</i> var <i>conjugatum</i>, <i>Hibiscus genevii</i> and <i>Gagnebina pterocarpa</i>.</p> <p>On the Agrobiodiversity side, the rescue of the unique palm <i>Hyophorbe amaricaulis</i> has again suffered setback as the one plantlet produced (<i>in vitro</i> germination then hardened under shade) died after a few months. The programme is ongoing. MSIRI had 41 maize accessions but only 28 remain in the collection at the PGR Unit. The PGR Unit has increased its collection from 220 accessions in 1985 to 450 in 2010.</p>

<b>Goals and targets</b>	<b>Progress</b>
<i>Goal 3. Promote the conservation of genetic diversity</i>	
<p>Target 3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.</p>	<p>Mauritius Oceanography Institute has embarked on a project on DNA bar coding for marine organisms in Mauritius for studying the genetic diversity and taxonomy</p> <p>Agro biodiversity conservation programmes are underway at the level of:</p> <ul style="list-style-type: none"> <li>• The Plant Genetic Resource (PGR) Unit at the Agricultural Services of the Ministry of Agro Industry: <i>the proportion of conserved varieties has been steadily increasing over the years and has reached about 450 accessions (see above), and are estimated to be more than 60% of existing landraces adapted over long periods. Many varieties have nevertheless been lost in the recent past, such as the rice varieties mentioned in chapter 1. No inventories have been systematically carried out on existing cultivars and landraces. Varieties of fruit tree species such as mangoes, longans and several others have not been given sufficient attention, partly because of acute land shortage and other land issues mentioned elsewhere in the report</i></li> <li>• the Agricultural Research and Extension Unit: <i>lesser resources are allocated to conservation, as priority is research and extension, but contribution is significant</i></li> <li>• the Mauritius Sugar Industry Research Institute (MSIRI): <i>the sugar cane cultivars and other species used in the breeding programmes are all carefully kept and regenerated in its collection of germplasm</i></li> <li>• the University of Mauritius: <i>the Crop Museum has a collection of species of plants of agricultural importance and are being rehabilitated, and still have more than 70% of the major species introduced</i></li> </ul> <p>Traditional knowledge slowly disappearing. Not yet fully documented, except in the case of medicinal plants: Field collection limited to a small collection at the SSRBG, and a few at the UoM. Medicinal plants need dedicated strategy for collection and multiplication</p>
<b>Promote sustainable use</b>	
<i>Goal 4. Promote sustainable use and consumption.</i>	
<p>Target 4.1: Biodiversity-based products derived from sources that are sustainably managed, and production areas managed consistent with the conservation of biodiversity.</p>	<p>The UNDP/GEF Sustainable Land Management Project</p> <p>One of the relevant areas for which there is some of form of control to promote sustainable use and consumption is in the fisheries sector. This is the quota system (Total Allowable Catch – TAC) as well as a limited number of vessels operating in the banks fishery.</p>

<u>Goals and targets</u>	<u>Progress</u>
	<p>The Fisheries and Marine Resources Act makes provision for the sustainable use of the marine resources. These are</p> <ul style="list-style-type: none"> <li>(i) Closed seasons from 1<sup>st</sup> October to the last day of February in the following year coincides with the peak-spawning season of most reef fishes, thus allowing recruitment of fish stocks; introduction of a 2 year moratorium inhibiting harvesting of sea cucumber starting 2009.</li> <li>(ii) Control on the use and ban on certain types of fishing gear, continuing buy back scheme for nets, promotion of FAD fishery are all measures introduced for reducing pressure on the lagoon.</li> <li>(iii) The establishment and management of six fishing reserves and two marine parks in Mauritius and 5 designated marine reserves and 1 marine park in Rodrigues provide for the long-term protection and conservation of marine biodiversity and the sustainable use of the coastal zone.</li> <li>(iv) Rehabilitation of Mangrove areas and propagation at new sites</li> </ul> <p>Another sector is tourism/ eco tourism. The tourism industry in Mauritius depends on the quality of the environment and in particular the coastal and marine environment. Tourism being also important from an economic perspective, a number of measures has set in place to ensure that development as well as consumption is sustainable.</p> <p>Concerning raw materials that are used in handicraft industry for example, Vacoas (<i>Pandanus heterocarpus</i> and <i>P. tenuifolius pandanus</i>) used in making of bags, hats, mats and other items are being produced by the relevant department to ensure that is no threat of depletion. Also these species are also being propagated as part of the community forest programme.</p> <p>Germplasm used in well-organised breeding programmes for sugar cane at the MSIRI, a much lesser extent at the AREU), but virtually nil at the PGR Unit, because of lack of qualified Plant Breeder and other resources.</p>

