MANAGING BEACHES IN THE CARIBBEAN: INVESTING IN OUR FUTURE

JUNE 18-21, 2001

EMBASSY SUITES HOTEL AND CASINO, SAN JUAN, PUERTO RICO

CONFERENCE SUMMARY

AUGUST 2001

FOREWORD

Our mission, at the University of Puerto Rico Sea Grant College Program, is the conservation, and the sustainable use of coastal habitats, biodiversity, and marine resources in Puerto Rico and the U.S. Virgin Islands. However, we have a wider view of our sphere of influence and interaction, and thus consider the Caribbean archipelago as our natural and cultural region. Guided by our Caribbean mission, we have joined efforts with partners such as the United Nations Educational, Scientific and Cultural Organization to assist many Caribbean islands in their beach management endeavours. We have also developed an aggressive outreach program for the conservation of beaches in Puerto Rico, with very successful results in the form of advances in policies, and public education; largely stimulated by the policy papers, and outreach efforts of our associate director, Ruperto Chaparro. On May 23 and 24 of 2000 we held in San Juan, a Beach Management Workshop which became a stepping stone towards this conference, 'Managing beaches in the Caribbean: investing in our future'. We have had the opportunity of listening to innovative and diverse ways to tackle the array of problems Caribbean countries face with their beaches. I expect that the lessons learnt will translate into improved efforts in beach conservation throughout the region. I hope you all keep us posted on the results of your conservation efforts.

Dr. Manuel Valdés Pizzini.
Director,
University of Puerto Rico Sea Grant College Program.

While the importance of beach-based tourism in the Caribbean islands is generally recognised, the same cannot be said of the need for beach management. Management involves a complicated set of approaches ranging from community participation to government policy, from voluntary agreements to law enforcement, and in the context of beaches, covers a wide range of subjects including erosion mitigation, user conflict resolution, water quality control, habitat conservation – to name but a few. Exchanging information on these and other subjects is vital to furthering successful approaches to beach management. Conferences such as 'Managing beaches in the Caribbean: investing in our future' play an important role in facilitating such exchanges. However, the process does not start and finish with the conference, rather the conference is just a beginning, where ideas are exchanged and wise practices are shared, so that in the years to come they can be applied at new sites and in new situations. Such that within a long- term framework, wise coastal practices for sustainable human development can be extracted, implemented and transferred.

Dr. Dirk G. Troost
Chief,
Environment and Development in Coastal Regions and in Small Islands (CSI),
United Nations Educational, Scientific and Cultural Organization (UNESCO).

Contents

List of Acronyms

BSTP	Barbados Sea Turtle Project
CAST	Caribbean Alliance for Sustainable Tourism
CHA	Caribbean Hotel Association
CMC	Center for Marine Conservation (U.S.A.)
CORALINA	Corporation for the Sustainable Development of the Archipelago of San Andrés, Old Providence and Santa Catalina, Colombia
COSALC	Coast and Beach Stability in the Caribbean Islands Project
CSI	Environment and Development in Coastal Regions and Small Islands (UNESCO)
DNER	Department of Natural and Environmental Resources (Puerto Rico)
EPA	Environmental Protection Agency (U.S.A.)
GEF	Global Environment Facility
GIS	Geographical Information System
NCC	National Conservation Commission (Barbados)
NCRPS	Negril Coral Reef Preservation Society (Jamaica)
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPRSGCP	University of Puerto Rico Sea Grant College Program
WCR	Wider Caribbean Region

INTRODUCTION

For four days in June 2001, 150 people involved in beach management in the Caribbean region met in San Juan, Puerto Rico, to exchange knowledge and experiences, to learn about each other's problems and solutions, and to begin to build a network of Caribbean beach expertise.

The conference, entitled 'Managing Beaches in the Caribbean: Investing in our Future' was organised by the University of Puerto Rico Sea Grant College Program (UPRSGCP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) through its COSALC project called Managing Beaches and Planning for Coastline Change. Other partners included:

- Caribbean Alliance for Sustainable Tourism
- Department of Natural and Environmental Resources
- House of Representatives
- Puerto Rico National Parks Trust
- Puerto Rico Tourism Company

This document represents a summary of the presentations given and discussions held during the conference. Many of the presentations are also available as full papers, and from October, 2001, they will be posted on the University of Puerto Rico Sea Grant College Program website at http://seagrant.uprm.edu

Monday 18th June, 2001.

OPENING CEREMONY PRESENTATIONS

Remarks by Dr. Manuel Valdes Pizzini, Director, University of Puerto Rico Sea Grant College Program.

A warm welcome is extended to all the participants on behalf of the University of Puerto Rico Sea Grant College Program and the United Nations Educational, Scientific and Cultural Organization (UNESCO) through its COSALC project (Managing Beaches and Planning for Coastline Change, Caribbean Islands). We must acknowledge the hard work of Mr. Ruperto Chaparro and Dr. Gillian Cambers in organizing this conference together with the committed staff of the University of Puerto Rico Sea Grant College Program. This conference provides a forum for the sharing of ideas, case studies and results and an opportunity to learn from one other's experience and knowledge. Two years ago, the UPR Sea Grant College Program found itself alone in trying to improve the management of beaches in Puerto Rico. Now the organization is assisted in this endeavour by the Caribbean Alliance for Sustainable Tourism (CAST), the Puerto Rico National Parks Trust, the Puerto Rico Tourism Company, the House of Representatives (Puerto Rico) and the Puerto Rico Department of Natural and Environmental Resources, all of whom have provided sponsorship to this conference.

Remarks by Attorney Ramon Luis Nieves, Director, Puerto Rico National Parks Trust.

The Puerto Rico National Parks Trust is a new agency, and as such we are especially pleased to work with the University of Puerto Rico Sea Grant College Program and UNESCO to sponsor this conference. We hope the conference will provide an opportunity to share knowledge about beach management and we would like to welcome all the participants.

Remarks by Mr. Ernesto Rivera, Chamber of Representatives.

The Government of Puerto Rico welcomes you to this important conference and we hope that it will provide an opportunity to improve the quality of our tourism product while at the same time conserving natural resources.

SESSION 1: BEACH QUALITY

Keynote address: An integrated approach to beach resource management: San Andrés Island, Colombia. Dr. June Marie Mow, Director, Corporation for the Sustainable Development of the Archipelago of San Andrés, Old Providence and Santa Catalina (CORALINA), Colombia.

Summary

Like other small islands in the Caribbean, beach resources on San Andrés are important as tourist attractions, for shoreline protection, as habitats, and for their scenic value. But as the economic importance of beaches increases, so do the threats to beach quality. CORALINA, the representative of the Colombian national environment system in the San Andrés archipelago, is responsible for environmental conservation, management, planning and education. In order to ensure long-term benefits from and sustainable use of island beaches, this agency has put into place a program to recover and maintain beach quality, in keeping with the broader goals of integrated coastal management. Actions have been developed in key program areas: 1) research, 2) management, 3) monitoring, 4) regulation, and 5) education. Although, the beach management program is a new one, certain results and recommendations for future coastal planning are already available. The program in San Andrés, the archipelago's most developed and populated island, is examined as are future actions to expand the scope of the program.

Discussion

- Funding for CORALINA comes from national and local taxes and a tax on electricity supply; through grants from organisations such as the Global Environment Fund (GEF) and the Center for Marine Conservation; and from fines.

- A study of the carrying capacities of the offshore cays was based on an extensive literature search as well as surveys of visitor expectations and their level of satisfaction regarding crowding. Figures provided in the literature ranged from 3.5 to 15 m^2 of beach space per person. The study conducted in San Andrés, based primarily on available beach area and data gathered from visitor surveys, yielded a total figure of 831 persons on Johnnie Cay, or 12.6 m^2 per person. The project is still in the initial phase and is to be included in the management plan for the cays. It has not yet been implemented. All stakeholders are being involved in the process. Government agencies and local businesses are working together on the management plan.

The importance of adopting and implementing the 1999 Aruba Protocol in the war against coastal pollution. Mr. Anthony Rivera, Department of Social Sciences, Inter-American University, Puerto Rico.

Summary

In October 1999, the countries of the Wider Caribbean Region (WCR) adopted the Land-based Sources and Activities Protocol, also known as the Aruba Protocol, concerning marine pollution in the region. This paper attempts to illustrate the importance of having the WCR countries adopt and implement at the national level the dispositions of the Protocol to ensure that land-based sources of pollution are controlled, reduced, and managed in order to achieve a cleaner marine environment in a region that relies on tropical beaches as its main economic activity. The paper also discusses the challenges that must be faced and overcome if the governments and the peoples of the region are to truly commit themselves to addressing the land-generated sources of pollution.

Discussion

- Status of the Protocol on Land-based sources of marine pollution. Six countries have signed the protocol but nine are needed for ratification. Among the signers are the U.S.A., France and the Netherlands; these countries already have strict standards in place. This is often the trend, namely that the more economically developed countries are ready to sign such agreements. Once the Protocol has been ratified by the U.S. Congress, it will be implemented in Puerto Rico.

- Suggestion to adopt the Namibia model: in this model, waste water is treated and used for drinking; the model could be used as an example for many other countries.

A study of the water quality and illness rates at four popular bathing beaches in Trinidad, West Indies. Ms. Christine Bullock, Institute of Marine Affairs, Trinidad and Tobago, West Indies.

