Physical Alteration and Destruction of Habitats: East Africa

Seychelles Report

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Executive Summary

A UNEP/GPA meeting in collaboration with the Secretariat of the Nairobi Convention and Governments in the region agreed on three main priority areas: Coastal tourism; Mangrove Destruction; and Ports and Land reclamation to address problems through the development of projects associated with those activities. The report at the request of UNEP is to review adequacy of national legislation and institutional arrangements; assesses the socio-economic importance of the three main priority activities; and present case studies on ecosystem restoration initiatives in the country.

The lowland or coastal vegetation has been severely modified by human activities at various stages in the history of the Seychelles, especially Mahe. Almost all species originally described still survive, but several are now found only at higher altitudes. There are still a considerable number of sites where small remnants of lowland palm forest exist or where there is good regeneration of lowland palm species under a cover of exotic trees. In the last 25 years the modification and loss of coastal ecosystems on the main granitic islands has accelerated as a result of rapid social and economic development. Consequently, the major threats to endemic species and vegetation on the main granitic islands are related to the rapid rate of development, which has led to the conversion of land for infrastructure, such as housing, roads, commercial and tourism. Habitat loss, including coastal wetlands, as a result of housing and tourism development is a major factor, particularly in the main granitic islands. During the nineteenth and twentieth centuries these habitats were gradually removed for agricultural purposes and now for tourism and housing. The pressures on these ecosystems have been further intensified by deforestation and construction on hillsides as the demand for land has increased. Reclamation activities have also increased significantly over the last 30 years to meet demands for land for development.

Coastal tourism: There is not one piece of legislation which governs coastal tourism in its entirety or its specificity. The only piece of legislation that makes specific mention of tourism and its related activities is the Environment Impact Assessment (EIA) regulations. However, in this case the conditions for the development are prescribed in the EIA report which is not always a legally binding document, as parties do enter into negotiations and often alternations to approved plans

are undertaken without the same legal due process established for the approval of the EIA. The Act governing the Protected Areas is essentially conservation oriented and does not specify or prohibit specific types of tourism, or the limit of visitors that can be allowed in such areas, or the length and types of trails to be development, with the exception that they should not have an impact on the ecosystem and the environment. On the issue of biodiversity preservation, there is a need for legislation to be strengthened and extended to cover for all the corals and shells that are collected and sold as souvenirs to tourists. The Licenses Act provides a good framework for regulating tourism activities, as 'conditions can be placed on licenses to ensure compliance to certain measures not yet applied under other laws. Specific regulations governing tourism activities needs to be amended and further developed.

Weltands: The best-developed mangrove forests are located behind beach ridges near open stream mouths. On the Western coast of Mahe, a last continuous mangrove belt exists between Port Launay and Port Glaud, with other areas significantly destroyed. On the East Coast of Mahe, five species of mangroves have recolonised the area created by the East Coast Reclamation project. On Praslin, only small, isolated mangrove swamps have survived near river mouths at Grand Anse, Anse Takamaka and Anse Lazio. Wetlands, which occur primarily in the granitic Seychelles is usually divided into two main categories in respect to their height above sea level: (i) Upland wetlands (or high altitude wetlands) usually occur in depressions above 200m altitude and (ii) coastal wetlands which are completely or temporarily separated from the sea. Due to the high degree of reclamation and modification of wetlands the exact area of wetlands remaining is not known. On Mahe Island, it is estimated that only 50 to 60 hectares may remain, out of a total of about 100 hectares. Wetland and Mangrove legislation in Seychelles is very sparse, fragmented and indirect. Seychelles is not yet party to the Ramsar Convention on Wetland Conservation. At present, only 10 wetland sites which are located within protected areas are otherwise legally protected. The recent listing of wetlands as an Ecologically Sensitive Area in the Environment Protection (Impact Assessment) Regulations is a step in the right direction. However, this categorisation of wetland habitats does not provide a pragmatic management approach for future conservation in view of intense public pressure for land for construction, nor does it lists which wetlands are to be preserved. As such, it leaves a lot of flexibility for modification of wetland space.

In conclusion, it is clear that the present legal regime does not protect wetlands but restrict its modification to an environmental authorisation (EIA process) in the case of development purposes.

Land Reclamation: It is estimated that 90% to 100% of the population is concentrated on the narrow coastal strip. Approximately 40% of the population is located on the East Coast of Mahe from Victoria to the International Airport on a coastal belt which is only about 7 km long by 1 km wide. The scarcity of flat land has always been a major constraint to the development of the Seychelles. The Seychelles International Airport, Commercial and Fishing Ports were built on reclaimed land from the sea. Land reclamation projects on reef flats in the coastal waters on the east of Mahe near Victoria, using dredged calcareous materials started in the 1970's and by 2002 there was about 200 hectares of land reclaimed in Seychelles.. A number of regulations provide the framework for reclamation of the coast in the Seychelles. An overview of the law has revealed that there is little specific requirement for environment protection for reclamation activities. The only evidence of this is in the EPA regulations which only list land reclamation as an activity subject to an EIA. Whilst this is an essential first step, it does not go as far as stating which types/size or location of the proposed development and whether all land reclamation projects should be subject to a full EIA.

The study has revealed a number of gaps in the legislative framework which will need to be addressed. However, without proper strengthening of the enforcement, the legal review will be futile. It is important that mechanisms are explored to enable compliance to existing laws and regulation, and also at the same time explore other mechanisms such as market-based mechanisms based upon economic measures.

Introduction

Purpose of the Report

On 17-18 July 2002 UNEP/GPA in collaboration with the Secretariat of the Nairobi Convention held a "Regional Meeting for Physical Alteration & Destruction of Habitats (PADH) in Nairobi, Kenya. The meeting brought together participants from Government and non-governmental organizations, research and academic institutions, as well as private sector. The participants came from the following countries: Kenya, United Republic of Tanzania, Comoros, Mauritius, Seychelles, Madagascar, Somalia, South Africa and Mozambique. The Meeting received presentation on Physical Alteration and Destruction of Habitats in the Eastern African Region and priority issues of concern in region regarding Physical Alteration and Destruction of Habitats were identified.

The meeting identified nine areas of concern which included: tourism, mariculture/aquaculture, ports, mining, salt works, agriculture, urbanization and land reclamation. These were grouped into three main priority areas namely Coastal tourism - which include issues related to land use planning such as urbanization, siting of hotels and eco-architecture and location of tourist facilities Mangrove Destruction, due salt works aquaculture, agriculture and mangrove harvesting Mining/ Sediment movement, Ports and Land reclamation and damming of rivers

The meeting urged the GPA Office in collaboration with regional institutions to organize a regional workshop in early 2003 to address Coastal tourism, Mangrove destruction, Mining/Sediment movement, Land reclamation and damming of rivers and to develop project proposals that will demonstrate how to address the problems of PADH that are associated with the above thematic areas.

The report therefore undertakes a review of national legislation relevant to the three main priority areas to be addressed; describes the national institutional arrangements; assesses the socio-economic importance of the three main priority activities; quantifies the magnitude of land-based sectoral activities; and present case studies on ecosystem restoration initiatives in the country. In

its conclusions the report makes recommendations for the necessary amendments of national legislation and adjustments of national institutional arrangements for achieving an integrated coastal management approach particularly taking into account the issue of physical alteration and destruction of habitats affecting coastal and marine resources.

Country Background

The Republic of Seychelles consists of 115 islands scattered over an Exclusive Economic Zone of 1.4 million square kilometres in the Western Indian Ocean. Ninety percent of all socio-economic activities are located on the coastal plains of the main granitic islands of Mahe, Praslin and La Digue (Payet, 1998).

Seychelles is classified as a middle-income country; however, a study by Bruguglio (1997) ranked Seychelles as the third most economically vulnerable country in the world. In 1998, GNP per capita stood at US$6,837, an increase of US$ 536 from 1996; with increases in GDP contributions mainly from the industry (mainly fisheries) and services (mainly tourism) sectors.

There are a number of pieces of legislation that addresses the impact, or activities causing, physical alterations and destruction of habitats in the Seychelles.

Within the GEF funded Sub-Saharan Project on 'Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa, a detailed environmental assessment of habitat and community modification was undertaken for the Seychelles by a team of Seychellois experts, including the author of this report (Jones *et. al.*, 2002). The report concluded that the most important impacts related to physical alteration and destruction of habitats are directly associated with development related activities.

Coastal History

The lowland or coastal vegetation has been severely modified by human activities (Sauer 1967), at various stages in the history of the Seychelles, especially Mahe.

When the first settlers arrived in Seychelles, the efforts to build a sustainable settlement and a resource exporter was undertaken, resulting in conversion of the coastal plateau into agricultural and coconut plantations. The coastal plains were originally described as being covered by magnificent trees reaching up to 20-25 m, with a circumference of 4-5 m and with very straight trunks. Lowland forests originally covered the mountainsides up to about 200-300 m.

As the coastal land availability decreased, the settlers moved inwards and uphill, which led to massive destruction of the Mahe forest until the early nineteen hundreds. This led to erosion, and is possibly linked to the great avalanche of 1862.

Almost all species originally described still survive, but several are now found only at higher altitudes. There are still a considerable number of sites where small remnants of lowland palm forest exist or where there is good regeneration of lowland palm species under a cover of exotic trees. However, most lowland areas have been invaded by a wide range of exotic plants.

The forests of the intermediate zone, between 200 m and 500 m, were once rich in endemic species, with a high canopy occasionally reaching up to 30-40 m and containing trees with very straight trunks. These were the forests, which were most thoroughly exploited by the settlers. Later the secondary forests were exploited for cinnamon and fuel to fire the cinnamon distilleries.

More information on the both original and present coastal vegetation of the islands can be found in Vesey-Fitzgerald (1940) and Stoddart and Fosberg (1984), and Taylor (1970).

As the population started to grow, with the shift from an agriculture-based economy, and emergence of the tourism industry, the activities shifted to building support infrastructure to sustain these changes. Consequently, changes along the shore included the new international airport and

port, the construction of sea walls, roads and houses. The impacts of which we are witness of today include sand mining and piecemeal land reclamation. Various policy, regulatory and management approaches have been in place over the last en years to curb the problem.

The National Context of PADH

In the last 25 years the modification and loss of coastal ecosystems on the main granitic islands has accelerated as a result of rapid social and economic development. Consequently, the major threats to endemic species and vegetation on the main granitic islands are related to the rapid rate of development, which has led to the conversion of land for infrastructure, such as housing, roads, commercial and tourism. While many species of plants are naturally rare, due to the small size of the islands and range restrictions of suitable habitats, habitat destruction has resulted in a further fragmentation of these habitats, particularly at low altitudes and on the coastal plateau. While the introduction of animal species has been the major cause for the rarity of invertebrates, the major threat to vertebrates has been human predation, although this has declined in recent years for most threatened species, such as turtles and birds.

Habitat loss, including coastal wetlands, as a result of housing and tourism development is a major factor, particularly in the main granitic islands. During the nineteenth and twentieth centuries these habitats were gradually removed for agricultural purposes and now for tourism and housing. The pressures on these ecosystems have been further intensified by deforestation and construction on hillsides as the demand for land has increased. The consequent erosion and leaching of Seychelles red earth has led to the over-siltation of wetlands. Another contributing factor has been the invasion of many freshwater wetlands by alien species. Finally, diversion of water from rivers for use by human settlements and for agricultural irrigation has resulted in insufficient throughput of water to wetlands.

Rapid social and economic development has intensified the pressure on the coastal environment as the scarcity of flat land has led to land reclamation over the reef flats. As coral rubble is used as fill, there is consequent loss of all shallow marine habitats in the vicinity, and some modification of surrounding habitats. Another contributing factor to the modification of the coastline is the increase

in beachfront developments, for housing, hotels and roads, which has resulted in the removal of coastal vegetation from dune land, thus increasing the vulnerability of beaches to sand erosion. The modification of ecosystems and/or ecotones has always been significant in the socio-economic development of the country, as upland areas are mostly unsuitable for either agriculture or other types of development. On the coastal areas, where land is at a premium, reclamation has been practiced extensively ever since the islands were first settled. Under such circumstances, it is difficult to identify immediate negative socio-economic impacts, as much of the development that has led to modification and/or loss of habitats have been associated with improvement to infrastructure for tourism, housing and recreation, which has benefited local populations. On the other hand, the costs of management of such "modified habitats" has increased, particularly on the large reclamation areas on the East Coast of Mahe, and the threat of sea-level change will greatly add to such costs as additional coastal protection measures will be required.

