He Pou a Rangi
Climate Change Commission

Priorities for action
2026 National Climate Change Risk Assessment
for Aotearoa New Zealand

April 2026

This assessment is required under sections 5ZP and 5ZQ of the Climate Change Response Act 2002.

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Disclosure statement: As anticipated by the appointment criteria, the Climate Change Commissioners come from varying fields such as adaptation, agriculture, economics, te ao Māori and the Māori–Crown relationship. While a number of board members continue to hold roles within these fields, our advice is independent and evidence based. The Commission operates under its Interests Policy, which is derived from the Crown Entities Act 2004. You can read more about our board members on the Climate Change Commission website. The Commission regularly updates and publishes on its website a register of relevant board interests.

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Message from the Chair

Tihei mauri ora!

Me wehi ki te Kaihanga

Kei ngā mate huhua o te wā, okioki atu rā

Kei te motu, tēnā koutou katoa

Kei ngā Tumuaki, kei ngā Kaihautū huri noa, ka mārama e ngunguru ana te whenua me te moana.

Ka tere whakamua kē tātou. Engari, he moana pukepuke e ekengia e te waka e hautū marino ana.

Mā te panoni āhuarangi e pīroiroi ake ngā whakataunga, engari mā tēnā, ka whakawhāiti te aronga a ngā Kaihautū.

Ki te aro ngā Kaihautū i ōna tūranga, me te māramatanga o te pae tawhiti, ngā whakataunga whakapūmau, te tūranga o Te Tiriti me Ngāi Māori i ā rātou mahi, ka tutuki te whakakitenga.

Urutaunga ai, auaha ai a Ngāi Māori, me ngā hapori, ngā kaunihera, ngā pūtahi, ā, ka āhei ngā Poari i te tautoko i a rātou.

Kia tau tātou katoa ki uta mā tātou anō, mā ngā uri whakatupu hoki.

The health of our communities, the strength of our economy and the future of our country depend on the state of our climate.

The complexity of the challenge presented by climate change is unprecedented. It is a challenge that government, businesses and community can only overcome as one.

This report provides an evidence-based view of the climate risks that matter most for Aotearoa New Zealand, and where coordinated action can most effectively reduce future harm. It recognises that not all risks can be addressed at once, and that prioritising early action is essential to avoid higher future costs.

The findings show where early and deliberate action will pay off the most. By clearly identifying where systems and governance are under strain, the assessment enables decision-makers to act deliberately rather than reacting under crisis conditions. In these areas, delay would compound risk and increase the cost of response over time.

Climate change makes decisions more complex, but it also sharpens priorities. This is a moment for leadership – where clear sequencing and sustained focus matter more than attempting to do everything at once. Leaders who focus on clear roles, long-term thinking and robust decision pathways can bring stability to an increasingly volatile world.

Strong governance is one of the most powerful tools we have. I have seen throughout my career that when roles are clear, decisions transparent, and people included early, institutions are able to act with confidence while under pressure. Good governance supports timely prioritisation – helping leaders focus effort where it matters most and avoid deferring decisions that become more costly over time.

Climate change is not business-as-usual hazard management. As Chair of the Commission, I have come to appreciate how essential it is to understand who and what is exposed, how risks flow across systems, and how future warming will shape the choices ahead. This assessment also reinforces that global action still matters – the level of warming the world reaches will directly influence the risks we face here at home, and the options available to us.

Ultimately, this report is about legacy and long-term resilience. The choices made in the near term will shape both the scale of future harm and the costs borne by communities and institutions. I believe that with clear, evidence-based advice, Aotearoa New Zealand can move from reacting to events to planning and adapting with confidence. This body of work gives us a shared foundation for action that will become stronger as we work across institutions, sectors and communities. If we act deliberately now, we can leave a more resilient, more stable future for the generations who will follow us.

I encourage those with responsibility for governance and decision-making to use this assessment to inform choices, align effort, and drive the action needed to reduce risk and build resilience for future generations.

I acknowledge the dedication of the Commission's team, our Commissioners, and the many people across the motu who shared their expertise, data, and lived experience. Their work ensures this assessment is rigorous, credible, and fit for the decisions it is intended to support.

Dame Patsy Reddy
Chair

Message from the Chief Executive

New Zealanders have always met challenges by working together to protect what matters most. Our connections to each other, to our environment, and to future generations give us a shared responsibility to act with care and foresight. This report sets out the climate risks we face, and where focused and coordinated action most strengthen the country's resilience.

Aotearoa New Zealand faces serious and far-reaching climate risks that affect every part of our lives – our homes and infrastructure, our economy, our environment, our health, and our communities. These impacts are already arriving faster and hitting harder, adding pressure at a time of rising living costs, social strain, and global uncertainty. Climate change is not the only challenge before us, but it is one that will increasingly shape how we live and the decisions we make. Making sure no community is left to face these risks alone means building systems that work for people and keep communities safe.

Across the motu, communities are already showing what is possible. Whānau, councils, iwi, businesses, and local leaders are working together to prepare for the impacts they know are coming. Their efforts are reducing risk, strengthening resilience, and protecting ways of life. Evidence shows that well designed, proactive adaptation can deliver benefits many times greater than its cost; in some cases, up to ten to one. Scaling up this proactive approach, rather than remaining trapped in an expensive cycle of response and recovery, will make a real difference for Aotearoa New Zealand.

The risk assessment, which is delivered every six years, acts as a national 'warrant of fitness'. It scans for emerging risks, assesses how serious they are, and highlights where readiness is lacking. This 2026 assessment builds on the first assessment published in 2020 and aligns with international best practice. A new focus this time is showing where action on one risk can reduce others, supporting more joined-up and effective decision-making across the motu.

Looking ahead to the severity of climate risks in 2050 or 2090 is not about predicting the future. It's about using the best available evidence to understand the consequences of delay and to act early where it will make the biggest difference. The choices we make now will shape the Aotearoa New Zealand our tamariki and mokopuna will inherit.

New Zealanders have always lived with climate hazards such as extreme rainfall, flooding, wildfires, and drought. As the climate continues to warm, however, climate hazards are expected to become more severe and widespread. This will narrow the adaptation options available to communities and sectors and increase the level of risk that cannot be avoided. Reducing emissions and adapting to climate change are not competing choices – limiting warming helps shape the future hazard environment and preserves the choices available to protect people, places, and livelihoods. Supporting and contributing to global efforts to limit warming, therefore, matters for New Zealand.

This report includes examples of action already underway, showing that progress is possible and scalable. With proactive planning, upfront investment, and collective effort, we can honour our role as kaitiaki and build a resilient future worthy of the generations to come.

Jo Hendy
Chief Executive

About He Pou a Rangi Climate Change Commission

He Pou a Rangi Climate Change Commission (the Commission) is an independent Crown entity established by the Climate Change Response Act 2002 (the Act) to:

a. provide independent, evidence-based advice to successive governments on mitigating climate change (including through reducing emissions of greenhouse gases) and adapting to the effects of climate change
b. monitor and review progress towards emissions reduction and adaptation.

In carrying out these roles, the Act requires the Commission to draw from the best available evidence and analysis, and to consider the impacts of climate change and the implications for Aotearoa New Zealand over time. The Act also directs us to consider the Crown–Māori relationship, te ao Māori, and specific effects on iwi/Māori in our work.

The Commission's impartial advice focuses on the outcomes that can result from government action and policy, and the choices that decision-makers have. The aim is to support the Government to fulfil its role under the Act, including achieving emissions budgets and the 2050 target, and allowing the people of Aotearoa New Zealand to prepare for, and adapt to, the effects of climate change.

The scope and timeframes for the Commission's advice and monitoring reports are set out in the Act. More information about the Commission's work programme can be found on our website, www.climatecommission.govt.nz.

At a glance

Summary for decision-makers

Climate change is increasingly affecting the core systems in Aotearoa New Zealand – the essentials that keep daily life running, the wellbeing of communities, the natural environment that supports life and livelihoods, and the way the country plans, decides and acts together.

This report sets out the 10 risk areas that stand out in the country's second national climate change risk assessment.

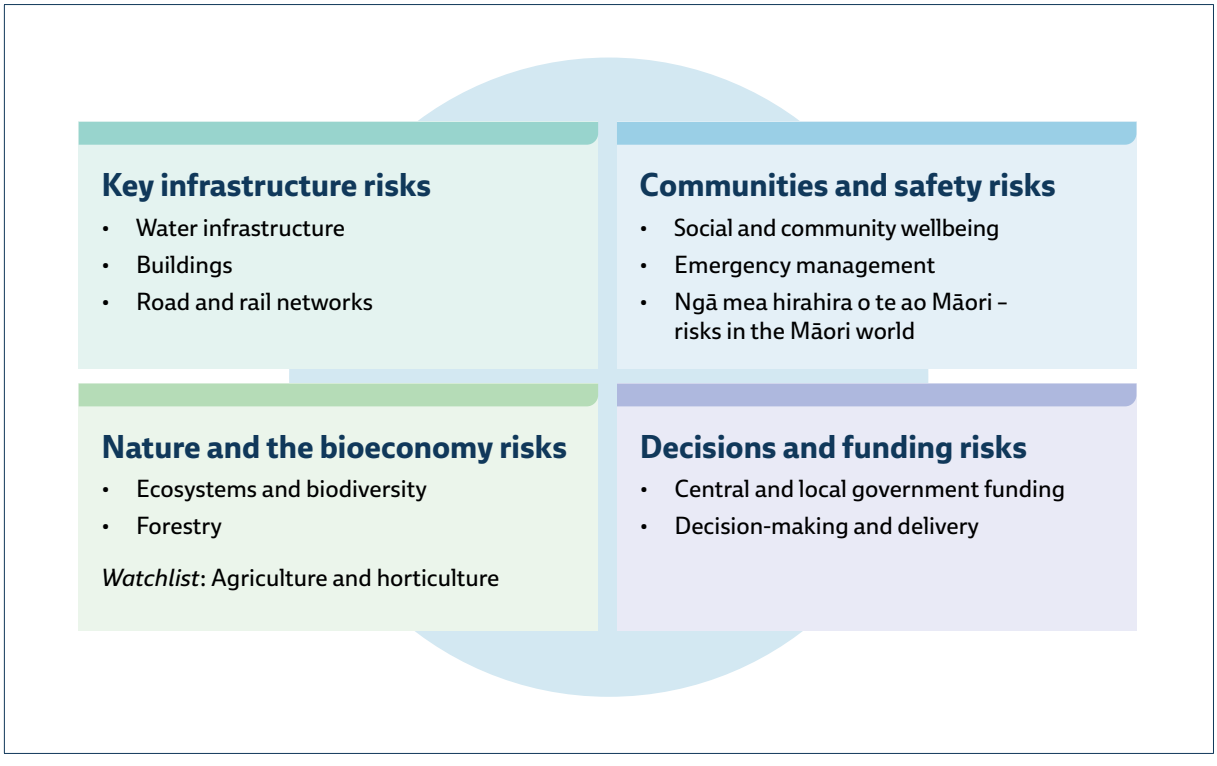
These are the significant risk areas where focused action would make the biggest difference.

These risks are already seriously affecting people, or will soon, and will take time to prepare for. And they are the risks where acting soon can have the biggest influence on many other risks.

They are shown under four categories:

- key infrastructure
- communities and safety
- nature and the bioeconomy
- decisions and funding.

Figure A.1: The ten most significant climate-related risks



Source: Commission analysis

Key infrastructure

Risks to water infrastructure

This risk is about the infrastructure that provides people with drinking water, carries stormwater away from towns, and manages sewage. Climate change will put increasing pressure on every part of this system, which is already under strain.

Drinking water pipelines are exposed to river and surface flooding, and drinking water supplies face increasing stress from drought, declining water quality, and higher temperatures. Rising seas, coastal flooding and more frequent and intense rainfall events threaten wastewater and stormwater networks.

As climate hazards continue to intensify, water services will be increasingly affected. For daily life, this could mean more service interruptions, boil water notices, or burst pipes, with flow-on risks to rivers and beaches, lost productivity for businesses and communities, and public health implications.

Some communities could even face the eventual withdrawal of services. The risk is greater because much of the infrastructure is already in a degraded state.

Major reforms to water infrastructure management are underway and present an important opportunity to plan for and embed resilience to climate hazards.

It is one of the most significant risks because critical services need to be immediately secured, and because action to strengthen the resilience of water infrastructure will help with many other climate-related risks. If it is not addressed, our assessment indicates it will be the first climate risk to reach an extreme severity level within the next 25 years.

Risks to buildings

Buildings across Aotearoa New Zealand are exposed to a range of climate-related hazards that threaten both their structural integrity and performance.

Flooding is a prominent hazard. Hundreds of thousands of buildings are in areas prone to flooding. For example, approximately 556,000 buildings are currently exposed to inland flooding, with a combined replacement value of NZ$235 billion.

Most buildings in Aotearoa New Zealand were not designed with high temperatures in mind. Under future climate conditions, this could make them at times unliveable, posing acute health risks. Some building types are more vulnerable because of their age, design, or foundation, while others were built in areas now understood to be hazard prone.

Households with fewer financial resources will find it harder to strengthen their homes, relocate away from hazards, or absorb higher insurance costs. In some regions, the level of exposure to hazards will be beyond what can be managed, and people may need to move.

This is identified as one of the most significant risks because of the centrality of buildings to daily life, and because better management of climate-related risks to buildings will help address challenges around insurability, displacement, and community cohesion.

Risks to road and rail networks

Climate hazards are putting increasing pressure on the country's road and rail networks, causing both short-term disruption and long-lasting damage. Climate change is expected to reduce the reliability and service levels of road and rail networks in a variety of ways, from more frequent closures, delays, and speed restrictions to higher maintenance and repair costs, and more frequent emergency works.

A large proportion of the network is already exposed to climate hazards: for example, around a quarter of roads and more than a third of rail lines are in areas exposed to surface, river, and coastal flooding.

Transport networks play a crucial role in national resilience. They connect communities, support emergency responses, and keep supply chains functioning.

This is a significant risk because when roads and rail fail, the effects ripple far beyond transport. Much key infrastructure is tightly bound up with road and rail corridors, while the emergency management system, critical supply chains, and large sectors of the economy also depend on reliable transport networks. Strengthening the resilience of road and rail networks will help to address many other climate risks.

Communities and safety

Risks to social and community wellbeing

This risk is about the increasing impacts of climate change on people's wellbeing – impacts the country is not well prepared for. It brings together two of the assessed risks that are closely connected in real life: what can happen when people choose or are forced to move by climate impacts, and the wider risk of effects on mental health from climate change.

The experience of devastating extreme weather events can cause long-lasting hurt, grief and fear that affects people's health. For example, in a survey of people affected by Cyclone Gabrielle one year later, 43% of respondents reported a direct negative mental or emotional impact.

Indirect impacts of climate change – including uncertainty about housing and livelihoods – can erode people's sense of safety and belonging. This is heightened when ongoing and progressive climate hazards, such as sea-level rise, threaten places that matter deeply to people, and communities have to consider moving permanently.

While in some places it may be a necessary solution in the face of repeated climate pressure, the prospect of relocation (particularly when it comes suddenly) can break relationships, divide communities and undermine trust in institutions. Planning and managing relocation well, working together with the affected communities, can help reduce those effects.

This is one of the most significant risks because of the high human and financial costs: both when people are forced to move, and when there is little relief for climate-related distress, grief, discontent and uncertainty. There are long lead times for the measures that would reduce this risk, so it is important to start as soon as possible.

Risks to emergency management

The country's emergency management system is under acute pressure and may struggle to respond to the increasing frequency, severity and extent of disasters that can result from climate hazards.

Pressure on the system from climate change is already rising: in the past five years, 80% of the declared states of emergency were for severe weather or flooding.

Strong emergency management saves lives and livelihoods, reduces injuries and trauma, limits damage to homes and businesses, and supports the long-term health, economic and social conditions in communities. The system is made up of people who work in a wide range of organisations, at community level, as full- and part-time workers and as volunteers. Together they are facing a steepening challenge.

Reviews following recent disasters have highlighted an urgent need to strengthen the emergency management system. The signalled changes in current reforms are promising, but it is too early to assess their potential to deliver the improvements needed to respond to the increasing frequency and scale of climate change impacts.

This is one of the most significant risks because the current emergency management system lacks the capacity or capability to deal with significant, complex, widespread events impacting multiple regions at once.

Ngā mea hirahira o te ao Māori – risks in the Māori world

Climate hazards interact with longstanding structural factors to create a set of interconnected risks that specifically affect whānau, hapū and iwi.

For iwi/Māori, climate change is not only a physical or economic problem. It reaches into identity, language, knowledge, governance and intergenerational wellbeing. Many cultural sites of significance to iwi/Māori sit in places now highly exposed to climate hazards. Access to taonga species is already changing in some rohe as marine heat, acidification, sedimentation and extreme weather events affect habitats and traditional harvesting practices.

Economic impacts will be felt in the climate-sensitive primary sectors where there are high levels of iwi/Māori ownership and employment. Climate change also exacerbates existing health risks for iwi/Māori. Many of the climate risks for te ao Māori arise not only from physical hazards, but from legal exclusion and inconsistent recognition of decision-making rights.

This is one of the most significant risks because climate change compounds the effects of distinctive historical, cultural, legislative, and economic conditions that continue to shape iwi/Māori resilience. This results in increased exposure to climate hazards and further constrains the adaptation options available to iwi/Māori. The inclusion of an ao Māori domain has been a key development since the first risk assessment in 2020. It was analysed by independent kaupapa Māori researchers whose report is published in full alongside this assessment. Their findings support its inclusion as one of the most significant risks.

Nature and the bioeconomy

Risks to ecosystems and biodiversity

Climate change is affecting the country's ecosystems – including land (terrestrial), freshwater, coastal and marine ecosystems – and indigenous biodiversity. Increasing land and marine temperatures change the environmental conditions species live in, while extreme weather events and wildfire cause shocks to ecosystems.

This risk is greater because of existing pressures and threats to the country's ecosystems such as land degradation, invasive species, resource extraction and pollution.

Under the higher climate impact scenario considered (see Box 1.2), from around the middle of the century the combined effects of climate change and existing pressures on ecosystems could push some systems past a point where they can recover. The consequences are important not only for the intrinsic value of ecosystems, but also for the effects that will flow across all aspects of life: water, soil and air quality, the viability of jobs and businesses that depend on nature, the health of individuals and communities, and cultural and recreational connections to nature.

We have combined climate-related risks to ecosystems and biodiversity into one significant risk because they are interconnected – with each other and with the wider risks in the assessment. Addressing risks to one ecosystem type is likely to reduce risks to others, while strengthening the resilience of these systems together will help to address many other climate-related risks. This makes it a priority for action.

Risks to forestry

This risk is about how climate change will affect the country's managed and production forests, and how the sector can better prepare for these impacts, including extreme weather, drought and wildfire, and new pests and disease.

Forestry delivers a suite of benefits to the country: wood products, export earnings and removal of carbon dioxide from the atmosphere. The sector is growing rapidly in both value and area, with the area in managed and production forests expected to nearly double over the next 50 years. It is also central to the country's action to reach net zero emissions.

Damage to these forests reduces not only their capacity to absorb carbon dioxide and the sector's economic contribution, but also exposes waterways and downstream communities to devastating sediment and debris flows.

This is one of the most significant risks because the risks to forestry from climate change are already great and there is a need to accelerate adaptation planning and action in forestry to increase resilience. Most forests planted now will not reach harvest age for more than 20 years – meaning they will grow under changing environmental conditions and intensifying extreme events. Acting now will help avoid locking in future outcomes that increase the risks to forestry.

Watchlist

We are also highlighting two closely related risks as ones to watch for the speed at which their severity might change. These are the risks to pastoral agriculture, and the risks to horticulture. These risks were rated at minor severity at present, but they are expected to move to major by 2050. Our assessment shows that as a range of climate hazards affect the productivity and profitability of these key economic sectors (see *Risks to watch: agriculture and horticulture* in *Chapter 3: Findings*), the impacts are likely to reach into other areas of the economy. This warrants early attention and preparation.

Decisions and funding

Risks to central and local government funding

This risk is about the growing pressure that climate change places on both central and local government finances. This is in the context of many councils, especially smaller ones, already facing constrained budgets or having already reached their debt limits.

As climate impacts intensify, governments face higher costs for disaster response, infrastructure repair, welfare and health services, and long-term adaptation. Disasters like the 2023 severe weather events in the North Island – which cost the Government NZ$6.65 billion – are hard to budget for because their exact timing, location, and scale can't be predicted. Yet they will become more frequent and extreme as climate change intensifies.

At the same time, climate-related impacts on the wider economy – including on primary industries – can reduce revenue from taxes and rates. Together, higher and more volatile expenditure and more uncertain revenue threaten governments' ability to maintain essential public services, invest in resilience, and plan for the long term.

The importance of central and local government funding for the operation of the whole country and economy makes this one of the most significant risks. Recent research suggests that 97% of the Government's expenditure on natural hazards since 2010 has been on responding to and recovering from disasters, with only 3% on risk reduction and resilience. If central and local government are forced to spend more on repeatedly recovering from natural disasters rather than planned adaptation, it could become harder over time to fund other core services such as health and education, pushing the costs on to future generations.

Risks to decision-making and delivery

The demands of climate change are putting Aotearoa New Zealand's ability to plan, decide and act together under increasing pressure. This risk area is focused on what is needed to support adaptation in ways that work for everyone in the country, and that can endure the pressure of intensifying impacts. It includes assessment of risks to how central and local government work together, how well people trust democratic institutions as they come under pressure for difficult decisions, and to the Crown's ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi.

As climate change hazards intensify, the kinds of issues that require stable decision-making and effective delivery are becoming more complex. The country needs to be able to drive forward on adaptation, to reduce the escalating impacts and costs of climate change. Otherwise, decision-makers will be increasingly caught up in urgent responses, which take time and resources away from planning for the future and reducing harm, and could result in locking in future vulnerabilities.

This is one of the most significant risks because of the need for immediate action. It will take time to work through adaptation decisions and implement policy and programmes that match the speed and scale of climate change – especially to do this in ways that build public trust and confidence, and uphold the Crown's responsibilities under Te Tiriti/The Treaty.

See *Chapter 3: Findings* for more information on these 10 significant risks, and the watchlist. Table A.1 shows the assessment ratings of all 37 climate-related risks – which are covered in more detail in our Full assessment report.

What this assessment provides

Comprehensive scan at national level

The 2026 national climate change risk assessment provides a scan of the country's climate-related risks, focusing on the potential consequences for people, places and ways of life, and where effort can go to reduce harm.

The assessment looks closely at how climate change acts on different aspects of life, and what is in place to respond to those effects.

The scope of the assessment is national and broad ranging, considering not only how climate change could change the natural environment and the towns and cities that people live in, but also the economy, te ao Māori, the health and wellbeing of communities, and potential future implications for decision-making and funding. The process raises those specific issues to national risks, which can inform government action to adapt to the changing conditions.

Because of its broad scope, the assessment relies on a wide range of evidence from many sources. It uses expert judgement from the Commission and others to interpret that evidence and draw conclusions.

Priorities for action

The most significant risks are the climate-related risk areas where our assessment suggests focused action under the Government's next national adaptation plan can make the biggest difference and achieve the greatest system-wide impact.

Decision-makers have a range of options available to address the risks. These include accelerating and joining up work already underway by the Government and supporting coordinated adaptation around the country (including providing clarity about how costs can be shared and met).

Action to address the challenges presented by climate change can return benefits that strengthen the economy, society and the environmental foundation of the country. Investing attention and resources into carefully prioritised adaptation action would substantially reduce future costs and losses associated with climate change.

Acting to strengthen the country's underpinning structures and tools – such as funding and financing systems, trust in democratic institutions, social connections and wellbeing – will be important to support the adaptation needed for climate change.

A view of what is underway

Action has begun in many ways across the country. The assessment reflects what is underway at central and local government level, as well as identifying what other actions can help to reduce the impact of climate change.

This report includes examples of what is happening already within local communities and businesses – the kinds of adaptation action that will be essential across the country, and which can be strengthened with comprehensive national planning.

A summary of climate change already happening and projections for the future

Chapter 2: Climate change in Aotearoa New Zealand provides a summary of current and projected climate change and the hazards that result, based on updated data, with information about people and infrastructure exposed to those hazards. This shows:

- **Climate change is reshaping the hazards that the country faces**
  Communities, ecosystems and infrastructure in Aotearoa New Zealand are exposed to shifting and intensifying pressures in 2026. As well as the physical hazards people in this country are used to dealing with (such as earthquakes), there are new – and intensifying – hazards from climate change that are creating challenges outside historical experience.

  Warming air and oceans, rising seas and changing physical and chemical patterns in the atmosphere and oceans are driving more frequent, intense and compounding extremes – especially extreme rainfall and flooding (inland and coastal), rainfall-induced landslides, heat extremes, drought, marine heatwaves and ocean acidification.

- **This is not business-as-usual hazard management**
  Climate change is shifting the country's 'normal'. Hazards are becoming more acute, as progressive changes and extreme events load on top of other challenges.

  The interval between damaging climate-related events is reducing, while the underlying conditions (such as air, water and soil temperatures) are altering. This combination is going to require ongoing adaptive management – systems will need to change in response: how water is managed, how homes are kept safe, how people farm, how decisions are made.

- **Supporting global efforts to limit warming is integral to climate risk management**
  Chapter 2: Climate change in Aotearoa New Zealand sets out projected differences in climate variables and their effects at two different levels of global warming later this century.

  Higher global warming levels drive more severe and widespread hazards, reduce the feasibility and cost-effectiveness of adaptation options, and increase residual risks and losses. Continued support for and contribution to global efforts to reduce emissions and limit warming shapes this country's future hazard environment – it would help keep risks manageable and avoid reaching adaptation limits for communities and sectors.

The hazards that underlie the assessed risks

- *Extreme events* like extreme rainfall, marine heatwaves, wildfires.
- *Progressive and ongoing hazards* like sea-level rise.
- *Changes to variability* like trends in temperature or rainfall.

What makes up the full national risk assessment

The Climate Change Response Act 2002 (the Act) requires an assessment every six years of the risks to the country's economy, society, environment and ecology from current and future effects of climate change. This assessment is also required to advise the Government on the most significant risks requiring attention in the next national adaptation plan.

The 2026 assessment is the country's second national climate change risk assessment. It was carried out by He Pou a Rangi Climate Change Commission (the Commission). It builds on the first assessment published by the Ministry for the Environment in 2020[1] and draws on the latest available evidence, international models for climate risk assessments, input from engagement with interested people and organisations through the process, and advice from expert reviewers.

Four reports make up the assessment.

- This *Priorities for action* report is focused on the most significant risks requiring immediate action to reduce serious consequences for people, places and ways of life. This report also provides a summary of recent projections for climate change.
- The *Full assessment* report covers all 37 risks assessed, and provides an overview across seven interconnected systems or 'domains' of risk (see box). It includes a more detailed presentation of current information about climate change in Aotearoa New Zealand.
- A companion report, *Ngā mea hirahira o te ao Māori*, provides a kaupapa Māori assessment of seven national climate-related risks that specifically affect iwi/Māori (these form part of the 37 risks).
- Our approach to assessment is described in a separate *Summary of method* report.

Other supporting material can be found on our website.

What happens next

After publication of a national climate change risk assessment, the Minister of Climate Change must respond, within two years, with a new national adaptation plan. This needs to address the most significant risks identified in the risk assessment.

The Commission has a role advising on the implementation and effectiveness of the national adaptation plan, and on how future plans can be more effective. Our next progress report on adaptation is due by August 2026. That report will review progress under the existing plan, and will also contain advice for the next one.

The seven domains of risk

- Natural environment (NE)
- Built environment (BE)
- People, health and communities (PHC)
- Ngā mea hirahira o te ao Māori – things of importance in the Māori world (NMH)
- Economy and finance (EF)
- Sectors relying on the natural environment (SRNE)
- Governance (G).

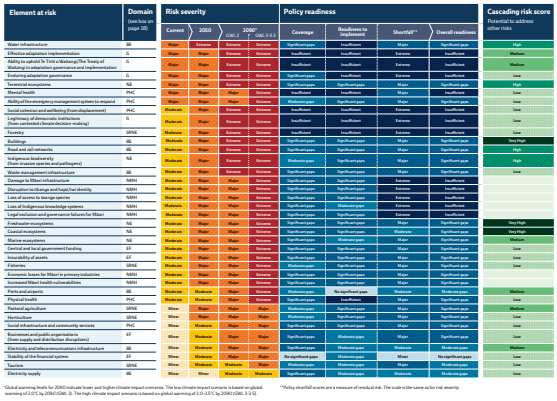
Box A.1: How to read the table of risks and scores

The risks are assessed in three ways

How severe it is: the severity assessment looks at the nature and scale of the potential consequences of each risk; this is rated from 'minor' to 'extreme' for three periods (present day, mid-century, and end of the century).

How ready the country is: the policy readiness assessment reviews existing government policies and plans and assesses how well they can address each risk; this is rated from 'no significant gaps' to 'insufficient'.

Connections to other risks: the indirect and cascading risks assessment examines the relationships between different areas, and identifies options for action in one area that could reduce multiple risks.



What the severity ratings mean

Minor: there could be occasional, minor loss and damage, and temporary impacts.

Moderate: there could be repeating loss and damage, and climate impacts could upset how well key systems run.

Major: there could be large or frequent loss and damage, serious or long-term disturbance to people, places and ways of life, and disruption to whole systems.

Extreme: there could be very large, very frequent loss and damage, permanent effects on people and the environment, and failure of systems. At this level, there is a high chance of reaching thresholds, when changes cannot be reversed.

See *Chapter 1: Introduction* for the formal assessment criteria for risk severity, as well as for policy readiness and cascading risk scores.