Summary

An epidemiological study to assess water quality and swimming-associated health effects was conducted at four popular beaches in Trinidad. This study was undertaken in the dry and wet seasons and 10,204 persons were interviewed. Total coliforms, faecal coliforms, *Escherichia coli* and enterococci were the water quality indicators used. There was seasonal variation in water quality at the four beaches, with bacterial levels being higher in the wet season than in the dry season. Only two of the six survey areas at the four beaches had bacterial levels in compliance with the United States Environmental Protection Agency 1976 and 1986 bathing beach standards. There were significant differences ($p<0.001$) in the number of participants reporting symptoms of the eight types of illnesses investigated. Symptoms of respiratory illness were reported most frequently

and symptoms of ear infection the least. Most of the participants reporting symptoms of the various illnesses were swimmers.

Discussion

- Proposed implementation following the studies: the results will be used to help develop water quality standards for Trinidad and Tobago and the Caribbean region. Eventually these standards will be used to determine whether it is necessary to close a particular beach for bathing. Other actions, such as repairing sewage lines, will have to be undertaken over a longer time frame.

- Blue Flag program: a recommendation was made that Trinidad and Tobago become involved in the Blue Flag program for beaches in the Caribbean.

- Use of non-swimmers as a control group rather than non-beach users: the non-swimmers were selected because they were exposed to the same factors as the swimmers except for the use of the seawater. Furthermore, the surveys included questions about other family members who did not go to the beach.

A preliminary analysis of marine debris monitoring in Region 4 (Port Everglades, Florida to Gulf Shores, Alabama, including Puerto Rico and the U.S. Virgin Islands), 1996-2000. Mr. Charles Barr, Center for Marine Conservation, Washington, U.S.A.

Summary

The Center for Marine Conservation (CMC), with funding from the U.S. Environmental Protection Agency, has been monitoring marine debris at 15 beach monitoring sites from Port Everglades, Florida to Gulf Shores, Alabama, including sites in Puerto Rico and the U.S. Virgin Islands, from 1996 through 2000. These efforts have been conducted as part of CMC's National Marine Debris Monitoring Program where volunteers conduct monthly marine debris surveys and beach cleanups at designated study sites. During this reporting period, volunteers collected and catalogued information on 79,586 pieces of debris during 695 surveys. Debris items were sorted and recorded into three debris-source categories: land-based, ocean-based, and general-sources. This report presents information, preliminary data and data summaries representing over 1,388 hours of volunteer efforts as part of this on-going national scientific survey of marine debris impacting the U.S. coastlines.

Discussion

- Use of the results: The results will be used by the Environmental Protection Agency (EPA) to evaluate whether ocean legislation is having an effect.

- Use of volunteers: volunteers come from universities, schools, communities, and through word-of-mouth. There is a large turnover of volunteers and it is a constant challenge to keep existing volunteers and to find new ones.

- Results showed a significant decrease in marine debris in Puerto Rico over the five-year period: there has been no real analysis of this trend yet, so explanations can only be very preliminary. Many agencies, including Sea Grant, have done a lot of work to increase awareness. Also involving people in beach clean-ups helps raise their level of awareness about the presence and quantity of debris.

- Disposal of the debris collected: it is the responsibility of the volunteers to properly dispose of the debris and where possible to recycle it.

- Difficulty in distinguishing ship-based and land-based debris: efforts are made to distinguish between the two sources based on the nature of the items.

- Beach selection: Efforts are made to stay away from hotel beaches because these are cleaned regularly.

Determination of the public health risks in the estuarine system of San Juan Bay. Dr. José Seguinot Barbosa, University of Puerto Rico, Puerto Rico.

Summary

El peligro natural al cual se exponen los residentes de determinadas zonas del estuario de la Bahía de San Juan está asociado a los niveles de calidad ambiental y a las condiciones socioeconómicas en que viven. Este hecho nos permite definir una geografía de la salud para la zona del estuario de la ciudad de San Juan. En este trabajo nos proponemos determinar los niveles de riesgo al cual se expone la población al entrar en contacto- mediante la pesca, el consumo de peces y la recreación- con algunas áreas del estuario de San Juan.

El riesgo asociado al contacto directo se midió entrevistando en un cuestionario a bañistas, residentes y personas que frecuentan las márgenes del estuario. Los datos obtenidos fueron correlacionados con las condiciones naturales, ambientales y socioeconómicas de los lugares incluidos en el muestreo. A base de los resultados obtenidos, se determinaron los diferentes niveles de riesgo (alto, mediano, bajo) para la salud pública. Con esta información se construyó el mapa representando la desigualdad espacial del riesgo y en los niveles de salud pública para la ciudad de San Juan (ver mapas).

Discussion

- Site selection: Sites were not randomly selected, instead problem sites were identified and control sites with no problems.

- Dissemination of results. Users of problem sites need to be informed of the risks and dangers.

- Application of the study: the results have been submitted to the agencies involved in the San Juan Estuarine Program for appropriate action.

A case study of the Carolina ocean outfall adjacent to Vacia Talega Bay, Puerto Rico. Ms. Clara O'Neill, CSA Architects and Engineers, Puerto Rico.

Summary

The Clean Water Act includes provisions under 301(h) that allow publicly owned treatment works to apply for variances from secondary treatment requirements for biochemical oxygen demand, total suspended solids, and pH for marine discharges. The Carolina Regional Wastewater Treatment Plant, in operation since 1986, discharges primary-treated disinfected effluent to the Atlantic Ocean through an ocean outfall that incorporates a high-rate diffuser. An application for a waiver from secondary treatment was submitted in 1979 and tentatively approved by the Environmental Protection Agency in 1989. As required by 301(h), a comprehensive marine monitoring program was developed and implemented to determine whether the Carolina Regional Wastewater Treatment Plant effluent discharge adversely affects the marine environment or beneficial uses of marine waters. This paper presents and discusses data collected as part of the Carolina 301(h) monitoring program, which includes influent and effluent quality, receiving water quality, sediment quality, benthic invertebrate communities, fish and epibenthic invertebrate communities, fish tissue bioaccumulation, coral community assessment; and a supplemental survey of benthic invertebrates and fish tissues in the inshore and offshore zone of initial dilution done in December 1998. Seven quarterly surveys were performed to characterise the Carolina Regional Wastewater Treatment Plant effluent and the receiving waters during the period of November 1998 through May 2001. More than 150 parameters were measured to assess the water and sediment quality in the study area in each quarterly survey. Water quality data were evaluated in terms of compliance with applicable criteria. Comparisons of biological communities at control and effluent discharge sites are discussed. Analysis of the data obtained confirms that the primary discharge from the Carolina Regional Wastewater Treatment Plant has had no significant impact on the marine environment after a 15-year period of discharge.

Discussion

- Availability of the raw data to the scientific community: there was some debate about whether or not the data are available.

- Use of economic savings from obtaining the waivers: while economic savings are not the main goal, they have been used to connect communities with no sewage services. (Only 52% of the population of Puerto Rico is connected to sewage treatment plants and there are some rural areas where sewage connections are impossible).

- Not all the primary treatment plants in Puerto Rico are problem free: for instance in Arecibo there have been problems related to pig-raising and a compost plant in the vicinity of the treatment plant. In addition, there has been some inaccurate publicity.

Water quality in Puerto Rico. Dr. Ana Navarro, University of Puerto Rico Sea Grant College Program, Puerto Rico.

Summary

During 1997 the water bodies of Puerto Rico received 8 million pounds of persistent toxic metals, 900,000 pounds of reproductive toxins (toluene) and 2,500 million pounds of carcinogens according to data from the Environmental Protection Agency (www.pirg.org). The most impacted water bodies are: Atlantic Ocean, Yabucoa Bay, Las Mareas Bay, rivers and creeks and the Caribbean Sea. The most contaminated municipalities for carcinogens are: Manatí, Arecibo and Barceloneta; for toxic metals: Yabucoa, Humacao, San Germán, Guayama and Juana Díaz; and for reproductive toxins: Barceloneta, San Germán and Mayaguez. Also, the primary waste water treatment plants located in six municipalities of Puerto Rico (Bayamón, Loíza, Puerto Nuevo, Aguada, Arecibo and Ponce) are discharging bacteria, viruses, grease, salts, heavy metals, organic substances, phosphates and nitrates to the contaminated Atlantic Ocean and Caribbean Sea.

During April 2001, the Puerto Rico Electrical Power Authority was the most contaminating installation followed by the industries Abbott Health Products (Barceloneta), Pharmacia & Upjohn Caribe (Arecibo), Coatings Inc. (Bayamón), Schering-Plough Products (Las Piedras) and Phillips PR Core (Guayama).

The causes of increasing pollution coming from point sources are: (1) the government has implemented a 'permit to pollute' rather than a pollutant discharge elimination system; (2) government enforcement of pollution prevention regulations has been weak and sporadic; and (3) the public's right to know has not been fully recognized.

On the other hand, the non-point pollution problem in Puerto Rico has recently been recognized. However, its control will need better management practices, environmental planning, pollution prevention, public education and effective government enforcement.

Discussion

- Analysis of water quality trends: some of the studies relating to impacts near the primary outfalls cannot be used for 'before and after' comparisons, since the species now found near the outfalls are the ones that are resistant to the particular pollutants.

SESSION 2: BEACH MANAGEMENT FROM THE PRIVATE SECTOR'S PERSPECTIVE

Keynote address: Beach management in Barbados: Coconut Court Hotel, Barbados. Mr. James Blades, Manager, Coconut Court Hotel, Barbados.

Summary

Hawksbill sea turtles are globally listed as a critically endangered species. Barbados is one of the most important nesting areas in the eastern Caribbean, and the coastline between Needhams Point and Dover is particularly significant. However, residential and commercial developments along this stretch of beach have severely altered nesting patterns in the area.

