

**Country Environmental Profile for the
Republic of Seychelles
in the Context of the
10th EDF**

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1 Executive Summary

State of environment

Seychelles is made up of 115 islands scattered over an EEZ of 1.37 million km², and has a total land area of some 455 km². This archipelago is divided into 2 distinct groups of islands: a granite group of 43 islands with mountainous peaks and narrow coastal strips covering a land area of 245km², and 73 low-lying largely uninhabited coralline islands with a total land area of 210km². One of these coralline islands is the UNESCO world heritage site of Aldabra, the largest raised coral atoll in the world.

The granite islands are ancient remnants of Gondwanaland, isolated from continental landmasses some 70 million years ago. These islands are composed of a core of granite rock which forms the uplands. These upland soils are often shallow, but deeper and more fertile (with more organic matter) in the valley bottoms. The coralline islands are much younger in geological terms than granite islands. The sandy soils of the coralline islands are alkaline in nature, coarse, porous, loose, with no soil structure and no clay content, thus with high water infiltration rates. It contains very little nutrients, apart from calcium, and is very low in organic matter. The coralline islands do not have the same degree of species endemism. Biodiversity is thus characterized by high rates of endemism and relatively low species diversity.

The major assets of the Seychelles are the exceptional beauty of its islands' natural environment and unique bio-diversity. The granite islands are a repository of over 80 endemic species of flowering plants, 10 endemic species of ferns and 62 endemic species of bryophytes and the coral islands are characterised by mixed scrub vegetation and have 15 known floral endemic species.

The climate is equatorial with the average annual rainfall of 2,200 mm and uniformly high humidity. Climatic conditions, however, vary considerably between islands, mainly in relation to their altitudes and positions. Although the Seychelles lies outside the tropical cyclonic belt, it is indirectly affected by such atmospheric perturbations as well as extreme climate changes.

Biodiversity in Seychelles is characterised by high rates of endemism and relatively low species diversity. However, Seychelles ranks third in the world in having the highest percentage (31%) of its native plants threatened. Over 80% of Seychelles land area is under some form of forest or vegetation cover. Another important feature of Seychelles environment is its large numbers of breeding seabirds. Endemism in scorpions, spiders and insects is also very high, including the world's largest millipede. Some 7% of the invertebrate species can be considered threatened and, of these some 50% are critically endangered. Various highly invasive animals and plants exotic species are causing major ecological imbalances on the island as well as bacterial and fungi species such as the recent Takamaka wilt disease. Seychelles is highly dependent on coastal and marine resources and therefore vulnerable to any degradation of these resources.

Seychelles is also characterized by a wide range of marine habitats, including shallow water fringing reefs, granite reefs, bank and plateau shelves and drop-offs, atolls,

lagoons, seamounts and pelagic habitats. Around 1,000 fish species are known to exist in the Seychelles waters and endemism amongst the fish fauna is low. Dugong sightings have been reported around Aldabra; the dugong is endangered species worldwide which is also close to extinction in this area. Four species of sea turtles live in the Seychelles waters, two of which are listed as “Critically Endangered”, and the two as “Endangered” according to IUCN. An estimated 18% of sponges that exist in the Seychelles are regional endemics.

Challenges

As a Small Island Developing State (SIDS), the Seychelles is characterised by the inherent vulnerabilities of SIDS including small land area, limited natural resources and environmental vulnerability. The main engine of economic growth rests on tourism and fisheries which account for 20% and 9% of GDP respectively. They both also represent important sources of foreign currency: tourism revenue is equivalent to almost half of services' exports whereas canned tuna accounts for more than $\frac{3}{4}$ of domestic exports. Given the country's limited success from economic diversification efforts, future growth will continue to depend on the expansion of these two sectors, which are inextricably linked to the quality of the natural and physical environment.

Urbanisation is one of the principal factors exerting pressure on Seychelles' limited land resources and coastal environment. Almost 90% of the population and infrastructure in Seychelles is on the main island of Mahé, of which 61% is concentrated in the north of the island around the capital. This saturation of the coastal areas has led to development on coastal sand dunes, on wetlands, and even on the buffer zone of 20 metres from the coastline. The scarcity of land has prompted the country to undertake four major land reclamation works off Victoria and the East Coast of Mahé from 1973 to date. Land reclamation projects represent just over 4% of the total land area of Mahé. In addition to these large-scale reclamation projects, there have been many small private reclamation works (usually for housing development) that have had a negative impact on coastal ecosystems.

Furthermore, due to large-scale construction projects soil erosion is a growing concern as large amounts of earth are being washed onto beaches and into the sea. Increased urbanisation of Seychelles granitic islands will continue to remain a major challenge for Government in the medium term in light of further hotel and urban development.

There is also a rise in coral reef degradation and marine pollution due to land-based activities, sewage discharge and over-exploitation. The 1997/98 El Nino event caused widespread coral bleaching throughout much of the Indian Ocean and in Seychelles' waters, the rise in sea temperature destroyed an estimated 50 to 90 percent of coral as deep as 23 m.

In 1992, the National Land Use Plan was introduced for the three main islands (Mahé, Praslin and La Digue) providing zoning schemes and defining land use patterns up to 2000. However, this Land Use Plan has served only as a planning instrument and has not acted as a regulatory instrument. In fact, the lack of land use plans at national and local level makes environmental planning increasingly difficult; for instance insufficient planning in some areas has affected drainage and increased flood risks.

As regards solid waste management, the 3 main islands are covered by a solid waste collection system operated by a private firm under the aegis of the Ministry of Environment. Collection is ensured practically daily and the population has been sensitized successfully in the past years. However, this success is now at risk as a result of the progressive erosion of environmentally friendly behaviours resulting in an increase in waste quantities and paper and plastic materials. Waste generated was around 50,000 tons in 2005, of which less than 10% reused (mainly construction waste, plus compost 3%), and is expected to increase to 66,000 tons in 2015 and 87,000 tons by 2025. Due to the limited extent of the islands and the high population density, there is a need to implement more long term and sustainable solid waste treatment and disposal. In addition a voluntary policy to promote recycling activities should be adopted.

The Seychelles can be considered as having an abundant water supply with an average 2,200mm of rainfall annually, the main water resources used are not evenly distributed: piped water supply has a large coverage of 92.5%, but is increasingly irregular during the dry period and close to maximum capacity in peak demand periods. However, at present there is no reported conflicting water usage. In the future, the tapping of streams and river courses at a larger scale may adversely impact on the environment and focus will need to be given to proper environment assessment and mitigation measures. The use of desalinization plants on a large scale would not add pressure on the fresh water resources, but may not be financially sustainable for the Seychelles.

Electrification rate is close to 100% but contribution of renewable sources of energy is still negligible (limited to some inner islands such as Curieuse, Arid and Cousin which produce electricity using Photovoltaic systems).

Artisanal fisheries are characterized by fishing techniques that are selective in their impacts on fish stocks, and which are not perceived to pose any particular threat to the environment. Nonetheless, coastal demersal resources (within 10 km from the granite islands) are generally considered to be fully exploited or over-exploited. There are indeed concerns regarding the sustainable exploitation of specific stocks targeted by the artisanal fishery; in particular holothurians (sea cucumber), shark and lobster fisheries. Industrial and semi-industrial long line fishing of tuna and swordfish are associated with the incidental catch of sharks. Most sharks have low fecundity, and thus are highly vulnerable to over-fishing. Cetacean (dolphins, whales and porpoises) and sea turtle by-catch is not considered to be an issue, although should be subject to routine monitoring. In order to preserve its shark stocks, the law prohibits the practice of shark fisheries solely for the purpose of harvesting the fins.

Policies

Environmental concerns are embedded in the Seychelles constitution (Article 38): “The State recognizes the right of every person to live in and enjoy a clean, healthy and ecologically balanced environment and with a view to ensuring the effective realisation of this right the State undertakes – ... (b) to ensure a sustainable socio-economic development of Seychelles by a judicious use and management of the resources of Seychelles.”

Seychelles remains a relatively high per capita investor in environmental conservation, management policies and environment education has been introduced into the school curriculum. The Seychelles is amongst one of the countries in the world with the highest percentage of land area legally protected for conservation purposes. At present, over 46% of the archipelago's land and an additional 228 sq km of ocean are legally protected in the form of national parks and reserves¹. A further 20% is classified as being sensitive.

Environmental management in Seychelles is guided by the second Environment Management Plan of Seychelles 2000-2010 (EMPS), which has as objective: "the promotion, coordination and integration of sustainable development programmes that cut across all sectors of society in the Seychelles". The EMPS covers 10 thematic areas covering all major social and economic sectors and includes land use, coastal zones and Urbanization; biodiversity, forestry and agriculture; fisheries and marine resources & processes, tourism and aesthetics; and Regulatory, Policy and Institutional Mechanisms. The EMPS also covers cross cutting themes such as education, awareness and advocacy; public consultation and civil society participation; training and capacity building; management; monitoring and assessment; and vulnerability and global climate change.

The country has institutionalised a diverse portfolio of environment-related laws and regulations. However, many need to be updated to reflect current priorities and address certain shortcomings. The most recent legislation has been orientated toward environmental management, such as pollution control and environment impact assessments rather than being conservation focused.

Enforcement capacity of environmental legislation remains a serious issue at all levels and presents one of the most challenging obstacles in implementing environment policies. For instance, the surveillance of poachers in particular on the remote islands of the Seychelles remains a serious challenge. Lack of financial resources aimed towards further research and specific conservation work is also a serious concern.

All ministries are involved in the environmentally sustainable development process of the country. In addition, there are also a number of more specialised agencies and authorities that include: Marine Parks Authority (mandated to manage Marine Protected Areas); Seychelles Fishing Authority (mandated to manage fisheries resources); and Public Utilities Corporation (mandated to provide access to water and sanitation services). Environmental education has also been introduced at all levels in schools; groups of young people are now regularly involved in environmental actions under the umbrella of the NGO, Wildlife Clubs of Seychelles.

The Seychelles is party to many international conventions including the Convention on Biological Biodiversity, CITES, UNFCCC, UN Law of the Sea, MARPOL Convention and the Montreal Protocol. Seychelles hosts the Regional Coordinating Unit for the implementation of the Nairobi Convention and adopted, in 1994, the Barbados

¹ Seychelles has a good record in designating and managing a system of protected areas as well as marine parks and reserves. The Aldabra Atoll (which has the world's largest population of a species of giant land tortoise), and the Vallée de Mai Nature Reserve (with endemic Coco-de-Mer palms¹) were added to UNESCO's World Heritage Sites list in 1982 and 1983 respectively

Declaration and Programme of Action at the UN Global Conference on Sustainable Development of Small Island Developing States.

Various international donor agencies provide financial assistance for the environmental management of the Seychelles. The Seychelles Environment Trust Fund, which manages the two World Heritage sites², has been established under the Global Environment Facility (GEF)-funded “Biodiversity Conservation and Marine Pollution Abatement Project”. The European Union has also contributed significantly to the protection of the environment in the Seychelles. Specific national and regional EDF projects have focused on various key environmental issues including:

- Solid waste management projects (under the 8th and 9th EDF NIPs Seychelles).
- The sensitization of nine to sixteen years old children on the environment (ARPEGE project) - to date, the Seychelles component of this regional pilot project has been the most successful in the region;
- The preservation of high value fish stocks (with the Regional Tuna Tagging and Fishing control & surveillance Projects financed under the 9th EDF RIP);
- The 9th EDF Regional programme for the management of coastal resources.

Conclusions

The most valuable asset for the Seychelles remains its environment which will continue to contribute to the country’s future economic development.

Most of Seychelles’ major environmental challenges are already addressed within its policy framework and legislation, although some legislation has to be reviewed. The main problem lies in enforcement of environment-related regulations and effective management of protected areas (land and marine areas). The enforcement of environmental regulations does not only require financial resources but also staff and equipment for the follow-up, for instance, of EIS and land use, construction inspections.

Urbanisation’s impacts of on coastal and forest environment have increased over the recent years. As a result there has been a loss of natural areas, pollution of fresh and coastal waters inducing reef degradation, increased erosion, etc.

