New England and North West

Climate Change Snapshot

NARCliM

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Photo caption:

The Emu in the Sky is an Aboriginal constellation that is made up of the dark clouds of the Milky Way. With the movement of the Earth, the position of the Emu in the Sky changes throughout the year. Aboriginal people in some nations across NSW and Australia relate the position of the Emu in the Sky to the breeding behaviour of the emu on the land. Cultural astronomy teaches us about the relationship between the sky and land; and that we are all interconnected.

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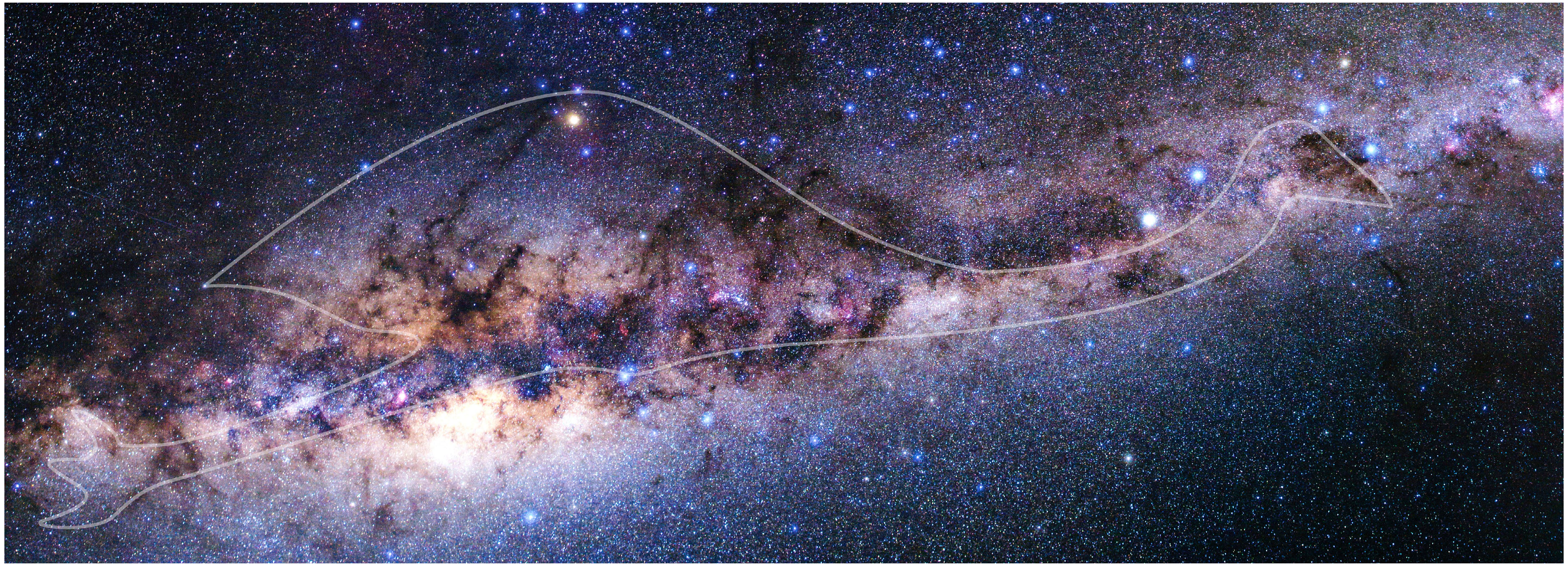


Acknowledgement of Country

The NSW Government acknowledges First Nations people as the first Australian people and the traditional owners and custodians of the country's lands and water. Australia's First Nations people have lived in NSW for over 60,000 years and have significant spiritual, cultural and economic connections with its lands, waters, seas and skies.

The New England and North West region encompasses the traditional lands of the Anaiwan, Banbai, Bundjalung, Githabul, Gumbaynggirr, Kamilaroi, Kwaimbul, Ngoorabel and Dunghutti peoples.

They are the first astronomers and scientists who have been listening, reading and understanding natural processes and caring for Country for generations.

We pay respects to Elders past and present and acknowledge the significance of their traditional knowledge in adapting to changes in climate over tens of thousands of years.

We recognise the importance of their cultural knowledge and guidance at this pivotal moment in time.

About this snapshot

The New South Wales (NSW) and Australian Regional Climate Modelling (NARCliM) project delivers high-resolution climate change projections for NSW and south-east Australia.

This snapshot provides the latest NARCliM2.0 climate projections for New England and North West under low, medium and high emissions scenarios for the middle of the century (2050) and end of the century (2090). It includes projections for key climate variables including temperature, average rainfall, hot days (days ≥35°C), cold nights (<2°C), and severe fire weather days (Forest Fire Danger Index >50). The projections help illustrate potential climate changes and their impacts, as well as associated climate risks.

NSW is already experiencing climate change. This document provides local-scale climate modelling insights to help New England and North West communities understand and plan for the impacts of climate change on their infrastructure, environment and way of life; and to support informed planning, risk assessment and action.

This snapshot offers a high-level overview, with more detailed data available through the AdaptNSW Interactive Map, Climate Data Portal and AdaptNSW.

How to use this snapshot

While there are several different ways to engage with the information in this snapshot, here are some key things to consider:

- **Explore each climate variable across scenarios –** review projections under low (SSP1–2.6), medium (SSP2–4.5), and high (SSP3–7.0) emissions scenarios to understand how climate risk differs depending on emissions pathways (Shared Socioeconomic Pathways, SSPs).
- **Compare scenario-based changes over time –** examine how each climate variable responds to different emissions scenarios for the middle of the century (2050) and the end of the century (2090) to understand how risks may evolve.
- **Identify where projections of climate variables align or diverge –** look for patterns across emissions scenarios and timeframes to see where risks remain consistent and where they escalate or diverge significantly.

Time periods in this snapshot

The projections for each time period represent averaged data across all climate models used for NARCliM for a 20-year period:

- **Baseline period: baseline** → The modelled average for each climate variable from 1990–2009, used for comparison with future projections.
- **Middle of the century: '2050' projection** → The projected average for each climate variable for 2040–2059.
- **End of the century: '2090' projection** → The projected average for each climate variable for 2080-2099.

About this snapshot

NARCliM climate projections

NARCliM is NSW's regional climate modelling project. NARCliM combines carefully selected global and regional climate models through a process known as dynamical downscaling, to generate detailed, locally relevant climate projections. These simulate a range of plausible future climates, helping to inform climate risk assessments and support planning at local and regional levels.

Launched in 2024, NARCliM2.0 provides nation-leading climate model data that span the range of plausible future changes in climate. It offers:

- climate projections out to the year 2100, and simulations of the past climate from 1951 to 2014
- 4-km scale projections for south-east Australia
- 20-km scale projections for the broader Australasian region
- projections for key climate variables and extremes.

There is more information About NARCliM, as well as specific information on Downscaling in NARCliM and Global and regional climate models used by NARCliM at AdaptNSW.

Methods and uncertainty

To help address future uncertainty, NARCliM2.0 is built on a selection of emissions scenarios, global climate models and regional climate models that, together, capture a range of climates that could occur. This is referred to as the NARCliM model ensemble. The NARCliM2.0 model ensemble is made up of different combinations of 5 global climate models and 2 regional climate models, giving 10 model combinations in total.

The data presented in this snapshot is generally an average for different 20-year time periods (e.g. the 2050 projection is the average for the 2040–2059 time period). Time series data are presented as annual averages. Combining multiple models through averaging and other statistical methods produces better projections by providing a comprehensive representation of possible future climate scenarios.

To ensure that NARCliM models adequately simulate regional climate, scientists use them to simulate the past climate and compare the results with actual observations. Outputs undergo rigorous quality control and scientific technical peer review.

There is more information on The NARCliM modelling methodology and NARCliM data processing, testing and validation at AdaptNSW.

Mental health support

Climate change information can be distressing for some readers, with many Australians of all ages experiencing significant eco-anxiety. For supporting information, please visit the Black Dog Institute or Australian Psychological Society or speak with your local healthcare provider.

About this snapshot

Shared Socioeconomic Pathways

NARCliM2.0 uses Shared Socioeconomic Pathways (SSPs), which are the most recent emissions scenarios adopted in Coupled Model Intercomparison Project Phase 6 (CMIP6) models and used in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report.

The SSPs are a type of storyline-based emission scenario that estimate the world's future emissions and how these will affect the climate. SSPs outline different global development trajectories based on factors such as population, economic growth, education, urbanisation and land use, and technological advancement.[1] By analysing SSPs, we can better understand the long-term consequences of today's decisions and determine if we are heading toward higher-risk scenarios.[2]

For more information on emissions scenarios visit Emissions scenarios used by NARCliM on AdaptNSW and Summary for policymakers report by the IPCC.

Why do we use 3 SSPs?

The future is uncertain. There are many plausible futures on the horizon, and the one we reach depends on the path we take to get there. NARCliM provides projections for 3 SSPs (low-, medium- and high-emissions), each representing a distinct future with varying levels of climate risk.

Considering a range of SSPs and understanding where these scenarios align or diverge – in both the middle of the century (2050) and the end of the century (2090) – helps inform better planning and decision-making. NARCliM data highlights just how stark the differences between futures can be.

For more information about how to integrate this information into your risk assessments see Climate risk ready guide and Limitations and appropriate use on AdaptNSW.

Low-emissions future

SSP 1–2.6

SSP1–2.6 describes a **low-emissions future** with a global transition towards sustainable and equitable development.

Medium-emissions future

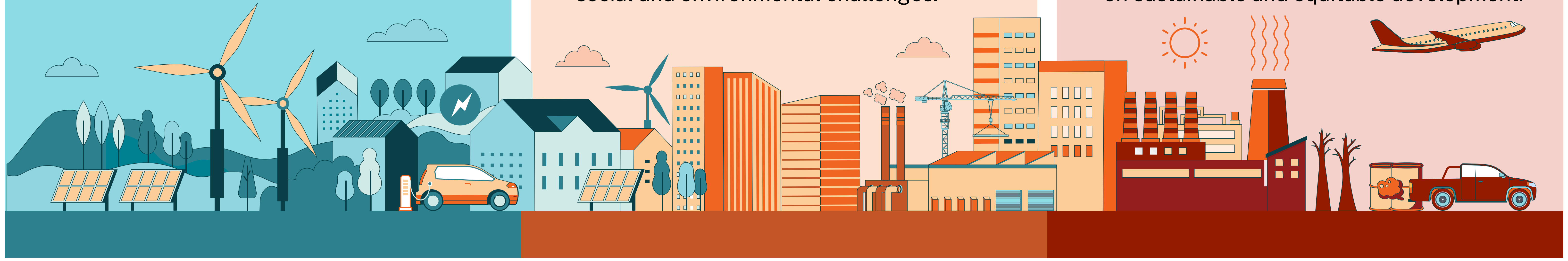
SSP 2–4.5

SSP2–4.5 describes a **medium-emissions future** with uneven economic growth, slow sustainability progress, ongoing environmental degradation, and persistent social and environmental challenges.

High-emissions future

SSP 3–7.0

SSP3–7.0 describes a **high-emissions future** of regional conflict and development where countries do not collaborate on tackling climate change and do not focus on sustainable and equitable development.



About this snapshot

Understanding the baseline period

To assess future climate projections, a climate baseline is used. This is a reference point which future change is relative to. In this snapshot, the baseline is the 20-year period from 1990 to 2009. This period is termed the baseline period to represent the average climate across those 2 decades.

A 20-year baseline averages out natural climate variability and avoids misleading comparisons with unusually hot, cold, wet or dry years. Using a fixed reference point prevents issues that may arise from using shifting reference points to compare future change against.

Climate during the baseline period is described in 2 ways in this snapshot:

- **Historical model:** The NARCliM2.0 simulation of past climate conditions.
- **Observed:** What was actually measured using weather station data during this period.