To try to reverse this trend, the Coconut Court Beach Hotel is collaborating with the Barbados Sea Turtle Project (BSTP) of the University of the West Indies and is encouraging other businesses and hotels in the area to follow suit. The aims of the Coconut Court Turtle Nesting Program are:

- to re-create an appropriate beach environment for hawksbills to nest;
- to encourage other hotels along the coast to become more sea-turtle friendly;
- to enhance opportunities for Barbadians and visitors to learn about nesting turtles as part of the BSTP's Hawksbill Monitoring Program.

The turtles nest between May and October, with a peak in activity between June and August. Every year between 1 June and 30 September BSTP personnel and volunteers monitor turtle nesting nightly on this important stretch of beach. This year (2001) Coconut Court provided facilities to enable BSTP staff to be based at the hotel, substantially reducing the costs of the monitoring program.

Other issues and policies include:

- Bright beach lighting deters turtles from nesting and disorients hatchlings when they emerge from the nest. To help avoid this, special measures have been taken and lights have been installed.
- Hawksbill turtles like to nest on natural, vegetated beaches, but many hotel beaches are cleared of vegetation, reducing their suitability for turtle nesting. The hotel's beachfront has been landscaped to re-create a more natural beach. Vegetation preferred by turtles, such as sea grape and goat's foot yam, will be planted. Shading vegetation such as dwarf coconut trees and scarlet cordia has also been planted to reduce light reaching the beach. All grasses and shrubs that germinate naturally will be allowed to remain on the beach. Non-native plants will not be planted.

The nesting program is being implemented as part of Coconut Court's overall environmental policy. There is no reduction in the range of guest activities; but instead,

activities are tailored to ensure that they do not adversely affect the nesting beach. For example:

- No beach barbeques are being held during the nesting season, nor any activities that will disturb the sand. The hotel had planned to invest in a mechanical beach cleaner, but further investigation revealed that it would compact the sand and could harm incubating eggs and hatchlings. Instead, the beach is being raked manually.
- Guests are asked to allow the beach to remain as natural as possible and to refrain from removing items, which wash up naturally such as shells, sponges and sea fans.
- Plastic items such as cups, bottles and straws are not allowed on the beach. The hotel provides receptacles for keeping cigarette butts off the sand.
- The hotel runs a daily Marine Educational Program, which aims to educate guests, schoolchildren, and interested citizens about the marine environment. Participants are taken on a beach walk where they are shown man's and nature's impact on the environment, and the 'do's' and 'don'ts' of marine environmental protection. They are then taken to snorkel where they are shown various species of fish, corals and sponges and are allowed to feed the fish.
- Coconut Court is a 'Green Hotel' and maintains strict policies regarding garbage recycling, energy management and waste reduction.
- A 50,000-gallon rainwater tank supplies the water to flush toilets, wash down the pool area and water the turtle-nesting habitat.
- The hotel's vegetable garden supplies the restaurant with part of its vegetable and herb requirements.
- Kitchen vegetable matter and leaves from the gardens are composted into fertilizer.
- Coconut Court is also the home of the Barbados Marine Trust. This is a non-governmental organisation whose function is to assist the Government of Barbados to protect and preserve the marine environment.

Discussion

- Hawksbill turtle nesting: there are approximately 900 hawksbill turtle nests a year on the quarter mile stretch of beach between Drill Hall Beach and Coconut Court Hotel.

- Training tourists and guests: Coconut Court have a marine education program for hotel guests, there are three to four trained employees who show guests the marine environment at low tide, this also involves a snorkelling trip and fish feeding. (Although there are biological drawbacks to fish feeding, this activity is very interesting for guests and therefore valuable to the program).

- Offshore breakwaters and reefballs: an offshore breakwater was built at Coconut Court Hotel in 1992, there are plans to replace this with a submerged breakwater made up of reefballs.

- Community participation: Coconut Court works with the Ministry of Education, in particular the Garrison Secondary School, and primary schools in the area, and school children are invited to the hotel's marine education program. They also work closely with the fishers association.

- Manual raking versus mechanical cleaning of the beach: Coconut Court Hotel manually rakes the sand on a daily basis, this method does not compact the sand, nor crush sea turtle eggs, nor kill other organisms such as crabs.

- Scale of proposed hotel expansion and impacts on turtle nesting: with the proposed expansion of 600 new rooms along this stretch of beach, there will be increased impact on the beaches which will require careful management if the beach is to remain a major turtle nesting site. Coconut Court is willing to work with others in this area.

A tsunami warning system for the Caribbean. Mr. Aurelio Mercado, Department of Marine Sciences, University of Puerto Rico, Puerto Rico.

Summary

The risk of tsunamis is a very real one in the Caribbean region. The 1918 earthquake and tsunami caused considerable damage along the west coast of Puerto Rico especially in the town of Aguada. A computer program has been prepared to predict the length of time it would take a tsunami to reach different parts of the Caribbean. For example, tsunami generated by an earthquake in Trinidad and Tobago would take about 90 minutes to reach Puerto Rico. (More information can be obtained at www.poseidon.uprm.edu) Puerto Rico and the U.S. Virgin Islands are taking part in the National Tsunami Warning Program of the U.S.A. Other measures include the establishment of warning signs in tsunami hazard zones. In December 2000, a meeting was held to establish a Tsunami Warning System for the Caribbean, this was sponsored by UNESCO through the Intergovernmental Oceanographic Commission. Following this meeting a proposal has been prepared to establish the Caribbean Tsunami Warning System.

Discussion

- Involvement of other agencies in the Caribbean Tsunami Warning System: agencies such as Civil Defense and the Planning Board will be involved in the preparation of flood maps, which will be made widely available. For example, in Hawaii, such maps are printed in the telephone directories. As a rule of thumb, if it is difficult to stand up during an earthquake, then a tsunami could be generated, so moving inland is advised.

- Tsunami flood maps will be generated based on the 'worst case' scenario. In Puerto Rico, laser mapping of the shoreline and high-resolution bathymetry will be used.

- Tsunamis and building regulations: in view of the rarity of tsunamis, it may not be feasible to change building regulations to allow for possible tsunami inundation.

- Education is the most important part of the tsunami warning system.

Panel discussion on 'Beach management from the private sector's perspective'

Ms. Ainoa Luna, Caribbean Alliance for Sustainable Tourism, Puerto Rico.

The Caribbean Alliance for Sustainable Tourism (CAST) and the Caribbean Conservation Association are among a consortium of agencies proposing a Blue Flag standard for Caribbean beaches. Other agencies include the United Nations Environment Program and the Foundation for Environmental Education in Europe. A workshop was held to introduce the program in the Caribbean and studies were undertaken. Blue Flag is a standard for recreational beaches and has four main criteria: water quality, safety, beach management and environmental education. There are still many activities that have to be completed before the campaign can be launched in the Caribbean. A study was conducted at Playa Bahibe in the Dominican Republic in 2000 to investigate how these beaches could comply with a Blue Flag standard. Several management areas, including beach facilities and beach accesses were identified. Further information is available at www.blueflag.org

Mr. Frederico Carlo, Montecarlo Resort, Puerto Rico

A large project in Boqueron Bay, Puerto Rico has been designed where an artificial wetland will be used for water treatment. There will also be a boardwalk from Boqueron to Combate, which will provide educational benefit. For large investments such as this, the Blue Flag standard is particularly important.

Ms. Alyssa Johnson, Caribbean Alliance for Sustainable Tourism, Puerto Rico.

The Caribbean Alliance for Sustainable Tourism (CAST) works with hotels in the areas of efficient use of water, wastewater, energy, protection of natural areas, solid waste, use of chemicals, hygiene and health, and environmental education. A survey showed 83% of travellers were concerned about environmental issues. Hotels themselves are environmentally conscious in order to reduce environmental impact, provide cost savings and marketing advantages, and to comply with national and international environmental laws. In addition, tour operators are now requiring environmental standards be met. Green Globe is a worldwide organisation, based in London, England. CAST manages Green Globe activities in the Caribbean and there are 15 Green Globe hotels in the Caribbean. Green Globe has a specific set of criteria, which require third party verification. For more information on CAST, see www.cha-cast.com

Discussion

- Green Globe criteria have a category dealing with stewardship which includes consideration of endangered species, wildlife etc. Once a hotel applies for Green Globe certification, CAST has consultants who will work with the hotel on the certification process.

- CAST is a membership organisation, which has a separate membership to the Caribbean Hotel Association (CHA), although most CHA members are also members of CAST. Any hotel can become a member of CAST. In the future, CAST plans to include a suppliers' membership; as well as a membership for non-governmental organisations, educators and site attractions.

- Enforcement: the possibility was voiced that some hotels might use Green Globe and Blue Flag certification to obtain certain permits, and once these permits were in place, the environmental standards would be abandoned. A comparison was made with environmental impact assessments, which are often prepared, but the results are not applied/implemented. Vigilance and enforcement are critical.

- Blue Flag is targeted at public beaches and those with a lot of tourists. The standard is not used in the U.S.A., the only country where Blue Flag standards exist outside of Europe is South Africa. At present Blue Flag is at a pilot level in the Caribbean with five countries involved. Blue Flag is working with the Caribbean Epidemiology Centre on water quality standards and a suggestion was made that they also work with the Institute of Marine Affairs, see the earlier presentation by Ms. Bullock of the Institute of Marine Affairs.

