Climate Change

IPCC Fifth Assessment Report
New Zealand findings

NEW ZEALAND
CLIMATE CHANGE CENTRE

The Intergovernmental Panel on Climate Change (IPCC) periodically assesses knowledge of climate change, using the evidence and analyses published in peer-reviewed journals and other credible sources.

The IPCC's Fifth Assessment involved 803 scientific authors and more than 3500 expert reviewers. It comprises four related reports:

1. The Physical Science Basis (September 2013)
2. Impacts, Adaptation and Vulnerability (March 2014)
3. Mitigation of Climate Change (April 2014)
4. Synthesis Report (October 2014).

The report on impacts, adaptation and vulnerability includes a chapter about Australia and New Zealand. Unless otherwise specified, this is a summary of some key findings for New Zealand from that chapter.

The big picture

As temperatures increase, so do risks of serious and irreversible damage.

The September 2013 report on the physical science of climate change found:

- warming of the climate system is unequivocal. Since the 1950s, many of the observed global changes are unprecedented over decades to millennia
- climate change is already influencing the intensity and frequency of many extreme weather and climate events globally
- human influence on the climate system is clear
- continued emissions of greenhouse gases will cause further warming and climate changes
- limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

New Zealand is already experiencing climate change

The climate is changing, with long-term trends toward higher temperatures, more hot extremes, fewer cold extremes, and shifting rainfall patterns in some regions.

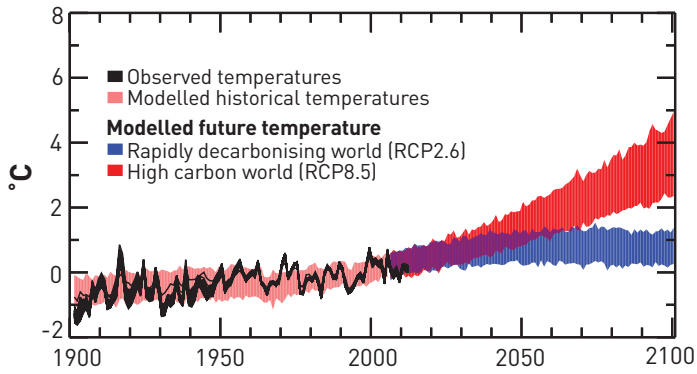
More change is expected

- Average temperatures expected to rise further, depending on future greenhouse gas emissions (more details below).
- Spring and autumn frost-free land area expected to at least triple by 2080s.
- Up to 60 more hot days per year (over 25°C) for northern areas by 2090.
- Significant shifts in rainfall patterns (more details on next page).
- Rise in extreme rainfalls (up to 8% more intense rain for every 1°C of warming, but with significant regional variations).
- Time spent in drought in eastern and northern New Zealand projected to double or triple by 2040.
- Global sea level rise by 2100 of about 0.5–1 metre above the 1986–2005 average in a high carbon world, or about 0.3–0.6 metre if there is rapid decarbonisation. Even if temperatures peak and decline, sea level is projected to continue to rise for many centuries at a rate dependent on future emissions. Sea level rise around New Zealand may be up to 10% higher than the global average.
- Increase in days with 'very high' and 'extreme' fire danger index in some locations by up to 400% by 2040 and 700% by 2090.
- Shifts in wind speed and direction, with the average westerly flow projected to increase in spring and winter, but decrease in summer and autumn by 2090.
- Decline in peak snow accumulation by about 30–80% at 1000 metres and by about 5–50% at 2000 metres by 2090.

Temperature rise

This graph, adapted from the report, shows projected changes compared to New Zealand's average temperature over the period 1986–2005. It shows:

- New Zealand has warmed by about 0.9°C since 1900
- New Zealand's temperature is expected to rise by another 0.8°C or so above the 1986–2005 average if the world rapidly implements stringent measures to limit greenhouse gas emissions (the blue band)
- by contrast, New Zealand's temperature is expected to keep on rising throughout this century – by about 3.5°C above the 1986-2005 average – in a high carbon world (the red band).



