

CLIMATE RISK AND RESILIENCE IN DUNEDIN

▶ A SUMMARY OF DUNEDIN'S PART IN
THE OTAGO CLIMATE STORY



Otago
Regional
Council

 **Aukaha**



TE AO
MĀRAMA INC.



About this summary

Climate change is already affecting the hills, plains, low-lying areas, coast, and estuaries across Dunedin. Heavier rainfall, a changing coastal environment, and warmer days and nights are placing more pressure on our infrastructure, services and way of life.

Dunedin can continue to thrive in the coming decades if we act now to understand and adapt to these changes. This work will be challenging, but done well, it can help build climate-ready communities where people, nature, culture and the economy are resilient.

The Otago Climate Change Risk Assessment (2021) describes the main risks that the Otago region, including Dunedin, may face over the coming decades and what they could mean for everyday life, local businesses and the services communities rely on.

This summary describes Dunedin's part in Otago's climate change story, including Kāi Tahu mana whenua knowledge and experiences. It explains how the climate across Dunedin is changing; what these changes mean for Dunedin's communities, infrastructure, services and natural environments; and what is being done today to build resilience.



Toroa / northern royal albatross

Cover image: St Clair, Ōtepoti Dunedin



Our place

Otago's communities, landscapes, infrastructure and ecosystems are all experiencing the effects of climate change. From the mountains to the sea, climate change is reshaping the systems that support the environment, people, businesses and services communities rely on.

Dunedin's climate change story is shaped by its harbour, hills, wild coastline and the productive inland plains that connect the rural townships. From the Otago Peninsula and the harbour edge to the inland valleys and plains of Middlemarch and the Taieri, people's lives are closely connected to the land, water and weather.

These places support everyday life in many ways. Dunedin's coast and Otago Harbour are important for culture, recreation and the local economy, with Port Chalmers providing a gateway for regional freight and international visitors. The central city's businesses, schools, university, and health services, and closely connected rural areas, all depend on reliable roads, water systems and well-functioning neighbourhoods.

As Dunedin continues to grow and invest in its future, climate change will shape where and how we build, maintain infrastructure and support communities. Planning ahead, through careful long-term planning and investment, creates an opportunity to make Dunedin safer, healthier and more resilient for future generations.

Ki uta ki tai | From the mountains to the sea

Kāi Tahu mana whenua hold traditional customary authority and maintain contemporary relationships within this area, determined by whakapapa (genealogical ties), resource use and ahikāroa (the long-burning fires of occupation).

Wai (water) and waka (canoes) feature prominently in Kāi Tahu oral histories. Storms described in oral histories battered and capsized ancestral waka such as Te Waka o Aoraki, Araiteuru and Tākitimu. Neither atua nor tipuna were exempt from the turbulence of a changeable environment, and the pūrākau (stories) remain to remind us of the consequences.

According to Kāi Tahu cosmology, atua shape the balance between land, water, climate and people. A changing climate reflects a shift in the balance between these atua and their domains, which has wide-ranging and severe impacts on us living in Te Waipounamu.

He taura whiri kotahi mai anō te kōpunga tai nō i te pū au. From the source to the mouth of the sea, all things are joined together as one.

Ki uta ki tai is a philosophy that has become synonymous with the way Kāi Tahu think about te taiao (the natural world). While commonly interpreted as 'from the mountains to the sea', ki uta ki tai is about standing on the land and knowing the effects, both positive and negative, in every direction. This ethos reflects the mātauraka (knowledge) that all environmental elements are interconnected and must be managed as such. It is a way of understanding the natural environment, including how it functions, how climate changes may impact it, how people relate to it and how te taiao can be looked after appropriately.

Our climate, now and in the future

Dunedin's climate, both today and in the future, is closely linked to its coast, harbour, hills and low-lying areas, and how these interact to affect the things that are relied on, like water supply.

Spanning from the tussock grasslands of the Lammermoor Range to the world-renowned wildlife reserve of Pukekura / Taiaroa Head, Dunedin covers a diverse landscape. Different parts of Dunedin will experience climate change differently due to their location and how exposed they are to changes in their local environment. However, many communities are already seeing the effects of heavier rain and changing coastal conditions.