Tuesday, 19th June 2001

SESSION 3 FIELD TRIP TO ISLA VERDE AND CONDADO BEACHES

A field trip was made to the Princesa del Mar development at Punta Las Marias Beach in Isla Verde, where participants viewed and discussed the ongoing development close to the beach. Work at this development had recently been stopped by a court order. Discussion centred around the permitting process, erosion issues, coastal development setbacks and the delineation of the maritime zone, and access to the beach.

During a field trip to the Ultimo Trolley beach in Condado, discussions focused on beach use in urban areas, including beach maintenance, sand dunes and windblown sand, re-vegetation and beach access.

Participants at Ultimo Trolley Beach, Carolina, Puerto Rico

SESSION 4: BEACH EROSION MITIGATION

Keynote address: The role of the Department of Natural and Environmental Resources. Dr. Carlos Padín, Secretary, Department of Natural and Environmental Resources, Puerto Rico.

Summary

The responsibilities of the Department of Natural and Environmental Resources (DNER) are energy affairs; solid waste management; and the administration of natural resources – including water and minerals, marine safety, protected areas, education and recreation activities, land acquisition for conservation, and flood control. In August, 1999, a Beach Board was established comprising representatives from the Caribbean Alliance for Sustainable Tourism, the Puerto Rico Tourism Company, National Parks Company of Puerto Rico, the Police Department, universities and communities. The Board meets monthly to discuss issues relating to safety, cleaning and inter-agency coordination. The Board is focusing firstly on cleaning and beach enhancement. An 'Adopt-a-beach' program is being pursued. Submerged lands and territorial waters belong to the people of Puerto Rico; DNER issues permits for the use of these lands. Coastal erosion and protection is a major concern. All structures have to be 20 m from the maritime zone, nothing can be placed in the first 6 m from the maritime zone, and nothing that acts as a barrier can be placed in the next 14 m. However, there are many violations of this regulation. The DNER is working through various initiatives to protect coral reefs, to avoid the construction of more seawalls, and to improve the management of sand extraction from the rivers.

Discussion

- Setback regulations: these do not accommodate turtle nesting, these animals need more than 20 m. There is a need for additional buffer zones, particularly at turtle nesting beaches. Surveyors control the precise delineation of the maritime zone, and there is a manual for this purpose. Concerns, such as those to do with nesting sea turtles should be conveyed to the Surveyors Association. There is a need to adapt the maritime zone criteria to accommodate natural changes and social reality.

- Composition of the Beaches Board: a suggestion was made that the University of Puerto Rico Sea Grant College Program should be a member of the Board.

- Recycling in Puerto Rico has had only limited success, for while much has been done in education, the necessary infrastructure for recycling does not exist. Efforts are now being concentrated on establishing markets for recycled products.

Shoreline changes along West Guapo Bay, Point Fortin, Trinidad. Ms. Charmaine O'Brien Delpesh, Institute of Marine Affairs, Trinidad and Tobago.

Summary

Historically, the shoreline of the west coast of Trinidad has been experiencing erosion even though this is the most sheltered coastline of Trinidad. Guapo Bay is located on the west coast of Trinidad in the area of Point Fortin. The western section of the bay is the site of two important recreational beaches, Clifton Hill Beach and Guapo Beach. The Institute of Marine Affairs' historical records have indicated that during the last 20 years the shoreline of west Guapo Bay has changed significantly as a result of erosion, coastal developments and coastal structures. Several attempts were made by the Point Fortin Regional Corporation to halt the erosion but none of these were successful.

During the late 1980s through November 1996, most sections of Clifton Hill and Guapo beaches were undergoing recession. In November 1996, there was an extreme wave event that caused significant loss of sediment at the western end of Clifton Hill beach. This loss of sediment progressed in an easterly direction through June 1999 when a 420 m long seawall was constructed to prevent further loss of this recreational beach and to protect a gas pipeline that was laid within the backshore of west Guapo Bay. The sediment lost from Clifton Hill beach was transported and deposited at Guapo beach resulting in an increase of approximately 1m in beach elevation.

Despite completion of the sea wall, erosion continued at the eastern end of the wall and in front of it. As a result, in April 2000, erosion control mats, which traditionally have been used to prevent scour, were installed offshore Clifton Hill Beach. It was hoped that the mats would stop the erosion in front of the seawall and would assist in the reconstruction of Clifton Hill Beach. To date this remedial action has been unsuccessful. However the eastern section of Guapo beach appears to have stabilized with the existing coastal conditions.

This paper presents a chronological account of the changes that have occurred along the shorelines of Guapo and Clifton beaches, the coastal protective measures that have been attempted to combat erosion and the coastal developments that have occurred at these two beaches.

Discussion

- The Institute of Marine Affairs is funded by the Government of Trinidad and Tobago, however, the Institute also undertakes consultations both in Trinidad and Tobago and in the Caribbean.

- The erosion control mats are made by Hydro Engineering Corporation, they did not work well in the Gulf of Paria because the sediment there is silt, not sand. The mats are designed for medium to low energy coasts, not high-energy coasts.

- The source of sand at Point Fortin is mainly from cliff erosion and relic sand.

- Environmental impact assessments in Trinidad and Tobago are prepared for large developments, but not usually for smaller developments such as seawalls.

Coastal erosion in Puerto Rico. Hon. Carlos Vizcarrondo, President, Chamber of Representatives, Puerto Rico.

Summary

The conservation of Puerto Rico's natural resources is one of the main priorities stated in the Constitution. There is a need for every citizen to serve as a community activist to protect the environment, and to take responsibility for his/her own actions. There are plans to draft a code of environmental protection, which will be a dynamic and integrated code and will speed up compliances. A fund has been established to clean polluted areas. The Blue Flag system is a positive program for improving beach quality. A proposal has been put forward to develop a National Department of Beaches and Coasts, which will be integrated with existing mechanisms. Legislation for this proposal will be considered this year.

Discussion

- The Blue Flag program should be tested on a pilot beach and its implementation will require the full involvement of other agencies and communities.

- Tourism in Puerto Rico is becoming especially important as other sectors, such as manufacturing, decline. There is also a need to learn from tourism developments in other countries.

- Beaches should be classified as (1) those suitable for recreation and tourism (and here the Blue Flag program will be especially important) and (2) pristine, natural sites (where seagrass beds and coral reefs are very important) and where visitor use should be minimal.

Multi-hazard coastal risk mapping, eastern Puerto Rico. Dr. David Bush, State University of West Georgia, U.S.A.

Summary

A series of coastal zone hazard maps were made covering the eastern approximately one-third of the Puerto Rico coastal zone, the area impacted by Hurricane Hugo in 1989. The mapping strategy was to develop a tool for quick visualization of multiple hazards for use by coastal planners, managers, property owners, and potential property owners. The Puerto Rico shoreline is heavily developed in places, and also highly compartmentalized in terms of shoreline types, geology, and adjacent shelf conditions. Hazards such as coastal erosion, storm surge, riverine flooding, landslides, and seismic impact also may be

compartmentalized. From a management perspective, resources can therefore be allocated on a compartment-by-compartment basis.

Six types of hazards were considered in this investigation: (1) shoreline-setting hazards (long-term coastal problems), (2) marine hazards (short-term impacts of coastal storms), (3) earthquake and slope hazards (ground shaking, landslides, liquefaction), (4) riverine hazards (historical floods), (5) development hazards (high-density development at risk or low-density development in extreme-hazard settings), and (6) engineering hazards (special cases where shoreline engineering projects such as breakwaters or sand mining have significant detrimental effects to portions of the shoreline). Shoreline reaches were ranked as being extreme, high, moderate, or low risk, depending on the number of hazards present within that stretch. These rankings are likely to change, either gradually over decades with natural coastal evolution, more rapidly as human development infringes on the coastal zone, or in an instant during a severe storm. The hazard maps provide a basis for hazard mitigation and management recommendations.

Discussion

- Availability of hazard maps for the eastern part of Puerto Rico: these are available at a modest cost from the United States Geological Survey. The hazard maps and reports will also be posted on the Internet.

- Database for hazard maps: the wave run-up from Hurricane Hugo was used for these maps, new wave run-up models are available.

Changing climate: changing beaches. Mr. Philmore James, Fisheries Division, Antigua and Barbuda.

Summary

Like most Small Island Developing States, Antigua and Barbuda is highly vulnerable, both physically and economically, to even slight changes in climate and fluctuations in sea level. The effects of global climate change and/or sea level rise as manifested in an increase in the number and intensity of tropical storms and hurricanes are directly evident within the Caribbean. Antigua and Barbuda experienced four major hurricanes within the last five years. It is critical that such effects be carefully monitored and analysed in an effort to implement appropriate mitigation strategies.

Geographical Information Systems (GIS), in addition to other methods, has been used as a tool in developing a Coastal Resource Inventory System for most of the English-speaking Caribbean countries. In addition, certain countries like Antigua and Barbuda and St. Kitts and Nevis have integrated GIS in evaluating their vulnerability to natural hazards. This includes the development of a model to show beach erosion hazards using available beach monitoring data for both countries. Beach changes are reflected mainly through the mapped rates of erosion along selected beach segments around Antigua and Barbuda. The value of geographical information systems (GIS) in this analysis will be demonstrated

through practical application especially in relation to the Coastal Resources Inventory System.

Discussion

- Beach changes since Hurricane Lenny in 1999: while some beaches have continued to erode, at others accretion has taken place. There are no general trends.

- Relationship between eroding and accreting beaches: it is difficult to tell whether the gains at accreting beaches are related to the losses at eroding beaches, because other factors come into play such as sand mining.