<u>Goals and targets</u>	<u>Progress</u>
<p>Target 4.2. Unsustainable consumption, of biological resources, or that impacts upon biodiversity, reduced.</p>	<p>A number of regulatory measures, policies and tools have been devised to control unsustainable consumption of biological resources. Development in sensitive areas are not allowed and for developments that have potential impacts on biodiversity are required to undergo the EIA process and ensure that mitigation measures are provided. Another example is the case of unsustainable fishing practices of octopus fishery in Rodrigues. A set of conditions have been prescribed in terms of minimum size of octopus for capture, banning the use of iron bars and iron spikes, decrease in fishing effort, introduction of a close season and identifying alternative employment and sources of income for octopus fishers.</p> <p>Other measures for the artisanal fishery includes</p> <ul style="list-style-type: none"> <li>- Introduction of a closed season from the 1<sup>st</sup> October to the last day of February the following year which coincides with the peak-spawning season of most reef fishes.</li> <li>- Reduction of the number of large nets, seine nets and gill nets under a buyback programme and training of fishers to other fisheries viz. FADs (Fish Aggregating Devices) fishery and swordfish fishery.</li> <li>- Quota system for banks fishery</li> <li>- Exercising tight control on import, storage and utilization of dynamites and ban of dynamites fishing.</li> <li>- Banning of the use of harpoons</li> <li>- Sustainable exploitation of octopus fishery in Rodrigues by prescribing a minimum size of octopus for capture, banning the use of iron bars and iron spikes, decrease in fishing effort, introduction of a close season and identifying alternative employment and sources of income for octopus fishers.</li> </ul> <p>One bold decision taken by the Government has been the banning of coral sand extraction from lagoon of Mauritius as from October 2001.</p>
<p>Target 4.3: No species of wild flora or fauna endangered by international trade.</p>	<p>Mauritius is a signatory of CITES. The Wildlife and National Parks Act 1993 and the Wildlife Regulations of 1998 both contain information relevant to trade in CITES listed species. There is no significant international trade in any species native to Mauritius and Rodrigues. National legislation being amended to make it more CITES compliant.</p> <p>The Fisheries and Marine Resources Act prohibits the landing, sale and supply of any turtle whether dead or alive, or part of a turtle, turtle eggs, stuffed turtles and any marine mammal or part of a marine mammal.</p>

<u>Goals and targets</u>	<u>Progress</u>
<b>Address threats to biodiversity</b>	
<i>Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.</i>	
<p>Target 5.1. Rate of loss and degradation of natural habitats decreased.</p>	<p>A number of policy and regulatory measures have been taken at the national level to mitigate and reduced the threat of habitat degradation. These include the application of EIA and other development control tools.</p> <p>The Ministry of Environment has promulgated a number of standards for effluent discharge into the ocean, discharges in water bodies, drinking water standards, and coastal water quality standards amongst others. These standards and guidelines are in line with international norms and standards.</p> <p>Ministry of Tourism has come up with guidelines and regulations to protect against degradation of marine environment (examples are the dolphin watch guideline, diving regulations and so on)</p> <p>The National Development Strategy (Government of Mauritius, 2003) includes the designation of a network of Environmentally Sensitive Areas to reinforce a ‘general presumption’ against development in these areas using the precautionary approach. The network includes coastal features, wetlands, mountain areas and other areas of high biodiversity (both privately owned and state lands).</p> <p>Recent ESA study (2009) has demarcated 14 categories of sensitive areas so as to enable better conservation and management</p> <p>Since 2008, the Blue Bay Marine Park was declared the second Ramsar Site of National Importance in Mauritius.</p> <p>The Fisheries and Marine Resources Act makes provision for the protection of mangroves and marine aquatic life.</p> <p>As sand mining activities have negative impacts on the marine environment, it has been banned since October 2001. Monitoring of ex sand mining sites has shown that these sites have recuperated and are being colonized.</p>
<i>Goal 6. Control threats from invasive alien species</i>	

