

Our changing coastline

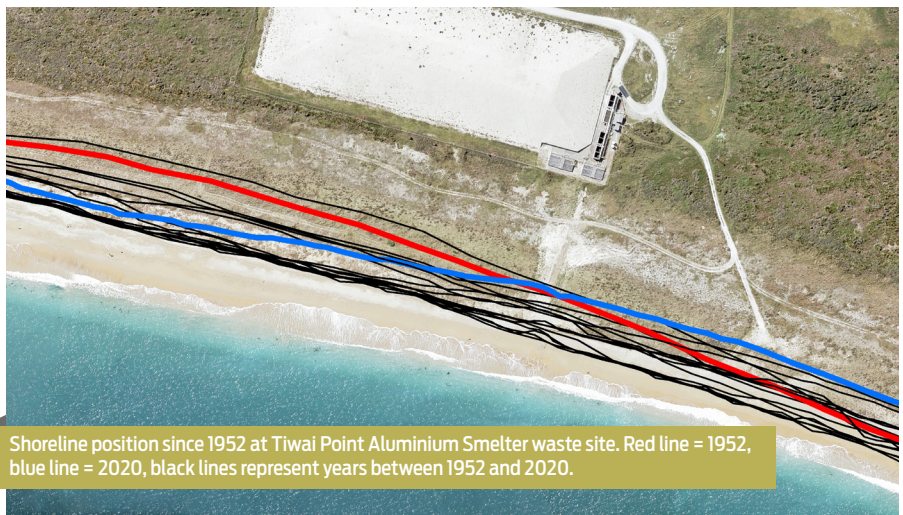
Researchers in the Coastal programme of the Resilience to Nature's Challenges National Science Challenge are developing new techniques to build a detailed understanding of coastal change that will give greater certainty about our changing coastline.

BY GAVIN MCCLEAVE, POSTGRADUATE STUDENT, UNIVERSITY OF OTAGO

RISING SEA LEVELS and increasing weather extremes are changing Aotearoa New Zealand's coast, threatening the places we live, the infrastructure we rely on and sites of deep cultural significance to Māori. There has been limited information available to communities and decision makers about the current state of our coastlines and likely future changes, despite the need to adapt to the changing coastal hazard risk.

Researchers are creating a national coastal-change database to help anticipate future shoreline changes. They will also develop a new suite of technical guidelines and policy advice for planners and decision makers about adapting to coastal change.

'Aotearoa New Zealand has a long and complex coastline with landforms that are exposed to coastal erosion and flooding hazards in different ways,' says Associate Professor Mark Dickson of the University of Auckland – co-leader of the Coastal research programme. 'Understanding historical coastal



Shoreline position since 1952 at Tiwai Point Aluminium Smelter waste site. Red line = 1952, blue line = 2020, black lines represent years between 1952 and 2020.

change is crucial in our efforts to anticipate the future effects of sea-level rise and to help us make better decisions about the type of adaptation measures that we will need.'

The Coastal programme incorporates three projects:

- New Zealand's Changing Coastline - mapping how our coastline is changing.
- Coastal Flooding - identifying the implications of our current and future coastal flooding hazards and risks.
- Coastal Adaptation - identifying how

Aotearoa New Zealand should prepare for our changing coastline.

Mapping coastal change

The last nationwide mapping of coastal erosion rates was completed in 1978. The New Zealand's Changing Coastline project is recording a sequence of detailed snapshots of the country's entire 15,000 km coastline in a geo-referenced database to understand the current state and nature and causes of past changes. The researchers use high-resolution satellite imagery and aerial photography archives to precisely map changes and identify erosion hotspots.

The researchers have mapped 90 years of changes to over 3,000 km of the Northland coastline and have begun to map the South Island's coastline.

Coastal flooding

'We have a fairly good understanding of storm surge and sea-level rise on our open coast and how these will change over the next 50 years,' says Professor Karin Bryan, Director of the University of Waikato's Environmental Research Institute, co-leader of the Coastal Flooding project. 'However, our coast is complex, with narrow inlets, estuaries, bays and fiords. Our next challenge is to translate our open coast predictions into the more-enclosed environments.'

'Another important aspect of our work is to understand how our decisions might change the storm surge hazard,' says Professor Bryan. 'We often assume that our attempts to protect ourselves from the ocean can only lead to improved outcomes. However, building stopbanks, removing wetlands and draining low-lying land can actually make the flooding hazard worse.'

Estuaries

A key area of focus for the Coastal Flooding researchers is our changing estuaries.



Akuhata Bailey-Winiata is researching the impact of coastal change on Māori communities.

'Aotearoa New Zealand has over 300 estuaries,' says Dr Shari Gallop (Ngāti Maru, Te Rarawa) of the University of Waikato's Environmental Research Institute. 'It's a surprise to many people that most of our largest cities are built around or near estuaries. Auckland is built around multiple estuaries.'

Estuarine areas often have great commercial, recreational, environmental and cultural significance and are especially vulnerable to coastal change. Climate change is causing sea levels to rise and is also increasing the number of extreme weather events that can cause surface flooding and rivers to burst their banks. Estuarine areas are caught in this flood sandwich between rising sea levels and flooding from rain.

Researchers in the Coastal Flooding project are studying two shallow estuarine areas - Tauranga and the Firth of Thames. They aim to model the changes and the factors causing them in detail and will then use machine learning to apply the computer modelling to other estuaries for which there is limited historical data.

Coastal Māori communities

Akuhata Bailey-Winiata (Te Arawa, Ngāti Tūwharetoa, Tūhoe), from the University of Waikato, is researching the impact of coastal change on Māori communities as part of the

Coastal Flooding project. 'Historically, Māori often favoured settling in coastal sites for the plentiful kaimoana and ready access to coastal transport and trade,' he says. He has identified 191 marae that lie within 1 kilometre of the coast. His work is also looking at urupā - traditional burial sites - and council-owned cemeteries near the coast in Bay of Plenty.

Bailey-Winiata says the importance of marae to the spiritual and mental health of the communities they serve should not be underestimated. 'Marae embody the Māori concept of tūrangawaewae. They are places of connection - connection to the land, ancestors, community and whānau.'

Many marae are in remote rural areas where there is limited infrastructure and can be crucial to the wider local communities in times of need, such as the Kaikōura earthquake, when the marae opened its doors to the stricken community and travellers.

Bailey-Winiata's research found that many coastal iwi and hapū accept the prospect of losing marae and other wāhi tapu (sacred places) to the rising seas and coastal change. Some are already working with local government to find solutions, and two hapū have relocated their marae.

Greater certainty

We know that sea levels are rising and the coastline is changing. The research of the Resilience National Science Challenge Coastal programme will help decision makers, planners and communities anticipate future coastal change. The work aims to make Aotearoa New Zealand more resilient by providing a world-leading toolbox of mitigation strategies, guidelines and policy advice for locally appropriate coastal adaptation. ◀

For more ▶ See the article on pages 54-55.

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