Extension of urban areas and isolated developments in environmentally valuable areas are related to changing life styles, a relatively generous social housing policy and lax land-use regulations’ enforcement than to increasing demographic pressure (population growth is limited to 1.2% annually). Recent increase in new resorts’ projects (more than 10 and a majority on Mahé Island) further contributes to the adverse environmental impacts caused by urbanisation, particularly in the most valuable and fragile coastal areas. Newly developed *resorts* are bound by law not to release untreated effluents in the natural environment and to minimize their visual impact on coastal landscapes. Older establishments still have to comply with this relatively new regulations but the negotiating power of the environment authority proved to be low and prone to discretionary measures. For resorts under construction, environmental impacts assessment studies have been reportedly weak and their environmental management plans implementation is not really controlled. No consistent monitoring system for resorts effluents has been set-up yet.

² Aldabra Atoll and the Vallée de Mai National Park.

Current water supply shortages during the summer dry season are becoming increasingly alarming. Although they are more related to under-developed storage capacity and high water losses (over 50% in Mahé due to accumulated maintenance backlog on the piping network), rather than to absolute rain deficit (annually around 2,200mm), increased consumption patterns by the population (a space of +8%/year) does worsen the situation, as well as longer and more severe dry periods do as a result of climate changes. Outdated social water tariffs since 12 years do not allow the PUC either to invest or to properly maintain water infrastructure assets.

Lack of financial resources for infrastructure investment in sewerage does not allow for a sufficient minimization of polluted effluents releases in the natural environment in densely populated areas, mainly because of limited sewerage networks coverage. Moreover the contribution of autonomous sanitation systems to pollution flows is increasing as a result of uncontrolled/defective devices.. Inadequacy of sewerage tariffs (under social considerations) induce heavy financial losses to Public Utilities Corporation department in charge of water supply and sewerage, and contribute to decreasing the ability to extend its coverage of most urbanized areas (Greater Victoria and Beau Vallon).

Even if solid waste collection is following the pace of changing life styles and urbanization, waste disposal remains inadequate, and its environmental impacts are not adequately monitored. In this context, under the 9th EDF, actions are planned to improve waste reduction and recycling and construct new waste disposal facilities. However limited financial resources may lead to a situation where only Mahé waste disposal is addressed. The sustainability, both economically and environmentally, of the design and technology chosen for waste disposal on la Digue and Praslin (where landfill condition is very bad) is questionable, and alternative sustainable solutions have yet to be devised...

Another consequence of climate change is an increasing exposure of the Seychelles to natural disasters. If appropriate coordination seems to have been set-up, the financial resources needed to ensure operational intervention capacity is lacking. A National Disaster Committee (NDC) for national disasters has been in existence for a number of years, under the aegis of different ministries and departments. This Committee is now directly under the aegis of the President's Office. Nonetheless, the weather events of 1997 and 2002 have led to the urgent need for an enhanced disaster management system. A National Disaster Fund has also been set up and Seychelles has become more active in regional disaster management initiatives.

The most important environmental problem caused by fisheries activities in the Seychelles is the overexploitation of coastal demersal resources. Incidental catch of sharks could also pose a problem for the sustainability of certain shark species.

Recommendations

The foremost priority for the environmental management in the Seychelles is *enforcement of the environmental and land use regulations* together with a *reinforced*

management of protected areas. Updated regulations should facilitate conviction of offenders by an independent and environmentally-sensitive judiciary and act as a real disincentive. Besides, the vision for the sustainable development of the country has to be rejuvenated in view of the new challenges (climate change, energy costs, economic liberalisation,..) , and a new EMPS will soon be needed to set a road map and action plan for the next decade 2010-20. Furthermore, focus should also be given to the *training* of technical staff and other human resources in order to allow for a better understanding of international environmental conventions and to enable an improved implementation of environmental regulations. Dialogue should be strengthened between the donor community and the Government in order to reinforce the government's commitment in allocating more financial resources to addressing these issues.

In addition, donor community support may also be required for strengthening of protected areas' management, particularly for the enforcement of regulations, means of enforcement and human resources in designing and implementation of management plans. This is particularly necessary for the outer islands. Due to their remoteness and fragile coralline environment, a close monitoring of their ecosystems has to be systematically done. Technical assistance is required at all levels and in particular a component to assist Government in matching tourism demand with conservation requirement, providing thus a better and more sustainable foundation for tourism development.

Fisheries' management plans for coastal demersal resources should be developed and implemented. The provisions included in the "shark fining law" should be enforced.

Another priority area that needs donors' support is *planning and programming*, principally through sector-wide approach, in the four sub-sectors which are high on the Government's agenda and require substantial investments: Water & Sanitation, Solid waste, Land drainage, and coastal erosion.

For environment policy as a whole, water and sanitation sector has a high level of priority as it addresses both freshwater resources management and pollution control of river and coastal waters.

2 The state of the environment

2.1 Physical environment

2.1.1 Basic geographic facts

Seychelles is an archipelagic state located between latitudes 3' and 7' south and longitudes 45' and 56' east in the South Western Indian Ocean (see map in appendices). It is made up of 115 islands scattered over an Exclusive Economic Zone (EEZ) of 1,374 million square kilometres. The total land area is 455.3 square kilometres. The archipelago is divided into two distinct groups of islands: a *granite group of 43 islands* and *72 low-lying coralline islands*. The granite islands are ancient remnants of Gondwanaland, isolated from continental landmasses for some 70 million years. The 72 outer islands are of coralline origin and include the UNESCO world heritage site of Aldabra, the largest raised coral atoll in the world.

The granite islands (the only mid-oceanic granite islands in the world) rise from the Seychelles Bank with depths ranging up to 60 meters, a sunken micro-continent and shoal area of about 31,000 square kilometres. These islands are composed of a core of granite rock of more than 600 million years old, which form the uplands, with the narrow surrounding coastal plains formed by beach sand (being a more recent deposit of about 6,000 years). The granite has been weathered to produce a lateritic soil on the uplands, which is high in kaolinitic clay, acidic in nature and low in nutrients and organic matter, therefore with low infiltration rate, low water-holding capacity and very difficult to work with when dry. These upland soils are often shallow, overlying granite bedrock, but deeper and more fertile (with more organic matter) in the valley bottoms. These soils are often found on strong slopes, sometimes in excess of 15 degrees, and therefore extremely prone to erosion.

The granite islands are generally characterized by a rugged central range of hills (highest point: Morne Seychellois, 900m above the sea level) with many steep, smooth, bare rock inselbergs known as “glacis”. Many islands in the group are characterised by a very narrow coastal plateau, which rarely rises 2 m above the sea level. With a land area of 148 square kilometres, Mahé constitutes about one-third of the total land area of the Seychelles. The two other islands of major importance are Praslin and La Digue, 33.6 km and 48 km from Mahé respectively.

Out of the coralline islands, Aldabra is the largest and the farthest, located 1,150 km to the South-West. The coral islands are small, flat and have developed from the slow accretion of coral, and are geologically much younger than the granite islands. Their average altitude is 1.6 m above mean sea level. The sandy soils on the narrow coastal plains and the coralline islands are alkaline in nature, coarse, porous, loose, with no soil structure and no clay content, thus with high water infiltration rates. It contains very little nutrients, apart from calcium (98%), and is very low in organic matter. On certain outlying islands soil fertility has been enhanced through bird guano deposits. These soils can be easily tilled and therefore very sought for intensive agriculture, with consequently high water and nutrient input.

2.1.2 Climate

The climate is equatorial with an average annual rainfall of 2,200 mm. Humidity is uniformly high, and mean temperatures at sea level range from 24°C to 30°C. The prevailing winds bring the wet northwest monsoon from December to March and the drier southeast monsoon from May to October, with heavier wind. Climatic conditions, however, vary considerably between islands, mainly in relation to their altitudes and positions; the mean annual rainfall in the country decreases from the north-eastern to the south-western islands. Rainfall can be as high as 5,000 mm per year on the top of Morne Seychellois (905m) on Mahé, and as low as 867 mm on the coralline island of Assumption. High intensity rainfall, with intermittent heavy downpours and even occasional torrential rains (up to 250 mm/day) may occur from December to March.

The main granite islands lie to the north of the Western Indian Ocean cyclone belt, but they can occasionally experience storm surges from cyclonic activity to the south. Recent meteorological research has shown that with on-going climate change the drought periods in the Seychelles could become longer and the frequency of extreme weather, including torrential rains, could increase.

Although the Seychelles is outside the cyclone belt., global climate change has increased the national environmental vulnerabilities. In August 1997, extreme rainfall conditions led to floods and landslides causing damage to more than 500 houses and almost 40% of the public roads. The 1997/98 El Nino event caused widespread coral bleaching throughout much of the Indian Ocean. In Seychelles waters, the rise in sea temperature destroyed an estimated 50% to 90% of coral as deep as 23 meters. The cost in ecological capital in terms of marine tourism and fisheries has not been quantified but is a major concern. In September 2002, a storm hitting Praslin (the second largest of the Seychelles islands whose population of 7,000 are primarily dependent on tourism receipts), destroyed terrestrial and marine biodiversity as well as physical infrastructure. Total losses were estimated at USD 86.7 million. On 26 December 2004, the Seychelles was struck by the Tsunami and sustained important damages, partly due to torrential rains following the Tsunami itself.

2.1.3 Air quality

Low human pressure does not, at present, make air pollution a serious issue. Nonetheless, in the near future, air quality will become a concern for the Seychelles for the following reasons: strong odours from the Indian Ocean Tuna (IOT) canning factory, open fires from charcoal manufacture, solvent and paint vapours from workshops, dust from quarries and particularly from a crushing plant near Mahé airport. Vehicle exhaust is also becoming a problem, technical controls being limited to basic security features.

2.1.4 Hydrology and water quality

The environmental situation regarding the use of fresh water resources and the impacts from polluting activities can be regarded as generally satisfactory in the Seychelles.

There are however, strong signals that the situation is slowly deteriorating. The interrelation of surface water use, sanitation and solid waste and resulting impacts on river and coastal water quality is becoming more visible as the island population and urbanization increase in the natural catchments areas, therefore requiring a more integrated management system. Such an integrated management system is also needed in the view of climate changes in the rainfall patterns (more severe droughts and floods expected).

The impact of land erosion as a result of construction activities is also more evident on the lagoon (mainly on the coral reefs). Inadequate planning has, in some areas, also affected natural drainage and thus increased foods risks. This is likely to worsen by climate changes in the rainfall patterns, with more extreme rainfall periods being expected. There is no doubt that the Seychelles needs to tighten its planning, control and enforcement capacity to better prevent and monitor negative impacts on the environment and in particular surface and coastal waters. Seychellois are conscious of the natural assets of their islands and of their importance, but there is a lack of consciousness as regards the rapid degradation of these natural assets and of the inadequate institutional arrangements to preserve them.

2.1.5 Land Reclamation

Seychelles suffers from the major structural constraint of very limited land for housing and commercial requirements, especially on the largest and most populous island of Mahé. The scarcity of land and the high environmental and infrastructure servicing costs of hillsides, prompted the country to undertake four major land reclamation works in Victoria and the East Coast of Mahé from 1973 to date.

Land reclamation projects made available a total of 629 hectares of land, representing about 4% of the total land area of Mahé (15,470 hectares), out of which the coastal plateau is only 108 hectares. In addition to these large-scale reclamation projects, there have been many small private reclamation works (usually for housing development) that have had an impact on the coastal ecosystems. Phase 3 of the reclamation project generated land area for a total of 3,000 housing units, and land for other developments such as extension of the commercial port, fisheries processing zones and light industries. Implementation of environmental controls for the reclamation was mandatory for each of the three phases of the reclamation. However, more stringent environmental controls were implemented for the third phase. For example, two types of dredgers were commissioned to do the works. This, although more costly, reduce suspended sediment levels by more than 75%, when monitoring data were compared. A number of other sediment control strategies were implemented and lessons learnt are now being used in other parts of the world. Whilst there was inevitable physical destruction of coastal habitats, impacts during the reclamation phase was very much minimised, and many new coral growths can now be observed along the boundaries of the reclamation. Extensive mangrove areas have developed as a result of the lagoons created by the reclamation.