Based on IPCC Working Group II Fifth Assessment Report Chapter 25, Figure 25–2; for more details and data sources see Chapter 21 Suppplementary material, section SM21.1 and Table SM21.5.

Photo: Dave Allen, NIWA

How will climate change affect New Zealand over the 21st century?

Freshwater

The best evidence available so far suggests lower flows in rivers originating in the northeast of the South Island and the east and north of the North Island but more in those from near and west of the main divide.

Natural ecosystems

There have been very few studies of climate change impacts on biodiversity in New Zealand. These suggest that threats such as invasive pests and weeds, and habitat loss, are more serious risks in the short to medium term than climate change, but more research is needed.

Coastlines and flood plains

Rising sea levels and increasing heavy rainfall are projected to increase flooding and erosion in many coastal areas and particularly near river mouths, with escalating risks to many low-lying ecosystems, infrastructure and housing. This is cause for serious concern given patterns of development and population distribution.

Oceans and fisheries

The report says it is "virtually certain" (more than 99% probability) that the oceans will continue to acidify, which is expected to affect many marine organisms. Specific studies from New Zealand are sparse but risks have been identified, notably to deep-sea corals.

A strengthening East Auckland Current in northern New Zealand is expected to allow some vagrant fish species to establish here. This suggests potentially substantial effects on wild fisheries and aquaculture.

Forestry

Projections for forestry include increased *Pinus radiata* growth in cooler regions where soil nutrients and rainfall allow it, reduced *Dothistroma* blight in the central North Island but more in the South Island, and significantly increased fire risk in some areas.

Agriculture

Rainfall changes and rising temperatures are expected to shift agricultural production zones and timing of some activities.

The impact on dairy, sheep and beef pasture production is expected to vary widely across the country. Some areas are likely to benefit from climate change, if farm management practices change to make the most of increased pasture production. Other regions face increased drought risk and uncertain changes in pests, weeds and diseases.

New Zealand could increase its wheat yields with appropriate choices of cultivars and sowing dates. Some cooler and elevated sites could become suitable for wine grapes.

Erosion could become an even bigger problem on farms, but that depends on how rainfall, and especially storm frequency, changes.

Energy

Annual average peak electricity demand is expected to reduce by 1–2% for every 1°C of warming, with less demand for heating in winter.

Tourism

It is hard to predict future tourist behaviour but New Zealand ski tourism could benefit from less snow in Australia.

Health

There are few New Zealand health findings in the report:

- Water- and food-borne diseases are projected to increase.
- There may be fewer cold-related deaths in some parts of the country.
- A wider area could become climatically suitable for transmission of dengue fever though non-climate factors such as water supply are likely to be more important in whether the disease spreads.
- An increase in climate-related disaster risk is expected to exacerbate mental health issues.

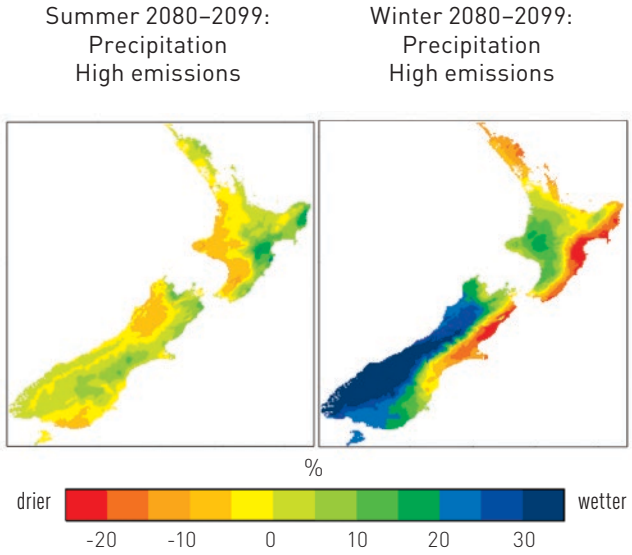
Māori

The impacts on Māori society are expected to vary widely. The Māori economy relies heavily on climate-sensitive primary industries, and Māori disproportionately face many challenges that constrain adaptation. On the other hand, strong social networks and culture give some Māori resilience. Combining traditional ways and knowledge with new policies and strategies will be key to long-term sustainability.