Nevertheless, the loss and modification of ecosystems, and consequent impacts on biodiversity, are not purely ecological issues, as the major economic sectors, particularly fisheries and tourism, are directly dependent on biological resources. In addition, ecosystems/biological resources provide many indirect values, including acting as a sink for wastes and residues and in the protection they afford to beaches and watersheds. Such resources also have the potential for future economic returns, including possible pharmaceutical, industrial and agricultural applications. Finally, there is also an intrinsic value to Seychelles' biological resources in terms of their cultural and aesthetic significance. If the country's biodiversity resources are lost or significantly diminished, the benefits that can be accrued from biological goods and services will diminish progressively, and will have a major impact on Seychelles' economy and society in general. However, biodiversity conservation also has cost implications, both in terms of direct expenditures and in terms of limiting certain production and consumption activities. For example, the cost of mitigating and protecting Seychelles' ecosystems includes (i) the cost of foregoing or diminishing unsustainable activities; (ii) the costs of replacing and/or adapting technologies that impact negatively on biodiversity; and (iii) the direct physical costs of biodiversity management and protection. The challenge facing Seychelles is to identify ways and means for apportioning the costs of conservation in the most efficient and equitable manner and, taking account of the

financial constraints of Government, how to generate revenues to finance biodiversity conservation.

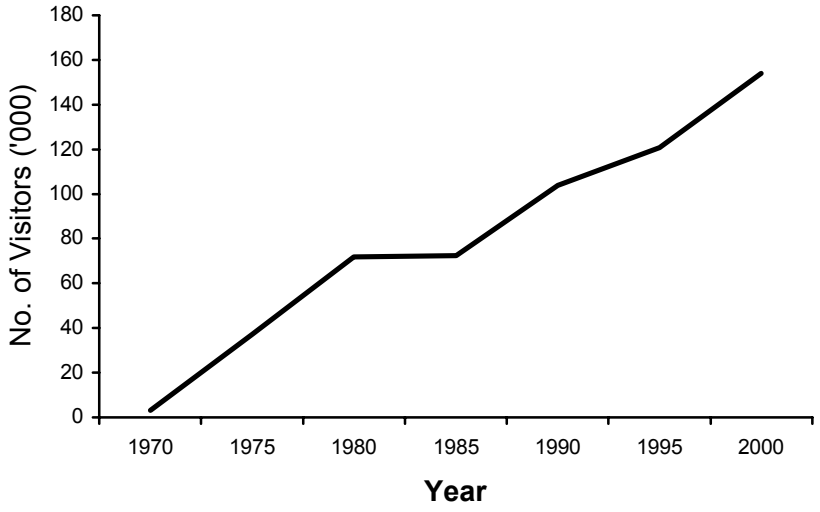
Coastal tourism

Background

Although agriculture dominated as early as 1771, and until the late 1960's, the inescapable temptation for Seychelles to become every tourist's dream has led to rapid development of tourism infrastructure over the last thirty years along the coastline of many of the Seychelles islands.

With the opening of the Seychelles international airport in 1971, the tourism industry began an upward and progressive trend to become the main pillar of the economy, in addition to the fisheries and services sectors. The unique and natural beauty of the Seychelles has provided tourism investors with the ideal setting for high quality resorts as well as abundant sun, sand and sea, which are relatively unpolluted. Europe is by far the most important market, led by France, then Germany, Italy and the United Kingdom.

Figure 1 Visitor arrivals to the Seychelles since the opening of the International Airport (per 000's)



Source: Ministry of Tourism Data, 1999

Although there is an increasing interest in ecotourism and other forms of tourism, the focus, even in marketing, is still on beach tourism. Most hotels are therefore located within the coastal plateau in front of a beach. Some hotels have even been built on the beautiful rock outcrops that are without a beach, just for a view of the sea. The most intensely developed parts of the coast on Mahe are the north-west coast, and recently the south-west. On Praslin the east coast is more developed in terms of tourism infrastructure. The National Development Plan for the period 1990-94 imposed a limit of 4000 hotel beds and a maximum number of 100,000 tourists per annum. But this has from time to time been increase, and according to the 'Vision 21' document (Ministry of Tourism, 2001), this will likely increase to 260,000 visitors by the ear 2010. Tourism development on other smaller granitic islands and some outlying coral islands has also taken precedence over the last ten years, with highly luxurious hotels being built on Fregate and Alphonse. Already, about four five-star hotels have been built and a number of existing hotels are upgrading to that level.

Review of National Legislation: Overview

There is not one piece of legislation which governs coastal tourism in its entirety or its specificity. Consequently, a number of legislation and parts of legislation are presented which directly, and in some instance indirectly govern coastal tourism in the Seychelles. A provision of the Seychelles constitution, which applies to the issue of coastal tourism, is also presented.

Seychelles Constitution under the Third Republic (1993)

The new constitution of the Seychelles in 1993 addresses the costal tourism issue in various respects, related to environment and land use rights.

Article 38 recognizes the right of everyone to a safe environment. The state undertakes to put in place measures to promote the protection, preservation and improvement of the environment; to ensure sustainable socio-economic development by judicious use and management of resources; and to promote public awareness of the need to protect, preserve and improve the environment. Similarly under Article 40 the constitution makes it a duty of every citizen to protect, preserve and improve the environment.

Two Articles concerning land use and property may be relevant in this context. Article 20 provides that no property be searched without the owner's consent except where provided by law and in the interest of *inter alia* nature conservation. Article 26 guarantees the private right to property, however, it also spells out the limitations which must be prescribed by law and may be those "necessary in a democratic society".

Each of these article described above illustrates the basic rights of the government, owner/investor/developer and also the people of Seychelles to continue to enjoy a safe and healthy environment without due impediment to its socio-economic development, which in this case is coastal tourism.

Town and Country Planning Act 1972 (Chapter 237)

The TCPA Act stipulates that permission is required for the development of any land, including the coastal plateau for tourism purposes. To that effect, no person shall carry out any building operations without a planning permission issued by the Town and Country Planning Authority under the provisions of section 3. Under the Act, the Minister may also make 'Tree Preservation Orders' and Building Preservation Orders, aimed at prohibiting the cutting down of trees within the area to be developed, and the preservation of any building with architectural or historical interest, respectively. Building operations must comply with the rules and codes of practice laid out in sections 7 to 83 of the Regulations.

Section 4 makes provisions for the preparation and adoption of a development plan for the whole of Seychelles. Such a development plan, which may include maps, shall specify areas for roads, public buildings, and nature reserves, including open spaces. The plan is to be reviewed every five years.

Section 14 provides for the issuance of prohibition and 'stop' notices in the case of illegal or unplanned developments, including sub-divisions of land. Additionally, the Act in Section 22

imposes abatement costs on the developer should the amenity of a particular area be affected ('seriously injured') by the stated development.

Building Licenses Ordinance 15/1973

The Building Licenses Board, established under the provisions of Section 4, controls all building activities. No person may commence or continue any building operation without a license issued by the Board. The Board has the power to impose any restriction or condition, or revoke any license for failing to comply with any requirements.

The Environment Protection Act 1994

The Environment Protection Act 1994 provides the main legal framework for the environmental impact assessment process, the establishment of sensitive areas, coastal zone management, waste management, standards and makes provision for prevention, control and abatement of environmental pollution. Regulations applicable under this Act are the EIA Regulations and the Miscellaneous Regulations (which contains standards for waste effluent quality). Appropriate fines and penalties are also specified in these regulations.

In addition the Act makes provisions (Section 7) for the preservation of fishing areas, aquatic areas and drinking water resources. The Authority is also given powers to prepare coastal zone management plans (Section 11) which includes evaluation of coastal ecosystem state and areas of scenic and outstanding beauty, an evaluation of the impact of coastal erosion and causes and sources of coastal pollution and degradation. Under the same section, regulations may be made to provide for the control and prevention of pollution of the marine environment from land-based sources (see Sec 11 (5) (b) (i)). The list below summarizes the legislation in force under this Act.

- Environment Protection (Miscellaneous) Regulations 1994
- Environment Protection (Standard) Regulations 1995
- Environment Protection (Designation of Solid Waste Agency) Regulations 1995
- Environment Protection (Marine Parks Authority) Order 1996
- Environment Protection (Impact Assessment) Regulations 1996

- Environment Protection (Noise Emission Standards) Regulations 1999
- Environment Protection (Ozone) Regulations 2000
- Environment Protection (Containers) Regulations 2001

Consequently, two authorities have been legally established under the EPA Act: The Solid Waste and Cleaning Agency in 1995 and the Marine Parks Authority (MPA) in 1996. Relevant regulations under the EPA are discussed below.

Environment Protection (Standard Regulations 1995)

This regulation prescribes effluent quality standards for the purposes of implementing the objectives of the EPA Act, and cover the discharge of effluents to a recipient system from any industry, operation or process. This includes al tourism establishments and related activities. The Effluent quality standard specifies maximum concentrations for a range of pollutants, includes organic and heavy metal pollutants which may be present in effluent discharges.

Environment Protection (Impact Assessment) Regulations, 1996

The regulation which has been published under the Environment Protection Act specifies the preparation an impact assessment report for any project or activity listed in its Schedule (Schedule 1), or any project or activity not listed but deemed to have an impact on the environment. Schedule 1 lists activities falling within the following sectors as being specifically regulated: mining, agricultural production, forestry, fish and associated products farming, Chemical industries, industry (construction), food and agro-industries, energy production and distribution, water reservoirs and distribution, sewage and wastewater treatment systems, solid waste management systems, the hotel industry (hotels, restaurants and tourism activities), transport (harbours, air transport infrastructure, roads and coastal defences); land reclamation, and housing development. The regulation lists the procedures for the development of the EIA and issuance of an 'environmental authorization'. The 'environmental authorization' is required in addition to other approvals to do any of these listed developments in the Seychelles. The regulation also provides

limits to development with a protected area or an ecologically sensitive area (listed in Schedule 2). Types of ecologically sensitive areas specified under schedule 2 include: historical sites and national monuments, remarkable natural landscapes, viewpoints, inter-urban buffer zones, water catchment areas, industrial risk areas, natural risk areas, skylines, beaches and intertidal zones, coastal strip, seabed, small and outlying islands and unique natural habitats not protected as protected areas.

The Public Health Ordinance Chapter 194

A provision for the control of nuisances (premises which are unhealthy, unsanitary, unventilated, overcrowded, noxious or dangerous to health, inhabited with rats, mosquitoes, dangerous or offensive animals, or where there are any wastes or other matter injurious to health) is also incorporated. In situations of an epidemic or emergency, this Act empowers the authorised officers to adopt any measures necessary to prevent the spread of disease.

The Licenses Act 3/1986

The Licensing Authority, established under section 3 of the Licenses Act 3/1986, directs and controls activities in the interest of public welfare, safety and health. The organisation issues and manages licenses for all the economic sectors of the country. The Authority may grant or refuse, suspend or revoke any license, or impose any conditions necessary, and upon receiving any complaint may investigate and take suitable action against the licensee. The Authority may order the closure of any premises for any breach of the conditions of a license, and may obtain the assistance of a police officer, a public official or other person to use such force as may be necessary to effect the closure of the premises. The schedules to the Act list those activities, which require licensing.

Beach Control Act, 1971 and Subsidiary regulations, 1991 (Cap 14)

Includes the definition of a beach, and provides for the regulation of activities on the beach, and including the 'inshore waters of the sea' (1,000 yards from below the water mark at the lowest tide). The beach or seashore is any part of land, which is alternatively covered and uncovered by the sea

at the highest and lowest tides. The Beach control regulations makes specific provisions for the regulation of use of pleasure boats and limits to water sports within the 'inshore waters' and gives powers to the designated authority to specific areas of the beach to allow several activities to be permitted without endangering the environment or public safety (Section 15). To date two areas (Beau Vallon and Port Launay) have been zoned in accordance to these regulations

Removal of Sand and Gravel Act, Chap 203

Regulations controlling removal of sand and gravel. Following the impact of the activity on the beaches, a ban on removal of sand from the beach and the plateau on the Seychelles have been imposed. Removal of gravel from rivers is still permitted. The Act makes provisions for prosecution under the law for operating an extraction activity without a permit.

National Parks and Nature Conservancy Act, 1969 (CAP 141)

Specific areas for protection are defined under this Act. The Act made special provisions for the set-up of various types of protected areas: National Parks, a Strict Natural Reserve, a Special Reserve or an Area of Outstanding Natural Beauty. The areas designated under this Act are summarized below, with an indication of type of tourism impacts within that designated area.

Table 1: Summary of protected areas and their relevance to tourism.