Table A.1: The risks we identified and how they scored in the assessment

Element at risk	Domain (see box on page 18)	Risk severity				Policy readiness				Cascading risk score Potential to address other risks
		Current	2050	2090* GWL 2	2090* GWL 3–3.5	Coverage	Readiness to implement	Shortfall**	Overall readiness	
Water infrastructure	Built environment	Major	Extreme	Extreme	Extreme	Significant gaps	Insufficient	Major	Significant gaps	High
Effective adaptation implementation	Governance	Major	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Medium
Ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi in adaptation governance and implementation	Governance	Major	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Medium
Enduring adaptation governance	Governance	Major	Major	Extreme	Extreme	Significant gaps	Insufficient	Extreme	Insufficient	Low
Terrestrial ecosystems	Natural environment	Major	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	High
Mental health	People, health and communities	Major	Major	Major	Extreme	Insufficient	Insufficient	Major	Insufficient	Low
Ability of the emergency management system to respond	People, health and communities	Major	Major	Major	Extreme	Moderate gaps	Significant gaps	Major	Significant gaps	Low
Social cohesion and wellbeing (from displacement)	People, health and communities	Moderate	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Low
Legitimacy of democratic institutions (from contested climate decision-making)	Governance	Moderate	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Low
Forestry	Sectors relying on the natural environment	Moderate	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Low
Buildings	Built environment	Moderate	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Very High
Road and rail networks	Built environment	Moderate	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	High
Indigenous biodiversity (from invasive species and pathogens)	Natural environment	Moderate	Major	Extreme	Extreme	Moderate gaps	Significant gaps	Major	Significant gaps	High
Waste management infrastructure	Built environment	Moderate	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Low
Damage to Māori infrastructure	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Disruption to tikanga and hapū/iwi identity	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Loss of access to taonga species	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Loss of Indigenous knowledge systems	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Moderate gaps	Extreme	Insufficient	
Legal exclusion and governance failures for Māori	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Freshwater ecosystems	Natural environment	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Very High
Coastal ecosystems	Natural environment	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Moderate	Significant gaps	Very High
Marine ecosystems	Natural environment	Moderate	Major	Major	Extreme	Significant gaps	Moderate gaps	Major	Significant gaps	Medium
Central and local government funding	Economy and finance	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Low
Insurability of assets	Economy and finance	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Low
Fisheries	Sectors relying on the natural environment	Moderate	Major	Major	Extreme	Moderate gaps	Significant gaps	Major	Significant gaps	Low
Economic losses for Māori in primary industries	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	
Increased Māori health vulnerabilities	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	
Ports and airports	Built environment	Moderate	Moderate	Major	Extreme	Moderate gaps	No significant gaps	Moderate	Moderate gaps	Medium
Physical health	People, health and communities	Moderate	Moderate	Major	Extreme	Significant gaps	Insufficient	Major	Significant gaps	Low
Pastoral agriculture	Sectors relying on the natural environment	Minor	Major	Major	Major	Moderate gaps	Significant gaps	Major	Significant gaps	Medium
Horticulture	Sectors relying on the natural environment	Minor	Major	Major	Major	Moderate gaps	Significant gaps	Major	Significant gaps	Low
Social infrastructure and community services	People, health and communities	Minor	Moderate	Major	Major	Significant gaps	Significant gaps	Major	Significant gaps	Low
Businesses and public organisations (from supply and distribution disruptions)	Economy and finance	Minor	Moderate	Major	Major	Significant gaps	Moderate gaps	Major	Significant gaps	Low
Electricity and telecommunications infrastructure	Built environment	Minor	Moderate	Major	Major	Significant gaps	Moderate gaps	Moderate	Moderate gaps	Medium
Stability of the financial system	Economy and finance	Minor	Moderate	Major	Major	No significant gaps	Moderate gaps	Minor	No significant gaps	Low
Tourism	Sectors relying on the natural environment	Minor	Moderate	Moderate	Major	Moderate gaps	Moderate gaps	Major	Moderate gaps	Low
Electricity supply	Built environment	Minor	Minor	Moderate	Moderate	Significant gaps	Moderate gaps	Moderate	Moderate gaps	Low

*Global warming levels for 2090 indicate lower and higher climate impact scenarios. The low climate impact scenario is based on global warming of 2.0°C by 2090 (GWL 2). The high climate impact scenario is based on global warming of 3.0–3.5°C by 2090 (GWL 3–3.5).

**Policy shortfall scores are a measure of residual risk: The scale is the same as for risk severity.

Chapter 1: **Introduction**

This is Aotearoa New Zealand's second national climate change risk assessment. It provides a scan of the country's climate-related risks, focusing on the potential consequences for people, places and ways of life, and where effort can go to reduce harm.

This risk assessment was carried out by He Pou a Rangi Climate Change Commission (the Commission) under the Climate Change Response Act 2002 (the Act).

The purpose is to assess the risks to the country's economy, society, environment and ecology from current and future effects of climate change, and to advise Government on the most significant risks requiring attention in the second national adaptation plan.

Four reports make up the assessment.

- This *Priorities for action* report is focused on the most significant risks where action can make the biggest difference for people, places and ways of life. This report also provides a summary of recent projections for climate change.
- The *Full assessment* report covers all 37 risks assessed, and includes a more detailed presentation of current information about climate change in Aotearoa New Zealand.
- A companion report, *Ngā mea hirahira o te ao Māori*, provides a kaupapa Māori assessment of seven national climate-related risks that specifically affect iwi/Māori (these form part of the 37 risks).
- Our approach to assessment is described in a separate *Summary of method* report.

Spotlight on action that makes the biggest difference

Together these reports provide a comprehensive picture of the potential consequences of climate change in Aotearoa New Zealand – in the present day and for the next generation – and how ready the country is to respond to those risks.

This *Priorities for action* report presents the most significant risks identified in the assessment. These are the 10 risk areas that stand out as the ones that will affect people the most – and the most quickly – if they are not addressed.

They are also the risk areas where acting soon can have the biggest influence on many other climate-related risks.

The challenges set out in this report are a demanding 'risk register' for a country to face.

Our assessment shows that investing attention and resources on carefully prioritised action would substantially reduce future costs and losses associated with climate change – economic, social and environmental. Those choices will be the focus of Government decisions, including about what is in the next national adaptation plan.

Action has begun in many ways across the country. Our assessment reflects what is underway, at central and local government level, as well as identifying what other actions can help to reduce the impact of climate change.

This report includes examples of what is happening already within local communities and businesses – the kinds of adaptation action that will be essential across the country, and which can be strengthened with comprehensive national planning.

Elements of this report

This report has three sections:

- *Chapter 1: Introduction* covers the purpose of the assessment, and summarises our approach – including what is required in the Act and how the assessment fits into the country's wider climate change response. It also introduces key concepts about climate-related risks and adaptation, to support understanding.
- *Chapter 2: Context* presents a summary of climate change already happening in Aotearoa New Zealand and projections for the rest of the century. This includes an outline of how people and infrastructure are exposed to the increasing hazards.
- *Chapter 3: Findings* sets out the key findings from the assessment, and the 10 risks identified as the most significant for immediate action (with notes on other important risks). It includes three community stories illustrating local adaptation.

Focus is on consequences not solutions

This report discusses the types of things that could help address climate-related risks but does not set out recommendations for specific action in response to the risks it covers. The Act separates the task of identifying risks from the work to define an action plan – that is the responsibility of the Government, as part of national adaptation planning.

The Commission does have a role advising on the implementation and effectiveness of the national adaptation plan, and on how future plans can be more effective, as part of its progress reporting on adaptation. Our next progress report is due by August 2026 – see section below: *Connections with the country's wider climate change response*.

Working through uncertainty

Adaptation is a complex process of adjusting to climate change and its effects. It is an area where uncertainty is a constant. This uncertainty is part of what motivates a risk assessment. It is important that uncertainty does not prevent action or obscure the urgency of acting. Enough is already known about the changes Aotearoa New Zealand will face over the coming decades to put the country in a good position to prepare for those impacts.

Some of the ongoing shifts brought on by climate change can be foreseen, such as the continued rise in sea levels. While the exact amount of sea-level rise will vary from place to place, it can in general be anticipated.

There is much more uncertainty when it comes to extreme weather events. While it is clear those events will become more frequent and severe, it is not at all certain when and where they will happen, or quite what impact they will have in combination with other hazards. Scientific understanding is growing about many of the hazards the country faces, and can over time guide effective adaptation, but there will always be uncertainty.

Risk assessments are not predictions – they help New Zealanders look ahead to understand potential impacts and act early to prevent them. These reports discuss climate change projections, and variability between models. We don't assume the average is what will happen (and didn't rely on that for our assessment). This is why we looked at different scenarios and relied on a range of published evidence to explore how serious the potential outcomes could be so that the country can take action to reduce them.

Box 1.1: The consequences of climate change do not fall evenly

Few people or communities think of themselves as vulnerable or like to be described that way. However, 'vulnerability' carries a particular meaning in the context of climate risk assessment (see Box 1.2). It refers to factors that determine how great the effect of climate change might be on people, places or things.

Some of the factors that determine vulnerability in a climate change context are socio-economic, cultural, and historical. These kinds of factors can have big – if sometimes invisible – influences on how climate change is experienced by different groups and communities. They also have a major influence on how well people can adapt.

For example, some people have greater physical sensitivity to the health impacts of climate change. This may include children, older people, people with pre-existing medical conditions and some disabled people. These groups may also be less able to get around and have greater difficulty evacuating during extreme weather events.

Others may be hit harder due to pre-existing challenges, such as low incomes or unemployment. These factors can make it harder for people to change their circumstances in response to climate hazards, like high rainfall events or heatwaves, or to participate in decisions about adaptation that affect them. For example, as extreme weather events increase in frequency and intensity, people with more financial resources may move out of harm's way, while others remain in a hazard zone and are hit by repeated events.

Often, these kinds of challenges are a result of long-lasting historic and structural factors that are beyond the ability of individuals to change. This means climate change impacts are very likely to exacerbate existing structural inequities, particularly for iwi/Māori – see *Ngā mea hirahira o te ao Māori – risks in the Māori world*.

Equity has been considered in the assessment of all 37 risks (see *Our approach*).

Box 1.2: Key concepts underlying this climate risk assessment

The nature of climate-related risks

Understanding 'climate change risk'

In a climate change risk assessment, risk has a specific meaning. It is formally defined by the Intergovernmental Panel on Climate Change (IPCC) as 'the potential for adverse consequences to human and ecological systems'.[2]

The risk comes from a combination of three factors: *hazard, exposure*, and *vulnerability* (Figure 1.1).

- *Hazard* refers to physical events or trends that result from climate change and that create problems for people or the environment. Climate-related hazards can be ongoing and progressive, like sea-level rise and changing weather patterns, or rapid onset, like extreme weather events and associated floods, landslides, or fires.
- *Exposure* considers who or what can be affected by climate-related hazards. The elements exposed can include communities, ecosystems, economic sectors, cultural assets, and infrastructure.
- *Vulnerability* focuses on the factors that determine how great the effect of a hazard might be on the exposed 'elements'. It covers what makes people, places, or things more or less likely to be harmed (sometimes referred to as 'sensitivity') and whether they will be able to adapt (sometimes referred to as 'adaptive capacity').

Figure 1.1: Factors in climate change risk

Source: Commission analysis derived from IPCC

Time horizons and global warming levels

Climate risk assessments look at how risks change over time, and how the consequences for people, places and ways of life would change depending on the rate of global warming.

In this assessment we have considered the severity of each risk for the present day, for the middle of the century (around 2050), and for the end of the century (around 2090).

While we assessed risks using two climate impact scenarios (based on different levels of global warming), risks were scored only once for 2050. This was because the difference in projected impacts between a low and high climate impact scenario by then is unlikely to be large enough to produce different scores.

Our scores for 2050 assume global warming of 1.5–2.0°C by the middle of the century – consistent with the 1.4°C of warming the world has already experienced from pre-industrial levels.[3]

When scoring the severity of risks in 2090, we considered two scenarios for different levels of global warming (as compared to pre-industrial levels) based on the latest international climate science:

- low climate impact scenario based on global warming of 2.0°C by 2090
- high climate impact scenario based on global warming of 3.0–3.5°C by 2090.

Indirect, compounding and cascading risks

While each of the 37 risks in the assessment has been analysed separately, in reality climate-related risks often interact.

An 'indirect risk' can emerge as a secondary consequence of a climate hazard, for example when extreme weather damages power lines, causing a power cut.

Sometimes multiple hazards can occur at once or in quick succession, creating a 'compounding' risk, for example when crews are unable to repair power lines damaged during a storm, because there is also a landslide blocking access.

Sometimes risks run in 'cascading' chains of cause and effect, for example when households lose income because people are unable to work due to an extended power outage after extreme weather and landslides.

An examination of how risks cascade was a particular focus of this second national climate change risk assessment – see **Box 1.4**. How climate-related risks cascaded in real life in Hawke's Bay following Cyclone Gabrielle in 2023 is shown in **Figure 1.2**.

This assessment has incorporated these interactions between risks. This includes introducing ratings for indirect and cascading risks for risks in the domains the Commission has analysed – see *Our approach* and **Table 1.4**.

Residual risk

Residual risk describes the part of a risk that remains after efforts have been made to reduce it. In this context, it describes the level of risk that remains after adaptation and other efforts to address a climate-related risk. We considered residual risk within our 'policy readiness' assessment of how prepared the country is to respond to climate-related risks (see **Table 1.3**).

Continued on next page

Understanding adaptation

Adaptation reduces exposure and vulnerability

When we talk about adapting to the effects of climate change, the focus is on avoiding or reducing the harm or damage from climate hazards.

Adaptation reduces the climate risk overall, but it is not reducing a *hazard* – it cannot slow sea-level rise or prevent extreme weather events. What it can do is reduce *exposure* (for example by moving key infrastructure out of a flood zone) and *vulnerability* (for example by ensuring new buildings are designed to withstand higher temperatures).

See the story in *Chapter 3: Findings* about action by Ngātiwai iwi to reduce their exposure to flooding risks on the east coast of Te Taitokerau/Northland.

Maladaptation can increase risk or transfer impacts

Not all action to adapt to climate change is effective at reducing the risk. Sometimes an action can make a risk worse, or it can move the negative impacts elsewhere.

This 'maladaptation' is usually an accidental consequence of well-intentioned action. It can increase the residual risk. For example, building up a roadway to reduce the likelihood of road closures from flooding could end up damming floodwaters and causing deeper floods on nearby properties.

Lead time and lock in

'Lead time' reflects the period between the recognition of an issue, and effective management of that issue. This can be because of delays in response, and also because the response decided on takes time to set up – for instance to train a workforce to new requirements.

'Lock in' describes a situation where future outcomes are determined by events or decisions in the past. It recognises that decisions and ways of thinking from an earlier period can sometimes limit options in the future – for instance present day building rules can 'lock in' performance standards that do not account for higher future temperatures.

Thresholds

There are points when change can reach a level where a species, for instance, or a community or part of a human system, cannot absorb further change, and is no longer resilient.

- Thresholds are limits beyond which certain systems are no longer able to function.
- Tipping points refer to abrupt re-organisation of a system, such as dynamic feedbacks.

Where that threshold or tipping point lies is not always clear, and can often only be confirmed in hindsight. Climate change increases the likelihood of breaching such thresholds.

For more information, see *Our approach* following, and the *Technical Glossary*.

Cascading impacts of Cyclone Gabrielle in Hawke's Bay

In 2025 Sustainable Hawke's Bay produced a short case study of the ongoing cascading impacts of Cyclone Gabrielle in the region, with support from the Commission (available on our website).

It focused on three areas:

- impacts on the natural environment, especially a taonga bird species, the nationally vulnerable banded dotterel
- impacts on food production and the local economy
- impacts on social cohesion, trust and governance.

Sustainable Hawke's Bay conducted a range of local engagements to illustrate these impacts. Their findings help demonstrate how a single climate-related extreme weather event can trigger cascading environmental, economic, and social consequences – as Richard Pentreath said, "The pressure doesn't ease just because the water's gone." (See **Figure 1.2** on next page).

Understanding of the impacts in the region was informed by in-depth interviews with 12 community stakeholders – these were people identified as having direct experience of ongoing impacts from Cyclone Gabrielle, or who worked closely with people or taonga species experiencing those impacts. Richard was representing Ngāi Tukairangi, an iwi trust operating orchards in Northland, Bay of Plenty, and Hawke's Bay.

The connection between Cyclone Gabrielle and climate change was later demonstrated by a nation-wide study that found human-caused warming intensified the storm's total rainfall by about 10% compared to the same storm with no warming.[4]

See over page for infographic.

Figure 1.2

Cascading impacts of Cyclone Gabrielle in Hawke's Bay

"The pressure doesn't ease just because the water's gone" – Richard Pentreath

Sustainable HB
CENTRE FOR CLIMATE AND RESILIENCE

This graphic is based on a 2025 case study from Sustainable Hawke's Bay investigating how a single climate-related weather event triggered cascading ecological, social, and environmental impacts.

Cyclone Gabrielle

13–14 February 2023

Impacts reported by Hawke's Bay Independent Flood Review 2024

- Exceptional rainfall, high winds, and widespread flooding – around 400 mm in 12 hours
- 5.3 km of stopbanks breached
- Major damage to infrastructure – road, rail, water
- Many marae, urupā, and papakāinga destroyed or extensively damaged
- 1,700 properties flooded
- Power outages affecting 75,000 people
- Complex and widespread emergency response

Ongoing cascading impacts over time in three focus areas

	Days – weeks	Weeks – months	Months – years	Long-term – ongoing
Ecosystems and the natural environment	Waste and organic matter deposited by floodwaters	Flood waste drives increased pest and predator numbers	Reduced pest and predator control due to constrained access and reduced funding	Habitat loss
				Increased pest and predator pressures
	Riparian plantings washed away	Extensive erosion, sedimentation, and accumulation of slash	Post-cyclone cleanup, while necessary, generates additional ecological disturbance	Harm to taonga species 15% decline in Hawke's Bay of nationally vulnerable banded dotterels
	Sedimentation damage to waterways			Altered river channels, permanent land changes
Food production and the local economy	Thousands of hectares of productive land covered by silt	Price increases for key equipment due to high demand	Some orchards revert to grazing, or are abandoned	Changing land use and ownership patterns
	Crop losses	Strained cashflows	Significant increases in insurance premiums	Uncertainty as interest-free recovery loans end
	Damage to equipment and buildings	Workforce disruption	Banks unwilling to lend for redevelopment	Loss of identity through land-use changes and land loss
	Disruption to trade			
Social cohesion, trust and governance	Systems for weather forecasting and preparedness overwhelmed	Service disruptions, stresses on councils and agencies	Erosion of trust in forecasting and planning frameworks	Mental health strain, grief, and uncertainty
			Friction through recovery processes	Lingering hostility towards institutions
	Pressure on emergency response	Burnout of volunteers and first responders	Perception that systems were not adequate for the event's scale	Risks to local government turnout and participation

Our approach

The second national climate change risk assessment looks at the consequences of climate change across seven interconnected systems or 'domains' of risk (**Figure 1.3**):

- Natural environment (5 risks)
- Built environment (7 risks)
- People, health and communities (5 risks)
- Ngā mea hirahira o te ao Māori – things of importance in the Māori world (7 risks)
- Economy and finance (4 risks)
- Sectors relying on the natural environment (5 risks)
- Governance (4 risks).

All 37 risks assessed are set out in **Table 3.1** in *Chapter 3: Findings*.

Figure 1.3: The seven domains of risk assessed in this report

Source: Commission analysis

How we assessed the risks

Under the Act, the Commission must assess the risks to Aotearoa New Zealand's economy, society, environment, and ecology from the current and future effects of climate change once every six years. The assessment must identify a list of the most significant risks, based on their nature, severity, and the need for coordinated action to address them.

This assessment built on the first assessment published by the Ministry for the Environment in 2020,[1] and continues the overall domain structure and many of the individual risks. It draws on the latest available evidence, international models for climate risk assessments, and advice from expert reviewers.

A key difference between the two assessments is the inclusion of two domains with specific focus. One is new and looks at matters of importance to Māori: Ngā mea hirahira o te ao Māori. Analysis for this domain was completed by researchers from the Bioeconomy Science Institute (Manaaki Whenua – Landcare Research Group) and Ngā Pae o te Māramatanga Māori Centre of Research Excellence.

The other domain – Sectors relying on the natural environment – was created by separating risks to the primary sector and tourism from broader economic risks.

For more information on how the assessment approach has evolved, including the contribution of experts and international reviewers, see the Summary of method report.

Requirements of the Climate Change Response Act 2002

Table 1.1 sets out the factors the Commission must consider when preparing a national risk assessment, and other matters it is required to consider in its advice.

The Commission may also take into account any opportunities that arise for the country as a result of the effects of climate change, and any other relevant or appropriate factor.

Table 1.1: Requirements of the Climate Change Response Act 2002

Factors the Commission must consider in a climate risk assessment	Key matters the Commission must consider in all its advice
• The economic, social, health, environmental, ecological, and cultural effects of climate change. • The distribution of the effects of climate change across society, taking particular account of vulnerable groups or sectors. • New Zealand's relevant obligations under international agreements. • How the assessment aligns or links with any other relevant national risk assessments produced by central government entities. • Current effects and likely future effects of climate change. • Scientific and technical advice.	• Current available scientific knowledge. • Existing technology and anticipated technological developments, including the costs and benefits of early adoption of these in New Zealand. • The likely economic effects. • Social, cultural, environmental, and ecological circumstances, including differences between sectors and regions. • The distribution of benefits, costs and risks between generations. • The Crown–Māori relationship, te ao Māori (as defined in section 5H(2)), and specific effects on iwi and Māori. • Responses to climate change taken or planned by parties to the Paris Agreement or the United Nations Framework Convention on Climate Change.

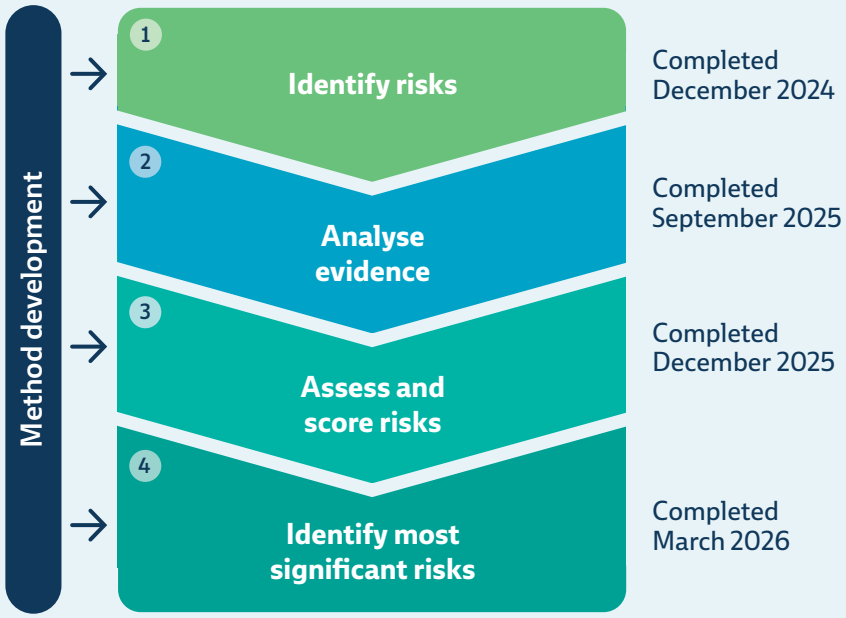
Key steps in the process

This section provides a short summary of steps in the assessment, to support understanding of the ratings and priority given to different risks. More detail is in the Summary of method.

As shown in Figure 1.4 the first step in our assessment was to identify the risks in focus, including what we would update from the first assessment.

We then analysed the available evidence, including material supplied in a Call for Evidence and other engagement (see following).

Figure 1.4: Steps in the assessment process



Source: Commission analysis

Engagement throughout the process

The Commission opened a formal public Call for Evidence between November 2024 and March 2025, which was supported by webinars to encourage people to submit material. We also conducted targeted engagement to build our understanding of particular risks. This provided a wide range of direct input from iwi/Māori representatives, communities, sector and non-government organisations, government agencies, councils, businesses, and subject matter specialists.

In 2025 we also carried out two case study visits (to Te Taitokerau/Northland and Westport) to hear directly from affected communities. Learning more about community experiences is particularly important for understanding climate risks and adaptation, as climate hazards play out differently in different areas, and the responses from communities, councils and industries vary widely. These two case studies built on the insights we had gathered from earlier case studies in South Dunedin and Wairoa in northern Hawke's Bay.

Assessing severity

Severity considers the nature and scale of the potential consequences of each risk. This gives an indication of how serious the impacts of climate-related risks may be – both for the immediate focus area of the risk (such as a sector like forestry, or a system like health services), and for the country as a whole.

Each risk was rated for the present day, for mid-century (2050) and for the end of the century (2090). For the more distant assessment, we have included ratings for two scenarios, for different levels of global warming: a low climate impact scenario, and a high climate impact scenario (see **Box 1.2**).

The severity ratings range from 'minor' to 'extreme' (**Table 1.2**).

They are based on expert judgement from the Commission and others, drawing from a wide range of evidence and with specific considerations for each domain. For more, see the separate Summary of method report.

Table 1.2: Risk severity assessment criteria

Minor	Moderate	Major	Extreme
• Minor and infrequent losses and damages. • No significant disturbance of system functionality. • Temporary and/or very slow onset impacts. • Unlikely to pose systemic risk.	• Moderate and/or recurring losses and damages. • Moderate disturbance of system functionality. • Medium-term and/or slow onset impacts. • Some potential to pose systemic risk.	• Large and/or frequent losses and damages. • Major and/or long-term disturbance of system functionality. • Long-term and/or rapid onset impacts. • Potential for impact thresholds or local tipping points to be reached, posing systemic risk.	• Very large and/or very frequent losses and damages. • Total and/or irreversible loss of system functionality. • Permanent and/or very rapid onset impacts. • High potential for impact thresholds or local tipping points to be reached, very likely to pose systemic risk.

Assessing readiness

The assessment of readiness focuses on the existing policies, plans and actions set by the Government. These can be in the country's first national adaptation plan (2022) or in other central government programmes.

The 'policy readiness' assessment examines whether the risk is adequately covered by those policies and plans, and how well they can be implemented.

Part of what is shown in the assessment is the 'residual risk' – the level of risk that remains after taking into account action to reduce the risk already, and adaptation efforts. This helps highlight where more action can further reduce consequences for people.

The readiness ratings range from 'no significant gaps' to 'insufficient' (Table 1.3).

The ratings are based on expert judgement from the Commission and others, drawing from a wide range of evidence. For more, see the separate Summary of method report.

Our analysis had a cut-off date of 31 October 2025 for considering new information, including policy announcements, in the formal assessment and scoring. Important subsequent developments (up to late February 2026) have been noted in our descriptions, but have not influenced scoring of risks.

Table 1.3: Policy readiness assessment criteria

No significant gaps	Moderate gaps	Significant gaps	Insufficient
• Policies respond well to this risk. • Mandate, funding and lead agencies are clear and active. • Risk largely mitigated by full implementation of current policy.	• Policies and actions only partially respond to this risk. • Some delivery under way, but there are gaps in mandate or uneven support. • Some risk would remain despite full implementation of current policy.	• Policy has not responded well to some important aspects of this risk. • Fragmented responsibility, unclear mandate or missing delivery structures. • Policies, plans and actions would leave major parts of the risk unaddressed, even if implemented as intended.	• Policy is either absent or has not responded to this risk. • Cannot be delivered under current conditions. No mandate, funding or mechanism for delivery. • Implementation would not reduce the risk meaningfully.

Indirect and cascading risks

The 2026 risk assessment has introduced ratings for indirect and cascading risks in the domains the Commission has analysed.[i]

This allowed us to consider the relationships between risks, and to identify options that would address more than one risk at the same time. This is a relatively new concept for risk assessment and has been included to help ensure adaptation actions are targeted to effect.

The cascading risk scores range from 'low' to 'very high' (**Table 1.4**). We tested the relationships between risks and then ranked them in order of their potential: where addressing one risk would help to address others. The scores are relative.

Risks with high or very high cascading scores are those that, if addressed, would have the greatest potential to address other climate-related risks. Some risks with a low cascading score may still be important for enabling action on other risks. For instance, access to central or local government funding will be important to enable action on many risks, but funding alone will not be sufficient.

See also **Figure 1.2** showing cascading impacts of Cyclone Gabrielle in Hawke's Bay, and **Box 1.4** for patterns cascades can follow.

Table 1.4: Cascading risk scores explained

Low	Medium	High	Very high
• These risks had lower-than-average potential to help address others. • They were in the bottom half of the ranked list.	• These risks had higher-than-average potential to help address others. • They were in the middle of the ranked list (between 51% and 75%).	• These risks were among those with the highest potential to help address others. • They were near the top of the ranked list (between 76% and 90%).	• These risks had the very highest potential to help address others. • They were in the top 10% of the ranked list.

i Risks in Ngā mea hirahira o te ao Māori were not scored in this way, although the researchers assessing the risks in that domain did take potential cascading impacts into account – see Summary of method.

Box 1.3: How we considered opportunity

Climate change may present opportunities as well as potential adverse consequences. Such opportunities are rare, but important to factor into risk assessments and planned adaptation actions.

We considered the opportunities that climate change might present, such as warmer average temperatures reducing some winter illnesses, or supporting new crops, as part of the severity assessment. This was included as part of our consideration of each area; for example, the potential to take advantage of changing weather patterns by adjusting farming or growing practices was included in the assessment of pastoral agriculture and horticulture.

This approach recognises that even when climate change presents opportunities in one area, it is likely to also present risks. By keeping this interplay visible, the assessment can support decision-making that avoids unintended consequences, or maladaptation (see Box 1.2). For more information see the Summary of method report.

Identifying the most significant risks

All of these ratings – for severity, policy readiness, and indirect and cascading risks – were considered in our identification of the most significant risks.

The identification of the 'most significant risks' was the last stage in our assessment.

We worked through three steps to identify what was most significant.

Step 1: we screened the risks using three principles

- Principle 1: Risks that present high potential for adverse consequences now with little in place to address them warrant immediate focus and can be considered significant.

  For this we screened for risks with a present-day severity rating of at least 'major', and a policy readiness rating of at least 'significant gaps'.
- Principle 2: Risks that will present high potential for adverse consequences by mid-century and have a very low base of current readiness will require significant lead time and can be considered significant.

  For this we screened for risks with a 2050 severity rating of at least 'major', and with a policy readiness rating of 'insufficient'.

- Principle 3: Risks that will present high potential for adverse consequences by mid-century and where acting now provides an opportunity to address several risks at once can be considered significant.

  For this we screened for risks with a 2050 severity rating of at least 'major', and with a cascading risk score indicating that actions to address them have 'high' or 'very high' potential to address other risks.

Step 2: we identified other potentially significant risks, taking into account:

- considerations such as equity or intergenerational impacts
- strategic decision points in the next six years
- where a risk was closely aligned with other risks already identified as significant.

Step 3: we looked for opportunities to combine risks, where:

- they were similar in scope
- they could be addressed by similar actions
- combining them would support explanation and action.

The 10 most significant risks are set out in *Chapter 3: Findings*. How each met the threshold for significance is shown in *Appendix 1*.

Box 1.4: How climate impacts flow from one area to another

The way risks can cascade was identified in discussions with key stakeholders as an area where the first risk assessment could be strengthened. This reflected the lived experience of the North Island Severe Weather Events of 2023, including Cyclone Gabrielle, where the way impacts flowed from one area to another was all too apparent – see also Figure 1.2.