A geomorphological study of Playa Larga, Isla Caja de Muertos, Puerto Rico (2000-2001). Dr. Maritza Barreto, Department of Geography, University of Puerto Rico, Puerto Rico.

Summary

Se realizó un estudio de los cambios geomorfológicos del sistema de Playa Larga en la Isla de Caja de Muertos desde junio del 2000 hasta marzo del 2001. Esta playa fue escogida como zona piloto de estudio como parte de un esfuerzo de evaluar las condiciones geomórficas de las playas dentro de los sistemas de reservas estatales. La evaluación de estos sistemas permitirá establecer bancos de datos de información geomórfica que permita delinear estrategias de manejo en zonas de playa dentro de las Reservas. Esta iniciativa es muy importante especialmente porque varias de estas playas tienen zonas de anidaje de tortugas marinas, praderas de yerbas marinas y áreas de arrecifes de coral. Además de ser zonas donde existen planes para desarrollo ecoturístico.

El estudio geomorfológico consistió en la colección de medidas de perfiles de playa en 10 estaciones perpendiculares a la línea de la costa a lo largo de 1,200 metros del plano de la playa. Las medidas fueron tomadas con un nivel y una vara calibrada desde la línea de vegetación hasta 2 ó 3 pies de profundidad submarina de acuerdo a las condiciones del oleaje. El estudio de los cambios temporales de la morfología del perfil ayuda a evaluar el grado de erosion o acreción, las fuentes de sedimentos y en el caso de que ocurra erosión, sus posibles causas.

Los resultados muestran que Playa Larga es un sistema geomorfológico que presentó cambios variados en la morfología a lo largo de las diez estaciones de perfiles (extensión y elevación) desde julio de 2000 a marzo del 2001. El mayor cambio en la extensión del perfil de playa (horizontal), se presentó en dos periodos: para los periodos de julio a octubre y de octubre a diciembre. Las estaciones presentaron una merma en su elevación a medida que avanzaron los meses de julio del 2000 a marzo del 2001. El mayor cambio en elevación (vertical) ocurrió para el periodo de diciembre a marzo en la mayoría de las estaciones. Esto indica que Playa Larga está sufriendo una importante pérdida de material sedimentario durante el periodo de estudio. Basado en los datos obtenidos, no se pudo

establecer una relación directa y segura de los posibles causales que están generando esta pérdida de sedimentos debido a la carencia de datos oceanográficos y físicos del área.

Discussion

- Impact of marine debris on erosion: large tree trunks washed up on this beach could interfere the deposition of sand.

- Turtle nesting data: as well as collecting the beach profile information, observations of the number of eggs near the profile lines could provide some information on turtle nesting.

- Duration of monitoring: the time period of less than one year was too short to observe any significant cycles or to determine the causes of the changes. There is also a need to look at historical information.

Dune restoration and beach protection: plans, practices and policies. Mr. Rob Patten, Coastal Dunes Inc., Florida, U.S.A.

Summary

Caribbean beaches are dynamic and rugged ecosystems that exhibit an amazing resilience to storms and other natural fluctuations. The beneficial interrelationships between the seagrasses, inter-tidal shoreline, sand dunes and back-dune coastal vegetation serve to protect, nourish and even restore the beach under most conditions. Unfortunately, some past beach management practices have, unbeknownst to practitioners, disrupted the natural balance of the beach system through, among other things, destruction of sand dunes, removal of nearshore seagrasses and the indiscriminate mining of sand. This often results in the creation of unattractive, erosion-prone beaches with a low recreational value.

Fortunately, we now have the resource management tools to restore and rebuild these damaged coastal ecosystems through beach nourishment, dune revegetation and the adoption and application of beneficial beach management policies.

This presentation will (1) explain the interrelationships of a typical Caribbean beach/dune system, (2) discuss improper past management practices, (3) illustrate cost-effective dune restoration techniques and (4) outline beneficial beach management policies.

Wednesday, June 20th, 2001.

SESSION 5: FIELD TRIP TO PIÑONES AND THE WATER QUALITY TREATMENT PLANT

During a field trip to Piñones, the main subjects of discussion were the boardwalk and the bicycle trail, safety, beach access and re-vegetation. Some of the participants also visited the water treatment plant at Carolina.

Participants at Piñones, Carolina, Puerto Rico

SESSION 6: MANAGEMENT OF BEACH USER CONFLICTS

Keynote address: The history of the development of Long Bay Beach in Negril, Jamaica. Ms. Katy Thacker, Negril Coral Reef Preservation Society, Jamaica.

Summary

This paper reviews the history of the development of Long Bay beach in Negril, Jamaica from a socio-environmental perspective. The small town on the furthest western tip of the island grew from a sleepy fishing village to an international tourism destination without a government policy for planned development. Original property owners sold family beach land to hotel developers. In so doing, they relinquished their rights of access to lands where they were born and raised. The public now has very limited access to the beach, which is predominantly lined with all-inclusive hotels. Fishermen have been forced to relinquish the beach and dock their boats along the riverbanks in unsanitary conditions on marginal lands. This situation has severely compromised their working standards and living conditions.

Without a development plan, basic infrastructure needs were not taken into consideration. Lack of sewage treatment commensurate with development led to decline in coastal water quality (as the area further developed). The coral reefs, fish stocks, and coastal water clarity have all deteriorated along with the once famous seven-mile beach that has eroded to less than half of its original width in many areas.

The government's efforts to improve infrastructure are inadequate. The biggest problem is with sewage. Properties are not required by law to hook up to the new central sewage system. The collection pipes only cover a limited area and many places are without sewage treatment at all. The waste that is collected is not treated to a tertiary level, so high levels of nutrients are still entering the coastal waters.

The government has recognized its inability to manage the area, which is the first legally established Environmental Protection Area in Jamaica. The Environmental Protection Area boundaries coincide with those of the new Negril Development Order. The government is prepared to delegate authority for management of parks and protected areas to local non-governmental organizations. Regulations for Environmental Protection Areas do not exist, although there are regulations for Marine Parks under the Natural Resources Conservation Authority Act. Recommendations for preservation of the natural resources outlined in the Negril Green Island Environmental Protection Plan and the Negril Development Plan are being ignored. The carrying capacity of Negril has not been taken into consideration and high-density development along the beach continues at a rapid rate.

Discussion

- Recycling activities: at present glass bottles and plastics are recycled and the Negril Coral Reef Preservation Society (NCRPS) is working with schools to recycle paper.

- Sound pollution: this originates from the hotels and the community, and while there are regulations, e.g. live shows must stop by 1 am., the regulations are not enforced.

- Relocation of vendors: when the vendors were relocated to a central area, there was some dissatisfaction because sales were lower.

- Effects of tourism on coral reefs: 20 years ago tourists used to stand on elkhorn reefs for photograph sessions, and there was a good business in selling sea fans and coral to tourists. Now this has for the most part been stopped. Dive operators and rangers help to educate the diving tourists. However, indirect tourism impacts, e.g. oil and gas pollution, and sedimentation, are impacting the coral reefs.

- Commercial fishing and sea turtles: there is very little commercial fishing in Negril and the area is not a turtle-nesting beach.

- Water quality monitoring is undertaken by several agencies including the Urban Development Corporation, the NCRPS, the Water Authority and the Environmental Control Division.

Resolving beach user conflicts in small islands. Dr. Gillian Cambers, University of Puerto Rico Sea Grant College Program, Puerto Rico.

Summary

As one of the activities of the project 'Managing beach resources and planning for coastline change, Caribbean islands,' workshops on 'Wise coastal practices for beach management' were held in nine Caribbean islands over the latter half of 2000. The main goal of the workshops was to initiate a dialogue among beach users about beach management practices. Several conflicts between different user groups were highlighted in the discussions: developers versus beach-user groups, e.g. fishers and beach vendors; coastal landowners versus the public over the right of access to the beach; sand-mining operators versus beach-users; coastal property owners protecting their land from inundation by the sea versus other beach users; persons dumping solid and other waste at the beach or inland versus beach users. Furthermore, these conflicts between different user groups are compounded by two main factors: political control of the planning process, and inadequate and ambiguous environmental legislation. A way forward to resolve the conflicts includes several strategies: capitalising on the human capacity to

care, instilling a sense of civic pride, invoking the principles of coastal stewardship; and at the micro-level, developing social contracts between beach users at specific beaches.

Discussion

- Examples of successful social contracts: the idea for developing such social contracts among beach users has not been tested yet, and the question of who should take the lead will depend on the local and national context.

- Soufriere Marine Management Area in St. Lucia is one example where key stakeholders have managed a marine protected area, and there is much that can be learnt from the failures and successes of such initiatives that can perhaps be applied to beach resources.

- Marginalization of fishers groups: this has occurred in many islands as a result of tourism and other types of coastal development. Communication and dialogue is key to reducing such conflicts.

- Ways to define the beach or maritime zone: one way that has been used in several small islands is to use the line of permanent vegetation as the benchmark for setback determinations.

Management of beach use conflicts in Jamaica. Mr. Lloyd Gardner, St. Thomas, U.S. Virgin Islands.

Summary

Caribbean islands are comprised of fairly small land areas, most with very mountainous terrain and very narrow coastal plains. As such, most of the urban areas are located in the coastal areas. Similarly, much of the economic activities also take place in the coastal areas. This creates a situation where sectoral economic activities compete with each other and with social activities for space and resources. The result is use and user conflicts, not only for control of space and coastal resources, but also for access to such resources.

This paper reviews the history of beach management in Jamaica, starting with the promulgation of the Beach Control Act in 1956, and ending with the Beach Policy of 1999. The paper identifies the main issues related to beach use and access, and presents some of the legislative and management initiatives devised to address the problems.