These 2 values are similar but not the same. Climate models aim to capture long-term patterns and trends, rather than matching observations perfectly. Observed values give context for comparison of the historical model with what it was in reality.

Looking backwards from the baseline

Before the baseline period, +0.84°C of observed warming had already occurred across NSW and the Australian Capital Territory (ACT) since records began. This is the difference between the 20-year average temperature of the 2 periods centred on 1920 (1910–1929) and 2000 (1990–2009). The Bureau of Meteorology's national climate records for temperature begin in 1910, making 1910–1929 the first available 20-year average for comparison with the baseline.

Consider the following when incorporating past warming into future projections:

- Warming before the baseline (+0.84°C) is not included in projections of future change.
- Warming after the baseline period is already included in future projections and should not be added again.

Looking forwards from the baseline

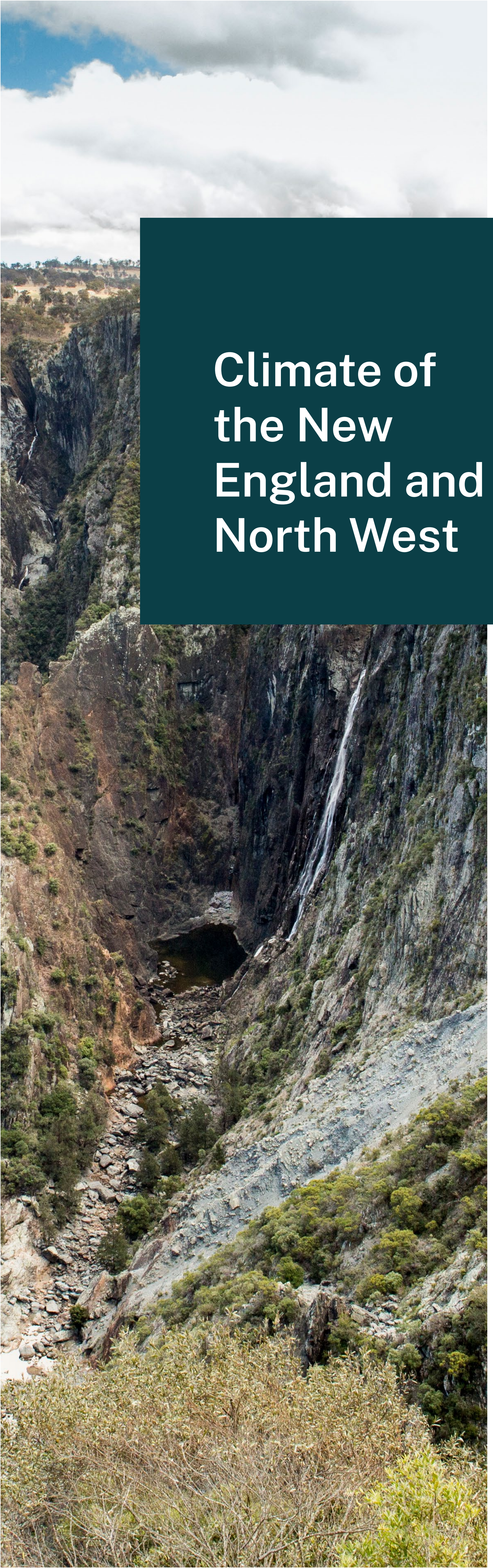
Use the historical model values in Table 1 as the baseline when interpreting both middle of the century and end of the century climate projections in this snapshot.

By comparing future projections to the historical model baseline values, we ensure the projected changes reflect genuine shifts, instead of also including the small differences between the modelled and observed data.

Table 1. Baseline climate for New England and North West

	Average temperature	Average maximum temperature	Average minimum temperature	Hot days	Cold nights	Rainfall	Severe fire weather days
Observed	17.0°C	24.1°C	9.9°C	20.5 days	50.5 days	728 mm	1.7 days
Historical model	17.0°C	23.1°C	11.5°C	20.8 days	48.9 days	623 mm	3.6 days

Table 1 outlines the annual average values for the baseline period in this snapshot. All observed data is calculated from Bureau of Meteorology products. Long-term temperature change data is from the long-term temperature record.[3] Observed information and data in graphs come from Australian Gridded Climate Data (AGCD).[4]



Climate of the New England and North West

The climate of New England and North West underpins a diverse array of important lifestyles, industries and natural ecosystems. A stable climate is critical to support a range of values in New England and North West, including our unique biodiversity, recreational activities and food systems.

The New England and North West region encompasses the traditional lands of the the Anaiwan, Banbai, Bundjalung, Githabul, Gumbaynggirr, Kamilaroi, Kwaimbul, Ngoorabel and Dunghutti peoples.

The New England and North West region covers a large area including the Liverpool Plains, New England Tablelands and the north-west slopes and plains. Tamworth and Armidale are the main urban centres in the region, with other regional settlements of Glen Innes, Inverell, Moree, Narrabri and Gunnedah. The region has rich, fertile soil, and is responsible for about 20% of NSW's agricultural production.

The New England and North West region has a diverse range of climates, from the cooler and more temperate Northern Tablelands through to the dryer and hotter north-west slopes and plains in the west. The tablelands have a temperate climate with warm summers and cool winters. The far north-west of the region is hot and semi-arid, while much of the North West Slopes has a humid subtropical climate. Extensive national parks occur along the escarpment. Other large parks include Mount Kaputar and Torrington on the tablelands and the Pilliga Community Conservation Area on the western plains. The region's wetlands support a diversity of flora and fauna that mostly depend on fluctuating water regimes of wetting and drying. The region contains some major floodplain wetlands including the internationally significant Gwydir Wetlands and Little Llangothlin Lagoon.

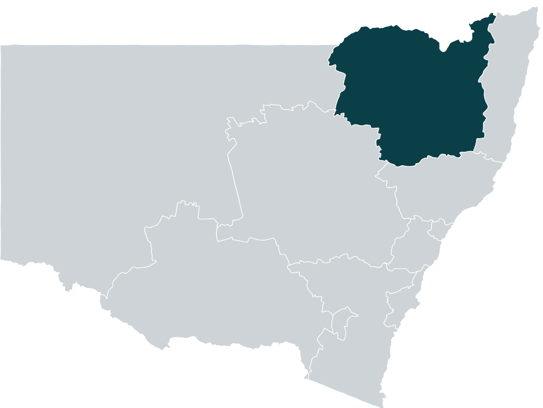
Children and adolescents (0–14 years old) make up 19.1% of the population (slightly higher than the NSW and ACE average of 18.2%), while people aged 65 and over represent 21.2% and working-aged people (15–64 years) represent 59.6% of the region's population.[5]

The New England and North West supports a diverse range of industries that are vital for NSW's economy, with the highest number of businesses in agribusiness (agriculture, forestry and fishing) as well as construction. The largest industries of employment for the region are health care and social assistance (14.1%), agribusiness (12.9%), education and training (10.8%), retail trade (8.8%) and construction (7.0%).[5]

The region's climate has provided the foundation for many of the region's current social, economic and ecological systems. These systems will be impacted by increased temperatures, more hot days, fewer cold nights, greater fire danger and higher rainfall variability.

The following pages outline the projected changes in these key climate variables across the New England and North West region.

PROJECTED CHANGES



	Low-emissions scenario 2050	Low-emissions scenario 2090	Medium-emissions scenario 2050	Medium-emissions scenario 2090	High-emissions scenario 2050	High-emissions scenario 2090
Increase in average temperature	+1.3˚C	+1.4˚C	+1.6˚C	+2.9˚C	+2.1˚C	+4.1˚C
Increase in hot days per year	+13.6	+14.6	+16.1	+29.9	+20.9	+43.5
Decrease in cold nights per year	–13.2	–15.6	–17.8	–29.7	–22.4	–38.0
Increase in severe fire weather days per year	+1.6	+1.2	+1.4	+3.2	+2.0	+3.8

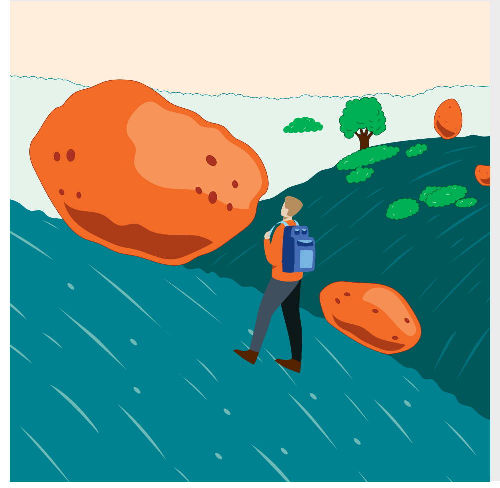
REGIONAL IMPACTS

Inland wetlands

Changes to rainfall

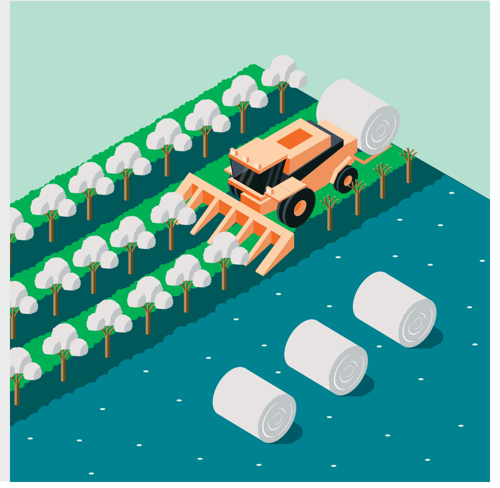
Water supply

Changes to rainfall



Increased severe fire weather

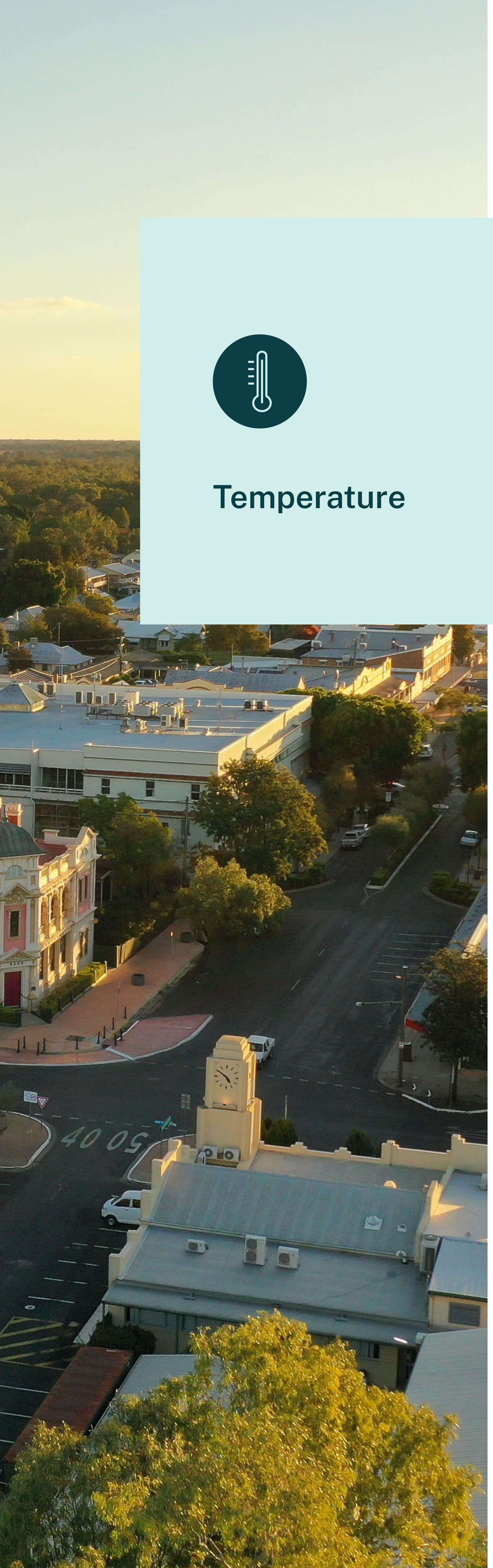
National parks



Increased extreme heat

Cotton production

Data is based on NARCliM2.0 projections for SSP1–2.6 (low-emissions), SSP2–4.5 (medium-emissions) and SSP3–7.0 (high-emissions) and is presented relative to the baseline period of 1990–2009. Values presented are averages across the NARCliM2.0 model ensemble, and do not represent the full range of plausible climate futures. Regional climate change impacts are used to highlight how the region is likely to be affected by climate change, and impacts are not limited to the examples provided.



