

Wise practices for coping with

BEACH EROSION



Montserrat



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UNESCO Environment and Development in Coastal Regions and in Small Islands

FORCES TO BE RECKONED WITH

Beaches are continuously changing – from day to day, month to month and year to year – as the natural forces of wind and water meet the land. These changes, which have been taking place for millions of years, are linked to variations in wind, waves, currents and sea level height.

But it is not just natural forces that change the beach, humans have a big role to play in this process as well, through mining stones and sand from the beaches, polluting and damaging coral reefs, and constructing buildings and walls too close to the sea.

Changes in the beaches affect everyone. The coast is a place we are all attracted to for recreation, sports and simple enjoyment. This constantly changing and hazard-prone coastal environment is also where important infrastructure (roads, ports, buildings) is concentrated. Especially in Montserrat, where the recent volcanic activity has rendered so much of the island unsafe for living, the state of its beaches is of major importance.

Natural forces

- **Hurricanes and tropical storms**, occurring between June and November, cause dramatic beach changes usually resulting in serious beach erosion.
- **High waves in winter** resulting from storms in the North Atlantic Ocean, and known as swell waves, or locally as 'groundseas'.
- **Sea-level rise**, which is a long-term factor, taking place very slowly over decades causes shorelines to retreat inland.

Since 1995, the Atlantic Basin (including the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico) has entered a more active hurricane cycle, which may continue for more than 20 years.

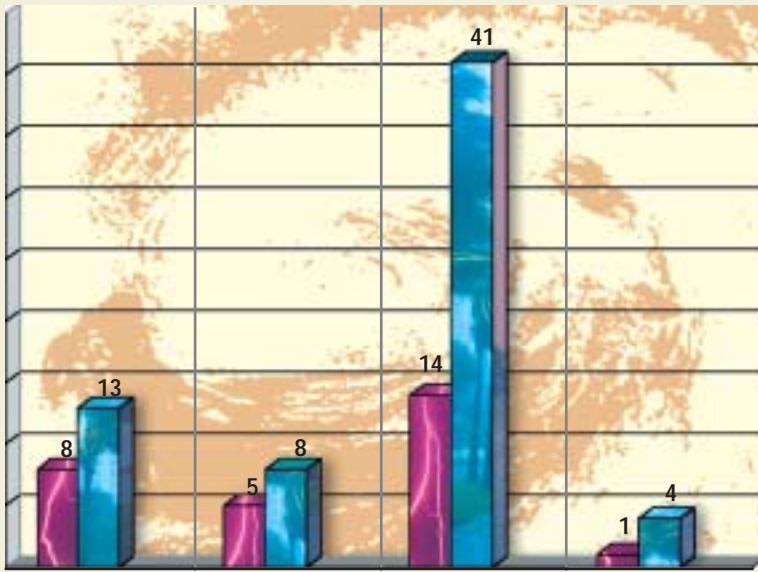


Number of
named storms
per year

Number of
hurricanes
per year

Number of
hurricane days
per year

Number of
category 3, 4, 5
hurricanes per year



Source: Gray et al <http://typhoon.atmos.colostate.edu/forecasts/1999/nov99/>

Hurricane
frequency
between 1990
and 1999
in the Atlantic
Basin

5 year periods

1990 - 1994
1995 - 1999

In the Atlantic Basin the number of really severe hurricanes (categories 3, 4 and 5) increased from one per year (1990 - 1994) to four per year (1995 - 1999).

Human forces

- **Removing sand** from beaches and adjacent areas for construction purposes causes erosion and the loss of beaches and coastal lands, destroying the natural heritage of the coast and reducing the vibrancy of the tourism industry.
- **Building too close to the beach** interferes with the natural sand movement and may impede beach recovery after a serious storm or hurricane.
- **Badly planned sea defences** may cause the loss of the beach, and of neighbouring beaches.
- **Pollution from human activities** on the land may damage coral reefs and seagrass beds; these biological systems protect, and provide sand to the beaches.
- **Removing vegetation from coastal areas** destabilises beaches; and clearing sites inland results in increased soil and dirt particles being washed offshore and smothering coral reef systems.

*Mining sand
destabilises the
beach and damages
turtle nests, Sturge
Park, 1988*



WHAT'S HAPPENING WITH MONTSERRAT'S BEACHES?