<b><u>Goals and targets</u></b>	<b><u>Progress</u></b>
<p>Target 6.1. Pathways for major potential alien invasive species controlled.</p>	<p>In line with the Convention on Biological Diversity, Cabinet has agreed to the adoption of the National Invasive Alien Species Strategy and Action Plan 2010-2019, which provides a comprehensive and coordinated approach in the management of invasive alien species with a view to minimizing the negative economic, environmental and human health impacts of the species that threaten the ecosystem</p> <p>Customs officers have been trained and made aware of the implications of IAS. Plant Protection Act reviewed in 2006. Quarantine measures exist and are being enforced by the authorities concerned.</p> <p>A national steering committee has been established to work into the issues pertaining to IAS in Mauritius. However concerning the ballast water, as per IMO regulations, ships carrying ballast water need to exchange ballast 200 Nm offshore from the port. However enforcement is still an issue.</p> <p>A survey of the port area has been initiated by the Mauritius Oceanography Institute and University of Mauritius towards establishing a baseline for the marine organisms currently occurring in the port area. The baseline will also be used to monitor any introduction in future.</p>
<p>Target 6. 2. Management plans in place for major alien species that threaten ecosystems, habitats or species.</p>	<p>The UNDP/GEF/GOM Protected Areas Network will take on board the management of IAS, enabling the expansion and connectivity of CMA's</p> <p>As part of the indicators retained under the environmental Information system, there is a proposed Environmental Indicator to monitor the change in distribution of the most important invasive species.</p>

<b>Goals and targets</b>	<b>Progress</b>
<i>Goal 7. Address challenges to biodiversity from climate change, and pollution</i>	
<p>Target 7.1. Maintain and enhance resilience of the components of biodiversity to adapt to climate change.</p>	<p>Assessment carried out under the Vulnerability and Adaptation and the Science and Variability reports (2005) under the NCSA and the Second National Communication to the UNFCCC (under finalization), have identified the following key areas, namely, agricultural sector, the fisheries sector, the coastal zone and marine ecosystems, and water resources will be seriously affected due to climate change.</p> <p>A study to assess the vulnerability of the sugar cane crop to climate change concluded that the latter is in fact vulnerable (MSIRI &amp; NCC, August 1999). GCM outputs for Mauritius indicate that the increase in temperature will affect most of our agriculture; the degree of change depending, amongst others, on the crop type and the geographical locations. Quantitative studies using four GCM scenarios reveal approximately 30% to 56% decrease in the yield [INC, 1999]. The recoverable sucrose content will be lower with increase in temperature. Higher frequencies of climate extremes such as cyclone, droughts and prolonged rainfall will also have an uncertain, more risky, impact on sugar production.</p> <p>On the other hand, short duration annuals of the C3 type are less likely to be negatively affected (Climate Change 2001, Synthesis Report, IPCC). However, an increase in the frequency of extreme weather events and the increased incidence of pest and disease is likely to cause a temporary decrease in yield.</p> <p>Global warming and Sea level rise is likely to impact on the ecosystem, including wetlands and mangrove, which are the nursery grounds for crab, shrimp and several fish species at juvenile stage.</p> <p>Temperature increases will alter the geographical range of some insect pests and diseases. Changes in insect population and/or the number of generations per year can result in severe losses. Agriculture and mangroves occupy a significant coastal frontage. Agricultural activities will be under risk as a consequence of saline drift from sea-spray that will contribute to land degradation through salinisation of neighbouring soil. The various impacts of climate change on crop and animal production could have higher order effects on income, employment, food production and exports. Production costs will change and may rise in terms of altered management requirements such as irrigation adoption or extension and reduction of pest and disease damages; thereby affecting profitability, in turn affecting employment and the society</p> <p>The impacts of climate change are likely to affect existing stresses on fisheries. Movement of tuna stocks may disrupt fish based industries. Changes in fish stock distribution and fluctuations in abundance of conventionally fished and “new” species may disrupt existing allocation arrangements. If forecast temperature changes lead to tuna moving to higher latitudes, conflict over the stock may arise both at an international and national level.</p> <p>Global warming may also result in an increase in the frequency and intensity of cyclones and cause damage to coral colonies down to 10-25m depth due to physical destruction of corals and smothering by sediment.</p> <p>Corals with branching growth forms, rapid growth rates, and thin tissue layers appear to be most sensitive to bleaching, and usually die if seriously bleached. Slow-growing, thick-tissues, massive corals appear to be less sensitive and commonly recover from all but the most extreme episodes.</p> <p>The Ministry of Environment is presently implementing the “Africa Adaptation Project: Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Mauritius” to the tune of USD 2.987 million. The objective of the project is to integrate and mainstream climate change adaptation into the institutional framework and into core development policy, strategies and plans of Republic of Mauritius. The project duration is January 2010 - Dec 2011. Key sectors concerned are, Disaster Risk Reduction, Agriculture and Fisheries, Water, Environment, Education, Tourism and Finance.</p>

