

# Coastal Erosion

## NATURAL HAZARDS IN THE PACIFIC - FACT SHEET 7



### Reducing Vulnerability of Pacific ACP States

Erosion is the process where soft shorelines (sand, gravel or cobble) disappear and land is lost. Erosion generally comes in two forms; 1) A natural part of the coastal environment where a soft shore moves and changes in response to cyclic climatic conditions, and 2) Erosion can be induced by human interference of natural sand movement and budget patterns. Erosion can be slow and ongoing over many years or fast and dramatic following large storm events. Many erosion problems in the Pacific today, occur because of poor planning, inappropriate shoreline development, over crowding, beach mining for building material and due to reef degradation.



Where inappropriate development changes natural coastal processes erosion can result in property loss and huge expense in protection measures which are often unsuccessful.

### Erosion, Accretion & Dynamic Equilibrium



Dynamic equilibrium - beautiful!

On an undisturbed healthy beach the amount of sand which is washed onto the beach is about equal to the amount of sand which is washed away, this is known as **dynamic equilibrium**.



Accretion - note coconut seedlings

When extra sand is continually deposited on the beach it builds and the land gets bigger, this results in **accretion** (note young germinating coconut palms).



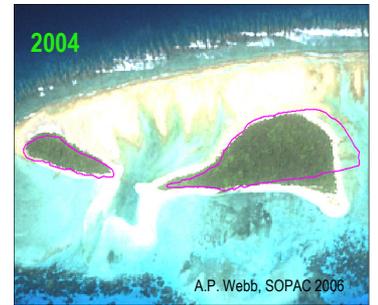
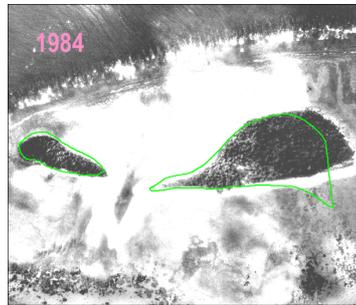
Erosion - note fallen mature palms

When sand is continually lost from the beach (**erosion**), the coast moves inland (note fallen mature coconut palms).

Most beaches naturally cycle between erosion and accretion depending on tide, current, season and weather.

### Erosion is a natural process

It is important to understand that erosion is a natural process and in many cases is accompanied by its equal and opposite process, "accretion". Put simply, sandy shorelines are dynamic and should be expected to shift and change over time, sometimes by 100's of metres! This process becomes an "erosion problem" if development is not carefully planned to avoid unstable shorelines.



A.P. Webb, SOPAC 2006

These small uninhabited and undisturbed islets are an excellent example of ongoing erosion and accretion. Note the eastern (right) shoreline position and how it has shifted over the last 20 years (coloured outlines show the comparative shoreline position). Over 70 m has been lost (erosion) on the eastern coast. However, over 100 m has been gained (accreted) on the southern coast. The overall land area of this islet has not changed significantly and the islet's environmental quality has not "suffered" as a result of these changes. This is a natural process and trying to stop this natural movement will only cause environmental, social and financial problems.

### Why is it that erosion seems more of a problem these days?



In past times, people lived in harmony with their moving coasts. Their houses could be easily moved too and shoreline homes were built in way which did not disturb shoreline processes (e.g. on stilts or pylons). People knew and avoided dangerous or unstable locations. Today, building styles have changed and homes cannot be easily moved or replaced and lack of space often results in people building in locations which are known to be inappropriate. When such buildings are situated too close to a naturally dynamic shoreline we end up with a human settlement and planning problem - The beach has always moved we just forget to plan for this movement .....

By far the best approach to erosion issues is to understand how a coastline may move and to plan for this movement when building near or developing such shorelines. Often we build first, then worry about erosion after. Such an approach often leads to property damage and huge expense trying to stop erosion. Sadly, these efforts to stop erosion often cause even more environmental problems!

# What causes problem erosion?

## ⇒ Coastal Engineering

Any development which changes how sand moves to, from or along a beach can cause erosion; these include: sea-walls, reclamation, groynes, causeways, boat channels, clearing of coastal vegetation (e.g. mangroves), changing water flow / current patterns, etc.



Seawalls



Groynes



Causeways



Boat channels



Reclamation



Building onto the beach

## ⇒ Beach Mining

Of increasing importance is beach aggregate (sand, gravel and rock) mining. As populations grow, the need for housing and infrastructure means that more and more material is being mined from our beaches. This upsets the sedimentary budget and can cause widespread, irreversible erosion.



Shovel and bag beach mining for sand and gravel.



Mechanised reef and beach mining for sand, gravel and rock.



## ⇒ Degraded reef health and productivity

Most Pacific Island coasts are protected by living barrier reef systems. These reefs produce huge volumes of sand, gravel and rock which build and maintain our beaches. Nearly all white beaches of the tropical Pacific are composed from once living reef organisms. Any disturbance to the populations, diversity or function of these reefs can result in changes to volumes of material moving to the beach and can lead to widespread erosion.



Underwater photography - Fumihito Takeda, 2005



Poor management, pollution and over exploitation of living reefs, can reduce the health and productivity of our reef systems - this in turn can reduce sand supply to our beaches - causing erosion.

## Future sea level and climate uncertainty

The IPCC (Intergovernmental Panel On Climate Change, 2007) indicates that whilst exact patterns of climate / ocean system changes are not well understood a clear trend of increasing atmospheric and ocean temperatures exists and these are accelerating. In turn, sea levels have risen during the 20th century by approximately 170 mm (about 6 1/2 inches) and are currently estimated to be rising at a rate of about 3.1 mm / year (about 1/8 inch / year).

Our natural systems such as beaches and living reefs have a limited ability to absorb and adapt to such environmental change. However, if we weaken our shorelines through inappropriate coastal development, beach mining and pollution it is likely these weakened shorelines and reefs will be less resilient. Put another way, avoiding activities which weaken our coastal reef and beach systems is an excellent way of assuring we have the best natural coastal defences to climatic stresses and uncertainty.

Protecting our reefs and beaches also has additional benefits to our communities, not only contributing to our health and wellbeing but also maintaining important economic activities such as tourism.

## What can you do about erosion?

### WHAT YOU SHOULD DO:

- Follow local building codes and zoning advice, if available .
- Plan very carefully **before** you build.
- Learn what you can **about** your coastline.
  - ⇒ *Elderly people who know the area are a good source of information.*
- Many countries have some GIS and historical mapping facilities, ask if they can show you such maps.
- Always leave an adequate distance back from the shore.

### WHAT YOU SHOULD AVOID:

- Avoid building barriers which prevent sand from moving along your beach, e.g. groyne, seawall, etc.
- Avoid building too close to an active beach.
- Avoid building seawalls unless absolutely necessary
  - ⇒ *Seawalls must be correctly designed or they will fail and cause more erosion.*
- Avoid dumping domestic waste and machinery on the beach to attempt to prevent erosion.

### IF YOU MUST BUILD NEAR OR ON AN ACTIVE BEACH:

- Consider the most extreme weather events in your area - the structure should either be movable or be able to survive these events.
- Consider your neighbours - if your building stops sand movement you will cause erosion to neighbouring areas, you may be liable for damages.
- Expect the beach to move - build on stilts so that the beach can move without affecting your structure.
  - ⇒ *Stilts also allow the natural movement of sand along the beach.*

### REMEMBER:

- The best protection against storm waves is a healthy functioning beach - it costs nothing and builds and repairs itself.