Standard approaches to climate risk assessment focus on direct risks – when an element is directly exposed and vulnerable to a specific climate hazard or hazards.

These climate risk assessments usually recognise the existence of compounding and cascading risks but it can be difficult to reflect their importance in the scores that are used to prioritise areas for action.

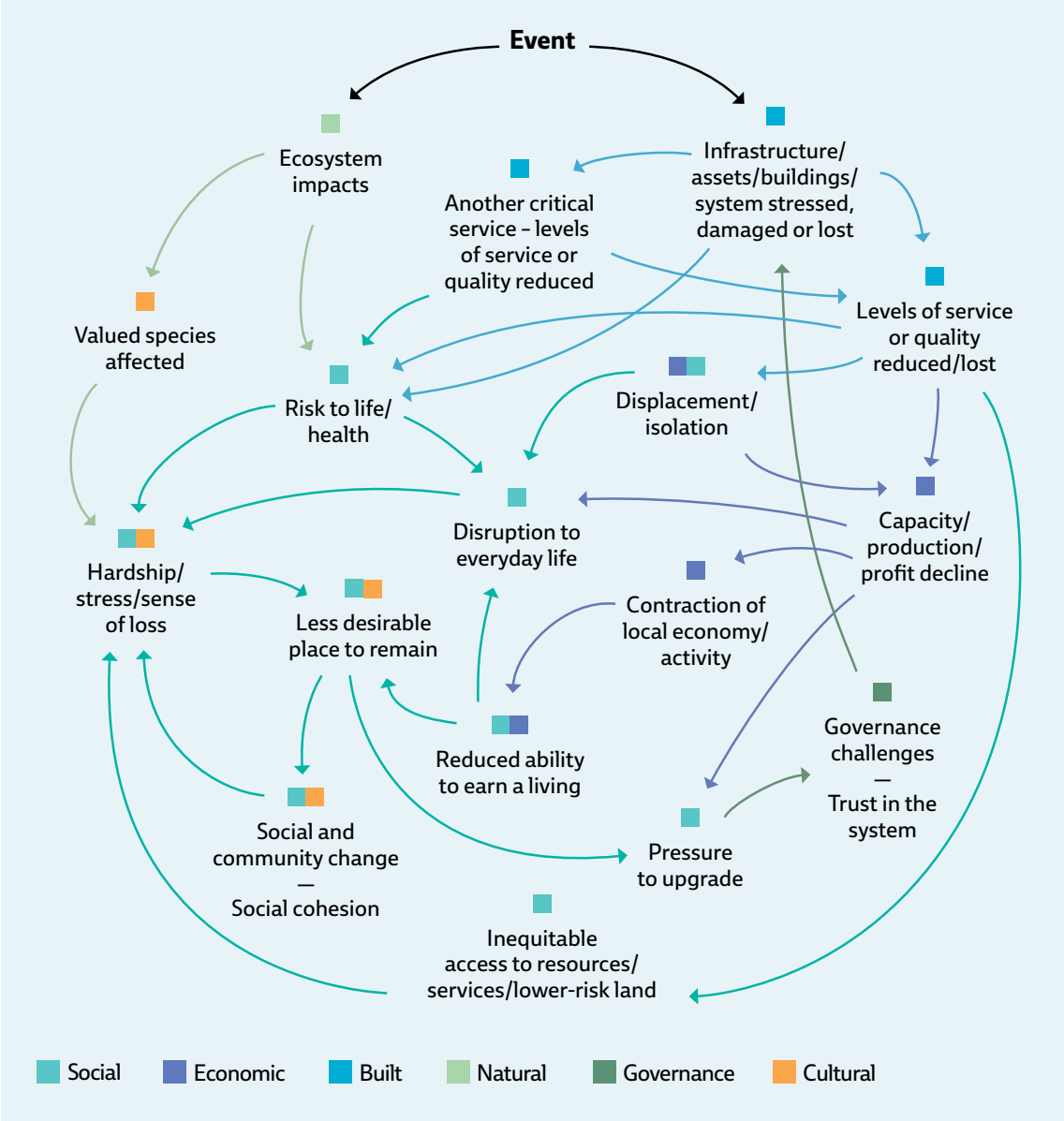
The Commission explored several ways to consider cascading risks in our assessment before settling on a scoring method. Stakeholder workshops explored cascading risks to the agriculture and horticulture sectors from drought, and cascading risks to the infrastructure sector from extreme weather. Insights from these workshops and the detailed cascades they revealed informed the assessment and are published as part of the evidence base (see the Deliberate report in the supporting materials on our website).

Continued next page

Experts in this area also shared emerging research on climate-risk cascades. Urban Intelligence has identified patterns that climate risk cascades tend to follow, which helped with our analysis.

Figure 1.5 is an example of one these patterns or 'archetypes'. It provides a visual demonstration of what can happen when there is 'too much' of something, like rain during an extreme weather event. It shows the flow of effects across different areas, from the initial damage to infrastructure through to how the economy and wider society may be affected. Other examples would be heat waves (on land or in the sea), coastal storms or landslides. (For other archetypes, see the Urban Intelligence report in supporting materials.)

Figure 1.5: How effects cascade when there is too much of something (e.g. rain)



Source: Urban Intelligence

Connections to the country's wider climate change response

A six-yearly national assessment of climate-related risks is established under the Act as a central element of the country's climate change response. It forms the basis of the Government's national adaptation plan, which is updated in response every six years.

After publication of this second assessment, the Minister of Climate Change must respond, within two years, with the next national adaptation plan. This needs to address the most significant risks identified in the risk assessment.

Our advice on the next national adaptation plan

The Commission also has a role assessing progress under each national adaptation plan. The next progress report is due by August this year.

That report will review progress under the existing plan, and will also contain advice for the next one.

Contributing to the global effort to reduce emissions

Higher global warming levels, caused by greenhouse gas emissions, drive more severe, frequent, and widespread climate-related hazards. Continued support for and contribution to global efforts to reduce emissions and limit warming will help keep risks manageable.

Aotearoa New Zealand has targets to reduce emissions. Many people, communities, and businesses are taking action. The Commission has a role advising on these targets, ways to meet them, and what progress is being made. Our reports on emissions budgets, emissions reduction monitoring, and advice on New Zealand Emissions Trading Scheme settings are available on our website.

Chapter 2: **Climate change in Aotearoa New Zealand**

This chapter sets out the physical changes that are driving an increase in climate hazards for the country. These hazards – such as flooding and landslides – are already affecting people and places here and are projected to intensify in coming decades.

The chapter provides a summary of current and projected climate change and the hazards that result, based on the latest data, with information about people and infrastructure exposed to those hazards.[ii]

The potential consequences of these effects of climate change are what is considered in the national climate change risk assessment. The priorities for action to reduce the risks are set out in *Chapter 3: Findings* – as the most significant risks for the country, where focused action can make the biggest difference.

Key conclusions

Climate change is reshaping the hazards that the country faces

Communities, ecosystems and infrastructure in Aotearoa New Zealand are exposed to shifting and intensifying pressures in 2026. As well as the physical hazards people in this country are used to dealing with (such as earthquakes), there are new – and intensifying – hazards from climate change that are creating challenges outside historical experience.

Warming air and oceans, rising seas and changing physical and chemical patterns in the atmosphere and oceans are driving more frequent, intense and compounding extremes – especially extreme rainfall and flooding (inland and coastal), rainfall-induced landslides, heat extremes, drought, marine heatwaves and ocean acidification (**Box 2.1**).

This is not business-as-usual hazard management

Climate change is shifting the country's 'normal'. Hazards are becoming more acute, as progressive changes and extreme events load on top of other challenges.

The interval between damaging climate-related events is reducing, while the underlying conditions (such as air, water and soil temperatures) are altering. This combination is going to require ongoing adaptive management – systems will need to change in response: how water is managed, how homes are kept safe, how people farm, how decisions are made.

ii This is based on material prepared in 2025 for He Pou a Rangi Climate Change Commission by Earth Sciences New Zealand (formerly NIWA). For more information see *Chapter 2* in our Full assessment report, and the supporting documents on our website.

Supporting global efforts to limit warming is integral to climate risk management

This chapter sets out projected differences in climate variables and their effects, at two different levels of global warming later this century – the same scenarios that underlie the national risk assessment.

Higher global warming levels drive more severe and widespread hazards, reduce the feasibility and cost-effectiveness of adaptation options, and increase residual risks and losses. Continued support for and contributions to global efforts to reduce emissions and limit warming shapes this country's future hazard environment – it would help keep risks manageable and avoid reaching adaptation limits for communities and sectors.

Box 2.1: Greenhouse gases and climate hazards

The Earth's natural greenhouse effect makes the planet liveable

When the Sun's energy enters the atmosphere it warms the air, oceans and land. In turn that warmth radiates back out into the atmosphere. Greenhouse gases (including carbon dioxide) absorb that heat and prevent it from radiating straight back out into space.

This system is natural. It keeps the Earth's atmosphere within a temperature range that supports life. Without the gases that trap warmth, most of the Sun's heat would radiate back out into space and the planet would be freezing.

The human-made greenhouse effect is warming the planet

Human actions are changing the balance in this natural system, by releasing additional greenhouse gases. Burning coal, oil and gas releases the greenhouse gas carbon dioxide (CO_2). So does cutting down or burning forests. Some farming activities release methane (CH_4) and nitrous oxide (N_2O). Some manufacturing processes also release fluorinated gases.

Adding greenhouse gases is like adding more blankets to a bed or more insulation to a building. Simply put, more of the heat that is produced is trapped inside the atmosphere – so, across the whole planet, ocean, air and land temperatures are warmer than they would otherwise be.

What happens when more heat is trapped?

Increased greenhouse gas emissions are making the planet warmer – by nearly 1.4°C since pre-industrial times – and temperatures continue to rise.[3] A warmer atmosphere also means higher peak temperatures, and more frequent very hot days.

A warmer atmosphere holds more water – about 7% more for every 1°C in warming.[5] This leads to higher average rainfall across the planet, and to more frequent storms with stronger winds and heavier rainfall.

Warmer temperatures also mean the ocean expands and ice sheets melt, causing sea levels to rise. The sea level rose by 0.21 metres on average across Aotearoa New Zealand between 1901 and 2020. Within that period, the rate of sea-level rise has approximately doubled since 1960.[6] Higher seas lead to increased erosion and coastal flooding, and can cause saltwater to intrude into coastal aquifers and groundwater.

Increased concentrations of carbon dioxide in the atmosphere also make oceans more acidic and can affect rates of plant growth.

Higher average and peak temperatures and changes in rain frequency and intensity change the conditions that support life. Species that evolved to live in a particular temperature range may be affected by changing temperatures and other weather patterns – this can reduce the suitable habitat for native species, and open up new opportunities for invasive pests and diseases, as well as new food crops.

Box 2.2: Reflecting an understanding from te ao Māori

Mātauranga Māori provides valuable insights into how the climate is changing, grounded in generations of careful observation and place-based knowledge of the natural environment.

In this report we have highlighted examples where local communities are working together to bring mātauranga into their management and response to climate change: see the story in *Chapter 3: Findings* about the Maketū Climate Action Plan, Te Toka Tū Moana Mō Maketū. See also accounts from communities in the 2025 case study report *Ā Te Taitokerau urutau i ngā āhuarangi: Responding to a changing climate in Te Taitokerau/Northland*.[7]

Throughout 2022 and 2023, we worked with iwi/Māori on a project called Maui.Tech, which took a case study approach to understanding the specific effects of climate change from iwi/Māori-led perspectives. The 13 case studies feature evidence and insights from whānau, hapū, iwi, ahuwhenua trusts, and other Māori collectives from different tribal rohe. These provide us with a body of localised mātauranga Māori and expert evidence, available on our website: www.climatecommission.govt.nz/get-involved/maui-tech

New domain: Ngā mea hirahira o te ao Māori

This risk assessment includes a new 'domain' of risk which looks at matters of importance to Māori: Ngā mea hirahira o te ao Māori. It was analysed by independent kaupapa Māori researchers whose report is published in full alongside the Full assessment report.

It contains mātauranga-informed insights about how climate change is affecting iwi/Māori, links to many mātauranga-based sources, and makes important observations about how this evidence base could be improved.

What is happening now

For most of the past 10,000 years Aotearoa New Zealand's climate has been relatively stable. There have always been variations, but those variations have occurred within a relatively narrow range.

This century New Zealanders are directly experiencing a changing climate. More frequent and more severe events are hitting communities all around the country, including storms and flooding, droughts and marine heatwaves. At the same time there are ongoing and progressive changes: to marine and air and land temperatures, to rainfall patterns and in the sea levels around the coast.

These are the result of physical changes in the global climate system (Box 2.1), changes that will continue and accelerate as greenhouse gas concentrations in the atmosphere increase.

The impacts are taking us outside historical experience, and are more intense and compounding

Changes in averages and variability matter, but in general the greatest effect on people and places and ways of life comes from the changes on the edge of 'normal ranges' of variability (see Box 2.3). That means the extremes – the highest storm surges, the most intense rainfall, the greatest wind speeds – and they have greater impact when they occur together (see Box 2.4).

The 2023 North Island Severe Weather Events collectively became the most severe and destructive weather events in Aotearoa New Zealand's recent history. These cover three events within a six-week period: Cyclone Hale, the Auckland Anniversary heavy rainfall, and Cyclone Gabrielle. As stated in the report of the Government inquiry into the response to those events, the likelihood of similar simultaneous and compounding extreme events taking place is expected to increase as the climate changes.[8] This was demonstrated again in the summer of 2026, when a string of extreme events occurred over four weeks, with loss of life and widespread distress and damage from Banks Peninsula to the Far North.

The contribution that climate change made to Cyclone Gabrielle was later demonstrated by a nation-wide study that found human-caused warming intensified the storm's total rainfall by about 10% compared to the same storm with no warming.[4]

This kind of attribution science can now quantify how warming changes the likelihood and intensity of extremes, and is beginning to demonstrate costs of those changes. For example, for events between 2007 and 2017, flood and drought costs attributable to human-driven climate change were estimated as NZ$120 million for insured damages from floods, and NZ$720 million for losses from drought – with the total costs almost certainly higher.[9]

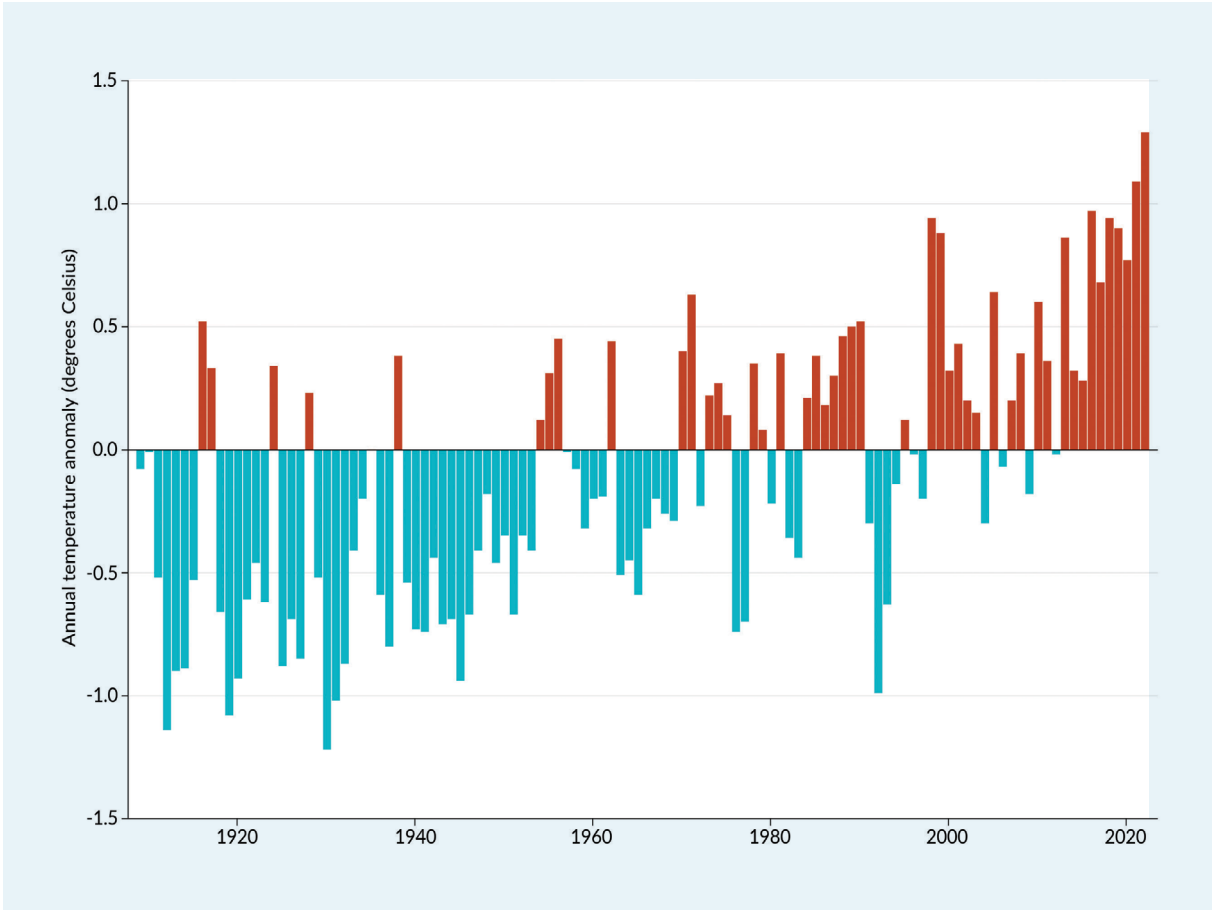
Far-reaching chains of effects

These are the long chains of effects set off by background temperature shifts on land and at sea. For example, during recent marine heat waves around the country in the last decade, the sea surface temperatures were significantly higher than historical values – with far-reaching impacts, for ecosystems, for fisheries and kaimoana, and for the contribution to the intensity of weather systems that travel across oceans to reach the country.

Average temperatures on land have been increasing over the last century, with warming of nearly 1.4 °C in the period 1909–2019. Four of the country's five warmest years since records began have occurred in the last five years.[10]

Figure 2.1 shows how much the average annual temperature each year varies from an average taken across the 30 years between 1961 and 1990 (the reference period). Blue lines indicate the temperature that year was lower than the average over the reference period; red lines indicate the year was hotter than the average over the reference period.

Figure 2.1: Annual average temperature anomaly for Aotearoa New Zealand (as compared to the 1961–1990 reference period)



Source: Ministry for the Environment using data from Earth Sciences New Zealand

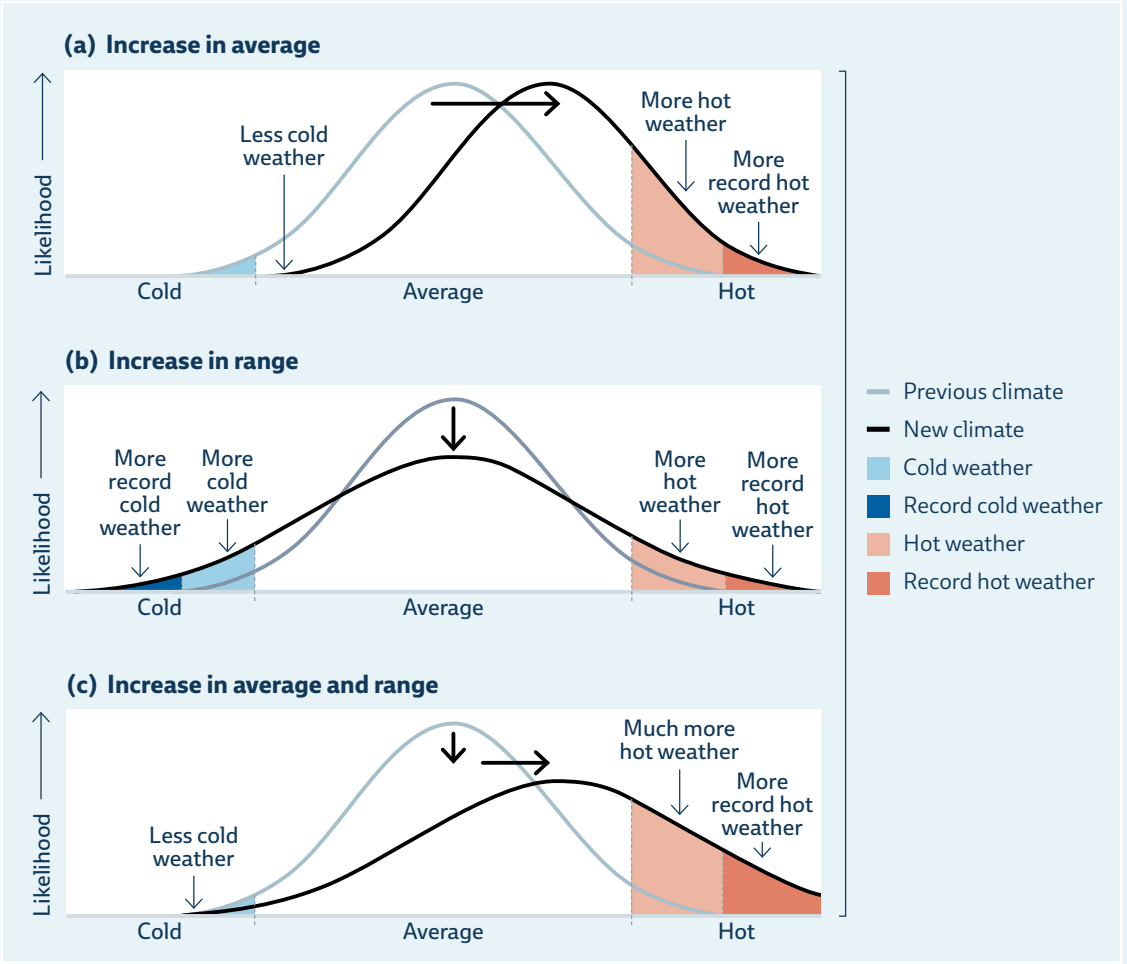
Box 2.3: Averages, extremes and frequency

The effects of changes in global and local climate patterns are usually felt through the weather events people experience – what the temperature is, or how often or heavily it rains. Scientists will often present the variation in weather at a particular place as a distribution graph showing the likelihood that different weather events are experienced – the 'bell curve' graph (as in Figure 2.2).

Changes in the climate can affect local weather events in three inter-related ways.

- Changes in climate can affect averages (the mean). This can be the average temperature in a location, the average high-tide level, or the average summer rainfall (Figure 2.2a).
- Climate change can also affect the variability in weather patterns – for instance the range of maximum daily temperatures, or the range in rainfall over the year – and this can make the hottest days hotter, or the wettest days wetter (Figure 2.2b).
- More and more, scientists are seeing that climate change affects *both* these things: averages are shifting and the range of weather patterns is broadening (Figure 2.2c).

Figure 2.2: What happens to extremes when 'normal ranges' of variability change



Source: adapted from IPCC *Climate Change 2001 – Impacts, Adaptation, and Vulnerability*[11]

How these changes play out in reality

A shift in average temperature might mean that a site rarely or never experiences frosts anymore. While that might make some new crops possible, it can also mean more insects that are horticultural pests survive through winter, which can result in damage and increased costs for control. Similarly, introduced predators like mice and rats survive better with warmer winters, with increased impacts on threatened native plants, birds and insects.

A change in variability could mean that more rain now falls on the wettest day of the year, which might affect flood frequency.

When both the average and variability shift, New Zealanders might see more days with heavy rain than before, and some of those days will be wetter than they have ever been.

In the risk assessment, we considered how ongoing and progressive changes, and the frequency and severity of extreme events, could differ in the future due to climate change, alongside exposure and vulnerability, to inform the identification of the most significant risks.

Box 2.4: Climate effects occurring together can have greater impact

Higher temperatures, more intense rainfall, rising sea levels and other environmental conditions can, in combination, create hazards that hit harder and more often. Among natural hazards that are most frequently experienced in Aotearoa New Zealand:

- The combination of more intense rainfall and sea-level rise can increase the frequency and severity of coastal flooding.
- More intense rainfall can combine with other factors such as changing land use to increase the frequency and severity of landslips.
- The combination of warmer ocean temperatures and more moisture in the air can increase the severity of tropical cyclones, while the area in which cyclones develop has been widening (and, in the southern hemisphere, moving closer to Aotearoa New Zealand) as ocean and air temperatures rise.
- A warmer atmosphere increases evaporation from plants and soils, leaving both drier, which can make droughts longer and more severe.
- Changing rainfall patterns can also increase the frequency and severity of drought. Warmer, drier conditions can also increase wildfire risks.

Sometimes multiple hazards can affect the same region or city in quick succession – such as when Cyclones Hale and Gabrielle struck the North Island in January and February 2023.

How these hazards can have 'cascading impacts' is shown in **Figure 1.2** in *Chapter 1: Introduction*.

What is projected to happen next

The latest climate projections for Aotearoa New Zealand show extreme events are expected to increase in intensity and frequency through this century. This includes extreme rainfall (and the inland flooding and landslips that result), very hot days and high winds, drought and wildfires, and sea-level rise and coastal inundation (flooding).

Some regions are more exposed to multiple hazards, and that exposure rises more quickly under higher warming levels. In general, regions around the country will experience a more extreme version of their current climate: dry areas getting hotter and drier, wet areas getting wetter.

Increasing exposure to hazards is a tangible result of the ongoing and progressive changes in temperatures, rainfall and other precipitation (like snow and hail), and sea levels around the country.

This section sets out a summary of national and regional projections for key climate variables. Changes to these variables drive changes in the frequency and intensity of climate-related hazards for the country; these changes are illustrated by points about the people, land and infrastructure exposed to those hazards. The projections show different effects by 2050 and 2090, for two scenarios: for lower climate impact and for higher climate impact (see Box 2.5).

How this relates to the assessment of climate change risks for Aotearoa New Zealand

Our assessment brings together three aspects of risk: all *hazards* affecting different elements (such as the built environment, or specific economic sectors), who and what is *exposed* to those hazards, and what the *vulnerabilities* are (these cover what makes people, places, or things more or less likely to be harmed and whether they will be able to adapt). Final risk scoring includes a review of the country's readiness, and how risks are linked and can be addressed together. See key concepts explained in Box 1.2 in *Chapter 1: Introduction*, and the Full assessment report.

Box 2.5: The climate projections used for this report

Climate projections provide information about how different future climates might unfold. They are not predictions – they provide scenarios and pathways that show what can happen for the planet's climate depending on the concentration of greenhouse gases in the atmosphere. This can help with assessing potential future impacts of climate change to inform decision-making and action.

The Intergovernmental Panel on Climate Change (IPCC) summarised the latest projections from global climate models in its most recent assessment report (the IPCC's Sixth Assessment Report). To be helpful for risk assessments, we need projections downscaled from a global scale to the country level and smaller. Earth Sciences New Zealand has recently done this for Aotearoa New Zealand. We have used these projections in this assessment.

The projections used in this chapter are based on an average of six different climate models (a multi-model mean). Individual model results vary because each model is built differently and relies on distinct assumptions.

Averaging across models provides a central picture that highlights overall directions and patterns of change. However, this central picture masks the wider range of outcomes shown by individual models. The key takeaway is that a multi-model mean should not be the sole basis for adaptation planning. Effective adaptation requires ensuring that systems are robust across a range of plausible future conditions, including more extreme scenarios.

Unless otherwise specified, all projections in this chapter refer to a baseline time period of 1995–2014 and represent projections under two scenarios: a low climate impact scenario (based on the IPCC's SSP1–2.6 scenario) and a high climate impact scenario (based on the IPCC's SSP3–7.0 scenario).

The low climate impact scenario broadly aligns with global warming of nearly 2°C above pre-industrial levels for both the middle and end of the century.[iii] The high climate impact scenario broadly aligns with a global warming level of 2°C above pre-industrial levels by the middle of the century and 3.5°C by the end of the century.

iii Under the low climate impact scenario it is assumed the world takes sufficient action to reduce emissions. For more information, see the Full assessment report.

Increasing extreme rainfall

An increase in extreme rainfall[iv] is projected for almost all parts of the country, but particularly in the west and south of the South Island.

This can have major effects for people, communities and infrastructure when the rainfall volumes exceed the levels that natural and human-built systems can absorb or withstand – such as flooding and landslides and their flow-on effects like loss of access to services including power, health and education (see boxes).[v]

By 2050, the average of six climate models suggests that the heaviest rainfall days of the year will be about 5% wetter, under both low and high climate impact scenarios.

By 2090, the models project that the wettest days will become wetter by about 4% on average in a lower climate impact future and up to 10% on average in a higher climate impact future.

By 2090 under a high climate impact scenario, the districts with the largest projected annual increase in extreme rainfall are Invercargill (25% increase), Gore (22% increase) and Southland (16% increase) (**Figure 2.3**).

Overall rainfall patterns

Across the country overall rainfall patterns are projected to change, including reduced annual rainfall in the North Island (particularly in the north and the east), and in the north and east of the South Island. Annual rainfall is projected to increase in the west and south of the South Island.

Changes in seasonal rainfall are more pronounced than for annual rainfall. There are relatively large increases in summer rainfall projected for parts of Northland, the central North Island and parts of the South Island by 2090 under the high climate impact scenario. In winter, relatively large increases in rainfall are projected for the west coast of the South Island, while reduced winter rainfall is projected for the eastern and northern parts of both islands. For more on seasonal variation, see *Chapter 2* in the Full assessment report.

The numbers in the boxes show how many more people and how much more infrastructure could be exposed to inland flooding and rainfall-induced landslides as storms intensify. They are not predictions, but signals of the direction and potential scale of change. This type of information can help inform decisions about where adaptation and risk management is most important.

iv The IPCC defines 'extreme rainfall' as rainfall in the 99th percentile of the daily rainfall distribution from 1995 to 2014, representing the amount of rain that falls on the four wettest days each year on average.

v The exposure estimates come from a climate hazard exposure census prepared by Earth Sciences New Zealand and current exposure refers to the year 2020. See the Full assessment report for more information.

Inland flooding

Inland flooding is currently the most widespread climate hazard in Aotearoa New Zealand. Already, 793,000 people are exposed to this hazard. Under the low climate impact scenario, another 13,000 people are projected to be exposed to inland flooding by 2090.

Under the high climate impact scenario, another 107,000 people are projected to be exposed by 2090.

Buildings: Currently, 590,000 buildings, with a combined replacement value of NZ$250 billion, are exposed to inland flooding. Under the low climate impact scenario, by 2090 this increases to 601,000 buildings exposed, with a combined replacement value of NZ$255 billion. Under the high climate impact scenario, by 2090 678,000 buildings, with a combined replacement value of NZ$290 billion, are projected to be exposed.

