D. THE MANAGEMENT OF BEACHES AS A TOURISM RESOURCE
DESTROYING THE GOOSE THAT LAYS THE GOLDEN EGG

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ABSTRACT

The unprecedented increase in economic development in Anguilla in the last decade has been due to an expanding tourism industry. However, this industry may be destroying the resources upon which its economic sustainability depends. Land clearing with the resultant increased sedimentation on the reefs, the replacement of natural vegetation with exotics requiring considerable doses of fertilizers, indiscriminate sand mining, the alteration and destruction of dunes and the lack of adequate development setbacks are all threatening the natural coastal resources of Anguilla upon which the tourism industry is based. The situation has not yet reached crisis point in Anguilla for the island still has many pristine beaches and coastal areas, nevertheless this does not provide grounds for complacency since increasing development pressure could change the situation in a short space of time.

BACKGROUND

Since the early 1980's, Anguilla has experienced a significant increase in economic growth. The gross domestic product in current prices increased by an annual average of 16% from EC $47.06 million in 1985 to EC $165.1 million in 1995. The unemployment rate, which was 26% in 1984, had dramatically decreased to 1% in 1989, though it was estimated to be about 7% in 1995 (Anguilla Statistical Unit, 1995).

This unprecedented increase in economic development is undoubtedly due to an expanding tourist industry. Visitor arrivals on this tiny Caribbean island of approximately 9,000 people, had jumped from 17,561 in 1982 to 123,780 in 1994. In 1985 the contribution of the hotel and restaurant sector to the gross domestic product was EC $13.2 million (28% of GDP). By 1994, the figure had increased to EC $60.76 million (36% of GDP).

Undoubtedly, the single most important tourist attraction of the island is its pristine environment, including the 32 spectacular white sandy beaches. Consequently, much of the tourist related development is concentrated in the beach areas. While this tourist related development around the beaches creates employment and generates wealth for the residents of Anguilla, it is resulting in the degradation of the beaches. Tourism can be economically self defeating since it destroys the very resource upon which its economic sustainability depends. In other words, tourism itself is destroying the goose that lays the golden egg.
This paper is therefore a discussion of the ways in which unsustainable tourism development policies and practices are directly and indirectly, destroying the beaches of Anguilla.

**BEACHES AS PART OF THE ECOSYSTEM**

It must be recognised that beaches are part of a wider ecosystem which includes inland areas such as mangrove, as well as seagrass beds and coral reefs. Damage inflicted on any element of this ecosystem will most likely have a negative impact on the beaches. For example, mangrove and other natural vegetation act as sediment traps thus reducing the amount of mud, silt and other debris reaching the inshore reefs. If these mangroves and other natural vegetation are cleared, the resulting sedimentation will smother the coral and reduce the amount of light reaching them. This eventually destroys the coral reefs. Every effort must be made to avoid this occurrence in Anguilla, since these reefs act as natural breakwaters which reduce the amount of erosion occurring in coastal areas during ground seas and hurricanes. Coral reefs are also a major source of sand for the island’s beaches.

Unfortunately, many local residents and foreign developers do not appreciate the importance of the various elements of the wider coastal ecosystem and so indulge in various practices which are now resulting in the degradation of the island’s beaches. In many parts of the island, large tracts of land are being completely cleared for hotel development, which sometimes never occurs, or in some cases, occurs long after clearing has taken place. Foreign developers often refer to the specially adapted scrub like vegetation as having little value and should therefore be replaced by less functional exotic plants requiring huge doses of fertilizer (with disastrous consequences).

There is the case of two local fishermen who were found cutting down the trees just behind the foreshore of one of the beaches. When confronted, the two fishermen politely explained that they were securing sticks to construct their fish pots. One further explained that they were helping to develop tourism by clearing the vegetation and making the beach look “nice”. The sad fact is that by obtaining the fish pot sticks from this source, they were removing vegetation, allowing mud to enter the sea and ultimately destroying the inshore reefs, the breeding grounds for the same fish they were preparing to catch. At the same time they were indirectly depriving the beach of its future source of sand and protection from ground seas and hurricanes.

Indications are that during Hurricane Luis in 1995, inshore reefs which may have been exposed to greater man made impacts, were more eroded than reefs offshore (Bybell and Buchanan, 1996). It also was observed that beaches on the north western coast suffered more erosion than beaches on the southern coast. One of the main reasons for this could have been the absence of any significant coral reef protection system along the north western coast.

It is therefore important that we do not only discourage those development activities which have a direct negative impact on the beaches, but also those which negatively impact on any part of the coastal ecosystem.

**SAND MINING**

The boom in the tourism industry resulted in a greater demand for sand to build hotel facilities. The boom also provided residents with greater employment opportunities and more wealth, and so they too built more homes and more commercial premises. These also required more sand. The demand for more sand resulted in indiscriminate sand mining and the consequent clearing of coastal vegetation around the island.

Sile Bay on the south eastern coast, is a glaring example of a lovely beach completely destroyed by sand mining. This beach was once backed by an extensive area of sand dunes about 20 ft. high, which were largely mined in the early 1980’s. One of the land owners then tried to prevent erosion of the mined out area by constructing a low concrete wall. However, it appears that this wall may be preventing accretion from occurring. The situation at Sile Bay was compounded during Hurricane Luis. With the Acropora palmata reef offshore reduced to rubble, the remaining portion of the dunes were swept away and the sea encroached 150 ft. inland.

Meads Bay at the western end of the island’s north coast, one of the island’s premiere beaches, also suffered severely from sand mining. The beach, which is home to one of Anguilla’s five star hotels, is scarred by a number of sand pits. One area was so badly mined that the sea breached the lowered dune and connected with the pond about 250 ft. inland. The Government of Anguilla finally responded by acquiring the parcel of land and rebuilding the dune.

The beaches were so mined by sand mining that the Government of Anguilla took the ultimate step in 1994 and prohibited sand mining at all beaches except at Windward Point at the eastern end of the island. However, some unauthorized sand mining still occurs.

With the plans for a new international airport, a projected increase in the number of hotel rooms and with the dwindling supplies of sand at Windward Point, there will be considerable pressure to resume the mining of sand on the beaches, unless an alternative source is found. This would considerably weaken the island’s ability to attract large numbers of tourists.

**SET BACKS**

In order for Anguilla to maintain its image as a high quality destination, it must maintain its clear blue waters backed by long wide stretches of sandy beaches, free of any structures. Unfortunately, this is changing. Some developers are being allowed on appeal to build too close to the high water mark.