<b>Goals and targets</b>	<b>Progress</b>
<p>Target 7.2. Reduce pollution and its impacts on biodiversity.</p>	<p>The Policy of Government is to reduce pollution in general including its impacts on biodiversity.</p> <p>In addition to details provided under target 5.1, the Ministry of Environment and other government agencies have developed guidelines that promoters would be required to abide so as to reduce pollution level in addition to compliance to the standards that have been promulgated under the EPA 2002 and other relevant legislation.</p> <p>Additionally, open dumping sites found in coastal areas have been closed down. Propagation of mangroves to stabilise loose soil sedimentation is ongoing. Sewerage programme is also ongoing (50% by 2015 and 80% by 2030) and waste water treatments facilities have been improved (treatment up to tertiary level) including a new outfall have been constructed further to appropriate EIA studies undertaken.</p> <p>Awareness raising is ongoing with regard to judicious use of chemical fertilizers and pesticides.</p> <p>Long term water quality monitoring programmes are being implemented by the organizations, namely, Ministry of Environment and Sustainable Development (NEL), Ministry of Energy and Public Utilities (WRU, CWA, WMA) and Ministry of Fisheries and Rodrigues (AFRC).</p> <p>In terms of oil spill preparedness both Mauritius and Rodrigues have an oil contingency plan whilst the port in Mauritius has an oil spill response plan. Drills and simulation exercises are held at least once a year in Mauritius.</p>
<b>Maintain goods and services from biodiversity to support human well-being</b>	
<i>Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods</i>	
<p>Target 8.1. Capacity of ecosystems to deliver goods and services maintained.</p>	<p>Refer to maintenance of ecosystem services by keeping forest cover</p> <p>Kindly refer to information provided for targets 5, 6 and 7</p> <p>The ongoing environmental monitoring programmes give the opportunity to follow the trends in temperature changes and the health of the ecosystem/ environment.</p>

<b>Goals and targets</b>	<b>Progress</b>
<p>Target 8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained.</p>	<p>Government is encouraging fishermen to fish off lagoon on Fish Aggregating Device.</p> <p>In 2007, an aquaculture master plan was developed. It indicates a potential for an annual production of 29 000–39 000 tonnes. A legal framework for fish farming in the sea is in place since July 2008 with a view to promote aquaculture development in Mauritius. The Fisheries and Marine Resources Act has been amended to allow for fish farming in the sea. The amended act makes provision for eight Fish Farming Zones out of which two sites for Ferme Marine de Mahebourg would be developed for marine aquaculture and one site reserved for Fishermen Investment Trust</p> <p>A Food Security Fund (USD 33 million) has been set up to encourage self-sufficiency. Other measures pertaining to agriculture and forestry supporting sustainable livelihoods and care for the poor people are in place. In the case of handcraft, the forestry unit in Rodrigues is propagating adequate number of <i>Pandanus heterocarpus</i> and <i>P. tenuifolius</i>, whose leaves are in the handicraft sector for the making of eco bags, hats and mats. Irrigation facilities are also being provided and mechanization of farmers' field is subsidized. Seeds and seedlings are offered at subsidized rate. In the livestock sector, numerous incentives are being provided to encourage growth and food processing. Other programmes include propagation of novel varieties, spraying of fields by the pest control unit, training on food processing activities.</p>
<b>Protect traditional knowledge, innovations and practices</b>	
<i>Goal 9 Maintain socio-cultural diversity of indigenous and local communities</i>	
<p>Target 9.1. Protect traditional knowledge, innovations and practices.</p>	<p>A Seed Bill and a Plant Breeders' Rights Bill have been drafted and these are at an advanced stage.</p> <p>The Seed Bill includes the following aspects; quality, import, export, marketing and seed production. This will help to control and regulate seeds coming in and leaving Mauritius.</p> <p>Comprehensive IPR Bill covering all fields of activities is also being examined by all stakeholders,</p> <p>MTA exists for MSIRI and institutions with which it shares plant germplasm, the PGR Unit and AREU are already bound by the MTA associated with international bodies falling under the CGIAR with which they share plant germplasm, and AREU is also confined to material that can only be shared freely, and not having IPR and royalties.</p>