2.2 Biodiversity

Due its long geological history of isolation in the Indian Ocean, the islands of the Seychelles are exceptional for their rare and endemic plants, birds, mammals, reptiles

even if species' diversity is relatively low. In Seychelles, a wide range of ecosystems exist from sea level arid scrub, through lowland intermediate and mist forests to arid mountain top inselbergs. There are small inland water systems and coastal and marine systems such as mangroves, coral reefs, sea-grass beds and the open ocean.

The geographical and evolutionary isolation of the islands coupled with the extreme antiquity of the granite islands has resulted in high endemism among certain animal and plant groups. The Seychelles islands are host to some 1,500 known species of endemic plants and animals. The biodiversity, similar to those of all small islands, is highly vulnerable to socio-economic development. Various highly invasive animals and plants exotic species as well as bacterial and fungi species such as the recent Takamaka wilt disease are now causing major ecological imbalances on the island.

2.2.1 Vegetation diversity

Over 80% of Seychelles' land area is under some form of forest or vegetation cover. However for the islands of Mahé, Praslin and Curieuse the vegetation cover is less dense since, , most stretches of land have either been urbanized or cultivated in the past (cinnamon, coconut trees, etc.). The main terrestrial habitats of the granite islands are beach and dune vegetation, lowland and coastal forests up to 200-300m, intermediate forests from 200 to 500m altitude, mountain mist forests over 400-500 m and granite inselbergs or "glacis" outcroppings at all altitudes.

The granite islands are a repository of over 80 endemic species of flowering plants, 10 endemic species of ferns and 62 endemic species of bryophytes. The latter are found mostly in the intermediate and mist forests of the interior mountains. Coastal vegetation (up to 100m above sea level) has been altered by human settlement activities and much of it was converted to coconut plantations.

The lowland forests originally covered most of the granite islands up to about 200 meters above sea level, but have been completely cleared, for timber, fuel and the production of cinnamon. Relatively large fragments of the intermediate forest (with high canopy forest, c. 30-40m) have remained. Endemic palm trees are found in the drier areas. The intermediate-altitude forests are the richest in terms of endemic taxa, but have now almost entirely been cut down and most of the remaining areas have been heavily invaded by exotic species, except for the "glacis" areas. The mountain cloud forests originally covered most of the land above 700 m, which still remain rich in mosses, lichens, ferns and epiphytic orchids. Important remnant natural forests still remain in selected areas of Mahé, Praslin and Silhouette. The Coralline islands are much younger in geological terms than the granite islands and whilst diverse, they do not inhabit the same level of species' endemism. The coral islands are characterised by mixed scrub vegetation and have 15 known floral endemic species. The vegetation of raised limestone and coralline islands has also been disturbed by human settlement activities, particularly phosphate mining, guano digging and the building of airstrips. Out of some 250 indigenous floral species in Seychelles, from 21% to 31% of the flora is now considered threatened.

Invasive species constitute, with uncontrolled housing development, the largest threat to terrestrial ecosystems in Seychelles. They have resulted from the uncontrolled,

introduction of exotic plants and animals. Invasive animal species are a serious problem, which has a significant impact on the endangered bird species recovery programmes. Wetlands, rivers and the forests of Seychelles are also affected by numerous invasive plant species. Root causes of this threat include: insufficient awareness amongst both the general public and the conservationist communities; incomplete socio-economic analyses of the seriousness of the situation; limited integrated policies/laws to address the problem; lack of strategic analysis and planning for invasive species' prevention and control; and a lack of specialised institutional and human resource capacities for invasive species management.

2.2.2 Animal diversity

The intermediate forest (200 to 500m altitude) is rich in endemic species as well as hardly reachable inselbergs habitats. The mountain mist forests are rich in endemics, although lower than in the intermediate forest. The rivers and streams have some indigenous and endemic invertebrates. There is the highest diversity between 100 – 400m transition zone from upper to middle course. There are wetlands, mangroves, marshes and freshwater wetlands, which host several endemic species, for plants as well as animals, important bird habitats and fish nursery. An endemic fish was found in the freshwater habitats. The rocky shores have got limited vegetation: Coconut, grasses and endemic *Pandanus balfourii*. There are molluscs, crabs, rock-hoppers, barnacles, algae and underwater: Foliose and encrusting corals.

An important feature of Seychelles is its vast numbers of breeding seabirds, both in the granite and outer islands. Some colonies regularly host more than one million birds and are among the largest in the world (e.g. Sooty Terns, or *Terna fuscata*). Although Seychelles is not situated along any important migratory route, however many migratory species, especially waders, are also regularly seen.

The terrestrial molluscs of Seychelles show high endemism on some granite islands and on Aldabra. Endemism in scorpions, spiders and insects is very high, including the world's largest millipede, and many species are single island endemics. Some 7% of the invertebrate species can be considered threatened and, out of these some 50% are critically endangered.

2.2.3 Marine biodiversity

Seychelles is characterized by a wide range of marine habitats, including shallow water fringing reefs, granite reefs, bank and plateau shelves and drop-offs, atolls, lagoons, seamounts and pelagic habitats. The country has often been described as a marine biodiversity “hot spot”; this despite the fact that the limited amount of what is known so far about the marine biodiversity is mainly from the reef environment and is limited to the top 20 meters. The marine and coastal environment shelters many different species of mangroves, sea-grasses, algae, phytoplankton, zooplankton, sponges, corals, worms, crustacean, molluscs, echinoderms, reef and pelagic fish, sea turtles, sea birds and marine mammals.

Altogether the Seychelles has been estimated to have a total of 1,690 sq. km of reef; recent surveys have indicated that this may be an underestimation. The coral reefs were

heavily impacted by the 1998 coral bleaching event which reduced coral cover by as much as 90% on many reefs, however the outer islands seem to have been less affected. Since the bleaching event, hard corals in general have shown a slow recovery, particularly on granite reefs, in spite of sporadic setbacks from further less harmful sea warming events observed in 2002 and 2003.

Extensive mangrove habitats are found in the lagoons of Aldabra, Cosmoledo and Astove Island groups, where they provide important nesting, nursery and resting habitats for a variety of seabird species, as well as nursery ground for fish. □ Extensive sea grass beds occur around the outer islands.

Close to 1,000 fish species having been recorded in Seychelles, some 400 of which are reef associated. Endemism amongst the fish fauna is low; examples are the Seychelles clown fish, the Seychelles bamboo shark. The whale shark is also common in Seychelles waters. Over 26 species of Cetaceans have been observed to date in Seychelles waters: 7 dolphin species and 19 whale species. Dugong sightings have been reported around Aldabra, but they have not been studied and therefore little is known about their status; despite the fact that they are an endangered species worldwide and probably close to extinction in this area.

Four species of sea turtles forage in Seychelles waters: The hawksbill turtle and the leatherback turtle are listed as “Critically Endangered”, while the green turtle and loggerhead turtle are listed as “Endangered” according to IUCN. Seychelles hosts one of the largest remaining nesting populations of hawksbill turtle in the world and a significant nesting population of green turtles.

An estimated 18% of sponges known to dwell in the Seychelles are regional endemics; more than 300 species of Scleractinian corals have been recorded in Seychelles waters. Recent offshore sampling identified 55 bivalve species of molluscs, of which 26 were new to the Seychelles and 10 were totally unknown.

2.3 Socio-economic conditions, socio-cultural conditions and human health

2.3.1 Population

The population of Seychelles was estimated at 84,600 as at June 2006 (90% in Mahé, 6% in Praslin, and 3% in La Digue). From 1994 to June 2006 the population growth rate remained fairly constant at a low 1.1% per annum.

Nonetheless, growing income disparities amongst the population has led to high demand for premium land on environmentally fragile hills, forests or seaside spots. Extension of urban areas and isolated developments in environmentally valuable areas are more related to changing life styles, fairly generous social housing policy and a lax enforcement of land-use regulations rather than to increasing demographic pressure

In addition, urbanization impacts on coastal and forest environment are increasingly visible: loss of natural areas, pollution of fresh and coastal waters inducing reef degradation, increased erosion, etc. Land reclamation projects are a classic example of relative neglect of the environmental impacts.

2.3.2 Economy

Fisheries

The fisheries sector is vital not only for food security but also for economic development. In terms of foreign exchange earnings it surpasses tourism, although the number of people employed in the sector has remained stagnant (except for the tuna canning factory) accounting for 15% of total formal employment. Marine capture fisheries have progressed considerably over the last two decades in tandem with the development of industrial tuna fisheries in the Western Indian Ocean. Seychelles now serves as the regional hub for industrial tuna fisheries in the region. Fishing activities can be categorised into more than 20 classifications, 3 of which are being artisanal, semi-industrial or industrial.

Artisanal fisheries have developed to exploit a high diversity of species and habitats, leading to a wide array of boat-gear combinations and strategies. They are characterized by fishing techniques that are selective in their impacts on fish stocks and which are not perceived to pose any particular threat to the environment. Nearly 1,800 people are employed in the artisanal fisheries sector, mainly within the handline fishery. The total landings for the artisanal fishery have remained fairly constant for the last 20 years with approximately 4,000 MT of fish landed annually. This catch supplies the local market demand, including hotels and restaurants. Nonetheless coastal demersal resources (within 10 km from the granite islands) are generally considered to be fully exploited or over-exploited. There are indeed concerns regarding the sustainable exploitation of specific stocks targeted by the artisanal fishery; in particular holothurians (sea cucumber, shark and lobster fisheries). Semi-industrial fisheries have only been developed since 1995, with the construction of a small fleet of national medium-sized longliners that mainly target swordfish and tuna. Industrial and semi-industrial long line fishing of tuna and swordfish are associated with the incidental catch of sharks. Most sharks have low fecundity, and thus are highly vulnerable to over-fishing, Cetacean (dolphins, whales and porpoises) and sea turtle by-catch is not considerable to be an issue, although should be subject to routine monitoring. In order to preserve its shark stocks, the law prohibits the practice of shark fisheries solely for the purpose of harvesting the fins.

Tourism

Tourism is the main service activity in the Seychelles. Some 43% of all hotels and guesthouses are found on Mahé (52% of the country's 2,759 available rooms), 32% on Praslin (30% of rooms) and 26% on other islands. After a decline in tourist arrival during 2002-2004, an upward trend has been noted since 2005 with 130,000 visitors (+7%). **This trend was maintained in 2005 with the figures (140,627) showing a 9% increase.** Expectations for 2010 are of some 200,000 visitors. Employment induced by tourism industry is of some 3,000 persons and is expected to be incremented by 5,000 up to 2010 with upcoming new projects.

Impacts from tourism are related to the location of facilities along the environmentally sensitive coastline and on the smaller islands. They can be grouped under two categories: impacts associated with the construction or physical development of new infrastructure and those associated with ongoing tourism operations (sewage and nutrient pollution).

Design and operations of hotels and resorts are strictly regulated in order to minimize those impacts on landscape and natural habitat.

Recent multiplication of new resorts projects (10 and more, a majority in Mahé Island) contributes to reinforcement of urbanization environmental impacts, particularly in the most valuable and fragile coastal areas. Newly developed *resorts* are compelled by law not to release untreated effluents in the natural environment and to minimize their visual impact on coastal landscapes. Older establishments still have to comply with this relatively new regulations but the negotiating power of the environment authority proved to be low and prone to discretionary measures. Economic and fiscal priorities are presently higher in government agenda. For resorts under construction, environmental impacts assessment studies have been reportedly weak and their environmental management plans implementation is not really controlled. No consistent monitoring system for resorts effluents has been yet set-up.

Forestry

The contribution of forestry to GDP has considerably declined during the last two decades although Seychelles has substantial forest plantations covering an area of 4,420 ha of mahogany and other high priced timber trees: Eucalyptus, Santol, Sandragon, Pine, Casuarinas, Calices du Pape. Although the forestry sector is marginal in terms of recorded income and employment, it supports a wide range of other economic values which are difficult to calculate (due to lack of data). Such values include watershed catchments protection, erosion control, tourist aesthetic value, fruits and medicinal plants.