Temperature

In NSW, 8 of the 10 warmest years on record since 1910 have occurred since 2013.

4.1°C

rise in average temperature across New England and North West by 2090 under a high-emissions scenario.

Temperatures are projected to be higher by 2050 under a high-emissions scenario than by 2090 under a low-emissions scenario.

New England and North West is getting warmer

Temperature is the most robust indicator of climate change. In NSW, 8 of the 10 warmest years on record since 1910 have occurred since 2013. The warmest year on record for both average temperature and maximum temperature in the New England and North West region was 2019, when the average temperature was 1.6°C above the 1990–2009 baseline average.[4]

Projections

Across the New England and North West region, average temperatures will increase throughout this century (Figure 1).

Under a low-emissions scenario, the average temperature increase across the region is projected to be 0.1°C between 2050 and 2090 (Table 2). However, a major temperature increases of 1.3°C under a medium-emissions scenario and 2.0°C under a high-emissions scenario are expected during the same period. Notably, the temperature projections for 2050 under a high-emissions scenario are expected to exceed the projections for 2090 under a low-emissions scenario.

Temperature increases are expected in all parts of the region (Figure 2) and across all seasons. Western areas of the region, including towns such as Moree and Narrabri, will see the greatest increases in temperature. By 2090, Moree is likely to experience an increase in temperature of 1.5°C under a low-emissions scenario, 3.0°C under a medium-emissions scenario and 4.3°C under a high-emissions scenario. Comparatively, Armidale is likely to experience an increase in temperature of 1.3°C under a low-emissions scenario, 2.6°C under a medium-emissions scenario and 3.7°C under a high-emissions scenario.

Table 2 and Figure 1 provide more information on how the projections differ across the 3 scenarios, and Figure 2 provides information on regional differences by 2090 across the 3 scenarios.

Table 2. Projected annual average temperature increase – New England and North West

2050

	Low-emissions	Medium-emissions	High-emissions
Temperature	**1.3°C** (0.6°C to 1.9°C)	**1.6°C** (1.1°C to 2.1°C)	**2.1°C** (1.2°C to 3.1°C)
Maximum temperature	**1.3°C** (0.6°C to 2.0°C)	**1.7°C** (1.0°C to 2.2°C)	**2.1°C** (1.3°C to 3.2°C)
Minimum temperature	**1.2°C** (0.7°C to 1.8°C)	**1.6°C** (1.1°C to 2.1°C)	**2.0°C** (1.1°C to 2.9°C)

2090

	Low-emissions	Medium-emissions	High-emissions
Temperature	**1.4°C** (0.6°C to 2.3°C)	**2.9°C** (2.1°C to 4.1°C)	**4.1°C** (3.0°C to 5.7°C)
Maximum temperature	**1.5°C** (0.6°C to 2.5°C)	**2.9°C** (2.0°C to 4.1°C)	**4.0°C** (3.1°C to 5.6°C)
Minimum temperature	**1.4°C** (0.7°C to 2.1°C)	**2.8°C** (2.0°C to 4.0°C)	**4.1°C** (2.9°C to 5.6°C)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range. Temperature increases are additional to the historical model baselines of 17.0℃ for average temperature, 23.1℃ for average maximum temperature and 11.5℃ for average minimum temperature.

Figure 1. Historical and projected average temperature change – New England and North West

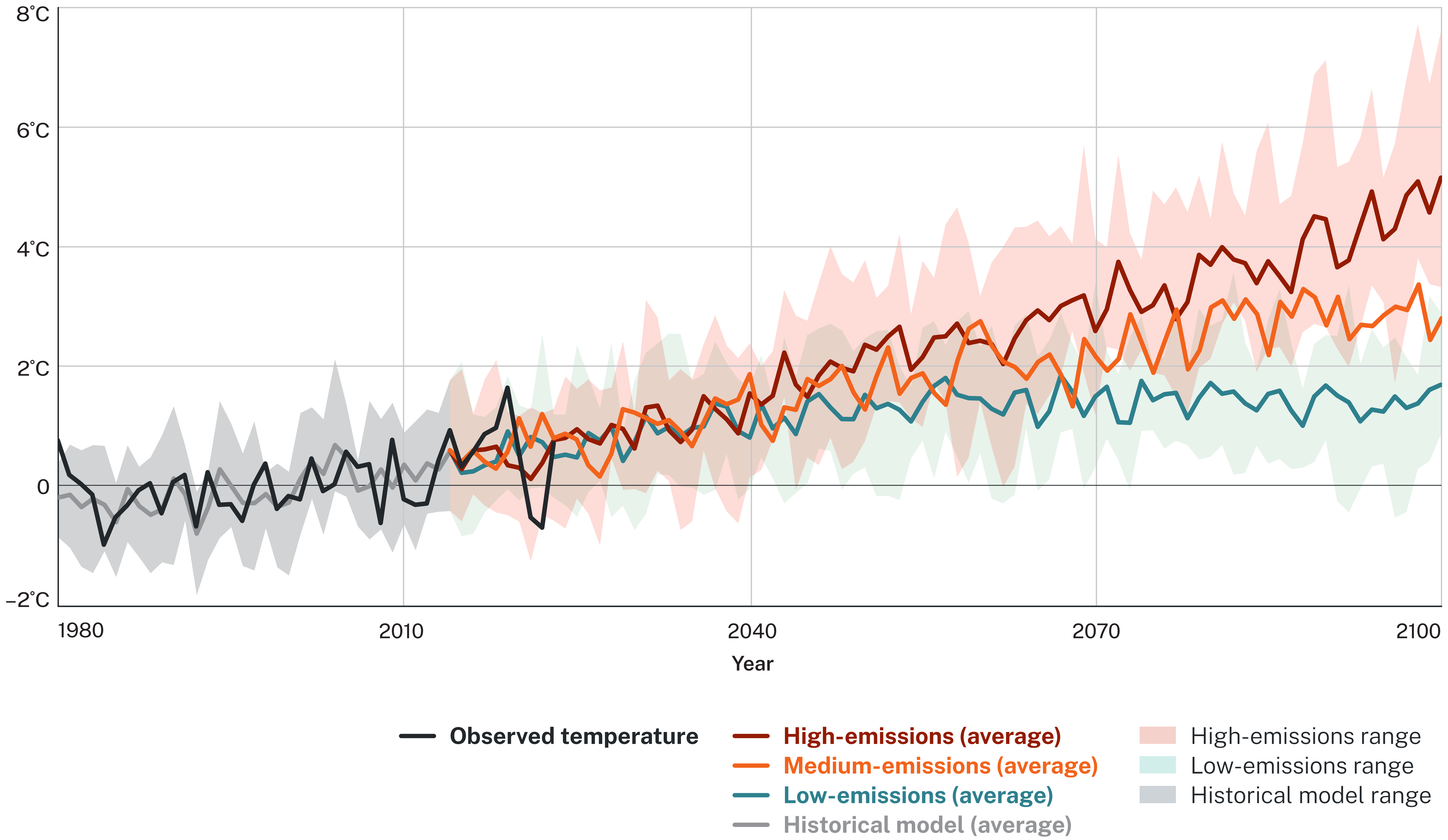
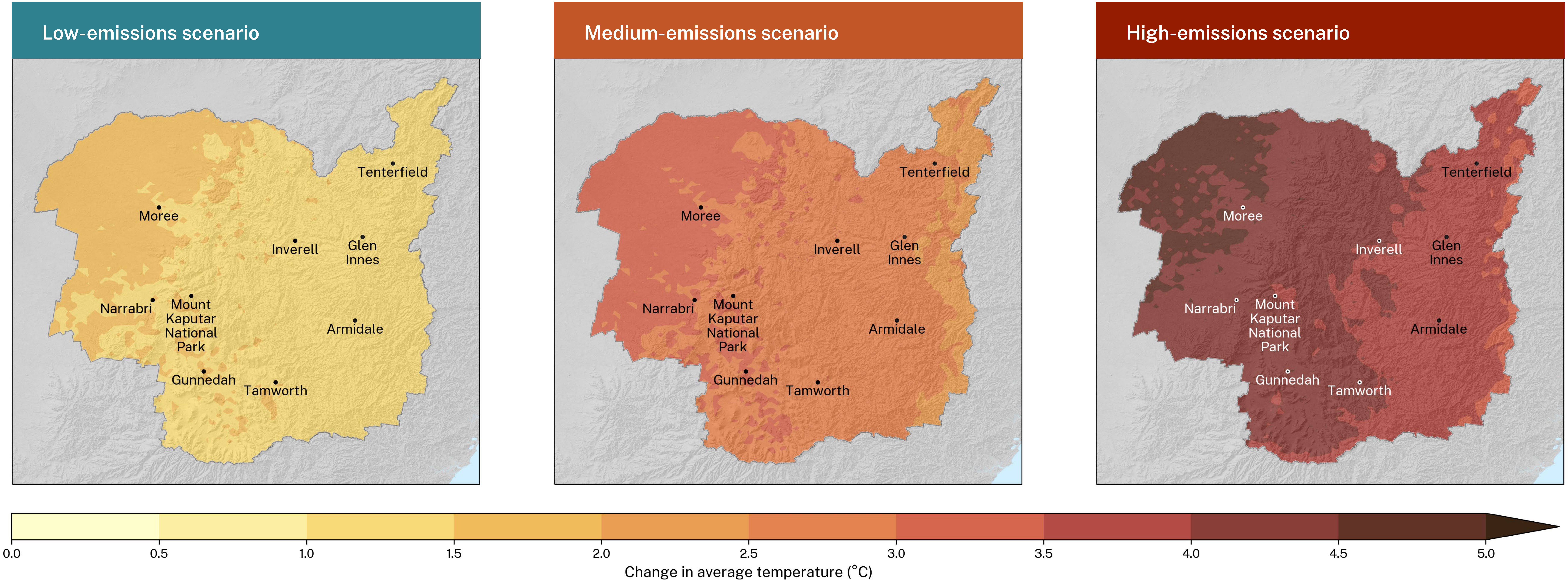


Figure 2. Projected change in average temperature by 2090 for New England and North West



Hot days

Changes to temperature extremes often have more pronounced impacts than changes in average temperatures.

3x

The number of hot days across New England and North West region is expected to more than triple by 2090 under a high-emissions scenario.

Higher maximum temperatures affect health through heat stress and exacerbate existing health conditions.

Hot days will become more frequent

Prolonged hot days, where maximum daily temperatures are equal to or above 35°C, increase the incidence of illness and death – particularly among vulnerable people. Seasonal changes in the number of hot days could have significant impacts on bushfire danger, infrastructure and native species.

Generally, the number of hot days in the New England and North West region increases from the east to the west of the region. During the baseline period, areas of higher elevation in the east of the region, such as Armidale and Tenterfield, had on average less than 1 hot day per year. Tamworth and Inverell, near the centre of the region, had on average 5–15 hot days per year, whereas in the west, locations such as Moree and Narrabi averaged 40–45 hot days per year.

Projections

Across the region, the average number of hot days per year will increase throughout this century (Figure 3).

The number of hot days will increase for the New England and North West region by 2050 for all emissions scenarios, with an even greater increase projected by 2090 under a medium-emissions scenario and a high-emissions scenario (Table 3). The number of hot days is projected to increase during spring, summer and autumn, with the largest increase in summer.

Under a low-emissions scenario, there is only 1.0 additional hot day per year projected across the region between 2050 and 2090 (Table 3). However, increases of 13.8 additional hot days per year under a medium-emissions scenario and 22.6 additional hot days per year under a high-emissions scenario are projected during the same period.

