



# TE ĀHUARANGI CLIMATE

## INTRODUCTION

Climate change is one of, if not the biggest, environmental challenges we face. Observed increases in temperature since the mid-20th century are now having measurable effects in many parts of the world including New Zealand. While we are uncertain about the pace and scale of change, we do know that a changing climate is likely to affect our economy, environment and way of life, and that this must be addressed with urgency.

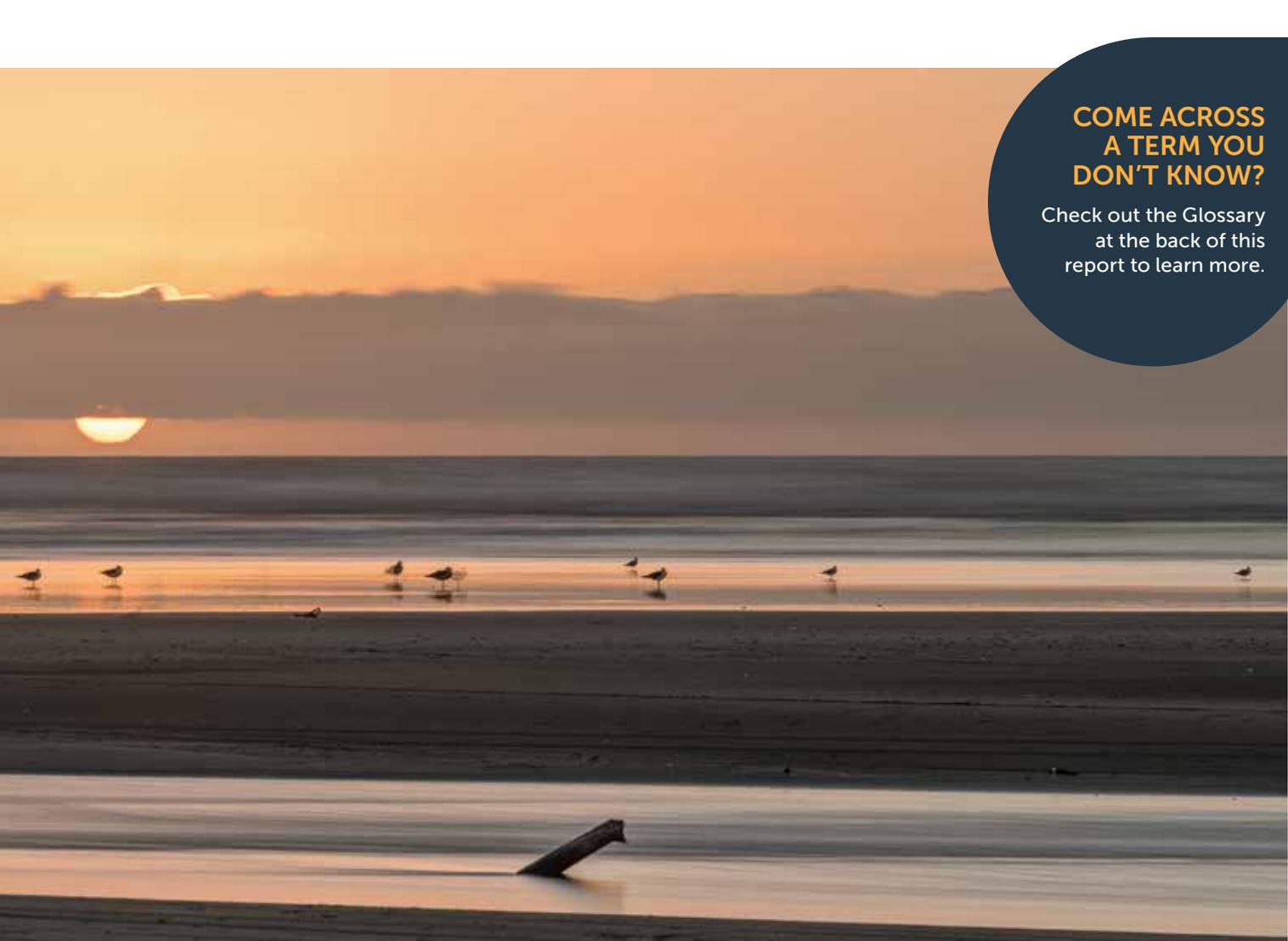
In the Horizons Region, a changing climate is likely to lead to changes in land-use suitability and impacts on primary production. Changing weather patterns, such as a warmer climate, may provide new opportunities for horticulture or cropping in some areas of the region; other impacts may be more problematic, such as an increase in the frequency and magnitude of rainfall and flooding events.