Protected Area	**Relevance to Coastal Tourism**
NP (Ste. Anne Marine (Designation) Order S/I 21/1973	Hotel, marine ecotourism
NP&NC (Designation of Special Reserve) (Cousin Island) Order S/I 100/1975	Land ecotourism
NP (Baie Ternay Marine) (Designation) Order S/I 54/1979	Research
NP (Port Launay Marine) (Designation) Order S/I 57/1979	Marine ecotourism
NP (Special Reserve Aldabra) (Designation) Order S/I 86/1981	Research
NP (La Digue Veuve Special Reserve) (Designation) Order S/I 8/1991	Land ecotourism
NP (Curieuse Marine National Park) Regulations S/I 15/1991	Land & Marine ecotourism
NP (Ile Cocos, Ile La Fouche, Ilot Platte) Regulations S/I 46/ 1997	Marine ecotourism
NP&NC (Special Reserve Aride Island) (Designation) Order S/I 99/1975	Land ecotourism
NP (Morne Seychellois) (Designation) Order S/I 53/1979	Not Applicable
NP (Praslin) (Designation) Order S/I 57/1979	Not Applicable
NP (Silhouette Marine) (Designation) Order S/I 74/1987	Hotel, land ecotourism
NP (Designation of Area Of Outstanding Beauty) (Grand Anse) S/I 18/2000	Eco-tourism ??

Some parts of the National Parks and Nature Conservancy Act have been superseded by other regulatory frameworks. Parts not in force today include the provisions for the setup of a Seychelles National Environment Commission (SNEC), which was a body corporate with very wide powers, which included the ability to own and transact land, to review all conservation laws, and to coordinate all activities of Government and other organisations. This function now rests with the Conservation Section in the Ministry of Environment, and some with the Marine Parks Authority Board.

The Public Utilities Corporation Act 25/1985

This Act provides for the establishment of the Public Utilities Corporation, a parastatal with a mandate to manage the supply of electricity and water, and the treatment and disposal of sewage. The Corporation has the authority to determine rights of access to any water supply extract of water from any source or pollute any water. Only the Corporation is permitted to divert or alter the course of any stream or river.

In this case, the developer will need to seek approval form PUC for any proposed diversion of watercourses. The latter is not encouraged.

Public Utilities (Sewage) Regulations S/I 9/I987.

The supply, control and management of sewerage are provided in these Regulations. Owners of land outside sewered areas are required to use, install and maintain a private sewage disposal system. No one may use, install and maintain a private sewage disposal system in a designated sewerage area without permission from the Corporation. The disposal method for sewage, solid wastes or non-domestic effluent must be under the direction of PUC. The protection of surface water where pollution or misuse may occur is provided for.

Public Utilities Corporation (Water Supply) Regulations S/I 26/1988

Sections 1 to 13 of these Regulations regulate the supply of water to consumers. PUC has the right to restrict the supply of water to consumers in times of drought, etc. No person may misuse, waste

or contaminate any water supply for public consumption. (Section 17). Part III of the Regulations contains provisions regulating applications for the supply of water and the use of storage facilities. Sections 23, 26 and 27 control the use of points of discharge, supply pipes and storage system in the interests of preventing pollution, waste or contamination.

No person may bathe in, or permit any animal, object or other matter to pollute any stream, reservoir or other place used for the supply of water. (Section 76).

Dumping at Sea Act 1974 (Overseas Territories) Order 1975 (Cap67)

This Act was extended to cover the Seychelles when it was a colony of the British (before Independence in 1976). It prohibits and specifies penalties for disposal of substances (including solid wastes) within the territorial waters of the Seychelles.

Maritime Zone Act, 1991 (Cap 122)

This Act defines and provides the regulatory framework which specifies the sovereignty of Seychelles within its Exclusive Economic Zone, as allowed under the International Law of the Sea. It also includes provisions for the 'Territorial Waters' of Seychelles. Section 15 makes provision for the development of regulations for the preservation and the protection of the marine environment and the prevention and control of marine pollution.

The Maritime Zones (Marine Pollution) Regulations 1981, makes it an offence for oil discharges (from ships, land sources and during a transfer process) into the coastal and marine environment within the EEZ of the Seychelles

Critical Review

In this section the legislation affecting coastal tourism is critically reviewed with a view of identifying key areas of weakness. This review does not consists of a legal review but attempts to highlight potential areas of conflict and the adequacy of current framework in regulating coastal tourism.

As observed in the overview section, the legislation concerning coastal tourism is not specific and fragmented in a number of legislation.

The only piece of legislation that makes specific mention of tourism and its related activities is the EIA regulations (Schedule 1). However, in this case the conditions for the development are prescribed in the EIA report which is not always a legally binding document, as parties do enter into negotiations and often alternations to approved plans are undertaken without the same legal due process established for the approval of the EIA. The Scoping Process which is an essential prerequisite in any EIA process is also not specifically detailed in the EIA regulations. Whilst the EIA process makes specific provisions for the public review and consultation of the EIA report, it falls short of defining how the public can resolve issues they are not happy with within the legal framework. The present legal framework lacks a mechanism for conflict resolution, which arises when coastal tourism development is planned (Decomarmond & Payet, 2002).

Regulations under the EPA act also provide for the application of effluent standards. The effluents standards are one of the highest in the world, and all hotels have to put in place treatment systems which abide to those standards. The legislation is also quite thorough in the taking of samples for determining compliance. However, the system is seen as being rigid and does not provide some flexibility for existing hotels to abide to the present standards within a certain time span. This is further complicated by the fact that it is often politically or socially unacceptable to close down a hotel, so the law must make provisions for a more stage-wise approach to compliance, and also include pollution abatement costs in any redevelopment/extension project.

The TCPA also encompasses tourism planning and development, but it is considered as part of general development and thus does to recognize the specific aspects of tourism development, and

issues such as tourism land use density, architecture and minimum distances to the high water mark are not specified in the law. Nor does the TCPA make specific provisions for the development of specific tourism development areas, where services can be optimized and specific environmental measures can be put in place.

The Act governing the Protected Areas is essentially conservation oriented and does not specify or prohibit specific types of eco-tourism, or the limit of visitors that can be allowed in such areas, or the length and types of trails to be development, with the exception that they should not have an impact on the ecosystem and the environment. Within Marine Parks which encompass large island, permission may be given under the TCPA for development beyond the 20m high water mark. Many of the eco-tourism activities undertaken (within and outside the protected areas) are therefore not subject to any environmental impact assessment or conditions of operations. In addition, although there are other biodiversity legislation (some protecting individual species) biodiversity many aspects remain to be addressed. Specific to coastal tourism include coastal ecosystems protection, introduction of alien species (flowers) using in landscaping of tourism establishments, and zoning of beach space for specific biodiversity uses, such as turtle nesting (although this could be undertaken under the Beach Control Act).

On the issue of biodiversity preservation, there is a need for legislation to be strengthened and extended to cover for all the corals and shells that are collected and sold as souvenirs. Although this is not as extensive as in the 1980's, it is not adequately covered by law and is also required under the Convention for International Trade in Endangered Species, (CITES).

The Licenses Act provides a good framework for regulating tourism activities, as 'conditions can be placed on licenses to ensure compliance to certain measures not yet applied under other laws. But this approach can lead to unfair conditioning of licenses, and also difficult to implement. Specific regulations governing tourism activities needs to be amended and further developed. For example, regulations governing diving (The Licenses (Diving business) Regulations (SI 48 of 1991), and amendment (SI65 of 1996), which regulates diving operations in the Seychelles), needs to be amended to become more stringent and promote high standards in that sector. The problem of pleasure yachting which impacts on the marine environment (anchoring on reefs, sea disposal of

wastes, etc.) is also an area which needs specific legislation, separate from the Merchant Shipping Act 1975 (cap 127).

Finally, much of the legislation is focused on control approaches, and provides little room for voluntary participation, economic incentives/disincentives and planning tools/indicators for sustainable management of coastal tourism. This approach has often led to an inflexible and often lack of transparency in the application of the law.

Implementation Obstacles

The implementation obstacles to legislation in Seychelles are universal in many respects, meaning they will also apply to other issues treated in this report. Enforcement issues and concerns are among the most important in addressing land-based sources of pollution. This is in fact the most common problem. A number of factor serve to aggravate this universal problem: poor enforcement capacity, poor legal knowledge, certainty of punishment, amounts of penalties imposed, enforcement of abatement/remedial measures. Situations are therefore such that many few cases are successfully pushed through the legal system. These factors are further discussed in the context of coastal tourism.

Poor enforcement capacity – This problem is ubiquitous in all the authorities' mandates to implement the regulations described in the preceding section. Lack of key personnel such as inspectors, enforcement officers, rangers and planning inspectors often reduce the effectiveness of the enforcement process. Many institutions now operation joint enforcement operations to overcome this problem of capacity and also reduce overlaps in decision-making which can often span several pieces of legislation. The other aspect of enforcement capacity is the nature of violation which may occur at any time and at any place within the territory. Since enforcement of these regulations is not the primary duty of the local police, institutions involved have to developed creative monitoring arrangements to detect violations. This is not always possible due to financial constraints and lack of sampling equipment. In Seychelles, bribery cum corruption is not extensive and therefore does not always constitute as an impediment to implementation of the law in Seychelles.

Poor legal knowledge – lack of in-depth knowledge in the application of law often leads to dismissal of court case or poor collection of necessary evidence.

Certainty of punishment – this is also a common problem in Seychelles, whereby the public is not confident that perpetrators would be adequately punished by the existing legal system. There has been several instances in which violators were apprehended by the authorities concerned, and the police (which has arrest powers) refused to cooperate adequately or lose evidence whilst in their custody. Although a lack of adequate training for both the inspectors and the police/judiciary is a cause of the problem, there is the additional complexity that Seychelles is a very small island and family ties are very close, and the fact that on several occasions senior Government officials have been allowed to commit such offences. These actions undermine the legal process and violators have taken this as a green card to continue violating. Another cause refers to the expectations by violators that there are a lot of loop-holes in the system, which may not only extend a prosecution process indefinitely but also cause it to be dismissed or with minimum sentence. Finally, this factor is affected by the fact that many tourism developers know that Seychelles (as a small economy) is heavily dependent upon tourism, in which case it would find it more feasible to negotiate out of court rather than order close-down and take the matter to court.

Amount of Penalties - There is a lot of disparity in the level of penalties in the laws of Seychelles. Whilst some laws still have very low penalties (that is it is less than the potential gain to the violator), others have penalties which provide the courts with too much flexibility. Where penalties are based on the value of the resource impacted, there is no legal guidance on how this value is determined. As a result the courts in most cases impose the least penalty.

Enforcement of Abatement or Remedial Actions - In many cases, the law is very clear about the violator in restoring the environment back to it previous state. But this is rarely done. If hotels have damaged the coastal vegetation during the construction phase no action is taken, except that the violator is warned and the activity is stopped with a promise that the environment will be restored. Monitoring and follow-up is also lacking.

Institutional Arrangements

The Ministry responsible for tourism planning and policy is the Ministry of Tourism and Transport. The Seychelles Tourism Marketing Authority is an autonomous body charged with marketing the Seychelles abroad as a tourism destination. The Seychelles Tourism and Hospitality Association (STHA) is a non-governmental organisation which represented the hotel industry (hotel owners, tour operators) in Seychelles, with the aim of addressing their needs and expectations to govern. The Seychelles also has its own tourism training school, the SHTTC.

The current policy document of the Ministry of Tourism and Transport is the 'vision 21' which specifies the vision for 2001 to 2010 as:

"*Tourism in Seychelles shall continue to be developed to the highest standards for the optimum social and economic benefit of the Seychellois people while maintaining a commitment to the protection and conservation of the natural environment*" Vision 21, page 2.

The vision is to be implemented through five mission statements. This is presented, with comments on how this mission will affect the coastal environment.

Mission Statement 1: Tourism in Seychelles will be expanded gradually, with facilities, services and infrastructure developed to a higher quality level and more activities provided for tourists.

Comment: This will likely lead to an increase in tourism infrastructure and consequently tourism pressure on the coastlines of the Seychelles. Additional pressures include habitat modification/destruction, water resources, food supply, energy supply and other generation of wastes and wastewater.

Mission statement 2: Tourist markets will be broadened to include more nationalities and both general and special interest tourists, and access will be improved to reach more market areas.

Comment: Opportunities for special tourism in Seychelles will be closely associated with eco and cultural tourism; both if unplanned can erosive and detrimental effects on the current protected areas.

Mission Statement 3: Expenditures per tourist will be increased and there will be more value-added in the country, which will enhance economic benefits to the Seychelles.