Increases to hot days will occur across all of the region (Figure 4). The greatest increases are projected to occur in the west of the region, including Moree and Narrabri. Other low-elevation areas including Tamworth and Gunnedah will also experience greater increases in hot days. By 2090, Moree is projected to experience 26.9 additional hot days per year under a low-emissions scenario, 51.4 under a medium-emissions scenario and 72.2 under a high-emissions scenario. Both a medium-emissions scenario and a high-emissions scenario are projected to more than double Moree's baseline period average of 43.2 hot days per year. Comparatively, in the south-east of the region, Armidale's baseline period average is 0.2 hot days per year. By 2090, Armidale is projected to experience an additional 0.9 hot days per year under a low-emissions scenario, 3.3 under a medium-emissions scenario and 7.1 under a high-emissions scenario.

Table 3 and Figure 3 provide more information on how the projections differ across the 3 scenarios, and Figure 4 provides information on regional differences by 2090 across the 3 scenarios.

Table 3. Projected increase in average annual number of hot days – New England and North West

2050

Low-emissions	Medium-emissions	High-emissions
13.6 days (5.8 to 20.6 days)	**16.1 days** (8.9 to 21.3 days)	**20.9 days** (8.9 to 35.3 days)

2090

Low-emissions	Medium-emissions	High-emissions
14.6 days (5.8 to 28.7 days)	**29.9 days** (17.4 to 48.1 days)	**43.5 days** (26.7 to 66.9 days)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range. Hot day increases are additional to the historical model baseline of 20.8 hot days.

Figure 3. Historical and projected average annual number of hot days – New England and North West

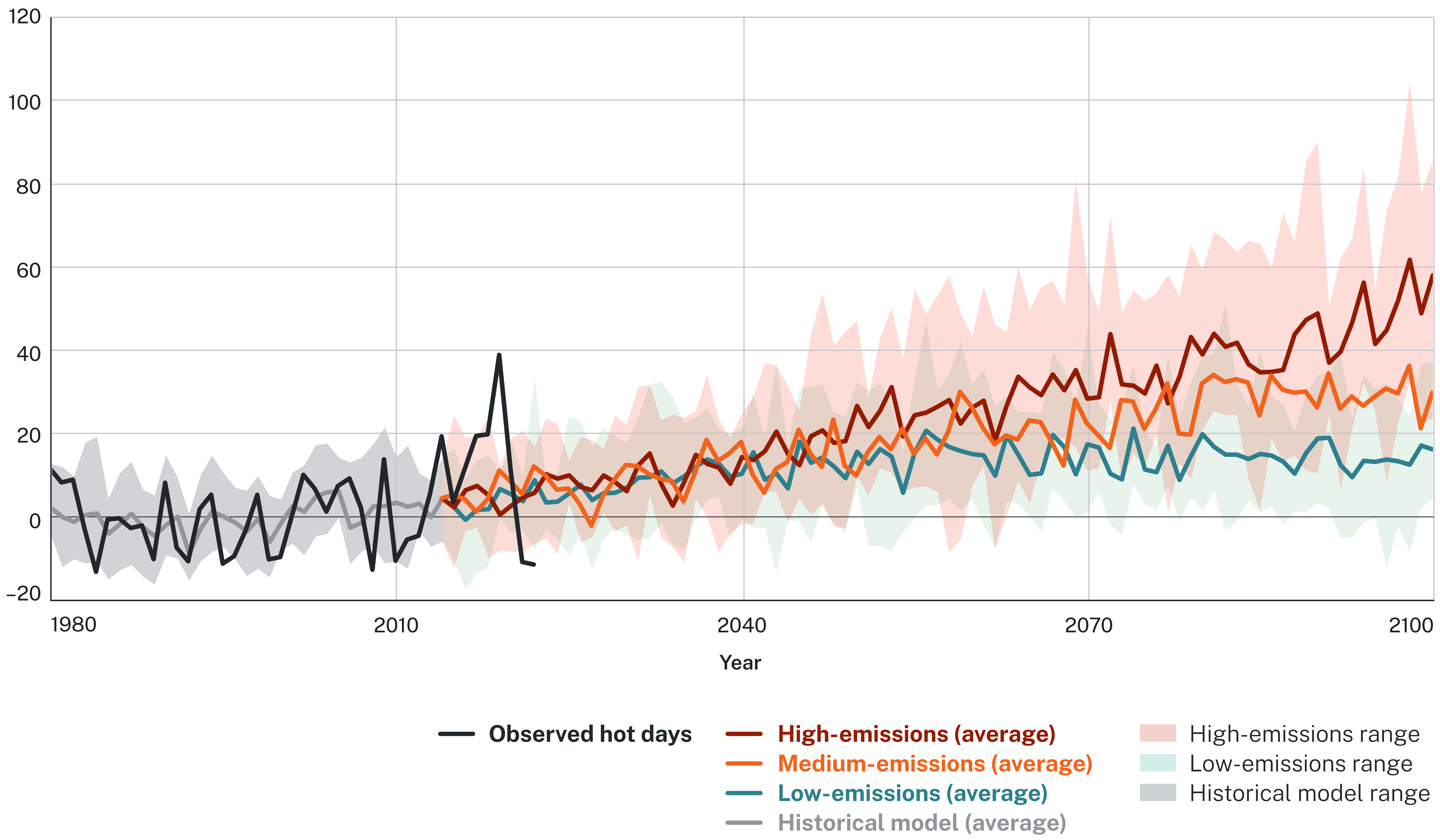
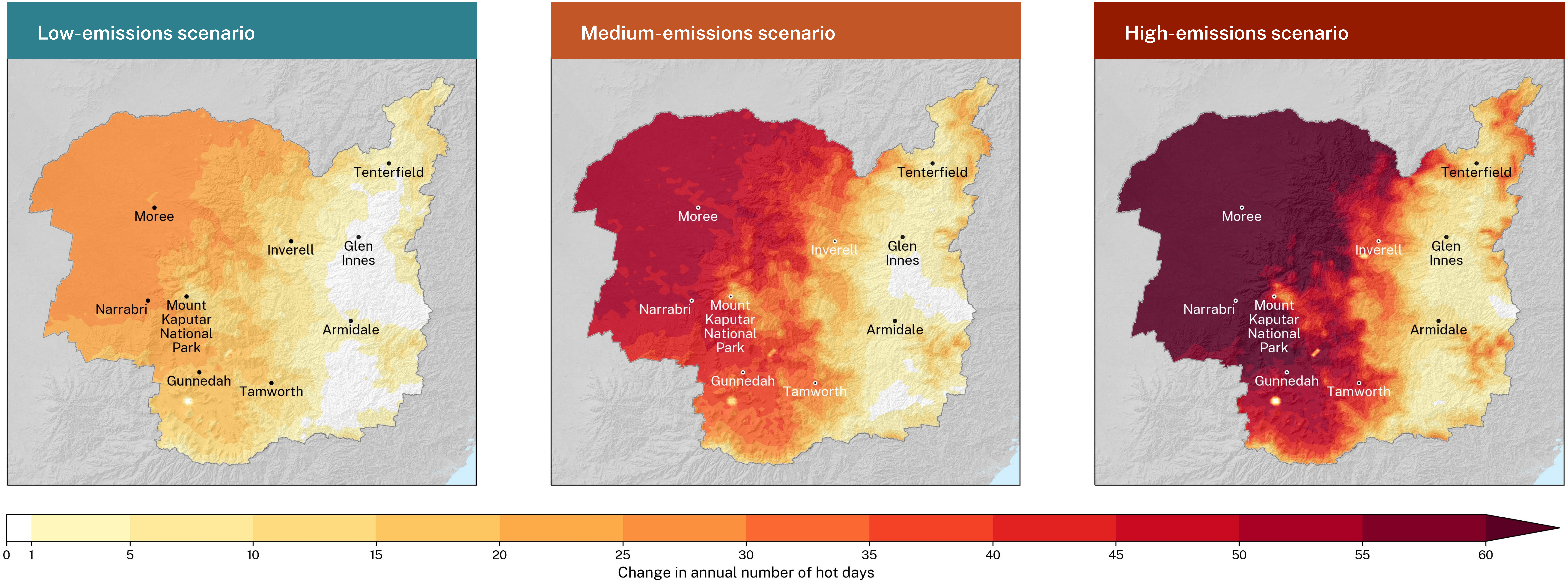


Figure 4. Projected change in annual number of hot days by 2090 for New England and North West



Cold nights

Cold nights are important for biodiversity in higher-elevation areas and the viability of important plant species, including some temperate fruits.

Under a high-emissions scenario, the number of cold nights across New England and North West could reduce by nearly 80% by 2090.

Under a low-emissions scenario, the number of cold nights across New England and North West could reduce by less than 35% by 2090.

Cold nights will decrease

Cold nights are those where the minimum temperature drops below 2°C. These are important for the viability of some important plant species. For example, some common temperate fruit species require sufficiently cold winters to produce flower buds.

The number of cold nights varies widely across the New England and North West region, but generally decreases from the east to the west. In the high country during the baseline period, Armidale and surrounds had, on average, more than 80 cold nights per year. Other high-elevation areas of the region such as Inverell and Mount Kaputar National Park had on average 60–70 cold nights per year. Low-elevation areas of the region such as Moree, Narrabri and Gunnedah had on average 15–25 cold nights per year during the baseline period.

Projections

Across New England and North West, the average number of cold nights per year will decrease throughout this century (Figure 5).

The number of cold nights across the region will decrease by 2050 for both a low-emissions and a high-emissions scenario, with an even greater decrease by 2090 under a medium-emissions scenario and a high-emissions scenario (Table 4). The number of cold nights is projected to decrease across autumn, winter and spring, with the largest decreases in winter.

Under a low-emissions scenario, there is a small decrease of 2.4 fewer cold nights per year projected across the region between 2050 and 2090 (Table 4). However, decreases of 11.9 fewer cold nights under a medium-emission scenario and 15.6 fewer cold nights under a high-emissions scenario are projected during the same period.

The number of cold nights will decrease across all of the region, particularly in high-elevation areas in the east (Figure 6). The greatest decreases are projected to occur near Armidale, Glen Innes and Walcha. By 2090, Armidale is projected to have 19.4 fewer cold nights per year under a low-emissions scenario, 39.2 fewer cold nights under a medium-emissions scenario and 52.7 fewer cold nights per year under a high-emissions scenario. A medium-emissions scenario is projected to reduce Armidale's 77.9 cold nights per year baseline period average by nearly 50%, while a high-emissions scenario is projected to reduce the baseline period average by more than 65%.

Table 4 and Figure 5 provide more information on how the projections differ across the 3 scenarios, and Figure 6 provides information on regional differences by 2090 across the 3 scenarios.

Table 4. Projected decrease in average annual number of cold nights – New England and North West

2050

Low-emissions	Medium-emissions	High-emissions
13.2 days (7.8 to 18.8 days)	**17.8 days** (11.0 to 23.3 days)	**22.4 days** (12.5 to 29.4 days)

2090

Low-emissions	Medium-emissions	High-emissions
15.6 days (7.9 to 22.3 days)	**29.7 days** (22.9 to 38.1 days)	**38.0 days** (31.1 to 44.8 days)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range. Cold night decreases are relative to the historical model baseline of 48.9 cold nights.