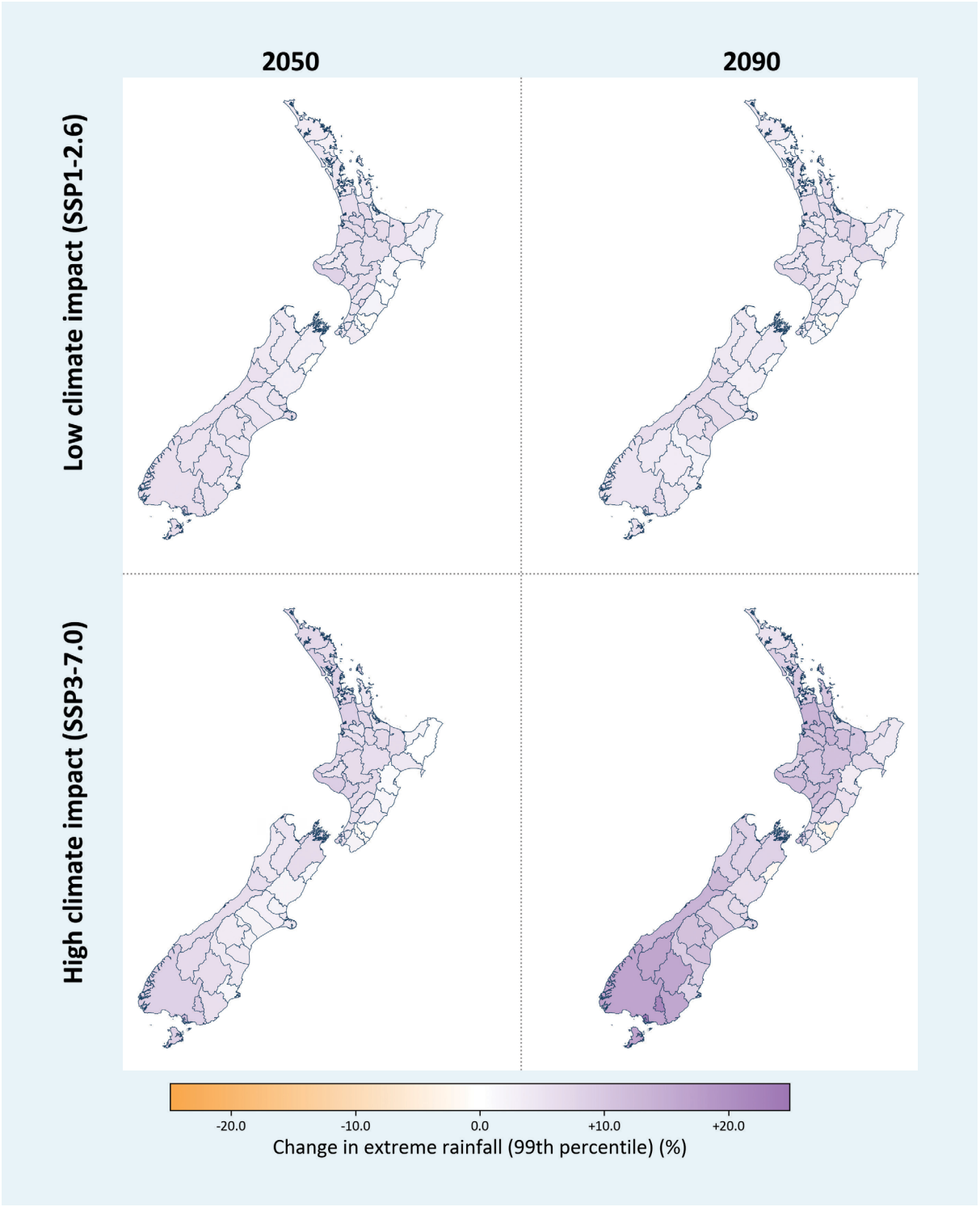
Rainfall-induced landslides

Currently, 95,000 people are exposed to rainfall-induced landslides. The numbers of people in the country projected to be exposed to this climate hazard rises by 10,000 under the low climate impact scenario by 2090. Under the high climate impact scenario, another 115,000 people are projected to be exposed by 2090.

Roads: Currently, 11,900 km (14%) of roads are exposed to rainfall-induced landslides. This is projected to grow by the end of the century, to 12,600 km (15%) of roads in a low climate impact scenario and 17,800 km (21%) of roads in a high climate impact scenario.

Electricity transmission infrastructure: Currently, 1,710 (7%) power pylons are exposed to rainfall-induced landslides. By 2090, this is projected to grow to 1,910 pylons (8%) in a low climate impact scenario and to 2,950 pylons (12%) in a high climate impact scenario.

Figure 2.3: Change in annual extreme rainfall by territorial authority (for 2050 and 2090, in two climate impact scenarios)



Source: Commission analysis, using data from the Ministry for the Environment and Toitū Te Whenua Land Information New Zealand

Note: Projections for 2050 and 2090 represent 20-year averages for the periods 2041–2060 and 2081–2100, respectively, with all changes calculated relative to the 1995–2014 baseline (centred on 2005).

These maps show the multi-model mean (see Box 2.5). Individual models may show different projections for the climate variable shown.

Increasing drought exposure

An increase in drought exposure is projected for the already drought-prone northern and eastern coasts of the North and South Islands (Figure 2.4).

Overall, land in Aotearoa New Zealand is projected to experience drier conditions in the future, driven by climate change.

See *Chapter 3: Findings* for discussion of the country's readiness to address climate hazards such as drought for sectors relying on the natural environment – particularly *Risks for forestry* (one of the most significant risks) and *Risks to watch: agriculture and horticulture.*

How likelihood of drought is measured

The measure used to project drought is the potential evapotranspiration deficit (PED), which represents the annual difference between:

- the amount of water available in the soil, *and*
- potential evapotranspiration – the water that is lost from soil due to evaporation by the sun and from plants as they grow.

When the PED measure is a positive number (above zero) this means there is not enough moisture in the soil for the plant to maintain its maximum growth, and the difference would need to be made up with rainfall or irrigation.[vi]

For more detailed information on projected drought intensity, see the Full assessment report and the domain called *Sectors relying on the natural environment*.

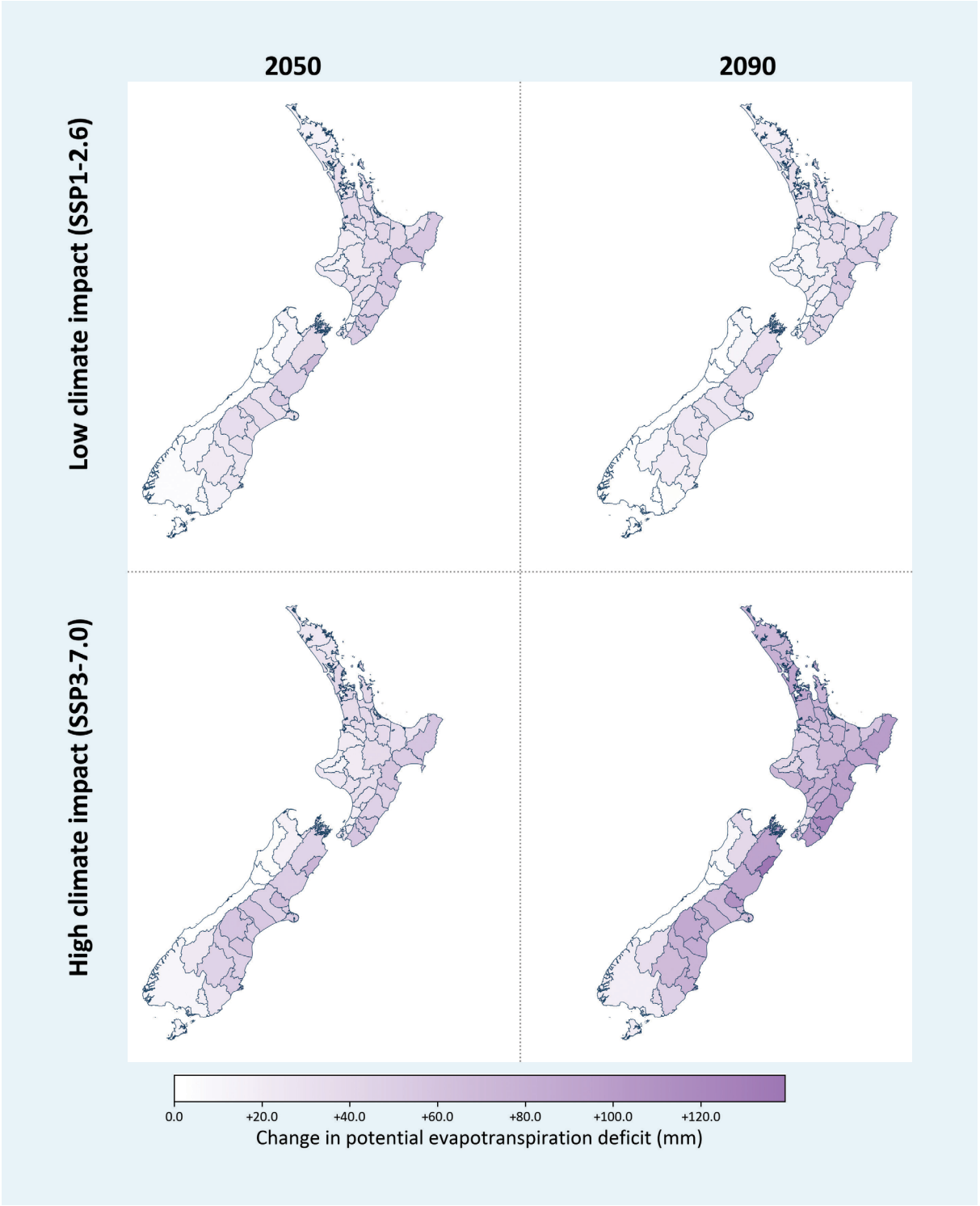
Drought conditions

Production land: Climate projections under the low climate impact scenario show nearly 40% of Aotearoa New Zealand's production land becoming markedly drier by 2050 (that area of land would see an increase in annual potential evapotranspiration deficit of more than 50 mm from the 2005 baseline). By 2090, under the low climate impact scenario this area shrinks slightly, representing only 28% of total production land.

In a high climate impact scenario, there is a shift towards drier land conditions, with 87% of production land (94,000 km^2) experiencing an increase in annual potential evapotranspiration deficit of more than 50 mm. Nearly half of that area (42,000 km^2) is projected to experience an increase of more than 100 mm of potential evapotranspiration deficit.

vi Changes in potential evapotranspiration are largely based on projected changes in temperature and rainfall (and snow and hail) patterns. Changes in other climate variables (solar radiation, relative humidity and wind) influence calculated PED changes to a lesser degree.

Figure 2.4: Change in annual potential evapotranspiration deficit by territorial authority (for 2050 and 2090, in two climate impact scenarios)



Source: Commission analysis, using data from the Ministry for the Environment and Toitū Te Whenua Land Information New Zealand

Note: Projections for 2050 and 2090 represent 20-year averages for the periods 2041–2060 and 2081–2100, respectively, with all changes calculated relative to the 1995–2014 baseline (centred on 2005).

These maps show the multi-model mean (see Box 2.5). Individual models may show different projections for the climate variable shown.

Heat extremes: more hot days, fewer frosts

The number of hot days (days above 25°C), and very hot days (days above 30°C) is projected to increase and the number of frost days is projected to decrease. See **Figure 2.5** for projected changes in the annual number of hot days above 25°C, and see box for information on very hot days above 30°C.

Northern and inland areas of Aotearoa New Zealand are projected to experience the greatest increases in the number of hot days above 25°C, with greater increases experienced in the North Island than in the South Island.

Sustained high temperatures have impacts for human health, for farming systems including for pasture and crop productivity and animal welfare, and for natural ecosystems, including freshwater environments.

Temperatures are projected to continue rising. New Zealand has already warmed by about 1.4°C, and under a high climate impact scenario average temperatures are projected to be around about 3.0°C warmer by 2090, relative to the 1995–2014 period used in the models.

The North Island is projected to experience slightly greater warming than the South Island. The five districts projected to experience the greatest annual average warming by 2090 under that high scenario are Kaikōura, Mackenzie, Kawerau, Whakatāne and Rotorua.

Fewer frost days

The greatest decrease in frost days (cold nights when minimum temperatures drop under 0°C) is projected for regions that currently experience cooler temperatures, particularly areas at higher elevations in both North and South Islands. This is likely as a result of reduced snow cover, and reduced albedo (light reflection off bright surfaces) in winter. The districts with the greatest decrease in cold nights by 2090 under the high climate impact scenario are Mackenzie (about 50 fewer cold nights), Queenstown Lakes (about 50 fewer cold nights) and Central Otago (about 40 fewer cold nights). See the Full assessment report for a map of regional variation.

Reduction in cold nights has an impact for productive systems that depend on frost for insect pest control or fruit production, for natural ecosystems, and for tourism activity focused on alpine activities such as skiing.

Very hot days

By 2090 almost 1.5 million people in Aotearoa New Zealand are projected to experience up to 10 more days above 30°C per year, under the high climate impact scenario.

Another 326,000 people would be exposed to those hot temperatures for up to 20 more days per year.

Production land: For land with production land cover (such as pasture), those hot temperatures are projected to happen on an extra 11–20 days per year, for 29,000 km^2 of land. Under the same high climate impact scenario, 4,200 km^2 of land is projected to experience 20 more days above 30°C.

Figure 2.5: Change in annual number of hot days above 25°C by territorial authority (for 2050 and 2090, in two climate impact scenarios)

Source: Commission analysis, using data from the Ministry for the Environment and Toitū Te Whenua Land Information New Zealand

Note: Projections for 2050 and 2090 represent 20-year averages for the periods 2041–2060 and 2081–2100, respectively, with all changes calculated relative to the 1995–2014 baseline (centred on 2005).

These maps show the multi-model mean (see Box 2.5). Individual models may show different projections for the climate variable shown.

Wildfires

Aotearoa New Zealand's geography and location in the southern Pacific Ocean mean the country has historically had a temperate climate, with consistent rainfall patterns. This has meant the country has not experienced extreme fire conditions, like those seen in Australia and drier parts of North America.

However, changes in temperature, rainfall and wind patterns are affecting the fire regime in parts of the country.

The number of wildfires is increasing, and the area burnt in recent years has been historically large. In our Northland case study visit we heard how community firefighters had been fighting not just a 100 ha fire in the Waipoua River area in February 2025, but had fought several other wildfires in the same period of high temperatures and drought. This was putting pressure on the land, people and communities.[7]

Fire regimes are projected to change significantly in the future, with fire frequencies and intensities under high-emissions scenarios rivalling those experienced in Australia, including the Black Summer of 2020/21.[12]

Chapter continues on next page.

Continued sea-level rise

The Ministry for the Environment's coastal hazards and climate change guidance shows the average sea level is projected to continue to rise around the country's coast, reaching 0.2 m above the 1995–2014 baseline by mid-century, and 0.4 m by 2090 under the low climate impact scenario, or 0.6 m under the high climate impact scenario.[6]

Higher seas lead to increased erosion and coastal flooding (see box), and can cause saltwater to intrude into coastal aquifers and groundwater. A 2015 study for the Parliamentary Commissioner for the Environment estimated that a sea-level rise of 0.3 m would mean that high water levels currently only experienced once in 100 years would happen around once every four years in Auckland, and every year in Wellington and Christchurch.[13]

There is wide variation across the country for how sea-level rise will affect particular coastlines. This is also affected by vertical land movement.[vii]

Coastal inundation (flooding)

Currently, approximately 32,000 people in Aotearoa New Zealand are exposed to coastal inundation (flooding with seawater). This number is projected to rise to 47,700 people by 2050 and 68,100 people by 2090, in a low climate impact scenario.

Exposure to coastal inundation is projected to rise to 51,700 people by 2050 in a high climate impact scenario and then is projected to nearly double to 94,300 people in 2090.

Buildings: Currently, buildings valued at NZ$11 billion are exposed to coastal inundation. Under a high climate impact scenario, the estimated value of residential buildings exposed to coastal inundation is projected to increase to NZ$36 billion by 2090.

The risks that climate change presents for the country

This chapter presented current and projected changes in the frequency and intensity of key climate-related hazards for the country, with illustrations of the people, land and infrastructure exposed to those hazards.

The potential consequences of those changes are what is explored in this risk assessment, which brings together the three aspects of climate-related risk: all *hazards* affecting different elements (such as the built environment, or specific economic sectors), who and what is *exposed* to those hazards, and what the *vulnerabilities* are.

The assessment also includes a review of the country's readiness, and how risks are linked and can be addressed together. The findings of the assessment are outlined in *Chapter 3: Findings*, with a focus on the most significant risks identified for Aotearoa New Zealand.

vii Site-specific estimates of sea-level rise under different climate projections were produced as part of the NZ SeaRise project. This five-year research programme, funded by the Ministry of Business, Innovation and Employment, was carried out by Te Herenga Waka–Victoria University of Wellington, GNS Science, NIWA, University of Otago and the Antarctic Science Platform. The estimates produced included the effect of local upward or downward movement of land on sea-level rise. Find it at: https://searise.nz/

Chapter 3:
Findings

This chapter provides an overview of the findings of our assessment of the country's climate-related risks, with a focus on the 10 risk areas identified as the most significant.

Climate change is increasingly affecting the core systems in Aotearoa New Zealand – the essentials that keep daily life running, the wellbeing of communities, the natural environment that supports life and livelihoods, and the way the country plans, decides and acts together.

This report sets out the 10 risk areas that stand out from the full assessment.

These are the significant risk areas where focused action can make the biggest difference and achieve the greatest system-wide impact.

The most significant risks

The risk areas identified as priorities for action are listed in Table 3.1 under four categories:

- key infrastructure
- communities and safety
- nature and the bioeconomy
- decisions and funding.

They are identified as the country's most significant climate-based risks, based on their nature and severity, and the need for coordinated action to address them.

They are risk areas that are already seriously affecting people, or will soon and take time to prepare for, and they are the ones where acting soon can have the biggest influence on many other risks.

Many of the most significant risks relate to systems that support people's quality of life and economic resilience: like roads and railways, drinking water, and natural resources. Effective adaptation to reduce those risks will depend on strengthening the country's underpinning structures and tools – such as funding and financing systems, trust in democratic institutions, social connections and wellbeing.

The method used to identify the most significant risks is set out in *Chapter 1: Introduction*.

Descriptions of each significant risk follow. They set out:

- what makes up each risk
- how it is being driven or made worse by climate change
- how people, ecosystems, communities and economic sectors will be affected.

They also summarise our assessment of each risk, including the key relationships it has with others, and explain what action is already underway to address it and what else may be needed.

Table 3.1: The most significant risks

Most significant risks in 2026 national climate change risk assessment
Key infrastructure
Risks to water infrastructure This is about the infrastructure that provides people with drinking water, carries stormwater away from towns, and manages sewage. Climate change will put increasing pressure on every part of this system, which is already under strain.
Risks to buildings This is about how buildings across Aotearoa New Zealand are exposed to a range of climate-related hazards that threaten both their structural integrity and performance.
Risks to road and rail networks This is about how climate hazards are putting increasing pressure on the country's road and rail networks, causing both short-term disruption and long-lasting damage.
Communities and safety
Risks to social and community wellbeing This is about the increasing impacts on people's wellbeing from the effects of climate change – particularly risks to individuals' mental health and to the ways society holds together. It combines two risks: Risks to mental health; and to social cohesion and wellbeing (from displacement).
Risks to emergency management This is about how the country's emergency management system is under acute pressure and may struggle to respond to the increasing frequency, severity and extent of disasters that can result from climate hazards.
Ngā mea hirahira o te ao Māori – risks in the Māori world This is about how climate hazards interact with longstanding structural factors to create a set of interconnected risks that specifically affect whānau, hapū and iwi. For iwi/Māori, climate change is not only a physical or economic problem. It reaches into identity, language, knowledge, governance and intergenerational wellbeing. It combines seven risks: Risks of loss of access to taonga species; damage to Māori infrastructure; economic losses for Māori in primary industries; disruption to tikanga and hapū/iwi identity; loss of Indigenous knowledge systems; legal exclusion and governance failures for Māori; and increased Māori health vulnerabilities.

Nature and the bioeconomy

Risks to ecosystems and biodiversity

This is about how climate change impacts the country's ecosystems and indigenous biodiversity. Increasing land and marine temperatures change the ongoing environmental conditions species live in, while extreme weather events and wildfires cause shocks to ecosystems.

It combines five risks: Risks to coastal ecosystems; freshwater ecosystems; marine ecosystems; terrestrial ecosystems; and indigenous biodiversity (from invasive species and pathogens).

Risks to forestry

This is about how climate change will affect the country's managed and production forests, and how the sector can better prepare for these impacts, including extreme weather, drought and wildfires, and new pests and diseases.

Decisions and funding

Risks to central and local government funding

This is about the growing pressure that climate change places on both central and local government finances, in the context of many councils, especially smaller ones, already facing constrained budgets or having reached their debt limits. As climate impacts intensify, governments face higher costs for disaster response, infrastructure repair, welfare and health services, and long-term adaptation.

Risks to decision-making and delivery

This is about how climate-related demands are placing Aotearoa New Zealand's ability to plan, decide and act together under increasing pressure. The country needs to be able to drive forward on adaptation, to reduce the escalating impacts and costs of climate change. Otherwise, decision-makers will be increasingly caught up in urgent responses that take time and resources away from planning for the future and reducing harm, and which could result in locking in future vulnerabilities.

It combines four risks: Risks to enduring adaptation governance; effective adaptation implementation; legitimacy of democratic institutions (from contested climate decision-making); and ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi in adaptation governance and implementation.

All assessed risks

While the risks in this chapter provide a shortlist of priorities for action, all of the 37 risks in the assessment warrant attention, including some that are expected to intensify quickly (see *Risks to watch: agriculture and horticulture*).

Most of the climate-related risks in this assessment are already present and serious. Of the 37 risks assessed, 29 have a current severity rating of at least moderate, and there are significant gaps in readiness to address almost all of them (Table 3.2).

Many of these climate-related risks can be managed in combination – for instance the risks to insurability of assets can be addressed along with the significant risks to buildings.

Range of options available

Decision-makers have a range of options available to address the risks. These include accelerating and joining up work already underway by government and supporting coordinated adaptation around the country (including providing clarity about how costs can be shared and met).

Action to address the challenges presented by climate change can return benefits that strengthen the economy, society and the environmental foundation of the country. Investing attention and resources on carefully prioritised action would substantially reduce future costs and losses associated with climate change.

Risks to watch: agriculture and horticulture

Though not identified as significant, we are highlighting two risks in this assessment as particular 'ones to watch'. These are the risks to pastoral agriculture and the risks to horticulture. These risks were rated at minor severity at present, but they are expected to move to major by 2050.

Currently both of these critical sectors of the economy are coping reasonably well with climate-related pressures on animals, feed, soil and yields. While the impacts in some areas may already be at moderate level (particularly for sheep and beef farming), on a national assessment level the severity of risk is still considered minor.

However, the intensification of climate change that is projected between now and the middle of the century means risks for both agriculture and horticulture are likely to rise quickly in that time. In the space of the next 25 years the potential impact of climate change on the two sectors could move from manageable impacts to large losses and damage, and potentially irreversible impacts (which is what the major rating indicates).

This step change is anticipated because drought and extreme weather events are expected to affect both horticultural crop yields and feed supplies for livestock, the impacts from soil erosion and coastal inundation on the pastoral sector may become irreversible, increased temperature extremes and pest pressure could substantially affect yields, and the increased frequency of extreme events will shorten recovery periods in both sectors. The ability of these sectors to adapt to climate change – although currently high – could become increasingly challenging and require sustained effort in future. At the same time the burden on these sectors of recovering from climate impacts will substantially increase.

Our assessment shows that as climate change affects the productivity and profitability of these key economic sectors, the impacts are likely to reach into other areas of the economy. This warrants early attention and preparation.

See the risk summaries and scores in the Full assessment report.

We recommend reading this report with the Full assessment report and the companion *Ngā mea hirahira o te ao Māori* report, to see how all 37 individual risks were assessed within their seven interconnected systems or 'domains' of risk.

Box 3.1: How climate-related risks are assessed

The risks are assessed in three ways:

- **How severe it is** – the severity assessment looks at the nature and scale of the potential consequences of each risk; this is rated from 'minor' to 'extreme' for three periods (present day, mid-century, and end of the century)
- **How ready the country is** – the policy readiness assessment reviews existing government policies and plans and assesses how well they can address each risk; this is rated from 'no significant gaps' to 'insufficient'
- **Connections to other risks** – the indirect and cascading risks assessment examines the relationships between different areas, and identifies options for action in one area that could reduce multiple risks.

How we reached those ratings, and then used the scores to identify the most significant risks, is set out in *Chapter 1: Introduction*, and the separate *Summary of method* report.

What the severity ratings mean

Minor: there could be occasional, minor loss and damage, and temporary impacts.

Moderate: there could be repeating loss and damage, and climate impacts could upset how well key systems run.

Major: there could be large or frequent loss and damage, serious or long-term disturbance to people, places and ways of life, and disruption to whole systems.

Extreme: there could be very large, very frequent loss and damage, permanent effects on people and the environment, and failure of systems. At this level, there is a high chance of reaching thresholds, when changes cannot be reversed.

See *Chapter 1: Introduction* for the formal assessment criteria for risk severity, as well as for policy readiness and cascading risk scores.

Table 3.2: The risks we identified and how they scored in the assessment

Element at risk	Domain (see Figure 1.3)	Risk severity				Policy readiness				Cascading risk score Potential to address other risks
		Current	2050	2090* GWL 2	2090* GWL 3–3.5	Coverage	Readiness to implement	Shortfall**	Overall readiness	
Water infrastructure	Built environment	Major	Extreme	Extreme	Extreme	Significant gaps	Insufficient	Major	Significant gaps	High
Effective adaptation implementation	Governance	Major	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Medium
Ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi in adaptation governance and implementation	Governance	Major	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Medium
Enduring adaptation governance	Governance	Major	Major	Extreme	Extreme	Significant gaps	Insufficient	Extreme	Insufficient	Low
Terrestrial ecosystems	Natural environment	Major	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	High
Mental health	People, health and communities	Major	Major	Major	Extreme	Insufficient	Insufficient	Major	Insufficient	Low
Ability of the emergency management system to respond	People, health and communities	Major	Major	Major	Extreme	Moderate gaps	Significant gaps	Major	Significant gaps	Low
Social cohesion and wellbeing (from displacement)	People, health and communities	Moderate	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Low
Legitimacy of democratic institutions (from contested climate decision-making)	Governance	Moderate	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Low
Forestry	Sectors relying on the natural environment	Moderate	Major	Extreme	Extreme	Insufficient	Insufficient	Extreme	Insufficient	Low
Buildings	Built environment	Moderate	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Very High
Road and rail networks	Built environment	Moderate	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	High
Indigenous biodiversity (from invasive species and pathogens)	Natural environment	Moderate	Major	Extreme	Extreme	Moderate gaps	Significant gaps	Major	Significant gaps	High
Waste management infrastructure	Built environment	Moderate	Major	Extreme	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Low
Damage to Māori infrastructure	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Disruption to tikanga and hapū/iwi identity	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Loss of access to taonga species	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Loss of Indigenous knowledge systems	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Moderate gaps	Extreme	Insufficient	
Legal exclusion and governance failures for Māori	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Extreme	Insufficient	
Freshwater ecosystems	Natural environment	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Very High
Coastal ecosystems	Natural environment	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Moderate	Significant gaps	Very High
Marine ecosystems	Natural environment	Moderate	Major	Major	Extreme	Significant gaps	Moderate gaps	Major	Significant gaps	Medium
Central and local government funding	Economy and finance	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Low
Insurability of assets	Economy and finance	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	Low
Fisheries	Sectors relying on the natural environment	Moderate	Major	Major	Extreme	Moderate gaps	Significant gaps	Major	Significant gaps	Low
Economic losses for Māori in primary industries	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	
Increased Māori health vulnerabilities	Ngā mea hirahira o te ao Māori	Moderate	Major	Major	Extreme	Significant gaps	Significant gaps	Major	Significant gaps	
Ports and airports	Built environment	Moderate	Moderate	Major	Extreme	Moderate gaps	No significant gaps	Moderate	Moderate gaps	Medium
Physical health	People, health and communities	Moderate	Moderate	Major	Extreme	Significant gaps	Insufficient	Major	Significant gaps	Low
Pastoral agriculture	Sectors relying on the natural environment	Minor	Major	Major	Major	Moderate gaps	Significant gaps	Major	Significant gaps	Medium
Horticulture	Sectors relying on the natural environment	Minor	Major	Major	Major	Moderate gaps	Significant gaps	Major	Significant gaps	Low
Social infrastructure and community services	People, health and communities	Minor	Moderate	Major	Major	Significant gaps	Significant gaps	Major	Significant gaps	Low
Businesses and public organisations (from supply and distribution disruptions)	Economy and finance	Minor	Moderate	Major	Major	Significant gaps	Moderate gaps	Major	Significant gaps	Low
Electricity and telecommunications infrastructure	Built environment	Minor	Moderate	Major	Major	Significant gaps	Moderate gaps	Moderate	Moderate gaps	Medium
Stability of the financial system	Economy and finance	Minor	Moderate	Major	Major	No significant gaps	Moderate gaps	Minor	No significant gaps	Low
Tourism	Sectors relying on the natural environment	Minor	Moderate	Moderate	Major	Moderate gaps	Moderate gaps	Major	Moderate gaps	Low
Electricity supply	Built environment	Minor	Minor	Moderate	Moderate	Significant gaps	Moderate gaps	Moderate	Moderate gaps	Low

*Global warming levels for 2090 indicate lower and higher climate impact scenarios. The low climate impact scenario is based on global warming of 2.0°C by 2090 (GWL 2). The high climate impact scenario is based on global warming of 3.0–3.5°C by 2090 (GWL 3–3.5).

**Policy shortfall scores are a measure of residual risk: The scale is the same as for risk severity.

Key infrastructure

Risks to water infrastructure

What this risk is about

This risk is about the infrastructure that provides people with drinking water, carries stormwater away from towns, and manages sewage. Climate change will put increasing pressure on every part of this system, which is already under strain. The impacts may include service failures and pollution that affect the health of people and the environment and disrupt the connection of iwi/Māori to wai (water).

