

## Climate change assessment for the Manawatu-Wanganui Region

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### **Background**

Horizons Regional Council commissioned NIWA to provide a report to understand how climate change could impact the Manawatu-Wanganui Region and Horizons Regional Council's business to inform a regional climate change strategy and prioritisation of work programmes by the Council and the community into the future.

This report (currently in draft) collates what is currently known about the region in terms of climate change projections and physical impacts (following a climate change projections report produced for the Council by NIWA in 2016<sup>1</sup>), and further assess impacts of climate change on the Council's business and responsibilities. The new knowledge created by this report will support decision-making and local adaptation discussion, and also reveal further information gaps.

Numerical information derived from model projections is provided where available, and qualitative information and expert opinion summarises potential issues.

The report has several parts:

- A summary of key trends, issues and obligations related to climate change globally and nationally that may impact the Council in the future.
- Background information on the key stakeholders (resource users, sectors) and assets in the region to illustrate key resources potentially at risk from climate change impacts.
- A summary of climate change projections for Horizons Region (based on the climate change projections report written for Horizons Regional Council in 2016 and updated with more recent guidance on extreme rainfall, sea-level rise and river flows).
- Qualitative assessment of climate change impacts on the Council's business and responsibilities, in light of knowledge of current regional characteristics.

In combination, these strands provide insights into the impacts of a changing climate on Council business and responsibilities.

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<sup>1</sup> <https://www.horizons.govt.nz/CMSPages/GetFile.aspx?guid=5414ca9a-1b04-481c-bb21-3a185c9c4b8a&disposition=attachment>

## Summary Tables

**Table 1: Climate change projections and impacts for the Manawatu-Wanganui region.** Based on Pearce et al. (2016), Ministry for the Environment 2017, Ministry for the Environment 2018a, and Ministry for the Environment 2018b.

Climate variable/ physical process	Direction and magnitude of change
Mean temperature	Progressive increase with greenhouse gas concentration. By 2040, up to 1.1°C warming since preindustrial for high emission scenario, up to 3.1°C warming by 2090.
Water temperature	Increase – amount depends on river elevation, catchment size, water source.
Hot days	Increase in hot days (days with maximum temperature >25°C) – doubling to tripling by 2090 depending on emission scenario.
Frosts	Decrease in frosts/cold nights (nights with minimum temperature <0°C) – almost no frosts by 2090 under high emission scenario (for areas <500m elevation)
Rainfall	Mixed direction of change for most seasons, emission scenarios and time periods but consistent increases for winter (around 10-15% increase in rainfall for winter by 2090).
Extreme rainfall intensity <sup>2</sup>	Increasing. Larger increases for shorter duration, rare events compared to longer duration, common events.
Potential evapo-transpiration deficit (drought potential)	Increasing everywhere, larger increases with time and emission scenario. Generally, the region becomes more drought prone, particularly the eastern half.
Hill country erosion	Increase with larger extreme rainfall events, more rainfall in winter.
Sediment loads	Increased extreme rainfall expected to increase fluvial sediment loads
Solar radiation	Small increases in summer, decreases in winter.
Sea-level rise <sup>3</sup>	Increasing. 0.5m SLR projected for NZ between 2060 (high emission scenario) and 2110 (low emission scenario). 1.0m SLR projected between 2100 and after 2200 for same scenarios. Subsidence is occurring in the south and west of the North Island (incl. Horizons Region coastline) so relative SLR may be higher than projected national amount.
Coastal hazards <sup>3</sup>	Increasing. More frequent and severe coastal inundation events with increasing sea levels and more intense storms. Most assets at risk from a 1-in-100-year storm tide event + sea level rise in Horowhenua and Whanganui Districts.
Manawatu river flows <sup>4</sup>	Decreases to mean annual low flow, increases to mean annual flood. Larger extreme floods more likely because of increased extreme rainfall.

<sup>2</sup> The extreme rainfall projections presented in Pearce et al. (2016) have since been updated by NIWA. This report includes only the updated information presented in Ministry for the Environment 2018a. Climate change projections for New Zealand: atmospheric projections based on simulations undertaken for the IPCC 5th Assessment, 2nd edition.