Figure 5. Historical and projected change in annual number of cold nights – New England and North West

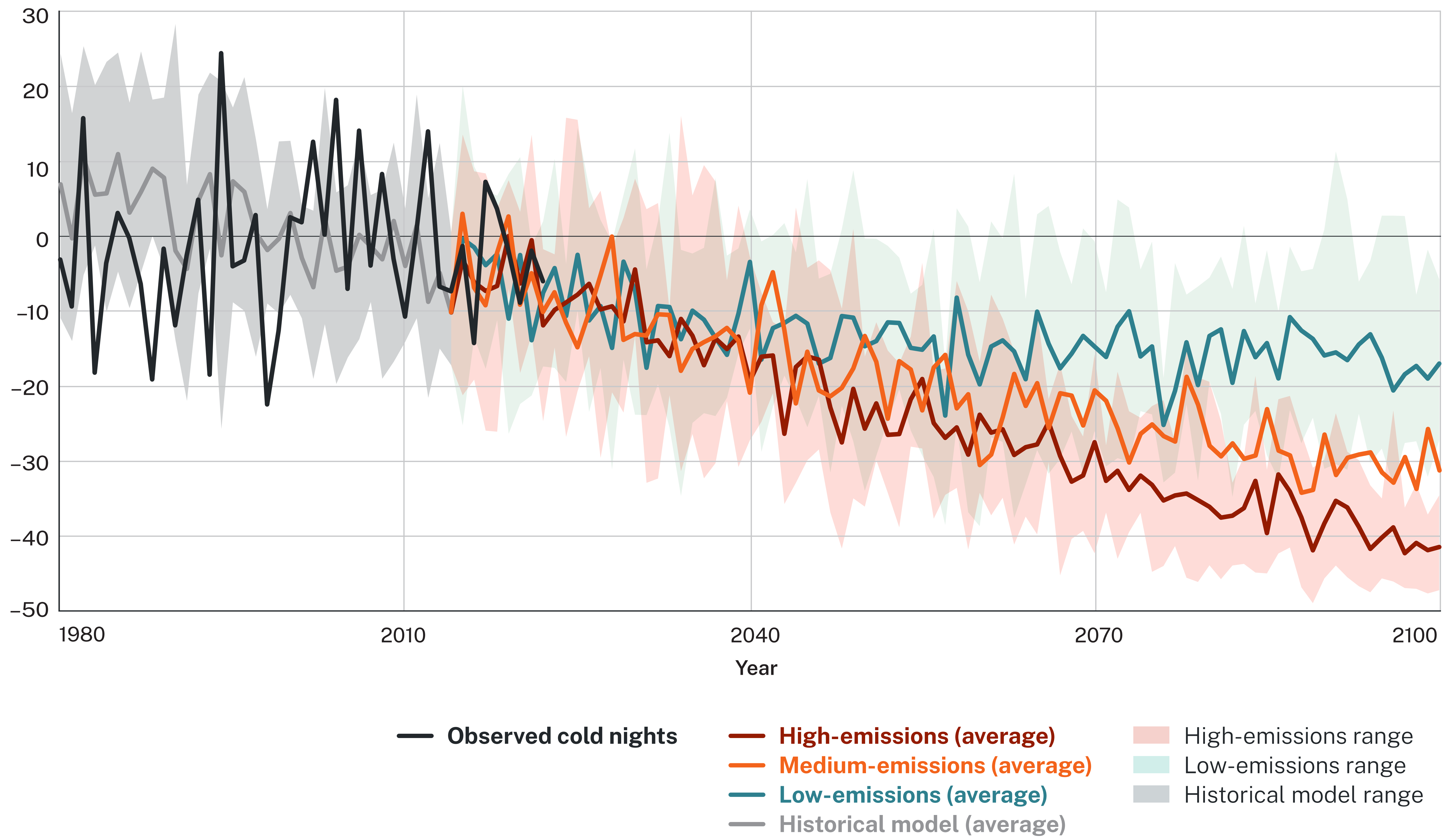
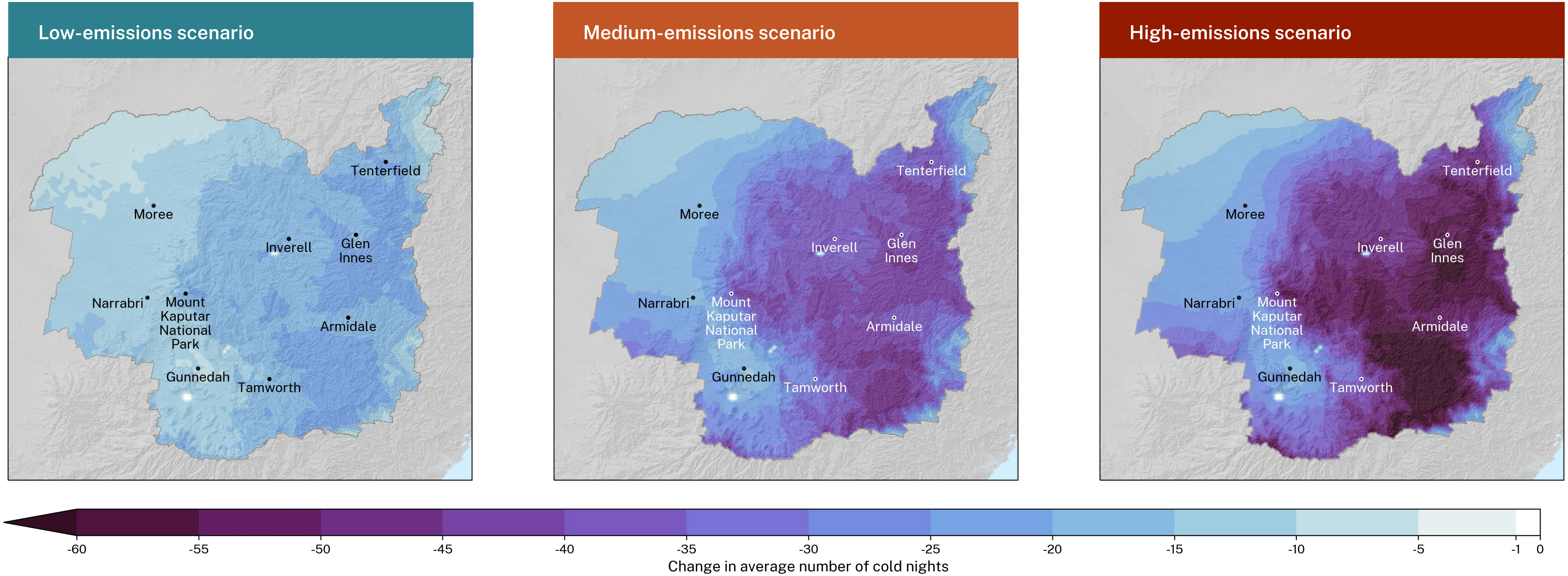
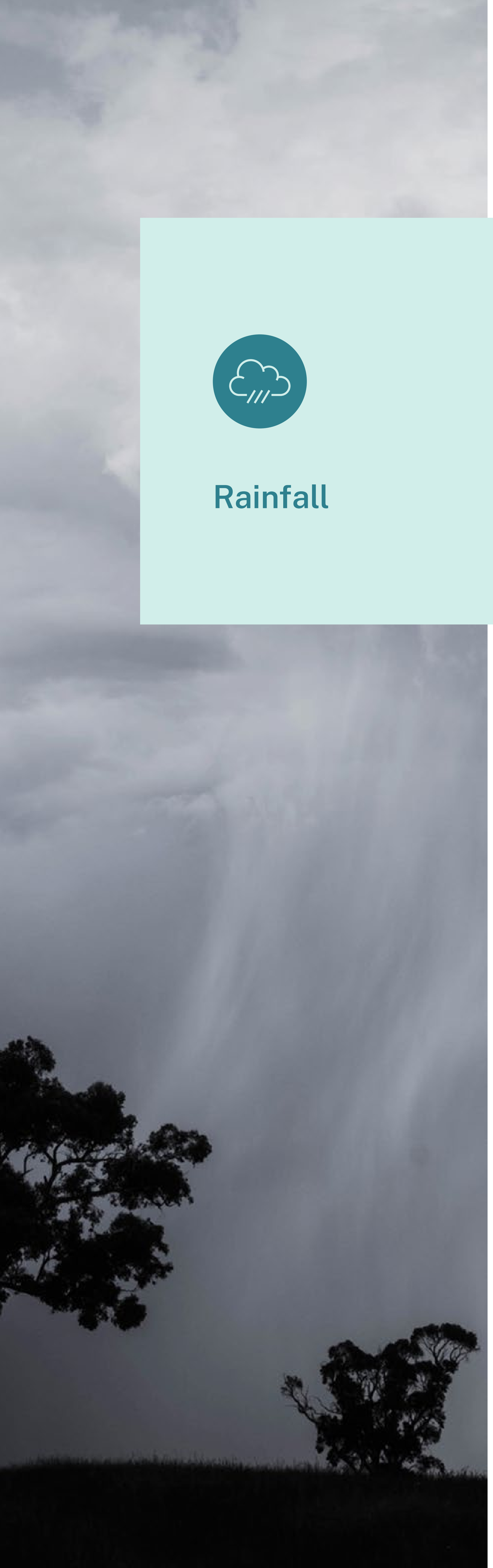


Figure 6. Projected change in annual number of cold nights by 2090 for New England and North West





Rainfall

Rainfall is projected to remain variable

Climate change will influence rainfall patterns and the total amount of rainfall that NSW receives. These changes may have widespread impacts on water security, agricultural productivity and native species' reproductive cycles. For example, subtropical rainforest communities may contract due to more variable rainfall and changes to humidity and evapotranspiration.

NSW has experienced rainfall extremes in recent decades, with significant impacts on communities, infrastructure and natural ecosystems.

Modelling rainfall is more difficult than modelling temperature due to the complexities of the weather systems that generate rain. NARCliM projections capture a range of plausible climate futures under the 3 emissions scenarios, including wet and dry outcomes. This means that rainfall is inherently more variable in the NARCliM projections than temperature, and the full range of rainfall projections should be taken into account. This can be explored further on the AdaptNSW Interactive Map.

This snapshot provides data on average rainfall change and does not provide data on rainfall extremes or the impacts of climate change on flooding.

Observed annual rainfall across the New England and North West region averages about 730 mm. Rainfall generally decreases from the east to the west of the region, with rainfall highest in the New England Tablelands. Rainfall is highest in summer, with winter being the driest season. The driest year on record was 2019, with an average of only 250 mm across the region.[4]

A decrease in average winter rainfall of 24–26% by 2090 is projected for the New England and North West under medium-emissions and high-emissions scenarios.

Projections

Annual average rainfall in the region is projected to remain variable throughout this century (Figure 7). By 2090, on average, annual rainfall is projected to decrease by 9% under a low-emissions scenario, by 13% under a medium-emissions scenario and by 8% under a high emissions scenario (Table 5).

On average, summer, autumn and spring rainfall is projected to change by 12% or less across the region by 2090 under all emissions scenarios, except for a 17% decrease in average spring rainfall projected under a medium-emissions scenario (Table 5).

By 2090, on average, winter rainfall is projected to change by 5% across the region under a low-emissions scenario, by 26% under a medium-emissions scenario and by 24% under a high-emissions scenario (Table 5). It is projected to decrease across the region, but particularly in the north-east near Armidale and Tenterfield (Figure 11).

Refer to the Interactive Map for further seasonal information.

Table 5 and Figure 7 provide more information on how the projections differ across the 3 scenarios, and Figures 8 to 12 provide information on regional differences by 2090 across the 3 scenarios by season.