Drinking water pipelines are exposed to river and surface flooding, and drinking water supplies face increasing stress from drought, declining water quality, and higher temperatures. Rising seas, coastal flooding and more frequent and intense rainfall events threaten wastewater and stormwater networks. As climate hazards continue to intensify, water services will be increasingly affected. For daily life, this could mean more service interruptions, boil water notices, or burst pipes, with flow-on risks to rivers and beaches, lost productivity for businesses and communities, and public health implications. Some communities could even face the eventual withdrawal of services. The risk is greater because much of the infrastructure is already in a degraded state. Major reforms are underway to how it is managed, and present an important opportunity to plan for and embed resilience to climate hazards.

How this risk is rated

Severity: there are major risks to water infrastructure now. Without effective adaptation, these will quickly increase to extreme by 2050 and remain extreme by 2090 under either a low or a high climate impact scenario.

Readiness: there are significant gaps in readiness to manage these risks.

Connections: addressing risks to water infrastructure has high potential to help address other climate-related risks. Strengthening water infrastructure would protect lives, improve public health, protect ecosystems, and reduce long-term costs.

2020 comparison: this risk was framed differently in the first national risk assessment. A risk related only to drinking water infrastructure was one of the most significant in that assessment.

Why it is one of the most significant risks

This is one of the most significant risks because critical services need to be immediately secured, and because action to strengthen the resilience of water infrastructure will help with many other climate-related risks. If it is not addressed, our assessment indicates it will be the first climate risk to reach an extreme severity level within the next 25 years.

How climate change is driving this risk

Drinking water supplies face increasing stress from drought, declining water quality, and higher temperatures that encourage the spread of waterborne diseases. Heavy rainfall can wash soil and pollutants into water sources, placing additional pressure on treatment plants, while sea-level rise can lead to saltwater getting into underground water sources.

Wastewater and stormwater networks are also exposed. Much of this infrastructure sits at the lowest points of towns and cities, close to rivers, coasts, and floodplains. Rising seas, coastal flooding, and more frequent and intense rainfall events increase the likelihood of overflows and system failures.

Ageing pipes and treatment plants, combined with historic underinvestment, mean many systems are already struggling to cope. Although wastewater and stormwater networks are designed to be separate, stormwater can enter wastewater pipes through illegal connections or damaged infrastructure, increasing the risk of overloading during storms. When wastewater systems are overloaded, they frequently spill into stormwater networks, worsening the problem. There were more than 1,000 overflows of untreated wastewater due to wet weather events around the country during 2021 and 2022.

Flooding, erosion, and repeated extreme weather events will accelerate the wear and tear on water assets, leading to more frequent failures and longer repair times. The combined effect of climate pressures will increase the cost of maintaining, upgrading, and retrofitting water infrastructure, placing additional strain on local government finances and potentially reducing service quality further.

How it will be experienced

If these risks are not addressed, more communities will face periods of time when they cannot safely drink the water from their taps. Water quality may decline as flooding becomes more common, temperatures rise, and groundwater becomes increasingly saline in coastal areas. Wastewater and stormwater systems are likely to overflow more often, causing flooding, environmental pollution, and reduced treatment performance. Droughts can also worsen blockages and damage in wastewater networks.

Addressing this risk will help to prevent people from getting sick. When heavy rain or floods hit, dirty water can get into drinking water supplies, bringing germs that cause diarrhoea and other illnesses. If wastewater systems break down, raw sewage can spill into neighbourhoods, exposing people to harmful bacteria, viruses, and parasites. Floodwater or broken pipes can also leave pools of standing water, which are ideal breeding spots for mosquito species that spread diseases. Floods can bring pollutants and wash chemicals from farms, factories, and homes into rivers and drinking water sources. On the other hand, droughts make water supplies shrink, which means pollutants like nitrates, heavy metals and toxins from algae become more concentrated and more dangerous.

Some areas have it worse than others; small, remote communities and those with lower average incomes are more likely to experience poor water quality, service disruptions, and the health impacts that follow. Communities in flood-prone areas, or reliant on tanks or local supplies, face greater risks. This includes many iwi/Māori communities, who also face cultural and economic impacts when the water is degraded and they are unable to gather kai (food).

Population growth adds another layer of complexity. Aotearoa New Zealand's population is projected to reach about 6.5 million by 2048. This growth will increase demand for water services, though it will not be evenly distributed. In some regions, a larger customer base may support greater investment in resilience, though expansion into hazard-prone areas to meet increased demand could deepen exposure and risk. Others are predicted to see very little population growth. Water service providers in these areas will not be able to rely on growth as a source of increased revenue to meet future costs.

Key relationships between this risk and others

Water sustains people and ecosystems, supports economic activity, and holds deep cultural and spiritual significance in te ao Māori, where it is understood as a taonga, an ancestor, and a source of mauri. Because of this central role water plays, risks to water infrastructure are closely connected with many others.

More resilient water infrastructure would lessen the financial burden on central and local government by reducing the need for frequent repairs, emergency works, and early replacement of damaged assets. It would help to address health risks by protecting communities from unsafe drinking water and overflowing sewage and stormwater. And it could help protect coastal ecosystems by reducing the frequency of untreated sewage being discharged into the sea during storms or floods.

Some of the links between this risk and others run both ways, creating opportunities for mutually reinforcing benefits. Because large parts of the water network run alongside roads and rail corridors, for example, coordinated planning and investment across these systems can reduce disruption, lower costs, and improve resilience for both infrastructure types. Similarly, freshwater ecosystems support the quality and reliability of drinking water sources, while resilient water infrastructure reduces contamination that harms those ecosystems.

What is underway, what else is needed

Water services have historically been largely provided by local authorities, council-controlled organisations or, in a few cases, privately. The system is under active reform, delivered under the Local Water Done Well policy package. In the future, most water services will be provided by water service entities owned by groups of councils.

These changes focus on governance and service delivery. While the new water service entities will have higher debt caps, meaning they should be in a better position to invest in resilience, there will still be differences in how water is managed and paid for in different regions, leaving some more vulnerable than others. They also leave responsibility for climate adaptation largely with local authorities and asset owners. The reforms present an important opportunity to plan for and embed resilience to climate hazards as part of the management of water infrastructure in future, though while they are going on and the resources of the sector are focused on implementation, important work to strengthen resilience may be delayed.

Outside these reforms, there is limited national-level policy specifically addressing climate-related risks to water infrastructure. Many councils and water providers are planning and investing in adaptation, but progress is uneven and often constrained by funding, governance complexity, and uncertainty about future expectations. There is currently no national-level direction incorporating climate adaptation considerations for water infrastructure, nor stable long-term funding mechanisms to support improvements.

A significant change in the reform package is the removal of the requirement to give effect to Te Mana o Te Wai, which previously recognised Māori as a principal partner in water management and required early, meaningful engagement. Engagement requirements now revert to the standards of the Resource Management Act, reducing the formal role of Māori in shaping water system decisions.

There is also no clear mechanism for water providers to reduce service levels in response to climate pressures. Communities expect high standards of safety, reliability, and aesthetics, making it difficult to adjust services even when adaptation or retreat may be necessary. Without national guidance and access to finance, asset owners may struggle to make timely investments in resilience. Delays during regular renewal cycles risk locking in higher long-term costs, and the absence of strategic planning for managed retreat (which could involve managed withdrawal of services, relocation of whole communities, or both) could lead to investment in assets that ultimately become stranded.

For more information see this summary of risk in the Full assessment report:

- Risks to potable water, wastewater and stormwater infrastructure due to progressive and ongoing changes in temperature and precipitation, sea-level rise and increased extreme weather events.

Risks to buildings

What this risk is about

This risk is about how buildings across Aotearoa New Zealand are exposed to a range of climate-related hazards that threaten both their structural integrity and performance. Flooding is a prominent hazard: hundreds of thousands of buildings are in areas prone to flooding, collectively worth hundreds of billions of dollars. A less common – but growing – climate change impact on buildings is from heat. Most buildings in Aotearoa New Zealand were not designed with high temperatures in mind, and this could make them unsafe and sometimes unliveable, posing acute health risks.

Some building types are more vulnerable because of their age, design, or foundation, while others were built in areas now understood to be hazard prone. Households with fewer financial resources will find it harder to strengthen their homes, relocate away from hazards, or absorb higher insurance costs. In some regions, the level of exposure to hazards will be beyond what can be managed, and people may need to move.

How this risk is rated

Severity: there are moderate risks to buildings now. Without effective adaptation, these will increase to major by 2050 and extreme by 2090 under either a low or a high climate impact scenario.

Readiness: there are significant gaps in readiness to manage these risks.

Connections: addressing risks to buildings has very high potential to help address other climate-related risks. Because buildings are so tightly linked with other systems, better management of these risks will help address challenges in insurability, displacement, and community cohesion.

2020 comparison: this risk was one of the most significant in the first national climate change risk assessment.

Why it is one of the most significant risks

Because buildings are central to daily life, addressing this risk has very high potential to help with other climate-related risks, which is why it is one of the most significant. Better management of risks to buildings will help address challenges in insurability, displacement, and community cohesion.

How climate change is driving this risk

Buildings are exposed to a wide range of climate-related hazards that threaten both their structural integrity and performance. This includes acute hazards such as coastal flooding and erosion, landslides, soil erosion and wildfires, as well as ongoing and progressive changes like sea-level rise.

Exposure is already extensive. For example, according to Earth Sciences New Zealand, approximately 556,000 buildings are currently exposed to inland flooding, with a combined replacement value of NZ$235 billion.[14] Under a low climate impact scenario by 2090, an additional 43,000 homes with an additional replacement value of NZ$19 billion will be exposed; this more than doubles under a high climate impact scenario. Exposure is much higher in some areas than others, including areas like the West Coast where 35% of buildings are projected to be exposed by 2090 under a high climate impact scenario.[15]

As sea levels rise and extreme rainfall intensifies, these numbers will increase, placing pressure on communities, insurers, councils and central government. Landslides, wildfires, and extreme heat will also increasingly threaten buildings.

This may be one of the most visible and publicly understood risks in this assessment – and one of the most tangible. There have been dozens of examples of coastal, river, and surface flooding inundating homes and buildings in recent years, as well as landslides and wildfires. In addition to damaging or destroying buildings, many of these tragically cause loss of life.

A less common – but growing – impact on buildings is from heat, both during acute heatwaves, and from ongoing and progressive temperature rise. Most buildings in Aotearoa New Zealand were not designed with high temperatures in mind, and this can make them unsafe and sometimes unliveable, posing acute health risks.

How it will be experienced

For households, the stakes are high. Homes are often a family's most valuable asset, and around two thirds of households own the place they live in. Insurance is becoming more expensive and more tightly tied to location as climate risks increase. Insurance retreat appears to have already started for some properties at high risk. According to Consumer NZ, the cost of house insurance has risen by more than 900% since 2000, and further shifts toward risk-based pricing mean homeowners may increasingly be priced out of insuring their biggest asset, or facing reduced cover.[16] Rising insurance costs can cause financial stress, particularly if mortgage rates are also high. This in turn has mental health and wellbeing impacts. For more information on insurance, please refer to the *Insurability of assets* risk analysis in the Full assessment report.

Businesses, too, rely on buildings to function. Damage to commercial buildings does not just disrupt the physical structure – it ripples through the economic system via trading, employment, and supply chains. Many businesses face similar insurance issues. Damage to buildings can disrupt education, healthcare, and retail services, impacting economic activity. Even short periods of downtime can lead to lost revenue, contractual issues and cash-flow pressures. In regions where multiple buildings are damaged at once, such as after storms or floods, effects can accumulate and lead to regional economic shocks.

Not everyone faces these risks equally. Some communities, such as those in low-lying or flood-prone districts, are exposed to far greater hazards. In South Dunedin, for example, around 50% of buildings currently face moderate or high risk of exposure to surface flooding, compounded by rising sea levels and coastal flooding.[17]

Others have fewer resources to prepare for or recover from impacts. Low-income households or renters may have limited ability to make resilience upgrades. When climate impacts make homes unsafe or uninhabitable, these groups are at greater risk of displacement, with long-term consequences for wellbeing and social cohesion.

The risks also touch the services people rely on every day. If hospitals, schools, aged care facilities, or key retail hubs lose functionality during or after extreme events, communities may struggle to access core services, food and essential supplies.

For iwi/Māori, the impacts can be particularly profound. Many marae and community buildings are in low-lying coastal areas that historically supported access to kaimoana (seafood) and connections with other hapū and iwi. Damage to these places, or relocation decisions made in response to climate risk, may weaken ties to whenua and the foundations of tūrangawaewae (places where people belong or have the right to stand). These losses can be cultural as well as physical, affecting identity, belonging and continuity across generations.

Finally, when buildings are damaged or destroyed, the environmental consequences are significant. Rebuilding can generate large volumes of construction and demolition waste, particularly when original materials cannot be reused. Without careful recovery and recycling, this can increase pressure on landfills and add emissions which cause further climate change.

Key relationships between this risk and others

Getting ahead of building-related risks offers a major opportunity to reduce pressure elsewhere. Because buildings are so tightly linked with other systems, better management of these risks will help address challenges in insurability, displacement, and community cohesion. Clear, early decisions about protection, insurance, or retreat can reduce uncertainty for households and strengthen social resilience. It can also impact decisions about whether to strengthen, repair or reduce services in other infrastructure systems such as roads and rail, water, and electricity and communications. The condition of homes and community buildings is also closely tied to physical, mental and social wellbeing, making this an important area for public health outcomes.

The financial implications are equally far-reaching. Repeated repairs, increased insurance costs, and reduced insurability could create funding pressures for both local and central government, while large-scale losses in the housing and commercial property sectors pose risks to lenders and the wider financial system. Managing these risks well is therefore essential not only for safety and wellbeing, but the long-term health of the wider economy.

What is underway, what else is needed

Aotearoa New Zealand has made a start on understanding and managing the climate risks facing buildings, but progress remains uneven and the scale of what is required is far greater than what is currently in place. National-level strategies like the emissions reduction plan and the national adaptation plan have begun laying the groundwork by identifying the need to retrofit buildings for resilience and update regulatory requirements so that homes and other structures can better withstand hazards. These signals are important, but many of the measures are still at early stages and are not yet translating into practical action that is driving change at the pace required.

Local and regional governments are also advancing their own work. Around 15 councils have carried out climate risk assessments to better understand which buildings in their areas are exposed and why. These efforts are helping communities plan for the future. But capacity and resources differ widely between councils, and many lack the technical or financial ability to undertake detailed assessments or implement adaptation measures at the speed required. Pressure for residential development to address housing needs can also create tensions for councils trying to plan for climate hazards.

Managing this risk will require a mix of measures including modifications like raising the height of buildings, zoning changes to prevent future building in hazard zones, and in some cases, planned relocation. Short-term protective measures like stopbanks and seawalls may also be part of the solution, but on their own can create a false sense of security and may encourage development in high-risk zones.

The Resource Management Amendment Act 2025 strengthens councils' ability to decline consents or impose conditions on new developments in hazard-prone areas. This will act as an interim measure to help regions avoid developing in hazard zones until wider resource management reforms are implemented, though it is too soon to know how local authorities are applying it or the impact it is having in practice. At the same time, the Building Act and the associated Building Code, which guide developments, are limited in their coverage of climate change impacts, and it is not yet clear how they will align with these new planning requirements.

Government proposals to move from broad, event-based compensation toward hardship-based approaches could reshape how buyouts work and what support is available after climate-related losses. Combined with a shift toward risk-based insurance pricing, these changes could have far-reaching social and economic implications, and it will be particularly important to ensure that they do not unfairly penalise households and communities with fewer resources.

Significant barriers remain. Many people are still unaware of the extent of the risks they face, and there are no mandatory climate-readiness requirements for most existing buildings. Knowledge gaps, unclear standards, and legislative misalignment create friction for councils, homeowners, the insurance sector and the construction industry. These challenges cannot be solved locally or through private initiatives alone. Coherent national leadership, decision-making pathways, funding mechanisms, and guidance for when to protect, when to adapt, and when to retreat would help with the pace and scale of change needed.

For more information see this summary of risk in the Full assessment report:

- Risks to buildings due to progressive and ongoing changes in temperature and precipitation, sea-level rise, extreme weather events, and associated impacts like flooding and wildfires.

Risks to road and rail networks

What this risk is about

This risk is about how climate hazards are putting increasing pressure on the country's road and rail networks, causing both short-term disruption and long-lasting damage. Climate change is expected to reduce the reliability and service levels of road and rail networks in a variety of ways, from more frequent closures, delays, and speed restrictions to higher maintenance and repair costs, and more frequent emergency works. A large share of the network is already exposed to a variety of climate hazards: around a quarter of roads and more than a third of rail sit in areas exposed to surface, river, and coastal flooding, for example.

Transport networks play a crucial role in national resilience. They connect communities, support emergency responses, and keep supply chains functioning. Many other lifeline services – electricity, telecommunications, water – run alongside or underneath them. In some cases, the impacts may be so severe that key transport routes – and the other infrastructure types they house and provide access to – will need to be moved away from high-risk areas.

How this risk is rated

Severity: there are moderate risks to road and rail networks now. Without effective adaptation, these will increase to major by 2050 and extreme by 2090 under either a low or a high climate impact scenario.

Readiness: there are significant gaps in readiness to manage these risks.

Connections: addressing risks to road and rail networks has high potential to help address other climate-related risks. Much key infrastructure is tightly bound up with road and rail corridors, while the emergency management system, critical supply chains, and large sectors of the economy also depend on reliable transport networks.

2020 comparison: this risk was framed similarly in the first national climate change risk assessment and was not included as one of the most significant.

Why it is one of the most significant risks

This is one of the most significant risks because when roads and rail fail, the effects ripple far beyond transport. Much key infrastructure is tightly bound up with road and rail corridors, while the emergency management system, critical supply chains, and large sectors of the economy also depend on reliable transport networks. Strengthening the resilience of road and rail networks will help to address many other climate risks.

How climate change is driving this risk

The biggest threat comes from more frequent and intense extreme rainfall, which leads to flooding, slips, and landslides – often in quick succession. A large share of the network is already exposed: around 26,800 km of roads (about a quarter of the total) and 1,500 km of rail (over a third) sit in areas exposed to surface, river, and coastal flooding today. As the climate warms and sea levels rise, even more routes will be exposed. By 2090, under a high climate impact scenario, coastal flooding alone could threaten 2,710 km of roads and 180 km of rail.

Sea-level rise and rising temperatures add further pressure. Higher seas mean that storm surges, in addition to extreme rainfall events, are more likely to overwhelm existing defences. Extreme heat can soften asphalt, create potholes, and reduce traction, making roads unsafe. Rail tracks can buckle, and bridge components can jam or fail. Much of the country's transport infrastructure is ageing, and many assets were not designed for the climate conditions we are now experiencing.

There are clear engineering limits to what current infrastructure can withstand. Design thresholds for heat, rainfall, and storm events are already being exceeded. As extreme events become more frequent, disruptions and damage will increase.

Recent events illustrate the scale of impact. During the 2023 storm events in Auckland, while a relatively low proportion of the road network was affected (0.12% of the network, primarily as a result of landslides), the repair cost was approximately NZ$390 million, with works continuing more than two years later. Even small percentages of network damage can result in major financial and social consequences.

And it is not just storm events impacting the road and rail network. In 2024, both Auckland and Wellington experienced train cancellations due to heat stress on rail lines, affecting commuters' ability to get to work in the city. As temperatures rise, similar disruptions will become more common and last longer.

How it will be experienced

Everyone who uses roads or rail will feel the effects of climate-related disruption. This includes everyday travel – getting to work, school, healthcare, or leisure activities – as well as freight movement, emergency services, and access to essential utilities.

When roads or rail lines fail, communities can be cut off for days or weeks. Emergency services may be unable to reach people in need. Repairs to other critical services, such as electricity lines, may be delayed because crews cannot get to the site. The consequences are especially severe for rural and isolated areas, where alternative routes are limited and sometimes non-existent.

Recent experiences in the Gisborne region illustrate this vulnerability clearly. In a single year, 2023, five separate extreme rainfall and storm events in the region caused road and bridge damage that left communities isolated. The region was one of the heaviest hit by Cyclone Gabrielle, when almost all rural roads in affected areas were closed, sometimes for weeks. Alternative routes, where they existed, were often longer and slower adding hours on to a single journey. Māori communities were among the worst affected and this is likely to also be true of future extreme events. Around 25% of Māori live in rural or remote communities, meaning they are likely to be more impacted by temporary or prolonged isolation from road closures.

Beyond isolation during and after extreme events, climate change is expected to reduce the reliability and service levels of road and rail networks in a variety of ways, from more frequent closures, delays, and speed restrictions to higher maintenance and repair costs, and more frequent emergency works. As more difficult decisions are made about relocating communities or ceasing to rebuild in exposed locations, long-term loss of service is likely for those who remain, though what form this will take is not clear.

The consequences of such disruptions are wide-ranging. Businesses may struggle to access goods or move products. People may be unable to reach their workplaces, reducing productivity, and longer or less reliable transport routes may increase costs for households and industry. They may also be unable to access healthcare and social services. Ageing infrastructure will become more expensive to maintain, and delays in maintenance will make disruptions more likely. In cities, people who rely on public transport may be particularly affected, especially as urban populations grow and demand increases.

Key relationships between this risk and others

Strengthening road and rail networks creates benefits that extend well beyond the transport system, helping to reinforce resilience across many other areas. Our assessment shows strong links with risks to ports and airports and with risks to water infrastructure. When transport routes are damaged or closed, it affects access to these facilities and the services they provide; likewise, if these networks are disrupted, it can hamper the functioning and repair of road and rail networks. Strengthening these systems together can create a virtuous cycle of improved resilience.

A resilient road and rail network strengthens many other parts of society and the economy. Reliable routes make it easier to maintain electricity and communication networks, help emergency services reach people quickly, support smooth supply chains, and reduce costs for businesses and public organisations. They also ease pressure on government finances by avoiding repeated repair costs, protect people's health by ensuring essential services can be accessed when needed, and support tourism by keeping key destinations reachable.

What is underway, what else is needed

Aotearoa New Zealand has begun laying the groundwork for adapting its transport system. The New Zealand Transport Agency Waka Kotahi (NZTA) has a Climate Change Policy for Land Transport Infrastructure Activities, which requires climate risks to be considered in planning, design, construction, and maintenance.[18] However, this requirement applies only to NZTA-led projects and is voluntary for councils (on local roads). Co-funding for council-led projects does not automatically apply the full NZTA resilience requirements. There is currently no dedicated funding to help local councils carry out adaptation work. This limits the policy's practical impact.

NZTA's climate adaptation plan, *Tiro Rangi*, sets an ambitious goal: a resilient land transport system by 2050 that supports wellbeing and liveability. It outlines foundational actions such as improving risk understanding, embedding adaptation into investment decisions, ensuring evidence-based planning and integrating te ao Māori perspectives.[19] However, these actions are broad and high level, and have yet to be translated into practical action that keeps pace with the level of policy ambition.

The Roads of National Significance programme could offer an opportunity to build resilience into new infrastructure. Publicly available information does not always make it clear how climate resilience is included in these projects and their practical outcomes. This is a pressing issue in part because of the long lifespan of roading investments and the need to avoid 'locking in' infrastructure now that will be unable to withstand the future climate.

Local and regional councils are increasingly assessing climate risks and developing adaptation strategies, but progress is uneven.

Overall, major gaps remain in policy readiness to address this risk. The biggest barriers are a lack of dedicated funding for local adaptation of road and rail networks, inconsistent uptake of climate-related policies by local authorities (including the Climate Change Policy for Land Transport Infrastructure Activities), and gaps in long-term planning. Coordinated action could help to limit unnecessary investment in transport infrastructure in highly exposed hazard zones – and help to discourage new development in such areas. There are also no specific policies in place that address the unique impacts of this risk on iwi/Māori communities.

The affordability of repeated repairs to the transport system is a growing concern for central and local government. Many regions are already struggling to keep up with maintenance demands, and climate change will only intensify this pressure. Addressing this risk will go a long way towards strengthening the country's overall climate resilience.

For more information see this summary of risk in the Full assessment report:

- Risks to road and rail networks due to progressive and ongoing changes in temperature and precipitation, sea-level rise and extreme weather events.

Community action snapshot

Buller District's Westport has limited connections to the rest of the South Island, and the road and rail routes that do connect them are regularly affected by extreme weather events – most often from surface flooding, landslides or fallen trees.

Fragile connections in Buller

"You can't do anything on a farm without roads – all our feed and fertiliser travels on the roading network, as well as the tankers that collect our milk."
Taane Johnsen

The town of Westport is surrounded by water on three sides – the Buller and Orowaiti rivers and the Tasman Sea. It is an area regularly affected by heavy rainfall that leads to flooding.

The town was hit by a duo of devastating floods in July 2021 and February 2022, which saw almost half Westport's residents evacuated, insured losses of more than NZ$70 million and homes left uninhabitable for months.

Since then, a package of flood-resilience measures has been developed, including flood walls along the coast, improved stormwater infrastructure, and the innovative Master Planning process. This design-based planning process has led to a long-term vision of a phased move of Westport residents to a new area of land at Cape Foulwind. The process is now in its third phase, looking at spatial planning, land access, and financial implications.

The fragile road and rail routes that connect Westport to the rest of the South Island are critical for connecting people to essential services and surrounding communities, as well as for export and import.

Taane Johnsen, Business Development Manager at Westland Milk Products told us: "You can't do anything on a farm without roads – all our feed and fertiliser travels on the roading network, as well as the tankers that collect our milk."

Increasingly accurate weather forecasts and council alerts (and improved cellphone reception or satellite internet to receive the alerts) help farmers to plan. Now when severe weather is forecast, Westland will collect milk early in order to minimise wastage.

The bridge crossing the Orowaiti River at Westport.

We also heard about slips causing closures on the Midland rail line between the West Coast and Canterbury, a critical connection to Lyttelton Port, the closest export hub. Some people we spoke to suggested coastal shipping (from Westport's smaller port around to Lyttelton) could help keep West Coast businesses moving during weather-related interruptions, as well as having resilience benefits for the town in the case of longer-term natural hazards, such as a rupture of the Alpine Fault.

Rosie McGrath, who works for the National Public Health Service in Health New Zealand | Te Whatu Ora, told us that around 90% of food on the West Coast is imported from other parts of the country. She explained how most milk that is produced on the West Coast travels to Christchurch for processing before it comes back to the region, so if roads are closed, even some local products are unavailable to the community.

She told us about community groups that are tackling food redistribution and establishing community pātaka. Part of her role is educating the community that while many Westport residents struggle to access enough food on a daily basis, "we are all food insecure in an emergency".

Communities and safety

Risks to social and community wellbeing

What this risk is about

This risk is about the increasing impacts on people's wellbeing from the effects of climate change – impacts that the country is not well prepared for. It brings together two of the risks we assessed that are closely connected in real life: what can happen when people choose or are forced to move by climate impacts,[viii] and the wider risk of effects on mental health from climate change.

The experience of devastating extreme weather events can cause long-lasting hurt, grief and fear that affects people's health. For example, in a survey of people affected by Cyclone Gabrielle one year later, 43% of respondents reported a direct negative mental or emotional impact.[20] Indirect impacts of climate change – including uncertainty about housing and livelihoods – can erode people's sense of safety and belonging. This is heightened when ongoing and progressive climate hazards such as sea-level rise threaten places that matter deeply to people, and communities have to consider moving permanently. While it may be a necessary solution in the face of repeated climate pressure, the prospect of relocation (particularly when it comes suddenly) can break relationships, divide communities and undermine trust in institutions. Planning and managing relocation well, working together with the affected communities, can help reduce those effects.

How this risk is rated

This significant risk combines climate-related risks to mental health (from all climate change impacts) and to social cohesion and wellbeing (specifically from displacement).

Severity: there are major risks to mental health now and they are expected to remain major by 2050 and by 2090 under a low climate impact scenario. Under a high impact scenario in 2090 they will rise to extreme. Risks to social cohesion are moderate now and expected to by major by 2050. They will be extreme by 2090 under either scenario.

Readiness: policy readiness is insufficient for both risks.

Connections: both these risks can be reduced by effectively addressing other climate-related risks.

2020 comparison: the risk to social cohesion from displacement was included as one of the most significant risks in the first national risk assessment. The risk to mental health was not included.

viii One of the risks discussed uses the term 'displacement' in its long name. In this explanation, we are using plainer terms which cover a wide range of ways people might end up relocating where they live. This reflects that the move might be planned, or it might follow an event when an area becomes suddenly uninhabitable.

Why it is one of the most significant risks

This is one of the most significant risks because of the high human and financial costs when people are forced to move, and when climate-related distress, grief, discontent and uncertainty go unchecked. The impacts can be particularly acute when it comes to people's sense of community and belonging. There are long lead times for the measures that would reduce this risk and its consequences for the country, so it is important to start as soon as possible.

How climate change is driving the risk

Recent experience of disasters like flooding and landslides shows clearly the immediate effects that climate change can have on people and their environment. While shared responses to devastating events can help heal much of the pain felt after disasters, there can also be long-lasting hurt, grief and fear that affects people's physical and mental health.

Indirect impacts of climate change can also affect people's mental health. These are things like loss of jobs, housing stress, insurance becoming unavailable, and damage or loss of natural areas and buildings that have particular value for people.

Research evidence and lived experience show that climate impacts can lead to enduring psychological harm, including depression, suicide risk and long-term distress. The effects can also show up as chronic stress, anxiety and grief.

A study of the consequences of the 2023 extreme weather events for people in Tairāwhiti and Hawke's Bay has this finding:

> *The people directly affected by the cyclone suffered extreme and enduring mental trauma. They told us of the loss of homes and assets, loss of livestock and pets, and loss of connection to family history and the past. Their plans for their future, and control over their lives, income and livelihood, all seemed doubtful. Many had altogether lost hope. These feelings were made worse by the thought that it could happen again at any time, and the fear they might be forgotten about and abandoned.*[21]

Meanwhile, ongoing and progressive climate hazards like sea-level rise can threaten places that matter deeply, such as marae and cemeteries, or key landscape features, and these hazards are projected to intensify (see *Chapter 2: Climate change in Aotearoa New Zealand*). As a result, some households and communities in Aotearoa New Zealand are already facing direct threats to their homes and ways of life. A decade ago, this might have been a short list; in 2026 there are many examples. The Commission has visited several in recent case studies, including South Dunedin, Te Taitokerau/Northland, Westport, and Wairoa in northern Hawke's Bay.

How it will be experienced

Social cohesion impacts from displacement

When a household or community is forced to consider moving to escape climate hazards and their effects, there are different implications for society as a whole. Displacement can undermine many of the things that hold people and communities steady, such as shared activities and values, and the sense of belonging that comes from connections to place and to each other.

The prospect of leaving an area that feels like home brings with it fear and hurt, tied up with concern about losing houses and land, which is where many people's money is. Along with this goes potential loss of jobs, support services, and treasured places like churches and marae, and ancestral links to places and species. The loss of connections matters particularly for people who rely on social networks, such as the elderly.