<sup>3</sup> The sea-level rise information presented in Pearce et al. (2016) has since been updated and is covered in Appendix 4. This report includes only the updated information presented in Ministry for the Environment 2017. Coastal hazards and climate change: Guidance for local government. Lead authors: Bell, R.; Lawrence, J.; Allan, S.; Blackett, P.; Stephens, S. Ministry for the Environment Publication ME-1292. Accessed at: <http://www.mfe.govt.nz/publications/climate-change/preparing-coastal-change-summary-of-coastal-hazards-and-climate-change>.

<sup>4</sup> The river flow information presented in Pearce et al. (2016) has since been updated by NIWA. This report includes only the updated information presented in MINISTRY FOR THE ENVIRONMENT 2018b. Hydrological projections for New Zealand rivers under climate change, NIWA client report 2018193CH prepared for the Ministry for the Environment, 107pp.

**Table 2: Potential impacts of climate change on key sectors in the Manawatu-Wanganui region.**

Sector	Impact	Comment – over time, anticipate:
Agriculture, fisheries and forestry • Sheep farming • Sheep and cattle farming • Beef cattle farming • Dairy cattle farming	<ul style="list-style-type: none"> <li>• Increased temperatures and increased drought risk will cause economic losses in direct and off-farm output</li> <li>• Increased risk of river erosion and flooding driven by increased rainfall and extreme events</li> <li>• Changes in temperature and humidity will alter the production zones and timing – some will benefit, and some will become more vulnerable</li> <li>• The risk of biosecurity hazards increases</li> <li>• Increased agricultural reliance on water driven by increased risk of drought and more competition over scarcely available water</li> <li>• Improved pasture farming due to increased number of growing degrees days for feed, but increased number of hot days and increased risk of droughts will lead to need for advanced planning (access to water)</li> <li>• If farming occurring in uplands, beneficial although need for improved planning of feedstock to cope with increased seasonal variability</li> <li>• If farming occurring in lowlands, beneficial although higher risk of drought will mean the need for improved planning</li> <li>• If farming occurring in coastal regions, harmful due to increased coastal inundation</li> </ul>	<ul style="list-style-type: none"> <li>• increase costs (planning, water quantity and quality, land loss, weed management) for farming and reduced profits</li> <li>• This may impact employment, equity and tax base</li> <li>• Some production will benefit</li> <li>• Increased physical and safety threats for farm infrastructure, livestock and staff (flood, inundation, drought)</li> </ul>
• Forestry (exotic and native)	<ul style="list-style-type: none"> <li>• Warmer temperatures and higher snowline have implications for weed &amp; pest management</li> <li>• Pine forestry may benefit due to increased <i>Pinus radiata</i> growth in cooler regions</li> <li>• Increased risk of fire – post fire regeneration of forests requires water, reducing water yields</li> <li>• Long production cycles expose forestry industry to climate change impacts over longer periods</li> <li>• Increased risk of pest and disease because of rising temperatures, and habitat loss via erosion and unstable land are key risks to the industry</li> </ul>	<ul style="list-style-type: none"> <li>• Improved opportunities for pine farming, but an increased risk of fire (increased temperatures, drought)</li> </ul>
• Horticulture and other crops	<ul style="list-style-type: none"> <li>• Potential to increase wheat yields</li> <li>• Increased temperatures extending the growing season for many vegetable crops</li> <li>• Increased risk of pest and disease with increased temperature, humidity and pest generation times, exacerbated by prolonged growing seasons</li> <li>• Seasonal changes will impact planting and harvest times, and there is a risk that waterlogged soils will delay planting</li> </ul>	<ul style="list-style-type: none"> <li>• Potentially higher crop production</li> <li>• Higher risk from pests and disease</li> </ul>

