



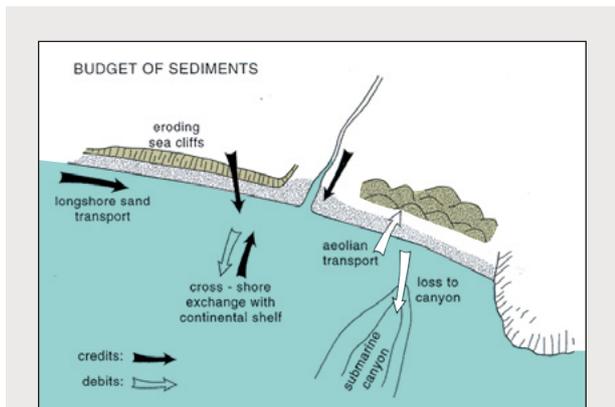
This is one of a series of fact sheets developed to accompany *Preparing for coastal change*, and provide further information on elements of coastal processes.

# Coastal erosion

This fact sheet provides information on coastal erosion, which will be affected by climate change and sea-level rise.

## A natural process

Coastal erosion is a natural process. In its natural state, the coast recedes or advances depending on sediment supply, climate and ocean conditions. Coastal *accretion* is where the shoreline builds out. Coastal *erosion* is when the shoreline retreats, either temporarily or permanently. Erosion becomes a hazard when it threatens people's activities or settlements or other things they value.



**Figure 1:** Elements of a typical sediment budget

Typical sediment **sources** to nearshore coastal systems:

- longshore transport – sediment moves into the area along the coast
- onshore transport – sediment is brought to the coast from further out at sea
- input from rivers – sediment flows down rivers and is deposited along the coast
- sediment is transported onto beach by the wind (aeolian transport)
- eroding sea cliffs deposit sediment on the coast
- beach nourishment – sediment lost through longshore drift or erosion is replaced from outside sources
- dune vegetation traps sand.

Typical sediment **losses** from nearshore coastal systems:

- longshore drift moves sediment out of the area
- wind blows sediment away from beach
- sediment is transported offshore by storms, swell, currents, etc
- abrasion – rock surfaces are ground away by other rock or sand particles carried by the wind
- sand is extracted
- waves bouncing off hard defences (eg, structures such as sea walls) carry sediment away
- dams and reservoirs trap river sediments, preventing them from reaching the coast.

Source: Derived from Komar P. 1998. *Beach Processes and Sedimentation*. New Jersey: Prentice-Hall Inc.

## Coastal change has many causes

Changes to coastlines are caused by many different and interconnected factors:

- *hydrodynamic driving processes* – are the forces of moving water. These include swell, sea waves, tides, storm surge, currents and the effects of climatic variability – for example, the El Niño-Southern Oscillation and the Interdecadal Pacific Oscillation. Climate change may affect each of these processes
- *geomorphology* – the coast's physical features (such as beaches, barriers and the types of sediment present), and its geological features (such as headlands and islands) and how these interact with the *hydrodynamic driving processes* described above. An example is sand spits, which are often unstable and prone to large and long-lived changes
- *sediment budget* – the rate at which sediment comes and goes from the coast, and whether this is balanced (see figure 1)

- *vertical land movement* – whether the coast is rising or subsiding
- *sea-level rise*.

## Predicting coastal change is difficult

Because many factors are involved in coastal erosion, and they are not all present all of the time, shoreline change in any particular location is *not* consistent year after year.