In order to manage these changes, Montserrat's beaches have been monitored since 1990 by the Ministry of Agriculture, Land, Housing and the Environment, and more recently by the Fisheries Division. They measure the beach slope and width every three months at several sites around the islands. During the volcanic emergency, 1995-1998, monitoring was interrupted, but recommenced in 1999.



Beach monitoring in progress at Little Bay, 1999

Location of monitored beaches in Montserrat

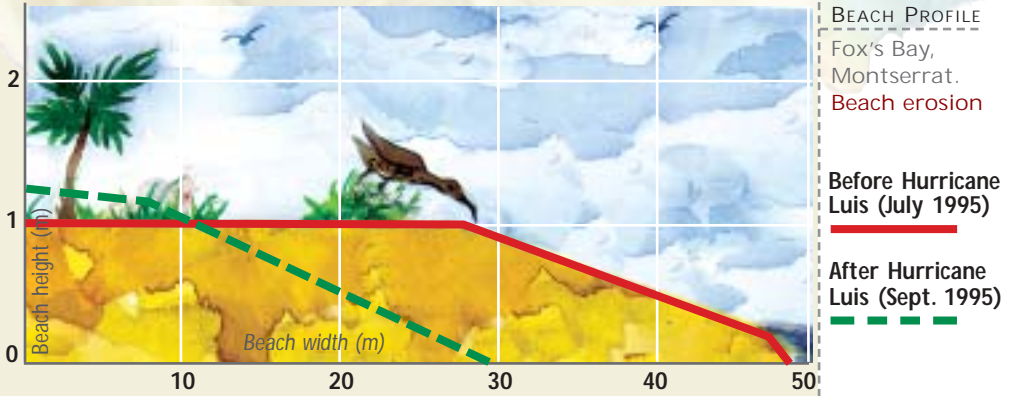


Little Bay, 1990



SAND IN, SAND OUT

When Hurricane Luis struck in 1995, much of the beach was lost at Fox's Bay on the west coast and at other beaches. In the months and years after the hurricane, the beaches recovered to some extent, but were further impacted by Hurricane Georges in 1998, and Hurricane Lenny in 1999.



Fox's Bay, 1994,
before Hurricane Luis

Fox's Bay, 1999,
after the impact of
Hurricanes Luis, 1995,
Georges, 1998,
and Lenny, 1999



HURRICANES WREAK HAVOC

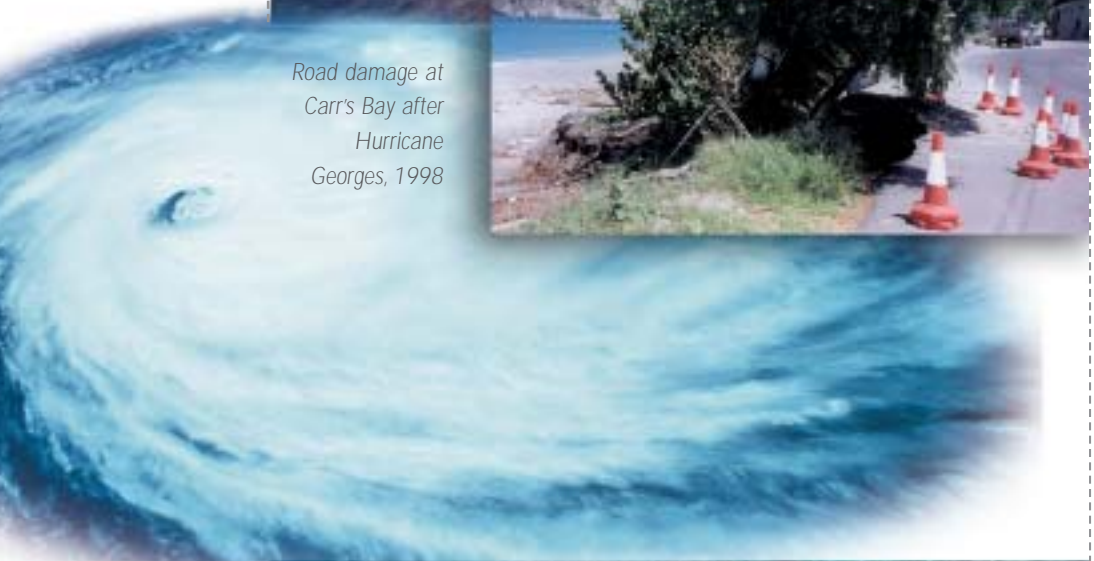
Montserrat has been impacted by several serious hurricanes in the past 25 years: David in 1979, Hugo in 1989, Luis in 1995, Georges in 1998 and Lenny in 1999. These resulted in serious damage to the beach and coastal environment as well as man-made infrastructure.