Comment: Giving the resource more value is highly recommended, however it is vital that mechanism are in place to enable this revenue to be reused for habitat restoration, coastal rehabilitation and conservation activities.

Mission Statement 4: Tourism will be developed on a sustainable basis and not exceed carrying capacities, and the unique land and marine environment and cultural heritage of the Seychelles will continue being protected and conserved.

Comment: This is indeed commendable, however both 'sustainable' and carrying capacity' are ambiguous statements unless quantified in a specific manner and the issue addressed in an integrated and holistic manner.

Mission Statement 5: Seychellois will continue being sensitised to the importance of tourism and providing good service standards to the tourists, and given opportunities to work in tourism at all levels.

Comment: There is a need to also sensitize the tourist on the unique natural environment of the Seychelles and the need for conservation of resources and limiting impacts in the coastal and marine areas.

The coastal tourism development approval process

A developer who wishes to undertake coastal tourism development in Seychelles has to engage in a number of consultations before moving towards implementation of the development. An initial consultation involves the presentation of the hotel (or any other tourism activity) concept to a Project Appraisal Committee, chaired by the Ministry for Tourism and Transport, in which the Ministry of Environment and other key ministries (e.g. Land Use and Habitat) are also represented. This committee is responsible in giving the initial guidance on how the concept can be further developed or amended to meet national polices and guidelines. It is often after this screening process, that the Ministry of Environment decides whether the project will be subject to an Environmental Impact Assessment (EIA). Once the EIA has been completed a first draft is submitted for public review, and also forwarded to the Authority for review by the EIA appraisal committee, which constitutes environment experts and representative of other sectors such as land use, the National Environment Advisory Council, tourism and social affairs, and for public review. At this stage the final concept is also sent to the Cabinet of Ministers for final approval.

Following the EIA review, comments and conditions attached to the proposed activity or project are communicated to the developer. After meeting all the requirements, the developer is issued with an environmental authorisation and proceeds to submit detailed plans for approval under the Town and Country Planning Act and associated building regulations. The entire process may vary from two months to six months, depending on the nature of the development and whether it involves modification of the coastline and or serious modifications in land use.

Socio-economic Importance

The tourism industry in Seychelles is the second most important and vital economic sector besides tourism. It is enormous implications in determining the availability of foreign exchange for imports and for employment. Not many studies have been undertaken to determine the economic importance of tourism to the Seychelles and reference is made to a rather dated paper by Archer and Fletcher (1996).

Government receives revenue directly from tourists in the form of departure tax, tourism tax on hotel beds, and indirectly in the form of other taxes on commodities consumed and licenses paid by the tourism establishments. From 1980 to 1990, tourism income increase from SR 330.9 million to 645.5 million (MISD data), which declined to 600 million by 2000, despite an increase in arrivals. Whilst these figures are based upon actual receipts, it is clear though, that the overall contribution of the tourism sector in the Seychelles is much more significant than previously assessed.

Table 2: The Impact of Tourism on the Balance of Payments (1991)

Tourism Expenditure (+) (excluding cruise visitors)		527,633
Imports (-)		(168,314)
Direct and Indirect		
Net Effect on balance of payments		+359,319
Imports induced (-)	(149,864)	

Ref: Table from Archer & Fletcher, 1996. In millions of Seychelles Rupees.

The amount of income generated is also a unit of tourism spending known as the tourism income multiplier. Archer & Fletcher (1996f) computed an average income multiplier of 0.8836, implying that the expenditure of an average rupee in the Seychelles creates 88.36 cents of income.

The tourism industry also provides direct employment for about 17% of the working population. In 1991, tourism expenditure was responsible for approximately 3772 full-time jobs and an additional 4520 jobs (Archer & Fletcher, 1996). The ration, therefore, between the total employment generated and the direct employment created by tourism was 2.20, that is an average direct tourism job supported 1.2 secondary jobs in the Seychelles.

Because of its physical isolation from major markets, Seychelles is described as an exotic long-haul destination, and due to its refocus on the market, aiming towards the higher end of the market, the figures described above have likely changed dramatically, but no further in-depth information is available at this stage.

Impact on the Environment

The impacts associated with coastal tourism can be looked at from a development perspective that is (i) the present location characteristics and physical works, (ii) the construction phase, (iii) the operating phase, and (iv) the post-operating phase. Furthermore, the impacts can be discussed in terms of the direct/indirect environment effect, nature, time-scale, intensity, and the occurrence probability of the impact. Reversibility of the impact, through reinstatement measures and mitigation of impacts is also an important consideration. It is important to understand that these effects are dynamic and often interactive. Since, the focus of this report is on physical alterations and habitat degradation; the discussion will be restricted to that area of concern. These impacts are best summarized, as shown in Table 3, below:

Table 3: Impacts of Coastal Tourism

Issues	**Nature (and Range) of impact**	**Impacts**
Occupation of site/boundary/ access rights	Social, public rights, (maybe long-term)	Development may encroach on the rights of other users/community Proposed development may prevent access to some resources, such as fisheries Affects access to the beach by the public.
Demolition of existing infrastructure	National heritage, (maybe long-term)	Proposed construction area may have historical/cultural significance or have national monuments
Underground structures-excavations/drainage	Destruction of habitats, (short-to-medium term)	Extent of excavations and disruption to the land before/during construction.
Aboveground infrastructure	Destruction of habitats, (permanent)	Location of infrastructure may destroy important ecosystems Distance (setback) from high-water mark, including impact on beach dune. Visual impact of architecture after removal of vegetation
Offshore structures	Destruction of habitats, (Long-term)	Impact on coral reefs and other marine habitats May cause coastal/beach degradation Modification of currents
Road and public access	Destruction of habitats, pollution (long-term)	Impact of new road network – including vehicular pollution, noise and people movement Access to public domain could be restricted with impact on public rights to access
Presence of rare and endemic biodiversity - plant, animal	Destruction of habitats (long-term)	Impact on endemic fauna and flora and on their habitats
Fragile habitats - wetlands, coral reefs	Destruction or modification of habitats (long-term	Impacts on coral reefs and associated ecosystems Impacts on coastal forests and wetlands, including fauna.
Migratory species	Destruction of habitats (long-term)	Increase movements and light on beach will affect turtle nesting Destruction of habitats will affect habitat for migratory birds.
Waste disposal - construction wastes, surplus materials	Pollution (short-term	Impact of construction wastes on the surrounding environment if not properly disposed. Elsewhere as filling material.

Effluents discharge and runoff	Pollution (medium to long-term)	Eutrophication of coastal waters Microbial contamination of coastal waters Propagation of diseases and their vectors Sediment accumulation and coloration of water and beach
Light and noise pollution	Pollution (medium to long-term)	Potential disturbance of nesting turtles Noise could affect avifaunal reproduction
Use of hazardous materials	Pollution (Long-term)	Contaminate water supply and soil Contaminate coastal bathing waters
Use of specially imported materials – wood, plants, aquarium fish	Indirect (Long-term)	Introduction of alien species Destruction of habitat in another location
Tourist activities and movement	Habitats modification, pollution	Impact of water-based activities on coastal ecosystems, trampling on reefs Impacts on eco-trails: removal of plants, disturbance of fauna, disposal of thrash
Energy use	Pollution, (medium to long-term	Impact on greenhouse effect Waste of energy by using air-conditioning even when room is vacant.

Case study 1: Severely Impacted Area and Ecological Restoration for Coastal Tourism: Beau Vallon Bay on Mahe Island

Background

On the main island of Mahe, Beau Vallon has become one of the top tourism spots on the island. With a long beach and calm seas, the Beau Vallon Bay provides an ideal mecca for sun-seekers from practically all over the world. Beau Vallon is also a rather densely populated developing region surrounding the coastal waters. In addition, the bay is a good resource for fishing, and the coral reef ecosystem provides excellent breeding grounds for certain types of fish.

Various economic activities take place within the Beau Vallon Bay area, including tourism, recreation, restaurants and artisanal fishing. Beau Vallon is therefore a very important coastal area for Mahe. However, numerous threats which may lead to subsequent degradation of the coastal zone have been identified. As a result the main ultimate objective of this exercise is to provide strategies to ensure sustainable development and use of the Beau Vallon coastal area.

Physical Characteristics

Situated at the North-West end of the island of Mahe, Beau Vallon Bay is shaped like a "blunt angle", with the beach bounded to the north by weathered rock outcrops (towards Glacis) and to the west by gigantic granitic cliffs (towards Dans Zilles). The coastal plateau is quite wide at the corner of this "blunt angle" (about 2 km wide) which subsequently narrows down to barely a few metres at the two extremities of this "angle".

In general, the climate of the Beau Vallon Bay coastal zone is typical of that of the whole of Mahe, which experiences a mean annual rainfall of about 2,524 mm. The relatively strong South-East trade winds blow mainly from May to October and bear significant influences on the forces governing the movements of the coastal waters. During the North-West monsoon, December to March, heavy rainfall is a usual characteristic. The weak nature of the tidal currents that govern the bay does not insure a sufficient renewal in new waters from the ocean body. As a result the bay which is situated out of reach of the strong South-East swells receives a net surplus of fresh water from inland. Studies performed by SETOI (1990) found two distinct current movements within the bay. During the SE monsoon the currents veer counterclockwise in the bay, whilst in the NW monsoon it reverses to clockwise directions.

Overlooking the Beau Vallon/Bel Ombre area are heights of up to 830 m in altitude at Pérard in the Morne Seychellois mountain group. The catchment basins are very small in area. Moreover, the soils consist of highly impermeable granitic sands and clays formed by decomposition of the granites, overlain by a layer of topsoil. Except in specific conditions of substratum fracturing, there is no in-depth seepage and accordingly there are virtually no groundwater reservoirs. In spite of the retarding effect of the very dense vegetation, the runoff water concentration times are very short (from 15 to 60 minutes), and since the coastal plain consists mainly of sandy (alluvial) soils, with a high permeability potentials, rainfall immediately causes temporary flooding in certain areas.

Most of the streams that empty into the bay are littered with granite rocks which create individual pools of stagnant water and irregularities in the breadth of the river, and are often flanked on their banks with trees, shrubs and grasses.

Table : River and Catchment Area Characteristics

Catchment Area/River	Surface Area (ha.)	Length (km)	Pollution Load (BOD5 kg/d)
Saint Louis River	389.5	8.85	69.55
Mare Anglaise River	182.8	2.37	70.58
Sullivan River	143.1	3.64	111.45
Mamzel Anna River	79.0	1.88	8.37
Athanas River	73.5	1.42	74.57
Loizeau River	17.9	1.04	23.27

(Adapted from DOE-PC, unpublished data (1991/1992) ; SETOI, 1990

The Ecological Characteristics

The ecological characteristics of the Beau Vallon Coastal Zone are numerous both spatially and in biodiversity, which includes brackish water marshes, coastal vegetation, coral reefs and other marine fauna and flora.

Of the few remaining brackish-water marshes on Mahe, the one at Boabab Pizzeria and in between Beau Vallon Bay Hotel and Fishermans Cove Hotel are an epitome of the reclaim of such biologically diverse ecosystems in the past. Various species of mangroves are predominant, and a host of crab and bird species are also often found. Such marshes have a typical conductivity of 1.3 μS and total suspended solids are of the order 0.67 mg/l (Pollution Control unpublished data, Division of Environment). The amount of dissolved oxygen is usually very poor, ranging from 2 to 4 mg/l. This often allows for the propagation of anaerobic conditions within the marsh area. These marshes act as buffer zones to reduce fresh water intrusions on the coral beds and provide a zone of stabilisation and degradation of organic matter.

The coastal vegetation is strongly characterised in Seychelles and plays a very important role in the stabilisation of coastal sand dunes, prevention of coastal erosion, and sheltering of beach scavengers. Two distinct zones are observed namely the "Outpost Species", for example Ipomea

sp., Scaevola sp. and Tournefortia sp., and the "Inner Littoral Zone" which consists of the familiar species of Casuarina sp., Callophylum sp. and Terminalia sp.. The natural zonation of these types of vegetation which stabilise and maintain the beach has been greatly disturbed by human activities.

The coral reefs in the Beau Vallon Bay are predominant at the southern part of the bay, but they lack biodiversity. These poorly developed embryonic reefs are made up of an inner reef flat, a reef front and an outer slope. Other coral reefs are also present at depths of 7 to 20 m beyond the outer slope. Unfortunately, soft coral which thrives on organic matter enrichments are thought to be competing with existing coral species. The coral reefs are poorly developed in the bay due to the desalinisation of the sea water from inland fresh water. There is also an extensive seaweed bed between the beach and the reef flat. Its role is very important, especially in the Beau Vallon Bay. These sea grass beds are able to soak up nutrient influxes from the coast and therefore provide a line of protection for the coral reef (SETOI, 1990).