Horizons recently engaged NIWA to downscale global and national climate models to investigate climate change scenarios for the region. This found

that climate change could result in both positive and negative effects for the Horizons Region.

The region is likely to experience warmer winters with fewer frosts, but hotter summers will bring increased risks of heat stress and drought.

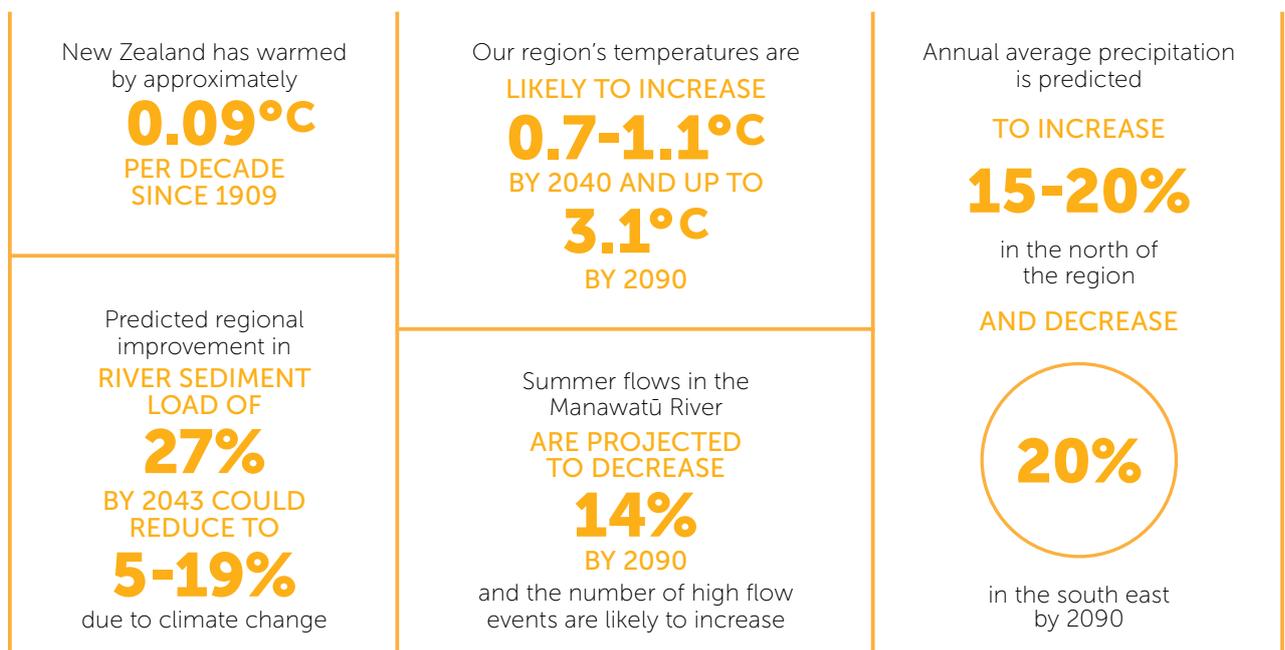
The introduction of new pests – or more favourable conditions for pests we already have – is likely to be an ongoing challenge, along with the possible introduction of subtropical diseases. Species that are already under threat or are at the limit of their climatic range may struggle to survive.



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A TERM YOU  
DON'T KNOW?**

Check out the Glossary  
at the back of this  
report to learn more.

The effects of rising sea levels are the focus of much of the national adaptation conversation. Locally, the effects of sea-level rise on flood protection in Whanganui (Anzac Parade) have been explored and climate research is a strong focus for local iwi. Climate change has been identified as a significant issue in Horizons' 30-Year Infrastructure Strategy, and in 2018, we introduced a dedicated research programme to investigate the impacts of climate change in our region.



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# WHERE WE'VE COME FROM

Since 1909, New Zealand has warmed by  $0.09 \pm 0.03$  degrees Celsius ( $^{\circ}\text{C}$ ) per decade.