Plymouth collection area for galvanized sheeting after Hurricane Hugo 1989



Abandoned snackette at Fox's Bay after Hurricane Lenny, 1999



Road damage at Carr's Bay after Hurricane Georges, 1998



The foundations of this house at Carr's Bay were washed out during Hurricane Georges, 1998

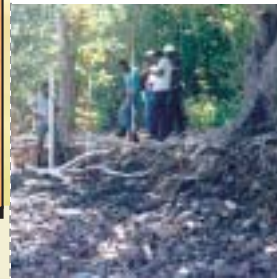
HERE TODAY, GONE TOMORROW

The table shows generalized rates of change at the measured beaches in Montserrat between 1990 and 1996. During this period most of the beaches showed erosion, a result, at least in part, of the impact of several severe hurricanes. However, most beaches in Montserrat show erosion along one part of the beach and accretion (or build-up) at adjacent sections, thus these figures must be treated as average trends.



Beach change rates in Montserrat (metres per year)

A negative rate of change (—) indicates erosion and retreat of the shoreline, a positive rate of change (—) indicates accretion or advancement of the shoreline towards the sea.



(top) Measuring the sand loss at Bunkum Bay in 1990 after Hurricane Hugo



Many of Montserrat's west coast beaches are sandy in the summer months but covered with stones in the winter months, as seen here at Bunkum Bay, 1995



WISE PRACTICES FOR A HEALTHY BEACH



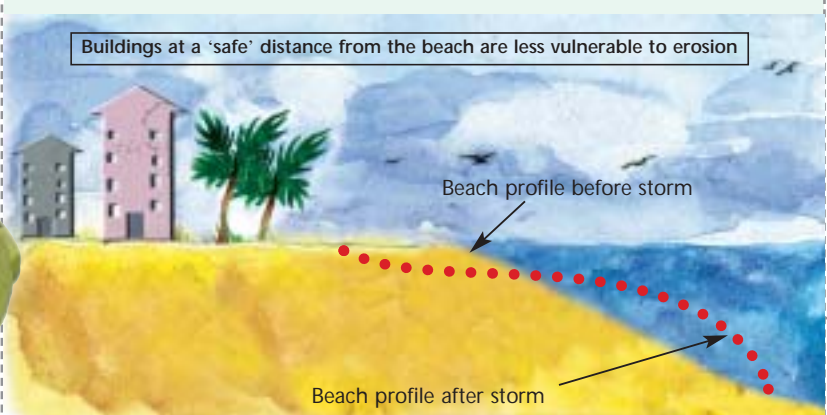
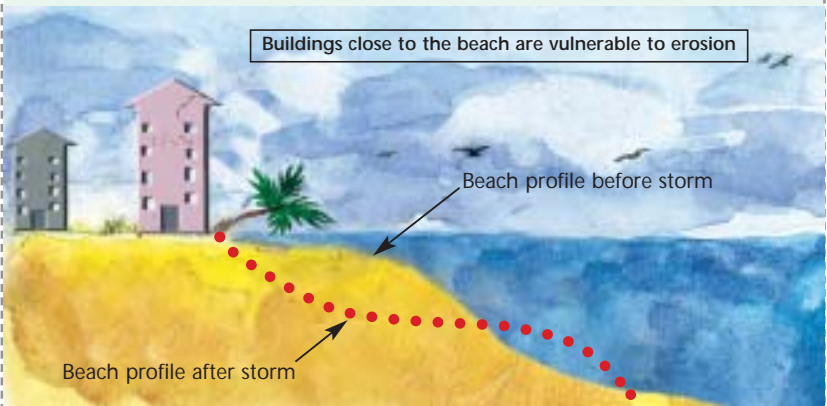
Seagrape trees, such as seen here at Fox's Bay in 1994, help to stabilise the sand as well as providing shade

The state of the beach affects everyone's lives. Montserrat faces special problems as it rebuilds its infrastructure after the volcanic activity, especially since only a few beaches are accessible in the 'safe' zone. There are no simple or universal solutions to shoreline erosion, since there are often several factors, both human and natural, contributing to the problem at a particular beach. Each beach behaves differently, so it is advisable to find out as much information as possible about a particular beach before taking any corrective action. It is necessary to consult the Ministry of Agriculture before undertaking any action at a beach.

