

Climate change implications for New Zealand

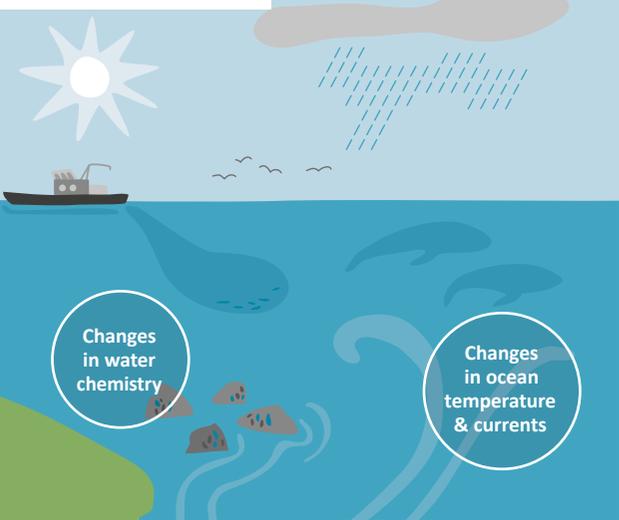
Summary

the ROYAL SOCIETY of NEW ZEALAND
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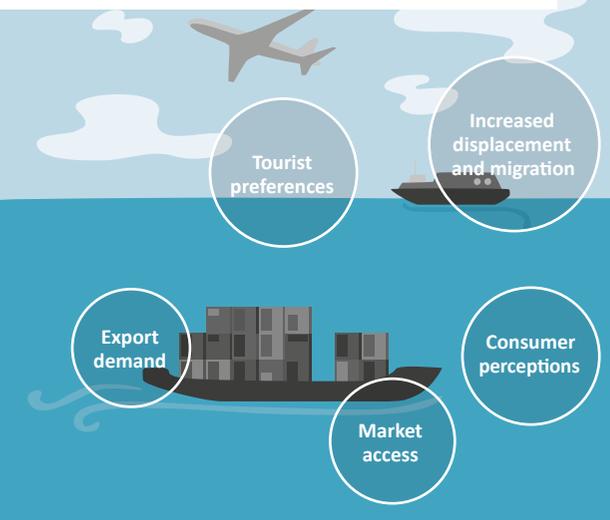
Risk as the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems



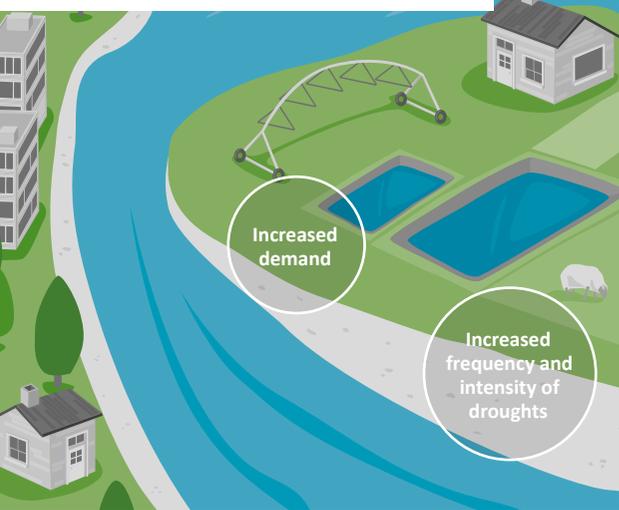
SURROUNDED BY OCEAN



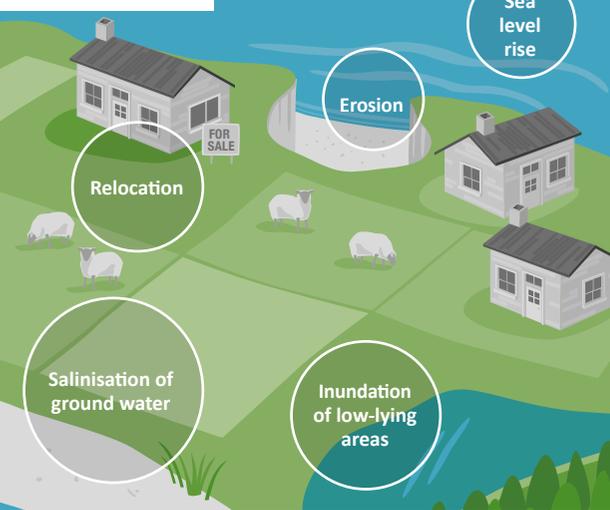
RELYING ON STRONG INTERNATIONAL CONNECTIVITY