The review is presented within the context of public sector developmental philosophy and resource allocation. The issue of how economic interests and public participatory processes influence public sector decision-making, with respect to beach management, is also explored.

Natural resource managers and the general public increasingly share the perspective that economic and social development must be given equal weight in development planning.

To achieve this balance, the existing scenario where special interest groups exert an overwhelming influence on beach use and access, must change. This shared philosophy provides the framework for guiding both public and private sector investments and management practices, thereby reducing social conflicts related to the use of beach resources.

Discussion

- Conflicts in Bermuda: here the conflict is not so much between different user groups as between conservation/preservation and tourism. Bermuda has traditionally taken a conservation approach, and as a result has lost out on a lot of tourism dollars. Proposals are now being considered to expand and diversify the tourism product.

- Use of prescriptive rights: in Hellshire, Jamaica, 10 acres of beachfront land were set aside for fishers in the 1970s. Recently the Urban Development Corporation had plans to relocate the fishers and build houses for them elsewhere, but the fishers chose not to give up their prescriptive rights.

Ambiguity in the definition of the coastal maritime zone. Mr. Aurelio Mercado, Department of Marine Sciences, University of Puerto Rico, Puerto Rico.

Summary

The delineation of the maritime zone is a very difficult task. In terms of the vertical limits, the range is very small because Puerto Rico has a very small tidal range. However, the horizontal and vertical limits of the maritime zone are also influenced by other factors including tides, storm waves, storm surges and even tsunamis. If the delineation of the maritime zone were to take account of conditions likely to be experienced during a category 5 hurricane, then the zone would have to be greatly expanded.

Discussion

- Delineation of the maritime zone is just one part of a setback determination: turtle nesting activities should also be accommodated, and there is a need for the various agencies to work together in setback issues.

- Delineation of the maritime zone on developed and pristine coasts: possibly different methods have to be used, for instance on pristine coasts the vegetation line can be used, but on developed coasts it is more difficult because existing developments have set legal precedents.

- Setbacks in the U.S.A.: in North Carolina, the vegetation line is used for the determination of setback distances, but there is a problem when there is no vegetation or when the developer has interfered with the beach/ vegetation edge.

In South Carolina, the crest of an 'ideal dune' is used for setback determination. This is based on calculations of sand in the sediment budget, and the 'ideal dune' is a line drawn on a map, which is admissible in court. The maps are updated every 5 – 10 years.

- Setbacks based on ecological characteristics: it is not just a case of determining how far the water penetrates, but also a case of taking into account the vegetation and the ecological community.

Coastal development conflicts at Punta Las Marias, Puerto Rico. Dr. Ingrid Padilla, Defensores Areas Costeras, Puerto Rico.

Summary

The Princesa del Mar project consists of 179 two and three bedroom apartments constructed in the last green space in the area. A breakwater was also proposed for the development, this was opposed by local residents, who, when investigating the development perceived a lot of irregularities, including height and density of the buildings, a lack of certification of the maritime zone, inadequate setbacks from the maritime zone, no environmental impact statement, unauthorised removal of sand from the site. The local community has lost access to the coast, a green area and a fishing area. The case is at present in court and construction has been stopped.

Discussion

- Proposal to the developers: the Defensores Areas Costeras would like to propose to the developers that they abide by existing laws and reduce the height and density of the development and observe legal setbacks from the maritime zone.

- Existing procedures for the determination of the maritime zone: The Department of Environment and Natural Resources has a manual for these procedures referred to by the Secretary, Dr. Carlos Padín, these include looking at the historical evidence and the pre-construction conditions.

- Other violations of the maritime zone in Puerto Rico: similar cases to the Princesa del Mar project are taking place all around the coast, and it often appears that there is one law for some people and a different law for others. Often communities do not get organised as was the case with the Princesa del Mar project. Puerto Ricans want to have access to their beaches.

Thursday, Junes 21st 2001.

SESSION 7: BEACH SERVICES AND COORDINATION OF BEACH MANAGEMENT

Keynote Address: Management of beach services in Barbados. Mr. Keith Neblett, General Manager, National Conservation Commission, Barbados.

Summary

The National Conservation Commission (NCC) is a statutory board, which was established by an Act of Parliament in 1982. The Commission is responsible for: (1) conservation of the natural beauty, topographic features, historic buildings, sites and monuments; (2) control and maintenance of public parks, beaches and public gardens; (3) provision of lifeguard and ranger services as determined by the Commission; (4) provision of beach and ancillary recreational facilities.

The management of beaches in the Caribbean is critical to the economies of most of the Caribbean islands, since tourism is a major foreign exchange earner. The government of Barbados has recognised that the development of its tourism product has to go hand in hand with the protection of the coastal environment and ultimately, the beaches.

The protection of coastal areas is a collaborative effort between governmental and non-governmental organisations. The Coastal Zone Management Unit is of specific note, in that the department has, as part of its functions, the responsibility for monitoring coastlines as well as the responsibility for the implementation of policies, strategies and standards for the development and maintenance of structures in the coastal management areas.

In Barbados, the government has embarked on an extensive program to reduce the level of effluent entering the sea, through the establishment of sewerage plants in Bridgetown and on the south and west coasts of the island, where much of the commercial activity is concentrated. In the long term, it is expected that this will protect the coral reefs, a critical aspect in the protection of the very fragile coastline and ultimately, the beaches - the core of our discussions this week.

Discussion

- Development setbacks in Barbados: these are 50 m from the high water mark, this is implemented by the Town and Country Planning Department. The Coastal Zone Management Unit has recently introduced new legislation to delineate beaches.

- Beach re-vegetation: planting is done to provide shade and stabilise the beach. A survey has shown that over 98% of the visitors want shade on the beach. Seagrape, ficus and casuarinas are the main species planted. Tree planting is also encouraged during the annual arbour day activities. In the past there have been

cases where the landowners pulled up the newly planted trees over night, now the National Conservation Commission ensures that they always have dialogue with the landowners before planting.

- Casuarina trees: experience in other areas, e.g. the Bahamas and Cuba, has shown that caution is needed with casuarina trees, since they are surface root trees and discourage the growth of other types of ground cover.

- Food vending on beaches: specific areas have been designated for this at some beaches, e.g. Rockley Beach. In general, the National Conservation Commission does not encourage the establishment of food vendors on beaches. There are other eating establishments, e.g. hotels.

- Health inspections: all food vendors and hair braiders need health certification permits for their operations.

- Solid waste collection from beaches: this is done three times a week and more often during the rainy season. Skips (garbage containers) are provided.

- Government liability for accidents: there has been only one case where the government was sued for a lifeguard accident, this incident occurred outside of lifeguard hours.

- Cooperation with fishers groups: the government in Barbados has made a special effort to provide good facilities for fishers, e.g. at Oistins. In Barbados there is a governing group of fishers associations. Fishers are a special group of beach users and continued dialogue with them is essential.

Keynote address: Beach services and facilities in Volusia County, Florida. Mr. Tom Renick, Department of Beaches, Volusia County, Florida, U.S.A.

Summary

The services and facilities provided by the Department of Beaches, Volusia County, Florida, include lifeguards, law enforcement, beach maintenance, concessions, beach facilities, arrangements for special events, and public safety presentations. Lifeguards are also trained as law enforcement officers, and while recruitment has been problematic in the past, the results of high school recruitment and a junior lifeguard program, as well as raised salary scales, have been beneficial this year. The most serious cause of weather-related deaths in Florida are rip currents. Between 1989 and 1999, 211 deaths were due to rip currents. Vehicles are permitted to drive on the beach, and most of the law enforcement infringements are related to vehicles and alcohol. Visitors have to pay a fee to take their vehicles on the beach. Beach maintenance activities include lifeguard towers, signage, restrooms, dune walkovers and upgrading beach roads. The Department has an annual budget of around US$ 5.5 million, property taxes and toll fees are the major sources of income. Other sources include private sponsorship.

Discussion

- Oil spills on the beach: at Volusia County, where cars are allowed to park on the beach, no special checks are conducted for oil leakages.

- Number of car accidents on the beach: this is low because of speed restrictions.

- Lifeguards and law enforcement: lifeguards are trained as law enforcement officers and go through the full 800-hour law enforcement academy course.

- User conflicts: these are few. There is an ordinance that gives bathers priority over fishers. Lifeguards sometimes have problems with intoxicated bathers who do not obey the rules, and sometimes have to use force.

- Funding for beach management services: all tax-payers of Volusia County contribute to the Department's budget. Funds have been tighter recently. The Department of Beaches comes under the Division of Public Protection, which also includes the Fire Department and Prisons. A separate department deals with sea turtles.

- Animal restrictions: animals are restricted on the beach except in two parks near the inlet where animals on a leash are permitted.

- Solid waste services are contracted out as well as cleaning restrooms and providing portable toilets.

- Water quality analysis is done three times a week at seven locations.

- Blue Wave Program: the Blue Flag program does not exist in the U.S.A., but there is a Blue Wave Program and Volusia County is negotiating to join this program.

- Nude bathing is not allowed at Volusia County.

- Recommendations for the management of small island beaches: the support of government and the local citizens is a key factor. Safety is also another very important component, it is likely that at Volusia County, there would be several drowning deaths a day without lifeguards.

Panel Discussion on 'Beach services and facilities'

Mr. Ruperto Chaparro, University of Puerto Rico Sea Grant College Program.