This has resulted in more extreme fluctuations in rainfall and temperature and an average rise in sea level of  $1.7 \pm 0.1$  millimetres per year since 1900.

Locally, an upward trend in mean temperature is apparent at the long-term climate monitoring site at Whanganui (Figure 1).

To date, international efforts have focused on limiting global warming to no more than two degrees – mitigating climate change. The Paris Agreement, adopted in 2015 and signed by New Zealand and 195 other countries, provides for parties to set their own targets, known as Nationally Determined Contributions (NDCs), to

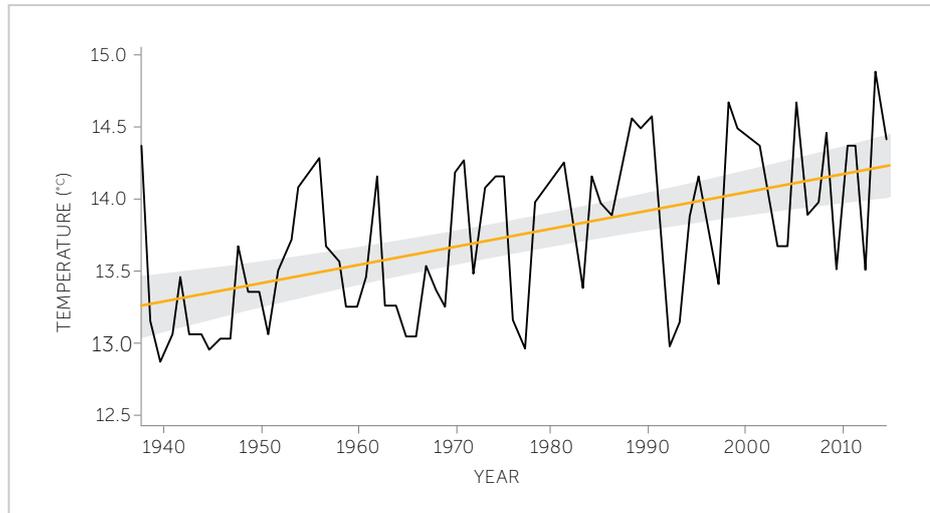


Figure 1: Annual temperature for Whanganui from 1938 to 2014. The orange line removes the year to year variability and shows an upward long-term trend; the grey shading shows the 95% confidence interval. Image courtesy of NIWA, 2016

reduce global greenhouse gas emissions.

NDC, which comes into effect from 2021, is a net reduction in emissions to 30 per cent below 2005 levels by 2030. This represents a reduction of approximately 16.6 million tonnes of carbon dioxide equivalent, to be

achieved through a combination of reduction in emissions and offsets (eg. forestry). Achieving this target would mean a significant step-change in mitigation effort; New Zealand's net emissions increased by 55 per cent between 1990 and 2005 and have likely continued to drift upwards since.

## CLIMATE

# WHERE WE ARE NOW – CURRENT PROJECTIONS

## CLIMATE CHANGE AND VARIABILITY IN THE HORIZONS REGION

It is almost certain that continued emissions of greenhouse gases will cause further warming and climatic change. Modelling enables us to explore the potential effects of these emissions on our region. Because there is much we do not yet know (for example, what mitigation measures might be put in place locally, nationally, or internationally, in the future), we need to consider a range of different possible scenarios.

Scenarios for New Zealand have been generated by NIWA scientists and are based on downscaling from 2013-14 global climate modelling by the Intergovernmental Panel on Climate Change (IPCC).

Horizons commissioned NIWA to make climate change projections for the Manawatū-Whanganui Region (2016) based on IPCC scenarios, to project regional changes in temperature, sea level, and precipitation for the coming century. Findings suggest annual average temperatures across our region are likely to increase by between  $0.7^{\circ}\text{C}$  and  $1.1^{\circ}\text{C}$  by 2040, and by up to  $3.1^{\circ}\text{C}$  by 2090. It is expected that this will result in an increase in hot days and decrease in cold nights by 2040, when compared to the period 1986 to 2005.

Seasonal precipitation is also expected to change by the end of this century. Even under the low emissions scenario, we can expect more snow and rainfall in

winter in western parts of the region, with Raetihi in the Ruapehu District potentially receiving up to 15 per cent more precipitation during winter by 2090. Assuming the worst case scenario, the northern part of our region could experience up to 20 per cent more snow and rainfall during winter, compared to 20 per cent less precipitation in the south eastern area (Figure 2).