Beaches are dynamic features. When beaches accrete, the high water mark extends
seaward. As the beach erodes, the high water mark recedes inland. Therefore, if structures are erected close to the high water mark, there is no room for the beach to move inland when erosion occurs. This results in the narrowing of beaches and possibly their disappearance.

Data collected under the ongoing beach monitoring exercise carried out by the Department of Fisheries and Marine Resources in Anguilla and the COSALC programme, show that our beaches are eroding. This is particularly disturbing when one considers the predictions for global warming and the consequent rise in sea level. This combined with the degradation of the reef system, our natural breakwaters and suppliers of beach sand, points towards the increased erosion of the coastline.

Hurricane Luis has shown quite dramatically the importance of having adequate set backs of buildings from the high water mark. Several properties were left projecting onto the beach. One notable example is Frangipani Beach Club which had the front portion of the main building completely destroyed. A portion of the building, which has since been rebuilt, now projects onto the beach. This has narrowed that portion of the beach.

Many of the owners of properties which were badly eroded or which had structures that were badly damaged, rushed to take a number of measures to protect their properties and the structures on them. Many of the measures will have very serious impacts on the beaches they sought to protect. One landowner, in an attempt to reclaim his beachfront property, dumped mud and stones in front of some villas on one of the island's best beaches. Much of it was eventually washed out to sea during the “ground seas” season (period during the winter months when high swell waves affect the Lesser Antilles). Other land owners applied for permission to build seawalls in front of their properties. These expensive walls detract from the aesthetics of the beach and thereby reduce the overall quality of these crucially important resources. These “protective” walls which have been built in what is now the active zone, will hinder the landward movement of the beach and may themselves cause further beach erosion, particularly on the adjoining properties.

Cap Juluca is a four star hotel located on the dunes at Maudays Bay. As Hurricane Luis proved, it was inadequately set back from the vegetation line. The beach was severely eroded and the dunes retreated by approximately 20 ft, losing approximately 30,000 cubic yards of sand in the process (Coastal Systems International Inc., 1995). Luckily, most of the sand was deposited in the shallow bay offshore. With the tourist season beginning within a few months of the hurricane, and with structures perched precariously at the edge of the eroded dunes, Cap Juluca was not prepared to wait on the beach to rebuild naturally. They therefore sought and obtained permission to dredge sand from the bay to reconstruct the dunes. Unfortunately, they were allowed on appeal, to dredge without the use of silt curtains. The setting ponds also proved to be too small. This resulted in unacceptable levels of silt entering the sea and may well have caused some damage to the seagrass beds and coral reefs offshore.

The point to be stressed here, is that if the buildings were set back adequately in the first place, there would have been no need for the use of expensive engineering solutions which detract from the quality of these beaches and which may very well cause long term damage.

"RECONFIGURATION OF DUNES"

Dunes in Anguilla perform a very important function. They act as a natural barrier thus protecting coastal areas during hurricanes. The sand from these dunes is also released to nourish beaches. Therefore they must not be seen merely as large sources of sand to make way for development.

This role of the sand dunes became more apparent with the passing of Hurricane Luis. It is believed that the south coast beaches suffered less erosion because they are backed by much higher dunes.

Unfortunately, the island’s dunes are not only being built on. At Rendezvous Bay, for example, a developer was allowed to reduce the dunes from a height of 20 ft to a height of 10-12 ft and to push them landward. The developers clearly wanted guests in the rented accommodation to have an unobstructed view to St. Martin, a wider sand beach and easier access to the beach in front of the dune. Some years earlier, dunes nearby were also lowered to make room for another hotel project. It was not surprising therefore to discover that with the passing of Hurricane Luis, beaches in this area had narrowed by 18 ft and the dune had retreated by an average of 20 ft (Cambers, 1996).

CONCLUSION

Anguilla is fortunate to be in the early stages of its development and so can benefit from the mistakes made by other islands. While it is clear that in the quest for economic growth, some of the beaches are being degraded, it must be pointed out that by no means has the degradation reached the crisis point. In fact, the island can still boast of having some of the finest beaches in the world, of which many are still in their pristine state. However, there is no room for complacency for with the increasing pressure for development in coastal areas, this can all change rapidly.

It is therefore imperative that certain measures are taken to ensure that development is carried out in such a manner that the beaches are not destroyed. One must therefore ensure that the development policies and practices do not have serious negative impacts on any part of the coastal ecosystem. These include finding an alternative source of sand for the construction industry; ensuring that structures are adequately set back from the high water mark; and allowing dunes to perform their intended function, that is, to be the first natural line of defence for our coastlines during storms. One must also involve the general public. They must be made aware of the fact that their very economic survival is being threatened. If these measures are not taken,
then Anguilla is well on the way to destroying the goose that lays the golden egg.

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BEACHES AND TOURISM IN BARBADOS
A PHYSICAL PLANNER'S PERSPECTIVE

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ABSTRACT

International tourism in the Caribbean is largely beach tourism. Its advent has given rise to a series of social and physical problems even though it has brought a good measure of economic prosperity. This paper traces the history of development planning in Barbados since its beginning in the 1950's. While the planning system in Barbados is achieving its objectives in shaping the pattern of land development in the country, it can by no means be said to have overcome all the problems associated with beaches and tourism. Successful physical planning must be a dynamic process capable of responding to constantly changing circumstances. The adoption of Geographical Information System (GIS) technology can assist in providing the rapid responses demanded.

INTRODUCTION

International tourism in the Caribbean is largely beach tourism. Its advent has given rise to a series of social and physical problems even though it has brought a good measure of economic prosperity to most of the islands which previously depended on a mono-crop economy.

Some of the islands, such as Barbados have long practised some form of development planning with the aim of enhancing the benefits to be derived from tourism while minimising the possible adverse impacts. Has planning in Barbados been successful and has it achieved its objectives? Are there lessons for other islands whose planning experience is not as long? Where does Barbados go from here in its efforts to improve?

This paper looks at the physical characteristics of Barbados, the pattern of tourism development engendered by these and other factors, the planning and development control system that evolved, where the situation now stands and the way ahead for Barbados.

BACKGROUND

Barbados is the most easterly of the islands in the Caribbean. It lies 59 degrees west of Greenwich and 13 degrees north of the equator. Its closest neighbours, St. Vincent and St. Lucia, are approximately 100 miles southwest and west respectively.