Table 5. Projected change to average rainfall – New England and North West

2050

	Low-emissions	Medium-emissions	High-emissions
Annual	**–9.5%** (–22.4% to +7.9%)	**–7.9%** (–23.4% to +23.9%)	**–12.3%** (–29.9% to +14.7%)
Summer	**–8.4%** (–24.7% to +19.6%)	**–3.5%** (–16.9% to +32.7%)	**–13.9%** (–42.0% to +17.2%)
Autumn	**–12.1%** (–28.1% to +3.3%)	**–8.4%** (–28.0% to +22.3%)	**–12.4%** (–24.1% to +34.1%)
Winter	**–12.5%** (–29.5% to +16.2%)	**–16.6%** (–36.5% to +38.1%)	**–14.9%** (–43.6% to +33.2%)
Spring	**–6.5%** (–30.9% to +28.9%)	**–7.8%** (–42.1% to +29.6%)	**–7.6%** (–37.1% to +34.2%)

2090

	Low-emissions	Medium-emissions	High-emissions
Annual	**–9.3%** (–19.9% to +8.6%)	**–13.0%** (–26.9% to +10.5%)	**–8.4%** (–36.2% to +39.4%)
Summer	**–12.6%** (–31.9% to +9.6%)	**–6.0%** (–20.7% to +48.3%)	**+3.3%** (–22.6% to +40.4%)
Autumn	**–6.3%** (–18.6% to +24.5%)	**–9.9%** (–23.9% to +22.4%)	**–12.8%** (–35.2% to +39.7%)
Winter	**–5.3%** (–27.2% to +39.5%)	**–26.4%** (–47.7% to +40.0%)	**–24.2%** (–61.3% to +63.2%)
Spring	**–10.0%** (–26.3% to +32.7%)	**–16.9%** (–31.3% to +32.3%)	**–10.8%** (–38.4% to +48.1%)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range. Percentages changes in annual average rainfall are relative to the historical model baseline of 623 mm. Average summer rainfall change is relative to a baseline of 232 mm, average autumn rainfall is relative to a baseline of 138 mm, average winter rainfall is relative to a baseline of 113 mm and average spring rainfall is relative to a baseline of 140 mm.

Figure 7. Historical and projected change in average rainfall – New England and North West

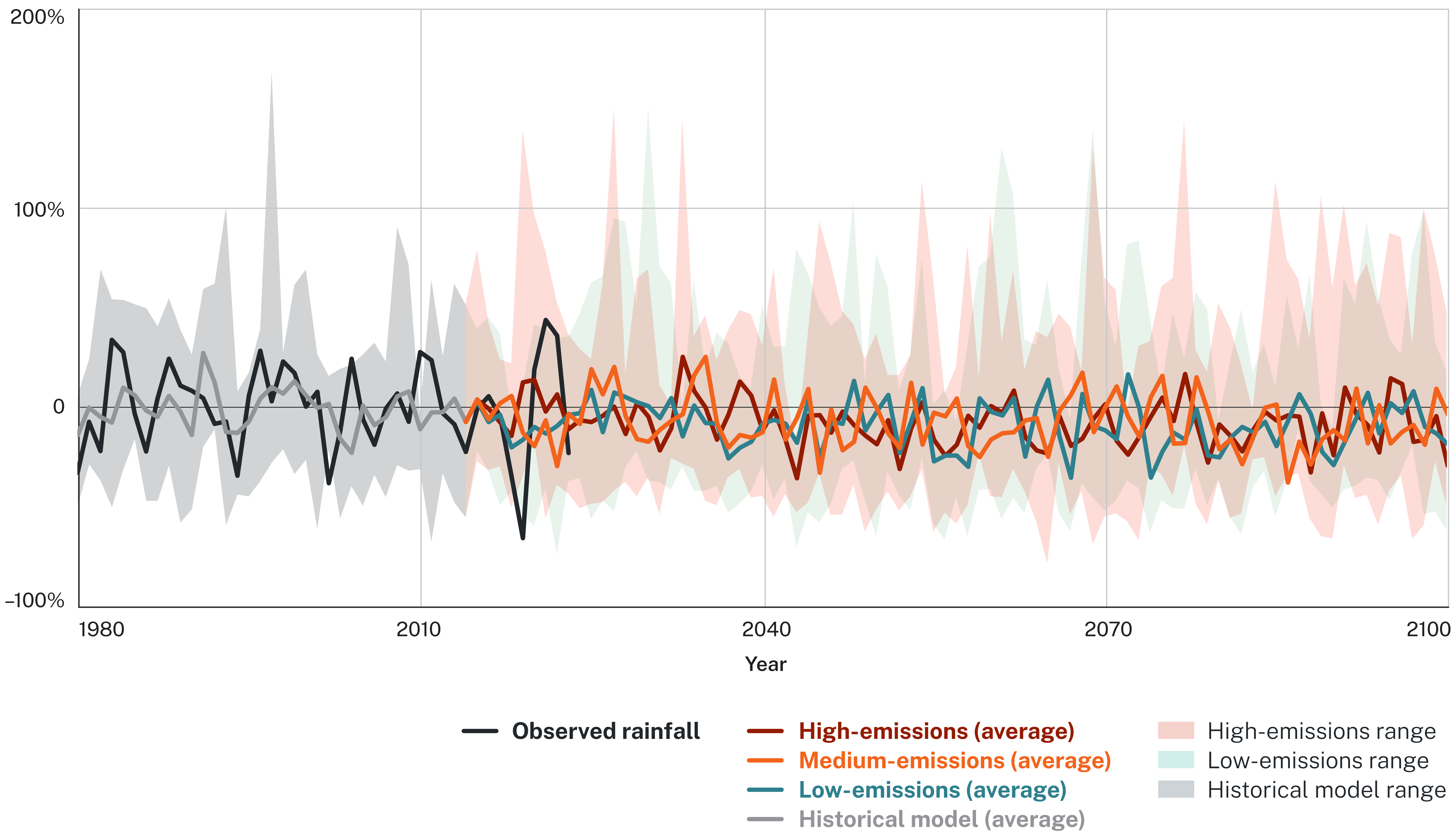


Figure 8. Projected change to average annual rainfall by 2090 for New England and North West

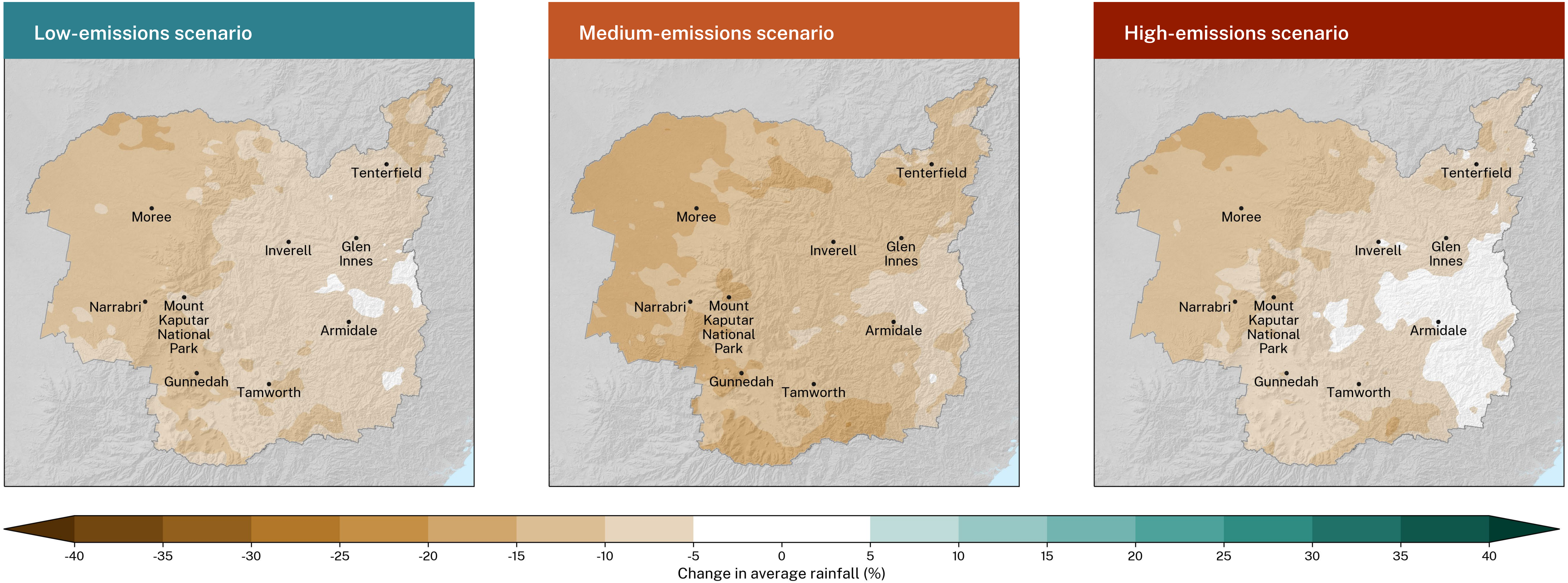


Figure 9. Projected change to average summer rainfall by 2090 for New England and North West

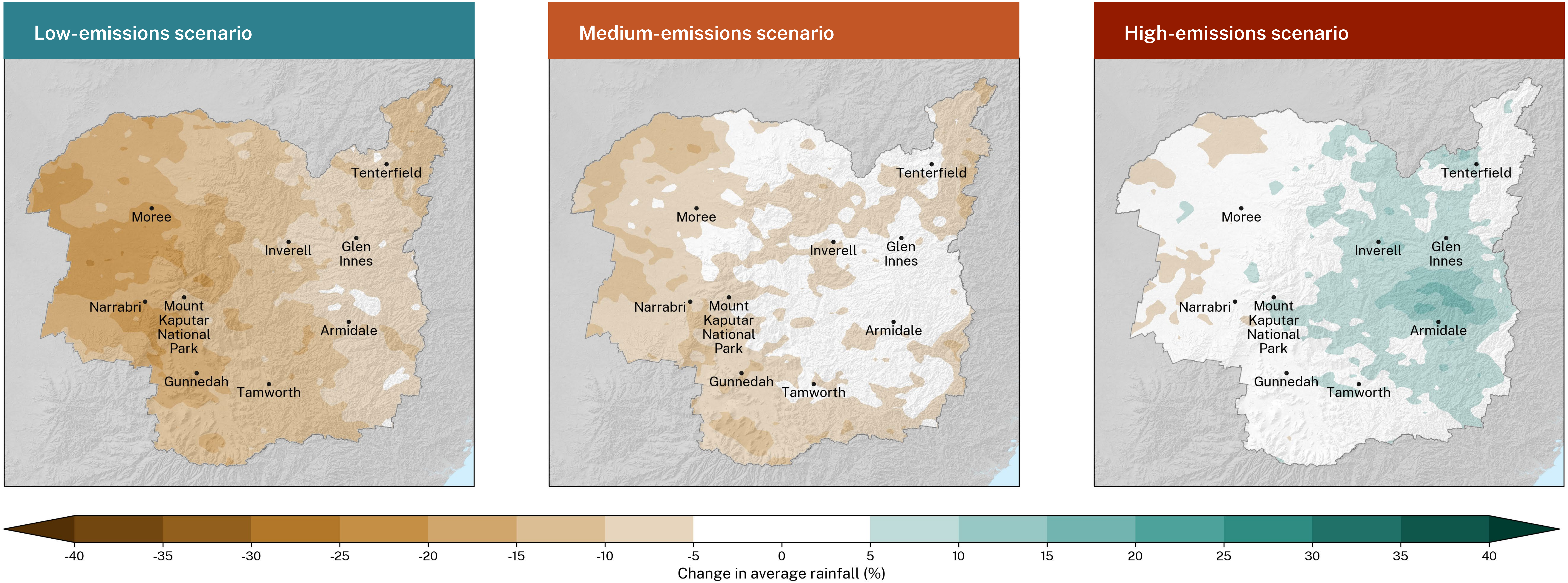


Figure 10. Projected change to average autumn rainfall by 2090 for New England and North West

