

**COASTAL RESEARCH**

**The shoreline erosion problem: lessons from the past**

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*How can we deal with the natural process of coastal erosion when it becomes a problem? And how can research help? An overseas expert presents his view of the issues in relation to New Zealand.*

**Teachers:**

*for ideas on how to use this article in the classroom, visit: [www.niwa.co.nz/pubs/wa/resource.htm](http://www.niwa.co.nz/pubs/wa/resource.htm)*

AROUND THE WORLD there are some spectacular examples of the damage caused by retreating shorelines. And there are equally spectacular examples of the expense to which some governments will go to hold their shorelines in place. More than 80% of the world's shorelines are eroding at rates varying from centimetres to metres per year. In undeveloped areas, of course, a retreating shoreline is no problem. Usually we are not even aware that it is happening, though often there are signs of erosion such as fresh cliffs in sand dunes or trees that have fallen onto a beach. Erosion only becomes a problem when a human-made structure is threatened.

**Why are shorelines retreating?**

Beaches exist in a dynamic equilibrium involving four factors:

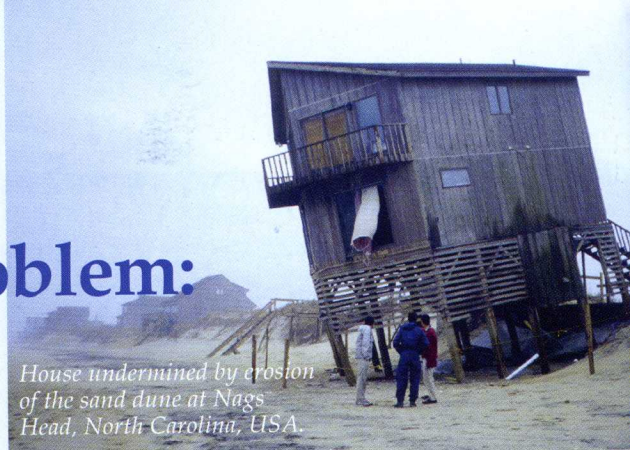
1. the supply of sand to a beach;
2. the wave energy (related to wave height);
3. sea-level change;
4. location of the shoreline.

**Sand supplies**

Sand is food for beaches. Sand sources include rivers, eroding bluffs, adjacent beaches and the continental shelf (seabed sands are combed ashore by fair-weather waves). The amount of sand available can vary a lot. On the west coast of the North Island rivers feed black sand to the coast from the rocks of Mt Taranaki. Towering Pleistocene sand cliffs crumble into the sea and this light-coloured sand is driven far up the coast

so that the beaches are less black to the north. In contrast, on the east coast of Northland and Auckland, rivers and cliffs provide only a trickle of sand to the coast. Headlands cause the sand to get locked up in small bays.

Human activities can affect the sand supply. Extracting sand near the shore can upset the balance of erosion and accumulation in bays where sand supplies are meagre. Damming rivers and extracting water for irrigation changes the flow condition in the rivers and supplies of gravel and sand to the Canterbury coast. Construction of ports which project



*House undermined by erosion of the sand dune at Nags Head, North Carolina, USA.*

offshore, such as Taranaki, alter the patterns of sand transport along the shore.

**Waves**

Waves, combined with tides and wind, are critical components of beach evolution. The higher the waves and the greater the angle at which they strike a beach, the larger the volume of sand carried. During storms, waves move sand offshore and flatten the beach. Most often shorelines retreat in jumps, each jump corresponding to a storm. Typically, after a storm sand builds up again, though recovery is much more gradual than erosion. However, when viewed over time spans of a few decades, storms are a constant and really are not the fundamental cause of the world's eroding shorelines.

**Sea-level rise**

Sea-level rise may underlie much of the world's coastal erosion. In New Zealand sea level is currently rising at a rate of about 15 cm per century. The rising sea brings each storm a tiny increment farther inland than the preceding storm. A huge debate is underway about the origin of sea-level rise and likely movement in the future. Sea-level rise is due primarily to the thermal expansion of sea water and melting of glaciers and ice caps. (New Zealand's glaciers are almost the only ones that are advancing at present.) Because New Zealand is an area with lots of volcanic and earthquake activity, it is a certainty that the sea-level rise is not the same on all beaches here.

**Shoreline location**

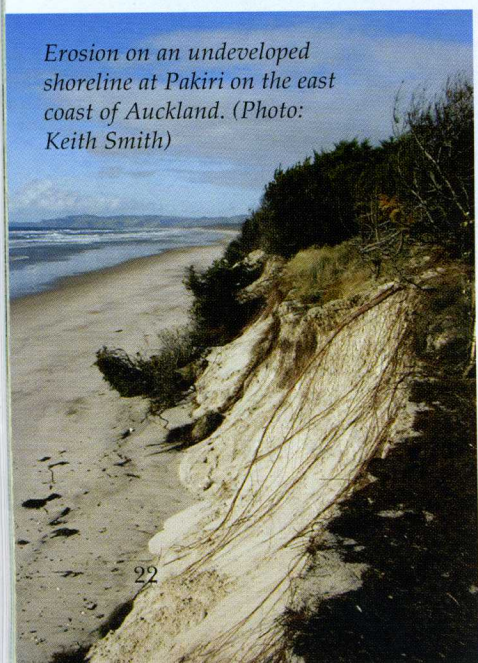
This is the visible part of the problem. Shorelines move back and forth between storms and periods of fair weather. It is when the shoreline movement impacts on human-made structures that it becomes a beach erosion problem.

**Managing shoreline erosion**

There are three approaches to erosion management.

**Hard stabilisation**

This is holding the shoreline in place using fixed hard structures, such as walls perpendicular to the shoreline (groynes, as at Hokitika), or sea walls parallel to the shoreline (for example, Milford



*Erosion on an undeveloped shoreline at Pakiri on the east coast of Auckland. (Photo: Keith Smith)*