Some areas are more likely to face the prospect of having to move because of the impacts of climate change: low-lying settlements where river or coastal floods happen more often, or where people are more reliant on the natural environment for their livelihoods. These are also jobs and areas with a high proportion of iwi/Māori, which increases this group's exposure to the risk of having to move because of climate effects (see *Ngā mea hirahira o te ao Māori – risks in the Māori world*).

A greater likelihood of having to relocate can contribute to loss of trust in institutions, dissent and resistance, and potentially create conflict in society.

This can be intensified in several ways. When relocation is forced by a catastrophic event, the long effects of trauma (and potentially of an inadequate response) can slow recovery and reduce people's readiness to cooperate for mutual benefit.

When a whole community has to move, but the shifts are not supported by funding for households that have less resources, a split can open between those with financial means who are able to move to new homes, and their former neighbours who get left behind.

Research shows the adjustments are considerable for all: those who remain, those who leave, and for the communities that receive the displaced.

Even when the community looks ahead and considers a move on its own terms (as at Amberley Beach, Westport and the Whirinaki area in Te Taitokerau/Northland), these are hard issues, and dealing with them can intensify differences. The evidence is clear, however, that the impact of relocation is less when it is planned and managed by the community together with authorities, and before another disaster.

Planning together for this kind of community upheaval – and for climate change adaptation in general – reduces the impacts. It can help preserve some of the bonds. It can also smooth out inequities that would mean some would be hurt more than others, and which can drive division and conflict.

For example, in our South Dunedin case study, people working on adaptation options for their neighbourhoods told us that the open-minded approach of councils in the South Dunedin Future process gave the community a voice, especially during decision-making. The various hui, events, research studies and other connections were seen as fruitful and allowed the community to co-develop potential solutions.[22]

Mental health impacts from wider climate change impacts

The added pressure of climate change on mental health comes at a time when mental health is deteriorating overall in Aotearoa New Zealand, and the health system is under strain.

It is not just individuals and their whānau who are affected by climate impacts on mental health. When people are unwell, they may be less able to work and contribute to the local economy or to their community. That can reduce participation in decision-making, or in activities that make their place more resilient, such as working bees for coastal or riverside planting.

The demand on health and social services rises in response – and this can be concentrated in areas where exposure to hazards like high rainfall events and storm surge overlaps with things that make communities more vulnerable, such as lower household incomes. Addressing the increasing need for support services in different areas will require workforce development and training, which takes time.

Part of the picture is that some groups are more sensitive to the impacts – including disabled people, children and young people, iwi/Māori, Pacific peoples, people who live in rural and remote areas, and emergency and health personnel. For instance, Pacific communities can have greater sensitivity overall to the mental health effects of climate change because of lower average incomes, over-representation in flood-prone areas of cities, and cultural and family ties to home islands that are already acutely affected. In a different way, rural communities are likely to face increased strain from drought and environmental degradation, as well as particular social isolation challenges and difficulty accessing health services.

Key relationships between this risk and others

This significant risk is linked with several others, including risks to people's physical health, social and community infrastructure and the risks of disruption to tikanga and hapū/iwi identity and indigenous knowledge in te ao Māori. These links reflect how social and community wellbeing depends on physical health and safety, strong relationships, and identity and belonging linked to place.

The two risks combined here – to social cohesion from displacement, and to mental health from the wider impacts of climate change – are strongly intertwined. When action is taken to reduce one, the other is likely to improve as well, creating a reinforcing cycle. Reducing both these risks can also help reduce the risk of declining trust in democratic institutions, especially when climate decisions are contested or affect communities unevenly.

In general, when climate change affects mental health and social cohesion it is often because a series of risks have played out in a chain of impacts that starts with physical hazards and ends with wellbeing (see *Chapter 1: Introduction*, Box 1.2). For this reason, action on several other risks will help to reduce the pressures on mental health and social cohesion. For example, strengthening buildings and improving insurability can help people stay in place safely, and protecting ecosystems can lessen environmental degradation that contributes to displacement and distress.

What is underway, what else is needed

There are long lead times for the measures that would reduce these risks and their consequences for the country, which makes it important to address these areas as soon as possible.

Most importantly for social cohesion, the country needs an approach to adaptation planning that directly supports communities to avoid, plan for and manage impacts in their area, including for relocation when necessary.

The Government's National Adaptation Framework published in late 2025 does not address displacement of people or communities. Neither is it clear about how action led by communities or local government can be funded (see *Risks to central and local government funding*).

Some councils are building adaptation plans with communities that set out what would work in the local context, but these cannot be put into action without additional funding.

The need for guidance and funding options for communities to work together on planned relocation is urgent. It takes a long time to set up processes that fairly address all needs, and there are communities already trying to navigate these choices.

The country's readiness to address mental health risks from climate change is insufficient in a different way.

There is an existing system for providing mental health care (already under severe strain), but it is not set up to deal with the rising risks to mental health from climate change.

The need to plan for the increasing demand for these services is urgent; this includes workforce development and training, which can also help reduce risks for health staff responding to disasters.

The current Health National Adaptation Plan 2024–2027 recognises climate change effects on both physical and mental health. One of the actions – an assessment of the impacts of climate change on mental health – could support a better understanding of this risk and future action, but there is no publicly available information indicating when and how this will happen. No agency holds clear accountability for post-disaster mental health and wellbeing support or climate-anxiety prevention.

Addressing the clear gaps in systems to help communities deal well with relocation, and in preparing for rising demand for mental health services, is a critical element of building resilience for climate change impacts across the country.

Reducing these key risks to the wellbeing of individuals, and to wider society can help maintain livelihoods, people's sense of belonging and connection, and the ability of all parts of society to work together to stand strong under pressure.

For more information see the summaries of risk for these two risks in the People, health and communities domain in the Full assessment report:

- *Social cohesion and wellbeing (from displacement):* risks to social cohesion, community and cultural wellbeing from the displacement of individuals, families and communities due to progressive and ongoing sea-level rise, extreme weather events, and associated impacts like flooding and landslides.
- *Mental health:* risks to mental health, identity and belonging from trauma and chronic stress, and anxiety due to progressive and ongoing sea-level rise, extreme weather events and associated impacts like flooding and landslides.

Risks to emergency management

What this risk is about

This risk is about how the country's emergency management system is under acute pressure and may struggle to respond to the increasing frequency, severity and extent of disasters that can result from climate hazards. Recent research shows the country has been in a declared state of emergency an average of 56 days each year for the past 10 years, compared to 13 days a year over the previous decade. In the past five years, 80% of the emergencies were for severe weather or flooding.[23]

Strong emergency management saves lives and livelihoods, reduces injuries and trauma, limits damage to homes and businesses, and supports the long-term health, economic and social conditions in communities. The system is made up of people who work in a wide range of organisations, at community level, as full- and part-time workers and as volunteers. It involves the National Emergency Management Agency and other government agencies, councils, emergency services, lifeline utilities, community groups, iwi/Māori, business and research and science organisations.

Together they are facing a steepening challenge. Reviews following recent disasters have highlighted an urgent need to strengthen the system. The signalled changes in current reforms are promising, but it is too early to say how successful they can be at improving the ability of the emergency management system to respond to the increasing frequency and scale of climate change impacts.

How this risk is rated

Severity: there are major risks to the ability of the emergency management system to respond now. Without effective adaptation, they will remain major by 2050 and under a low climate impact scenario by 2090. They will increase to extreme by 2090 under a high climate impact scenario.

Readiness: there are significant gaps in readiness to manage these risks.

Connections: addressing risks to emergency management may help to reduce risks to physical health. There is potential to reduce risks to emergency management by reducing risks to electricity and telecommunications infrastructure, and risks to road and rail networks.

2020 comparison: this risk was not included as one of the most significant risks in the first national climate change risk assessment.

Why it is one of the most significant risks

This is one of the most significant risks because the current emergency management system lacks the capacity or capability to deal with significant, complex, widespread events impacting multiple regions at once.[8] There is an urgent need to act to coordinate and accelerate action to strengthen the system. This includes doing more earlier in the process, to reduce risk as well as respond to disasters when they occur.

How climate change is driving the risk

While Aotearoa New Zealand is already familiar with the challenge of living with many natural hazards, climate change is adding a new intensity. The frequency, severity and extent of disasters that can result from climate hazards is increasing – such as flooding, landslides and coastal storm surges during extreme weather events, and heat waves and wildfires in drier and hotter conditions. That amplifying effect – that makes the impacts harsher on the land and the people, and makes the recovery time between shorter – is projected to increase through this century as global temperatures rise.

Because of where most people live – on the coast or in river valleys and floodplains – the country's population has a high level of exposure to the impact of extreme events, as well as to the exacerbating effects of gradual, ongoing changes such as sea-level rise and coastal erosion. This exposure has increased over time as new development continues to be permitted in these areas. A 2025 report from Earth Sciences New Zealand on flood hazards showed that, in a rainfall event that has a 1-in-100 chance of happening in any given year (under current conditions),[ix] 754,000 people and NZ$235 billion worth of buildings are exposed to flooding.[14]

Climate change will also increase the risk of multiple hazard events occurring at the same time, stretching the capacity of the emergency management sector.

How it will be experienced

The many recent examples of extreme weather events that have caused tragic loss of life, destroyed homes and businesses, and left large repair bills leave little doubt about the potential implications of an unprepared emergency management system. The Government Inquiry into the response to Cyclone Hale, the Auckland Anniversary storm and Cyclone Gabrielle in 2023 found the system was not able to cope with significant and complex events hitting multiple areas. Those events collectively became the most severe and destructive weather events in the country's recent history. Fifteen people lost their lives and between NZ$9 and NZ$14.5 billion of physical damage was caused to households, businesses and infrastructure.[8] After those events, the inquiry found that the current emergency management system is not fit-for-purpose and must change to meet the reality that Aotearoa New Zealand is facing more frequent and severe weather events.

ix As the climate changes, the level of flooding associated with an event that has a 1-in-100 chance of happening in a given year will increase over time – meaning the rainfall event that would cause the level of damage associated with a current 1-in-100 event is expected to become more likely over time.

On the other hand, those events also highlighted the effectiveness of local preparedness. Some of the most effective and rapid responses to those cyclones and storms were carried out by iwi/Māori who provided manaakitanga (kindness and support), critical equipment, response and wellbeing support, money and facilities for welfare to people in their rohe (district or territory). Similarly effective responses and significant community support were facilitated by iwi/Māori in the aftermath of the Canterbury and Kaikōura earthquakes and the floods in Edgecumbe, as well as during multiple emergencies in early 2026.

The country is also affected by the increasing global need for emergency response, including in the Pacific region and in Asia, where Aotearoa New Zealand is a trusted partner and provider of humanitarian aid. The projected increase in weather emergencies may also limit the support received from other states. For example, the existing arrangements to share equipment and firefighters with Australia and the United States of America may not be possible as fire seasons lengthen and overlap.

When an emergency is managed well, efforts are directed to the areas that best address both immediate and long-term need. Such efforts can restore the conditions for life more quickly and maintain strong connections that help people to thrive. For instance, reopening transport routes helps people get medical help, access other support, and get to work and school. Clearing away pollution removes dangerous contaminants for communities and allows natural systems to recover. Equally, looking after emergency workers and health providers who operate under high pressure during a crisis can protect their health, safety and emotional wellbeing, and set them up well for the next event.

Successful emergency management starts long before a disaster occurs. People working in this area in Aotearoa New Zealand talk to the four Rs: risk reduction, readiness, response and recovery.[24]

- **Risk reduction** is about identifying hazards and the risk they present – and then either eliminating the risk or reducing its impact or likelihood. An example is flood protection such as stopbanks or the preparation of an adaptation plan.
- **Readiness** is about being set up beforehand, including at local and professional level, with, for example, community plans.
- **Response** is the action taken at the time: as a hazard event (like a flood) forms, as well as during and after the event to save lives, property and limit harm.
- **Recovery** is focused on coordinated efforts to support the affected community to heal and build back to strength after an emergency.

An emergency system that prioritises action across all four Rs provides a strong foundation for communities to not only restore the conditions for life and maintain strong connections following an emergency, but that also helps them prepare for, or avoid, another disaster. This includes talking together about how they will manage future challenges. While the signalled reforms in the emergency management system are intended to strengthen action in all four of these areas, there is a long way to go: recent research suggests that 97% of the Government's expenditure on natural hazards since 2010 has been on responding to and recovering from disasters, with only 3% on risk reduction and resilience.[25]

By contrast, a weak emergency response can make a disaster worse – in the moment, and in the aftermath. Responses can fail if they are stretched too far: by lack of planning, skills or resources, or if there are too many things happening at once. Infrastructure failures can also undermine the response and make recovery much slower with higher cost across the board.

Key relationships between this risk and others

Strengthening the emergency management system can have benefits that flow into other areas of wellbeing. Our analysis shows that improving how the system prepares for and responds to events can help reduce risks to people's physical health, because effective emergency responses keep people safer during and after disasters.

This risk is also closely connected to the resilience of other essential systems. Electricity and telecommunications outages caused by a severe weather event can mean that people are unable to contact emergency services or are unable to receive warnings or other information relating to the emergency management response. Roads, bridges and other critical infrastructure can also be damaged during severe events, making it more difficult to carry out an emergency management response. Improvements in these areas directly support emergency responses and help reduce the overall impact of extreme events.

There is also an important relationship between emergency management and public trust. When responses are timely, coordinated, and fair, they support people's confidence in councils and government. When they fall short, they can erode trust and contribute to wider social tensions, including risks to social cohesion and governance. Ensuring the emergency management system is well resourced is part of the picture, but resilience also comes from the wider environment: healthy ecosystems, strong built structures, and well-functioning social systems all help reduce the harm from extreme events before emergencies occur.

What is underway, what else is needed

In 2023, the National Emergency Management Agency said that work to improve the system cannot progress until changes to emergency management legislation are resolved.

The Government introduced an Emergency Management Bill in December 2025 (after the substantive analysis for this assessment was complete). The objectives for the new legislation are to strengthen the role of communities and iwi/Māori in emergency management; provide for clear responsibilities at national, regional and local levels; enable a higher minimum standard of emergency management; minimise disruption to essential services; and ensure agencies have the tools to be effective in an emergency.

These changes, combined with an Emergency Management System Improvement Programme, aim to address the improvements needed, including addressing the historical omission of the role played by iwi/Māori in official emergency management legislation and documentation. These ongoing reforms are promising, though it is too soon to tell how successful they will be at improving the ability of the emergency management system to respond to the increasing frequency and scale of climate change impacts.

While reform is necessary, timely action to address this risk now can also help safeguard some of the more effective parts of the current system. These include local response networks and the iwi/Māori networks and places that are mobilised to secure community wellbeing in the aftermath of disasters. Some of these, such as coastal and riverside marae, are themselves vulnerable to the effects of climate change.

There are other work programmes underway across government that may contribute to disaster resilience and help to reduce this risk. These include resource management reform, the national adaptation framework, local government reform, and the national risk and resilience framework. There are important areas of intersection between these so it will be important to ensure that all changes with implications for emergency management, natural hazard planning, and climate risk reduction are joined up when the reforms are finalised.

Stronger preparation for, and responses to, emergencies will be critical to preventing the country entering a downward spiral of urgent rescue and recovery missions. That would tie up the people and funds that could otherwise be used to safeguard lives and livelihoods through effective adaptation. This significant risk therefore ties closely to the *Risks to decision-making and delivery*, and *Risks to central and local government funding*.

For more information see this summary of risk in the Full assessment report:

- Risks to the ability of the emergency management system to respond to the increasing frequency and scale of climate change impacts in Aotearoa New Zealand and the Pacific region.

Community action snapshot

Te Taitokerau/Northland iwi, Ngātiwai, are no strangers to extreme weather events. The iwi has put in considerable effort to shore up their emergency response plans, and put climate adaptation measures in place, as extreme weather events put pressure on services in small, isolated communities like Mokau and Tuparehuia.

Forward-thinking pays off for community

"Our marae become our safe haven, not just for our people but for everybody." Clive Stone

Flood damage in Mokau and Oakura in January 2026 could have been "a real disaster".

Ngātiwai taiao lead and civil defence co-ordinator Clive Stone told us that recent climate adaptation work meant the damage wasn't as bad as it could have been.

Just two months prior, the two big awa in the area, Punaruku and Mokau, had all the debris removed, as part of climate adaptation work developed in conjunction with Whangarei District Council.

"If the rivers weren't cleaned out, we would've looked like the east coast.

"Because of [the clean-up], the water was able to disperse really quickly and that gave us a lot of opportunity to respond straight away.

"So, we were really fortunate that we had done that work prior to the storms... because the cost of the cleanout of the river probably would be a fraction of the cost of the damage if they didn't clean it."

Alongside their climate adaptation efforts, this Te Taitokerau/Northland iwi, which covers the coastal area from Oakura to Whangaruru, has been building its emergency preparedness capacity.

It was a false tsunami warning around 2024, resulting in "a lot of confusion" that triggered the iwi into action, Clive told us.

Emergency responders gather at Mokau Marae to coordinate the response to the January 2026 flooding event.

"People were going left, right and centre, there was no coordination, nobody knew where everybody was, it was just a bit chaotic."

Like many other iwi, Ngātiwai set about building a relationship with the local civil defence group so they could become an integrated part of any emergency response.

They also set their marae up with solar, petrol generators, satellite internet, stocked food supplies and put emergency preparedness plans in place for each of the five marae.

So, when over 100 people were forced to relocate from Tuparehuia Campground due to flooding, Tuparehuia marae was one of the marae that was able to quickly spring into action.

"Our marae become our safe haven, not just for our people but for everybody," Clive Stone said.

Clive told us when it rains now in Te Taitokerau, it is heavier. He compares it to Cyclone Bola where he said the flooding was the result of a build-up after weeks of rain.

"Now, it's downpours that match Bola in a day."

In March when we talked to Clive, the iwi was in recovery mode, with accommodation and infrastructure the biggest challenges.

Roughly 15 whānau were still displaced from their homes, which were yellow- or red-stickered. Many of them don't have insurance.

Meanwhile, roading is a challenge, with the main road in and out of Oakura closed until June 2026 for repairs due to severe damage, with over 100,000 cubic metres or more than 15,000 truckloads of dirt, rocks and trees to be moved.

As they still grapple with these recovery challenges, Clive told us the emergency response efforts showed "that we've grown".

He said consent and regulatory changes could make things easier in future emergencies, like changing consents to allow people to store more petrol on their property.

Ngā mea hirahira o te ao Māori – risks in the Māori world

Noho tahanga a Papatūānuku, kia whakakorowai i a ia
Our Earth Mother lies bare, let us cloak her in a rich tapestry of biological diversity to restore her energy and vibrancy – Keita Ngata

What this risk is about

This risk is about how climate hazards interact with longstanding structural factors to create a set of interconnected risks that specifically affect whānau, hapū and iwi. For iwi/Māori, climate change is not only a physical or economic problem. It reaches into identity, language, knowledge, governance and intergenerational wellbeing.

Across Aotearoa New Zealand, many cultural sites of significance to iwi/Māori sit in places now highly exposed to climate hazards: low-lying coastal areas, riverbanks, floodplains and eroding hillslopes. Access to taonga species is already changing in some rohe as marine heat, acidification, sedimentation and extreme weather events affect habitats and traditional harvesting practices. Economic impacts will be felt in the climate-sensitive primary sectors where there are high levels of iwi/Māori ownership and employment; farming, forestry, fisheries and aquaculture among them. Climate change also exacerbates existing health risks for iwi/Māori. Higher baseline rates of certain conditions such as respiratory and cardiovascular illness, diabetes and renal disease mean many Māori are more susceptible than non-Māori to climate-related health impacts.

Many of the climate risks for te ao Māori arise not only from physical hazards but from legal exclusion and inconsistent recognition of decision-making rights. When iwi and hapū are not in the room, adaptation is less effective, slower to implement and more likely to generate adverse consequences.

How this combined risk is rated

This combines climate-related risks of disruption to tikanga and hapū/iwi identity, loss of indigenous knowledge systems, legal exclusion and governance failures for Māori, loss of access to taonga species, damage to Māori infrastructure, economic losses for Māori in primary industries, and increased Māori health vulnerabilities.

Severity: all the combined risks are moderate now. Without effective adaptation, all will by major by 2050 and remain so in 2090 under a low climate impact scenario. Under a high climate impact scenario in 2090 they will be extreme.

Readiness: policy readiness is insufficient for most of these risks (the lowest level), with significant gaps for the risks for Māori in primary industries and Māori health vulnerabilities.

Connections: these risks were not scored for their cascading impacts.*

2020 comparison: There was no domain for specific risks in te ao Māori in the first national climate change risk assessment. Two specific risks to Māori social, cultural, spiritual and economic wellbeing were included in the Human domain. Neither were included in the most significant risks.

* It was agreed that adding this step may be misaligned with an ao Māori world view, where interdependence is the starting point rather than the outcome.

The inclusion of an ao Māori domain with seven specific risks has been a key development since the first risk assessment in 2020. Analysis for this domain – Ngā mea hirahira o te ao Māori, which translates as 'things of importance in the Māori world' – was completed by independent researchers from Manaaki Whenua Landcare Research (now part of the Bioeconomy Science Institute) and Ngā Pae o te Māramatanga Māori Centre of Research Excellence, contracted by the Commission. Their work is published in full alongside this report and can be read as a standalone Māori climate risk assessment.

The risks in this domain were scored for severity and policy readiness by independent kaupapa Māori researchers using the same criteria as the rest of the assessment. Their findings support its inclusion as one of the most significant risks.

Why it is one of the most significant risks

This is one of the most significant risks because of the specific ways in which whānau, hapū and iwi are exposed to the effects of climate change, including economic impacts, risks to property, and risks to health. Climate change compounds the effects of long-standing structural factors on iwi/Māori, such as land marginalisation and alienation, resulting in increased exposure to climate hazards and further constraining the adaptation options available to iwi/Māori. In turn, this is likely to create further impacts on iwi/Māori legal rights, cultural and spiritual practices, identity, language, knowledge, governance and intergenerational wellbeing.

All 10 of the most significant risks in this report, as well as all those analysed in the Full assessment report, will affect iwi/Māori, and these impacts have been noted. But action to address the other risks alone is unlikely to fully capture and take account of the 'things of importance in the Māori world' that give this risk its name. In addition, addressing risks in *Ngā mea hirahira o te ao Māori* domain will enhance both our understanding of and response to the other risks outlined in this report.

How climate change is driving this risk

Across Aotearoa New Zealand, many cultural sites of significance to iwi/Māori sit in places now highly exposed to climate hazards: low-lying coastal areas, riverbanks, floodplains and eroding hillslopes. This reflects both ancestral settlement patterns and the historical marginalisation of Māori land. As the climate changes, marae may face repeat inundation; urupā can be destabilised; papakāinga can become harder to insure, maintain or defend; and wāhi tapu can be lost altogether.

Access to taonga species is already changing in some rohe as marine heat, acidification, sedimentation and extreme weather events affect habitats and harvesting practices. These shifts have practical consequences for kai security and health, but also cultural consequences: interruptions to maramataka-guided activities, diminished opportunities to teach and learn, and the erosion of place-based knowledge. Terrestrial taonga are also under threat as climate change and biosecurity pressures alter ranges and increase stress.

Economic impacts will be felt in the climate-sensitive primary sectors where there are high levels of iwi/Māori ownership and employment; farming, forestry, fisheries and aquaculture among them. Exposure in these sectors is often higher where landholdings are fragmented, on erosion-prone soils, or where investment constraints limit diversification. Where large iwi-led organisations have governance capacity and balance sheet strength, they are already reallocating capital toward more resilient land uses, but not all communities and businesses have that option.

Climate change also exacerbates existing health risks for iwi/Māori. Higher baseline rates of certain conditions, such as respiratory and cardiovascular illness, diabetes and renal disease, mean many Māori are more susceptible than non-Māori to climate-related health impacts. Displacement and damage to culturally significant places can deepen stress and affect mental health, particularly where tikanga is disrupted.

Finally, governance settings are important for iwi/Māori. Many of the climate risks for te ao Māori arise not only from physical hazards but from legal exclusion and inconsistent recognition of decision-making rights. When iwi and hapū are not in the room, adaptation is less effective, slower to implement and more likely to generate adverse consequences.

How it will be experienced

Across the seven specific risks analysed by these researchers, clear themes were present. First, place matters: climate risks for iwi/Māori are heightened where culturally significant sites and iwi/Māori landholdings are concentrated in hazard-prone locations, or where relocation would itself carry cultural harm. Second, decision-making matters: outcomes for iwi/Māori depend on whether adaptation law, funding and governance make space for iwi/Māori decision-making, data sovereignty and locally led planning. Third, capacity matters: where iwi and kaupapa Māori providers are resourced and connected with councils and agencies, readiness is higher; where resources are thin, communities face repeated shocks with fewer tools to respond.

Key relationships between this risk and others

There are connections between the risks in te ao Māori and the risks in the wider assessment

Table 3.3 shows the close links between the risks in this domain and other risks across the assessment.

Table 3.3: Links between risks in te ao Māori and risks in the wider assessment

Risks in Ngā mea hirahira o te ao Māori domain	Linked to these risks
Risks of damage to Māori infrastructure	Risks to buildings (Built environment domain) Risks to social and community infrastructure (People, health and communities domain)
Risks of loss of access to taonga species	Aspects of all risks in the Natural environment domain
Risks of economic losses for Māori in primary industries	All risks in the Sectors relying on the natural environment domain
Risks of disruption to tikanga and hapū/iwi identity	Risks to social cohesion and community and cultural wellbeing (from displacement) (People, health and communities domain)
Risks of loss of indigenous knowledge systems	Risks to social cohesion and community and cultural wellbeing (from displacement) (People, health and communities domain) All risks in the Natural environment domain
Risks of legal exclusion and governance failures for Māori	Aspects of all risks in the Governance domain
Risks of increased Māori health vulnerabilities	Risks to physical health Risks to mental health (both are in People, health and communities domain)

Because of these many connections, the full risk assessment also embedded iwi/Māori considerations into the evaluation of every risk as much as possible.

What is underway, what else is needed

The full assessment of Ngā mea hirahira o te ao Māori acknowledges growing iwi/Māori-led adaptation practice: marae-centred emergency response and recovery; mātauranga-based monitoring of environmental change; iwi climate strategies; and locally-led restoration projects, including innovative approaches in aquaculture and kelp forest recovery. Some councils are improving partnership approaches and commissioning risk work that better accounts for iwi/Māori priorities. Recent emergency management reforms have signalled intent to clarify roles and strengthen decision-making, though the extent and pace of change remain uncertain.

These developments show momentum, but they do not yet match the scale of risk. Funding tends to be short-term or pilot-based; recognition of mātauranga Māori in policy does not consistently translate into implementation; and building and planning regimes remain misaligned in ways that slow practical action on the ground.

The external researchers identify five system shifts that would materially reduce the combined risk to te ao Māori:

- Integration: ensuring climate policies and plans consider impacts on iwi/Māori
- Rights-based adaptation: embedding Te Tiriti o Waitangi/The Treaty of Waitangi obligations into adaptation governance and investment
- Localisation: supporting whānau, hapū, and iwi to lead adaptation planning using mātauranga Māori
- Systems change: designing finance, infrastructure, and policy settings that enable Māori-led adaptation and climate-positive economic futures
- Data sovereignty: building kaupapa Māori data systems to track exposure and adaptive capacity at the rohe level.

These approaches emphasise locally led, centrally enabled, evidence-based adaptation, principles that are essential for an effective response not only for iwi/Māori, but for everyone living in Aotearoa New Zealand.

For more information: see the full independent assessment of Ngā mea hirahira o te ao Māori on our website. The seven risks analysed in that report are:

- *Damage to Māori infrastructure:* this risk examines how climate change threatens significant sites such as marae, urupā, wāhi tapu, wāhi tūpuna and papakāinga, disrupting tikanga, identity, and resilience.
- *Loss of access to taonga species:* this risk assesses the impacts of climate change on access to taonga species, highlighting the threats it poses to Māori food resilience, tikanga, and the transmission of intergenerational knowledge
- *Economic losses for Māori in primary industries:* this risk describes the potential economic losses for Māori in primary industries from exposure to climate-related stressors such as droughts, floods, ocean acidification, and new biosecurity threats.
- *Disruption to tikanga and hapū/iwi identity:* This risk examines how climate change-induced displacement, coastal erosion, and managed retreat risk severing iwi/Māori connections to whenua, threatening identity, sustained practice of tikanga, and intergenerational wellbeing.
- *Loss of Indigenous knowledge systems:* This risk concerns how climate change threatens the continuity of mātauranga Māori by disrupting the ecosystems, practices, and governance structures that sustain it.
- *Legal exclusion and governance failures for Māori:* This risk concerns how legal exclusion and governance failures can undermine iwi/Māori decision-making and participation in climate adaptation.
- *Increased Māori health vulnerabilities:* This risk assesses the climate-related health vulnerabilities iwi/Māori face, focusing on how structural inequities, ecological degradation, and governance exclusion compound health risks and reduce adaptive capacity.

Te reo Māori glossary

Kupu/rerenga kupu Māori
English contextual translation

awa
river, stream

hapū
kinship group, tribe, subtribe; a kinship group descended from a common ancestor; the primary political unit in traditional Māori society

iwi
tribe, nation or people; a large kinship group descended from a common ancestor

kaupapa Māori
Māori approach or approaches, issues, perspectives, matters for discussion

mahinga kai
garden, cultivation, food-gathering place

marae
communal or sacred place that serves as a venue for whānau, hapū, iwi, and community gatherings; often a key focal point for tribal affairs

maramataka
traditional lunar calendar used to guide planting, fishing, and other activities

mātauranga
historic and contemporary knowledge, wisdom, understanding, skill

mātauranga Māori
historic and contemporary Māori knowledge, the body of knowledge originating from Māori ancestors, including the Māori world view and perspectives, Māori creativity, and cultural practices

moana
ocean

papakāinga
Māori housing or homestead generally on ancestral land

rohe
boundary, district, region, territory

taonga
treasured possessions

tikanga
correct procedure, custom, habit, lore

urupā
cemetery or burial ground

wāhi tapu
sacred place, sacred site

wāhi tupuna, wāhi tūpuna
ancestral places

whakapapa
genealogy, lineage; the layering of relationships that connect people, places, and knowledge systems

whānau
extended family, family group

whenua
land; also refers to placenta, symbolising the deep connection between indigenous people and place

Nature and the bioeconomy

Risks to ecosystems and biodiversity

What this risk is about

This risk is about how climate change impacts the country's ecosystems and indigenous biodiversity. Increasing land and marine temperatures change the ongoing environmental conditions species live in, while extreme weather events and wildfires cause shocks to ecosystems. This causes changes to where species live, how they interact, and their life cycles and patterns. From around the middle of the century, under a high climate impact scenario, the combined effects of climate change and existing pressures on ecosystems could push some systems past a point where they can recover. The consequences of ecosystem loss are important not only for their intrinsic value but also for the effects that flow across all aspects of life: water, soil and air quality, the viability of jobs and businesses that depend on nature, the health of individuals and communities, and cultural and recreational connections to nature. This risk is greater because of existing pressures and threats to the country's ecosystems such as land degradation, invasive species, resource extraction and pollution.