RELYING ON THE AVAILABILITY OF FRESHWATER



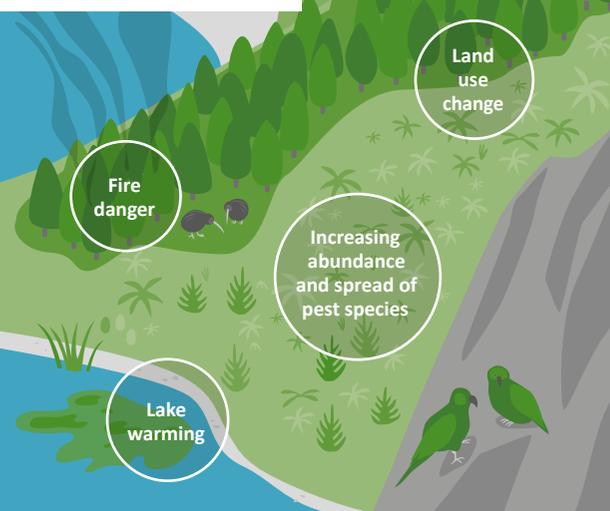
LIVING ON COASTS



LIVING ON FLOODPLAINS



WITH UNIQUE ECOSYSTEMS



NEW ZEALAND'S SENSITIVITIES TO CLIMATE CHANGE

LIVING ON COASTS

Hazard: Rising sea levels, stronger storms, inundation, coastal erosion.

Vulnerability/exposure: Main population centres on coasts, increasing numbers of people retiring to these areas, coastal heritage sites in these areas.

LIVING ON FLOODPLAINS

Hazard: Increased extreme rainfall events, floods, inundation, erosion of land.

Vulnerability/exposure: Main population centres on the floodplains of major rivers, urban water supply and storm-water systems not designed for changing climate extreme.

RELYING ON THE AVAILABILITY OF FRESHWATER

Hazard: Increasing frequency and intensity of droughts and risk of wild fire.

Vulnerability/exposure: Urban expansion and increasing demand for water from agriculture, New Zealand's economy is tied to primary industries strongly linked to freshwater availability.

SURROUNDED BY OCEAN

Hazard: Changing ocean temperature, water chemistry and currents.

Vulnerability/exposure: New Zealand has important fishing, aquaculture, marine recreational use and iconic wildlife.

WITH UNIQUE ECOSYSTEMS

Hazard: Changing temperatures and moisture availability will change where New Zealand's species can be located.

Vulnerability/exposure: New Zealand has many unique indigenous ecosystems, and aquatic managed ecosystems that are critical to the country's economic, social and cultural well-being, particularly for Māori.

RELYING ON STRONG INTERNATIONAL CONNECTIVITY

Hazard: Climate impacts on international crops, food production and population migration.

Vulnerability/exposure: New Zealand is an open economy with important trading links with Europe, Australia, the US and China. Climate change-related impacts on trading-partners have the potential to affect our ability to sell our goods overseas, migration, and social and cultural ties.

New Zealand is being affected by climate change and impacts are set to increase in magnitude and extent over time. Floods, storms, droughts and fires will become more frequent unless significant action is taken to reduce global emissions of greenhouse gases, which are changing the climate. Even small changes in average climate conditions are likely to lead to large changes in the frequency of occurrence of extreme events.

Our societies are not designed to cope with such rapid changes. For example, the development of coastal infrastructure reflects an assumption that sea levels remain static, as they have been for several thousand years until recently.

The Panel considered six key areas that are at risk from the effects of climate change in New Zealand and are likely to have significant implications for New Zealand's prosperity and well-being.

Risks from climate change relate to a combination of the occurrence of adverse events, and the level of exposure and vulnerability to those events. Risks can be reduced, even in the face of an increasing number of adverse events, if exposure and vulnerability can be sufficiently reduced.



Coasts

Shoreline ecology, public infrastructure, residential and commercial assets, community values and the future use of coastal-marine resources will be severely affected by coastal change due to sea level rise, storm surges, and secondary effects such as erosion and flooding.

Many New Zealanders live either on coasts or on floodplains, exposing us to coastal inundation and flood events.

It is very likely that the rate of sea level rise around New Zealand will exceed the historical rate and exceed the global average. At least another 30cm is virtually guaranteed this century but the rise could exceed 1m. With a 30cm rise in sea level, the current '1 in 100 year' extreme sea level event would be expected to occur once every year or so in many coastal regions. Along the Otago coast, for example, the difference between 2-year and 100-year storm surges is about 32cm.

Rising sea levels mean rising coastal water tables, leading to semi-permanent or permanent inundation (flooding) of low-lying areas, and the potential for salt water to get into freshwater systems.

The implications for coastal populations will vary widely, depending on the shape of the coast, the distribution of buildings and structures at risk and their vulnerability, and the differentiated make-up of communities themselves. However, the recent report of the Parliamentary Commissioner for the Environment indicates that thousands of households in many towns and cities will be affected.