Socio-economic situation

The demand to meet higher socio-economic standards, concerted with increases in populations, has turned Beau Vallon Bay into one of the best tourism centres on the island. Beau Vallon Bay is still dominated by "beach tourism" although plans for other such as types of tourism, such as eco-tourism are being formulated. Large aggregations of hotels dominate the coastal zone of Beau Vallon, Bel Ombre, Glacis area which has both excellent beaches and bathing waters. Most of the large hotels are now privately owned by international firms, however quite a number of family-run small hotels have sprung up over the last 10 years. The tourism sector also provides employment and business opportunities covering a wide range of services, from entertainment services to taxi drivers. Beau Vallon is very important zone for recreation not only for the tourists but also for the local community. Recreational activities include swimming, snorkeling and diving and water sports. Although these recreational activities pose certain impacts, a high level of environmental protection is required to meet the criteria for such activities.

- Swimming-requires the bay to be clean of pathogens and wastes.

- Snorkeling/Diving - requires good visibility and healthy marine life.

- Water Sports -requires the bay to be clean of solid wastes.

The recreational sector provides additional employment and maintains a state of holiday ambiance in the area.

Fish is considered the staple diet of the nation and fish consumption is expected to increase further with the development of more processed fish products. The percentage of the total working population who are engaged in fishing has risen from a mere 3.6 % in 1977 to about 9 % to date, and at least 50 % of these are self employed. Coastal fishing at the Beau Vallon bay is mainly dominated by hand-lines, traps and beach seines. The most important species caught are Carangidae , the red snapper, green snapper, groupers, and the Indian mackerel (SFA, 1992).

Increasing pressure form urbanization is also an important factor. According to the general census of 1987, approximately 75% of the houses in the Beau Vallon Bay area are served by a potable 'treated' water network. This proportion should increase to 85% in the next five years, with an estimated population growth rate of 1.17% per year, the population in Beau Vallon is expected to rise from 7,256 (1987 data) to about 10,837 by the year 2010. This will probably be due to urbanisation and concentration of economic centres in the northern parts of the island.

In the absence of collective sewerage infrastructures, the existing houses are equipped with simple septic tanks followed by a cesspool or a dry-pit from which the overflow waters seep into the ground and rivers.

In the 1987 census, 15% of the houses were declared to be unequipped with modern lavatories: latrines in the best of cases, and sometimes without any treatment facilities, which means that pollutant materials are spread on the surface of the ground.

It is now very common for households to rear pigs and chickens close to their homes. This increases the level of human impact on the surroundings as animal slurries are more destructive than that of humans. According to a survey made at Beau Vallon, quite a number of households (even those living in flats) has pig sties with slurry pits and outfalls near the river (Payet, unpublished 1992).

Main Impacts and Restoration Activities

It is important to consolidate and expand any relevant ongoing development activities that divulge in sound environmental practices on the coastal zone of Beau Vallon. The key to sustainable development is the wise management of the national resources, and should take into account:

- The assimilative capacity of Beau Vallon Bay;
- The objectives of the development as defined by national priorities within the sustainability framework;
- The economic feasibility and long-term benefits of these development activities.

The current and future land use activities are illustrated on Map 1. The present state of the environment at Beau Vallon is a result of:

1. The unforeseen development of high density human settlements in an area of high touristic value.
2. The generation of domestic waste linked to both population and tourism growth.
3. The uncontrolled siting of sanitation facilities.
4. The expansion of hotel facilities with lack of attention given to coastal protection and adequate sewerage facilities.

5. Improper management of river and marsh water quality.

6. Lack of community and stakeholder participation in the decision-making procedure, environment and coastal protection programming.

Sewage Pollution

The Beau Vallon Bay area contains no industry and is completely given over to tourism and residential use. The pollution sources can therefore be easily identified:

- Large Hotels and small family-owned hotels:
- Restaurants.
- Residential subdivisions
- Recreational Activities
- Cottage Animal Husbandry

This issue is being addressed through the establishment of a centralized wastewater treatment plan. This project is already being implemented with a sea outfall in the bay. Although the investment cost is very high, it was felt that pollution from tourism and urbanization could threaten the attractiveness of the area as a tourism zone. With a total population of about 7,300 people sewage effluents discharged were estimated at 900 m^3/day. The major impacts of the existing hotels is pollution of coastal waters due to discharge of untreated or partially treated sewage. O a small proportion of these hotels have treatment plants and most do not function properly.

Coastal Erosion

The main root causes of coastal erosion along the Beau Vallon Bay beach is as a result of:

- tourism development on the beach front.

- destruction of sand dunes and natural coastal vegetation

- introduction of erosion control measures without proper mitigating evaluations, especially revetments and groynes.

- interference with outlets and other hydraulic mechanisms which maintain current regimes in the bay.

- poaching of beach sand for construction.

Many parts of the beach now face severe erosion, especially have heavy storms. Restoration efforts have focused on replanting coastal vegetation, prevention of cars and people from trampling on beach vegetation and implementation of stricter planning laws for hotel development, which includes the specification of a set-back line.

Annex 1: GIS Map of case study site

Mangrove/Wetland Destruction

Mangrove Biodiversity

In 1772, Brayer du Barre reported in his writings that mangroves fringed the east coast of Mahe so thickly that it was difficult to find passages though them to get to shore. However, after more than 200 years of human intervention less extensive mangrove areas now exist in the granitic islands of the Seychelles, although some significant stands remain on the outer coral islands, for example Aldabra atoll has about 800ha of interesting mangroves areas and Cosmoledo atoll about 100ha, in contrast to about 20ha for the Port Glaud mangrove area on the granitic island of Mahe. Since the major impacts on mangroves and wetlands occur on the granitic islands, this discussions is limited to those islands.

The best-developed mangrove forests are located behind beach ridges near open stream mouths. On the Western coast of Mahe, a last continuous mangrove belt exists between Port Launay and Port Glaud, with other areas significantly destroyed. On the East Coast of Mahe, five species of mangroves have recolonised the area created by the East Coast Reclamation project. On Praslin, only small, isolated mangrove swamps have survived near river mouths at Grand Anse, Anse Takamaka and Anse Lazio. The areas along the south-eastern coast, which originally were much more extensive, have been destroyed. On Curieuse Island, a well-developed, intact and extensive mangrove swamp is located around the Turtle Pond lagoon. Some mangrove areas which have been modified exist near La Passe and Grand Barbe on Silhouette Island.

Mangrove species found in Seychelles are typical of the Western Indo-Pacific region, with *Rhizophora mucronata* or Avicennia *marina* being the common pioneer species on the seaward side, depending on the nature of the substrate (Stevenson *et al.,* 1997). Also present are *Sonneratia alba*, *Bruguiera gymnorhiza* and *Ceriops tagal*. In small areas with considerable freshwater discharge *Lumnitzera racemosa* is dominant, and there are occasional large trees of *Xylocarpus granatum.* There are no endemic plant species in the mangal. However the mangrove

forests supports a wide range of marine invertebrates, as well as fish, birds, amphibians and reptiles. Other species utilising mangroves are also spiders and insects.

Wetland Biodiversity

Wetlands, which occur primarily in the granitic Seychelles is usually divided into two main categories in respect to their height above sea level: (i) Upland wetlands (or high altitude wetlands) usually occur in depressions above 200m altitude and (ii) coastal wetlands which are completely or temporarily separated from the sea. Due to the high degree of reclamation and modification of wetlands the exact area of wetlands remaining is not known. On Mahe Island, it is estimated that only 50 to 60 hectares may remain, out of a total of about 100 hectares.

Upland wetlands are not very common and are only found on the three main granitic islands: Mahe (Mare aux Cochons), Praslin (Plaine Hollandaise) and Silhouette (Mare aux Cochons). All have been variously modified by past agricultural practices, however much of the original habitats remain. Only one of these, the one on Mahe is legally protected as it falls within a National Park. Upland wetlands are important habitats for invertebrates, insects, birds and possibly the rare amphibians of the Seychelles. These areas are now the focus of ecotourism activities, but more research is needed.

The typical flora of freshwater wetlands consists of reeds, sedges, grasses and herbs, including *Typha javanica* (Zon), *Eleocharis dulcis* (Ref), *Cyperus articulatus, Mariscus pennatus, Pycreus polystachyos, Paspalidum geminatum, Ludwigia octovalvis* (Lerb Lanmar) and *Polygonum senegalense* (Persiker). The water fern *Ceratopteris cornuta* (Kreson Lanmar) occurs in some wetlands and the large fern *Acrostichum aureum* (Fouzer Lanmar) is common around the edges of lowland marshes. Common coastal trees such as *Calophyllum inophyllum* (Takamaka), *Terminalia catappa* (Bodanmyen) and *Hibiscus tiliaceus* (Var) often establish themselves near the edges. Introduced weed species, in particular *Eichornia crassipes* (Water Hyacinth) and *Pistia stratiotes* (Water Lettuce), now dominate many wetlands on Mahé, Praslin and La Digue.

The fauna of freshwater wetlands also includes pantropical indigenous species as well as introduced ones. Endemic insects such as *Rhagovelia, Nepidae* and *Notonectidae* still occur in healthy marshes. Caecilians have also been seen in marshes, *Hypogeophis rostratus* being the most common species. The two endemic sub species of terrapin, *Pelusios castanoides intergularis* and *Pelusios subniger parietalis* are restricted to wetlands. Crabs *Sesarma impressa* and *Cardisoma carnifex* also frequent wetlands. *Orechromis mossambicus* has been introduced to the islands and is now found in habitats ranging from saline pools to wetlands. An endemic bird the Black Paradise Flycatcher, *Terpsiphone corvina*, is sometimes associated with La Mare Soupape on la Digue. This marsh is important in the ecology of this bird because it is the breeding ground of insects, which the bird captures on the wing. Traditionally, Moorhens (*Gallinula chloropus)* were abundant but restricted to these habitats in the granitic islands; populations have been reduced in recent times, although now humans no longer eat them.

Review of National Legislation

Wetland and Mangrove legislation in Seychelles is very sparse, fragmented and indirect. Seychelles is not yet party to the Ramsar Convention on Wetland Conservation. At present, only 10 wetland sites which are located within protected areas are otherwise legally protected as shown in the list below.

The Environment Protection Act 1994

"Wetlands" are defined in section 3 of the Environmental Protection Act 1994 as "all fresh water and tidal areas that are or may be submerged or periodically submerged under fresh or salt water, including all bodies or areas commonly referred to as marshes, swamps, beaches and flats". Wetlands are included under Schedule 2 B.2. (Ecologically Sensitive Areas) of the Environment protection (Impact Assessment) Regulation, 1996 under Marshes and Wetland habitats as "Areas where the water table enables specific vegetation to thrive, whether the areas is permanently or temporarily flooded, or fresh or salt water, including all mangroves".

Likewise under the Environmental protection (Designation of Solid Waste Agency) Regulations, 1995, the Solid Waste and Cleaning Agency was established and it has the full authority to regulate and monitor the contamination and degradation of the environment from the waste disposal (Section 5(1)). Therefore this mandate is also extended to control the waste disposal in wetland areas.

National Parks and Nature Conservancy Act, 1969 (CAP 141)

Certain wetland sites have automatically included in the National Parks and Nature Conservancy Act Chapter 141 (Subsidiary Legislation) 1991. These ten sites are listed below:

1. Aldabra (Special Reserve 1981)
2. Aride Island (Special Reserve, 1975)
3. Baie Ternay Marien (Marine National Park, 1979)
4. Cousin Island (Special Reserve, 1975)
5. Curieuse Marine (Marine National Park, 1991)
6. Grand Anse (Area of Outstanding Beauty, 2000)
7. La Digue Veuve (Special Reserve, 1991)
8. Port Launay Marine (National Park, 1979)
9. Silhouette Marine (Marine National Park, 1987)
10. St. Anne Marine (National Park, 1973)

State Land and River Reserves Act Chapter 228

Enacted to protect and govern property management of state land contains some provisions related to the management and protection of rivers (part IV). This act also provides for the appointment and management of forest rangers who shall be under control of the Director of Agriculture, and for the protection of trees and brushwood on river reserves. Schedule A of the Ordinance lists the 146 rivers and rivulets found on the islands of Mahe, Praslin and La Digue and areas on the banks of the rivers set aside as river reserves which are to remain covered with trees or brushwood.

Removal of Sand and Gravel Act 1991 Chapter 203.