Getting drier AND wetter

The best evidence currently projects lower annual average rainfall in the northeast South Island and northern and eastern districts of the North Island, with higher annual average rainfall elsewhere. But uncertainty in projected rainfall changes remains large for many parts of New Zealand, which creates significant challenges for adaptation. Also, seasonal variations often matter more than the annual average, especially in agriculture.

The maps here show projected rainfall change (in %) for summer and winter, comparing the period 1980–1999 to 2080–2099, for a high emissions scenario. So, for instance, parts of East Cape would get wetter by 5–20% in summer and drier by up to 25% in winter, but the opposite direction of change for Taranaki. If the world adopts a low emission path, the change is expected to be similar but much smaller.



These maps show results from global climate models used in the Fourth Assessment. Results for New Zealand from the latest generation of models are expected to be similar, but the detailed analysis has not been done yet.

How well will New Zealand cope?

As a temperate maritime country, New Zealand may not face some of the worst effects of climate change this century, unlike parts of Australia where many more days with peak temperatures over 40°C are projected.

New Zealanders are generally well-equipped in principle to adapt to climate change, and some adaptation is already occurring. Planning for sea-level rise is becoming more common, for example, although implementation of specific policies remains piecemeal, subject to political changes, and open to legal challenges.

Overall, however, adaptation faces major constraints arising from:

- absence of a consistent information base and uncertainty about projected impacts
- limited financial and human resources to assess local risks and to develop and implement effective policies and rules
- limited integration of different levels of governance
- lack of binding guidance on principles and priorities
- different attitudes towards the risks associated with climate change
- different values placed on objects and places at risk.

Action despite uncertainty

Responding to climate-related risks involves making decisions and taking action in the face of continuing uncertainty.

In many cases, reducing vulnerability and exposure to present climate variability and extremes is a practical first step.

But exclusive reliance on near-term benefits is not always the most effective approach longer term. For example, enhancing protection measures after major floods, combined with rapid rebuilding, accumulates fixed assets that can become increasingly costly to protect as climate change continues.

Key adaptation challenges

Two "key and related challenges" for adaptation are identified:

- When and where adaptation may imply transformational rather than incremental changes.
- Where specific interventions could overcome adaptation constraints, e.g., better coordination between central and local government.

One example of transformational change is shifting from flood protection through reliance on stopbanks to accommodation or avoidance of flood risk, including retreat from eroding coasts.