Unlike its neighbours in the Windward chain, and indeed most of the Caribbean, the island
is relatively flat. The land rises in a series of terraces from the coast to its highest point of 1100 feet above sea level. There is also little natural indigenous vegetation except in the Scotland District where is found a small relic of semi-evergreen seasonal forest at Turner’s Hall (about 46 acres). This almost complete removal of the natural vegetation occurred within 40 years of the island's settlement in 1627 and was no doubt a consequence not only of the need to capture as much cultivable land as possible but also the inviting nature of the terrain which made the task easy.

The island is pear-shaped. The Scotland District mentioned earlier is the most visually distinctive part of Barbados. It is situated in the northeastern part of the island where the coral cap has been eroded. The terrain is rugged and subject to severe problems of soil slippage and erosion. The highest point in the island, Mount Hillaby, is on the rim of this area.

The north and southeast are flat, wind-swept rocky table lands with rather shallow soils. The best soils are to be found on the upper terraces in the middle of the island, where the soils are deepest and the rainfall highest and in the St. George valley which lies between the upland area and the Christ Church dome to the south. The sheltered coastal areas to the west and south receive the lowest rainfall but provide the most numerous drainage outlets to the sea.

One of these outlets, called the Hole, was the chosen site for the first settlement which became known as Holetown a name it still bears today. The capital was later moved to Bridgetown on the southwest and is itself at the mouth of the Constitution River, probably the longest drainage course in the island.

The exposed east coast of Barbados, stretching from Pico Teneriffe to Cattlewash, contains the most extensive beach systems in the island. The beach is long and wide and backed by a series of sand dunes, some of which extend quite far inland. It is largely by reason of the fortunate occurrence of these inland dunes that the island has been spared the scourge of beach sand mining.

Also of interest is that long before the present upsurge in international tourism to the Caribbean, a part of this area known as Bathsheba and Cattlewash had been established as the seat of domestic tourism for well-to-do Barbadians. It remains so to this day. It is where they go to spend their week-ends, and annual vacation and to recuperate after illness. Smaller sites, also on this coast such as River Bay, Bath and Skeet’s Bay enjoyed the same fame. This coast has also been always popular with Barbadians in general for picnics and outings.

The rocky table lands of St. Lucy in the north and St. Philip in the southeast are ringed by vertical cliff faces, indented here and there by small sandy bays. These are generally frequented only by nearby residents who are familiar with the accepted footpaths through private lands and down the steep rock faces.

As the west and south coasts of Barbados presented the natural gateways to the island it should not be surprising that these have been the areas of the earliest and most dense settlements. The entire island was of course covered with sugar plantations with here and there small tracks grudgingly left for passage of man and animal between the fields. These eventually became widened to accommodate animal drawn carts and later motor vehicles.

At those frequent points on the west coast, and to some extent the south coast, where the drainage gullies emptied into the sea there was often ponding. The situation is largely unchanged. There developed certain salt resistant plants, grasses and trees and were the breeding ground for insects and crabs. The fine sandy beaches along these coasts remained largely unexplored and unexploited until recent times.

**PATTERN OF TOURISM DEVELOPMENT**

In the days when sugar was king, planters made sure that every suitable square foot of land was cultivated. Homes for workers were sited on the steep hillside 0r on the water's edge. Ironically, these have now become the most sought after building sites. That is also why you can find luxury hotels on the coast sited cheek by jowl with poor chattel houses which incidentally turn their backs to the water.

The earliest resort hotel in Barbados is said to have been the Crane Hotel which still exists and is sited on a high rocky cliff overlooking the Crane Beach in the southeast. Other early hotels, such as the Ocean View which is also still existing, are to be found on the south coast, on the outskirts of Bridgetown. The Marine Hotel, the largest of these, was only recently demolished to make way for a hotel school. In spite of its name, it was interestingly enough not sited on the coastline though within easy reach.

Barbados began collecting tourist statistics in the mid nineteenth-thirties. In 1956 some 17,829 long-stay tourists and 12,301 cruise ship visitors came to the island. They were estimated to have spent U.S. $4 million. Of the long-stay visitors 10,141 stayed in guest houses and small hotels, which were mostly on the south coast, and had a total of 1,190 beds.

Many of these early tourists were wealthy persons from North America and Europe who built palatial residences on the newly discovered west coast. Once the bush and the mouths of the drainage courses were cleared, it was realised that some of the best swimming beaches were to be found in this part of the island.

The west coast established itself quite early as the luxury zone of Barbados and has succeeded in maintaining this character.

The north of the island has never been attractive to tourism developers. One hotel was established there but did not survive and has fallen into ruin.
In the Scotland District, on the northeast, there have from time to time been enquiries and proposals but no development has actually materialised. This area has now been designated a national park and it is unlikely to see any major building development.

The southeast coast where it all started has seen a smattering of development but has never really flourished. There are a few good sites remaining and even at this moment a number of proposals are under consideration.

The south coast was already highly urbanised when international tourism struck. In many instances tourist accommodation was competing with domestic residential usage. Indeed, many of the substantial residences first converted to guest houses then expanded to small hotels. This became the area mostly associated with small sites and dense tourism development.

The road along the coast, particularly the west coast, is in some places, on the water’s edge. In many other parts it is no more than one house plot depth away. This strip was also generally well wooded, while cultivated land bordered the other side of the road. Tourism development along the coast was therefore destined to contend with many issues, some of its own making. These included: restricted sites, high land values, drainage and sewerage, road congestion, arable land, open and wooded areas, beach erosion, public access.

Under the Barbados legal system property on the coastline extends to the highwater mark (Land below the highwater mark is public domain). This means that the boundary is moveable. Some properties have been known to lose land and others to gain. This becomes rather complex on a bay where the extension of boundary lines to claim accreted land can lead to dispute due to the lines tending to converge.

Another characteristic of the coastal property system is that when plantations sold beach lands, rights-of-way were often reserved for those who lived on the land side - them, their servants and assigns. With the passage of time these rights have become public. As a consequence numerous rights-of-way exist from the public road to the beach.

There are other associated problems for example to do with trespass and the building of structures within and on seaward boundaries. Also when these structures become threatened by the sea property owners do not readily accept that they cannot take certain actions to protect their properties.

Although it has been largely ignored for a long time, sewage disposal in an area with a high water table, being on the coastline, and with no mains system, has become a major problem with the development of tourism.