Total forest cover of the Seychelles has been estimated at 40,600 ha, of which productive plantation forests comprise some 4,800 ha. The Vallée de Mai, a “coco de mer” palm forest, is one of the main tourist attractions on Praslin Island. The craft industry is also dependent on Non- timber forest products; it is estimated that this sub-sector contributes about US\$ 7.5 million annually to Seychelles’ economy. Forest fires constitute a serious threat to terrestrial ecosystems. The biodiversity of Seychelles’ humid tropical forests is very poorly adapted to survive and to recover from forest fires. It is likely that forest fires will become more common with climate change. The fire threat is aggravated by the lack of strategic analysis of the causes of fires and the lack of professional strategies for fire prevention and suppression. The future issue to be addressed is to increase forest fire surveillance and early response, as forest areas are very small and fires may threaten entire habitats within hours from starting.

Agriculture

The agricultural sector employs around 3,800 persons and it contributes to about 3.8% GDP. One of the most striking features of agricultural development from 1800’s to 1960 was the need for continued adjustment to changing circumstances and a marked movement away from food production into a cash crop economy, mainly copra. As from 1971, with the start of the tourism industry, there was an shift of labour from agriculture to other sectors, especially tourism and construction, which resulted in a general decline in the production of traditional crops.

Agriculture is currently characterized by small farms with an average size of 0.75 ha and rarely exceeding 2 ha. Currently, about 500 registered farms are dispersed throughout the

major granite islands of Mahé, Praslin and La Digue, where they are found on both the coastal plains and the uplands. Seychelles agriculture is focussed on fruit and vegetables, cucurbits in particular which are strongly affected by melon fruit flies. An eradication campaign (not harmful to the environment) was financed under the 8th EDF NIP.

Agriculture poses relatively small threats to environment with only 200 hectares of land under intensive cultivation on sites which were already deforested in the distant past. Current threats concern runoff from agricultural lands that may be contaminated with pesticides, chemical fertilizers, animal manure and sediments which may have some impact on freshwater streams, wetlands, lagoons and coral reefs habitats.

Industry and Mining

The industrial sector is very small and little growth is expected in industry of considerable size in the near future under the currently economic circumstances (overvaluation of Seychelles rupees and high production costs), which makes it very difficult for goods produced in Seychelles to compete in the export market. Industry creates a particular demand for land reclamation near the port facility and may pose threats from chemical and organic pollution. There is, however, no mineral exploitation at any significant scale which could affect environment in the Seychelles

2.3.3 Land use and land regulations

Seychelles has a well-defined system of land tenure and rights. In spite of the acute shortage of land to meet the demands of development, the country has maintained an effective conservationist approach to land use. Areas protected for environmental purposes now cover about 47% of the land area. Seychelles has a good record in designating and managing a system of protected areas as well as marine parks and reserves. Two sites have been designated as UNESCO World Heritage Sites – Vallée de Mai on Praslin and the Aldabra Atoll – because of their outstanding and unique flora and fauna. Management controls are also extended over other areas of activity to prevent environmental degradation, such as depletion of forests.

Despite this good record, it is recognised that there is a need to expand and improve the management of protected areas, and to strengthen the enforcement of regulations. Coastal urbanization has for example lessened the ability of the natural environment (wetlands, mangroves) to filter superficial waters and seriously damages coral reefs. Land degradation is mainly related to an increasing urbanization, affecting environmentally valuable areas such as mountainous as well as coastal areas. Insufficient land use management, particularly on the enforcement side, accounts for growing threats on natural habitat and biodiversity. Those threats are either direct through new developments, or indirect through poorly-controlled urbanization-led nuisances, mainly freshwater and marine pollutions.

Land degradation has dramatically increased as a result of environmental neglect by contractors when preparing sites as well as via the extraction of rocks and red earth. Even if Guidelines were developed under the EMPS 1990-2000 and Environmental management plans are systematically prepared and adopted, there are wide discrepancies between regulations and practices, once again related to a very lenient enforcement.

The Town and Country Planning Act is the primary instrument dealing with land use and development for the last 28 years. An inter-ministerial body, Town and Country Planning Authority, has been created under this Act, which is responsible for the approval of all land development proposals.

In 1992 the National Land Use Plan (*Plan d'Aménagement du Territoire – PAT*), was introduced for the three main islands providing zoning schemes and indicating land use patterns up to the year 2000. The Land Use Plan has only been used as a planning instrument on an ad-hoc basis as it was not a regulatory instrument; the Plan was also not followed through with detailed Land Use/Development Plans at district level. The National Land Use Plan is currently under review, but no firm date of finalisation has been set. However, a number of regional and district land use plans have been developed and adopted by Cabinet. Land use plans for the reclaimed areas are mandatory and implemented.

The National Land Use Plan has never been made into a legal document which could be opposed to all ministerial and individual initiatives. Decisions affecting biodiversity, agriculture and land degradation directly or indirectly can be made without taking strictly into account the Plan directives.

2.3.4 Access/transportation

Road network: The Seychelles has total length of 350Km of roads and streets, of which 192km are on Mahé, 87km on Praslin and 21km on La Digue. Due to the absence of footpath and the narrow width of lanes, temporary vehicle stops are often done on roads (particularly by buses), obstructing the traffic and causing accidents with pedestrians. It is often difficult, however, to identify suitable land for parking space or bus lay-bys because of the shortage of land in urban areas as well as in hilly roads. The increase in number of vehicles and the lack of diversion in the capital Victoria have led to the appearance of traffic jams in particular from/to the north. Past reclamation projects have however been used to construct the highway linking Victoria to the International airport and the south of Mahé.

Ports: Victoria shelters the commercial Port, the fishing Port and the Inter-Island terminal managed by the Seychelles Port Authority (SPA) created in October 2004. Level of sea pollution and air nuisances is reportedly high, enhanced by nearby tuna canning industry. The redevelopment of the fishing and commercial ports is planned in the next years. Careful impact assessments will be required in view of such major project.

2.3.5 Power sources

Amongst the country's total import of fuel about 13% is used for power generation. The electricity power supply system is managed by the Electricity Division of the Public Utilities Corporation (PUC). Electrification rate is close to 100% with a total of over 26,000 customers in 2004. A third of the electricity supplied is domestic, 55% for industrial, commercial and export, and the rest for public usage and institutions. Losses are restricted to less than 10%. Sufficient investments and utmost priority given to maintenance in previous years have led to an excellent supply situation, with very few

supply unplanned interruptions. The average growth rate for electrical energy and power demand in the last five years was 4% per annum.

Contribution of renewable sources of energy is still negligible (limited to some inner islands such as Curieuse, Arid and Cousin which are auto producers of electricity from Photovoltaic systems). There is a need to increase such contribution, in view of the increasing financial weight of the energy bill in the country economy.

2.3.6 Water supply

Currently, around 92.5% of the population is supplied with treated water. The number of customers in year 2004 was 21,374 including 19,611 domestic and 1,763 industrial/commercial customers. The Public Utilities Corporation (PUC) has the monopoly over the provision of water supply, its quality control and distribution in the three main islands of Mahé, Praslin, and La Digue. For people who live in areas not yet served with treated water, untreated water is obtained through direct stream abstraction which is under the control of the Rivers Committee, the body under the chairmanship of PUC (W&S).

There is plentiful water as attested by a 2,200mm/year average rainfall, however the main water resources used (streams and rivers, the rest being supplied by groundwater and desalination) are not evenly distributed in space and time: south Mahé, Praslin and La Digue are less favoured, and there is a well demarcated dry season from June to September. Piped water supply is increasingly irregular during the dry period and close to maximum capacity in peak demand periods. Since several years, the main islands however have faced water rationing during the dry season. This shortage will increase both in duration and acuteness with the effects of climate change, leading to more disruption of economic activity and public health problem during the 4 to 5 months of dry season. Desalination plants have brought relief in Praslin and La Digue where total demands are low, but on Mahé they have only provided partial relief, and in addition have experienced operational problems. With the increase in population and urbanisation demand, there is already the need for additional resources and additional large storage capacities at medium/long term on Mahé, while enhancing water saving.

Treated water production currently stands at over 37,000 Kl/day in Seychelles, from 4 main treatment works. In view of the critical water shortages experienced, The Government has invested heavily in desalination plants in 2003 (4 are operational). Approximately 53%, 27% and 32% of the total water production is unaccounted for in the distribution system on Mahé, Praslin and La Digue. A programme to monitor and reduce unaccounted for water has been devised by PUC and is to be undertaken aiming to keep unaccounted-for-water at say 20% maximum, but this program is hampered by lack of financing.

At present there are no reported conflicting water usage, and no reported worrying cases of endangered wetlands. In the future, the tapping of streams and river courses on a larger scope may have impact on the environment (dam sites, diminution of wetlands, downstream users, and lower dilution of septic tanks seepage in surface waters) and a particular attention will have to be paid to proper environment assessment and mitigation

measures. The use of desalinisation plants on a large scale would not add pressure on the fresh water resources, but is not financially sustainable for the small Seychelles economy, moreover requesting already badly lacking foreign currency for proper maintenance.

The present tariff structure is outdated with the last revision having been done in 1994. Extracts from the profit and loss statements show PUC's financial situation, with both the water and sewerage sectors experiencing severe deficits. Being calculated as a fix rate per kl, the present tariff structure does not provide an adequate incentive to save water, leading to a level of consumption (about 150 l/person/day) which is not proportionate to Seychelles level of socio-economic development. There have been some policy measures to introduce water saving devices in new buildings, but such measures have yet to be generalized to show effects. Insufficient tariffs, coupled to PUC's inability to obtain adequate foreign exchange from the Government arbitration procedures has contributed over the years to create a high maintenance backlog which is becoming a high priority to sustain operations. This is particularly critical for the distribution networks that generate 50% losses in water produced, and experiences a excessive number of breakdowns.

In conclusion, current water supply shortages during the summer dry season are becoming increasingly alarming. Although they are more related to under-developed storage capacity and high water losses (over 50% in Mahé due to accumulated maintenance backlog on the piping network), rather than to absolute rain deficit (annually around 2,200mm), increased consumption patterns by the population (a space of +8%/year) does worsen the situation, as well as longer and more severe dry periods do as a result of climate changes. Outdated social water tariffs since 12 years do not allow the PUC either to invest or to properly maintain water infrastructure assets.

2.3.7 Sanitation and Sewerage

It is estimated that about 75% of the population rely on septic tanks and 15% are equipped with latrines, leaving 10% connected to the two existing public sewerage systems serving Victoria and Beau Vallon, the main urbanized areas on Mahé.

These public sewerage systems are recent Providence in 2000 (7000 kl/day covering Victoria), and Beau Vallon in 2003 (capacity 3000 Kl/day). They were an urgent necessity in order to reduce the pollution load into Victoria Harbour (situated in proximity to St Anne marine national park) and in the bay of Beau Vallon, the main tourist area on Mahé. However, the schemes operate at only 30% and 25% of their nominal capacity respectively due to the limited extension of their reticulation networks. As a result, population coverage by sewerage facilities is only one third of the expected target, which is largely insufficient to fulfil the environmental objective of these facilities and provide sufficient revenues to PUC for Operation and maintenance purposes. Sewerage tariffs are insufficient to cover operation and maintenance costs associated to a smaller volume of effluent treatment than initially planned, but tariffs increase was not allowed by the Government. The sewerage activities are loss making operation for PUC.

Individual sanitation using flush toilets emptying into septic tanks is widespread, as expected from the high proportion of individual water connections. However many of the systems are believed as not functioning properly, although no surveys or record are available. Regulations exist but are hardly enforced during construction and controlled thereafter. Growing pollution of rivers and coastal waters is empirically witnessed, but without evidence due to the lack of sampling and analysis. Even if no serious pollution incidences are recorded, this situation together with the continuous development of urbanization in natural catchments and the growing utilization of surface water flows for water supply purposes will worsen the pollution flows by effluents, ultimately generating significant impacts on the surface and coastal water quality.

