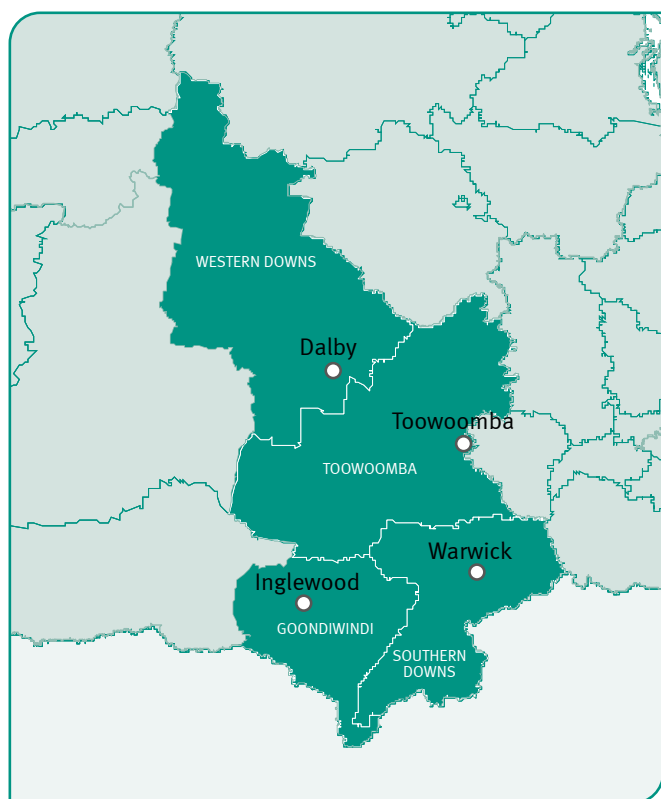


# Climate change in the Eastern Downs region

VERSION 1



UNDERSTAND | ADAPT



## Eastern Downs region snapshot

The Eastern Downs region is located at the headwaters of the Murray–Darling Basin in southern Queensland, and includes the towns of Dalby, Toowoomba and Warwick. It is bordered by New South Wales to the south, Maranoa and District to the west, South East Queensland to the east and Wide Bay–Burnett to the north.

## How will climate change affect the Eastern Downs region?

In the future, the region can expect:



higher temperatures



fewer frosts



hotter and more frequent hot days



less rainfall in winter and spring



harsher fire weather



more intense downpours

## How can we deal with these changes?

Queensland often experiences climate extremes such as floods, droughts, heatwaves and bushfires. Climate change is likely to exacerbate the frequency and severity of these events. We will increasingly be affected by changes in temperature, rainfall, sea level and extreme weather conditions.

It makes sense to take appropriate action to better manage our climate risks. Well-considered and effective adaptation measures can limit the adverse impacts of climate change on communities, the economy and natural systems. We can achieve more if we act together to plan for and manage current and future climate impacts across different sectors and regions.

The Queensland Government is working with a range of stakeholders, using the best available science to address the risks climate change presents to our economy, environment, infrastructure and communities. This publication presents details of the expected changes to temperature and rainfall. It highlights the likely impacts on people, businesses and the environment and presents ways to respond. For more information on climate change in Queensland, visit [www.qld.gov.au/environment/climate/climate-change/resources/science](http://www.qld.gov.au/environment/climate/climate-change/resources/science).



## Looking to the future

### Our current climate

The Eastern Downs region has a temperate climate with hot summers and cool winters (due to elevation). The climate is cooler than the rest of the state.

The average annual temperature is 19°C. The summer average temperature is 25°C, in autumn and spring it is 20°C, and in winter 12°C.

Annual and seasonal average rainfall are variable, affected by local factors such as topography and vegetation, and broader scale weather patterns, such as the El Niño–Southern Oscillation.

Annual average rainfall is 614mm, with much occurring during summer (246mm per year) either as heavy thunderstorms or from tropical rain depressions.