Mention must also be made of the increased pedestrian and vehicular traffic generated by tourists movements on a road system that has not much changed since the days of the horse and donkey carts.

Reference has already been made to the threat to arable agricultural land, particularly in proximity to the coastline. The leading luxury hotel on the west coast as well as an adjoining major apartment and villa complex have been built on former sugar plantations that were in operation within living memory. The current threat to agricultural land which is also of interest to coastal planners is the development of major golf courses even when these are sited well inland.

PLANNING AND DEVELOPMENT CONTROL

The realisation of the need for some government control over these matters came in the late nineteen-fifties. Even though the legislation did not set out to deal with tourism development specifically it is interesting that it was first applied to the west and south coastal areas and the capital city - being the areas most obviously in need of development control.

Barbados can in fact boast of a development control system that goes back to the beginning of the century. As early as 1908 Barbades had a Public Health Act intended largely to deal with the various epidemics that swept the region from time to time. Among its 59 sections were five, Sections 52 to 56, which dealt with the development of land to be let or sold for housing purposes. This followed the British late 19th century practice of tacking town planning on to Public Health legislation. The Barbados Act sought to control the size of lots, the width of roads, the provision of sanitary facilities, water for domestic consumption, and drains for carrying off waste and surface water. The selling price of land was also fixed.

It is however, true to say that until quite recently there was little control over land development in Barbados. The consequences have been many and varied - ribbon development along main highways and fine stretches of coastline, unsatisfactory provision for public and social services, low density sprawl and the loss of prime agricultural land, mal-distribution of land uses and congestion within the city.

In 1959, the Town and Country Development Planning Office was set up to try through comprehensive planning and control, to correct the bad existing features and to promote higher standards in new developments.

The Town and Country Planning (Interim Control) Act 1959 was passed and came into effect. Its main purpose was to provide for control of development on the west and south coasts of the island (the tourist development areas) as well as the city of Bridgetown. Provision was also made to control development in the northeastern portion of the island which was and still is subject to erosion and landslides.

The Act was intended to remain in force for three years. During this time it was expected that more comprehensive and permanent legislation and perhaps, even a development plan would have been prepared. In fact, the interim legislation had to be extended and it was only in 1965 that
a comprehensive Town and Country Planning Act passed the legislature. Even so, this Act, as amended, did not come into force until 1968. It provides the legislative framework for the present system.

A development plan prepared between 1964 and 1967 was published in 1970. It received final approval and came into effect officially in 1976. That plan was intended to cover the period 1965-85. Work on amending the plan was carried out between 1978 and 1981. The amended plan was published in April 1983 and towards the end of 1985 a public enquiry into the plan was held.

With regard to tourism the 1970 Physical Development Plan stated as follows:

"The brunt of demand for tourist accommodation will fall on whatever land is available that is contiguous with or adjacent to good safe bathing beaches. Primarily this means the region of the South and West Coasts of the island. Competition between permanent residents and tourists for these areas of high amenity has been resolved in favour of the dollar with the highest value. Other areas suitable for tourist development - rugged coastlines, old plantation great houses and yards have yet to be exploited. The problem of land availability for tourism will be resolved completely when it is fully appreciated that the balm of tropic sunshine is uniformly distributed over Barbados and that no habitable area is more than 30 minutes by good motorable road to a safe bathing beach. The provision of land for tourist accommodation is not a matter for serious concern in the land use economy of Barbados while close on 1000 acres of land which has been committed to tourist development at least three years ago remains undeveloped at this date."

The amended 1983 plan justified its revision of the above in these terms:

"The reason for omitting a number of areas from tourism development and for allocating them for other uses stems from the fact that the first plan overestimated the rate of growth for tourism development and therefore all the allocated lands were not required. Consequently, in accordance with adjusted locational policy, tourism has expanded in a concentrated form along the prime beach areas rather than by scattering or dispersal to areas of secondary attraction value."

CURRENT SITUATION

In 1995 Barbados received 442,107 long stay visitors as well as 484,670 cruise ship arrivals. It is estimated that they spent U.S. $679.5 million.

In addition to the making of development plans there has evolved an elaborate system of control of land development through the making and determining of planning applications. In relation to tourism facilities this includes attention to matters such as location, siting, design, external appearance, height of buildings, density, sewerage and drainage, access, car parking and even landscaping.

Planning and development control in Barbados have now become rather complex and in the view of some developers and international funding agencies is stifling the development process.

There has quite naturally been a considerable increase in the number of applications for development made to the Town and Country Development Planning Office. The number of agencies to be consulted before a decision is made has also increased. In addition, all applications to do with the coastal area and all applications for major developments anywhere must now be referred to the Minister for decision. Before making a decision the Minister appoints a person or persons to conduct a hearing of the matter. Such applications can therefore take years to reach a decision.

The question therefore is whether or not planning and development control are achieving their purpose and if not what can be done to improve them.

In spite of any perceived shortcomings the planning system in Barbados works and is by and large achieving its objectives in shaping the pattern of land development in the country.

The Coastal Management Unit of the Ministry of Environment is one of the more recent institutions involved in the development control process. The Division works closely with Town and Country Planning on matters affecting the coastal area.

In other areas of concern such as sewerage, work is currently in progress to construct a mains sewer system for the south coast while a study is being done for the west coast. Construction has also begun on a new solid waste disposal site to serve the island.

In a few months a major project to overhaul the entire system of "Environmental Management and Land Use Planning for Sustainable Development" funded by the Interamerican Development Bank (IADB) will begin in Barbados. There are three elements to this project. These consist of:

1. Environmental Planning, Legislation and Management.
2. National Park System.
3. Land Use Policy and Planning.

The main objectives are:
(a) to establish national policy priorities for natural resource management, including guidelines and procedures for Environmental Impact Assessment of development actions in Barbados;

(b) to develop a framework for a comprehensive information system on natural resources;

(c) to formulate an environmentally sensitive framework and land use plan to govern land use development for the next ten years;

(d) to make recommendations for institutional strengthening of the Environmental Unit within the Ministry of Health and Environment and the Town and Country Planning Office, regarding staff requirements and needs, as well as for a training programme for staff from all agencies involved in environmental management.

These activities emanate from the evolving planning process. This project suggests that the government recognises the need for major adjustments to the management of the country’s land resources and is prepared to do something about it.

It is also important to note that some attention is being paid to making use of modern technology in attempting to improve the system. The adoption of new technology however will not by itself bring about any desired change particularly in the absence of political will.