<b>Goals and targets</b>	<b>Progress</b>
Target 9.2. Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit-sharing.	In terms of right to local communities over their traditional knowledge, safeguard for traditional knowledge has been covered in the International Treaty on Plant Genetic Resources for Food and Agriculture and to some extent in WIPO, an international institution dealing with property rights.
<b>Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources</b>	
<i>Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources</i>	
Target 10.1. All access to genetic resources is in line with the Convention on Biological Diversity and its relevant provisions.	Mauritius is party to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGFRA)  A Material Transfer Agreement (MTA) for any biological material (native and exotic) has been approved by the State Law Office and is in place. MTA allows access to our native genetic resources for non commercial purposes. The MTA is in line CBD objectives and the International Treaty on Plant Genetic Resources for Food and Agriculture.
Target 10.2. Benefits arising from the commercial and other utilization of genetic resources shared in a fair and equitable way with the countries providing such resources in line with the Convention on Biological Diversity and its relevant provisions	MSIRI has got MTAs and MoUs with the institutions and entities with which it shares germplasm.  PGR Unit is bound by the conditions of sharing by the CBD, SADC GRC and other (international) organisations with which it shares germplasm.
<b>Ensure provision of adequate resources</b>	
<i>Goal 11: Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention</i>	
Target 11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20.	Mauritius received GEF funding for a number of biodiversity related projects through the Implementing Agencies, namely, World Bank, UNEP, UNDP and FAO. Financial and technical assistance received under initiatives such as “Darwin, UK”, Millenium Seed Bank (UK), EU and others  Funds and equipment received by PGR Unit of Ministry from SADC GRC (Genetic Resource Centre)
Target 11.2. Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4.	There has been some transfer of knowledge and genetic material in the area of research, in particular, in agriculture. These are rather in the form of scientific and technical Cooperation with various other Contracting Parties through international centers and regional bodies.  Also as part of various regional and multilateral agreements that Mauritius has signed and ratified, Mauritius is participating and actively contributing to numerous activities which are of direct relevance to biodiversity conservation and sustainable use. At the

<b><u>Goals and targets</u></b>	<b><u>Progress</u></b>
	<p>Western Indian Ocean region level, Mauritius is cooperating with other regional countries in the following regional initiatives:</p> <ol style="list-style-type: none"> <li>1. Western Indian Ocean Project on Land Based Sources and Activities under the Nairobi Convention</li> <li>2. Agulhas and Somali Large Marine Ecosystems Assessment</li> <li>3. Maritime Highway Project for the Prevention of Marine Pollution</li> <li>4. IOC project – Tuna Assessment and Tagging Project,</li> <li>5. IOSEA Marine turtle MOU</li> <li>6. IOC Coral Reef Network Project</li> <li>7. IOC Setting up of a Marines Protected Areas network for the western Indian Ocean countries.</li> <li>8. The South West Indian Ocean Fisheries (SWIOFP) Project is a 5 year regional project that seeks to enable the collective assessment and sustainable use of the region common key fisheries resources according to an ecosystem approach amongst the participating countries. Mauritius is participating in 5 out of 6 components. The component 5 of SWIOFP deals with Mainstreaming Biodiversity in National and Regional Fisheries Management.)</li> <li>9. BIOPS – Projet Biodiversité Pélagique – ( Regional project on Study of biodiversity around Fish Aggregating Device)</li> </ol> <p>There is extensive collaboration and transfer of technology between stakeholders within the country, and experts abroad. Many of these collaborations are long-standing. For examples, intensive management of critically endangered bird species, conservation Management Areas development, and invasive species control from islets, Collaboration with International Agricultural Research Centers</p> <p>Mauritius has established many bilateral relations in the field of plant genetic resources. A few of these are :</p> <ol style="list-style-type: none"> <li>1. Indo-Mauritian Commission covering exchange of sugarcane germplasm between Mauritius and Coimbatore (India) as well as with various sugar cane growing countries;</li> <li>2. Between the CIRAD (La Réunion, France) and the AVRDC;</li> <li>3. Between Mauritius and China in the field of Medicinal plants;</li> <li>4. Among countries that are party to the Indian Ocean Commission and which are implementing a number of biodiversity and environment related projects ;</li> <li>5. SADC Plant Resources Genetic Center including training through the SADC GRC for staff of PGR Unit of the Ministry of Agro Industry and Food Security.</li> </ol>

## 4.2 Targets for the Global Strategy for Plant Conservation

Targets	Status as at December 2009
<b>a) Understanding and documenting plant diversity:</b>	
<p><b>Target 1:</b> A widely accessible working list of known plant species, as a step towards a complete world flora.</p>	<p>Mauritius and Rodrigues have nearly completed botanical description and their distribution of all of the known species. This is part of a long-term project over the last 35 years to publish a 'Flore des Mascareignes'. Only Poaceae, Cyperaceae and Orchidaceae remain to be published.</p> <p>Basic taxonomic information and distribution on native Mascarene species information can be found at <a href="http://www.plantmasc.org">http://www.plantmasc.org</a>. This preliminary database was done by the NNTPC and the Conservatoire Botanique National de Mascarin, with funds from the EU and Region Reunion.</p>
<p><b>Target 2:</b> A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels.</p>	<p>The National Native Threatened Plants Committee (a committee set up in 1994 and consisting of all stakeholders involved in plant conservation) coordinated a preliminary updating of IUCN status for all plants Mascarene endemic species in Mauritius and Rodrigues in 2007.</p>
<p><b>Target 3:</b> Development of models with protocols for plant conservation and sustainable use, based on research and practical experience.</p>	<p><i>In situ conservation.</i></p> <p>Within the protected areas, there is a network of actively managed areas for which protocols for restoration of very rare species are in place. This is an adaptive process; being continually reviewed and improved (in terms of efficiency and cost). A World Bank GEF project for restoration of Round Island was completed in December 2004, and flora management plan based on experiences was produced. Regional management plans for four native species were produced in 2008 by the NNTPC and the Conservatoire Botanique National de Mascarin, and a draft of these documents can be found at <a href="http://www.plantmasc.org">http://www.plantmasc.org</a></p> <p><i>Ex situ conservation</i></p> <p>There a number of <i>ex situ</i> facilities for threatened plants of the uplands has been established, and the protocol is available for development of a similar facility for other regions in the island that are managed by government agencies, parastatals and NGOs. Protocols to collect and propagate many native plants are in place. A database to allow sharing of information amongst conservation stakeholders on plant propagation activities is being developed. A seed bank facility for native species is in operational. Protocol for micropropagation of some orchid species are functional. International cooperation have led to the propagation of some species on the brink of extinction.</p>