The frequency of drought in the region is estimated to increase by around five per cent by 2030-2050 and up to ten per cent by 2070-2090, compared to 1980-1999. The frequency of extreme winds is also expected to increase in the lower North Island over the 21st century.

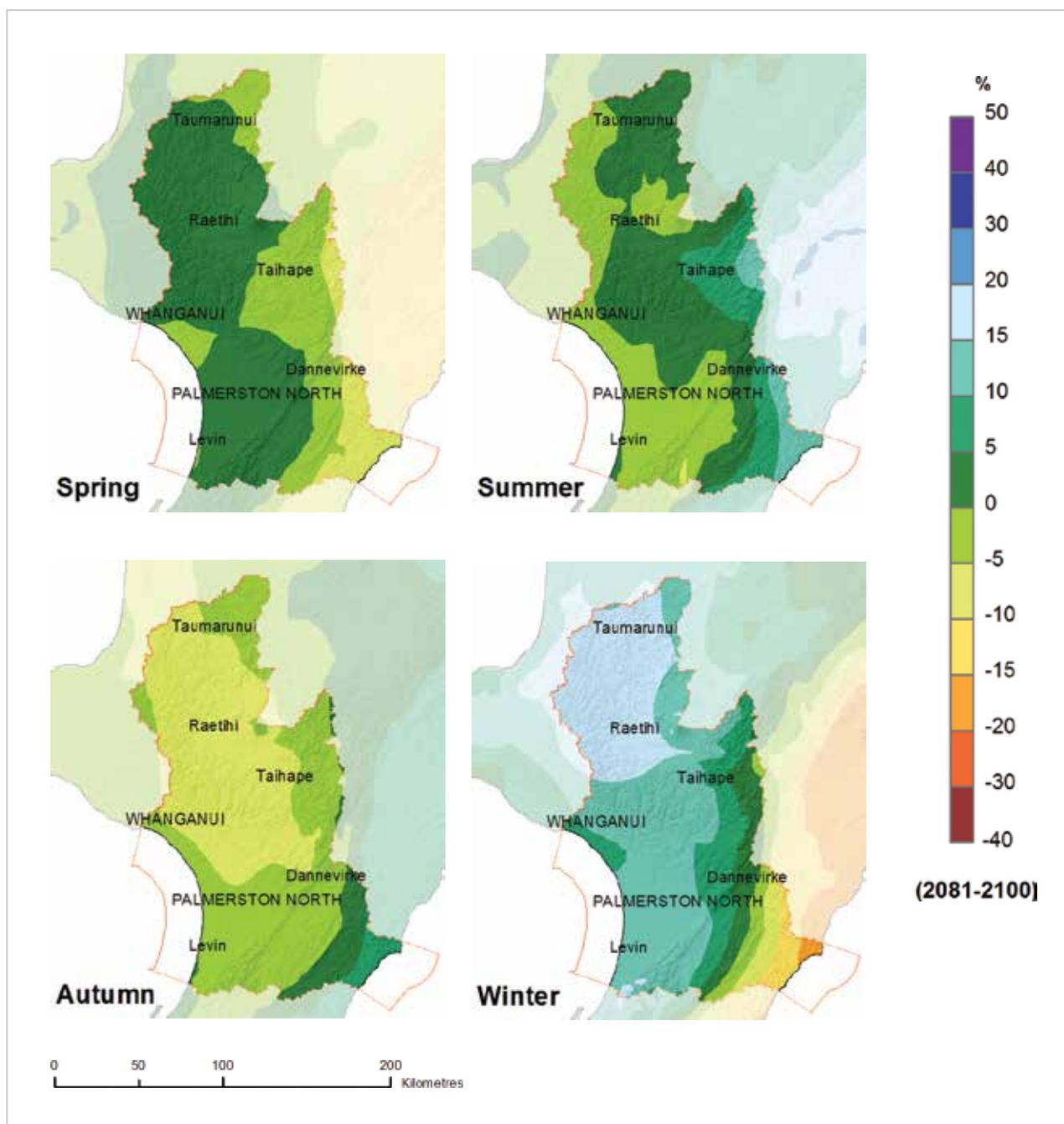


Figure 2: Projected seasonal precipitation to 2090 for the Horizons Region, assuming a high emissions scenario. Image courtesy of NIWA

## CLIMATE

# WHAT WE'RE DOING

Four key impacts of climate change are identified for our region: sea-level rise, rising temperatures, changes in rainfall patterns, and an increase in the size and frequency of storms.