As a result, prevention and mitigation measures need to be defined now, and should include the establishment of surveys and a monitoring system for streams/rivers quality and individual sanitation devices, a stricter control and enforcement of regulations for new septic tanks, and a strong voluntary policy of increasing sewerage coverage of the existing facilities in Victoria and Beau Vallon in the short term.

In conclusion, lack of financial resources for infrastructure investment in sewerage has not allowed a sufficient minimization of polluted effluents releases in the natural environment in densely populated areas, mainly because of limited sewerage networks coverage. Moreover the contribution of autonomous sanitation systems to pollution flows is increasing as a result of uncontrolled/defective devices.. Inadequacy of sewerage tariffs (under social considerations) induce heavy financial losses to Public Utilities Corporation department in charge of water supply and sewerage, and contribute to decreasing the ability to extend its coverage of most urbanized areas (Greater Victoria and Beau Vallon).

2.3.8 Waste generation

The three main inhabited islands are covered by a solid waste collection system operated by a private firm under the aegis of the Ministry of Environment. Beach and street cleaning is also ensured under the same arrangement. Collection is ensured practically every day and Seychellois have been sensitized successfully over the years about preserving their environment. However, this success is now at risk as a result of progressive erosion of environment friendly behaviours, noted everywhere, as well as a subsequent increase in waste quantities and paper and plastic materials as a result of change in consumers' habits and products packaging. Total waste generated on the 3 main islands of Mahé, Praslin and La Digue was around 47,000 tons in 2005, of which less than 10% reused (mainly construction waste, plus compost 3%), and is expected to increase by 3 to 3.5% per year to 66,000 tons in 2015 and 87,000 tons by 2025.

Final disposal of the waste generated on Mahé and Praslin is below expected standards (sanitary landfill on Mahé but unlined and on the sea shore; dump site in a marshy area on Praslin) and the pollution generated and its impacts are not properly monitored. The situation is better on la Digue (lined sanitary landfill), but it is expected that the site will reach saturation within 2 years. EC projects have since the 7th EDF tried to address the

waste disposal dimension, and the 9th EDF includes new lined sanitary landfill on Mahé and possibly a specific scheme on La Digue, the promotion of solid waste recycling and reuse, alternative longer term disposal solutions in the 3 islands, and the launching of sensitization campaigns and incentive measures to reduce waste disposal. The review of the institutional and cost recovery framework of the sector and capacity building support to the executing agency (SWAC) are also part of the objectives of the project.

Due to the limited extent of the islands and the high population density, there is a need for implementation of long term and sustainable solid waste treatment and disposal, as well as a strong voluntary policy to promote recycling and reuse activities.

Industrial waste originates largely from the fishing industry. Some of this waste is processed as animal feed. The capacity of the animal meal plant is inadequate, but it is being augmented. Although there has not been a direct policy to address hazardous wastes, its generation has been substantially limited due to the light-industrial nature of the industry sector in Seychelles. There are also a few industries that generate hazardous waste, including those that produce paint, cosmetics and plastics.

In conclusion, even if solid waste collection is keeping the pace of changing life style and urbanization, waste disposal is inadequate, and its environmental impacts are not monitored. In this context, under the 9th EDF, actions are planned to enhance waste reduction and recycling and construct new waste disposal facilities. However limited financial resources may lead to a situation where only Mahé waste disposal is addressed. The sustainability, both economically and environmentally, of the design and technology chosen for waste disposal on la Digue and Praslin (where landfill condition is very bad) is questionable, and alternative sustainable solutions have yet to be devised.

3 Environmental policy, institutions and legislative framework

The natural environment is the best asset for the Seychelles past, present and future development with tourism and fisheries being the driving factors for economic growth. It is equally important for the well being of present and future generations of Seychellois.

The Seychelles has a strong history of *commitment* to the protection, conservation, and sustainable use of environmental and natural resources, but past environmental challenges were modest compared with present and forthcoming ones: increased exploitation of natural resources, tourism development, changing life styles and consuming patterns, growing urbanization, climate change, etc.). Seychelles is continuously introducing new regulations and improved organizational set-up to enhance environment management and protection. The Town & Country Planning Authority has been strengthened and the Environment Impact Assessment Regulation was introduced in 1994. The Ministry of Environment and Natural Resources and its partners have also set quality standards (ISO 1401) for the environment, especially on noise, air and effluent pollution.

Past environmental challenges were successfully met due to a combination of factors among which the limited human pressure, thanks to low demographic and economic pressure, coupled to the will to preserve the natural character and beauty of the islands, concretised through legislative measures and environmental education. Socialist principles and strong control exerted by the former regime up to the beginning of 90s' over the country's economic development (all forms of economic liberalism were rejected) and population habits have also played a role in these factors. In the recent years however, the situation evolved fairly quickly with the multiplication of development projects (in particular sea reclamation, housing and hotel constructions), the lower control by Government over economic activities and enforcements of land use and environmental policies, and the increase of population consumers' behaviours..

A great number of Seychelles environmental challenges may be addressed by the existing policy and legislation framework, however certain regulations require updating, and there is a strong need to ensure the **enforcement** of environment-related regulations and effective management of protected areas (both land and marine). Besides, a new vision for the sustainable development of Seychelles will be required in the next few years, in view of the progressive economic liberalisation recently introduced, the ongoing densification of the islands and the threats from climatic changes.

These challenges and issues may be addressed through a critical analysis of the current institutional and policy framework and of the impacts of the past and current EMPS, and the working out of a new policy and EMPS for the next decade or more. Issues to be addressed under enforcement include staffing and equipment, regular follow-up/monitoring strategy including the application of sanctions as regards land use and related constructions regulations. .

3.1 Policy and action plans

3.1.1 Sustainable development plans

Environmental concerns are embedded in the Seychelles constitution (Article 38): *“The State recognizes the right of every person to live in and enjoy a clean, healthy and ecologically balanced environment and with a view to ensuring the effective realisation of this right the State undertakes – ..(b) to ensure a sustainable socio-economic development of Seychelles by a judicious use and management of the resources of Seychelles.”*

Environmental management in Seychelles is guided by the second Environment Management Plan of Seychelles (EMPS 2000 - 2010), which has the following goal: *“the promotion, coordination and integration of sustainable development programmes that cut across all sectors of society in the Seychelles”*. The EMPS covers economic sectors (fishery, agriculture, forestry, and tourism), infrastructure (transport, water, sanitation, solid waste) and regulation as well as capacity building.

The EMPS is overseen by a 40-members’ National Steering Committee including NGOs (6) and private sector representatives. A Coordinating Unit (CU) fulfils the role of Secretariat to the Steering Committee (SC) of the EMPS. The main objective of the CU is to ensure that the EMPS is integrated across sectors and that the broader principles of the EMPS are incorporated into all sectors programmes.

The EMPS 2000 – 10 follows on from, and aims to improve upon, the previous 1990 – 00 document. It attempts to integrate environment management concerns into other development sectors while addressing core concerns. It is therefore the country’s leading strategy document for the realization of sustainable development objectives. The EMPS has ten thematic areas covering: land use, coastal zones and urbanization; biodiversity, forestry and agriculture; fisheries and marine resources & processes, tourism and aesthetics; environmental economics, mainstreaming and sustainable financing; and regulatory, policy and institutional mechanisms. The action plan also covers cross cutting themes such as education, awareness and advocacy; partnerships, public consultation and civil society participation; training and capacity building; management; science, research and technology; monitoring and assessment; and vulnerability and global climate change (refer to appendices). The following table provides a summary of the main programme areas in the EMPS and Indicative Budget. Total investment under this 10-years plan amounts to more than € 170 million.

Environment Management Plan Sub-sectors	Programme 2000/10 ('000 US\$)	Financing needs ('000 US\$)
Water, sanitation and solid waste	117,230	55,909
Land, coastal & urban planning	3,977	3,528
Sub Total 1	121,207	59,437 (60%)
Society, health, population	2,016	1,143
Biodiversity, forestry & agriculture	15,050	12,874

Environment Management Plan Sub-sectors	Programme 2000/10 ('000 US\$)	Financing needs ('000 US\$)
Energy & transport	25,085	17,987
Fisheries & marine resources	690	552
Tourism & beautification	2,150	1,620
Sustainable financing & economic supports	3,600	2,850
Institutional and legal mechanisms	130	88
Trade, industry & productive fields	2,450	1,990
Programme support	160	128
Sub Total 2	51,331	39,232 (40%)
TOTAL	172,538	98,669 (100%)

The EMPS was designed to be a “living” document which could adapt to changing circumstances through a built-in review mechanism. Mid-term advancement status and sector reviews of the EMPS has not been formally done even if a monitoring division is in place. By and large, there have to date been fewer achievements than expected due to lack of resources, due to changes in the donor and financing climate internationally, and also mainly because foreseen insufficient external and local financing resources could be mobilized. This is partly explained by the economic difficulties experienced by Seychelles in the past decade including the lack of access to multilateral donors and IMF funding. Only GEF’s and EDF contributions and some bilateral support were made available since the beginning of the second EMPS implementation. The table below indicates implementation of these various sectors. EMPS implementation delays have brought the UNDP funded capacity building project to propose to extend the EMPS’ implementation duration up to 2015, in order to achieve its initial objectives. Meanwhile Government has supported implementation of certain components through its specific budgetary allocation for the Department of Environment.

Environment Management Plan Sub-sectors	Project (s)	Donor (s)
Water, sanitation and solid waste	(i) EU 9 th EDF Solid Waste Project (ii) Adaptation of the water sector to Climate Change	(i) EU/GOS (ii) GEF/GOS PDF USD 300,000 Full size project proposed for USD 4million
Land, coastal & urban planning	(i) Mainstreaming Biodiversity Management into Production sector activities (Full size Project) (ii) Regional Programme of Sustainable	(i) GEF/GOS USD 3.7million (ii) EU/ COI/ GOS

Environment Management Plan Sub-sectors	Project (s)	Donor (s)
	Management of Coastal Zones of the Indian Ocean Countries	
Society, health, population	Various small projects	GOS
Biodiversity, forestry & agriculture	(i) Mainstreaming Biodiversity Management into Production sector activities (Full size Project) (ii) Capacity Development for Sustainable Land Management (Medium size project) (iii) Mainstreaming Prevention and Control Measures for invasive Alien Species across the production Landscape (Full size 'Biosecurity' Project)	(i) GEF/GOS USD 3.7million (ii) GEF/GOS USD 500,000 (iii) GEF/GOS Proposed USD 2million
Energy & transport	GEF project proposed for 2008/9	
Fisheries & marine resources	(i) Mainstreaming Biodiversity Management into Production sector activities (Full size Project) (ii) Regional Programme of Sustainable Management of Coastal Zones of the Indian Ocean Countries	(i) GEF/GOS USD 3.7million (ii) EU/ COI/ GOS
Tourism & beautification	(i) Mainstreaming Biodiversity Management into Production sector activities (Full size Project) (ii) Regional Programme of Sustainable Management of Coastal Zones of the Indian Ocean Countries	(i) GEF/GOS USD 3.7million (ii) EU/ COI/ GOS USD
Sustainable financing & economic supports	(i) Mainstreaming Biodiversity Management into Production sector activities (Full size Project)	(i) GEF/GOS USD 3.7million

Environment Management Plan Sub-sectors	Project (s)	Donor (s)
Institutional and legal mechanisms	Various Initiatives Including the Capacity Building project to extend the EMPS to 2015	UNEP GEF/GOS USD 400,000
Trade, industry & productive fields	-	-
Programme support	Setup of the Project Implementation Unit	UNDP GOS

3.1.2 Renewable energy plans

The EMPS states that energy provision should be environmentally and economically sustainable. It aims to promote energy conservation practices as well as the appropriate utilisation of renewable energy resources and technologies. Management priority areas are to increase and promote the use of energy conservation, renewable energy and energy efficient and clean technologies to reduce the production of greenhouse gases and other pollutants so as to safeguard both the environment and human health; as well as to implement monitoring of impacts by the energy sector and take measures to mitigate them **There is little progress in the implementation of this sector.**

3.1.3 Biodiversity conservation plans

Conservation has a distinguished history in the Seychelles dating back to the first settlements. Modern conservation started in the 1960s, a point marked by some authors with the acquisition of Cousin island in 1968 by an international conservation NGO. Various plans have been set up over the years to address environmental conservation issues. The *National Biodiversity Strategy and Action plan* (NBSAP, 1997) addresses conservation and sustainable use of biodiversity. The *National Strategy for Plant Conservation* (2005) was recently completed by an NGO in collaboration with the Ministry of Environment and Natural Resources (MENR). This Strategy addresses the conservation and sustainable use of plants, especially the indigenous plants, containing 5 objectives and 14 targets.