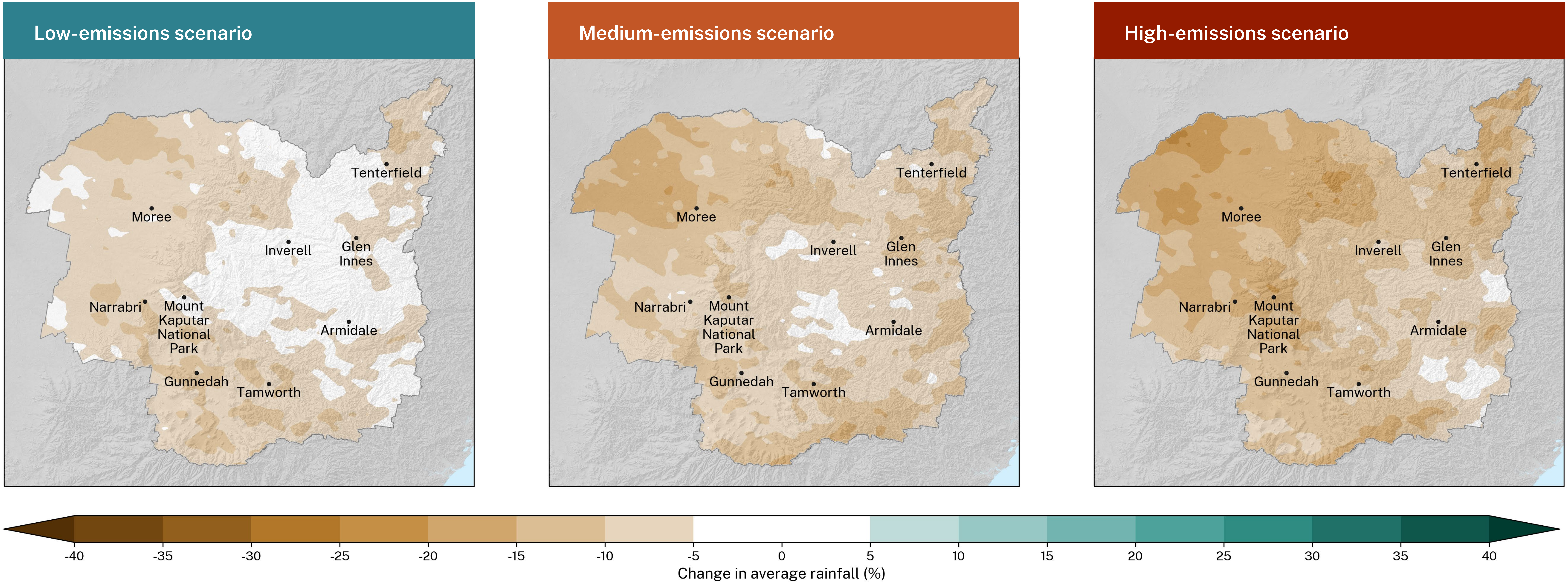


Figure 11. Projected change to average winter rainfall by 2090 for New England and North West

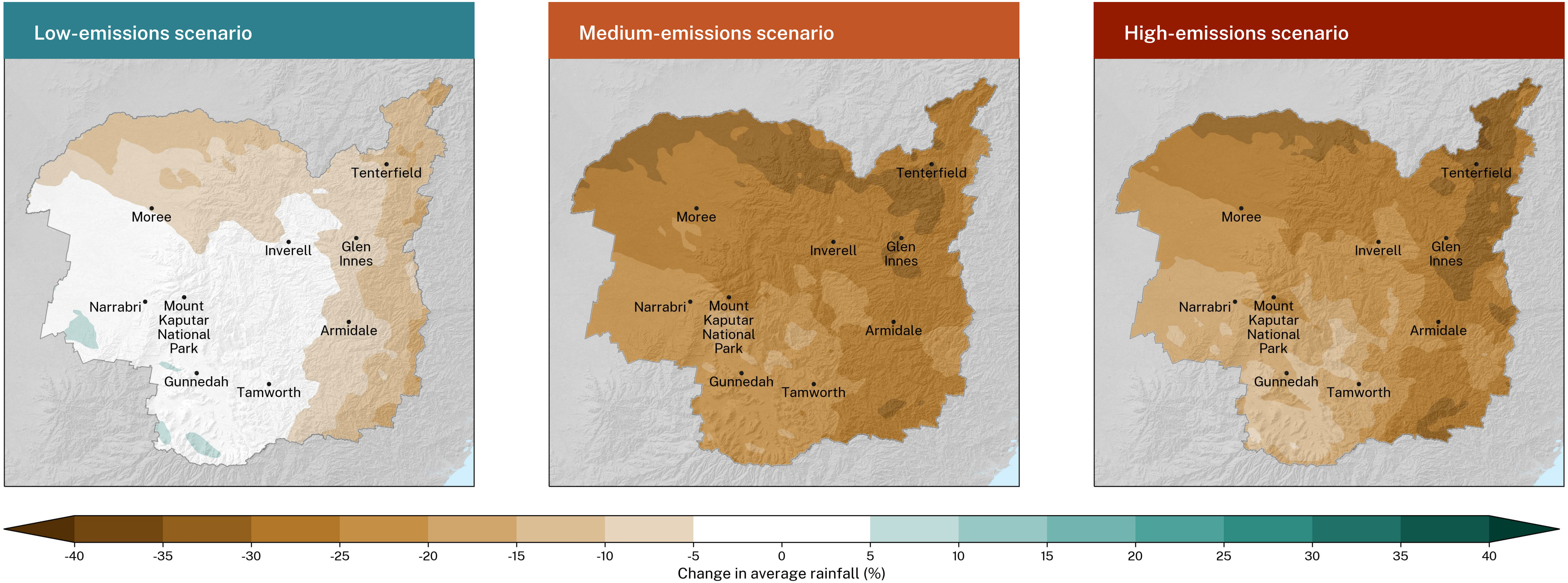
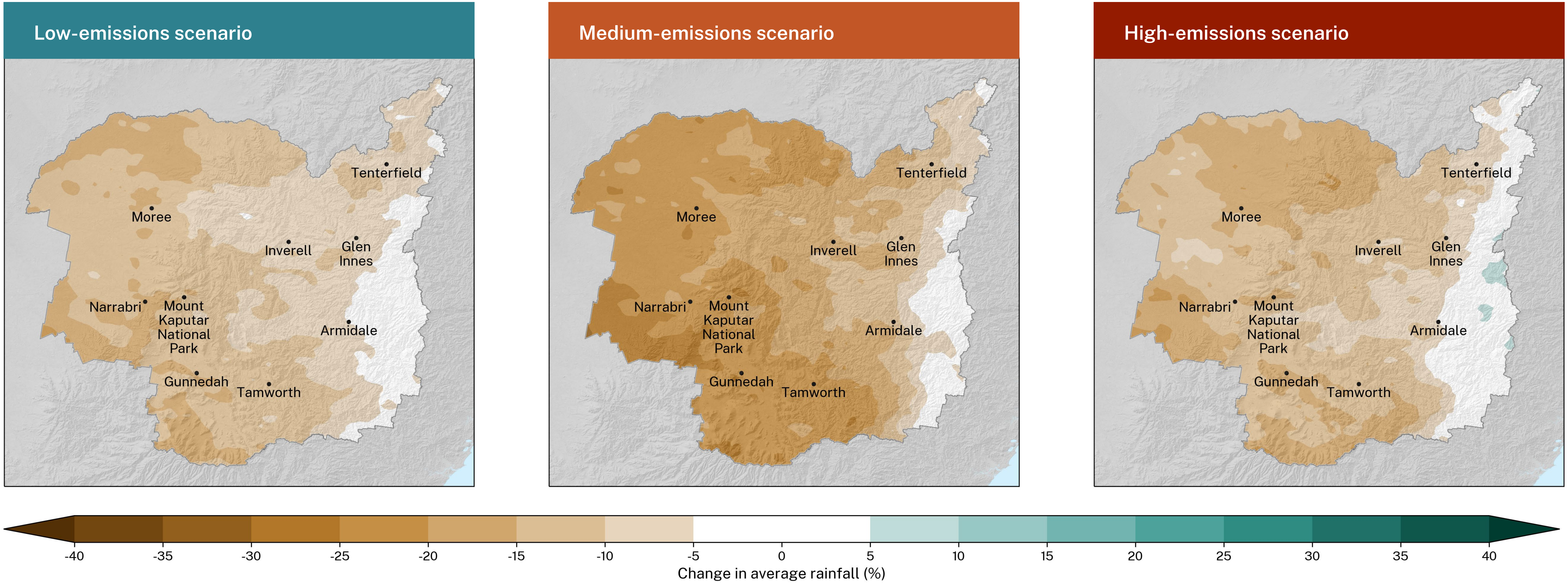


Figure 12. Projected change to average spring rainfall by 2090 for New England and North West



Changes to rainfall

Changes to rainfall and increased temperatures from climate change are expected to have significant impacts on the region. There is the potential for an increased risk of lower median inflows and cease-to-flow periods in key river catchments such as the Namoi and Gwydir rivers.[6,7] The internationally significant Gwydir Wetlands could be impacted by changes to rainfall and increased temperatures, which could cause enhanced evaporation, reductions in available water to plant communities and a reduction in waterbird breeding.[8]

Several years with consistently low water availability would impact the viability of many irrigated agricultural operations and have flow-on impacts to regional towns and their economies.[7]

Changes in water availability affect the wetland inundation patterns that support vegetation. These may cause significant contraction of inland wetlands and change their ecological functions.[14]

Increased rainfall variability, increased evapotranspiration and a shift in seasonal patterns are likely to impact town water supplies, agriculture and internationally significant wetlands in the region.[6,7,8]

Severe fire weather

Severe fire weather will increase

The Forest Fire Danger Index (FFDI) represents an estimate of fire weather risk. The FFDI is calculated from temperature, relative humidity and wind speed, as well as an index representing fuel dryness.

Severe fire weather (FFDI greater than 50) is most likely in summer and spring. Fire weather was the strongest determining factor of house loss during the Black Summer bushfires.[8] FFDI was monitored by weather stations across NSW until the introduction in 2022 of the Australian Fire Danger Rating System. FFDI is used in this snapshot as it can be simulated using the NARCliM projections, whereas data used by the Australian Fire Danger Rating System currently cannot. FFDI also provides a long history of data and gives context to the NARCliM projections.

2x

Under a high-emissions scenario, the number of severe fire weather days per year could more than double across New England and North West by 2090.

Fire weather was the strongest determining factor of house loss during the Black Summer bushfires.[9]

Projections

Across the New England and North West region, the average number of severe fire weather days per year will increase throughout this century (Figure 13).

The number of severe fire weather days will increase for the New England and North West region by 2050 for all emissions scenarios, with an even greater increase projected by 2090 under a medium-emissions scenario and a high-emissions scenario (Table 6). The number of severe fire weather days is projected to increase during spring and summer, with the largest increase in summer.

Increases to severe fire weather days are projected to occur across most of the region (Figure 14). The greatest increases are projected to occur in the west of the region around Moree and Narrabri. Other low-elevation areas including Tamworth and Gunnedah are also projected to experience increases in severe fire weather days. By 2090, Moree is projected to experience 2.0 additional severe fire weather days per year under a low-emissions scenario, 5.0 additional severe fire weather days under a medium-emissions scenario and 5.6 additional severe fire weather days per year under a high-emissions scenario. Both a medium-emissions scenario and a high-emissions scenario are projected to nearly double Moree's baseline period average of 4.6 severe fire weather days per year. Comparatively, in the east of the region, Armidale's baseline period average is 0.1 severe fire weather days per year. By 2090, Armidale is projected to experience 0.1 additional severe fire weather days per year under a low-emissions scenario, 0.4 additional severe fire weather days per year under a medium-emissions scenario and 0.4 additional severe fire weather days per year under a high-emissions scenario.

Table 6 and Figure 13 provide more information on how the projections differ across the 3 scenarios, and Figure 14 provides information on regional differences by 2090 across the 3 scenarios.

Table 6. Projected increase in average annual number of severe fire weather days – New England and North West

2050

Low-emissions	Medium-emissions	High-emissions
1.6 days (0.5 to 3.1 days)	**1.4 days** (–0.3 to 3.4 days)	**2.0 days** (0.0 to 5.9 days)

2090

Low-emissions	Medium-emissions	High-emissions
1.2 days (–0.4 to 3.5 days)	**3.2 days** (0.8 to 7.7 days)	**3.8 days** (1.1 to 9.4 days)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range. Severe fire weather increases are additional to the historical model baseline of 3.6 severe fire weather days.