The region's annual average potential evaporation is more than twice the annual average rainfall, which contributes to the depletion of soil moisture.

However, the climate is changing across Queensland.

Average temperatures across the state are currently 1°C higher than they were 100 years ago. Recent decades have shown a clear warming trend. Our climate is already highly variable but climate change is leading to shifts beyond this natural variability.

### Our future climate

Our climate is changing primarily because increasing amounts of greenhouse gases in the atmosphere are trapping heat, warming the air and oceans.

To determine what our future climate might be, scientists use global climate models to simulate the Earth's climate system. The models use a set of mathematical formulae that describe the physical processes of the atmosphere, ocean, land and ice.

Population, the economy, policy decisions and technology will all affect future emissions of greenhouse gases. We don't know exactly what these effects will be, so to cover a range of possibilities, scientists use emissions scenarios called representative concentration pathways (RCPs) to develop climate projections. These projections describe a lower emissions future, where greenhouse gas emissions are substantially reduced (using a scenario termed RCP4.5), and a high emissions future, where high levels of greenhouse gas emissions are set to continue (using a scenario termed RCP8.5).

The projections in this summary are given for 20-year periods centred on 2030 and 2070. The 2030 high and low emissions scenarios are so similar that only the high

emissions scenario has been used in this publication. Projections are represented as a change relative to the average for the period 1986–2005.

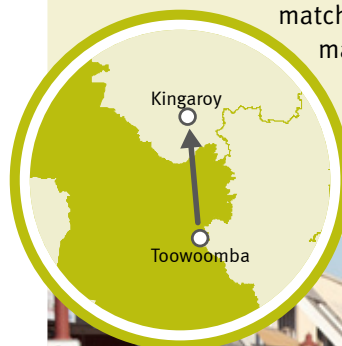
For example, in 2070 under a high emissions scenario, temperature in the Eastern Downs region is projected to rise by 2.9°C (2.0 to 3.8°C). In this case, the middle temperature rise determined by all the models is 2.9°C. The range is between 2.0°C and 3.8°C, meaning 95% of model results indicated a rise of at least 2.0°C and 95% of the model results indicated a rise of 3.8°C or less.

The Queensland Climate Transition Strategy outlines how we will transition to a zero net emissions future that supports jobs, industries, communities and the environment. Find the strategy at [www.qld.gov.au/environment/climate/climate-change/response](http://www.qld.gov.au/environment/climate/climate-change/response).

### Toowoomba 2030

In 2030, under a high emissions scenario, the climate of Toowoomba will be more like the current climate of Kingaroy.

To find out what the future climate will be like where you live, use the climate analogues tool on the Climate Change in Australia website at [www.climatechangeinaustralia.gov.au](http://www.climatechangeinaustralia.gov.au). The tool matches projected rainfall and maximum temperature with the current climate experienced in another location for the years 2030, 2050 and 2090.



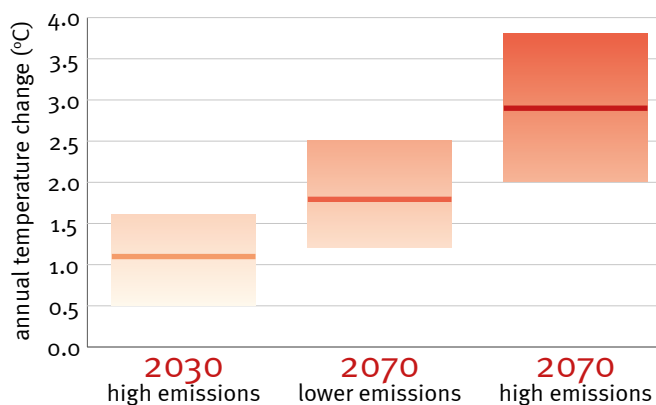
# Climate projections for Eastern Downs



## Higher temperatures

Maximum, minimum and average temperatures are projected to continue to rise. For the near future (2030), the annually averaged warming is projected to be between 0.5 and 1.6°C above the climate of 1986–2005. By 2070, the projected range of warming is 1.2 to 3.8°C, depending on future emissions.