A WAY FORWARD

Geographic Information Systems (GIS) technology has reached Barbados and its use is beginning to spread like the proverbial wild fire. It may be an overstatement to say its use is spreading because there are systems in place but it cannot truly be said that they are being used and effectively so.

It is understood that there are systems in place at the following institutions:

- Coastal Management Unit
- Ministry of Agriculture
- Ministry of Transport and Works
- Ministry of Health (Environment Division)
- Ministry of Labour
- Ministry of Education
- Lands and Survey Department.

Computerised databases exist in many other departments and institutions of government such as Land Registry, Land Valuation and Town and Country Planning.

Experience has shown that the most problematic part of developing a GIS capability has been data conversion and data input. To make best use of this capability it would seem a good idea to aim for economy in this effort.

The way GIS is being introduced in Barbados and indeed in many other places is through separate projects in separate institutions with no working relationship with each other even though many of them must have recourse to the same information. Little attempt is being made to ensure the transferability of information across the various systems. Fortunately this is becoming less of a problem as many software developers are providing translators and other means for sharing information. There is also a need to develop certain standards and conventions for successful co-existence.

The Barbados Town and Country Planning Office does not yet have GIS. It is hoped that it will by the time the IADB project is completed. At present it has a computerised system for recording and tracking development applications. This information is of great value to many other institutions so ways must be found for accessing it.

The Coastal Management Unit is perhaps the most advanced institution in Barbados in its development and use of GIS. There is a good opportunity here for developing an “Integrated Framework for the Management of Beach Resources”.

There is a good deal of socio-economic and spatial/land information that is common to coastal management and land planning. This would include (but is not limited to):

- population characteristics
- settlement structure
- topography
- climate
- environmentally sensitive areas
- coastal installations
- beach characteristics
- vegetation
- land use
- land values
- land ownership
- legal systems.

In the case of Barbados much of this information has been collected, converted to digital format and is being used by the Coastal Management Unit. It is expected that this information will be made available to Town Planning when required and there is no doubt that it will be. On the other hand Town Planning is a provider of information in the matters it deals with on a daily basis.
and the changes it makes to land by its decisions. In either case the information provided by one side is not always in a form that can be readily used by the other. This is apart from any differences in software programmes. There should therefore be prior consultation and cooperation to ensure greater usability.

Land planning operates on many levels. The first or strategic level is concerned, among other things, with determining areas most suitable for major urban expansion. Coastal area management, often regarded as a local area activity, has, in fact, an important role to play at the strategic level.

It is at this stage of land planning that constraints to major physical development are identified. Areas of concern are marked for exclusion. These include:

- areas too steep for development (erosion and sedimentation problems)
- forestry areas
- environmentally sensitive areas (wetlands, mangroves, wildlife habitats, national parks - terrestrial and marine)
- areas subject to tidal surges.

The need for major coastal installations - harbours and fishing ports, electrical generation facilities, beach facilities and other recreational accommodations must also be considered. There is great scope for land planning and coastal management to come together at this stage of the planning process in a mutually beneficial way.

The attached Gantt Chart, Figure 1, was developed for a study in "Incorporation of Coastal and Marine Considerations into Physical Planning" with respect to Union Island in the state of St. Vincent and the Grenadines. It is offered for consideration here as a tool for building an Integrated Framework for the Management of Beach Resources in the Smaller Caribbean Islands.

If the collaborative effort is made at the planning level of the process the time spent in considering development applications could be considerably reduced and be limited to those matters which depart substantially from the approved plan.

CONCLUSIONS

Before the advent of international tourism there were no beach problems. Beaches came and went but there were no real problems of permanent beach erosion and serious threat to valuable property. Apart from traditional fishing, coastal and beach usage was limited to some occasional picnicking and sea bathing. There were no real concerns of trespass on private property in gaining access to the coastline. As beaches were never overcrowded no social conflicts attributable to such cause ever arose. Pollution of beaches by liquid or solid waste did not exist.
Barbados has a long history of planning and development control but can by no means be said to have overcome all problems associated with beaches and tourism. The making and implementing of plans and the development application process must be capable of responding rapidly to constantly changing circumstances. The process is dynamic, like the coastline itself. The adoption of GIS technology can assist in providing the kind of rapid response that is being demanded.

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Town And Country Planning Act, 1965-60.


ISLAND BEACHES: NEW DIRECTIONS IN BEST MANAGEMENT PRACTICES

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ABSTRACT

Several newer categories of generic “Best Management Practices” (BMPs) for beach systems are discussed. These BMPs involve the identification, acquisition and use of new sources of information. These include a watershed management approach; a paired beach monitoring technology; the use of untapped historical data sources to provide “new” environmental baselines; the adaptation of risk assessment methodologies as a beach management tool. Several examples of beach management and analysis models which have worked elsewhere in the region are outlined.

INTRODUCTION

In the same way that a field or pasture cannot be “seen” in its entirety from within, neither can a beach. It is always a constructive tactic to back away from a single beach, whatever its problems, and examine the beach system within the context of its buffer zone/boundary conditions, adjacent biotic ecotones and abiotic inputs.

It is often useful, even essential, to characterize the full spectrum of inputs and outputs from both “upstream” (watershed) and “downstream” (oceanic) sources, treating both groups within a three dimensional context over time. How do they interact both on the beach and with the beach? Are there adverse aggregate or positive synergistic effects or both? What constitutes a healthy beach? An impoverished beach? A high risk beach? A problem beach? There are few simple solutions and beyond a nomenclature problem, one finds a variety of competing system and management models.

In the first place, however, the word “beach” lacks precision. A beach can be perceived as simply a biotic or abiotic ecotone separating and buffering land and sea areas. For some, a beach is a dynamic sand quarry, or a sandy recreational area or amenity. For others, it is a boundary for more valuable coastal “real estate”. Still others see a fragile and resilient storm buffer and so on. It is a long list.

This paper seeks to address several newer categories of generic “Best Management Practices” (BMPs) for beach systems regarding the identification, acquisition and use of new sources and kinds of information about beach behavior drawn from unconventional locations.
BEST MANAGEMENT PRACTICES FOR BEACH SYSTEMS

Watershed Management Approach

Every beach is part of a watershed. This approach explores what can be learned using a watershed management approach which sees the beach principally as part of the coastal sediment sink and lower boundary at the base of the watershed. Inputs to the beach zone are evaluated, and key indicators monitored, especially run-off water quality and adjacent reef system health.