As described in the preceding chapter on coastal tourism, this act regulates the removal of sand and gravel from rivers, streams and coastal areas. Since wetlands and mangroves are part of the coastal environment, then application of this legislation to wetlands and mangroves is implied. Other legislations where application of law to wetlands and mangroves is implied is summarised in table 4 below.

Table 4: Other relevant legislation

Legislation	**Implied Objective**
Town and Country Planning Act, 1972	Development planning with areas defined for conservation.
Maritime Zones Act, 1977	Maritime sovereignty of Seychelles, providing exclusive jurisdiction to preserve and protect the marine environment
Harbour Ordinance (Chapter 210) and the Harbour Regulations GN 16/1933	Provisions for pollution from ships onto coastal habitats
Land Reclamation Act (Chapter 106).	The proposed reclamation may affect the natural beauty of the coastal area (Sec 5(c))

Critical Review

As shown in the overview the legislation focussing specifically on mangroves and wetlands is not very clear and does not address the current degradation of wetlands in Seychelles.

In particular, the definition given under the Section 3 of the Environmental Protection Act 1991 doesn't cover all the types of wetlands, nor does it cover the ecosystems associated with wetlands, and the fact that wetlands are dynamic environments, whose areas change as a function of the floodplain.

The recent listing of wetlands as an Ecologically Sensitive Area in the Environment Protection (Impact Assessment) Regulations is a step in the right direction. However, this categorisation of wetland habitats does not provide a pragmatic management approach for future conservation in view of intense public pressure for land for construction, nor does it lists which wetlands are to be preserved. As such, it leaves a lot of flexibility for modification of wetland space. In conclusion, it is clear that the present legal regime does not protect wetlands but restrict its modification to an environmental authorisation (EIA process) in the case of development purposes.

On the other hand, it may be argued that wetlands and mangroves as coastal ecosystems are covered under other pieces of legislation. For example, discharges of effluents in wetlands would also be subject to the Effluent quality standards specific in the relevant law, and likewise for solid waste, marine pollution impacts.

For wetlands protected under the protected areas legislation, there still remain a number of other specific wetland areas which need to be specified under that law, not as part of a national forest park or marine park, but as a unique wetland habitat, for example all the upland wetlands deserved protection under the protected area status. Similarly, a few relatively intact coastal wetlands could be set aside as protected areas.

State Land and River Reserves Act Chapter 228 is the only legislation dealing with the fresh water ecosystem which may be extended to include the protection of wetlands against reclamation and as receptors of solid wastes. However, the act doesn't have an ecosystem approach. The resources in the rivers and streams include wide variety of species, which has not been fully identified or afforded legal protection. And the clearing of trees and vegetation on river reserves for construction and development is regulated by section 31 of the Act but as there are no provisions to demarcate minimum construction lines on areas bordering rivers there is resulting uncontrolled construction on the banks of rivers and streams has resulted in the creation of pollution, erosion and destruction of the environment.

Removal of Sand and Gravel Act Chapter 203 deals with removal of sand gravel from very sensitive wetland areas. The Controller of sand and gravel should take the environmental factors into consideration when granting an application. But this is not specified in the act. The controller has the absolute discretion to grant or refuse an application for an abstraction licence.

Maritime Zones Act 15/1977. The resources of the coastal zone include sensitive wetlands, beaches, mangrove forests, and coral reefs has not been fully identified in the act and also provided the proper legal protection. Uncontrolled development has resulted in considerable disruption to the marine eco-systems; wetland areas and coral reef areas have been encroached and destroyed by reclamation and other activities; land based pollution has been permitted to contaminate the coastal and foreshore area without any assessment of its effect upon marine life.

The Town and Country Planning Act 1972. The Land use plans only been used as planning instrument on an ad-hoc basis and plan was not followed through with detailed Land Use/ Development Plans. Inappropriate land use has occurred throughout the island, leading to deforestation, erosion, pollution and aesthetic problems especially in the coastal zones.

Land Reclamation Act (Chapter 106) lays down the procedure that has to be followed when there is a private or public reclamation of land by filling any foreshore (Section 3 (1)). But if any person is objecting to any land reclamation under degradation of environment he or she have to object under section 5 (C) of First Schedule to the act which states that the proposed reclamation may adversely affect the natural beauty of the coastal area where the reclamation is to be carried out. Unfortunately, this criteria does not cover all the environmental impacts or factors associated with land reclamation.

Implementation Obstacles

In addition to the implementation obstacles described in the preceding chapter, the following additional problems need to be highlighted:

Lack of adequate legal framework – This issue creates a number of problems for enforcing any of the above legislation within the mangrove and wetland context. Key problems that arise are the dividing line between private property and the wetland. Since wetlands are dynamic environments this is not always an easy task, even to prescribe in the law. Identification of violators can also be quite difficult since debris in wetlands can originate anywhere along its meandering towards the coastline. The high pressure for conversion of wetlands into housing areas causes many people to declare their right to housing. Since the wetland boundary s dynamic, property owners often seek to reclaim part of the wetland as a justification to a right to housing. This leads to constriction of the wetland area, and causes flooding in other areas.

Poor Perception of wetlands – Due to poor perception on the importance of wetland as a biological and physical system, the application of any law related to the problem of wetlands is problematic and does not get the highest attention, as compared to violations for killing and possession of protected species of turtles and birds. Wetlands are also modified through tourism development, as they are seen as wastelands and should not be seen by visitors. Hence, in most cases they are dug up and converted into ponds with planted shrubs.

Lack of a pragmatic ecosystem management-based approach – This is consistent with many of the legislations related to biodiversity conservation in the Seychelles. To address the complex nature of the problem required that the law makes provisions for specific management and guidance priorities so that decisions are taken in the most transparent manner and with due consultation and investigation of the issues and impacts at stake.

Linking national legislation to international conventions – There is a need to explore the linkages between different conventions such as Convention on Biodiversity, Convention on Migratory Species and the Ramsar Convention to determine what aspects are covered under present legislation and which mechanisms needs to be put in place to improve the management of these ecosystems.

Need for legally-binding land use plans – This is fundamental to any effort for the protection of sensitive habitats, and address issues of public right to housing and property. Relocation

mechanism could be indicated under such a framework, as well as other potential areas for housing development could be identified as a trade-off in the most transparent manner.

Institutional Arrangements

The management of wetlands falls under the responsibility of the Ministry of Environment, Division for Policy, Planning and Services. A wetland unit was setup within that Division in 1999, and currently has over 20 full-time staff. The primary role of this unit was to control the problem of the water hyacinth in the wetlands. The work of this team now includes enforcement and monitoring of wetland habitats. It is also consulted on construction projects that will have an impact on wetlands. The unit also works closely with a local NGO, the Nature Protection Trust of the Seychelles, who has undertaken several assessments of wetlands, as well as runs a successful terrapin hatchery. With the Ministry of Environment, the wetland unit works closely with the Conservation and Forestry Section. The functions of the wetland unit are listed below:

- Periodical maintenance and management of coastal wetlands and flood-control
- Undertake monitoring and ecosystem health assessments of wetlands
- Develop and implement public education programmes for the preservation and wise-use of wetlands
- Provide advise to government on the issue of management and conservation of wetlands
- Cooperation with other agencies to implement the wetland policy and activities.

The Wetland Unit, in an attempt to address some of the issues outlined above, has developed a wetland policy which hopefully will be adopted by government in mid-2003. To implement the national policy an implementation framework is proposed, with a specific listing of wetlands, and proposing a new classification structure, which provides a much more pragmatic approach to wetland management in the Seychelles. Following successful adoption of this policy, much of the framework would be integrated into law. In connection with this wetland policy, a GIS system has been setup to allow effective management of this degraded ecosystem. The elements of this policy is summarised below:

Policy Objective: "Protect and conserve wetlands so that wise and sustainable use of their functions and values, including indirect benefits, are secured now and in the future".

Policy Targets:

1. Reverse trend in the loss, modification or degradation of wetland functions in Seychelles by end 2005.
2. Incorporate and recognize wetland functions in resource planning, management and economic decision-making for all national projects, programs and activities by beginning 2003.
3. Maintain and enhance wetland functions and values derived from wetlands throughout Seychelles.
4. Adopt wise use of wetlands that ensures and enhances the prospects of a sustainable and productive manner for future generations of Seychellois.

Socio-economic Importance

There has been no direct study done in the Seychelles to determine the socio-economic importance of wetlands, primarily because they are not commercially exploited. However, the cost of indirect destructive uses such as reclamation can provide an insight into the perceived value of wetlands.

On average it would cost about 100 rupees to reclaim a cubic metre of wetland, and assuming about 400 sq meters is required for one house, reclamation of a wetland for one house would cost about 25, 000 to 50,000 Seychelles Rupees to reclaim. On the other hand estimated cost for 400 sq meters of land on the coast can cost from 80,000 to 100,000 Seychelles Rupees. This implies that it is cheaper to reclaim than to buy a piece of land on the coast. The added complication is that often this land is not available.

However, when the value in terms of services to the environment is considered, such as protection against potential flooding, the real cost of wetland conversion becomes more real. For example,

recent flooding within the Anse aux Pins area on Mahe, may include costs such as damage to property and roads.

Impact on the Environment

Threats to the wetlands of the Seychelles are numerous, the most immediate being that posed by development. For over two centuries, wetlands have been considered as sites for conversion for agricultural land, and most recently for construction of houses. Following the first settlement in 1770, a rapid process began of clearing of the forests and wetland vegetation for the cultivation of nutmeg, cinnamon, cloves and maize. The pressure will continue to increase as the population of Seychelles increases and as the tourism industry grows.

As well as encroaching on land area covered by wetlands, development can disturb the hydrology of wetlands upon which characteristic vegetation assemblages may depend (e.g. La Mare Soupape, La Digue). The rate at which water is removed for drinking or for agriculture may exceed that at which it is supplied by the surrounding drainage basin (e.g. La Passe, Silhouette). Pollution from areas of development includes the dumping of refuse and sewage in wetland areas, waste from intensive farming of livestock (pigs and chickens at La Mare Soupape) and run off of fertilisers. Such pollution may change the nutrient balance in wetland habitats producing changes in composition of the biota. For example, fertilisers may stimulate algal growth which reduces oxygen availability for other aquatic organisms (eutrophication).

A substantial threat is posed by exotic plants that have been introduced to Seychelles Islands, in particular, have been severely affected by the accidentally introduced species of many taxa. Such species, in the absence of their native control agents (predators, parasites ad such like) become fast-growing and invasive and thus widespread at the expense of characteristic wetland vegetation. For example, after the introduction of water lettuce (Pistia stratiotes) to La Mare Soupape, La Digue in 1993, all aquatic plants and some Badamier trees (Terminalia catappa) died (Duncombe, 1996). This species covers the entire surface of areas of water. It reduces the space, light and nutrients available to other organisms. The threats posed by introduced species are described on pages 13-15.

A considerable threat is posed in the long term by the probability of rising sea levels. This (sometimes coupled with a man-made reduction in level of the coastal ridges between the wetland and the sea) can lead to silt deposition and an increase in salinity of some wetlands. Duncombe (1996) describes how this can accelerate the process of succession, i.e. a non-seasonal, directional change away from characteristic vegetation assemblages found in the wetlands of the Seychelles towards dense secondary forest. Thus it is necessary to be aware of the dangers of rising sea levels and that of lowering coastal ridges for development (e.g. for a shooting range at Grand Police Bay).

Table 5: The main threats and impacts to wetland ecosystems are summarised in the table below.

Threats	**Activity**	**Impact**
1. Reclamation	a. Housing construction b. Road building c. Agriculture	• Continual and permanent loss of exceptional or irreplaceable wetlands
2. Pollution	a. Dumping grounds for wastes b. Discharge of effluents	• Euthrophication • Microbiological • Propagation of disease vectors
3. Alien Species introductions	*a.* Cuttings from imported plants for decorative purposes b. Disposal of aquarium fish	• Modification of community structure and/or species composition
4. Water Diversions/Fresh Water Shortage	a. Human use b. Irrigation	• Reduction in flow • Stagnant and fouling of water body • Odours from anaerobic decomposition
5. Siltation	a. Deforestation b. Construction on steep slopes c. Dumping of construction materials	• Oversiltation with red earth, gravel • Blockages from debris

Case study 2: Severely Impacted Area and Ecological Restoration of Wetlands: Mare Soupape on La Digue.

Background

On La Digue, it is estimated that 70% of the total population of about 2,500 live and depend on the coast, as almost two-thirds of the island is mountainous and rocky, and therefore inaccessible to development and human settlement. The marine ecosystem and the low-lying coastal belt are the backbone to the island's socio-economic development. A large coastal wetland supports a diversity of wildlife, including the endemic paradise flycatcher. Multiple and diverse use needs, conflicts, resource constraints, institutional support, and awareness at this interface are very important issues that need to be addressed in any restoration effort.