The region's summer average temperature is 25°C. This could rise to over 26°C by 2030 and to over 28°C by 2070.



Projected annual average temperature changes for the Eastern Downs region. The horizontal line on each bar is the middle (median) projected temperature change. The extent of each bar indicates the range of projected changes.



## Hotter and more frequent hot days

There is likely to be a substantial increase in the temperature reached on the hottest days, and an increase in the frequency of hot days and the duration of warm spells.



## Fewer frosts

A substantial decrease in the frequency of frost risk days is projected by the end of the century.



## Harsher fire weather

Fire weather is a measure of fuel dryness and hot, dry, windy conditions. Climate change is likely to result in harsher fire weather in the future.

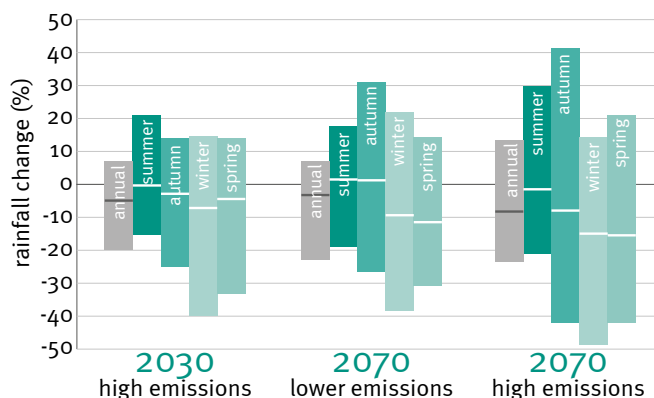


## Less rainfall in winter and spring

High climate variability is likely to remain the major factor influencing rainfall changes in the next few decades.

Decreases in winter and spring rainfall are projected by 2070. However, high variability will continue.

The intensity of heavy rainfall events is likely to increase.



Projected annual and seasonal rainfall changes for the Eastern Downs region. The horizontal line on each bar is the middle (median) projected rainfall change. The extent of the bar indicates the range of projected changes.



## Changes to drought are less clear

Projecting changes in the frequency and duration of drought is difficult. However, by late this century, under a high emissions scenario, it is likely that the region will experience more time in drought.

Climate change projections are based on Climate Change in Australia data from CSIRO and the Bureau of Meteorology. More detailed information on these and other climate variables is available at [www.qld.gov.au/environment/climate/climate-change/resources/science](http://www.qld.gov.au/environment/climate/climate-change/resources/science).



# Climate risks, impacts and responses

The range of likely changes to Queensland's climate in the coming years and decades presents opportunities and risks. Extensive work is being done to identify the likely impacts, sector by sector, and how best to respond to them.