Figure 13. Historical and projected change in annual number of severe fire weather days – New England and North West

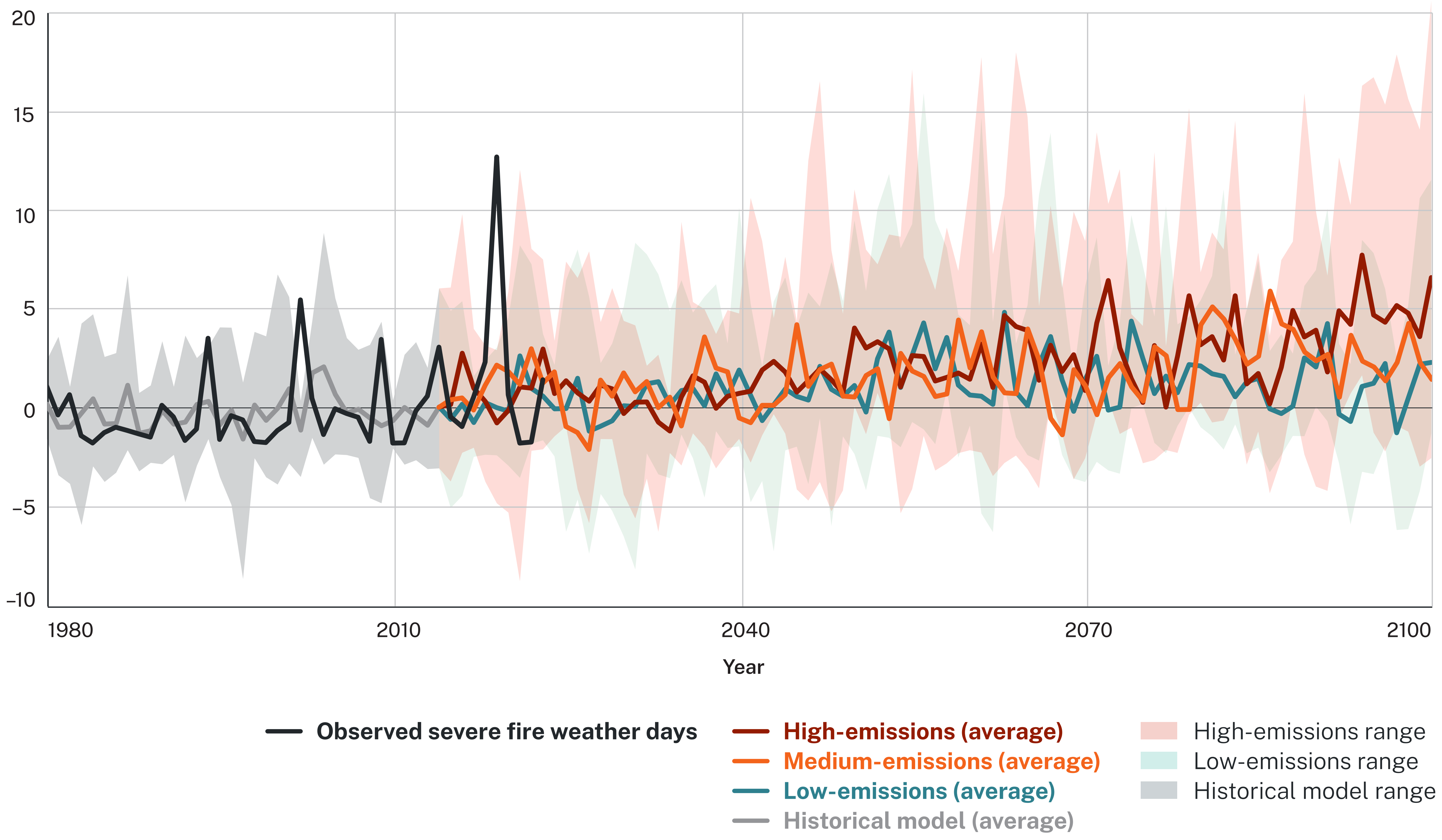
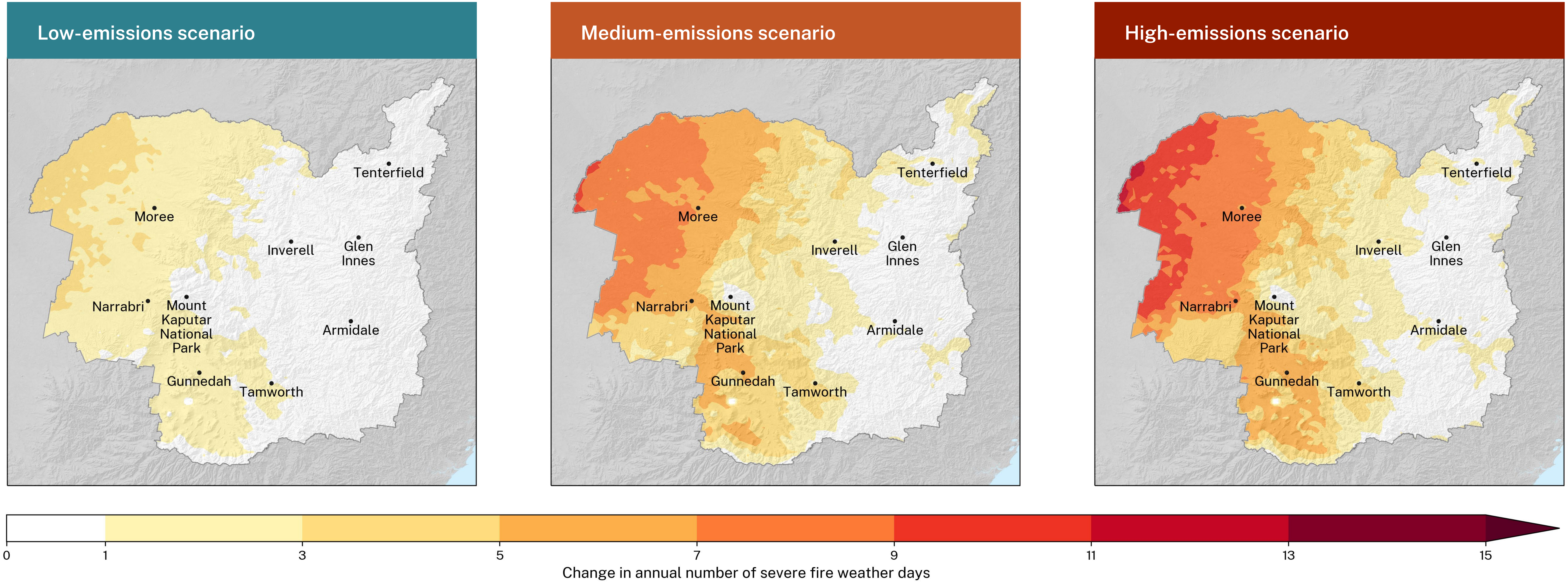


Figure 14. Projected change to average annual number of severe fire weather days by 2090 for New England and North West



Bushfires

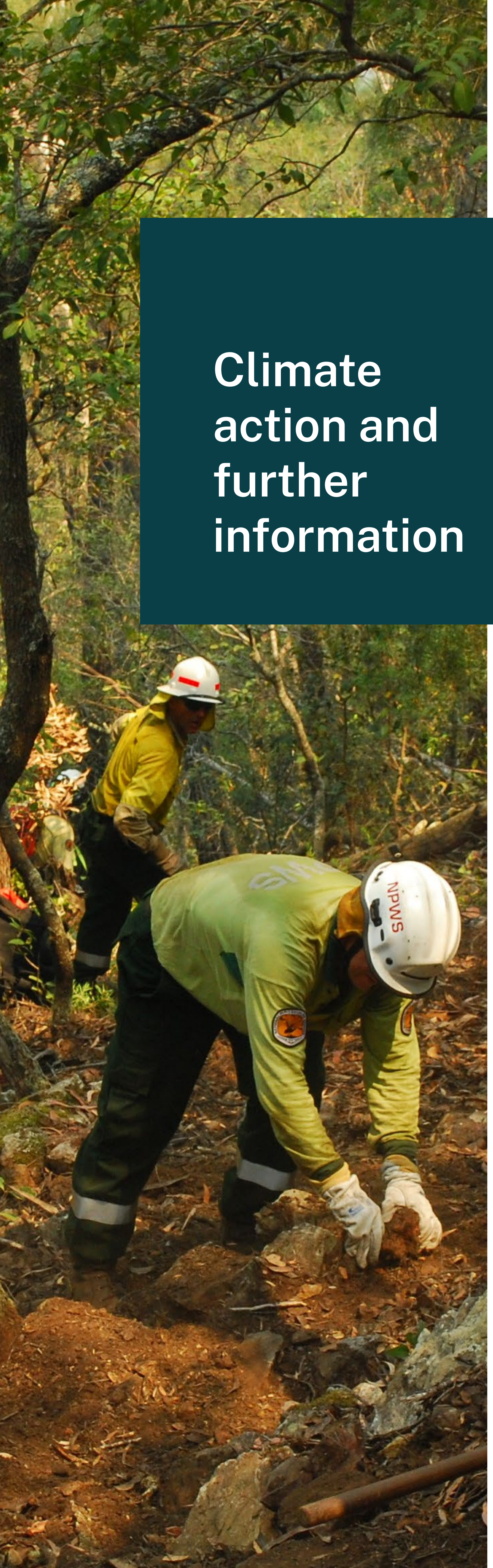
The 2019–20 bushfire season caused extensive damage to communities, infrastructure and natural ecosystems in the New England and North West region. Over 570,000 hectares of the region were burnt and 3,450 buildings were impacted, including 164 homes which were destroyed.[9] Large areas of bushland and some rural areas such as Torrington experienced extreme fire severity. Over 120,000 hectares of NSW national parks listed in the Gondwana Rainforests of Australia World Heritage Area that are entirely or partly within the region were burnt.[10] Approximately 20,000 hectares of Mount Kaputar National Park were also burnt.[11]

Climate change is expected to reduce the interval between fires, increase fire intensity, and shorten the window for safe fire management activities.[12] More frequent fires disrupt ecosystem structure and composition, potentially shifting ecosystems into different states and threatening biodiversity.[13]

Increases to severe fire weather are expected to be greater in the west of the region.

Although bushfires are a natural part of the Australian environment, climate change is increasing the frequency, duration, extent and intensity of 'fire weather' in south-east Australia.[15,16]

The New England and North West, with its extensive areas of bushland, is highly vulnerable to the impacts of increasing number of days of severe fire weather. Severe fire danger days, which create the underlying conditions for large-scale bushfires, are expected to become more common in the future, particularly under a high-emissions scenario.



Climate action and further information

Climate action

The NARCliM projections for the low-, medium- and high-emissions scenarios highlight the stark difference in climate change impacts that will be experienced under each scenario. The differences provide a reminder of the required action across the world to reduce emissions, and specifically within NSW to meet our legislated Net Zero by 2050 emissions reduction targets. This is our best chance at ensuring the future projections under the high-emissions scenario are avoided. The NARCliM projections highlight the importance of taking action to adapt to the impacts of climate change. For more resources on reducing emissions and adapting to the impacts of climate change, visit AdaptNSW.

Additional resources

- For information on other climate change impacts, including sea level rise, visit AdaptNSW
- Climate change resources for local government on AdaptNSW
- Generate detailed climate information based on your local government area using SEED
- Climate Data Portal
- NARCliM case studies
- Climate risk ready NSW guide
- Local government climate change action in NSW: a guide to leadership

Further information

NARCliM projections are delivered with support from: the ACT, South Australian, Victorian and Western Australian governments; National Computational Infrastructure; Murdoch University; and the University of New South Wales. Detailed information on the methodology and application of the projections can be found on the AdaptNSW website. Climate change information in this snapshot is delivered as part of the NSW Government's commitment to 'Publish regularly updated and improved local level climate change projections' under Action 3 of the NSW climate change adaptation strategy.

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