Physical characteristics

La Digue Island lies 50 km Northeast of Victoria, Mahe, the capital of the Republic of Seychelles (see MAP). It is the fourth largest granitic island in the Seychelles group, after Silhouette. However, it the third most populated island with a population growth rate of about 0.4 %. It also lies four and a half kilometres from Praslin, the second largest island in the archipelago. Praslin provides electricity and the closest air-link to the island. There are day-hourly sea-links between Praslin and La Digue, and daily links between Mahe and La Digue. The island, with an area of ten square kilometres, is protected on all but its south-east shores by an encircling coral reef of outstanding biodiversity and landscape. The highest hill on La Digue, which rises up to three hundred and thirty-three metres, covers almost the entire hinterland, the narrow coastal plain lying to its west. The island's only plateau is about 2.75 km long and 1 km wide. The wetland, called Mare Soupape or 'turtle swamp' measures over 18 hectares and is located on the coastal plateau. Sluice gates have been built at the two extreme discharge points to minimize salt water intrusion. La Digue depends on ground water for its water resources so conservation of the wetland is also an important issue for the residents.

Ecological characteristics

La Digue is also host to one of the world rarest birds, the Paradise Flycatcher. Set on La Digue western plateau and rising up to two hundred metres, the Paradise Flycatcher reserve covers fifteen hectares of forest dominated mainly by *Terminalia catappa* (Badamyen) *Calophyllum inophyllum* (Takamaka), *Cocos nucifera* (Coconut), *Casuarina equisetifolia* (Casuarina) and so on. The large wetland harbours a wide variety of insect faunas, and endemic species of terrapin. Protection of land and the marsh has always been a very controversial issue, as it involves land acquisition, an issue not favourable as the indigenous population is very closely associated with the land. Logging and construction activities have also contributed to the decrease in potential habitat.

Socio-economic aspects

The population on La Digue depends upon the wetland for two basic services: water resources and tourism. Tourism infrastructure caters for about three hundred and fifty beds which is mostly concentrated on the coastal plain. Migration to La Digue includes mainly professionals in government and the service sectors, whereas from La Digue mainly students leave for further education on the mainland. An estimated 15% of the population is engaged in agriculture, with La Digue having the highest number of cattle per head. In the fisheries sector, it is estimated that only 11 % of the population are engaged in artisanal fishing. On the other hand, tourism employs, directly and indirectly about 34% (indicative) of the population. An estimated 80% of the population of La Digue has access to treated water, sourced mainly from ground aquifers. The island is also well service with electricity, IDD telecommunications, a school and a small hospital. The main staple diet on La Digue consists of almost fish and rice, with meat eaten on special occasions. Annual consumption of fish is about 75 kg per person.

Main Impacts and Restoration Activities

The main impacts of human activities on the wetland on La Digue include sea level rise, invasion of the water lettuce (*Pistia stratoites*), and pollution in the form of solid wastes and wastewater.

According to a recent survey carried out by the Conservation and National Parks Section of the Division of Environment (CNP-inform, 1992) there has been a marked decrease in total woodland area of the western coastal plateau. This is due to logging activities since 1978 which has reduced the total area of the reserve (about 161.3 ha.) by 25.5 %. However, Fly Catcher populations seem to be stable, indicating that probably the adjoining marsh is contributing as nesting habitats for the species. There is also evidence to show that logging activities have intensified over the last four years, from a 1% decrease/year to a staggering 4 % decrease/year.

Wetlands are essential features of island topography, and they control the outflow of water into the marine environment, thus minimising the risks of coastal flooding after torrential rains. Their convective feature allows them to expand during periods of heavy downpours and accommodate the huge amount of flood waters. Therefore a the typical wetland on La Digue is found to be a few centimeters below sea level, so that it can effectively capture the surface runoff and then by slow dissipation through surface outlets or ground water shuttles into the marine environment. La Mare Soupape also harbours a plethora of plants and organisms. Among those include the freshwater terrapins (Pelusios subniger & Pelusios castanoides) and insects for both the Fly Catcher and the Seychelles Cave Swiflet (Collocalia elaphra), and typical marsh-plants like reeds, sedges, grassess and water plants (e.g. *Cyperus articulatus*, *Typha javanica*, *Ipomoea aquatica* and *Eleocharis dulcis*).

Several restoration efforts are ongoing:

1. Replanting of the original woodland – replanting activities is undertaken periodically by Ministry of Environment staff.
2. Removal of the invasive water hyacinth. This is a permanent and ongoing effort, whereby all those invasive lilies are manually removed and destroyed.
3. Schools are being involved as well in ensuring that the reserve also remains clean of litter which is a common problem in the wetland.

Annex 2: GIS Map of case study site

Coastal Mining and reclamation

The principal terrestrial part the coastal area on the granitic islands consists of "plateaus" and marshy areas. The plateaus, which lie up to two meters above sea level, is a discontinuous elevated terrace that runs along the shore in a narrow band and consist of calcareous reef material. (Baker, 1963) These have accumulated in the last 6000 years (Braithwaite, 1984) derived form coral reef, molluscan sandy deposits and terrigeneuos debris (Lewis, 1968). The main island of Mahe is 27 kilometers long and six kilometers wide, with a coastline of Mahe is about 105 kilometers in length of which 36 kilometers are sandy beaches. The plateau area on the islands is very small, as shown in table 6 below.

Table 6 : Availability of coastal land area on the main granitics.

Island	Total land area (ha.)	Coastal plateau land area (ha.)	Percent
Mahe	15470		
Praslin	3756	193	5.1 %
La Digue	1010	165	16 %

Source: Payet 1998.

It is estimated that 90% to 100% of the population is concentrated on the narrow coastal strip. Mahe has a total land area of 148 square kilometres, which leads to a population density in excess of 400 persons per square kilometres. Approximately 40% of the population is located on the East Coast of Mahe from Victoria to the International Airport on a coastal belt which is only about 7 km long by 1 km wide. Previously, coastal resources that were mined included coral reefs (until late 1960's) and beach sand (until late 80's). Both of these activities are now prohibited, and much f the coastal mining is now done through reclamation.

Land Reclamation in Seychelles

The scarcity of flat land has always been a major constraint to the development of the Seychelles. The Seychelles International Airport, Commercial and Fishing Ports were built on reclaimed land from the sea. Land reclamation projects on reef flats in the coastal waters on the east of Mahe near

Victoria, using dredged calcareous materials started in the 1970's and were been completed in 1992 resulting in about 200 hectares of land.

The first reclamation took place in 1973 at Victoria harbor and at Anse Des Genets. The 102 ha. of reclaimed land was required for the International Airport and the construction of a cruise ship port, power station and bulk fuel storage facilities, and key back-bones for a developing economy.

In 1986, a further 133 hectares of land stretching from Victoria to Providence was reclaimed due to the pressing requirement of land to meet the demands of an expanding economy and population. The main end-uses of this land were for housing, industry and waterfront developments, and also provided the first basis for launching the international business sector in Seychelles.

The third dredging and large-scale land reclamation took place in 1991 in the vicinity of the airport and in other pocket areas closer to Victoria. The project yielded 85 hectares of land and a coral fill stockpile of 1.3 million cubic metres. The provided additional land for industry and for the siting of key utilities infrastructure such as wastewater treatment, a new power station, and a solid waste sorting and treatment center. Furthermore, the land was utilised for the extension of the international airport, a yacht marina, a dry-dock, sewerage treatment works. The needs of the new International Business Centre, the components of which include the development of an International Trade Zone, the incorporation of international businesses in Seychelles, the development of financial services to support international trading and international businesses and the promotion of the registration of certain activities in Seychelles were also further developed.

The coral fill stockpile was created to reduce pressure on illegal extraction of sand form the country's beaches and to provide an alternative to the construction industry.

The first reclamation undertaken in the early 1970's under the supervision of the British Government was not subject to an Environmental Impact Assessment, and this trend continued until the East Coast Reclamation Phase II.

The most recent phase, East Coast Phase III, ending in February 2003, included the reclamation of about 15 zones with a total area of about 343.5 ha. (or 848.8 acres), requiring about 11.6 million m^3 of coral fill fro the bottom of the sea, along the east coast of Mahe island, and creating a stockpile of a total of 3.5 million m^3 of fill to meet construction demand for sand. This was by far the largest reclamation project undertaken by the country and its primary objective is to cater for the physical requirements of the future urban development of Greater Victoria over the next 25 years.

Review of National Legislation

A number of regulations provide the framework for reclamation of the coast in the Seychelles. Only those of direct relevance are discussed.

Land Reclamation Act 1991 (Cap 106)

The land reclamation act provided the framework for the authorisation of land reclamation. Currently, only the President may authorise "any owner of land…to fill in the whole or any portion of the foreshore which borders on the land belonging to such owner" (Sec 2 (1)). The law goes further in specifying the rights of the individual with respect to that law. It states that "Any person having any objection to an undertaking or any claim of private right in respect thereof shall submit such ….." Section 6(3). Section 7 clearly states that upon publication of authorisation, all public and private rights of navigation or fishing…..shall cease to exist. In Section 9, the Supreme Court is established as the authority to hear and determine claims for compensation. Under the first schedule, Section 5, a person may object to the proposed reclamation on the following grounds: (a) the proposed reclamation may affect any property owned; (b) may affect public rights; and (c) may affect the natural beauty of the coastal area.

Other relevant legislation within that framework is the:

- Land Reclamation (Amendment of schedule) (1975)
- Land Reclamation (Amendment of schedule) rules (1988)

- Land Reclamation (Amendment) Decree (1978)
- Land Reclamation (East Coast Development) Retrospective Authority order
- Land Reclamation (Retrospective Authority) order (1987)
- Land Reclamation Delegation of statutory Functions order (1972)

Environment Protection Act 1994

Land Reclamation is an activity which is specified in Schedule 1 of the Environment Protection (impact Assessment) regulations, implying that such activities will be subject to environmental authorisation following an environmental impact assessment.

Maritime Zones Act (1997)

The Maritime Zones Act of 1997 is another basic statute to be taken into account. The Act declares national prediction over the territorial waters, the continental shelf and the exclusive economic EEZ zone of the Seychelles. The use EEZ the Seychelles has "exclusive prediction to preserve and control marine pollution".

Town and Country Planning Act, 1972

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The Act does not refer to reclamation, but controls all development, including land reclamation. Therefore all reclamation projects are also subject to the TCPA (Town ad Country Planning Authority) approval.

Removal of sand and gravel Act (1982)

This regulation apparently does not cover extraction of sand from the bottom of the sea, although it clearly states in Section 3(2) (a) that prohibition includes abstraction of sand or gravel from any place, including the public domain.

Minerals Act 1991, (Cap 129)

The Act governs and defines minerals and its extraction within the Seychelles. It specifies that the entire property in and control of all minerals in, under or upon any land in Seychelles or in all rivers or streams throughout the Seychelles is hereby vested in the Republic and the Republic shall have the exclusive right of prospecting and mining for such minerals (Section 3). In Section 6 it providing mining rights in the form of a special mining lease granted by the Minister. However, the definition of minerals does not include coral, sand or sediments.

Critical Review

Whilst many of the legal gaps indicated above are also applicable to this issue, some pertinent issues arise here with respect to the regulation of reclamation activities.

Specific requirements for Environment Protection – An overview of the law has revealed that there is no specific requirement for environment protection for reclamation activities. The only evidence of this is in the EPA regulations which only list land reclamation as an activity subject to an EIA. Whilst this is an essential first step, it does not go as far as stating which types/size or location of the proposed development and whether all land reclamation projects should be subject to a full EIA. Noting the potential environmental effects and impacts a reclamation project ay have on the environment, such guidelines should be available and inserted into law. Secondly, there is no process or ambient standards (e.g. silt concentrations) for the reclamation process. Provisions to make use of proven approaches and use of best technologies which have the minimum impact on the environment are not clearly specified. The reference to ‘natural beauty ‘ in the Land

Reclamation Act is a clear reference to an impact on amenity values, however stops short on how this should be evaluated or measured.

Reclamation Land Development Planning – The law is surprisingly very silent on the issue, although there is some emphasis on the TCPA on land use development plans. This provision should be extended to reclaimed areas, stipulating also the need to conserve and extend existing public services such as storm –water discharge. Zones where there should be no reclamations have been specified under the Town and Country Planning Act, as a matter of policy and not inserted into law. Such embargoes often do not hold for long, as pressure to allow exceptions leads to piece-meal reclamation along some coastal areas. An attempting at streamlining the way piece-meal reclamation is done has further complicated the issue, as much of the guidance is not in written form, but such development is decided on a case by case basis.