Sector	Climate risks ↑ = increase, ↓ = decrease	Impacts	Potential responses
	<ul style="list-style-type: none"> <li>↑ storm intensity</li> <li>↑ fire weather</li> <li>↑ heatwaves</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and infrastructure damage from extreme rainfall events</li> <li>Increased maintenance costs</li> <li>Increased disruption to services</li> </ul>	<ul style="list-style-type: none"> <li>Consider future climate, bushfire and flood risk when locating and constructing new developments and infrastructure</li> <li>Increase road heights</li> <li>Insure public assets</li> </ul>
	<ul style="list-style-type: none"> <li>↑ temperature</li> <li>↑ storm events</li> <li>↑ fire weather</li> </ul>	<ul style="list-style-type: none"> <li>Increased threats to tourism infrastructure</li> <li>Damage to popular environmental sites</li> <li>Risks to tourists unfamiliar with conditions</li> </ul>	<ul style="list-style-type: none"> <li>Consider climate risks in emergency planning for tourist sites</li> <li>Adopt appropriate cancellation policies for extreme weather</li> <li>Prepare for changing seasonal demand</li> </ul>
	<ul style="list-style-type: none"> <li>↑ inundation and flooding</li> <li>↑ fire weather</li> <li>↑ heatwaves</li> </ul>	<ul style="list-style-type: none"> <li>Disruption to supply chains</li> <li>Disruption to workplaces and infrastructure</li> <li>Loss of customers during emergency recovery</li> </ul>	<ul style="list-style-type: none"> <li>Business continuity planning</li> <li>Shift critical infrastructure out of hazard zones</li> <li>Enable flexible working arrangements</li> <li>Diversify customer base and products</li> </ul>
	<ul style="list-style-type: none"> <li>↑ temperature</li> <li>↑ hot days</li> <li>↑ fire weather</li> <li>↓ rainfall</li> <li>↑ drought risk</li> </ul>	<ul style="list-style-type: none"> <li>Changed distribution of pests and diseases</li> <li>Heat stress on livestock and crops</li> <li>Farms affected by bushfire</li> <li>Reduced water security</li> </ul>	<ul style="list-style-type: none"> <li>Consider diversifying outputs or business</li> <li>Consider different crop varieties and sowing times</li> <li>Improve water efficiency</li> </ul>
	<ul style="list-style-type: none"> <li>↑ fire weather</li> <li>↑ temperature</li> <li>↓ rainfall</li> <li>↑ drought risk</li> </ul>	<ul style="list-style-type: none"> <li>Existing threats to flora and fauna are exacerbated</li> <li>Changes to habitat</li> <li>Altered disturbance regimes</li> <li>Changing dynamics of invasive species</li> </ul>	<ul style="list-style-type: none"> <li>Develop strategies to respond to new and emerging diseases and pests</li> <li>Increase green urban infrastructure and urban biodiversity</li> <li>Link habitats to allow species to move</li> <li>Consider moving selected populations to new areas</li> </ul>
	<ul style="list-style-type: none"> <li>↑ heatwaves</li> <li>↑ fire weather</li> </ul>	<ul style="list-style-type: none"> <li>More stress on health and emergency services</li> <li>More heat-related deaths, particularly among the elderly and disadvantaged</li> <li>Mental health effects</li> <li>Changes in disease occurrence</li> </ul>	<ul style="list-style-type: none"> <li>Use existing social networks to support vulnerable community members</li> <li>Implement rural mental health care programs</li> <li>Consider climate risks when developing emergency planning for schools, hospitals, services</li> <li>Increase green spaces and cool zones for heat stress</li> </ul>
	<ul style="list-style-type: none"> <li>↑ inundation and flooding</li> <li>↑ fire weather</li> <li>↑ heatwaves</li> <li>↑ rainfall intensity</li> </ul>	<ul style="list-style-type: none"> <li>Increased fire season duration and fire intensity will affect urban fringe communities</li> <li>Increased storm intensity will increase flooding risk</li> </ul>	<ul style="list-style-type: none"> <li>Improve bushfire safety standards for urban development</li> <li>Increase focus on community preparedness and prevention</li> <li>Update risk management standards to account for increased risk from climate change</li> </ul>



# Adapting to climate change

Queensland's environment, economy and communities are already experiencing the impacts from a changing climate. The development of a Queensland Climate Adaptation Strategy will assist government, businesses and communities to manage and respond to our changing climate.



## Human settlements and infrastructure

Toowoomba is the largest city and commercial centre of the region, with a population of approximately 165,000. Other major town centres are Warwick and Dalby.

Flooding, due to more intense extreme storms, could affect water, sewerage, stormwater, transport and communications infrastructure. Flash flooding and wind damage could exacerbate these impacts. This may increase the cost of insurance to business and the community.

Increased bushfire risk will threaten infrastructure, homes and agricultural industries.