We have combined climate-related risks to ecosystems and biodiversity into one significant risk because they are interconnected – with each other and with the wider risks in the assessment. Addressing risks to one ecosystem type is likely to reduce risks to others, while strengthening the resilience of these systems together will help to address many other climate-related risks. This makes it a priority for action.

How this risk is rated

This significant risk combines climate-related risks to land (terrestrial), freshwater, coastal and marine ecosystems, and indigenous biodiversity from invasive species and disease.

Severity: the risk to terrestrial ecosystems is major now and the others are moderate. Without effective adaptation, all will be major by 2050 and extreme by 2090 under a high climate impact scenario. Some will reach extreme by 2090 even under a low climate impact scenario.

Readiness: there are significant gaps in readiness to manage all the risks combined here.

Connections: action to address most of these combined risks has high or very high potential to help address other climate-related risks. The potential is medium in the case of marine ecosystems.

2020 comparison: these risks were framed differently in the first national risk assessment. The two natural environment risks named as significant were focused on coastal environments and indigenous ecosystems and species.

Why it is one of the most significant

This is one of the most significant risks because addressing it would have immense benefits across many other areas. Diverse and resilient ecosystems shield the country from the worst impacts of climate change and provide essential 'ecosystem services' that protect people and places. Aotearoa New Zealand's natural environments span an extraordinary range. Maintaining the country's unique biodiversity helps reduce risks to sectors like fisheries, forestry, pastoral agriculture, tourism and many other areas. If ecosystems are allowed to degrade it creates cascading risks across the economy and the country as a whole.

How climate change is driving the risk

Climate change is intensifying existing pressures such as land degradation, invasive species, resource extraction and pollution on already fragmented natural areas and ecosystems. Ongoing changes in climate like increasing temperatures and changes in precipitation place pressure on natural systems by changing the background environmental conditions for life. Higher average temperatures and changing rainfall patterns can also encourage the emergence of new diseases and pests or the invasion of exotic species that dominate indigenous ones. The increasing frequency of extreme events such as storms and wildfires causes shocks to ecosystems.

The combined impacts of these climate-related pressures on biodiversity influence changes to where species live, how they interact, and their life cycles and seasonal patterns.[26]

There are thresholds when change can reach a level where a species, or a whole ecosystem, cannot manage further change, when it is no longer resilient. From around the middle of the century, under a high climate impact scenario, the combined effects of pests, damaged habitats, and climate change could push some ecosystems past a point where they can no longer recover.[27]

While it is clear climate change increases the likelihood of passing tipping points where ecosystems collapse, where that point lies is not always clear, which increases the risk of crossing it. This is why early action to protect ecosystems and biodiversity is important, long before these tipping points are reached.

How it will be experienced

The natural environment is the complex, interwoven foundation for life on the farm and in the city, for the economy of the country, and for people's connection to place and identity. A healthy natural environment provides important ecosystem services that support the food and fibre and tourism sectors, filter pollution from the air and water, and facilitate cultural connection.[28] It also acts as natural infrastructure that can protect coastlines from storm surges, prevent erosion and limit the impacts of inland flooding.[27]

Damage to ecosystems and the diversity of species has wide-reaching consequences for the country. As ecosystems become damaged it means the loss of the important services those systems provide to the country and increases the risks posed by the changing climate. These changes could disrupt food production, increase damage from extreme weather and impact health and wellbeing.

Some species are limited in their ability to adapt to changes in environmental conditions. If an area becomes consistently too hot or wet, if food sources decline, or if new diseases or new species become established, the animals and plants living there can struggle to survive, and the ways the ecosystem functions can weaken and even collapse. In Te Taitokerau/Northland, the warming of coastal waters has led to the spread of caulerpa, an exotic seaweed, which is smothering shellfish beds. This hits at the heart of food gathering and cultural connection for locals.[7]

Ecosystem decline can exacerbate risks for iwi/Māori and remove options for them. If the impacts of climate change are not managed to maintain healthy ecosystems this can threaten the ability for iwi/Māori to retain traditional relationships with taonga species, to meet responsibilities of kaitiakitanga (duties of care or guardianship of the environment), and to use mahinga kai (food-gathering areas or sites) along with the mātauranga (knowledge) and tikanga (culture and customs) associated with such practices.

Key relationships between this risk and others

Because ecosystems and biodiversity are central to food, livelihoods, cultural practice, and community wellbeing, changes in the natural environment can flow through many parts of society. This significant risk is particularly closely related to and overlaps with several risks in Ngā mea hirahira o te ao Māori.

For food and fibre producers that rely on the natural environment – namely fisheries, forestry, pastoral agriculture, horticulture and tourism – there are strong two-way relationships with ecosystems and biodiversity risks. These sectors are directly affected when ecosystems decline, and they can also have significant impacts on these ecosystems. Focused action across these risks to protect biodiversity and reduce vulnerability to shared hazards such as drought, wildfire and pests reduces risks to both domains.

Risks to electricity and communications networks and buildings are reduced by strengthening ecosystems. For example, wetlands and intact forests can reduce the volume of stormwater reaching adjacent areas.

Risks to mental health can also be reduced by strengthening people's relationship to and enjoyment of Aotearoa New Zealand's unique environments.

Together, these relationships highlight how efforts to protect the natural world also strengthen resilience across communities, services, and the wider economy.

What is underway, what else is needed

The natural systems on which the country depends require an integrated, holistic approach for effective management that responds to the pressure of rapidly shifting climate change effects. This will also depend on increased investment in science, to provide necessary data and to improve understanding of climate change impacts and the effectiveness of different interventions.

Currently, there are few policies and actions to directly support adaptation in the natural environment. While a range of environmental and natural resource management policy and legislative instruments are in place, they do not address adaptation needs comprehensively and remain fragmented and under-resourced.

There is growing local action across the country to build the resilience of natural systems to climate change (see the story below about Maketū residents taking adaptation into their own hands). Like other community and iwi/Māori-led adaptation action though, this kind of action can struggle to have effect at scale without greater coordination and support from central government.

The Department of Conservation has a three-year plan to increase the resilience of wildlife and conservation land to the impacts of climate change. The Climate Change Adaptation Action Plan 2025–28 (the department's third) is intended to assist with prioritisation and to be implemented within the department's existing resources.[29]

There are policy and legislative reforms underway, including to resource management and local government, that relate directly to environmental management. These reform programmes concentrate on management of access to resources and miss opportunities to systematically address exposure, vulnerability or resilience to climate change. To foster resilience and avoid maladaptation, policy action would incorporate climate change considerations and adaptation needs into all land use, land management, environmental management and conservation policies.

Recurrent barriers to adaptation action include lack of funding, investment uncertainty, lack of data, inadequate research support and slow implementation. Addressing these barriers to enable greater investment to prevent degradation and restore ecosystems would improve climate resilience.

Robust monitoring programmes and further research into how ecosystems may change and function under different climate change scenarios are required to understand thresholds and other non-linear changes to ecosystem function. The results of this need to be integrated into biodiversity and biosecurity planning and systems.

Effective support for the resilience of the natural environment is critical for reducing serious climate change risks. Integrated and responsive environmental policy would strengthen the natural infrastructure of the country. Intact and resilient ecosystems can better withstand change and shocks as well as continue to provide ecosystem services to people via food and fibre, protection from the effects of storms, recreational, cultural, and spiritual connection to the natural environment, and underlying processes like nutrient cycling. Resource management that maintains these services can directly help reduce risks to the country's water systems, transport networks, home and businesses and economic activity – as well as people's health and wellbeing.

For more information: see the summaries of all five risks in the Natural environment domain in the Full assessment report:

- *Coastal ecosystems:* risks to coastal ecosystems due to progressive and ongoing changes in temperature and precipitation, sea-level rise, extreme weather events, and associated impacts like coastal flooding and erosion.
- *Freshwater ecosystems:* risks to freshwater ecosystems due to progressive and ongoing changes in temperature and precipitation, sea-level rise, extreme weather events, and associated impacts like erosion and groundwater contamination.
- *Marine ecosystems:* risks to marine ecosystems due to ocean warming, marine heatwaves, and associated impacts like ocean acidification and deoxygenation.
- *Terrestrial ecosystems:* risks to terrestrial ecosystems due to progressive and ongoing changes in temperature and precipitation, extreme weather events, wildfires and drought.
- *Indigenous biodiversity (from invasive species and pathogens):* risks to indigenous biodiversity from the enhanced spread of invasive pests, weeds and pathogens due to progressive and ongoing changes in temperature and precipitation, and extreme weather events.

Community action snapshot

This coastal community in the Bay of Plenty is taking climate adaptation into its own hands. We spoke with Roana Bennett, Raewyn Bennett and Elaine Tapsell from the Maketū Iwi Collective about their extensive adaptation efforts, which they fund and action themselves.

Taking adaptation into their own hands

When Maketū residents noticed that kōiwi (human remains) were increasingly becoming exposed due to more frequent landslides, they decided to act.

They held a series of five wānanga over eight weeks in 2021 to build up understanding of climate change within the community.

Photo (L-R): Raewyn Bennett and Roana Bennett at Te Heriheri Wetland in Maketū.

"Just about everyone could find a hook to connect with because they'd been working in the taiao (environment), they'd seen the changes," Kaiwhakahaere for the Maketū Climate Adaptation project, Roana Bennett told us.

Even though Maketū has a small population of just under 1,500 people, the community are ahead of the curve when it comes to climate adaptation planning.

The development of the Maketū Climate Action Plan, Te Toka Tū Moana Mō Maketū, was led by three Maketū Iwi Entities – Te Rūnanga o Ngāti Whakaue, Ngāti Pikiao Environmental Society, and Whakaue Marae Trustees, but with contributions from the whole community.

The town is built largely on low-lying land, which is prone to flooding as extreme weather events become more frequent.

These homes were built on whenua that was allocated to them by the Māori Land Court.

"A lot of them in Maketū are built where they never should've been, it goes back to colonial times," board member of the Ngāti Pikiao Environmental Society, Raewyn Bennett said.

However, the collective is firmly focused on solutions.

They have identified land on the hills where there is room to begin building new homes so the low-lying homes can be retired.

They've purchased 30 ha of drained wetland, that they are in the final stages of restoring, which will turn paru (dirty) water into clean water.

Elaine Tapsell from Maketū Iwi Collective testing the environmental health of one of the estuaries.

They are restoring drains back into streams, by digging bends back into them, and planting natives throughout the gullies and wetlands of the Waihī and Maketū estuaries.

This environmental restoration is at the heart of the Maketū climate adaptation work.

Whaea Elaine Tapsell has been monitoring oxygen levels, sediment, pollution and surveying shellfish populations in the estuaries for decades now.

The extreme weather in January 2026 in Bay of Plenty area has led to further sediment dumps in the fragile estuaries that mana whenua rely on for kai and whakapapa.

Raewyn told us that the tuangi and pipi used to be plentiful but now they're drowning in sediment.

This puts kaimoana as a food source at risk, but also the knowledge that comes with it.

"The cultural learnings, they're about our identity, our kids' identity... that's where they learn their rangatiratanga (leadership), their taiaotanga (environmentalism), their kaitiakitanga (stewardship).

"If that's not there, what happens to that part of their culture?"

The community has the solutions, and they are partnering with numerous stakeholders to support the restoration of the estuaries as much as possible.

They are looking to local government to help fund this work. Both Elaine and Raewyn recall a time when the estuary was healthy and overbrimming with life and are fighting to get that back for their mokopuna.

"The goal is to leave it in a better condition than we found it," Elaine said.

"Well, we're supposed to but we're not going to be able to, are we Elaine... but we'll keep on trying to do it," Raewyn said.

Risks to forestry

What this risk is about

This risk is about how climate change will affect the country's managed and production forests, and the forestry sector's preparation for these impacts, including extreme weather, drought and wildfires, and new pests and disease. Forestry delivers a suite of benefits to the country: wood products, export earnings and removal of carbon dioxide from the atmosphere. The sector is growing rapidly in both value and area, with the area in managed and production forests expected to nearly double over the next 50 years.[30] It is also central to the country's action to reach net zero emissions. The forests in focus for this risk are the country's managed and production forests. These are mostly radiata pine, with some Douglas fir, cypress and eucalyptus; there are also some planted areas of indigenous species. Damage to these forests reduces not only their capacity to absorb carbon dioxide and the sector's economic contribution, but also exposes waterways and downstream communities to devastating sediment and debris flows.

How this risk is rated

Severity: there are moderate risks to forestry now. Without effective adaptation, these will increase to major by 2050 and extreme by 2090 under either a low or a high climate impact scenario.

Readiness: policy readiness is insufficient to manage these risks (the lowest level).

Connections: addressing this risk together with related risks to ecosystems and biodiversity will have mutual benefits.

2020 comparison: Forestry was considered as part of a wider risk to productivity and output of the land-based primary sector in the first national climate change risk assessment. It was not included as one of the most significant risks.

Why it is one of the most significant risks

This is one of the most significant risks because the risks to forestry from climate change are already great and there is a need to accelerate adaptation planning and action in forestry to increase resilience. An important part of this risk recognises the carbon stored in forests is relied upon to meet emissions budgets and the net zero emissions target.

Most forests planted now will not reach harvest age for more than 20 years – meaning they will grow under changing environmental conditions and intensifying extreme events. Progress adopting adaptation measures in the forestry sector has been slow to date with unclear roles and responsibilities. Acting now will help avoid locking in future outcomes that increase the risks to forestry.

In this risk assessment, forestry is the only risk from the sectors relying on the Natural environment domain identified as significant risk at this time because other primary sectors, so far, have been able to adjust to and recover from climate change impacts reasonably well (though the severity of risk is expected to climb quickly in other primary sectors – see *Risks to watch*: *agriculture and horticulture* later in this chapter).

How climate change is driving the risk

Some existing hazards to forests from climate change are increasing and becoming greater and more frequent, such as wind throw, wildfires, and the effects of heavy rainfall – particularly on soft rock hill country prone to landslides. Some hazards will emerge over time, such as newly introduced pests and diseases that could lead to widespread damage to both forest productivity and carbon stores. Most forests planted now will not reach harvest age for more than 20 years. Ongoing and progressive changes in that time will alter the underlying environmental conditions, affecting tree growth and forest ecosystems.

How it will be experienced

About the sector

The forestry sector is Aotearoa New Zealand's fourth largest primary export earner, with an estimated export value of NZ$6.1 billion in 2025. This is expected to rise to NZ$6.6 billion by 2028. Forest Owners Association statistics also show the sector employs almost 41,000 people – about 11% of the food and fibre workforce. In 2023, the total area in managed and production forests was approximately 1.8 million hectares – not quite 7% of the country's land area. This is projected to nearly double to 3.4 million hectares by 2070.[31]

Forestry is also one of the climate-sensitive sectors where iwi/Māori have significant involvement – see the related risk in the full independent assessment of Ngā mea hirahira o te ao Māori on our website. Māori forestry assets are valued at NZ$4.5 billion, and Māori comprise 44% of the forestry workforce.[30]

Likely impacts

Climate change effects on the forestry sector become more damaging as they increase in frequency and when they overlap. Recent extreme weather events – partially attributable to climate change – have damaged parts of the forest estate and cost the sector. These pressures could combine with increasing climate disruptions to transport systems.

The flow-on effects of damage in forests for the rivers and settlements downstream are also challenging the foundations of the sector as climate hazards increase. In high rainfall events, forests can produce debris flows including pruning and harvesting residue (slash) and fallen trees. These have been devastating consequences of recent extreme weather events in vulnerable areas (such as Te Tau Ihu/Nelson and Marlborough, Te Tairāwhiti/Gisborne region, and Te Taitokerau/Northland).

Recent growth in forest area is partly fuelled by the country's climate policy, which relies on removal of carbon dioxide from the atmosphere by growing trees to meet its emissions reduction target. This is key to the way successive governments have chosen to meet Aotearoa New Zealand's contribution to global action to slow climate change. Carbon stored in forests is not permanent, however, meaning these removals are threatened when the forests themselves are at risk. The consequences of widespread disease outbreaks, catastrophic wildfires, or damaging extreme weather events for forest carbon stores are serious enough to demand focused adaptation action.

Key relationships between this risk and others

This significant risk is closely connected with the risks of economic losses for Māori in primary industries and with the significant risk to ecosystems and biodiversity. In particular, there are strong links between risks to forestry and risks to terrestrial ecosystems and indigenous biodiversity from invasive species and pathogens. Addressing these risks together is likely to be mutually reinforcing.

What is underway, what else is needed

Coordinated adaptation in forestry is critical to protect both the country's primary carbon store and the sector's economic contribution. Adapting forestry practices in the face of more frequent and more intense weather events is also vital for reducing soil, vegetation and debris from forestry operations washing into waterways and floodwaters.

While people in the sector are aware of the physical effects of climate change on managed and production forests, only limited steps have been taken to build a response to climate threats. The incremental progress to date has not been enough to drive effective adaptation for a sector with 20-plus-year timeframes.

Most of the industry focus related to climate change has been on carbon removals rather than adaptation.

The effects of recent extreme weather events have increased awareness – notably Cyclone Gabrielle in 2023 and the subsequent Ministerial Inquiry on Land Use, which highlighted damage from flood-borne forestry debris. However, there is no coordinated government and industry approach to directly address climate risks to forestry.

The 2023 update to the National Environmental Standards for Commercial Forestry aimed to give councils greater control over commercial forestry by providing clear rules on harvesting practices and new requirements on slash removal from erosion-prone land. This is intended to manage the environmental effects of forestry but does not explicitly address climate change adaptation risks or needs for forests themselves.

The first national adaptation plan did include actions relevant to forestry, but there was no direction on land use or the role of forests in adaptation. Some of the actions set out there, such as improved access to climate data, information and tools, could support forestry adaptation if appropriately targeted.

The coordinated response needed to drive adaptation in forestry requires government and industry to work together. With focused, urgent effort, these significant risks can be reduced – safeguarding jobs, export earnings, people's homes and communities, and the streams and rivers they depend on, as well as the country's main carbon store.

For more information see the summary of this risk in the Full assessment report:

- Risks to managed and production forests due to progressive and ongoing changes in temperature and precipitation, extreme weather events, wildfires and enhanced spread of pests and diseases.

Decisions and funding

Risks to central and local government funding

What this risk is about

This risk is about the growing pressure that climate change places on both central and local government finances. This is in the context of many councils, especially smaller ones, already facing constrained budgets or having reached their debt limits. As climate impacts intensify, governments face higher costs for disaster response, infrastructure repair, welfare and health services, and long-term adaptation. Disasters like the 2023 North Island Severe Weather Events – which cost the Government NZ$6.65 billion[32] – make it difficult to plan and manage spending because their exact timing, location, and scale can't be predicted. Yet they will become more frequent and extreme as climate change intensifies. At the same time, climate-related impacts on the wider economy – including on primary industries – can reduce revenue from taxes and rates. Together, higher and more volatile expenditure and more uncertain revenue threaten governments' ability to maintain essential public services, invest in resilience, and plan for the long term.

How this risk is rated

Severity: there are moderate risks to central and local government funding now. Without effective adaptation, these will increase to major by 2050. They will remain major by 2090 under a low climate impact scenario and increase to extreme under a high climate impact scenario.

Readiness: there are significant gaps in readiness to manage these risks.

Connections: there is a strong two-way relationship between this significant risk and the risk to effective adaptation implementation. Actions to reduce one are likely to reduce the other.

2020 comparison: this risk was one of the most significant in the first national climate change risk assessment.

Why it is one of the most significant risks

This is one of the most significant risks because central and local government funding is coming under increasing pressure as climate change advances. This affects every part of the economy and society. The need for central and local government to respond to increasingly frequent and intense events has the potential to crowd out the funding of other core services such as health and education (services that will themselves be directly and indirectly impacted by climate change).

This risk is compounded by the imbalance in current spending between disaster response and planned adaptation – including to ongoing and progressive changes like sea-level rise. Recent research suggests that 97% of the Government's expenditure on natural hazards since 2010 has been on responding to and recovering from disasters, with only 3% on risk reduction and resilience (see *Risks to emergency management*).[25] The result may push very high costs onto future generations.

How climate change is driving this risk

More frequent and severe storms, floods, droughts, and wildfires are driving up spending on emergency response, infrastructure repairs, social support, and recovery. Ongoing and progressive changes such as rising seas, higher temperatures, and shifting rainfall patterns increase maintenance and replacement costs for assets owned by central and local government. Climate impacts on primary industries and other parts of the economy can reduce productivity and profitability, lowering tax revenue at the same time government spending needs rise. The compounding and cascading effects of climate change further intensify these fiscal pressures, underscoring the need for new approaches to funding adaptation.

Arriving at quantified estimates of the impact on central and local government funding is difficult as it will depend on how climate change intensifies the hazards that the country faces, the amount and type of actions that the country takes to adapt, and how much of the cost of those actions is borne by central and local government.

Disasters like the 2023 North Island Severe Weather Events – which cost the Government NZ$6.65 billion[32] – are hard to budget for because their exact timing, location, and scale cannot be predicted. Yet they will become more frequent and extreme as climate change intensifies. Some of this spending can be anticipated through long-term planning, but major disasters will always create spending pressures, and the cost of recovery will continue to escalate.

The uncertainty around who pays for climate change adaptation – whether central government, councils, communities, or the private sector – is itself a secondary climate-related driver of this risk. Repeated attempts by successive governments to resolve how these costs will be shared have not yet resulted in a way forward (see *Risks to decision-making and delivery*). Local communities that have developed possible funding mechanisms for local solutions have not been able to progress these without central government assistance or a legislative mandate. Many councils lack the funding or borrowing capacity to directly implement the changes they have identified. This delays resilience building and increases future costs.

How it will be experienced

This risk has at its core the overall ability of central and local government to fund and provide public services, and the country's ability to plan for the future. The increase in government expenditure – and drop in potential revenue – from climate change may strain the ability to manage public finances, and threaten the credit ratings of central and local government.

If there are delays in spending on early action in key areas, the impacts of climate change will be greater. Government will face increasing costs for disaster recovery, repairs to the infrastructure it owns (such as roading and power networks), and related health and social welfare needs. That growing burden could divert funding from other purposes, such as education.

At council level, there will be increasing costs to pay for adaptation in local areas, upgrades to council infrastructure like waste and water systems, local roads, and for emergency management. Local government is already dealing with rising operating costs and the need to replace aging or failing infrastructure – and debt and rate levels are pushing the limits.

Communities in regions with high exposure and small rating bases such as Te Taitokerau/Northland, Tairāwhiti/Gisborne, Buller and Tasman may face the greatest pressure, with rising costs for infrastructure upgrades and emergency management. Differences in the ability to pay could deepen inequities between districts.

The actual scale of risk to central and local government funding depends on the decisions being made (or not) around cost-sharing. The longer these issues are left unresolved, the greater the chances that government will be expected to pay for adaptation action, particularly as the insurer of last resort after extreme weather events.

The risks to government funding from climate change include the pressures that build in society when services reduce or when one group experiences greater loss than others. This can lead to a breakdown in relationships and trust in councils or the Crown. This also presents a challenge for the Government's obligations under Te Tiriti o Waitangi/The Treaty of Waitangi. See *Risks to decision-making and delivery*.

For this risk with its focus on funding, one area of importance for iwi/Māori is around the funding of emergency management, and the delivery of readiness and response services by hapū without formal funding arrangements (see *Risks for emergency management*).

Key relationships between this risk and others

Impacts on people and communities are difficult to predict as they depend on how quickly the climate changes, how much government contributes to responses, and how much adaptation action happens – and who funds it. In this way, how this risk plays out depends in large part on how other climate risks are managed. There is a spiral of effects that could turn either way.

If there is little action to address other climate-related risks (such as those to buildings, infrastructure, and the natural environment), then the financial risks for the Crown and for councils increase. So do other risks for how communities connect and organise themselves – as in the *Risks to decision-making and delivery*, and *Risks to social and community wellbeing.*

On the other hand, if central and local government take action on adaptation, the costs to government and the overall economy are expected to be lower. Many adaptation actions have high benefit to cost ratios – for instance, the flood management around Kaitāia, where a NZ$15.5 million investment in the Awanui River scheme saved an estimated NZ$50 million in avoided losses as well as people's lives.[7]

What is underway, what else is needed

Government at central and local level has begun to address funding risks around climate change, but more could be done to anticipate and plan for the full extent of impacts.

Climate change effects are now being considered as part of central government's long-term planning of revenue and expenditure. The Treasury has included some climate-related risks in its fiscal reports. However, this planning is not fully addressing the flow-on effects on tax revenue or for welfare costs.

Local government planning for adaptation is underway, but faces major difficulties in funding at the required scale. Local authorities must prepare and update Long Term Plans that include climate resilience actions and consider the costs councils will face, but these often include actions that have not yet been funded. Many local councils are close to or already exceeding their self-imposed debt limits, which limits their ability to borrow more to implement these plans.

Certainty about how adaptation costs will be shared and met between central and local government is critical to support more action to reduce risks from climate change.

The Government's National Adaptation Framework includes a pillar of cost sharing pre- and post-event, which sets out that "[t]he expected costs from natural hazards like floods and storms, and the costs of adapting to them, are shared across society and over time." While helpful for the Government to signal this, the National Adaptation Framework does not include detail of when or how decisions will be made around how costs will be shared.

If funding arrangements become more secure, better understood and able to support action to reduce other risks, this can also reduce related costs such as cost of response to extreme events, health impacts and economic disruption.

For more information see this summary of risk in the Full assessment report:

- Risks to central and local government funding from economic impacts associated with lost productivity, disaster relief expenditure and unfunded contingent liabilities due to progressive and ongoing changes in precipitation and temperature, sea-level rise and extreme weather events.

Risks to decision-making and delivery

What this risk is about

This risk is about how climate-related demands are placing Aotearoa New Zealand's ability to plan, decide and act together under increasing pressure. It covers four aspects of climate change decision-making and delivery:

- how the country makes decisions about adaptation that can work for everyone and last under strain
- how central and local government, iwi/Māori organisations and communities can deliver timely and effective adaptation action together
- how people can maintain trust and confidence in elected representatives at local, regional, and central government (especially through contested climate decision-making)
- how the Crown can maintain its responsibilities under Te Tiriti o Waitangi/The Treaty of Waitangi.

As climate change hazards intensify, the kinds of issues that require stable decision-making and effective delivery are becoming more complex. The country needs to be able to drive forward on adaptation, to reduce the escalating impacts and costs of climate change. Otherwise, decision-makers will be increasingly caught up in urgent responses that take time and resources away from planning for the future and reducing harm, and which could result in locking in future vulnerabilities.

How this risk is rated

This significant risk combines risks to adaptation implementation and decision-making, the ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi in adaptation, and the legitimacy of democratic institutions from contested climate decision-making.

Severity: three of the four combined risks are major now; risks to the legitimacy of democratic institutions are moderate. Without effective adaptation, all four will be major by 2050 and extreme by 2090 under either climate impact scenario.

Readiness: policy readiness is insufficient to manage all these risks (the lowest level).

Connections: decision-making, delivery, and funding are closely linked, meaning this significant risk and the risks to central and local government funding can be addressed effectively together. Reducing risks to social cohesion and wellbeing from displacement may also help to reduce risks to adaptation decision-making and delivery.

2020 comparison: the two governance risks named as significant in the first national risk assessment were framed differently and focused on maladaptation and institutional arrangements.

Why it is one of the most significant risks

This is one of the most significant risks because of the defined need for immediate action. It will take time to make adaptation decisions and deliver actions that match the speed and scale of climate change – especially to do this in ways that build public trust and confidence and uphold the Crown's responsibilities under Te Tiriti o Waitangi/ The Treaty of Waitangi.

How climate change is driving the risk

Our assessment shows climate impacts are already hitting the country harder and faster, demanding more complex and urgent decisions than systems are set up for. This is expected to accelerate in the next decade as extreme weather events increase in frequency and severity, and ongoing and progressive changes such as sea-level rise also increase in impact.

The extreme weather events in the North Island in 2023 showed what happens when the emergency response is challenged by multiple, widespread shocks. The ongoing strain the system is under shows in the delayed delivery of improvements in emergency management – delays caused in part because resources had to be diverted to other, urgent disaster responses (see *Risks to emergency management*).

Physical hazards like river and coastal flooding – and related effects such as reduced availability for new insurance in some exposed areas – are forcing communities to confront difficult choices. Those decisions, maybe even to leave homes and change ways of life, will not be straightforward for the people or organisations involved.

These are the kinds of issues confronting the community of Westport, which sits in a narrow zone between the Tasman Sea, big rivers and the active fault zone of the Southern Alps (see the story earlier in this chapter about fragile connections in Buller).

The decision-making and governance challenges of climate change are some of the hardest kind. They involve weighing up urgent and long-term needs – including the effects of decisions across generations, well beyond council and Parliamentary election cycles.

They create overlapping demands on scarce resources – to support effective action to reduce risks and build resilience at the same time as coping with loss and damage across the economy, environment and society (see *Risks to central and local government funding*).

How it will be experienced

Aotearoa New Zealand has many strong governance features, by international standards. For example, we have established institutions, free and fair elections, and an independent judiciary underpinning the rule of law. Yet our democratic institutions were not necessarily developed to deal with issues as large and complex as climate change.

The growing impact of climate change is a stress test on the country's systems. Under that pressure, any weaknesses in the way things are organised and decided are magnified. This means unclear roles and responsibilities, slow or patchy coordination, and weak action and funding can combine in cycles of confusion and delay that block effective planning and action.

If there are delays in effective adaptation, the energy and funding that could have gone into reducing harm before it happens will be used up by emergency responses and recovery. Delay also makes choices harder, more expensive, and more politically contested. This can lead to erosion in public confidence and trust.

The consequences of failures in overall management of the climate response will land hardest on the people who are already the most exposed or sensitive to climate change impacts.

This can be the people who live in areas that get hammered by the weather events that are becoming more frequent and more intense – especially the areas with smaller, rural councils with lower rates income. Or it can be population groups where the impacts are disproportionate, such as for iwi/Māori (see *Risks to social and community wellbeing*, and *Ngā mea hirahira o te ao Māori*).