<b>b) Conserving plant diversity:</b>	
<b>Target 4:</b> At least 10% of each of the world's ecological regions effectively conserved.	16 out of 27 national and internationally designated terrestrial/ forest areas are effectively conserved through ongoing conservation and management measures. The total area of terrestrial sites (zoned for conservation) amounts to 119 km <sup>2</sup> out of 152 km <sup>2</sup> legally protected land area. This amounts to 78 %
<b>Target 5:</b> Protection of 50% of the most important areas for plant diversity assured.	Not all of the most important areas for plant biodiversity (partially identified by Page & d'Argent 1997) receive adequate protection. For example, the National Park is located in the South West, and most of the Nature Reserves are also within this area, while there are very important areas in the North, the Southeast and the in the middle of the island which are protected. This uneven geographical representation reflects land ownership – most of forest in the South East is privately owned, although part is classified as Mountain and River Reserve which receives legal protection, but enforcement is lacking. In Rodrigues there are only 2 protected areas on the mainland, but these represent virtually the only native forested areas left on the island. There are also 2 islets declared as Nature Reserves and plans to expand the protection to other islets have been done, and are awaiting agreement of the Regional Assembly. Legal protection covers only a few native species, and the penalties incurred are small, and rarely applied. However increase of legal protection is also being revised at present.
<b>Target 6:</b> At least 30% of production lands managed consistent with the conservation of plant diversity	Production lands tend to be high-intensity monoculture (sugar, tea, tobacco, commercial plantations and market gardening). This landscape supports almost no native biodiversity (apart from the occasional native plant left in a hedge, or the side of a field). Thus, in terms of conservation of native biodiversity this is not a priority. However, pilot projects of mixed forestry plantations (native and alien species) are ongoing.
<b>Target 7:</b> 60% of the world's threatened species conserved <i>in situ</i> .	At least 57% (Strahm 1992) of all native species are present in protected areas, although it omits some of the rarest species are highly localized. Many species have small population size on the protected areas may not allow the populations to be self-sustaining, or contain sufficient genetic diversity for their longevity. Weeding of alien species is proven to be beneficial to many native species and expansion of management areas is a must and it is being planned..Increasing the network of actively managed areas also need to be established in other parts of the island to increase the number of species and the number of their populations represented in such areas. This is important if the aim is to conserve genetic and ecosystem diversity in Mauritius. Some critically endangered species have been included in in