Increased extent and frequency of drought will affect water supplies for towns and communities.

### Adaptation measures

- Consider how to adapt existing homes and communities to deal with projected inundation.
- Plan for new developments and infrastructure to take into account climate impacts and extreme events such as flooding and bushfires.



## Tourism

The region offers a diversity of national parks (such as Girraween and Sundown National Parks), the Granite Belt wineries and historical sites.

Increases in temperature could extend the season when the region is attractive to visitors. This will need to be balanced against increased bushfire and flooding risk which may threaten tourism infrastructure and damage popular environmental sites. The increased risks to tourists unfamiliar with these conditions will need to be managed.

### Adaptation measures

- Consider climate risks in emergency planning for tourist sites.
- Adopt appropriate cancellation policies for extreme weather.
- Prepare for changing seasonal demand.

**'Ready Set Go'** is a smartphone app designed to assist tourism operators prepare for the impacts of extreme weather events, such as floods and cyclones. The app has been developed by the Queensland Tourism Industry Council, EC3 Global and National Centre for Studies in Travel and Tourism. For more information visit [www.apple.com/au/itunes](http://www.apple.com/au/itunes) and <http://play.google.com>.





## Business and industry

The region has a prosperous mining industry with coal and natural gas in the Surat Basin, and greater Dalby and Chinchilla areas which have assisted in the development of the region's energy resources. Other industries include metal and machinery manufacturing and food processing.

Increased frequency of flooding and inundation, bushfires and heatwaves may disrupt supply chains, make it difficult for staff to get to work and prevent customers from accessing services and products. Extreme events may also damage workplaces, equipment and facilities, especially if the businesses are unprepared. This may increase the cost of insurance.

Flooding can affect contaminated water storage requiring additional security and protection measures. Conversely, reduced water availability for minerals processing and mine operations may create competition for water resources with other users, such as communities, farmers and natural processes.

Businesses who are prepared will be able to ensure continuity of supply to their clients during/following a disruptive event. Investment in infrastructure, insurance and risk planning will increase as businesses prepare for the impacts.

### Adaptation measures

- Undertake business continuity planning accounting for likely increases in extreme weather and events.
- Shift critical infrastructure out of hazard zones.
- Enable flexible working arrangements.
- Diversify customer base and products.



## Agriculture

Agriculture is the most significant sector in the Eastern Downs region. The major agricultural industries are cropping (wheat, sorghum, barley and cotton), horticulture (including the apple and grape growing regions near Stanthorpe) and grazing (22% of state production) and related activities such as feed lots, abattoirs and processing plants. There is significant sheep grazing, cattle farming and dairying.

Increased temperatures may damage crops, stress livestock and cause difficulties in supplying sufficient water to meet demand. Conditions may increase plant diseases, weeds and pests, and allow movement southwards into areas where they are currently excluded. Lower rainfall and increasing evaporation will cause more frequent depletion of soil moisture, reduced ground cover and lower livestock carrying capacity.

### Adaptation measures

- Manage climate variability and change by using forecasts of rainfall (and temperature) in decision-making about crops and planting times.
- Monitor the spread of pests, weeds and disease.

The Managing Climate Variability program has developed **CliMate**, designed for producers who seek to understand recent weather and probabilities of future weather events. The tool uses weather data, statistics and forecasts with farming system information, such as soil water and heat sum. It is available at [www.australianclimate.net.au](http://www.australianclimate.net.au).





## Biodiversity and iconic ecosystems

The Brigalow Belt is the largest bioregion in Queensland and is rich in species, including many plants and animals with small ranges. The outstanding feature of the New England Tablelands is the Granite Belt, an elevated rocky plateau that has long served as a refuge for plants and animals.

For further information on Queensland's bioregions see [www.qld.gov.au/environment/plants-animals/plants/ecosystems/framework/](http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/framework/).

Increased warming and extended drought periods will significantly threaten species in the Brigalow Belt with small ranges and limited ability to migrate.