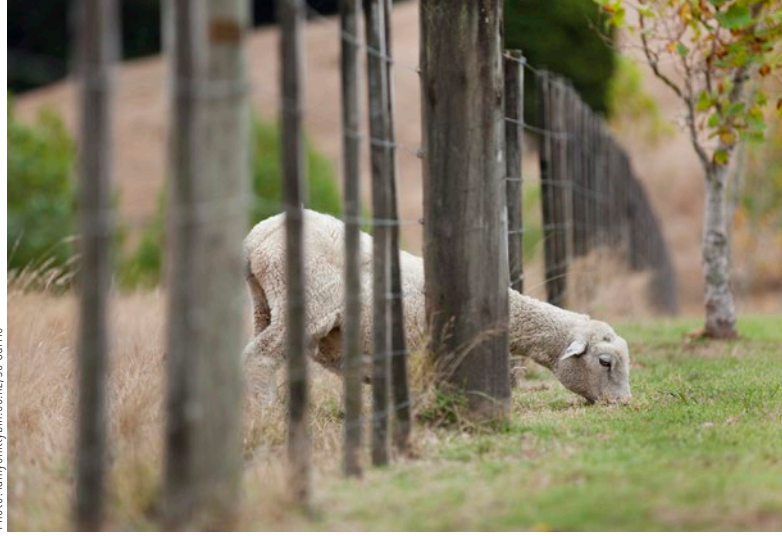


Photo: ©mychillybin.co.nz/Jo Currie

Adapting to changes overseas

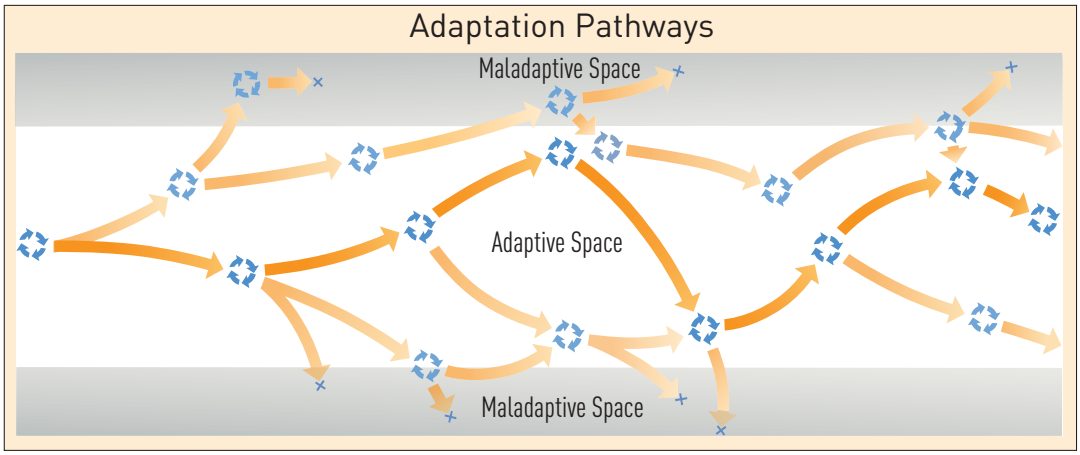
To fully understand how big an issue climate change is for New Zealand, one must consider flow-on effects from climate change impacts and responses outside our region. These could be significant for trade-intensive sectors (agriculture and tourism in particular), potentially outweighing some direct climate change impacts within New Zealand, but little work has been done to fully understand their implications.

Insurance

In New Zealand, floods and storms are the second-most costly natural hazards after earthquakes.

Insurance helps buffer the risk presented by such hazards and can also act as an incentive for policy holders to reduce their risk, e.g., through resilience ratings on buildings. But it can also discourage adaptation if people living in climate-risk prone areas pay discounted or cross-subsidised premiums or policies fail to encourage betterment after damaging events by requiring replacement of 'like for like'. The effectiveness of insurance thus depends on the extent to which it is linked to a broader national resilience approach to disaster mitigation and response.

> "Without adaptive measures, projected increases in extremes and uncertainties in these projections will lead to increased insurance premiums, exclusions and non-coverage in some locations, which will reshape the distribution of vulnerability, e.g., through unaffordability or unavailability of cover in areas at highest risk."



Based on IPCC Working Group II Fifth Assessment Report Chapter 25, Figure 25-3. Adaptation is not a one-off action but an iterative risk-management process. There is no single correct adaptation pathway, although some sets of decisions are more likely to produce positive outcomes long term – especially those that retain flexibility to deal with changes in community expectations and climate. Some decisions, e.g., planning for settlements and major infrastructure, have significant long-term consequences; in such cases, their ability to deal with a range of climate futures needs to be considered at the planning stage.

Key risks for New Zealand

The report identifies three "key risks" for New Zealand from climate change during the 21st century. A "key risk" is one where:

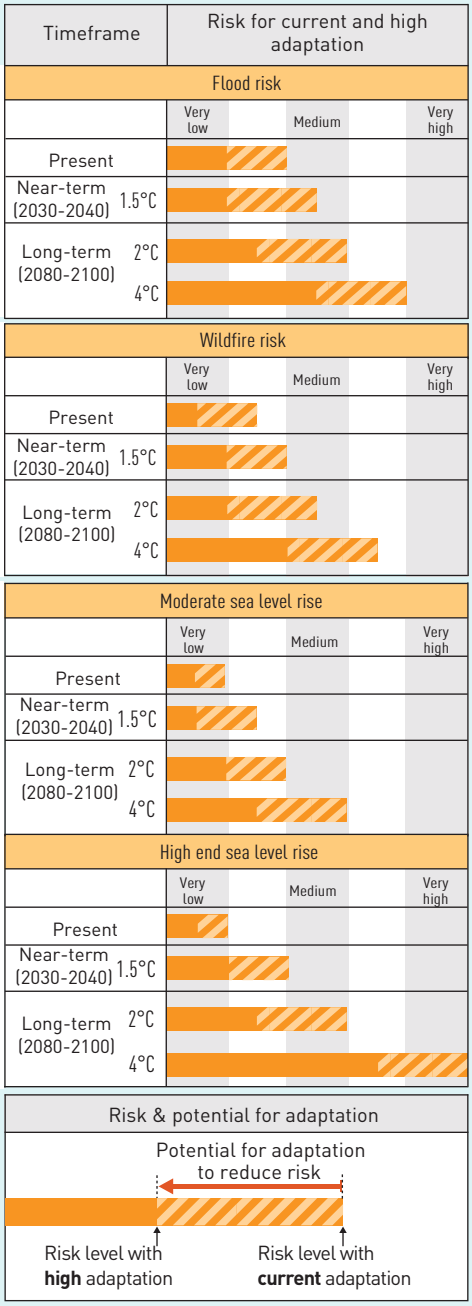
- there is strong, reliable research with multiple lines of evidence
- the potential impacts could be severe
- some affected systems may be unique
- adaptation could be difficult.

The diagrams on this page show how severe the key risks are now for New Zealand and Australia combined (from 'very low' to 'very high'), and how they would increase if the world warms by 1.5°C, 2°C and 4°C above pre-industrial levels, based on expert judgement. The shaded section of the bar roughly represents the difference more adaptation could make if people use the full range of options available (such as retreat from the most vulnerable areas).

Increased frequency and intensity of flood damage to settlements and infrastructure. Effective adaptation includes land-use controls and relocation as well as protection and accommodation of increased risk; in many locations, reliance on increased protection alone will become progressively less feasible.

Increased damage from wildfires – to ecosystems and settlements, economic losses and risks to human life in many parts of New Zealand. Local planning mechanisms, building design, early warning systems and public education can help with adaptation. This risk is already very real in Australia. Since the risk levels in the diagram are for both countries, the wildfire risk for New Zealand alone is probably lower than shown.

Increasing risks to coastal infrastructure and low-lying ecosystems from continuing sea level rise, with widespread damage if the more severe projections are realised. Some communities are already struggling with coastal erosion and inundation risk, and successive building and protection cycles constrain flexible responses. Coastal retreat is a long-term adaptation strategy but challenging to implement; options for some natural ecosystems are limited due to the speed of change and lack of suitable space. Sea level will continue to rise beyond 2100 even if global warming is limited.



The future impacts of both these key risks (flood and wildfire) can be reduced substantially by globally effective measures to curb greenhouse gas emissions combined with adaptation. The more the climate changes, the more adaptation will have to rely on novel ways of dealing with risks, such as retreating from the most affected areas.

The diagram shows both a moderate and a high-end sea level rise. The impacts would be very serious if the worst projections eventuate.

Based on IPCC Working Group II Fifth Assessment Report Chapter 25, Table 25-8.

What about Australia?

The report identifies five other key risks that, based on the currently available evidence, apply to Australia only:

- Damage to Australian coral reef systems.
- Shrinking mountain habitats and loss of some native species.
- Constraints on water resources in southern Australia.
- Increased illness, death and infrastructure damage during heat waves.
- Reductions in agriculture production in parts of Australia.

This does not necessarily mean that New Zealand has nothing to worry about in these areas; in some cases, there is simply not enough New Zealand research.

This summary was produced by the New Zealand Climate Change Centre. It was written by M. Hollis, and reviewed by D. Wratt, A. Reisinger, R. Nottage, A. Tait, P. Newton, D. Frame, B. Glavovic and F. Sullivan.

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