The greatest problem with beach management in Puerto Rico is the budget. This is especially a problem on islands with limited economic resources. The President of the Chamber of Representatives, the Hon. Carlos Vizcarrondo, suggested establishing a Beach Department, but my major concern is with the budget and where the money will come from. In Volusia County, the funding comes from private sponsorship and taxes, in islands it is different, because many low-income people live near the beach, so the tax-base is not there.

Attorney Ramón Luis Nieves, Fomento Recreativo, Puerto Rico.

The National Parks Company manages public beaches and 'balnearios' (bathing areas) in Puerto Rico. This represents 16% of Puerto Rico's beach area (20 km out of a total of 120 km). Water safety is one of the main problems, especially the shortage of certified lifeguards as we enter the high summer season. Puerto Rico needs a lifeguard training school. Cultural events, such as St. John's night when people stay at the beach all night, also increase the risk factor. Proposals have been made for a Beach Department, but it will be necessary to see how this would be integrated with other agencies. It is not just a case of new legislation but a matter of determining how the new agency would function. The National Parks Company is interested in the Blue Flag program, and there are plans to start a pilot project for Blue Flag at Luquillo and Escambrón beaches.

Dr. Efrank Mendoza, University of Puerto Rico.

There are no official statistics for drowning deaths in Puerto Rico. A study was conducted using information from the Police Department between 1992 and 1997. This showed that there were 319 drowning deaths during that period, 123 at beaches, 22 at lagoons, 95 at rivers, 6 at canals, 22 at pools and 51 other drowning deaths. The data showed that there were many drowning deaths at Isabela, this included a vessel with illegal aliens, many of whom drowned trying to enter Puerto Rico illegally. In Puerto Rico there are an average of about 20 drowning deaths a year at the beaches. This compares unfavourably with, for example, Honolulu, where 17 million people use the beaches every year, and there are 3 drowning deaths a year. Thus the figure in Puerto Rico is very high. Beaches with a high incidence of drowning have been identified. There is definitely a need to have a school for lifeguards. The problem with drowning deaths in rivers is more difficult to solve, some warning signs have been erected.

Discussion

- Many Caribbean people cannot swim: this is one of the major problems and there is a need to provide swimming lessons for schoolchildren. However, many municipalities do not have swimming pools. In Negril, Jamaica, children are taught to swim in their natural environment – the sea. This may be possible in

some municipalities in Puerto Rico, but not in others where water quality and wave/current conditions may prove to be dangerous.

- Lifeguard training: lifeguards need to be trained in providing medical treatment and in the enforcement of safety regulations. They also need to have enforcement authority, better economic incentives, medical benefits, retirement plans; furthermore provision for upward mobility in the system needs to be provided. In Puerto Rico, a lifeguard is not viewed as a professional. However, lifeguards in Puerto Rico do an excellent job. Lifeguards can also fulfill other beach management roles, such as patrols, monitoring nesting sea turtles etc.

- Zoning of beaches is an important safety measure. However, in some places swimming buoys have been placed, but with no lifeguards.

- Budget for beach management: there is a need to first of all acknowledge the economic importance of beaches and to be creative in budgeting. It is also necessary to get the mayors in the municipalities interested in the program. Possibly it may be best to start on a small scale with a few municipalities and expand accordingly.

- Multiplicity of agencies dealing with beach management: in Puerto Rico there is considerable duplication of effort with more than 20 agencies dealing with beaches and coastal resources.

- Blue Flag: the criteria still have to be established and there is still a lot of mis-information about the program.

- The Surfing Association has done a lot of work with beach cleaning, safety and education, and may be able to play an active role in the overall management of Puerto Rico's beaches.

SESSION 8: VALUATION AND COORDINATION OF BEACH MANAGEMENT.

Keynote address: The need for services and facilities for beaches in Puerto Rico. Senator José Ortiz Daliot, Puerto Rico.

Summary

There is an urgent need for the coordinated management of beaches. All the tourism advertisements feature the island's beaches, in addition, most hotels are located on the beach. During the fiscal year 1999/2000, there were 4.6 million tourists spending 2.6 billion dollars. Despite this, Puerto Rico takes its beaches for granted. In 1999, an inter-agency Beach Board was established, however, this has not been very effective, mainly because the different agencies could not find a way to work together in an efficient manner. A new proposal for a Beach Management Department has been put forward, but this may create more bureaucracy and may not be what is needed at the present time. Another alternative would be to have the Department of Environment and Natural Resources in charge of beaches, but they would have to be assigned the necessary financial resources. At the moment there are too many laws and not enough compliance. There is also a need to emphasize the role of the private sector in beach management. The Blue Flag pilot project program is a good starting point for action.

Discussion

- Need for further studies of erosion in San Juan: while this may be the case in some areas, there is a need, first and foremost to comply with existing laws. In some areas there are too many studies.

- Budget for beach management: the Department of Environment and Natural Resources has received a budget cut this year, so it is unlikely to have sufficient funds to manage beaches, beyond what it is already doing.

Market based mechanisms to support national climate change adaptation policy. Ms. Leisa Perch, Organization of American States, U.S.A.

Summary

It is now widely accepted that climate variability and global climate change will present significant challenges to the management of coastal and marine resources, particularly amongst small island nations such as those in the Caribbean region.

Many nations felt the direct impact of Hurricane Lenny in 1999, in terms of torrential rains and wind, uprooted trees, wrecked homes and commercial properties, and storm surges, from Anguilla in the north to as far south as Barbados and Trinidad and Tobago. For many countries, coastal resources were the hardest hit. St. Kitts is still without a functioning cruise-ship dock and the Four Seasons Hotel in Nevis only re-opened in November 2000, a year after the hurricane.

Climate change will likely become one of the most significant threats to the beaches in the Caribbean over the coming century. Beaches in the Caribbean have already been exposed to increased wave action and extreme weather events to disastrous effect. The situation worsens when one considers the lack of beach nourishment, haphazard development on the coastal strip, sand mining and other challenges being faced by technicians and policy-makers. Climate change now presents a challenge in terms of long-term management in beaches and increases the need for effective investment in sustainable beach management practices. Likewise, policies for managing beaches and other coastal resources must incorporate climate change issues.

Small island nations are therefore pressed to develop innovative strategies to encourage and ensure that adaptation to climate change is part of the economic framework to secure sustainable growth and development. What policies or tools can government use to address the issue of climate change? What policies are necessary to protect the coastal and marine environment? What processes are likely to be effective in designing management responses? What investments can government make to ensure a viable and sustainable future?

In this paper, two case study approaches addressing these concerns and questions will be presented and discussed. The case studies focus on economic and regulatory approaches to policy and reflect the implementation of two pilot projects in Antigua and Barbuda and St. Kitts and Nevis as part of the Caribbean Planning for Adaptation to Global Climate Change Project. These pilot projects both focused on the management of beaches in different ways: one addresses the issue of sand mining, the other, development in the coastal zone. Policy responses including setback regulations, incentive-based programs, diversification in the use of sand resources, certification programs, amongst others, will be explored. The paper will recommend viable options and opportunities for the effective implementation of national climate change policies.

Discussion

- Change in hurricane tracks: while there was some suggestion that hurricane tracks may be turning away from the Caribbean, it only needs one hurricane to cause severe damage. Furthermore, islands in the north-eastern Caribbean, e.g. Antigua and Barbuda have experienced at least one hurricane a year over the past few years.

- Improved international diplomacy is needed for small island states: while the islands are small, they are numerous, and they need to improve their diplomatic skills to make a difference in the way decisions are taken. For instance small islands may not always have expert negotiators and often may not send representatives to important international meetings. International diplomacy is not perfect, but it is the best mechanism we have at present.

- Valuation of endangered species: it is not necessarily possible to put a dollar value on an endangered turtle. The species are valuable just because they exist.

A beach policy for Jamaica. Mr. Bernard Blue, Natural Resources Conservation Authority, Jamaica.

Summary

The beaches of Jamaica are world famous and contribute in a significant way to the growth of the tourism industry and are vital to the well being of the economy. However, inadequate protection and overuse have been leading to the degradation and destruction of beach resources in several cases. Actions need to be taken to manage them as a system in order to make optimal use of the opportunities and benefits they provide. This paper presents an overview of the Draft White Paper, 'A Beach Policy for Jamaica', which was presented to the Ministry of Land and the Environment in December 2000. It provides a background as to the need for the policy and also identifies the main issues affecting the use and management of the island's beaches. It summarizes the main objectives and the measures that will be taken to achieve them. The paper also identifies the main strategies that will be undertaken for effective implementation of the policy.

Discussion

- The process for establishing the policy: this began in 1997 with a draft Green Paper, which was discussed with a large cross section of civil society in most parishes around the island. People also sent in written comments. Over a three year period, all the comments were evaluated and in December 2000 a draft White Paper was produced, which was presented to the Minister of Land and Environment. The next step is for the paper to be presented to Parliament.

- Access along the foreshore is not a right in Jamaica. However, licenses for private use of the foreshore are no longer being granted.

- The Beach Protection Act is out of date, it was drafted in the 1950s, and has been amended, but there is a need to redraft the law.

- Budget for beach management: fees are collected from licenses and accesses, however, this money goes to a central fund and only a fraction is used for beach facilities.

SESSION 9: ECOSYSTEM MANAGEMENT

Managing beaches for sea turtles. Ms. Marelisa Rivera, U.S. Fish and Wildlife Service, Puerto Rico.