Some places are more exposed than others because of how Dunedin has grown around low-lying land, steep hills and the coast. Low-lying areas such as South Dunedin and the Lower Taieri face flooding from a mix of heavy rain, high groundwater, coastal influences, and drainage system capacity being exceeded. Coastal areas are also affected by erosion and rising sea levels, while steeper hill areas, like the Otago Peninsula and Ōtepoti Dunedin's hill suburbs, can be prone to slips.

Over time, Dunedin is expected to become warmer, with fewer frosts and more intense rainfall. Sea levels will keep rising, and some dry periods may last longer. These changes will put more pressure on homes, infrastructure, our iconic wildlife and the places people care about, making it important to plan ahead.

Emergency management in Kāi Tahu whānau

Severe weather events across the lower plains are already increasing vulnerability to isolation and disruption. Power outages, road damage, and blockages are particularly common in rural areas, heightening the risk of disconnection from critical lifelines, essential services, communication disruptions and key resources.

During previous flood and wind events, access to food has been a significant concern, with road closures disrupting supply chains and limiting the ability of whānau to access and gather natural food resources. Mahika kai areas across the lower plains, including rivers, wetlands, and raupō habitats, can also become unsafe during and after these events due to increased sedimentation and the mobilisation of contaminants. Strengthening the resilience of lifeline infrastructure, protecting and restoring mahika kai, and supporting community-led adaptation approaches will be critical to reducing these risks over time.

Communities across the lower plains do not all have the same ability to prepare for, respond to, and recover from climate-related hazards. Adaptation responses therefore need to recognise the different capacities, resources, and support needs of whānau and sectors across these areas. Some communities will require targeted investment, technical expertise, and sustained support to build resilience and ensure equitable outcomes.

As Mana Whenua Emergency Facilitators working across the takiwā, we believe there is no one solution, no one agency, no one area and the strength remains in our collective Kotahitanga.



Mauriri Kimura-McGlinchey
Mana Whenua Emergency Facilitator | Araiteuru

Angie Hopkinson
Mana Whenua Emergency Facilitator | Murihiku

Key climate change risks in Dunedin*

Risks to transport and supply chain infrastructure, including Dunedin Airport, the port, and SH1 from coastal and inland flooding, extreme weather and sea-level rise.



Risks to coastal ecosystems, farmland, homes, buildings, and important infrastructure in low-lying areas from sea-level rise, coastal flooding, erosion and rising groundwater.



Risks to Dunedin's three waters networks, infrastructure, buildings, businesses, and communities from more frequent and severe flooding, storms and changing temperatures.



Risks to Dunedin's businesses, tourism, primary industries, infrastructure providers, and households from more frequent damage, disruption, and increasing costs associated with climate-related hazards.



Risks to coastal and marine ecosystems, fisheries, aquaculture, and related businesses from warming ocean temperatures, marine heatwaves and ocean acidification.



*Key risks summarised from the Otago Climate Change Risk Assessment (2021).

Sea-level rise and coastal storms

Ranging from Te Hakapupu / Pleasant River to near Taieri Mouth, many of Dunedin's low-lying coastal households, roads, farms and wetland ecosystems are sensitive to changes in sea level, groundwater rise, storm surges and erosion. Large parts of Dunedin, like Karitāne, Waikouaiti and Waitati sit near or below sea level and rely on drainage systems that are closely linked to coastal conditions, so even small increases in sea level will affect how water moves through the area.

South Dunedin is a well-known hazard area, where changing coastal conditions already affect groundwater levels and drainage. Here, water doesn't drain away and has to be pumped out. So, rainfall, especially during high tides, can more easily exceed stormwater drainage capacity and cause surface flooding.

Heavier rainfall and flooding

Heavier rain is likely to become more common across all areas of Dunedin over time. As these events continue to become more frequent and intense, our stormwater drains and flood protections can be overwhelmed, causing flooding of streets, homes, businesses and farms.