This is especially applicable where salt ponds or wetlands are found behind the beach berm. In this case the beach becomes a resilient, energy-buffering, sand filter separating the watershed and its wetland from the sea. This perspective drives a different set of questions and presents new management issues arising out of upland deforestation, land use, erosion and runoff management. It is concerned with reducing sediment and nutrient inputs and with potential flooding of beach berms are hardened (like levees) in any way, impounding flood waters, with or without pollutants, intentionally or otherwise.

In this case the beach offers some protection to coral reefs from land based sources of pollution. This is a reversal of the more traditional image of the reef as a protector of the beach. It also changes the list of stakeholders.

“Paired Beach” Monitoring

The tested classic “paired watershed” technology developed by the Environmental Protection Agency, is translated into a “paired beach” monitoring study evaluating the effectiveness of various management practices and indicators.

This involves simultaneous monitoring with a fixed protocol of developed and undeveloped beach sites, which are similar, to test the in situ effectiveness of selected management practices. The pairing accelerates the learning process as it facilitates the separation of natural and anthropogenic causes.

Historical Baselines

Previously untapped historical data can be developed, surrogate or retrospective, to provide environmental baselines for selected important or threatened beach sites over a longer time frame.

New techniques of finding, verifying and using the so called “old” environmental data from previously untapped sources e.g. university research team reports, student theses, dissertations, early external environmental impact assessments (EIA’s), feasibility studies, aerial photographs, etc. make it possible to develop new “old” baselines. Once these are established, it is possible to carry out comparative resurveys and develop appropriate indicators to establish rates of change and other previously elusive dynamic characterizations regarding beach histories and modifications over time.

Risk Assessment Methodologies

Standard risk assessment methodologies can be adapted as beach management tools (including beach erosion, overwash and flooding contingency plans). Beach/reef/water ecosystem “health characterization” can be combined with risk assessment procedures to shape beach system monitoring regimes, establish preferred storm damage mitigation and prevention agendas leading to risk management priorities, remedial BMP’s and worst case intervention schedules.

Application of Tested Management Models

Several management models which have been tested elsewhere in the region can be adapted and applied to beach systems. These include:

“Sediment Reduction Guidelines for Islands” which were developed for St. John in the U.S. Virgin Islands and are available from the United Nations Environment Programme’s Regional Coordinating Unit in Jamaica.

“Dune Management” guidelines have been developed for Puerto Rico’s Department of Natural Resources (DNR) by the Island Resources Foundation (IRF) and are available from DNR or IRF.

Dredge spoil island guidelines are available from the U.S. Army Corps of Engineers in a booklet entitled “Dredging is for the Birds.”

Beach revegetation is covered in a new U.S. Department of Agriculture booklet entitled “Plants for Dunes.”

A “model” for estimating erosion and sediment discharge from unpaved hillside roads, called ROADMOD, has been tested by the Virgin Islands Resource Management Co-operative on St. John and is more accurate than other models such as the USDE or RUSLE or TR55.

Model submerged artificial reefs for beach protection have been tested by the Barbados Coastal Zone Management Unit.

A simple pollution susceptibility model for embayments and beach areas which enables one to rank the risk at all bays and beaches around an island has been tested in several locations including the U.S. Virgin Islands, and is available from the IRF. The model relies principally on differences
in calculated tidal flushing and the time required for dispersion and dilution.

CONCLUSION

These approaches, concepts and models provide new frameworks and methodologies with which to view beaches and their management. Many have been tested with some success in other parts of the region and information about them is freely available to innovative coastal managers.

PROTECTING OUR COASTAL RESOURCES: WHO WILL PAY THE FINANCIAL COST

David Simmons, Caribbean Tourism Organization, Barbados.

ABSTRACT

Two aspects of tourism related activity, sewage disposal and solid waste disposal, both of which have a significant impact on coastal resources, are discussed and strategies for their control are addressed. Sewage effluent is one of the most serious pollutants impacting the marine environment. Several countries have constructed central sewerage systems particularly in their high density tourist areas. The paper discusses various mechanisms for cost recovery of these very expensive systems. The volume of solid waste entering the marine environment poses serious threats to health and also adds to economic and aesthetic problems. The OECS waste management project, which seeks to upgrade and construct new facilities for solid waste disposal is discussed as well as several options for cost sharing. Recommendations are made for the regulatory authorities and the tourism industry.

INTRODUCTION

Over the past two decades we have been hearing a considerable amount about the impacts of tourism on beach resources and the extent to which continued unsustainable practices will result in the loss of beaches, a valuable ingredient of the tourism product being offered by the region. Many of these warnings have their origins in studies (Cambers, 1990; Hendry, 1992; Archer, 1990) which show a direct correlation between unplanned tourism development activities and a degradation of coastal resources including marine ecosystems. However, though it is relatively easy to point an accusing finger at the developer who is financing these tourism projects, tourism activities alone cannot account for all the degradation and destruction taking place along coastlines of individual countries.

In a United Nations Environment Programme report (UNEP, 1989) it was stated that:

"The primary danger to the environment comes not from tourists, but from a flawed development process that must be accepted as the responsibility of the region's governments and private sector to correct. Institutional weakness with respect to comprehensive planning, project review, impact assessment and capital programming for supporting infrastructure need to be addressed as priority concerns of Governments, donor agencies and leading institutions".

When approached in this holistic manner, the role of tourism entities in ensuring the sustainability of beach resources is as critical as that of the planners and regulatory authorities. In this
presentation we will focus on two features of tourism related activity which are having a significant impact on coastal resources and examine the strategies being employed to address them. These are the issue of liquid waste disposal from land-based tourism facilities and solid waste on Caribbean beaches.

SEWAGE DISPOSAL: IMPACT ON THE MARINE ENVIRONMENT

Sewage effluent is generally believed to be one of the most serious pollutants impacting on the marine environment (Vlugman, 1993; Ward & Singh, 1987; Gladfelter & Ogden, 1995). One of the major sources of that sewage effluent is the hotels and other land-based tourism establishments. These facilities are situated almost exclusively along the coastline and effluent disposal at sea, from treatment facilities operated by these hotels, is common throughout the region. This has been allowed to develop without the benefit of appropriate scientific data, fundamental to the proper design and siting of submarine outfalls, and inadequate monitoring of the operation of these treatment plants as well as the placement of these submarine outfalls. As a result there are instances where either partially treated or untreated hotel effluent are disposed of (a) in the immediate vicinity of the establishment, (b) in the bathing zone at locations treasured for their recreational value, and (c) in the vicinity of sensitive marine ecosystems (e.g. coral reefs, sea grass beds and mangroves).