There is a need to grow and develop our awareness of climate change impacts, including understanding and managing our environment for future weather conditions. To date, research commissioned by Horizons has included the following two case studies that look at forecasting the long-term climate change impacts on the effectiveness of our Sustainable Land Use Initiative (SLUI), and investigating potential future changes for the Manawatū River flows.

## HORIZONS IS WORKING TO

help our communities adapt to the effects of climate change. This includes:

### PROMOTING RESILIENT LAND-MANAGEMENT PRACTICES

under Horizons' Sustainable Land Use Initiative (SLUI), which will reduce the impacts on freshwater ecosystems and flood schemes, and remove carbon from the atmosphere at the same time.

### PLANNING FOR CHANGES

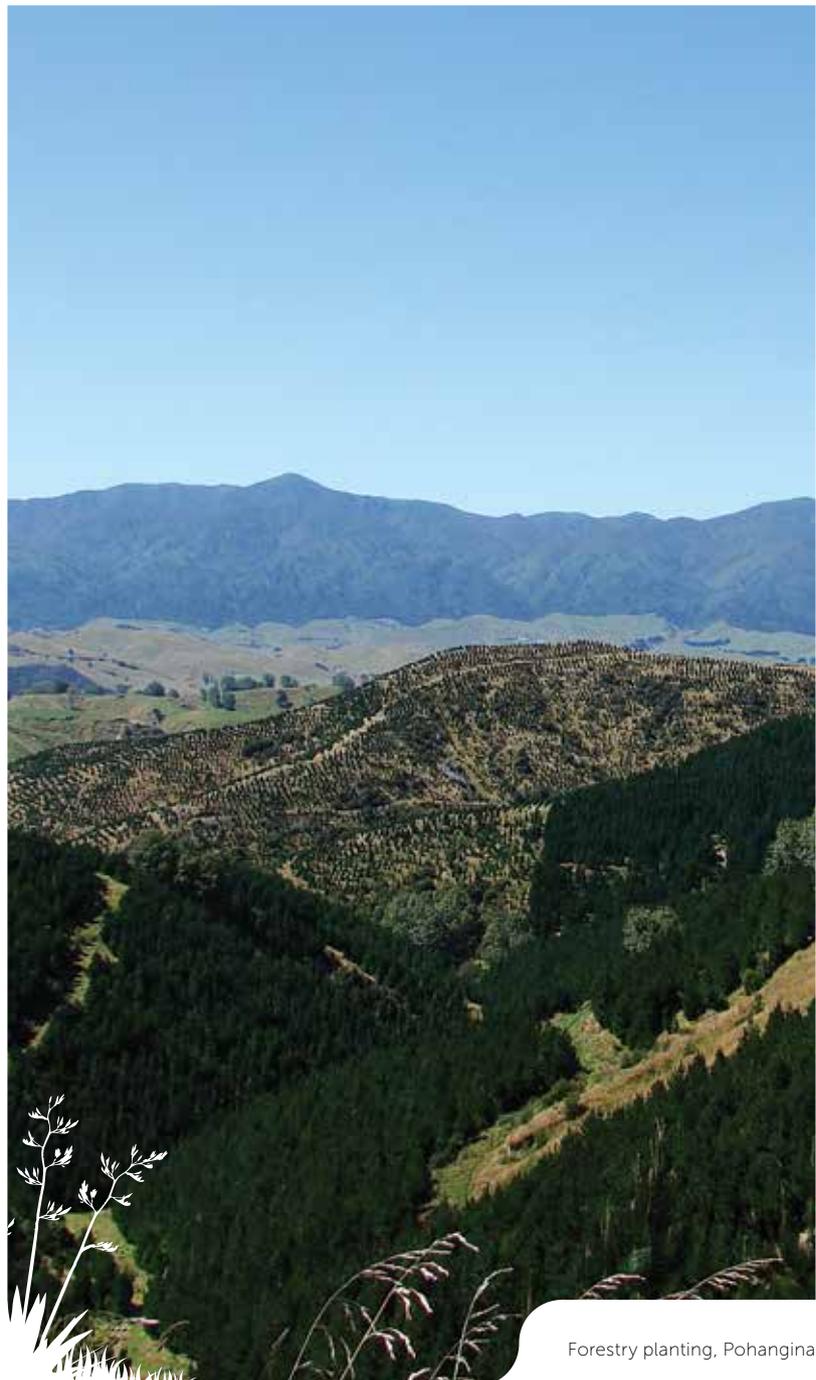
to the scale and frequency of natural hazards, for example through providing for climate change in our river management activities.