Heavy rain can also put pressure on Dunedin's hill suburbs, coastal and peninsula communities. In some places, very wet ground can lead to slips, damaging homes, roads and important services. For communities living on or below these slopes, particularly those along the Otago Peninsula, slips during heavier rainfall can block important transport routes, disrupt travel and isolate households.



St Clair cliffs

▼ KEY CLIMATE CHANGE RISKS CONTINUED

Warmer lands and sea

Climate change is already putting pressure on Dunedin's natural environment by warming the ocean and increasing flooding and runoff into sensitive coastal ecosystems during storm events. These changes are already affecting Dunedin's coastal wetlands and marine ecosystems that native wildlife and mahika kai depend on.

For iconic species like the hoiho / yellow-eyed penguin, warmer seas and changing marine food sources are making it harder to find food and survive, while also increasing the impact of other threats, such as habitat loss, disease and human pressure.

Planning for a changing coastline

The St Clair – St Kilda Coastal Plan | Whakahekerau–Rakiātea Rautaki Tai is helping Ōtepoti Dunedin prepare for a changing coastline shaped by coastal erosion, sea-level rise, stronger storms and climate change over time. The plan was developed to look ahead over many decades and to balance the need to protect public spaces, infrastructure, recreation, access, wildlife habitat and cultural values along the coast. It is designed as an adaptive plan, meaning actions can change over time as conditions change and as more is learned about future coastal hazards.

A key part of this work has been listening to the community and mana whenua about what matters most along the St Clair and St Kilda coastline. Through surveys, workshops, beach walks, art-based engagement and other public input, the plan has brought together community values, such as recreation, beach access, safety, dune protection, natural character and environmental restoration.

The plan also includes practical resilience measures that work with natural coastal processes, not just hard structures alone. These include ongoing coastal monitoring and improved dune management to manage vulnerable areas, such as the old landfill behind Middle Beach.



St Clair and St Kilda beaches



What matters most?

Reliable water supply

Dunedin's water supply is expected to face increasing pressure from climate change, with growing risks from rising sea levels, floods and hotter temperatures. More frequent hotter, drier periods will place more strain on water sources, like Deep Creek and Deep Stream, while heavier rainfall, flooding, fire and sea-level rise can damage water infrastructure or affect water quality. Across the Otago region, Dunedin has by far the highest proportion of water supply pipes exposed to coastal flooding.

As climate change makes it harder to provide safe and reliable drinking water, this can create wider impacts for public health, households, businesses, farming and community wellbeing. Planning ahead is important to protect source catchments, strengthen infrastructure, manage demand, and reduce the risk of future water shortages or disruptions.

Resilient transport infrastructure

Dunedin's roads, rail lines, port links and airport access are expected to face growing risks from climate change, especially from heavier rainfall, flooding, sea-level rise, coastal erosion and slips. Low-lying and coastal areas, such as Mosgiel and the Taieri Plain and parts of State Highway 1 north and south of Ōtepoti Dunedin, are particularly exposed to more frequent flooding, disruption and damage.

Damage or disruption to Dunedin's roads and rail can affect much more than travel times. Flooded roads, damaged bridges, closed rail lines, or disrupted port and airport operations can make it harder for people to get to work, school and healthcare. It can also interrupt freight, prevent the delivery of food supplies and isolate households, particularly communities with limited road access like Aramoana. Continuing to strengthen key routes, improve drainage and flood protection, and manage coastal risks is important to make sure Dunedin communities have safe, reliable connections during and after extreme weather events.

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Safe homes and communities

Climate change will make it harder to keep some Dunedin homes, buildings and public spaces dry, safe and usable. Heavier rain, rising seas, higher groundwater and coastal erosion will increase the chance of flooding and damage, especially in low-lying areas, such as South Dunedin, the Taieri Plain and other coastal communities. In these areas, more frequent flooding can leave long-lasting problems, such as dampness and damaged foundations.

These risks are not just about property damage. When homes are flooded or become harder to heat, repair or live in, the impacts can flow on to affect household costs, health and people's sense of security. Parks, reserves, community facilities and heritage places are also at risk from flooding, erosion and rising groundwater, impacting the places people value and rely on. Preparing for these changes will require careful choices about where and how Dunedin develops, improving drainage and flood protection, and supporting residents, especially those with fewer resources, to adapt over time.