In a study undertaken for the Caribbean Tourism Organization (Simmons, 1994), it was revealed that sewage and wastewater management practices in the wider Caribbean region are inappropriate with a high percentage (80 - 90%) of that sewage generated by hotels being disposed of nearshore coastal waters without adequate treatment (Rodriguez, 1981; Reid, 1981; CEPPOL, 1991; Vlugman 1991).

Approximately half of the wastewater treatment facilities in the Eastern Caribbean are operated by hotels and resorts. These are largely of the pre-fabricated (packaged) secondary treatment plant variety. Primary and secondary sewage/wastewater treatment systems, as used by hotels, are of limited value with regards to microbial and nutrient removal. Inappropriate sewage treatment facilities result in millions of gallons of untreated fecal matter being discharged into the marine environment. This practice poses serious threats to tourists and locals who use the beaches for recreational purposes like swimming etc., and also impacts negatively on the marine environment. These adverse impacts are manifested by damage to coral reefs, seagrass beds and mangrove ecosystems, increased algal growth, coastal erosion, and a decline in nearshore fisheries.

Throughout the Caribbean, several countries have reported poor water quality at several of the recreational beach areas monitored, and even higher fecal coliform (FC) densities in marinas and harbours (CEHI 1985; 1986; 1989; 1991; 1992; Ward and Singh, 1987; Ward & Singh, 1992). On occasion, fecal coliform densities have been in excess of the maximum limit recommended as being safe for full body contact recreation under the proposed regional interim criterion (<200FC/100 ml of sample with no more than 10% of samples exceeding 400FC/100ml). Bacterial densities in excess of the maximum limit of the more lax water quality requirements of the EU (200FC/100 ml sample) have on occasions been reported at recreational sites and more frequently in the marinas and harbours monitored (Simmons, 1994).

FC densities in excess of 200/100ml are generally found in waters adjacent to point sources of sanitary significance (i.e. rivers, storm drains and sewer outfalls). At many of the recreational monitoring sites, effluent from hotel treatment facilities represents the single most important concern as a point source of fecal contamination.

RECENT TRENDS IN REGIONAL SEWAGE/WASTEWATER MANAGEMENT

In response to the problem of polluted coastal waters and in particular the poor quality of some popular recreational beaches, several countries (Barbados, Cayman Islands, Grenada, Jamaica and St. Lucia) have all invested heavily in the construction of central sewage systems to facilitate the appropriate level of treatment and adequate disposal of sewage and wastewater from the hotels and other private establishments in critical coastal areas.

In Barbados, for example, the South Coast Sewerage Project, which should be commissioned within the next six months, has cost an estimated US$89m. The West Coast Sewerage Scheme for which plans are still be prepared, is estimated to cost US$100m. A similar project in St. Lucia which was commissioned in December 1995 cost the Government of St. Lucia US$9m. The Government of Jamaica has invested some US$41m for a central sewage scheme for Negril and Montego Bay, and anticipate spending a further US$20m for a similar scheme for Ocho Rios. A similar sewage scheme has also been commissioned in the Cayman Islands at a cost of US$10.5m, see Table 1.

A close analysis of the sewerage scheme in each of these countries will reveal that they are constructed in areas of high tourism concentration, a direct response to the perceived notion that the coastal waters in those areas were most at risk from sewage effluent emanating from the tourism establishments and other private and public buildings and households in the immediate vicinity. These systems, because hook-up is usually mandatory, are expected to relieve some of the environmental stresses on the coastal ecosystems, by redirecting that effluent into deeper waters offshore where tidal currents will take it away from shore and away from sensitive marine habitats. This system represents an improvement over current sewage/wastewater treatment and disposal practices of hotels and other private establishments.

The fundamental question for consideration is who will bear the responsibility of financing these developments. In St. Lucia, for example, the Government of St. Lucia bore the cost of constructing the project, but have plans to recover some of that cost through a mandatory hook up of all the hotels and tourism establishments in the area as well as other households within a half mile radius of the sewer line. In Barbados, for example, it is proposed that all the hotels and
tourism establishments on the south coast of Barbados as well as households up to the 6m contour or approximately 400 m distance from the sewer line will be hooked up to the sewerage system in order to allow the government to recover the cost of the system.

Table 1 Cost of Sewerage Systems in Select Caribbean Countries

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>COST (US$) Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbados</td>
<td></td>
</tr>
<tr>
<td>- South Coast</td>
<td>80</td>
</tr>
<tr>
<td>- West Coast</td>
<td>100 (est)</td>
</tr>
<tr>
<td>Jamaica</td>
<td></td>
</tr>
<tr>
<td>- Negril</td>
<td>20</td>
</tr>
<tr>
<td>- Montego Bay</td>
<td>21</td>
</tr>
<tr>
<td>St. Lucia</td>
<td></td>
</tr>
<tr>
<td>- Rodney Bay</td>
<td>9.0</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>10.5</td>
</tr>
</tbody>
</table>

It is estimated that approximately 3000 households and business establishments will be hooked up to this sewerage system. The cost recovery mechanism being proposed will involve commercial establishments paying higher rates as part of their monthly water bills. It is also proposed that households hooked up to the system will have high water bills based on the amount of water used as registered on their water meters. Revenues from households and other commercial entities represent only 30% of the cost of the system. It is being proposed that the other 70% will be met through increased taxes distributed across the tax paying public. The rationale for this thinking is that the coastal resources are part of the national patrimony and the whole economy benefits from maintaining this resource in a pristine manner.

If, as has been established, tourists use 1.5 times more water than the general public the question is why are they not asked to pay a larger share of cost of the sewerage system? First of all, commercial establishments pay higher rates of water use. Secondly, the tourism industry is heavily taxed. In view of declining revenue per room in the tourism industry in the Caribbean, some will argue that it is not in the best interest of the region that more taxes should be levied on hotels.

Another point which should be considered is that the hotels and other tourism establishments which are hooked up to the central sewerage system will realize savings as a result of not having to make initial costly outlays on individual treatment plants and other facilities for treating their sewage. They are also expected to realise savings as a result of lower maintenance costs as it is well established that these packaged treatment plants, commonly found at hotels and other tourism establishments have high maintenance costs. A strong case can be made for some of these savings to be passed on to the authorities responsible for the operation of the central sewerage system.