Various types of protected areas exist, to date covering 47% of the land area, but *sensu lato* under the Sensitive Areas designation, virtually the entire nation is protected by legislation. Legislation exists to protect species, sites and habitats. The main authority is the MENR; but various other Government and parastatal agencies are involved as well as five NGOs.

The lack of site-specific conservation strategies and management plans reduces the long-term effectiveness and sustainability of many actions taken by the Government and its partners. For example, few of the islands have environment management plans which address threats to biodiversity and ecosystem health in an integrated manner. This is particularly needed for most of the coralline islands that are typically fragile environments. Up to now these islands have been relatively protected by their

remoteness and the limited number of visitors. However the development of boating activities (charter boats, on going Eden Island marina project) may result in high exposure to over fishing and degradation (anchors, pollution). A mechanism for the coordination of different conservation activities is thus required, as well as conservation plans for most of the remote islands.

3.1.4 Forestry plans

Forests within the National Park and protected areas are generally well protected, though not necessarily well managed. Forest production activities, i.e. harvesting of timber and non timber products take place within and outside of these Parks, but only few management plans exist and are applied. There is no defined forest policy; the policy is based on the quite comprehensive but outdated Forest Management Plan (1993). The main challenge is the implementation of these plans and enforcement of the existing laws. Some effort has been made to train forestry staff and staff from NGOs in law enforcement methodologies, but they are too limited and not comprehensive enough to make an impact.

The Seychelles Forest Management Plan (INDUFOR, 1993) proposes a framework for forest policy and additional development activities in the forest sector. Some revisions of the original Plan have been proposed and several studies were carried out, e.g. on the production, transformation and utilization of wood, through the cooperation with the French Department of La Reunion (2003). To date the Seychelles does not have a comprehensive and clear policy specific for the forestry sector.

The devastating effect of forest fires, which is particularly prominent on Praslin and Curieuse islands, has long been recognized by the authorities in Seychelles. The Department of Environment, under the MENR, has been given the mandate to control and suppress forest fires, but there is little involvement of civil service groups, NGOs, private land owners and the local communities in forest fire management and control. Some of the necessary infrastructure, tools and equipment exist such as Fire Contingency Plan that defines responsibilities for forest fire fighting which is, on the other hand, outdated.

The recently (July 2006) adopted *National Wetland Conservation and Management Policy* attempts to address and reverse the degradation of wetlands in the Seychelles.

3.1.5 Natural disasters risks plans

A National Disaster Committee (NDC) for national disasters has been in existence for a number of years, under the aegis of different ministries and departments. This Committee is now directly under the aegis of the President's Office, which is complemented by a National Disaster Secretariat within the President's Office.

The *Draft National Policy on Disaster Management* aims at addressing the increasing incidences and emergence of both slow and rapid on-set disasters, which result in serious

human distress and suffering, destruction of property and infrastructure, disruption of the environment and overall welfare of the society.

Nonetheless, the weather events of 1997 and 2002 have led to the urgent need for an enhanced disaster management system. A National Disaster Fund has also been set up and Seychelles has become more active in regional disaster management initiatives. The National Disaster Secretariat has been entrusted to carry out a country wide hazard risk assessment. This comprises the stock taking of past landslides and establishes the likelihood of future landslides, based on the qualitative analysis of the slope types, geology, alongside historical information on past land movements in the respective areas. The information gathered will be used to prepare a landslide risk map for every district. The Secretariat also works in collaboration with the Ministry of Education to help create awareness and preparedness on natural disasters in schools, of which landslide features as one of the five natural disasters have been identified.

- Disaster- project proposal 2005,UNDP funded 2006
- 2 more projects- risk assessment and capacity building
- Meteo- established the multi-hazard colour warning system 2005, awareness campaign; still have work to do, to be in line with the complete system.
- Very good detection of early warning systems in the inner/outer islands but still have weaknesses on the socio-economic indicators and how to deal with the imminent hit of an hazard

3.1.6 Land use and tourism development plans

The “Plan Indicatif d’Aménagement du Territoire” (PAT, or Land Use Indicative Plan, 1992) which lays the ground rules for land use planning based on sustainable development, has never been developed into law. It has and is still used as a guideline document, and only covers the three main granite islands... The National Land Use Plan has never been made into a legal document which could be opposed to all ministerial and individual initiatives. Decisions affecting biodiversity, agriculture and land degradation directly or indirectly can be made without taking strictly into account the Plan directives.

The National Land Use Plan is currently under review but no firm date of finalisation has been set. However, a number of regional and district land use plans have been developed and adopted by Cabinet. Land use plans for the reclaimed areas are mandatory and implemented.

The Tourism Policy and Vision (commonly known as Vision 21) encourages protection of natural resources to underpin tourism development. The Ecotourism Policy promotes increased emphasis on ecotourism development in Seychelles.

The current policy document on tourism development in Seychelles; Vision 21, stresses the need for eco-tourism and repositioning Seychelles as an exclusive and quality destination. It advocates coordinated national efforts to maintain and expand the tourism sector’s contribution to the economy, in a manner which is environmentally and socially sustainable. In line with this decision, Government has established certain incentive policies to guide tourism development in the country. These policies are designed to

encourage Seychellois to invest in the tourism sector, and to encourage all new developments to incorporate environmental activities into the concept of tourism products. A Policy Planning & International Cooperation Division in the Department of Tourism is mandated to facilitate the development and adoption of good practices pertaining to sustainable development within the tourism industry.

3.2 Institutional structure and responsibilities

While all of the Ministries within the Seychelles Government are involved in the sustainable development process of the country, the environmental and natural resources management institutional framework is strongly relying on discretionary decision and does not have appropriate capacity (human resources and updated knowledge) to face forthcoming challenges.

3.2.1 Ministry of Environment and Natural Resources

The Department of Environment (DOE), has the leading responsibility for environmental management. The Divisions under DOE are: Nature Conservation (NC), Pollution Control and Environmental Impact (PC&EI) and Policy Planning and Services (PPS).

The National Parks & Forestry Section under NC has the mandate to manage, protect and exploit the forests and forest plantations in Seychelles, whilst the Conservation Section deals with biodiversity conservation. The Environmental Impact Assessment Unit under PC&EI handles all administrative issues related to the EIA process. A wetlands Unit under PPS deals with conservation of wetlands. Newly formed Environmental Engineering Section deals primarily with drainage and flood control.

The Department of Natural Resources (DNR), which used to fall under the Ministry of Agriculture and Marine resources, until this Ministry merged with the Ministry of Environment to become MENR in 2004, is responsible for Agriculture and Fisheries. The Agricultural Extension Services Section under the Crop Development & Promotion Division provides advice to the farmers on a continuous basis. Information is also provided through the media (television, radio, newspaper articles), as well as through occasional field demonstrations. The Vegetable Research Section is responsible for agricultural research, including soil fertility management. The Plant Genetic Resources Section manages and conserves the crop genetic resources.

The MENR is parent ministry to several agencies dealing with the environment. These include the Marine Parks Authority (mandated with the management of marine protected areas), the Seychelles Fishing Authority (mandated to manage fisheries resources), and the Public Utilities Corporation (mandated to provide access to water, electricity and sanitation services). The Department also works in close collaboration with a number of local and international NGOs.

The annual 2005 budget of the MENR was € 6.6 million, out of which personnel charges accounted for 47%. It accounts for 7.6% of the total Budget. To be noted that a third of

MENR budget is dedicated to the solid waste sector, mainly in payment of services outsourced to private operators. The respective share of environment and natural resources is as follows:

:

	2006 Budget € '000
Dept of Natural Resources	2 599
Administration	389
Planning and training	362
Plant generic resources development	411
Livestock development	304
Veterinary services	437
Vegetable and evaluation research	262
Extension	245
Plant protection	188
Dept of Environment	5 997
Administration and finance	778
Nature and conservation	1 125
Pollution Control and environmental impacts	3 276
Landscaping and town beautification	-
Policy planning and services	666
Minister's secretariat	154

A major positive aspect is the increase in environmentally trained human resources (professionals and technicians) over the last decade. Individual capacity has been built through scholarships, workshops and meetings partly funded under multilateral and bilateral donor projects. A human resources development policy and plan is undertaken by the Government to optimize the use of this limited personnel. This function is taken over at MENR level by an HRD coordinator who leads a staff training policy.

However, those actions and changes have not yet been able to solve major weaknesses such as inadequacies in number and quality of trained environmental professionals and technicians, limited funds devoted to scholarships abroad, and the limited size of the population. In addition, there are particular contract management and monitoring needs regarding the solid waste sector due to the fact that outsourced services are involved, and that major investments are required in that sector in line with EMPS projections.

3.2.2 Ministry of Land Use and Habitat

The Ministry of Land Use and Habitat (MLUH) is responsible for overseeing land and infrastructure development, land reclamation, land use planning, planning and building applications under the under the Department of Land Use (Lands & Territories Division, Geo-Informatics Division); and for urban and architectural guidelines, monitoring and control, under the Department of Habitat (Development Control Division and Habitat Division). The Local Government Division under the Ministry of Local Government, Culture and Sports (MLGCS) also has a Planning Section for infrastructural projects requested by District Administrators.

The Planning Authority is set up under the Town and Country Planning Act, chaired by the Principal Secretary of the MLUH, with membership of all relevant ministries, parastals and some non government stakeholders, and is mandated to prepare land use plans. The Planning Authority is legally required to request an environment authorization from the Department of Environment in advance of deciding a planning application.

The Licensing Act should provide an improved approach to granting contractors license. The current procedure involves consultation with MLUH, but there is no systematic way

of assessing an application for a new building contractor licence or an upgrade to a higher licence. This is usually done by the Development Control Committee based on a quality approach.

3.2.3 Other National Institutions

The other main institutions involved with environment management are the following.

- Seychelles Fishing Authority (SFA): Its duties are to promote, organize and develop fishing, fishing industries and fishing resources in the Seychelles. Its parent ministry, the MENR set up a Fisheries Policy Unit in 2005 which works in close collaboration with SFA on fisheries policy matters.
- Marine Parks Authority (MPA): manages Marine Parks, some of which include land areas, e.g. Curieuse Island.
- The Public Utilities Corporation (PUC): responsible for provision of water, sewerage and electricity to the country's consumers.
- The Islands Development Company (IDC): manages a number of outer islands and Silhouette is responsible for their economic and physical development.
- The Seychelles Tourism Board (STB) has recently been established (April 2005), with members from both the public sector and the industry, and aims to strengthen cooperation and partnership for the development of the tourism product and the promotion of Seychelles. STB is expected to address the challenges outlined in Vision 21. In addition to the STB, a Tourism Advisory Committee has also been appointed by the Vice President (responsible for the Department of Tourism) with representatives from the public and private sector and it is mandated to advise government and STB on the planning and development of the industry. The Seychelles Investment Bureau (SIB) facilitates Tourism Investment Proposals in Seychelles. The required project memoranda for Tourism Investment Proposals need also to elaborate the environmental aspects/impacts of the project.

