

Section C4b

Marine Environments: Assessment of Impacts



Objectives

- To identify the environmental resources of coastal areas.
- To identify the aspects of the coastal environment that are at risk to natural hazards.
- To outline how to measure impacts and damage of coastal and marine related resources



Introduction

The overall aim of this section is to describe the various forms of environmental damage to coastal Caribbean areas, and the relevant methods of assessing damage costs.

Coastal and Marine Environmental Resources

The following table outlines the major coastal resources/ecosystems found in the Caribbean, and their main functions.

Table 15
Major coastal resources/ecosystems found in the Caribbean and their main functions

Coastal Resource/Ecosystem	Physical Functions	Ecological Functions
Seagrass Beds	<ul style="list-style-type: none"> • Aid in the stabilization of nearshore sediments 	<ul style="list-style-type: none"> • Provide habitat for fish, lobster and conch (especially juveniles).
Mangroves	<ul style="list-style-type: none"> • Provide buffer between the marine and terrestrial environments • Provide natural coastal protection (i.e. may serve to provide a “hurricane hole”]. • Act as a filter to remove nutrients from land based water discharges. 	<ul style="list-style-type: none"> • Provide habitat for fish and birds. Roots provide habitat for non-motile species, e.g. oysters.
Coral Reefs	<ul style="list-style-type: none"> • Barrier against storm waves. • Source of sand 	<ul style="list-style-type: none"> • Habitat for fish and other marine organisms. Formed by marine organisms. Promote biodiversity of an area.



Coastal Resources at Risk for Natural Hazards

The most significant natural hazards to coastal resources in the Caribbean are hurricanes. The waves that are generated by the intense winds associated with a hurricane can often damage the seabed and those marine ecosystems that are found there. For example, hurricane waves can result in mechanical damage to coral reefs and the uprooting of seagrass beds. The large waves that are generated can also interact directly with the seabed, causing significant reshaping of the shoreline.

The damage that can occur includes:

1. Seagrass beds:
 - Smothering of seagrass beds with silt.
 - Uprooting of large mats of beds.
2. Mangroves
 - Uprooting of trees.
 - Breaking of roots.
3. Coastal Water Pollution
 - Turbid waters from increased sedimentation
 - Overflow of sewage treatment facilities and direct discharge of sewage into coastal waters.
4. Coral Reefs:
 - Breaking of corals.
 - Sedimentation of corals.
 - Bleaching of corals.
5. Sandy shores (Beaches)
 - Degradation due to erosion, litter, uprooted seagrass



❖ **Assessment of Damage Costs**

For many of the coastal environmental resources, the costs incurred are direct costs, associated with the loss of ecosystem function and physical functions.

❖ **List of Baseline Data Sources**

In order to assess the extent of destruction, it is important to have information about the resources prior to the destructive event. Baseline information on coastal resources can be obtained from:

- Aerial photographs.
- Coastal Managers (government and private).
- State of the Environment Reports/National Environmental Profiles.
- Environmental Management Agencies.
- Non-governmental Organizations.
- Property Owners.
- Planning Agencies.
- Divers/Dive shop operators.
- Water sports operators.
- Local resource users e.g. fishers, recreational boaters.

Once the damaged amenity and area have been identified, the assessment of the resource can continue.

❖ **Assessment Methods**

Seagrass Beds

Value of seagrass beds can be linked to the cost of replanting programs, evaluated on a per hectare basis. Values can also be determined through estimation of the sand producing potential of the seagrass beds, and subsequent valuation of the beach enhancing potential of the sediment.

Mangroves

Value of mangrove loss can be based on the cost of replanting strategies. Studies done on the replanting of mangroves have indicated costs ranging from US\$10,000 to US\$ 30,000 per hectare. The cost varies depending on



the values assigned to functions of the mangroves including: the filtrating services of mangroves, habitat functions, food production, recreational amenities and the inherent natural capital of the mangroves.

Coral Reefs

Coral reef damage can be valued by underwater video reconnaissance or information from local dive professionals to estimate the aerial extent of damage – percentage change in the coral coverage. Coral reefs have been valued for Montego Bay, Jamaica and for Bonaire, Dutch Antilles. Values developed range from US\$7,000.00 to \$500,000 per hectare, depending on the location of the reef and its role in the overall ecosystem. Recent work on coral reef valuation includes the importance to the pharmaceutical industry.

Sandy Shores

Beach loss costs may be based on real estate values or cost of repair. Renourishment costs can vary from US\$5/m³ up to \$50/m³ depending on the scope and value of the work. Protective structures may also be required if the resilience of the beach is affected by repeated hurricane strikes.

Example – Assessing the cost of damage to mangroves.

A class four hurricane has passed over island X, and the combination of wind and wave action in a relatively shallow coastal area has resulted in the uprooting of a large mangrove stand. Assess the cost of the damage to the area.

- Consider the data you will need in order to assess the extent of the damage. You will need data representative of the area prior to and after the hurricane.
- Determine/Quantify the area of mangrove destroyed by the hurricane.
- Identify the relative functions of the mangroves in that area. e.g. water filtration, habitat provision, food production, and recreation.
- Apply the unit cost of replanting the mangroves in the devastated area.



Self Assessment

You should now be able to identify the main environmental resources of coastal areas, and identify the aspects (functions) of the resources that are at risk to natural events. You should also be able to list sources of information that can assist you in determining the extent of coastal environmental damage caused by a disaster, and consider methods of assessing the cost of this damage.