	situ restoration programmes, e.g. <i>Tectiphiala ferox</i> , <i>Trochetia parviflora</i> , <i>Barleria observatrix</i> , <i>Psiadia arguta</i> , <i>Dictyosperma album</i> var <i>conjugatum</i> , <i>Hibiscus genevii</i> and <i>Gagnebina pterocarpa</i> . In Rodrigues, this approach has been in place for the restoration of upland and a lowland site.
<b>Target 8:</b> 60% of threatened plant species in accessible <i>ex-situ</i> collections, preferably in the country of origin and 10% of them included in recovery and restoration programmes.	Over 60% of the Mascarene endemic species of Mauritius are represented in ex-situ collections. The majority of the species are seed banked in Mauritius, with duplicate collection in the UK. A series of arboreta exist in the island. Some Mauritian species are represented in collection in Europe (Kew and Brest mainly) and in the USA (Hawaii). One field genebank was established for the upland species targeting 20 species with up to 50 individuals in the wild to capture genetic diversity of these species from each known wild individual. But such initiative is costly and not all species are being successfully represented. Some constraints involving propagation of problematic species are being addressed with help from national and international specialists in e.g. tissue culture, grafting, etc. The NPCS, MWF and Forestry Services have successfully propagated c 100 of the CR species. Ferns and orchids are also propagated for an ex situ reference collection
<b>Target 9:</b> 70% of the genetic diversity of crops and other major socio-economically valuable plant species conserved and associated indigenous and local knowledge maintained.	The proportion of PGR conserved varieties has been steadily increasing over the years and has reached about 450 accessions and are estimated to be more than 60% of existing landraces adapted over long periods. Many varieties have nevertheless been lost in the recent past, such as the rice varieties mentioned in chapter 1. No inventories have been systematically carried out on existing cultivars and landraces. Varieties of fruit tree species such as mangoes, longans and several others have not been given sufficient attention, partly because of acute land shortage and other land issues mentioned elsewhere in the report
<b>Target 10:</b> Management plans in place of at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems.	There are no management plans in place for any of the invasive alien species, although ecosystem management through weed control is carried out in CMAs. Some of these areas also include control of alien invasive animals (rats, cats, monkeys, etc).  A black list of invasive plant species was prepared by the National Invasive Alien Species Committee for inclusion in the review of the Plant Act in 2006, but it has not been accepted.  There is also an environmental indicator set up to monitor the change in distribution of the most important invasive species, though it is not been tested or use in monitoring.
<b>c) Using plant diversity sustainably:</b>	
<b>Target 11:</b> No species of wild flora endangered by international trade	The Wildlife and National Parks Act (1993) and the Wildlife Regulations of 1998 both contain information relevant to

	trade in CITES listed species. Also, there is no international trade in any plant species native to Mauritius or Rodrigues.
<b>Target 12:</b> 30% of plant-based products derived from sources that are sustainably managed	<p>Very few native plants or plant-based products are used. The Critically Endangered <i>Dictyosperma album</i> is used for palm hearts and harvested from plantations. There is some use of native plants for medicinal purposes in Mauritius, but the impact on wild plants seems to be very low.</p> <p>In Rodrigues the endemic <i>Pandanus heterocarpus</i> and <i>P. tenuifolius</i> are used for making hats, mats, bags etc. This involves harvesting the young leaves and is carried out from wild plants. There is also some traditional use of native plants and a community garden has been established to provide material for local use.</p>
<b>Target 13:</b> The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted.	The native biodiversity in Mauritius does not form a major part of people's livelihoods. There is also little knowledge remaining on the general population about the medicinal use of native plants.
<b>d) Promoting education and awareness about plant diversity</b>	
<b>Target 14:</b> The importance of plant diversity and the need for its conservation incorporated into communication, educational and public-awareness programmes.	<p>Public education and awareness forms an integral part of the routine activities carried out by the government departments and NGOs.</p> <p>Poster exhibitions, brochures, films and newspaper articles are usually produced regularly. For example in 2006, a campaign of awareness against invasive species has launched and reinforced in 2009. Posters were designed in 2008 to be displayed in the field offices of the National Park. The MWF published calendars, diaries, and produce souvenirs with endangered species photos, engraving, etc.</p> <p>Talks on forest biodiversity on schools can be carried out by government agencies and NGOs. Endemic plant corners are created in many of the schools on Mauritius and also on Rodrigues. New nature walks were set up in the last years in different areas by the FS.</p> <p>Rodrigues has a dedicated MWF education officer who visits schools regularly and organises weekly weeding and planting for volunteers in the forest.</p>
<b>e) Building capacity for the conservation of plant diversity</b>	
<b>Target 15:</b> The number of trained people working with appropriate facilities in plant conservation increased, according to national	Apart from ad hoc training, there is no comprehensive policy to train additional staff in relation to this strategy. In 2006, members of the NNPTC received training on use of GIS software but due to high cost of the software little

needs, to achieve the targets of this strategy.	improvement was achieved. Under the Darwin Project for seed banking of native species, the NNTPC members received training on seed collection and storage, and plant propagation.
Target 16: Networks for plants conservation activities established or strengthened at national, regional and international levels.	<p>The National Native Threatened Plants Committee, with members from most stakeholders involved in plant conservation was revitalized for some years with the aim of coordinating, directing and strengthening plant conservation.</p> <p>The National Invasive Alien Species Committee coordinated in 2003-2005 an awareness raising campaign on invasive alien species.</p> <p>The Mascarenes Plant (ex- Indian Ocean Plant) Specialist Group (IUCN SSC) has members in Mauritius, including the Chairperson. A grant to conserve a Critically Endangered species has obtained through this group in 2001.</p>

### 4.3 Status on the Programme of Work on Protected Areas

The Government of Mauritius in collaboration with the Private sector, UNDP and GEF has formulated a project, titled, “Expanding Coverage and Strengthening Management Effectiveness of the Terrestrial Protected Area Network on the Island of Mauritius”. The project has been approved at the level of the GEF. The total project cost is USD 11 747 000. GEF has already approved the project. Implementation has just started and will span over 5 years.

