

ECLAC Disaster Assessment Methodology

Coastal Areas: Environmental Sector

Presented by
David A.Y. Smith, Ph. D. P.Eng.
Managing Director, Smith Warner International Ltd.

Objectives

- Description of coastal or marine ecosystems and related potential environmental damage resulting from natural hazards
- Assessment of impacts and quantification of damage costs

Coastal/Marine Ecosystems and Environmental Damage

- Seagrass Beds
- Mangroves
- Coral Reefs
- Coastal Water Pollution
- Beach Degradation

Seagrass Beds

- Seagrass beds function as habitat for fish, lobster and conch (ecological function)
- They aid in the stabilisation of nearshore sediments (physical function)
- Extensive damage to seagrass beds can occur as a result of hurricanes from:
 - Smothering of seagrass beds with silt
 - Uprooting of large mats of beds

Mangroves

- Beneficial habitat for fish and birds, and roots provide habitat for non-motile species such as oysters (ecological functions)
- Provide natural coastal protection, and as a buffer (physical function)
- Act as a filter to remove nutrients from wastewater discharges (physical function)
- **Damage occurs from breaking of roots and uprooting of trees**

Coral Reefs

- Habitat for fish and other marine organisms (ecological function)
- Promotes biodiversity of an area (ecological function)
- Provides a barrier against storm waves (physical function)
- Are a good source of beach sand (physical function)
- **Damage results from: breaking of coral; sedimentation of coral; and bleaching of coral.**

Coral Reefs

- Reefs may be damaged by bleaching as a result of climate change impacts (temperature increases)
- Reefs also damaged by smothering by suspended sediments generated by storm waves, and by die-off of beneficial organisms such as *Diadema antillarum* (Sea Urchins)
- Reefs act as a barrier against storm waves that would otherwise erode the shoreline (induces wave breaking)
- Reefs promote biodiversity of marine organisms and act as a source of sand, either through mechanical weathering or indirectly from fish or algae

Coastal Water Pollution

- Coastal water pollution occurs as a result of extreme turbidity
- Water pollution also occurs as a result of overflow of sewerage lagoons and septic tanks, and direct discharge of untreated sewage to the sea.
- Pollution has negative impacts on recreational bathing water **and** on marine ecosystems.

Beach Degradation

- Beach degradation results from wave erosion, litter, uprooted seagrass and other debris
- Requires clean up efforts
- May require beach nourishment and protective structures if the resilience of the beach is affected by repeated hurricane strikes

Beach Degredation



Assessment of Damage Costs

- For coastal environmental resources, there are both direct costs associated with the loss of ecosystem and physical functions, and indirect losses associated with loss of revenues from reliance on the resource.
- Value of mangrove loss based on replanting strategies, or, if systems are allowed to regenerate naturally, on the cost of protecting the newly exposed shoreline
- Values have ranged from US\$10K – 30K per ha (replanting), or US\$2K – 5K per metre (protection)

Assessment of Damage Costs (Coral Reefs)

- Estimate damage from underwater video reconnaissance or from dive shop interviews
- Important to know status **before** hurricane
- Coral reefs have been valued for Montego Bay, Jamaica and for Bonaire, Dutch Antilles. Values developed range from US\$7000 – 500,000 per hectare.
- Importance of coral to pharmaceutical industry

Assessment of Damage Costs (Beaches)

- 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 work.
- Costs may increase if protective structures are deemed to be required.

Assessment of Damage Costs (Seagrass Beds)

- Value of beds linked to cost of replanting programme
- Can also be determined through evaluation of sand producing potential of beds, and subsequent beach enhancing potential of the sand

Baseline Data Sources

- Important to have baseline data **before** event
- Aerial photographs
- CZMA
- NGO's
- Property owners
- Dive Shop/Water Sports operators
- Local resource users (boaters, fishers, etc.)

Example

- A category 4 hurricane has passed over Belize and resulted in the loss of several mangrove stands. You need to assess the cost of damage.
- What data will you need?
- Where will you get it?
- How will you quantify the area of mangrove destroyed?
- Identify the relative function(s) of the mangrove stand in that area (e.g. filtration, habitat provision, food production, recreation, shoreline protection)

Self Assessment

- The main environmental resources of coastal areas?
- Aspects (functions) of these resources that are at risk from natural events?
- Sources of information to aid evaluation?
- Some cost estimation methods?