Ambiguity in the Law – The law is ambiguous with respect to extract of sand form the sea floor for the purposes of construction. Although the Removal of Sand and Gravel is clear on the issue under control, it does not seem to cover the seabed, nor anything outside the foreshore, or even the territorial waters of the Seychelles. In the same respect, a review of the Minerals Act showed that both sand and gravel are not covered in that specific legislation. So it follows that there is no law banning extraction of coral or sand from sea bottom (to verify with lawyer).

Institutional Arrangements

The planning for reclamation projects is undertaken by the Ministry of Land Use and Habitat, with the economic feasibility study undertaken by the Ministry of Economic Planning. The proposal is then discussed at the National Inter-Ministerial Committee and then at the Cabinet of Ministers. If the project is approved an Reclamation Committee consisting of senior officials of different government ministries, with representatives of the private sector is constituted under the chairmanship of the President of the Republic. Initial steps include the preparation of the design and EIA, following by preparation of contracts and the Environment Management Plan.

Once the project starts, a project management committee is setup which overseas the day-to-day running of the project. This involves weekly meeting with the contractor with respect to maintaining the conditions of the environmental authorisation.

Key institutions which are directly involved or affected by the proposed development are summarised below.

Ministry of Environment - ME has the primary role in the formulation of policies for sustainable development with special emphasis on environmental management. ME interacts with various other Ministries such as MOH on health matters; MAMR on agricultural health matters; MLUH on land use matters; MIIB with industrial development matters; and with the MTCA for tourism and air transport matters.

Ministry of Land Use and Habitat - The Ministry of Land Use and Habitat (MLUH) has two main divisions, the Lands and Infrastructure Division, and the Housing Division. The Lands and Infrastructure Division handles all issues of land use planning, land management, surveys, boundaries, ownership of land, and monitor all land development in the Seychelles. The Housing Division is responsible for housing development. A new section, the GIS and Land use Information section has been set up with the main task of maintaining a GIS and Land Resources database for the country.

Socio-economic Importance

Land reclamation projects have a permanent impact on the economy and social structure of the country. Whilst it offers many potential advantages, it also has many disadvantages, including loss of habits and the high cost of reclamation. Although the size of the GDP relative to the investment could raise concerns on economic stability, the projects offers Seychelles new opportunities for economic diversification, and especially consolidate other economic sectors, rather than the exclusive dependence on tourism and fisheries

For example the last reclamation is estimated to have cost government a total of US$ 110 million, with a foreign exchange component of US$ 47 million. The cost also increase significantly to justify the strict environmental imposed by the EIA and the Ministry of Environment. Additional contributions to the cost also included raising the ground level of the reclamation for 2.5 m to 3.2 m, to accommodate anticipated sea level rise.

Land Reclamation projects are often implemented to alleviate the acute problems of land shortage. However, the benefits of this additional land may not be totally exploited if suitable land use policies are not put in place. It is imperative that at this stage opportunity for making maximum use of the proposed reclaimed land, and other reclaimed land is undertaken, to ensure maximum return on investment, and maximum management and protection of threatened core natural resources.

In addition, several representatives of the various constituencies or districts have raised the need for economic diversification at community level. Land reclamation projects allow for the development of business parks close to the villages and thereby foster local economic growth. The availability of land for the provision of business areas and social services to the various districts on the north coast is also an important long-term benefit. However, it is important to note that the area is predominantly tourism orientated and efforts should be guided towards consolidating that sector also.

However, on the other hand fisheries and biodiversity are invariably affected by land reclamation activities. For the East Coast Phase III reclamation project it has been estimated that fish habitat loss would amount to USD 600,000 per year. The income to local subsistence fishermen will therefore be significant. This will in turn cause such persons to invest in bigger boats for offshore fishing and consequently spend more time at sea. Coastal fisheries in crustacean, molluscs and bivalves will be more or less eradicated in the short-to-medium term.

The recreational benefit derived from the view of the open sea will no longer be an asset for tourism establishments along coasts which have been reclaimed. Increased debris and pollution in the lagoon may also limit coastal recreational use of the area, especially after heavy rainfall.

Notwithstanding the previous argument concerning decrease in recreational use, proper planning of the new coastline could lead to new opportunities for tourism and other recreational uses.

Overall a land reclamation project, if properly planned can bring a number of economic benefits to a country where land constraints negatively impacts on the economy. On the other hand if the environmental effects are considered, the economic return is only felt in the long term.

Impact on the Environment

All of the earlier reclamation activities led to siltation of reefs and destruction of live coral (Payet, 1998) however, in the longer-term siltation of nearby reefs may be due to land run-off as well as unstable reclaimed areas. In the second phase of the East Coast Reclamation, silt screens and filter cloth were used to mitigate siltation, and filter cloth liner covered by rock armoring at the base of the fill area was utilized to trap suspended solids. This approach reduced the impact significantly. Monitoring of the impact was also initiated during the second phase, as a result providing critical background data in determining the extent of environment protection of subsequent phases of reclamation.

Historical Impacts

The nature of the previous impacts of the reclamation has not been well studied and documented, so only qualitative observations would be given. However, it is important to understand the nature of these impacts since they may have synergistic and dynamic effects on any further development in the area.

According to a survey undertaken by De Silva (1986) within the Ste Anne Marine Park and other sites within close proximity to the dredged areas, serious levels of stress due to sedimentation were apparent. There were signs of sediments on the reef and benthic organisms, and there were signs of excessive mucous secretion, pale spots (expulsion of zooxanthellae), tissue loss and coral deaths. Impact of sediment ranging from very fine clayey particles to crushed coral was reported. However, it was also noted that upto 30 – 40% of the live coral in the fore-reef area appeared to

have recovered reasonably well, especially the *Porites sp*. and *Platygyra sp*. Sediment deposits were observed on the reef flat as well as in the depressions and channels, which characterise the coral reef.

The indirect biological or environmental effects associated with dredging and reclamation includes:

- reduction of feeding and respiratory efficiencies and induced mortalities in bottom dwelling , non mobile organisms, such as bivalves and corals, attributed to increased sedimentation;
- Reduction of primary productivity (destruction of seagrass bed) and due reduced light transmission caused by turbidity in the water column.
- Introduction of abnormal volumes of organic material and nutrients, increasing biological oxygen demand and, in turn, reducing levels and productivity;
- Re-introduction of toxic substances uncovered by the dredging activity in the water column. Posing risk of introducing in the food web;
- In advert destruction of adjacent habitat (Ste Anne Marine Park and reef slope of the fringing reef) critical to life cycles of certain organisms;
- Disruption of migratory routes of motile marine organisms and possibly sea birds.
- Other effects on corals include reduced rates of growth (possibly due to declines in photosynthetic rate of the symbiotic zooxanthellae) and reduce species diversity.
- Continued resuspension of fine sediments in the vicinity of coral reefs may prevent substrate consolidation and subsequent recolonisation by many benthic organisms, especially planktonic larvae of corals, as well as other reef invertebrates, which require hard bottom to become established.

Case study3: Severely Impacted Area and Ecological Restoration of Reclaimed Areas: East Coast of Mahe.

Background

Since the first reclamation in 1973 for the main port and the international airport, a phase 3 of the East Coast Project has just been completed in February 2003, which resulted in the reclamation of 297 hectares of land around the capital city of Victoria. The primary objective of the project was to

cater for the physical requirements of the future urban development of Greater Victoria over the next 25 years. However, in view of the disastrous impacts of such activities a restoration programme is proposed as part of the environment impact assessment process. This restoration programme is then adopted by the developer within an environmental management plan.

Restoration management plan

Following completion of the project the contractor is expected to green the reclamation zone, and restore the coastal mangroves. However, since growth is accelerated in Seychelles, on several occasions it was not necessary to plant mangroves as they seem to grow better naturally. What was observed is that the mangrove tend to be mono-species specific in the first stage, and then starts to become more diverse as the stands matures. Such decolonization of mangroves also brings about a number of birds and fish.

Whatever the Works to be executed, the littoral channels will require, after the construction of the reclamation retaining embankments, regular maintenance in order to eliminate the accumulation of debris, flush the eventual sedimentation zones. At the same time, it is imperative to organise the collection and treatment before safe disposal of effluents; the training of watercourses to reduce flood-induced erosions; water quality monitoring programme.

The rock armouring should be maintained to protect the coastline from erosion as the incident waves are expected to be quite strong, compared to when the coast was located one km inshore. Periodic inspections of the rock armouring would indicate whether silt is seeping out into the ocean. All efforts should be undertaken to minimise this small but long-term outflow of silt into the coastal area, especially within the vicinity of Ste Anne Island.

Reclaimed sediment contains excessive amount of salts and a high pH, and since it is primarily calcareous in nature with no nutrients, certain plants ideal for landscaping will find it difficult to adapt to such conditions. Consequently the strategies have been found to work in the first stage of a restoration project:

1. Through the action of the rain, the salts are allowed to slowly leach out.
2. Spread and apply organic compost and slurry to condition the soils
3. Aggressively plant Casuarina, Albizia and even some grasses and sedges commonly encountered on the outer islands to allow the first line of plant colonisers to become established.

The expected results from these activities include stabilisation and enrichment of the soil. The dispersion of fine sediments through uplift and deposition by the wind should not be ignored, and if vast areas are left unplanted, the atmospheric deposition of the silt may lead to additional impacts in the coastal marine environments.

In a second stage the reclaimed area is planted with various local exotic plants and soon it is difficult to say which land is reclaimed and which ones are not.

Lower Trees	**High trees**
Manglier patience	Bonnet Carre bord de mer
Bois matelot	Bois blanc
Calotropis	Badamier
Var	Takamaka
Bois Citron	Lafouche grande feuilles
Bois be Rose	Porcher
Bois cassant bord de mer	
Bois tabac	
Bois Chaplet	
Vacoa de riviere	

Conclusions and Recommendations

Laws and the capacity to address those three critical issues in Seychelles are very fragmented with no one institution or a national strategy to address these issues. Although the Environment Protection Act is quite modern in the sense that it provides the framework to address those issues, its potential is as yet untapped. A formal framework to address land-based sources of pollution is therefore important. A policy focused on more stakeholder involvement and empowerment may also be useful in this demarche.

The case studies provided in the report indicates that there is much to be learned from restoration of degraded habitats. In fact, in most cases the financial and human resources are not available to undertake those enormous tasks. The identification of clear model for the successful implementation of a national strategy to address land-based sources of pollution is important if it is to be successful, as the study has shown that even with good legislation, if there is no enforcement then the effectiveness of the policy is abated. This common problem of enforcement is an issue faced by a number of countries, and it is clearly linked to political will, strengthening of existing inspectorate functions within the various departments and devising innovative approaches to surveillance. In addition, it is also clear that the legal system needs to be relooked at in terms of how environmental cases are handled to reduce time to conviction.

Finally, it is vital that legislation, which are essentially command-and-control approaches are considered in isolation. The role of market-based mechanisms should not be underestimated, and the role of stakeholders and the private sector should not be ignored. The national strategy should include very clear indications about how this will be achieved.

The PADH project has also been closely linked to the development of the second generation Environmental Management Plan in Seychelles, the EMPS 2000-2010. Through an extensive participation process with stakeholders, the private sector and the civil society a plan was defined which maps out the environmental strategy for Seychelles for the next ten years. Many of the issues being addressed by this report in much grater detail is outlined in this plan. The participative process created by the EMPS development process will be an essential springboard for increasing

stakeholder participation in resolving some of those issues. The level of coastal resource conflicts are quite low in Seychelles, but these are likely to increase as more land is protected (-leading to coastal use restrictions), more land is reclaimed (-taking up fisheries areas), and more hotels are built (-lay exclusive claim to beaches). With population growth likely to exceed 100,000 by 2020 (MISD, 1997), land use and access to public resources conflicts will also increase. There is therefore the need to build conflict prevention and management approaches at all levels, and to primarily focus on coastal communities likely to be affected in the long term.

The potential threat of sea level rise, climate-induced coastal erosion, coral stresses, explosion of pests, invasive species and diseases, coupled with intense human pressure and resource depletion should not be ignored. With increased emphasis for coastal rehabilitation and replanting, there would be nevertheless huge amount of funds dedicated to protection of coastal infrastructure through hard and soft options. There will be the need for coastal engineering and hydrodynamics expertise as the number of rehabilitation and coastal protection activities increase.

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