In the rangelands ecosystems more frequent and severe droughts would be detrimental to ground cover and possibly grassland composition. Increased deep soil cracking with more frequent or intense droughts may particularly affect perennial grasses.

### Adaptation measures

- Undertake weed management and rehabilitation of native plant species, including community education.
- Place restrictions on weedy plants grown and sold.
- Increase conservation of forests on fertile soil for koalas, sugar gliders and other foliage-feeding fauna.

**NatureAssist** targets properties that have significant conservation values, connectivity and predicted resilience to a changing climate for protection. Landholders are able to work with the Department of Environment and Heritage Protection to voluntarily secure their properties under a Nature Refuge Agreement, and employ targeted conservation actions to enhance the properties' resilience. Further information is available at [www.des.qld.gov.au](http://www.des.qld.gov.au).



## Human health

Higher temperatures and more hot days could result in heat exhaustion and increased mortality among vulnerable people, including the very young and old. People in locations that have not regularly experienced such high temperatures may struggle to adapt to these conditions.

Increases in extreme events can lead to increased pressure on health systems, including an increased demand for health professionals, ambulance and hospital workers. Many parts of the country already find it difficult to recruit dedicated health care and social service professionals.

Rural, regional and remote communities are particularly exposed in a deteriorating climate. Climate change compounds the chronic difficulties and inequities that already face many communities.

The emotional and psychological toll of disasters can linger for months, even years, affecting whole families, the capacity for people to work and the wellbeing of the community.

### Adaptation measures

- Develop agreements with workers on how to manage extreme hot days.
- Clearly identify public cool zones or shaded areas for the community.
- Develop social support networks.

The **Queensland Government** addresses the impact of hotter days on school children by providing guidelines on managing excessive heat in schools. There are clear indicators of when children need to be protected from excessive heat, and strategies to ensure their safety, such as limiting physical activity and sporting events during the hottest part of the day. There is more information at [www.education.qld.gov.au](http://www.education.qld.gov.au).







## Emergency services

Over the past few decades there have been significant bushfires and flooding events, the most notable being the floods of 2011.

Higher temperatures and longer dry seasons will increase bushfire risk, particularly for urban fringe communities where natural ecosystems abut houses and businesses. Increases in storm intensity will see a higher risk of flooding throughout the region.

## Adaptation measures

- Improve bushfire safety standards for urban development.
- Increased focus on community preparedness.
- Update risk management standards to account for increased risk from climate change.

**MetEYE**, a map of weather observations and official forecasts produced by the Bureau of Meteorology, can increase community preparedness by providing forewarning of extreme weather events such as heatwaves, cyclones and flooding rain. This service provides seven-day forecasting of many climate variables including temperature, wind, rain, humidity, frost and snow. See [www.bom.gov.au/australia/meteye/](http://www.bom.gov.au/australia/meteye/).

## What's happening in your region?

The Queensland Government is interested to know what innovative climate adaptation initiatives are happening in your region. You can share this information by emailing [adaptation@des.qld.gov.au](mailto:adaptation@des.qld.gov.au).

## Queensland climate change resources

To find out more about the Queensland Government's policy response to climate change, including commitments to reduce emissions and adapt to our changing climate, visit [www.qld.gov.au/environment/climate/about-climate-change](http://www.qld.gov.au/environment/climate/about-climate-change).

The Bureau of Meteorology website provides access to weather forecasts, severe weather warnings, observations, flood information, marine and high seas forecasts and climate information at [www.bom.gov.au](http://www.bom.gov.au).

Climate outlooks are available from the LongPaddock website at [www.longpaddock.qld.gov.au](http://www.longpaddock.qld.gov.au).

Information about the projected future climate and its impacts is available from the Queensland Future Climate Dashboard at [www.qld.gov.au/FutureClimateDashboard](http://www.qld.gov.au/FutureClimateDashboard).

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