These communities will need to plan for and adapt to change and some will need to decide whether to 'hold the line' or relocate in response to known risks or actual climate change impacts. Without clear legislative guidance, litigation is likely to increase.



Flooding

Damaging flood events will occur more frequently. They will affect rural and urban areas differently. Near the coast, floods will be exacerbated by rising sea levels and storm surges. Away from the coasts they will increase erosion, siltation and building damage.

About two-thirds of New Zealand's population lives in areas prone to flooding. Flooding is New Zealand's most frequent and, after earthquakes, most costly insured disaster.

Extreme heavy rainfall events are expected to become more frequent in most parts of the country, by a factor of up to four, especially those regions where an increase in average rainfall is expected.

Engineering solutions such as stop-banks, and static planning measures such as land-use zoning, while helpful in the short term, could reduce New Zealand's ability to respond as flood risk increases over time. Communities will need to find sustainable solutions and manage on-going risk.



Freshwater resources

Decreasing annual average rainfall in eastern and northern regions of both main islands, plus higher temperatures, will increase the frequency and intensity of droughts and the risk of wild fire. At the same time, urban expansion and increased demand for water from agriculture will result in increased competition for freshwater resources.

The use of freshwater is already a controversial issue in New Zealand, both on allocation and quality. There is competition over use of water for safe urban supply, storage dams and irrigation, hydropower schemes, native ecosystem maintenance, and cultural and recreational purposes.

There will be increased pressure on water resources due to both climate change and economic development. Decreasing rainfall in the east and north, plus higher temperatures, will increase the frequency and intensity of droughts. At the same time, urban expansion and increased demand for water from agriculture will result in increased competition for freshwater resources. The increased pressure on water resources and increased demand for water resources also puts our freshwater ecosystems at risk.

Fire danger is projected to increase in many parts of New Zealand due to changing rainfall and higher summer temperatures. The number of days with very high and extreme fire weather is expected to increase, with greatest changes in the east and north of both islands.

Factoring climate change into strategic planning for future water supply and demand is critical to ensure a sustainable water use in New Zealand.

Oceans

Changes in ocean temperature, water chemistry, and currents will have impacts on New Zealand's marine life, fisheries, and aquaculture, including southward migration of species and negative effects on shell-forming species such as pāua and mussels.

A fifteen-year time series taken off the Dunedin coast shows that ocean chemistry is already changing in the waters around New Zealand, consistent with measurements from other sites around the world.

Model projections show that the waters around New Zealand will warm and acidify, with the greatest warming occurring in the Tasman Sea. Studies on different marine organisms have shown that there will be impacts ranging from productivity to ecosystem community structure as a result of these changes.



Ecosystems

Over half of New Zealand's more than 50,000 species are found nowhere else in the world; over three quarters of the vascular plants, rising to 93% for alpine plants, and over 80% for the more than 20,000 invertebrates.

Existing environmental stresses will be exacerbated by shifts in mean climatic conditions and associated change in the frequency or intensity of extreme events, especially fire, drought, and floods.

Native ecosystems are being directly affected by climate change and also indirectly by expanded ranges for pests and diseases, increased fire risk, and land use change.

Even with the current rise in average temperatures (about 1°C above pre-industrial), up to 70 species of native plants are likely to be at risk of extinction this century.

Warming of New Zealand's normally cold lakes, combined with nutrient runoff from the surrounding production landscape (e.g. agricultural, forestry, dairy land), will likely increase occurrence of cyanobacterial blooms, while the abundance and spread of pest species (e.g. wilding pines) will be an added cost for Councils and may affect New Zealand's 'clean and green' image.

International

New Zealand is strongly dependent upon international connections. The way other countries respond to climate change will influence New Zealand's international trade relationships, and potentially migration patterns.

New Zealand is strongly dependent upon our international connections, and so climate change impacts far from our shores are likely to be felt here. While New Zealand agriculture could benefit from increasing global commodity prices in the long term, there are many negatives.

Reduced food security, increased displacement and migration (e.g. from the Pacific) and potential political instability suggest that patterns of international trade, demand for services, and international tourism, could change substantially in the future as a consequence of climate change.

We gain significant revenue from long-haul tourism which could be reduced if the acceptability of long-haul travel, and costs of fossil fuels, are affected by climate change.

Ultimately, how the future plays out depends critically on significantly cutting emissions of greenhouse gases as quickly as possible over coming decades in order to limit climate change to below 2°C. Even 2°C is not risk-free and will still result in significant consequences. Effective management of these risks will require active engagement at all levels of government, industry and society.

For further information

Please contact info@royalsociety.org.nz

or go to the Royal Society of New Zealand web page: www.royalsociety.org.nz/climate-change-implications-for-new-zealand

ISBN 978-1-877317-14-9

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