The project has been designed to meet the relevant goals and targets of the Programme of Work on Protected Areas. This project will enable Mauritius to meet its commitment under Article 8(a) of CBD and is a priority objective under NBSAP (Strategic Objective No 1: Establish a representative and viable Protected Area Network (PAN).

The project goal is to catalyze working partnerships between private, public, NGO and community stakeholders to more effectively conserve native forest biodiversity in the protected areas of Mauritius. The project objective is to expand and ensure effective management of the protected area network to safeguard threatened biodiversity to place under protection at least 8% of Mauritian terrestrial area within a PAN by 2015, 10% by 2020 and 25% by 2030.

The PPG phase started in October 2008 and was completed in November 2009, with the help of international and local consultants and public and stakeholder consultation. Eight service providers (consultants) were contracted by UNDP to carry out the necessary studies (the legal /policy matters on biodiversity, systematic conservation planning, economic issues of PA, current biodiversity status and & IAS action plan). One chief consultant was hired to prepare the document project proposal. A local national consultant was contracted for coordinating the work of service providers and to liaise and interact with stakeholders (biodiversity institutions and private forest owners). Three workshops were organized to sensitize stakeholders about the need and importance of the project.

Private forest owners, biodiversity institutions and NGO were canvassed to support the project by in kind co-financing.

The proposed project will achieve its objectives (Systemic framework for PA expansion improved; PA institutional framework strengthened and Operational know-how in place to contain threats) through the following outputs:

1. Enabling national policy for a representative system of protected areas is formulated
2. Legislative and regulatory framework for the PAN is updated and reformed
3. Rationale for PA expansion in place, and conservation stewardship strategy and tools established to guide implementation
4. Business-oriented financial and business plan prepared for PAN
5. Awareness of the need to conserve native biodiversity is improved
6. Management and governance options for the PAN reviewed.
7. Strategic planning for PA institutions completed
8. Financial sustainability of PA institutions improved
9. Conservation stewardship unit established and pilot programme implemented
10. Skills and competencies of PA staff improved
11. Integrated management plan prepared for Black River Gorges National Park
12. Cost-effective IAS control measures, and ecosystem restoration techniques, developed and tested

13. Enforcement and compliance capability improved
14. Information management system for recording, exchanging and disseminating information in place

The details are as follows

**PROJECT TITLE:** Expanding Coverage and Strengthening Management Effectiveness of the Terrestrial Protected Area Network on the Island of Mauritius

**GEF AGENCY:** UNDP

**OTHER EXECUTING PARTNER(S):** Ministry of Agro-Industry and Food Security

**GEF FOCAL AREA(S):** Biodiversity: SO-1 Catalyzing Sustainability of Protected Area Systems

**GEF-4 STRATEGIC PROGRAM(S):** BD-SP3: Strengthening Terrestrial Protected Area Networks

Three sets of barriers are currently impeding efforts to secure the conservation status and ecological integrity of the remaining natural habitats on private and state land in Mauritius. These are: i) capacity deficits at the systemic level; ii) limited capacities at the institutional level; and iii) weak technical capability at the operational level.

In order to overcome these barriers and achieve the project objective of '*expanding and ensuring effective management of the protected area network to safeguard threatened biodiversity*', the project's intervention has been organised into three **components**:

Component 1: Systemic framework for PA expansion improved

Component 2: PA institutional framework strengthened

Component 3: Operational know-how in place to contain threats

General comments: As a party to the CBD, Mauritius is committed to implement the Programme of Work on Protected Areas (PoWPA). A preliminary analysis of key gaps in the country's implementation of the CBD PoWPA was undertaken during the preparation of this project. Several PoWPA Goals stood out as high priorities, including: Goal 1.1 (ecological representivity); Goal 1.4 (site-based participatory planning); Goal 2.1 Action 2.1.2 (integration of communities and private sector into management); Goal 3.1 (economic valuation, positive incentives and enabling environment); Goal 3.2 (building capacities for establishing and managing PAs) and Goal 3.4 (financial sustainability). Component 1 of this project contributes towards addressing PoWPA Goals 1.1, 3.1 and 3.4, while Component 2 deals in part with Goal 2.1, 3.2 and 3.4 and Component 3 responds to selected activities of Goals 1.4, 2.1 and 3.2. The project specifically conforms to the COP 9 decision IX/18 on prioritising the implementation of PoWPA in the SIDS.

*Source: Prodoc, NPCS/MAIFS*