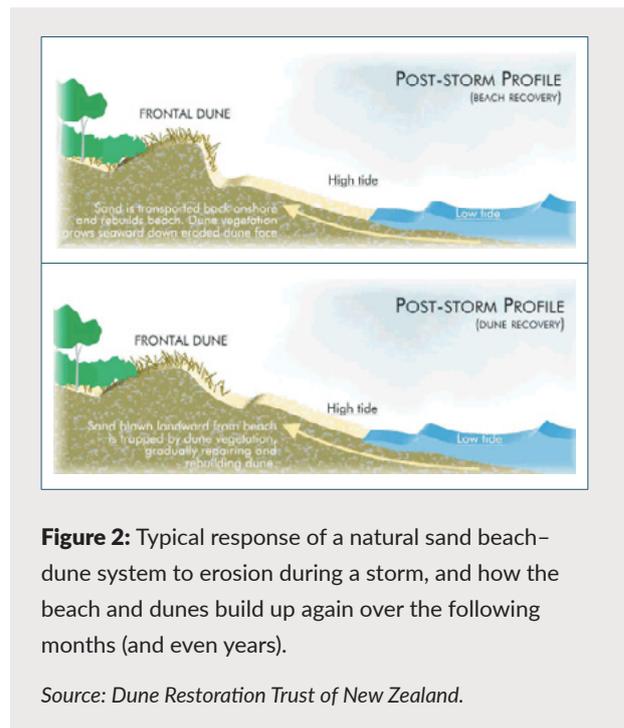
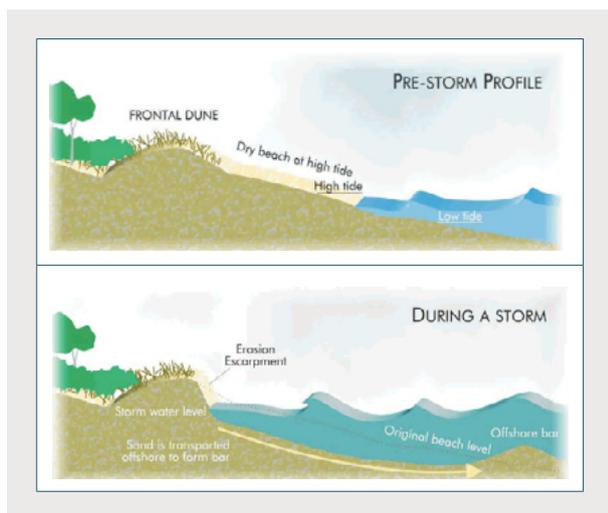
Erosion and accretion can occur in cycles, particularly on sandy coastlines. Changes can happen seasonally, annually, or over several decades. Erosion and accretion can also be caused by particular events such as storms (figure 2) – there may be little change for many years until a storm (or a sequence of storms) causes rapid erosion.

Even over short distances of coast, patterns of erosion and accretion can vary, producing erosion hotspots, for example linked to the occurrence and movements of nearshore sandbars.

Because of this variability, coastal erosion is typically divided into two timescales: *short-term fluctuations* (days to a few months) and *long-term trends* (from seasonal, to decades or centuries).

The variability in when and how coastal erosion happens makes it very difficult to estimate what may occur at a specific place.

Data and historic information about shoreline changes and sediment budgets are needed, along with an understanding of how vulnerable the coast is to climate change.



**Figure 2:** Typical response of a natural sand beach–dune system to erosion during a storm, and how the beach and dunes build up again over the following months (and even years).

Source: *Dune Restoration Trust of New Zealand*.

## People’s influence on the coast

What we do can have a big impact on that natural ebb and flow of coastal sediments. Our impacts can markedly alter or control natural processes by:

- changing how sediment flows from catchments to the coast, via rivers and streams. For example, by our land-use practices, urbanisation, building dams and extracting water for irrigation
- dredging tidal entrances and harbour channels, which affects how sediment moves
- removing sand or gravel from nearshore areas
- building coastal protection, such as groynes, breakwaters, artificial reefs and seawalls. This affects the natural buffering, movement and distribution of sediments on beaches and in shallow coastal waters
- adding sediment to beaches and shallow coastal waters (beach nourishment)
- permanently modifying the coast in ways that affect the natural movement of beach and nearshore sediments. This includes removing dunes, removing or changing vegetation, reclaiming land, and building wharves and marinas.

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