Climate change is also increasing what is at stake. Decisions such as whether (and how) a whole town should move are not what the country's governance structures were set up for. The consequences of making that decision, or failing to make it, are also greater than they used to be.

Key relationships between this risk and others

Decision-making and delivery is central to every other risk in this assessment. Strengthening the systems and frameworks that guide how decisions are made can reduce other climate-related risks, and strengthen the country's ability to respond to challenges in other areas such as health and education, welfare and economic growth, the environment and defence.

Improvements in any one area of governance – whether it is decision making, public trust, Te Tiriti/Treaty obligations, or institutional capability – are likely to support improvements in the others. There is also a particularly strong relationship between this risk and the significant risk to central and local government funding. When stable decision-making supports better long-term financial decisions; and when funding is stable and sufficient, it strengthens the capacity of institutions to govern effectively.

Reducing pressures on social cohesion and wellbeing, including risks from displacement, can also help lower the risks in this area. Strong, stable communities with high levels of trust and connection are better able to participate in decision-making, support adaptation efforts, and uphold the legitimacy of democratic systems.

What is underway, what else is needed

While Aotearoa New Zealand has systems in place to guide decisions at different levels, and to help turn those decisions into action, many are not fit-for-purpose under the increasing demands of climate change.

The development of new ways of planning, deciding and acting together on adaptation has begun but is not happening at the pace required.

In October 2025, the Government released a high-level National Adaptation Framework outlining its approach to helping the country prepare for, and respond to, the impacts of climate change. The framework sets up four pillars for action: risk and response information- sharing, roles and responsibilities, investment in risk reduction, and cost-sharing pre- and post-event.[33]

However, it is not clear when or how decisions will be made on a critical issue: how costs – for adaptation planning, action, and climate-related loss – will be shared between government, councils and private property owners (see *Risks to central and local government funding*).

The framework does set out a clear intention to make local government responsible for local adaptation planning, supported by more consistent information and processes. Proposed law changes, alongside resource management reform, would require councils to prepare adaptation plans in priority areas. Those changes have not yet (in February 2026) been introduced to Parliament.

Overall, our assessment found further work is required urgently to strengthen decision-making and delivery for an effective adaptation response across the country.[x] This will require innovation, including to make climate change a central focus in policy and legislative reform.

This significant risk can be reduced with action to set out clear roles and responsibilities, stable long-term direction, effective Treaty-consistent governance, sufficient funding arrangements, and the delivery capability needed to respond at speed.

Addressing risks to decision-making and delivery would help resolve these issues:

- frequent changes in policy, including proposals that are not completed – which ties up resource and reduces people's ability to plan or invest with confidence
- remaining uncertainty about who is meant to do what part of the work, and on the shared goals and direction
- limited opportunity for iwi/Māori to participate and/or lead decision-making in ways that would give effect to Te Tiriti/The Treaty
- funding and financing gaps, including how national costs would be shared, and how councils and communities can invest in local adaptation at the scale needed
- workforce development, to address shortages in critical skills that will otherwise slow delivery of critical projects.

Delays leave the country facing spiralling costs – including for central and local government – without effective ways of planning and acting together. Decisive action is needed now. Importantly, action that can secure people's readiness to settle difficult decisions in ways that work for communities and the country.

For more information, see the summaries of risk for all four risks in the Governance domain in the Full assessment report:

- *Enduring adaptation governance:* risks to enduring and equitable adaptation decision-making from governance failures exacerbated by the increasing frequency and severity of climate hazards.
- *Effective adaptation implementation:* risks to timely and effective adaptation implementation from operational constraints exacerbated by the increasing frequency and severity of climate hazards.
- *Legitimacy of democratic institutions (from contested climate decision-making):* risks to the social legitimacy of democratic institutions from contested adaptation decision-making exacerbated by the increasing frequency and severity of climate hazards.
- *Ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi in adaptation governance and implementation:* risks to the Crown's ability to uphold Te Tiriti o Waitangi/The Treaty of Waitangi in adaptation governance and decision-making from unclear roles, mandate and resourcing, exacerbated by the increasing frequency and severity of climate hazards.

x This covered many areas of the current Government's reform programme, including emergency management, resource management and planning, and water infrastructure. The announcements of proposed local government reform came after the 31 October 2025 cut-off for analysis; this has increased uncertainty for ongoing governance while creating possibility of far-reaching improvement in the future.

Appendix 1

Supporting assessment information

This appendix presents additional assessment detail for each significant risk area.

Risks to water infrastructure

Links with other risks in the assessment

Our analysis of how risks cascade shows strong two-way relationships between this significant risk and several risks in other domains. Actions to reduce any of these are likely to reduce the others, potentially creating a virtuous cycle of positively reinforcing impacts. The other risks are:

- Risks to freshwater ecosystems
- Risks to road and rail networks
- Risks to buildings
- Risks to waste management infrastructure.

Actions to reduce this significant risk may also help reduce several other risks:

- Risks to physical health
- Risks to coastal ecosystems
- Risks to central and local government funding
- Risks to ports and airports.

We also found that reducing risks to electricity and telecommunications infrastructure, and risks to terrestrial ecosystems, may help reduce this water infrastructure risk.

How this risk met the threshold for significance

This risk was rated at major severity in the present day, with significant gaps in policy readiness. It has a cascading risk score that indicates actions to address this risk have high potential to address other risks.

The risk to water infrastructure was identified as one of the most significant because it satisfies these two principles of our review for significance.

- Principle 1: These risks present high potential for adverse consequences now, with little in place to address them, warranting immediate focus.
- Principle 3: These risks present high potential for adverse consequences by 2050, and acting now provides an opportunity to get ahead of future impacts and address several risks at once.

How similar risks were assessed in 2020

This risk was framed differently in the first national climate change risk assessment. The risk for potable (drinking) water was analysed separately from other water infrastructure types. It was rated extreme with an urgency score of 93 out of 100 and was included in the most significant risks. The risk to wastewater and stormwater systems was rated extreme with an urgency rating of 85 out of 100, but was not included in the most significant risks. The selection process for the significant risk list was different in 2020 – see our separate Summary of method report.

Risks to buildings

Links with other risks in the assessment

This significant risk closely relates or overlaps with risks to the insurability of assets, and also risk of damage to Māori infrastructure in Ngā mea hirahira o te ao Māori.

There is a strong two-way relationship between this significant risk and the significant risk to water infrastructure. Our analysis of how risks cascade shows actions to reduce one risk are likely to reduce the other, potentially creating a virtuous cycle of positively reinforcing impacts.

We found that actions to reduce this significant risk may help reduce these risks:

- Risks to social cohesion and wellbeing from displacement
- Risks to the insurability of assets
- Risks to the stability of the financial system
- Risks to central and local government funding
- Risks to physical health
- Risks to mental health
- Risks to social infrastructure and community services
- Risks to tourism.

We also found that actions to reduce several risks in the Natural environment domain may help reduce this significant risk through contribution to flood protection and temperature regulation in cities. These are:

- Risks to coastal ecosystems
- Risks to freshwater ecosystems
- Risks to terrestrial ecosystems.

How this risk met the threshold for significance

The risk to buildings is rated at major severity by 2050, and has a cascading risk score that indicates actions to address it have high or very high potential to address other risks.

This risk was identified as one of the most significant because it satisfies the third principle of our review for significance.

- Principle 3: These risks present high potential for adverse consequences by 2050, and acting now provides an opportunity to get ahead of future impacts and address several risks at once.

How similar risks were assessed in 2020

This risk was named as significant in the first national climate change risk assessment. It was rated extreme with an urgency score of 90 out of 100. The selection process for the significant risk list was different – see our separate Summary of method report.

Risks to road and rail networks

Links with other risks in the assessment

Our analysis of how risks cascade shows strong two-way relationships between this significant risk and two other risks. Actions to reduce any of these risks are likely to reduce the others, potentially creating a virtuous cycle of positively reinforcing impacts. The other risks are:

- Risks to ports and airports
- Risks to water infrastructure.

We also found that actions to reduce this significant risk may also help reduce these risks:

- Risks to electricity and communications infrastructure
- Risks to the ability of the emergency management system to respond
- Risks to businesses and public organisations from supply and distribution disruptions
- Risks to central and local government funding
- Risks to physical health
- Risks to tourism.

How this risk met the threshold for significance

The risk to road and rail networks is rated at major severity by 2050, and has a cascading risk score that indicates actions to address it have high or very high potential to address other risks.

This risk was identified as one of the most significant because it satisfies the third principle of our review for significance.

- **Principle 3:** These risks present high potential for adverse consequences by 2050, and acting now provides an opportunity to get ahead of future impacts and address several risks at once.

How similar risks were assessed in 2020

This risk was framed similarly in the first national climate change risk assessment. It was rated as extreme, with an urgency score of 60 out of 100, but was not included in the most significant risks. The selection process for the significant risk list was different – see our separate Summary of method report.

Risks to social and community wellbeing

Links with other risks in the assessment

This significant risk closely relates to or overlaps with these assessed risks:

- Risks to physical health
- Risks to social and community infrastructure
- Risks of disruption to tikanga and hapū/iwi identity
- Risks of loss of Indigenous knowledge systems.

There is a strong connection between the two risks combined in this significant risk. Our analysis of how risks cascade shows actions to reduce one are likely to help reduce the other, potentially creating a virtuous cycle of positively reinforcing impacts. We also found that reducing this significant risk is likely to help reduce the risk to the legitimacy of democratic institutions from contested climate decision-making.

Action to address other risks could in turn help reduce this significant risk. As well as risks to physical health, and risks to social infrastructure and community services (shown above as closely connected), the other risks where action can help reduce risks to community and social wellbeing are:

- Risks to buildings
- Risks to the insurability of assets
- Risks to pastoral agriculture
- Risks to coastal ecosystems
- Risks to freshwater infrastructure.

How this combined risk met the threshold for significance

The risk to mental health was rated at major severity in the present day, and the risk to social cohesion and wellbeing (from displacement) was rated major by 2050. The readiness for both risks was assessed as insufficient (the lowest score).

We have combined these risks as one of the most significant for urgent action because they are similar in scope, they can be addressed by similar actions, and combining them would support explanation and action.

The combined risk to social and community wellbeing was identified as one of the most significant because it together satisfies the first two principles of our review for significance.

- Principle 1: These risks present high potential for adverse consequences now, with little in place to address them, warranting immediate focus.
- Principle 2: These risks will present high potential for adverse consequences by 2050, and because of the very low base of current readiness, significant lead time is required to prepare for them.

How similar risks were assessed in 2020

These two risks were framed similarly in the first national climate change risk assessment, but the selection process for significant risks was different – see our separate Summary of method report.

The risk to social cohesion from displacement was rated extreme with an urgency score of 88 out of 100, and named as significant. The risk related to mental health was rated as having major consequence with an urgency score of 80 out of 100; it was not included in the most significant risks.

Risks to emergency management

Links with other risks in the assessment

Our analysis of how risks cascade shows that reducing this significant risk may help to reduce risks to physical health.

We also found that there is potential to reduce this significant risk by reducing risks to electricity and telecommunications infrastructure, and risks to road and rail networks.

How this risk met the threshold for significance

The risk to emergency management is rated at major severity in the present day, with significant gaps in policy readiness.

This risk was identified as one of the most significant because it satisfies the first principle of our review for significance.

- Principle 1: These risks present high potential for adverse consequences now, with little in place to address them, warranting immediate focus.

How similar risks were assessed in 2020

This risk was framed similarly, although it was in a different domain (Governance) in the first national climate change risk assessment. It was rated as having major consequence with an urgency score of 70 out of 100 but was not included in the most significant risks. The selection process for the significant risk list was different – see our separate Summary of method report.

Ngā mea hirahira o te ao Māori – risks in the Māori world

Links with other risks in the assessment

Outlined in report body – see Table.3.3.

How this combined risk met the threshold for significance

All seven of the assessed risks to Ngā mea hirahira o te ao Māori were rated at major severity in 2050. Four were assessed as insufficient (the lowest score) for readiness, while three others were found to have significant gaps.

We have combined these risks as one of the most significant areas for urgent action because they are similar in scope, they can be addressed by similar actions, and combining them would support action.

The combined risk was identified as one of the most significant because it together satisfies the second principle of our review for significance.

- Principle 2: These risks will present high potential for adverse consequences by 2050, and because of the very low base of current readiness, significant lead time is required to prepare for them.

How similar risks were assessed in 2020

There was no domain for specific risks in te ao Māori in the first national climate change risk assessment. Two specific risks to Māori social, cultural, spiritual and economic wellbeing were included in the Human domain, one from the loss and degradation of lands and waters as well as cultural assets and one from loss of species and biodiversity. Both were rated extreme with an urgency score of 80 out of 100 but were not included in the most significant risks. There was also a risk to Māori and European cultural heritage in the same domain rated as major with an urgency score of 75 out of 100, also not included.

Risks to ecosystems and biodiversity

Links with other risks in the assessment

This significant risk closely relates or overlaps with risks in Ngā mea hirahira o te ao Māori, particularly the risks of loss of access to taonga species, risks of disruption to tikanga and hapū identity, and risks of loss of indigenous knowledge systems.

There are many connections to other risks, reflecting that the natural environment is foundational to life and for jobs, businesses, and the health of communities. Our analysis of how risks 'cascade' (flow on to affect other areas) found these likely effects for reducing risk:

- Actions to reduce risks to one ecosystem type are likely to reduce risks to others because of the interconnected nature of the natural environment.
- There are also strong two-way relationships between this combined ecosystems and biodiversity risk and risks in other domains, particularly for Sectors relying on the natural environment and the Built environment domains. Actions taken to reduce this significant risk are likely to help reduce these other risks, and vice versa, potentially creating a virtuous cycle where positive effects build on each other across:
  - Risks to fisheries
  - Risks to forestry
  - Risks to tourism
  - Risks to pastoral agriculture
  - Risks to water infrastructure.
- Our examination of how risks cascade also suggests that actions to reduce the risks to ecosystems and indigenous biodiversity are likely to help reduce several other risks (but without necessarily creating a two-way relationship). These are:
  - Risks to horticulture
  - Risks to electricity and communications infrastructure
  - Risks to buildings
  - Risks to mental health.

- Looking at the flow of effects in the other direction, our analysis also suggests that reducing risks to waste management infrastructure could help to reduce the combined risks to ecosystems and biodiversity.

How this combined risk met the threshold for significance

The coastal, freshwater, and terrestrial ecosystems risks and the indigenous biodiversity risk all are rated at major severity by 2050 and have cascading risk scores that indicate actions to address them have high or very high potential to address other risks.

Risks to the natural environment should be considered together given the interconnectedness of all ecosystems and the potential for breaching thresholds. We have combined these risks, along with the marine ecosystems risk, as one of the most significant for urgent action because they are similar in scope, they can be addressed by similar actions, and combining them would support explanation and action.

The combined risk to ecosystems and biodiversity has been identified as one of the most significant because it together satisfies the third principle of our review for significance.

- Principle 3: These risks present high potential for adverse consequences by 2050, and acting now provides an opportunity to get ahead of future impacts and address several risks at once.

How similar risks were assessed in 2020

The two natural environment risks named as significant in the first national climate change risk assessment focused on coastal ecosystems, rated major with an urgency rating of 78 out of 100, and indigenous ecosystems and species, rated major with an urgency rating of 73 out of 100. The risks in that domain were framed differently, and the selection process for the significant risk list was different – see our separate Summary of method report.

Risks to forestry

Links with other risks in the assessment

This significant risk closely relates to or overlaps with the risks of economic losses for Māori in primary industries in Ngā mea hirahira o te ao Māori and with several of the risks in the Natural environment including the risks to freshwater ecosystems.

Our analysis of how risks cascade shows strong two-way relationships between this significant risk and two others. Action to reduce any of these risks are likely to reduce the others, potentially creating a virtuous cycle of positively reinforcing impacts. The other risks are:

- Risks to indigenous biodiversity from invasive species and pathogens
- Risks to terrestrial ecosystems.

How this risk met the threshold for significance

The risks to forestry were rated at major severity by 2050, and the readiness rating was insufficient (the lowest score).

This risk was identified as one of the most significant because it satisfies the second principle of our review for significance.

- Principle 2: These risks will present high potential for adverse consequences by 2050, and because of the very low base of current readiness, significant lead time is required to prepare for them.

How similar risks were assessed in 2020

Forestry was considered as part of a risk in the Economy domain focused on the productivity and output of the land-based primary sector. That risk was rated as major with an urgency score of 81 out of 100, but was not included in the most significant risks. The selection process for the significant risk list was different – see our separate Summary of method report.

Risks to central and local government funding

Links with other risks in the assessment

This significant risk closely relates to or overlaps with the assessed risks to the stability of the financial system and to the insurability of assets.

There is a strong two-way relationship between this significant risk and the risk to effective adaptation implementation. Our analysis of how risks cascade shows actions to reduce one are likely to reduce the other, potentially creating a virtuous cycle of positively reinforcing impacts.

We also found that reducing the following risks may help reduce the risks to central and local government funding:

- Risks to buildings
- Risks to road and rail networks
- Risks to waste management infrastructure
- Risks to water infrastructure.

How this risk met the threshold for significance

Our approach to identifying the most significant risks included a scan for risks that might not score as highly as others, but that need immediate focus for other reasons – see Box 1.3.

The risks to central and local government funding are expected to combine with and intensify other risks from climate change, with potential consequences across generations to come. Without adequate central and government funding for adaptation planning and action, the demand to fund intensifying climate impacts may make it difficult to fund other basic services such as health and education over the long term. For this reason, it was identified as one of the most significant.

How similar risks were assessed in 2020

This risk was named as significant in the first national climate change risk assessment. It was rated extreme with an urgency score of 90 out of 100. The selection process for the significant risk list was different – see our separate Summary of method report.

Risks to decision-making and delivery

Links with other risks in the assessment

This significant risk closely relates or overlaps with risks in Ngā mea hirahira o te ao Māori, particularly the risks of legal exclusion and governance failures for Māori.

The four risks in the Governance domain are strongly connected. Our analysis of how risks cascade suggests action to reduce any one of them is likely to help reduce the others.

There is also a strong two-way relationship between this combined governance risk and the significant risk to central and local government funding. Action taken to reduce either of these significant risks is likely to help reduce the other, potentially creating a virtuous cycle where positive effects build on each other.

We also found that reducing risks to social cohesion and wellbeing from displacement may help to reduce this combined governance risk.

How this combined risk met the threshold for significance

Three of the four governance risks in our assessment were rated at major severity in the present day, and the other was at major by 2050. All four governance risks were assessed as insufficient (the lowest score) for readiness.

We have combined these risks as one of the most significant for urgent action because they are similar in scope, they can be addressed by similar actions, and combining them would support action.

The combined risk to decision-making and delivery was identified as one of the most significant because it together satisfies the first two principles of our review for significance.

- Principle 1: These risks present high potential for adverse consequences now, with little in place to address them, warranting immediate focus.
- Principle 2: These risks will present high potential for adverse consequences by 2050, and because of the very low base of current readiness, significant lead time is required to prepare for them.

How similar risks were assessed in 2020

The two governance risks named as significant in the first national climate change risk assessment were focused on maladaptation, and the possibility that institutional arrangements not being fit for purpose would exacerbate climate change impacts. Both were rated extreme with urgency scores of 83 and 80 out of 100 respectively. The risks in that domain were framed differently, and the selection process for the significant risk list was different – see the separate Summary of method report.

Technical glossary

Note there is a reo Māori glossary provided at the end of the section focused on *Ngā mea hirahira o te ao Māori – risks in the Māori world*, which provides English contextual translation of kupu Māori used in that section.

adaptation	The process of adjusting to the actual or expected changes brought about by climate change. For people, and the systems people create, this means making changes to try to avoid or minimise the harm or damage from climate change and its effects – or to benefit from opportunities climate change might provide. These could be changes, for example, to laws, policies, practices or processes, as well as to physical structures and the built environment. In nature, and within natural systems, adaptation can happen by itself through ecological and evolutionary processes, or with human assistance, by helping those systems adjust to climate change and its effects.
adaptive capacity	The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences from climate impacts.
biodiversity	The variability among living organisms from all sources including, among other things, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.
bioeconomy	An economy based on use of biological resources and processes to produce products and services, such as food, fibre and recreation.
carbon dioxide	A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, and of land-use changes and industrial processes. It is the principal greenhouse gas that affects the Earth's atmosphere. See 'greenhouse gases'.
cascading impacts	Occur when a climate-related risk or hazard generates a sequence of secondary events in natural and human systems that results in physical, natural, social or economic disruption – the resulting impact is often significantly larger than the initial impact.

Climate Change Response Act 2002	The Act that establishes the Climate Change Commission and contains the framework for the 2050 emissions reduction target and emissions budgets. It also provides a legal framework to enable Aotearoa New Zealand to meet its international obligations under the United Nations Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement; and provides for the implementation of the New Zealand Emissions Trading Scheme (NZ ETS) and the synthetic greenhouse gas levy.
climate resilience	The ability to prepare for and respond to, and capacity to cope with, the impacts of changing climate without losing essential functioning and identity, including those progressive and ongoing changes that can be anticipated and those that occur as extreme events.
coastal erosion	The loss of land due to coastal processes such as waves and tidal currents wearing land away over time. Occurs when a net loss of sediment or bedrock from the shoreline results in landward movement of the high-tide mark.
coastal inundation	Flooding of coastal land due to extreme sea levels driven by tides, storm surge, wave processes, or sea-level rise.
compounding impacts	These arise from the interaction of hazards, which may be characterised by single extreme events or multiple coincidental or sequential events that interact with exposed systems or sectors.
displacement	The involuntary movement, individually or collectively, of persons or other species from their home or community.
domain	The second national climate change risk assessment is framed around seven 'value domains' – groupings of tangible and intangible values, assets and taonga that are important to Aotearoa New Zealand. The seven domains are: Natural environment; Sectors relying on the natural environment; People, health and communities; Built environment; Economy and finance; Ngā mea hirahira o te ao Māori (things of importance in the Māori world); and Governance.
drought	Drought is an exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind). See 'dry spell'.
dry spell	Dry spells are periods of abnormally reduced water availability, but shorter and not as severe as a drought.
ecosystem	A functional unit consisting of living organisms, their non-living environment and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases, they are relatively sharp, while in others they are diffuse. In the current era, most ecosystems either contain people as key organisms or are influenced by the effects of human activities in their environment.

effective adaptation	Effective adaptation reduces climate risk, anticipates and accounts for complexities, anticipates and accounts for the uncertain nature of climate change risks and impacts, and aims to avoid maladaptation.
emissions	Greenhouse gases released into the atmosphere. The Climate Change Response Act 2002 covers the following greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.
equity	The principle of being fair and impartial, and a basis for understanding how the impacts and responses to climate change, including costs and benefits, are distributed in and by society in more or less equal ways.
exposure	How much of value is present in the face of a particular hazard – the people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.
extreme weather event	An event that is rare at a particular place and time of year. Definitions of 'rare' vary, but an extreme weather event would normally be as rare as, or rarer than, the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense.
forest ecosystem	A vegetation type dominated by trees consisting of living organisms, their non-living environment and the interactions within and between them. Many definitions of the term 'forest' are in use throughout the world, reflecting wide environmental, social, and economic differences.
global warming levels (GWLs)	Global warming levels (GWLs) offer a relatively new way to look at and communicate future climate change. In this approach, the regional climate change response is shown relative to the average global warming (e.g. 0.5°C, 1.0°C, 1.5°C, 2.0°C) above a specified baseline period, typically pre-industrial (1850–1900).
greenhouse gases (GHGs)	Atmospheric gases that trap heat and contribute to climate change. The gases covered by the Climate Change Response Act 2002 are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
hazard	In this assessment, we refer to hazards as physical events or trends caused by climate change. Climate hazards can be progressive and ongoing changes (such as sea-level rise, warming temperatures, and changing seasonal weather patterns) or extreme events (such as cyclones, droughts and wildfires). While climate change does not necessarily cause extreme events, it makes them more frequent and severe.

heatwave	Heatwaves are periods of abnormally hot weather, often defined with reference to a relative temperature threshold, lasting from two days to months.
high climate impact scenario	In this assessment, we assessed risks using two climate impact scenarios (based on different levels of global warming, as compared to pre-industrial levels). The high climate impact scenario was based on global warming of 3.0–3.5°C by 2090.
impact	The consequences of realised risks on natural and human systems, which result from the interactions of climate-related hazards (including extreme weather events), exposure and vulnerability. Impacts in this assessment are generally effects on human lives, livelihoods, health and wellbeing; ecosystems and species; economic, social and cultural assets; services (including ecosystem services); and infrastructure. They can be harmful or beneficial. Also known as consequences or outcomes.
indigenous species	Indigenous species of plants and animals, also known as native species, are species: 1. that were present 85 million years ago and are still present, or 2. that descend from those present 85 million years ago, or 3. that have arrived since but without human assistance and have survived.
indirect risk	An indirect climate risk can emerge as a secondary consequence of a climate hazard, for example when extreme weather damages power lines, causing a power cut.
Intergovernmental Panel on Climate Change (IPCC)	Intergovernmental panel under the United Nations, which prepares comprehensive Assessment Reports about the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place.
inundation	The condition of being flooded – for example, coastal inundation refers to flooding from the sea.
landslides	The movement of rock, soil and vegetation down a slope. Landslides occur when the strength of a slope is overwhelmed by stresses imposed on that slope which can be sudden (earthquake or heavy rain) or gradual.
lead time	This reflects the period between the recognition of an issue, and effective management of that issue. This can be because of delays in response, and also because the response decided on takes time to set up – for instance to train a workforce to new requirements.

lock in	A situation in which the future development of a system, including infrastructure, technologies, investments, institutions and behavioural norms, is determined or constrained ('locked in') by historical developments.
loss	Damage to, and/or destruction of, homes, natural and constructed assets, property and livelihoods by climate-related hazards.
low climate impact scenario	In this assessment, we assessed risks using two climate impact scenarios (based on different levels of global warming, as compared to pre-industrial levels). The low climate impact scenario was based on global warming of 2.0°C by 2090.
maladaptation	When negative outcomes result from adaptation actions. This could include, for example, actions that may lead to increased risk of adverse climate-related outcomes, including increased greenhouse gas emissions, increased vulnerability to climate change impacts and/or reduced welfare, now or in the future. Maladaptation is usually an unintended consequence.
managed retreat	An approach to reduce or eliminate exposure to intolerable risk, by enabling the relocation of assets, activities and sites of cultural significance away from areas at risk from climate change and natural hazards.
marine heatwave	A period during which water temperature is abnormally warm for the time of the year relative to historical temperatures, with that extreme warmth persisting for days to months. The phenomenon can manifest in any place in the ocean and at scales of up to thousands of kilometres.
model, modelled	Representation of an idea, object, process, or system to describe or explain phenomena that cannot be experienced directly, to discover features of and ascertain facts about a system and its behaviour.
North Island Severe Weather Events	A collective term for the Cyclone Hale (January 2023), Auckland Anniversary heavy rainfall (January 2023) and Cyclone Gabrielle (February 2023) extreme weather events. The term was specifically used for the 2023 Government Inquiry into the Response to the North Island Severe Weather Events.
nutrient cycling	Processes through which essential nutrients, such as nitrogen, phosphorus, and other elements, are captured and made available for use by organisms, including corals. This cycling is crucial for maintaining cultural health and promoting primary productivity in marine ecosystems.
ocean acidification	Ocean acidification is the process through which, as concentrations of carbon dioxide in the atmosphere increase, more is absorbed into oceans, making them more acidic. See also 'ocean warming'.

ocean warming	Ocean warming demonstrates the uptake of heat by the global ocean, which increases as global surface temperature increases.
policy readiness	Consideration of how prepared Aotearoa New Zealand is to address each risk, based on an analysis of current and planned policies, plans and actions. Each risk has been given an overall policy readiness rating from 'no significant gaps' to 'insufficient.'
projections, projected	Estimated value of a future quantity (such as emissions levels) based on a prescribed set of assumptions.
residual risk	The level of risk related to climate change impacts that remains after adaptation, and after efforts have been made to mitigate risk.
resilience	The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation.
risk (climate-related risk)	The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Adverse consequences may affect human lives, livelihoods, health and wellbeing; economic, social and cultural assets and investments; infrastructure; services (including ecosystem services); and ecosystems and species. See 'hazard', 'exposure', and 'vulnerability'.
risk assessment	The scientific estimation of risks, which may be either quantitative or qualitative.
river and surface flooding	The overflowing of the normal confines of a water body or the accumulation of water over areas that are not normally submerged. Floods can be caused by unusually heavy rain, for example, during storms and cyclones.
scenarios	A plausible set of assumptions about economic and social development, and technological and behavioural changes.
sea-level rise (SLR)	Increases in the height of sea levels over time, which may occur globally or locally.
sedimentation	The deposition of rock fragments, soil, organic matter, or dissolved material that has been eroded – that is, has been transported by water, wind, ice or gravity.
sensitivity	The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change.

severity	Severity considers the nature and scale of potential consequences Aotearoa New Zealand faces from each risk. This gives an indication of how serious the impacts of climate risks may be for each affected sector or system, and for the country as a whole.
slash	Tree waste left behind after commercial forestry activities.
social cohesion	Describes the sense of belonging, connection and solidarity among groups in society. The social cohesion risk analysis considers both the impacts on those who move away and the impacts on the community left behind.
storms, and extreme rain and wind	Storms are weather systems with winds that average over 88 km/hour. Winds this strong are often accompanied by rain, thunder, and lightning. With global warming, storms are becoming more intense and frequent. Extreme rain and wind refers to rain and wind events that are at the highest end of the typical range. They are often described as the 3–4 wettest or windiest days of the year.
Te Tiriti o Waitangi/The Treaty of Waitangi (Te Tiriti/The Treaty)	Aotearoa New Zealand's founding document, signed between Māori and representatives of the British Crown in a series of signing events beginning 6 February 1840. See Schedule 1 of the Treaty of Waitangi Act 1975.
thresholds	There are points when change can reach a level where a species, for instance, or a community or part of a human system, cannot absorb further change, and is no longer resilient. Where that threshold lies is not always clear, and can often only be confirmed in hindsight. Climate change increases the likelihood of breaching such thresholds. See also 'tipping points'.
tipping point	A critical threshold beyond which a system reorganises, often abruptly and/or irreversibly.
vulnerability	The conditions that determine how climate change impacts may affect an area, system or community – it includes sensitivity to harm, and the ability to cope and adapt (adaptive capacity). See 'adaptive capacity'.
wildfire	Wildfires are a type of fire which burns strongly and out of control on an area of grass, bush or forest. As the climate changes, wildfires are becoming more frequent.

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