### DEVELOPING A STRATEGY

to support a consistent and effective response and prioritise key actions across the Council.

### RESEARCHING IMPACTS

of climate change on our communities and environment.



Forestry planting, Pohangina

# RIVER SEDIMENTATION CASE STUDY

Climate change experts predict larger and more frequent storm events in our region during this century. The challenges ahead of us are significant, not only in terms of managing hill country erosion and increased sedimentation, but also responding to sea level rise and coastal erosion.

To explore possible effects of erosion on the region, global climate change projections have been used by Horizons and Manaaki Whenua – Landcare Research to model future sediment inputs using a national sediment model SedNetNZ.

SLUI works to date are estimated to have reduced sediment load in rivers by 835,000 tonnes (6 per cent), with the greatest reductions (up to 19 per cent) in Kai Iwi, East Coast and Lower Rangitikei. With ongoing implementation of SLUI works similar to our current pace, the annual average sediment load could be decreased by 27 per cent and visual clarity improved by 29 per cent by 2043.

Climate change, however, is likely to alter annual rainfall patterns and impact rates of hillslope erosion and river sedimentation, particularly in the northern and western areas of the region. Modelling suggests that this could result in a potential change to the predicted reduction in sediment load from 27 per cent by 2043 to just 19, 12 or 5 per cent under minor, moderate and major climate change scenarios with the amounts varying across the region (Figure 3).

Modelling also shows that New Zealand's largest hill country erosion programme, SLUI, may not offset the increases in sediment load from climate change in the longer term, as sediment loads in the river could increase by between 40 and 180 per cent by 2090. This suggests the long-term effectiveness of work already undertaken through SLUI is expected to reduce under climate change, as heavier rainfall events increase sediment loading in the region's rivers. It also means that continued investment in SLUI, or other programmes for erosion mitigation, will be required to offset the potentially severe effects of climate change.