Summary

In island systems, humans have a constant relationship with the beach. Since the beginning, Caribbean beaches were the first landing areas for humans. At beaches humans fished, collected food, lived, enjoyed recreation and practised religious ceremonies. Now these human practices continue, although in different forms and intensities. However, beaches are not only used by humans, together with adjacent sea grasses and corals, they harbour essential habitats for terrestrial and marine species. Sea turtles inhabit coastal areas and use beaches during the nights for nesting.

In Puerto Rico, there are three species of sea turtles nesting in the beaches: the hawksbill sea turtle or 'carey de concha', the leatherback sea turtle or 'tinglar' and the green sea turtle or 'peje blanco'. The loggerhead sea turtle or 'caguama' and the Olive Ridley are also reported from the coastal waters of Puerto Rico. Sea turtles nest in different types of beaches since habitat requirements vary among the species.

Although there are still poaching problems at specific beaches in Puerto Rico, in general, the implementation of the Endangered Species Act for more than 20 years in Puerto Rico, in conjunction with beach patrolling activities, have resulted in a reduction of poaching of sea turtles and their eggs.

Today there are many threats to sea turtles (nest destruction by natural events; nest predation by ghost crabs, rats, mongooses, birds and other animals; predation of hatchlings by fish, and predation of adults by sharks), however, human activity is the primary cause of the decline in sea turtles.

Managing beaches for sea turtles includes: (1) the monitoring of beaches to identify nesting activities; (2) protecting nesting habitat and enhancing coastal vegetation with the planting of native plants; (3) assisting other agencies in the enforcement of existing laws and regulations; (4) designing and implementing appropriate set backs for construction, fences, lighting and intensive use; (5) implementing light management plans appropriate for sea turtles; (6) promoting sea turtle friendly uses of the beach and avoiding night time use; (7) promoting public involvement in the conservation of coastal resources and sea turtles through outreach and education activities. Responsible management of natural resources is a challenge that all of us need to embrace.

Discussion

- Guidelines for observing turtle nesting: there should be no more than ten persons in the group, they should stand 50 m behind the turtle so the turtle cannot see them, and they should keep silent. Turtles are very sensitive during nesting.

- Turtle nesting beaches, especially those with more than 200 nests per year, should not be developed.

- Probability of successful nesting: In Puerto Rico, 70% of the turtles who come out of the water, actually nest.

- Appropriate lighting systems at hotels: despite much effort in education, the results have been poor. Only one hotel has put in an appropriate lighting system, and they were forced to do this through the Endangered Species Act. However, some small hotels, still in the design phase, are including proper lighting systems.

The co-management of Jamaican beaches: the case of the Portland Bight Protected Area. Mr. Brandon Hay, Caribbean Coastal Area Management Foundation, Jamaica.

Summary

With the economies of the Caribbean becoming more dependent on sun-sand-sea tourism, the long- and short-term health of Caribbean sandy beaches is of growing importance. With the frequency of hurricanes and storms in the Caribbean, and the reality of sea-level rise due to global warming and climate change, it is very important to monitor the sand economy as a predictive tool as well as an indicator of management effectiveness and future economic well-being.

Coastal protected areas are promising vehicles for successful natural resource conservation since national policy on natural resource management – and manpower and finance – may be focused on an area of more manageable proportions than the nation as a whole. Local planning allows concentration on specific problems and solutions, with focused research and monitoring, community environmental education and enforcement.

Co-management adds another dimension, it allows for the meaningful participation of grass-roots civil society in the planning and execution of natural resource management strategies.

The paper discusses co-management of the coastal resources in the Portland Bight Protected Area on Jamaica's south coast, particularly as it relates to protecting beach resources. It suggests that the combination of the twin strategies of coastal protected areas and co-management in a concrete real-life context has a good chance of obtaining consistent, good quality data, as well as in disseminating information and sensitising local people.

Discussion

- Maintaining the interest of fishers in the co-management process: this is achieved in several ways: the fishers who come to the meetings look on themselves as an extended family, they are committed to the process and feel a sense of

responsibility. In addition exchange visits have been arranged, e.g. with fishers from Haiti and one is planned with fishers from San Andrés, Colombia.

Environmental information center: an alternative for conserving beaches while enjoying them. Ms. Lesbia Montero Acevedo, University of Puerto Rico Sea Grant College Program, Puerto Rico.

Summary

Las playas representan uno de los principales recursos para el desarrollo del turismo (turismo externo e interno) en Puerto Rico. Asimismo constituyen el hábitat de muchas especies de fauna y flora, por lo que son valiosas tanto desde el punto del vista económico como ecológico. Para asegurar a corto y largo plazo la integridad, conservación y el uso de las playas es importante educar a los usuarios sobre este ecosistema (en términos de los organismos que habitan en el) y orientarlos de los eventos que allí ocurren. El desarollar un Centro Informativo Ambiental en los balnearios le ofrecería a los usuarios de las playas información educativa del recurso que visitan. De esta manera los usuarios entenderán la importancia de conservar ese ecosistema por su valor ecológico y recreativo.

POSTER SESSIONS

Monitoring our beaches: a volunteer program. Dr. Ana Navarro, University of Puerto Rico Sea Grant College Program, Puerto Rico.

Summary

Volunteers from seven municipalities in Puerto Rico (Aguada, Aguadilla, Arecibo, Mayaguez, Cabo Rojo, Ponce, Guayama and Vieques) are monitoring their coastal waters, which are highly impacted by sewage discharges. The volunteers collect and analyze monthly water samples for one year. They determine dissolved oxygen, biochemical oxygen demand, pH, temperature, phosphates, nitrates and turbidity using La Motte water quality testing kits (www.lamotte.com). Total and faecal coliform counts are determined by the coliscan easygel kit (Microbiology Laboratories, LLC).

Preliminary results show high levels of phosphate, 4 parts per million (ppm) and low levels of dissolved oxygen and biochemical oxygen demand (4 ppm) in the discharging waters. At some stations, pH values are higher (9) than the standard value of the Environmental Quality Board. Total and faecal coliform counts are higher in two municipalities (200-10,000 colonies/100 ml).

All the monitoring data will be published in the University of Puerto Rico Sea Grant home page under the water quality section (http:\\seagrant.uprm.edu).

Non-point source pollution in Puerto Rico and the U.S. Virgin Islands. Ms. Mayra Suárez-Vélez and Dr. Ana Navarro, University of Puerto Rico Sea Grant College Program, Puerto Rico.

Summary

La contaminación por fuentes dispersas es diferente a la contaminación proveniente de industrias o de una planta de tratamiento de aguas usadas ya que no viene a través de un tubo o de una fuente que podamos identificar directamente. La contaminación por fuentes dispersas tiene su origen en muchas fuentes; una de éstas es el agua de lluvia que al correr por la tierra arrastra contaminantes. Estos son depositados en canales de drenaje, charcas, playas, aguas costaneras y aguas subterráneas.

Se ha desarrollado un modelo para demostrar contaminación por fuentes dispersas en islas tropicales; éste es interactivo y mediante su uso la audiencia puede reconocer las fuentes de este problema de contaminación.

El concepto de cuenca hidrográfica es representado mediante una montaña con una pendiente pronunciada, lo cual es común en la topografía de las islas del Caribe. El modelo presenta como el manglar sirve de trampa de sedimentos y escorrentías y demuestra que si eliminamos las trampas de sedimento naturales éstos van a parar a las praderas de hierbas marinas y a los corales. También incluye un lugar de construcción

donde se elimina la capa vegetal y se demuestran los problemas de erosión y pérdida de suelo. Además presenta zonas de carreteras como fuentes de sedimentos, aceites, químicos, tierra, basura, etc. Cuando hay lluvias toda esta contaminación es arrastrada por las escorrentías y eventualmente llega al mar.

Beach width and profile comparison between natural beaches and beaches fronting seawalls, Puerto Rico. Mr. C.W. Jackson, Dr. D.M. Bush, Mr. D.M. Adams, Mr. E.E. Wright, Mr. W. J. Neal, State University of West Georgia, U.S.A.

Summary

Controversy exists over the impact of seawalls on beaches. Few studies have addressed the problem. One study was a master's thesis by E. E. Wright (1989) in which he profiled 230 walled and unwalled beaches around the island of Puerto Rico. The objectives of this study were: to reoccupy as many of Wright's profile sites as possible in a one-month field project, to test if his results could be replicated, and evaluate trends of erosion/accretion for these beaches over a decade time span. Over 100 beach profiles and dry-beach width measurements were taken around Puerto Rico during summer, 2000, to investigate the role of shore-parallel hard stabilization (seawalls and revetments) on beach degradation. The Emery (1961) stake and horizon method was used for profiling. Dry beach widths were compared for beaches in front of seawalls and adjacent unwalled beaches. Data sets were grouped by region based on the orientation of shorelines (e.g., east, south, west and north) and associated wave climate conditions.

Although only 45% of Wright's profile sites were reoccupied, preliminary results replicate his overall conclusions. Dry beach widths are narrower in front of seawalls than for unstabilized beaches in 97% of the locations. No dry beach exists in front of 55% of the shoreline stabilization structures, and many lack any beach. To date, problems in interpreting the original data set have limited conclusions regarding the 10-year erosion/accretion trends, however, many of the beaches are steepening and narrowing. The three types of beach loss in front of seawalls include loss due to placement of the wall on the beach, active loss due to wave interaction with the wall, and passive loss where a wall is placed at the back of the beach but becomes active as the shoreline retreats into the wall. For many of Puerto Rico's seawalls, no historic data exists for the conditions at the time of seawall construction, but some recent walls are known to be causing placement and active beach loss. The results of this study support the conclusion that seawalls contribute to beach loss. Such shore-hardening structures are a poor choice for managing eroding shorelines.