IMPACT OF SOLID WASTE ON THE MARINE ENVIRONMENT

The volume of solid waste entering the marine environment posed a serious threat both to the marine and terrestrial environment. The impact of solid waste on the marine environment ranges from that which impacts on marine ecosystems, to that which washes up on shores of the wider Caribbean and impacts on human health and causes aesthetic and economic problems for the islands. Some of these impacts are as follows:

(a) Impact on Flora and Fauna

It is estimated that plastics constitute some 60% of the debris entering the marine environment. These products degrade slowly and remain suspended at the sea surface, or sink to the bottom and remain there for a long time. The accumulation of this debris poses significant threats to marine mammals, seabirds, turtles, fish and crustaceans. Ingested plastics cause death via starvation. Also, animals become entangled in loops or openings of floating debris and may drown.

(b) Physical Degradation

The large input and slow degradation of plastics and other marine debris leads to an accumulation of unsightly garbage on many coves and beaches. Metals and glass, when disposed of near reef systems, can also lead to an accumulation of garbage on those reefs and even lead to their destruction.

(c) Aesthetics and Economics

The presence of garbage on beaches is unsightly, particularly in areas where the tourism product is highly dependent on a reputation for beautiful beaches and healthy ecosystems. An
increase in the accumulation of marine debris could decrease the beauty of these beaches and consequently lead to a decrease in the number of visitors and beach users. This translates into lost revenue for hotels and to the tourism industry in general.

Marine debris also poses a problem for commercial and recreational fishing. Debris may foul or damage fishing gear and boats which are costly to repair and or replace. This translates into lost income for fishermen and boat operators.

(d) Health

Bottles, glass and metal containers which wash up on the beach can pose a threat to bathers and other beach users who may accidentally cut or otherwise injure themselves. The contents of these containers could cause serious health problems if skin contact is made or if accidentally ingested. In addition, the health impact of medical waste represents a real threat if improperly or inadvertently handled by a beach user.

Every year the Center for Marine Conservation together with several other regional and local organizations embark upon the International Voluntary Beach Cleanup. Table 2 provides some indication of the amount of garbage collected at several beaches in a number of Caribbean countries during this international cleanup initiative in 1994.

<table>
<thead>
<tr>
<th>Country</th>
<th>No. Of Volunteers</th>
<th>Debris Kg</th>
<th>Pounds</th>
<th>Kilometers</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahamas</td>
<td>348</td>
<td>2,236</td>
<td>4,926</td>
<td>16.6</td>
<td>10.5</td>
</tr>
<tr>
<td>Barbados</td>
<td>20</td>
<td>82</td>
<td>180</td>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>Belize</td>
<td>580</td>
<td>1,816</td>
<td>4,000</td>
<td>29</td>
<td>18</td>
</tr>
<tr>
<td>Bermuda</td>
<td>250</td>
<td>4,450</td>
<td>10,000</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>136</td>
<td>4,958</td>
<td>10,920</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>Grenada</td>
<td>300</td>
<td>1,816</td>
<td>4,000</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Jamaica</td>
<td>459</td>
<td>3,598</td>
<td>7,925</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>St. Kitts &amp; Nevis</td>
<td>194</td>
<td>1,318</td>
<td>2,902</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>St. Vincent &amp; the Grenadines</td>
<td>250</td>
<td>4,540</td>
<td>10,000</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Turks &amp; Caicos</td>
<td>30</td>
<td>524</td>
<td>1,154</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Under the Organisation of Eastern Caribbean States (OECS)/World Bank Waste Management Project, several of the OECS countries have agreed to upgrade and construct new facilities for managing and disposing of both ship-generated and land based solid waste.

In order to justify the OECS Waste Management Project it was argued that cruise ships were a major contributor to the problem of garbage washing up on Caribbean beaches. The project was therefore conceived as a means for addressing the problem of ship-generated waste while also providing facilities for accommodating the land-based waste disposal problem.

The OECS Waste Management Project will support and provide for five principal programmes. These are:

(a) Construction of new sanitary landfills, or the upgrading of existing landfills.
Tourism establishments must become more proactive in devising approaches to minimising the amount of pollutants being disposed in the marine environment. They must undertake guest sensitisation and educational awareness programmes to inform guests of the need to minimise waste. Most important, they must recognise that there is a cost to pollution and that under the polluter pays principle, they must take greater responsibility for their contributory role in polluting the marine environment.

Like the central sewerage schemes designed to minimise the pollution of the pristine marine environment, the upgrading and construction of new facilities are going to impose a financial burden on the governments of the participating countries. Recognising that the sustainable use of beach resources is both the responsibility of planning and regulatory authorities as well as the responsibility of those in the tourism industry, there is need for greater monitoring by the planning and regulatory authorities as well as better monitoring of the operations of the hotels and other tourism establishments. In this context, a set of recommendations have been outlined below, which if followed, will enhance the capacity of those involved to achieve greater results in their individual areas as they relate to the sustainable use of beach resources.

RECOMMENDATIONS

(a) Concerted efforts should be made to improve national monitoring programmes particularly with regards to treatment plant inspections, effluent and coastal sanitary water quality monitoring.

(b) Training of public health inspectors and laboratory personnel in the respective inspection and analytical procedures should be undertaken to facilitate the implementation of the monitoring and enforcement mandate of the Ministries of Health.

(c) Control of the proliferation of packaged plants in the hotel sector should be implemented through the development of centralised sewage treatment and disposal systems and/or the promotion of alternative low technology systems which offer greater environmental protection.

(d) National/regional legislation should be developed and enforced with a sharp focus on the protection of coastal environmental resources.

Hotel/Tourism Sector

(a) Effluent disposal in the immediate recreational area and in the vicinity of coastal ecosystems should be restricted or prohibited. Construction of longer submarine outfalls
at locations which allow for the maximum speed of offshore effluent dilution and dispersion should be urgently considered.

(b) Hotels and other tourism establishments should be made aware of the regional/national environmental and waste management criteria (either programmed or enacted) and employ appropriate self-regulatory measures within the industry to meet their requirements.

(c) Codes of environmental practice should be developed, which recognise the importance of the coastal resources to the survival of the tourism industry and to the regional economy.

(d) Sewage/wastewater reduction and recycling schemes should be implemented.

(e) Link-ups with established central sewerage systems should be encouraged and promoted within the industry.

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