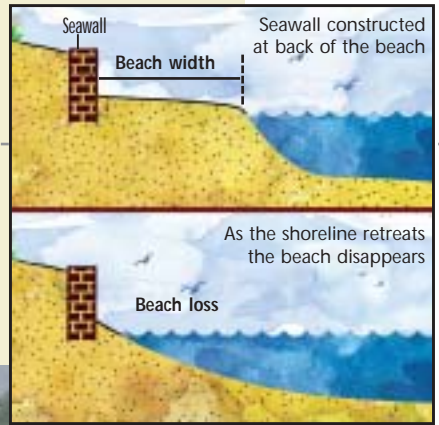
Some forces of change, such as hurricanes and winter swells are natural, and there is little we can do to stop them, yet there are ways we can help to slow down the rate of erosion:

- Planning new development so that it is a 'safe' distance behind the beach will reduce the need for expensive sea defence measures in the future.
- Revegetating beach areas beyond the reach of storm waves, and other coastal areas, with native vegetation, e.g. grasses, vines and salt resistant, deep-rooting trees, such as sea-grape.

Ensuring new development is a 'safe' distance from the dynamic beach zone, helps conserve the beach and the buildings



Rock revetments, as here in Plymouth in 1981, protect roads and buildings from wave action, but they do not promote beach build-up



(below) Groynes, such as seen here at Sugar Bay in 1989, result in sand build-up on one side, but erosion on the other side



- Resorting to 'hard' engineering structures such as seawalls, revetments and bulkheads, only when there is a need to protect beachfront property from wave action. Such structures, even with careful design, result in the loss or narrowing of the beach over time.
- Considering all other beach enhancement measures such as offshore breakwaters, groynes and beach nourishment (placing sand from the offshore zone or from an inland source on the beach) at a particular site. All such measures require careful design and environmental impact assessments, so always first consult the Ministry of Agriculture.

One of the challenges facing Montserrat is to find uses for the recently deposited volcanic material, seen here in the Belham Valley, 1999...



...So that beautiful beaches such as Iles Bay (1999) can be conserved and wisely managed



WISE PRACTICES ✓ CHECKLIST

- ✓ **Plan for existing and future coastline change** by positioning all new development (large and small) a 'safe' distance landward of the vegetation line (consult the Physical Planning Department for information on 'safe' distances).
- ✓ **Review and carefully consider ALL options** when planning ways to slow down the rate of coastline change, these should include planning, ecological and engineering measures.
- ✓ **Continue to monitor the rate of coastline change** and share the findings with all other stakeholders.
- ✓ **Coordinate an integrated approach to beach management**, by ensuring that individuals, the general public, governmental and non-governmental agencies are involved and work together.
- ✓ **Promote the concept of coastal stewardship** and the importance of conserving Montserrat's remaining beaches for the social benefit of its residents, as well as its growing tourism industry.
- ✓ **Respect the rights of all beach users.**
- ✓ **Stop the unsustainable practice of mining** sand and stones from the remaining beaches in the safe zone, and utilise alternative sources of construction material.
- ✓ **Provide for public access to all beaches** in the safe zone, and where appropriate provide facilities for beach users (e.g. parking, safety measures, sanitary facilities).
- ✓ **Carefully manage those beaches** which are important turtle nesting sites.
- ✓ **Conserve and restore vegetative cover**, both adjacent to the beach in order to stabilise the sand, and further inland to reduce sediment reaching the reefs and seagrass beds.

For more information on shoreline change in **MONTSERRAT** consult:

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For more information on shoreline change in the **CARIBBEAN** consult:

Coping with Beach Erosion
by Gillian Cambers
UNESCO Publishing, 1998
ISBN 93-3-103561-4

This booklet is a result of co-operation between UNESCO, the Caribbean Development Bank and Montserrat's Governmental agencies

To view this booklet on-line, please see:
www.unesco.org/csi/act/cosalc/brochmon.htm