3.2.4 Coordination committees

At other levels of Government, there are a number of coordination committees, which aim at facilitating policy co-ordination and implementation. For instance, the Ministry of Tourism has a Vision 21 Tourism Focus Group, with representatives from both government and private sector. The Ministry of Environment has several multi-sectoral committees, for example the National Environment Advisory Council mandated to advising the Minister on Environmental Issues and the Environment Plan Steering Committee, which oversees the implementation of the EMPS 2000-2010.

The Rivers Committee handles communal and private issues pertaining to water abstraction, and a water supply committee was set up in 2004 to analyse and make recommendations regarding the water shortage crisis. Recommendations were presented in a report in 2005 on water developments needed on the period 2005-25. This committee is no longer functioning in the same capacity. As is the case with the Drainage Task Force, created by Cabinet following serious flooding incidents in 2004. The committee made recommendations to government which lead to the formation of the 'Environmental Engineering Section' (EES) under the Department of Environment.

More specialized committees, such as the sea cucumber fisheries management committee, are set up on a more temporary basis.

Some of the more permanent committees are:

1. the National Climate Change Committee, set up since in 1992 and is increasingly involved in research and policy matters, such as the development of the first and second National Climate Communication Plan (SINC),
2. the multi stakeholder Invasive Alien Species Committee, which albeit may meet irregularly to discuss matters concerning the prevention and control of Invasive Alien Species, is the national platform of communication for all coordinating bodies..
3. The UNCCD committee recently set up in 2005 with the accession to the convention and preparation of our first national plan

3.2.5 Non Government actors

The NGO sector in Seychelles is relatively young and in the process of development.. Difficulties mainly arise from lack of a clear framework for interaction of NGOs within Government's planning process as well as their accountability as they seek to become implementers. It may be noted as well that there is a large number of NGO relative to the size of the population. This factor certainly limits the potential capacity and coordination of these actors.

A lack of a wide base of local capacity for NGO's to take up environmental conservation implementation activities has also been a serious impediment The process of greater involvement of NGOs needs to be continuously developed in a transparent and accountable framework, within which both NGOs and Government are aware of one another's roles in the drive towards sustainable development.

Almost all environment related NGO's are active primarily in the area of conservation and environment education. Some are also involved in land management, as they manage islands (ICS – Aride, Nature Seychelles – Cousin, Seychelles Island Foundation – Aldabra and Vallée de Mai, Praslin). Some of them have also considerable experience in habitat restoration, especially on privately owned small islands in partnership with island owners. There has been increasing cooperation and partnerships with governmental organizations, NGOs and private agencies in forest management over the past decade. The Liaison Unit for NGOs in Seychelles (LUNGOS) is the official "porte parole" of the NGO community with Government and offers a number of services to its members. It is represented on several environment committees including the Steering Committee of the Environmental Management Plan of Seychelles and provides a coherent approach through its relevant members. Its paid up members related to Environment currently include Nature Seychelles, the Wildlife Clubs and the Seychelles Islands Foundation as well as many natural resource related associations including fishers', farmers' and craft persons groups.

3.3 Legislative framework

The Environment Protection Act 1994 defines the protection, preservation and improvement of the environment and the control of hazards to human beings, other

living creatures, plants and property. The Department of Environment administers the Act, and the Act makes provisions to co-ordinate the activities of other agencies concerned with the protection of the Environment. Two authorities have been legally established to date under the Act: the Solid Waste & Cleaning Agency (SWAC, 1995), and the Marine Parks Authority (MPA, 1996).

3.3.1 Legislation

The Lighting of Fires (Restrictions) Act (1940) is the only regulation aiming to protect forest. Requesting a permit from the Forestry Department before lighting open fires is for instance, stipulated in this Act. Bans are put into force during the dry period and these are monitored and enforced by the staff of the Ministry of Environment. The Act needs to be updated and its scope enlarged.

Biodiversity related legislation ensures a wide coverage of Seychelles' species protection (refer to list of acts and regulations in appendices). Most of the relevant protected areas (National Parks and Special Reserves) have been set up under the National Parks and Nature Conservancy Act. Few of these protected areas have management plans and qualified professional and technical staff to implement the plans. Other relevant ordinances and Acts that impact on Land management are the State Land and River Reserves Ordinance (Cap 150) of 1903; and the Forest Reserves Ordinance (Cap 153) of 1955.

Numerous pieces of legislation address land management in general. The Environment Protection Act 1994 provides for the protection, preservation and improvement of the environment, including land.

The Town and Country Planning Act of 1972 provides the basis for land use planning. The Act provides sufficient basis for environmental protection, but is based on a top-down, Government-driven approach to land use planning with little provision for stakeholder involvement and integration of conservation objectives into planning efforts, and is currently out of date. This Act also lacks a statutory Land Use Plan, and enforcement is difficult as developments continue to outpace the regulatory framework. The Town and Country Planning Act is currently under review, in order to bring it up with the pace of development

Provisions for landslide prevention and best practices for slope protection need to be included. There is also a need for introducing better guidelines in development of regulations to ensure proper construction procedures on slopes. Enforcement protocols need to be streamlined for more effective results. The Ministry of Land Use and Habitat is drawing up district land use plans, with the input of local stakeholders. Hazard risks management and best practices in construction will feature in this exercise

All development, including tourism projects, is subject to environmental authorisation and an Environment Impact Assessment (EIA) procedure is required for all projects that may have environmental impacts. In addition, developments should each have an environmental management plan prepared, which is approved and monitored by the MENR.

All development, including tourism projects, are subject to environmental authorisation. Detailed Environment Impact Assessments (EIA) are required for projects mentioned in the EIA regulations and any other projects that the authority decides will have significant environmental impacts. In addition, developments should each have an environmental management plan prepared as part of the preparation of the EIA, which is approved and monitored by the MENR..

EIA is defined under the Environment Protection (Impact Assessment) Regulations. The legislation stipulates carrying out an EIA study as well as obtaining an environmental authorization if any person commences, proceeds with, carries out, executes or conducts it. The criteria, which establish the necessity of an EIA is found in the EP (EIA) Regulations 1995 which list the categories of projects or activities requiring environmental authorization as well as protected and ecologically sensitive areas. For the more complex cases the proponent hires an appropriate consultant to prepare a document usually referred to as a class 1 EIA which is subject to public inspection. Less complex class (2) EIA are undertaken by staff of the MENR.

3.3.2 Enforcement

Enforcement and compliance to the extensive range of legislation is inconsistent due to insufficient definition of the mandates and responsibilities of key agencies, lack of complete understanding of environment laws among enforcement officials, lack of legal challenges and legal testing of the current environmental laws in court, insufficiencies in the auditing, monitoring and testing framework on the ground, low priority accorded to environmental cases by the police and judicial system. In addition, there is also the problem of the public not being fully aware of the full requirements of environment laws, which reflects on the quality of education given to the public as well as the publicity that should be given in the case of convictions.

- The success rate on convictions is increasing as deficiencies are corrected, officers get more practice with case preparation and processing and the judicial system give more attention to environmental cases. However, several aspects need to be improved in order to have high and consistent application of the law. Lack of experience and less than optimum application of the right skills by officers often prevents cases from being watertight and convincing. Support from the police in evidence gathering also contributes to the low quality of cases by the department. Some of the existing laws are also outdated and the penalties they provide are low.

3.4 Key international environmental conventions

Seychelles is party to all major environment related international conventions (see the list in appendices).

A coordination unit has been created in the MENR and a close follow-up is undertaken.

International conventions share the same enforcement constraints as the national legislative and institutional frameworks. Nonetheless, overall the MENR has been able to comply with their legislative requirements, with external expertise and financial support.

3.5 Integration of environmental concerns into the main economic sectors

The two main economic sectors are fishery and tourism. Both are strongly related to natural resources management and environment protection.

Fishery The fishery sector in Seychelles is managed by the Seychelles Fishing Authority (SFA) which is an efficient and well organised national institution; most of SFA budget is financed by EC fisheries agreement.

EU is funding an important regional tuna tagging programme in the Indian Ocean. The objective is to improve the monitoring of the status and behaviour of the tuna stock. The Regional Tuna Tagging Project-Indian Ocean (RTTP-IO) is a 9th EDF project coordinated through the Inter-Regional Coordination Committee (IRCC) which includes the institutions of COMESA, IGAD, EAC, SADC and IOC. The Indian Ocean Commission (IOC), based in Mauritius, is the Contracting Authority for this project, while technical supervision is executed by the Indian Ocean Tuna Commission (IOTC), based in the Seychelles. The European Commission signed a Financing Convention with IRCC in December 2003, agreeing to be the sole financial donor for this project to the value to 14 Million Euros. Additionally, in collaboration with the “Institut de Recherche pour le Development” (IRD), the ongoing tuna sampling programme in Port Victoria with the aim of collecting length frequency and species composition has been intensified. In order to regulate industrial tuna fisheries activity in Seychelles’ waters, the Fisheries Monitoring Centre at the Seychelles Fishing Authority (SFA), became fully operational in 2002. The system will enable SFA to effectively monitor all Seychelles flagged vessels and those licensed to fish in the EEZ. This has already improved understanding of catch areas and reduced illegal fishing.

In accordance with the increasingly internationally accepted instruments for the preservation of fish stocks, Government is in the process of enacting laws and regulations for the establishment of Special Fisheries Reserves at various locations in the EEZ. A comprehensive research and management programme has also been developed to investigate the importance of reef fish spawning aggregations to the sustainable management of artisanal fisheries. A number of smaller research programmes in collaboration with both local and international counterparts are implemented in a bid to better understand and manage fish stocks.

3.5.1 Tourism

Seychelles tourism policy has always taken into account environmental conservation and has sought to limit negative impacts by setting limits on visitor arrivals while seeking to maximise per capita visitor yield. At the same time, hotel development on the coastal zone has been subject to increasingly strict regulations, including setback limits and aesthetic standards.

However, the concept of tourism carrying capacity has not been sufficiently studied and accordingly inadequately developed in Seychelles. While the actual impacts of tourism development are largely unquantified, it is the cumulative impact of this rapidly growing sector that is deemed to be the greatest threat to the conservation of the natural environment.

The present capacity of the hotel sector is 5,000 beds and another 2,000 hotel beds are under construction or planned (40% increase) over the period 2006-08, especially on Mahé and 2 new hotels on Silhouette. Seychelles has been able to establish and to maintain relatively high standards for the tourism industry in comparison to many other countries. However, the combined impacts on biodiversity may become much more significant if biodiversity conservation is not mainstreamed into the sector. A number of legislations, strategic documents, and institutions are in place to deal with these issues, but the coordination and monitoring, and most importantly the enforcement are insufficient to guarantee effective results and the achievement of preservation objectives.

Vision 21 contains specific sections addressing management of national parks and other protected areas, coastal zone and marine resource management, tourism planning and development standards, tourism development area and land use planning, tourist facility site planning and design standards, improving tourism related infrastructure, including roads and road services; sea transportation, water supply; electric power, telecommunications and waste management (including sewage, solid waste & waste from nautical tourism). Government is also working with tourism enterprises to promote environmental conservation by, for example, adopting alternative sources of energy, conservation of energy and water resources, minimising production of solid waste, and the elimination of detergents containing phosphorous compounds. However, as planning must be a flexible and continuous process, Vision 21 will be updated as required based on continuous monitoring of tourism development and market trends.

Under the Environment Protection Act (Environment Protection Impact Assessment Regulations, 1996), all tourism projects must submit an Environmental Impact Assessment, a law which is being fully enforced. The main weakness is in follow-up of the enforcement of Environment Management Plans associated to IAS. The MENR does not have sufficient capacity and means to really control on-site EMP implementation by builders.

4 EC and other Donor environmental co-operation

4.1 EC environmental co-operation in the Seychelles

Under the 7th EDF programme, although the environment was not the focal sector, EC resources were nonetheless targeted towards biodiversity conservation strategy drafting, creation of protected areas department and support to regional programme on coastal areas protection. Under the 8th and 9th EDF, the EU-Seychelles Country Strategy Papers targeted the environment sector as the focal sector for the Seychelles (respectively €4.4 and €3.3 million) and more specifically address the waste disposal dimension. Although and because the construction of a landfill at Anse Royale under the 8th EDF did not bring expected results, EC support has been given to the update of the Solid Waste Master Plan, completed in 2004, with recommendations in terms of capital projects for implementation, together with an indicative investment plan and calendar of interventions. A feasibility study was also carried out in 2005 for the sector, focused on the provision of new landfill facilities in the 3 main islands Mahé, Praslin and La Digue.