Sector	Impact	Comment – over time, anticipate:
Public Administration and Safety	<ul style="list-style-type: none"> <li>• Need for increased fire management, particularly clarifying objectives for different responses, for example, preserving biodiversity versus protecting buildings will increase management costs</li> <li>• Increased resourcing pressure on emergency services – including the flow on effect of damage to infrastructure considering the amount of regional population in rural areas</li> </ul>	<ul style="list-style-type: none"> <li>• Increased costs</li> <li>• Increased monitoring for fires</li> </ul>
Retail Trade	<ul style="list-style-type: none"> <li>• Threats to infrastructure (from inundation and flooding) imply increased risk of being cut off from transport and associated impacts on the sector</li> <li>• Tourism related retail will be harmed over time for alpine areas (reduced snowfall impacts the ski industry. Reduced snow may result in a gradual tourism shift over time to the South Island)</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced ski related retail profits</li> <li>• Potential impact on employment</li> </ul>
Education and Training	<ul style="list-style-type: none"> <li>• Threats to infrastructure (from inundation and flooding) imply increased risk of being cut off from transport and associated impacts on the sector</li> </ul>	<ul style="list-style-type: none"> <li>• Increased operating costs</li> </ul>
Manufacturing	<ul style="list-style-type: none"> <li>• Threats to infrastructure (from inundation and flooding) imply increased risk of being cut off from transport and associated impacts on the sector</li> </ul>	<ul style="list-style-type: none"> <li>• Increased operating costs</li> <li>• Potential impact on employment</li> </ul>
Health Care and Social Assistance	<ul style="list-style-type: none"> <li>• Increased threat of respiratory illness, such as asthma</li> <li>• Heat related deaths at risk of increase, but reduced deaths to cold conditions</li> <li>• Indirect impacts include increased incidence of existing and new diseases – more frequent pandemics, increased stress and mental health issues</li> <li>• Threats to infrastructure (from inundation and flooding) mean implication of being cut off from transport and associated impacts on the sector</li> </ul>	<ul style="list-style-type: none"> <li>• Increased costs of healthcare and associated critical infrastructure (e.g. hospitals)</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Risk for low-lying airports</li> <li>• Sea level rise will hinder the drainage capability of storm water pipes</li> <li>• Sewer networks may overflow with more intense and frequent heavy rain events</li> <li>• Wind energy generation will benefit from increased westerlies, but risk damage and shutdown in extreme winds plus variability increases risk</li> <li>• Transmission lines damage risk increased from wind</li> <li>• Greater variability of wind makes this energy generation vulnerable</li> <li>• Seasonal changes in electricity demand, for example, increased demand for air conditioning in summer, but decreased demand for heating in winter; electrification of vehicle fleet</li> </ul>	<ul style="list-style-type: none"> <li>• Increased maintenance and replacement costs</li> <li>• Increased costs to service rural users due to infrastructure failure (eg., roads under water)</li> </ul>

Sector	Impact	Comment – over time, anticipate:
	<ul style="list-style-type: none"> <li>Increased risk of landslides and damage to infrastructure and safety</li> <li>For coastal areas, increased likely harm to infrastructure from increased coastal inundation, wear and tear and increased maintenance costs</li> </ul>	
Housing	<ul style="list-style-type: none"> <li>Increased risk of landslides and damage to housing and safety</li> <li>Implication for being cut off from transport and associated impacts</li> <li>For lowland areas, increased flooding of communities</li> <li>For coastal areas, increased inundation of communities from sea level rise (storm surge)</li> </ul>	<ul style="list-style-type: none"> <li>Changing insurance cover in response to climate change risk</li> <li>Increased replacement costs</li> </ul>
Water	<ul style="list-style-type: none"> <li>Increased risk of landslides and damage to infrastructure</li> <li>Increased precipitation over winter</li> <li>Increased water availability generally but reduction in low flows for the Manawatu River</li> <li>Increase in extreme rainfall events. As well, increased sediment loads all leading to increased risk of flooding</li> <li>For lowland areas, increased precipitation leading to higher quantities but risk of harm to infrastructure due to increase over wash and sea level rise</li> <li>For lowland areas, likely increased demand for water due to increased risk of drought – especially from agriculture</li> <li>For coastal areas, Increased salinity due to sea-level rise</li> </ul>	<ul style="list-style-type: none"> <li>Increased risk of flooding but also increased risk of drought</li> <li>Changing availability of water</li> </ul>
Environment/ tourism	<ul style="list-style-type: none"> <li>Limited evidence, but high agreement that the alpine biota is at risk (biodiversity)</li> <li>Coastal areas such as Horowhenua (Otaki, Foxton, Levin) and Whanganui which are important cultural heritage sites (food gathering) at risk of inundation and harm</li> <li>Communications infrastructure increased vulnerability, increased maintenance and repair costs</li> <li>Interconnected infrastructure networks mean that there are increased compound effects</li> <li>Snow cover is reducing more rapidly in Australia than NZ, so there may be an increase in ski tourism. In the longer term, the higher temperature and lower ski days will be detrimental</li> <li>Implication for being cut off from transport and associated impacts on the tourism and industry sector</li> </ul>	<ul style="list-style-type: none"> <li>Coastal areas at risk from sea-level rise</li> <li>Interconnected infrastructure at risk from inundation/flooding</li> </ul>