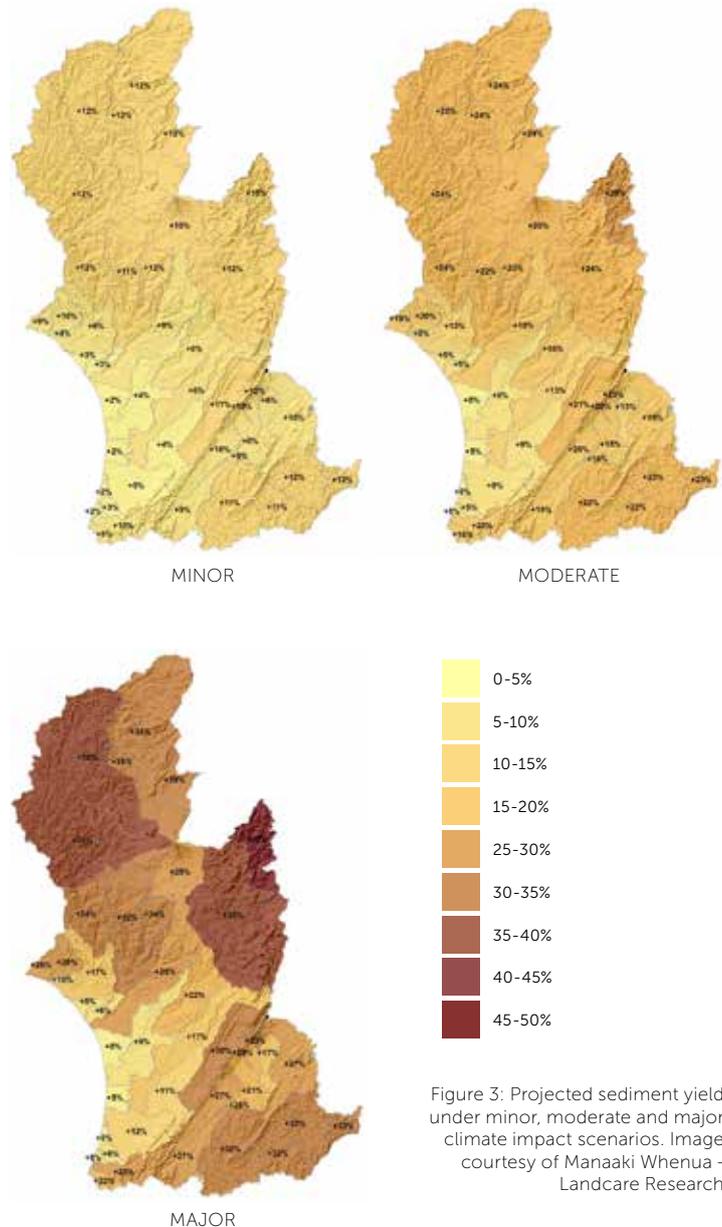


Figure 3: Projected sediment yield under minor, moderate and major climate impact scenarios. Image courtesy of Manaaki Whenua - Landcare Research



Feilding flood response

## MANAWATŪ RIVER FLOW CASE STUDY

Climate change is a consideration in determining appropriate levels of flood control. Changing rainfall patterns are likely to be accompanied by changes in river flows throughout the region. This may require us to adapt how we manage the use of water, or design our infrastructure. To explore these potential effects, Horizons commissioned NIWA to model future flows for the Manawatū River in 2040 and 2090, under a range of climate change scenarios and compared them to climate data for the period 1986-2005.

Modelling suggests little change from the current average (mean) annual flow over the next 70 years, which means that, on average, the same amount of water will flow down the river every year. There are,

however, likely to be changes in how and when flows occur. For example, summer flows are projected to decrease by 14 per cent by 2090, but we are likely to experience an increase in the average number of high flow (flood) events per year.

These projected outcomes present challenges, but there are also opportunities to adapt to change if we are adequately prepared. Further work is required to understand these changes and potential impacts, which is why Horizons recently introduced dedicated funding for climate change research through our 2018-28 Long-term Plan and identified climate change as one of the four key issues in its 30-Year Infrastructure Strategy.



Motoua Flood Gates, Manawatū River

# WHERE WE'RE GOING AND WHAT YOU CAN DO

A changing climate is a part of our operating environment; both land and river management already factor adaptation into erosion and flood control planning. There is a need to develop further knowledge about other activities such as biodiversity, biosecurity, water availability, and healthy waterways and ecosystems.

Future work includes establishing a regional climate change strategy, region-specific modelling of sea-level rise and investigating coastal hazard drivers such as storm surge and waves, and flow projections for rivers across the region.

Responding to the future impacts of climate change requires long-term vision, a willingness to identify and embrace opportunities, and a commitment to act, despite uncertainty. While there are significant

challenges ahead, there are also opportunities for our region. For example, trees planted to offset emissions can also stabilise vulnerable soils, reducing erosion and sedimentation of waterways and benefiting both flood control and freshwater aquatic systems.

During the next ten years, Horizons has committed to developing a climate change strategy and undertaking research around the potential impacts (and opportunities) climate change may bring.

## WHAT YOU CAN DO...

- 'Investing in tomorrow' produced by the Ministry for Primary Industries highlights the wide range of national resources for sustainable land management and climate change completed between 2007 and 2018. Visit [www.mpi.govt.nz](http://www.mpi.govt.nz);
- The Dairy Action for Climate Change, led by DairyNZ, supports farmers and industry to address on-farm methane and nitrous emissions. Find out more at [www.dairynz.co.nz](http://www.dairynz.co.nz);
- According to the Ministry for the Environment, the transport sector contributes 19 per cent of New Zealand's total greenhouse gas emissions.
  - Walking, cycling, catching a ride to work with a friend or co-worker, or taking public transport are ways to reduce our vehicle use;
  - If you fly, look at setting up your next out of town meeting as a video conference rather than hopping on a plane;
  - Reduce electricity usage by switching off lights and electronics when not in use; and
  - Check out your own emission contribution using handy calculators at Enviro-mark Solutions [www.enviro-mark.com/calculators](http://www.enviro-mark.com/calculators).