Our coastal identity and economy

Dunedin's beaches, harbour and coastal areas are under growing pressure as sea-levels rise, coastal erosion increases, storms become more damaging, and marine heatwaves and ocean acidification affect coastal and marine life. Dunedin's estuaries, dunes, wetlands and kelp forests are already under threat and increasingly vulnerable.

As the coastal environment changes, so too could the important wildlife and livelihoods that depend on it. Fisheries, tourism, recreation, heritage sites and access to mahika kai are at risk from more frequent damage, disruption, declining water quality and the loss of valued coastal landscapes. These impacts create real costs for Dunedin's coastal communities and businesses. Restoring coastal habitats, protecting cultural and heritage values, and making long-term choices about where and how coastal activities continue will be important for keeping Dunedin's coastal identity strong in a changing climate.



View from the Rock and Pillar Range



The changing coastal environment

“The fact that we, as kaitiaki, are in the coastal environment daily means that we can see changes happening over time. This constant presence is really important for our people because it means that we are not able to turn our backs on what is happening out there.

We are seeing an increase in sedimentation, the impacts of climate change, and a reduction of freshwater inputs into our saltmarshes. We have also seen an increased frequency of marine heatwaves, and invasive species like gorse, lupins, and undaria doing better than our native species.

The impacts of climate change, particularly flooding and sea-level rise, and the vulnerable location of infrastructure, is also adversely affecting our mahika kai practices and our ability as mana whenua to connect to the environment.”

Brendan Flack (Kāti Huirapa Rūnaka ki Puketeraki)

He waka eke noa | We are all in this waka together

Kāi Tahu mana whenua often perceive climate risk and climate change through a lens informed by te ao Māori values and perspectives.

An example of a Kāi Tahu-led approach to climate risk assessment is provided by the South Dunedin Future Mana Whenua Risk Assessment Report, which used core values of mana, mauri, whakapapa and tapu/noa to frame a range of specific risks. While framed as risks to mana whenua values, these also encompassed a broad understanding of risks to South Dunedin, including wider environmental, social and economic risks.

Tying this back to the ki uta ki tai philosophy, climate change is viewed by Kāi Tahu as a disruptor to interconnected systems. Only by bringing a holistic approach in responding to all types of climate risk will our society achieve a fair and lasting transition to a climate-safe future that keeps our collective waka upright and afloat.

What is being done?

Kāi Tahu, councils, businesses and community groups are taking action today to respond to and prepare for climate change in the Dunedin area.

Work is underway to strengthen resilience through initiatives such as native planting projects, community resilience programmes and efforts to strengthen local energy resilience.



Planning for South Dunedin's future

Dunedin City Council and Otago Regional Council are working together on South Dunedin Future, a long-term plan to help one of the city's most climate-vulnerable areas adapt to flooding, rising sea levels, rising groundwater and heavier rainfall.

Restoring Dunedin's coastal habitat

The Yellow-eyed Penguin Trust's 'From Seeds to Trees' project is restoring coastal shrublands and wetlands with native plants to create safer habitat for hoiho / yellow-eyed penguins and other wildlife.

Making room for water in Dunedin

Some of Dunedin's future flood-resilience options involve using streams, wetlands, parks, roads and other open spaces to safely direct or store floodwater during major storms. This approach combines infrastructure with nature-based solutions to help protect homes, businesses and essential services.

Enabling citywide resilience

Dunedin City Council is working to develop a citywide adaptation plan for Ōtepoti Dunedin to enable a more effective citywide response to the current and anticipated impacts of natural hazards and climate change.

Planning for reliable and safe water

Dunedin City Council has been working in partnership with mana whenua over the past five years to create a robust plan to keep Dunedin's drinking water, wastewater and stormwater services reliable, safe and affordable for the next 50 years and beyond.

Dunedin Coastal Catchments

A Catchment Action Plan is being developed for Dunedin's coastal catchments to help protect, enhance and restore native biodiversity and freshwater quality across these areas.



Outram floodbank