As a result of these studies, an "Integrated Solid Waste Management Programme" for the solid waste sector has been designed, and will be implemented from 2007 to 2009 on 9th EDF financing. The projects includes new lined sanitary landfill on Mahé and possibly a specific scheme on La Digue, the promotion of solid waste recycling and reuse, alternative longer term disposal solutions in the 3 islands, and the launching of sensitization campaigns and incentive measures to reduce waste disposal. The review of the institutional and cost recovery framework of the sector and capacity building support to the executing agency (SWAC) are also part of the objectives of the project. It is also expected that the landfill built in Anse Royale under the 8th EDF will be optimised.

At the regional level, EC resources (€4.8 million) are also committed to the Programme Régional de Protection des Végétaux (PRPV), which has as objective to promote horticulture by providing a reviewed regulatory framework, capacity building targeted for enforcement and, support to producers through research, networking and quality controls.

Under the 10th EDF actually in the programming stage, the EC will support the Seychelles' in its transition towards sustainable growth and social achievements by strengthening the environment sector management, in particular the most sensitive sub-sector, notably integrated water supply management as part of Government's reform programme for the water sector (including sanitation and land drainage), and possibly solid waste management in complementarities and extension to the actual programme under 9th EDF funding..

Sector wide programme approach is envisaged whatever the environment sub-sector targeted. The needs in the water and sanitation sector require an integrated approach and financial resources that largely exceed EDF allocation and will attract other donors, while the solid waste sector benefits from a sector programme already financed under the 9th EDF. The main actions proposed are:

- Water incl. sanitation: institutional and capacity building of the sector and of PUC, including the development of a Master Plan, technical assistance and training; and improvement of

water supply and sanitation infrastructure, including works and measures to reduce water losses and provide sewerage extension

- Solid waste: institutional and capacity building of the sector, technical assistance and training; and provision of solid waste treatment and disposal facilities on Praslin and La Digue

4.2 Other funding agencies

Within the environment sector its main development partners are the GEF, UNDP and French Bilateral Assistance.

The Global Environment Facility (GEF) has acted as a key partner in promoting sustainable development. The following are the key GEF-funded projects for Seychelles:

- Enabling Activities under the Stockholm Convention on Persistent Organic Pollutants for Seychelles;
- Integrated Ecosystem Management of Seychelles;
- Enabling Seychelles to Prepare its First National Communication Framework to the UNFCCC;
- Management of Avian Ecosystem Project;
- Management of Marine Ecosystem Project;
- Development of the National Biosafety Framework.

The UNDP country programme for Seychelles for 2003-2006 focused on upstream support for the implementation of the second environment management plan for Seychelles (EMPS-II). The proposed activities addressed four programme areas.

- Institutional and human capacity-building for EMPS 2 with an emphasis on strengthened capacities and partnership with environmental NGOs;
- Integrated water management, focusing on the improvement of safe yield of water resources for integrated river-basin management, aimed at increasing water supply in a selected area of Mahé through innovative approaches; and improvement of wastewater systems and on their sustainable management;
- Bio-diversity conservation, addressing key forest ecosystems and identified priority threats;
- Climate change and energy efficiency, focusing on establishing key technology needs for the mitigation of the impact of climate-change and for capacity-building in this area.

The objectives of the 2007-2010 UNDP country strategy are as follows:

- Fostering and enabling environment for civil society empowerment in delivering services to achieve the MDGs;
- Promotion of gender and human rights;
- Promotion and protection of the environment and access to sustainable energy services;
- Sustainable disaster management.

The UNDP will mobilize for this programme an amount of MUS\$ 0.1 from its own resources and US\$ 7.2 mio from GEF resources for this 3-years-long programme estimated US\$12.3 mio.

UNDP/GEF intends also to run two support programs on capacity building for Improved Environment Management and sustainable land management, and one program focused on Adaptation of the Water Sector to Climate Change.. This last program could amount for € 12 million of which € 4 million form the GEF special climate change fund, and € 8 million of co-financing.

These programs under preparation show a strong consistency with proposed 10th EDF focal sector intervention. Close contacts will have to be entertained during all preparatory phases from both sides, as the time schedule of both programs is quite similar: feasibility stages in 2007 and implementation by 2008.

In the past, except for EDF and UNDP/GEF resources, the general tendencies on the involvement of other funding agencies show a decline of available resources along with the Seychelles GDP growth. This situation has also been the result of macroeconomic difficulties, with Seychelles being unable to reimburse past loans from multilateral donors, as well as being unable to reach an agreement with the IMF on macro-economic reforms. The Seychelles having cleared at the end of 2006 most arrears with multilateral donors, and being in dialogue with the IMF, it may be expected that access to external funding improves in the next years...

To date, although there are no formal procedures for co-operation between funding agencies, the size of the country, the limited number of assistance programmes, and the integrated framework of the EMPS have allowed coordination and co-operation to be effective.

5 Conclusions and recommendations

5.1 Conclusions

Environment is the best value, more for Seychelles than for any other country, present and future development and economic growth.

1. Past *environmental challenges* were modest compared with present and forthcoming ones: increased exploitation of natural resources, tourism development, changing life styles and consuming patterns, growing urbanization, climate change, etc.). Past challenges were met mainly through legislative measures and environmental education, but more truly because of a limited human pressure (low urbanization and industrial growth). Natural resources exploitation has not been much more careful than elsewhere.
2. Most of Seychelles major environmental challenges are already addressed by the policy and legislation framework, even if updating some regulations is necessary. The main problem lies in enforcement of environment related regulations and effective management of protected areas (land and marine ones). Enforcement is not only a matter of means (staff and equipment) for the follow-up of EIS and land use and construction inspections and controls, but also is a matter of conviction and disincentive sanctions. Management of protected areas shares former concern but needs both more staffing and improved organization and capacity.
3. Institutional framework of environmental and natural resources management does not have appropriate capacity (human resources and updated knowledge) to face forthcoming challenges. Moreover, mandates and responsibilities of key agencies are unclear. The wide sector coverage of the MENR (everything from forestry to water supply) leads to decisions between sub-sectors' priorities that can be detrimental to environment protection, while, in the other hand, absence of strong functional links with land-use planning and management forbids to efficiently protect natural habitat from growing urbanization. Last, environmental policy is in the way to be considered as a secondary priority, compared to government's economic priorities, for example in tourism industry developments and fishery agreements.
4. Urbanization impacts on coastal and forest environment is increasingly felt: loss of natural areas, pollution of fresh and coastal waters inducing reef degradation, increased erosion, etc. Land reclamation projects are good examples of the relative carelessness when it comes to determining the environment impact of such projects.
5. Extension of urban areas and isolated developments in environmentally valuable areas are more related to changing life styles, fairly generous social housing policy and lax land-use regulations enforcement than to increasing demographic pressure (population growth is limited to 1.2% annually).
6. Recent multiplication of new resorts projects (10 and more, a majority in Mahé Island) within three or four years is contributing to reinforce urbanization environmental impacts, particularly in the most valuable and fragile coastal areas.
7. Lack of financial resources for infrastructure investment in sewerage and sanitation does not allow minimizing polluted effluents releases in the natural environment (limited sewerage networks, ineffective waste water treatment). Inadequacy of sewerage tariffs (under social considerations) induce heavy financial losses to Public Utilities

Corporation department in charge of water and sewerage, and contribute to lessen its ability to extend its coverage of most urbanized areas (Greater Victoria and Beauvallon).

8. Newly developed resorts are compelled by law not to release untreated effluents in the natural environment and to minimize their visual impact on coastal landscapes. Older establishments still have to comply with this relatively new regulations but the negotiating power of the environment authority proved to be low and prone to discretionary measures. Economic and fiscal priorities are presently higher in government agenda. For resorts under construction, environmental impacts assessment studies have been reportedly weak and their environmental management plans implementation is not really controlled. No consistent monitoring system for resort' effluents has yet been set-up.
9. Artisanal fishery based on demersal species has never been controlled. They have been even promoted without a clear idea of resources capacity. Empirical evidences show that this capacity has reached its saturation level. No action has been taken yet in this respect.
10. The most important environmental problem caused by fisheries activities in the Seychelles is the overexploitation of coastal demersal resources. Incidental catch of sharks could also pose a problem for the sustainability of certain shark species.
11. Even if solid waste collection keeps the pace of changing life style and urbanization, waste disposal is inadequate, ill-conceived and its environmental impacts not monitored. Strong actions are planned under 9th EDF to improve recycling and disposal in Mahé but no action is foreseen in Praslin (where landfill conditions are appealing) or La Digue. Design and technology chosen for waste disposal is questionable as its consistency with Seychelles needs and specific context has still to be evidenced. Its sustainability, both economically and environmentally has not been fully proved.
12. Climate change is a long term threat to access to water. Current shortages during the limited summer dry season are more related to under-developed (and maintained) storage capacity and losses (up to 48% in Mahé), due to accumulated maintenance backlog rather than to absolute rain deficit (annually around 2,200mm) or increasing population. Outdated social tariffs for water have not allowed for years PUC neither to invest nor to maintain properly costly assets.
13. Another consequence of climate change is an increasing exposure of the Seychelles to natural disasters. If appropriate coordination seems to have been set-up, needed financial resources to ensure operational intervention capacity is lacking.

5.2 Recommendations

1. The utmost priority for environmental policy in the Seychelles is now *enforcement of environment related and land-use regulations and strengthening of the management of protected areas*. Both are to be conceived as to lead to conviction of offenders by an independent and environmentally sensitive judiciary, and really disincentives sanctions.
2. The major capacity constraints of the environment sector have been explicitly identified during the implementation of National Capacity Self-Assessment (NCSA) project. It showed limited capacity at the systemic, institutional and individual level as being the primary barrier to effective management of global environmental commitments for sustainable development. The limited institutional knowledge of the environmental conventions, environmental rights and obligations, and institutional models and

systems, were singled out as the major limitations for the incorporation and implementation of international commitments in the local context.

3. EC support should thus be devoted to enforcement capacity and updating of related environment regulations. This should lead to support legislative and institutional framework appraisal, including land-use planning and involvement of police and coast guards forces.
4. A dialogue is to be set-up to gather government's commitment to devote more financial resources to those aspects by reallocating funds inside MENR budget. New infrastructure investments should leave some means for running environment-related regulation and administrative management.
5. EC support is also needed for strengthening of protected areas' management, particularly to enforcement of regulations, means of enforcement and human resources in designing and implementation of Conservation areas management master plans and Environment management plans within environmental Impact assessments. Economic growth required by the Government to remedy major macroeconomic unbalances and debt burden gathered along the last decade to fuel ambitious investment projects and social welfare policy, may induce too much flexibility in foreign investors construction and industrial projects in land use. Technical assistance is required at all levels. A component of particular importance is to match tourism demand with conservation requirement, giving better and more sustainable ground for tourism industry development.
6. Fisheries management plans for coastal demersal resources should be developed and implemented. The provisions included in the "shark fining law" should be enforced.
7. Another priority area is planning and programming by supporting sector-wide approach for the four sub-sectors for which high concerns have been expressed by the Government and entail heavy investments: Water & Sanitation, Solid waste, Land drainage, and coastal erosion. Solid waste sub-sector has been 8th and 9th EDF's focal sector and thus should have one by the end of the 9th EDF programme. Coastal erosion is also covered by a regional 9th EDF EC project which should design such sector-wide approach. The remaining priority areas are water and sanitation and land drainage.
8. For environment policy as a whole, water and sanitation sector has a high level of priority as it addresses both freshwater resources management and pollution controls of river and coastal waters through sewerage extension and the improved treatment it would also entail better functioning of individual septic tanks. It should be considered as a suitable 10th EFD focal sector.