

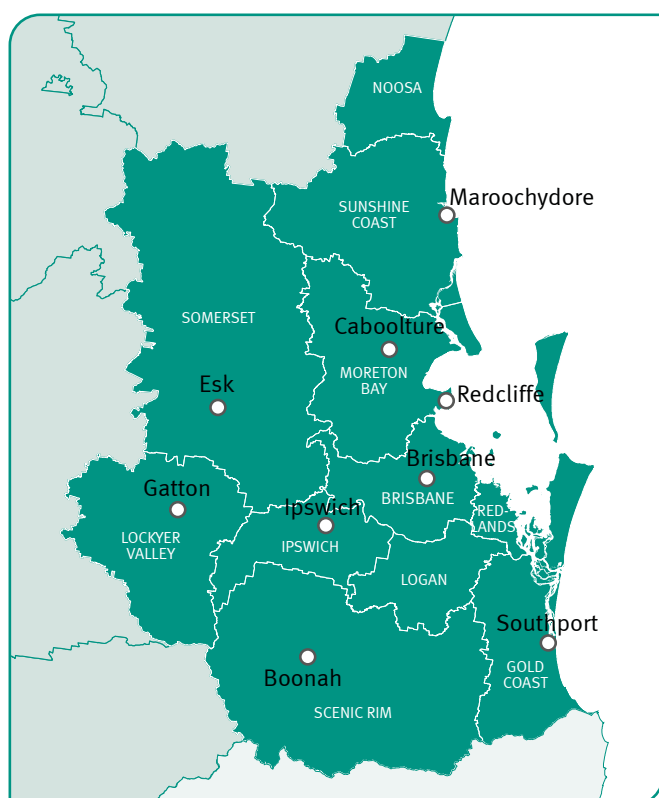
# Climate change

## in the South East Queensland region

VERSION 1



UNDERSTAND | ADAPT



### South East Queensland region snapshot

South East Queensland is a diverse region stretching from Noosa Heads in the north to Coolangatta in the south and west to Toowoomba. This is one of Australia's largest and fastest growing urban regions. It is heavily urbanised, with the population concentrated along the coast.

The population is about 3.3 million, representing 70% of the state's population in just 1.3% of the state's total area.

### How will climate change affect the South East Queensland region?

In the future, the region can expect:



temperatures to continue to increase year-round



hotter and more frequent hot days



harsher fire weather



fewer frosts



reduced rainfall



more intense downpours



rising sea level



more frequent sea-level extremes



warmer and more acidic seas

### 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, rainfall and the sea. 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 South East Queensland region has a sub-tropical climate influenced by tropical systems from the north and fluctuations in the high pressure ridge to the south.

The average annual temperature is 19°C. Summer average temperature is 24°C, in autumn and spring it is 20°C, and in winter 14°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. Most rainfall occurs in summer and autumn (388mm and 295mm per year, respectively).

The region's annual average potential evaporation is almost 50% greater than 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 South East Queensland region is projected to rise by 2.6°C (1.9 to 3.3°C). In this case, the middle temperature rise determined by all the models is 2.6°C; 95% of model results indicated a rise of at least 1.9°C and 95% of the model results indicated a rise of 3.3°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).

## Brisbane 2030

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

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.



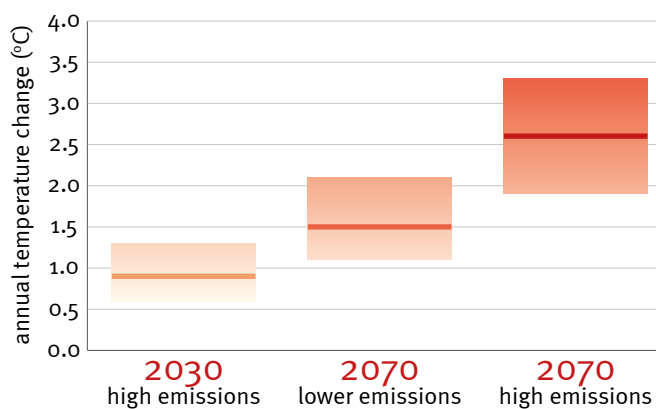
# Climate projections for South East Queensland



## 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 0.6 and 1.3°C above the climate of 1986–2005. By the year 2070, the projected range of warming is 1.1 to 3.3°C, depending on future emissions.

The region's current summer average temperature is 24°C. This could rise to over 25°C by 2030 and to over 27°C by 2070.



Projected annual average temperature changes for the South East Queensland 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.

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).

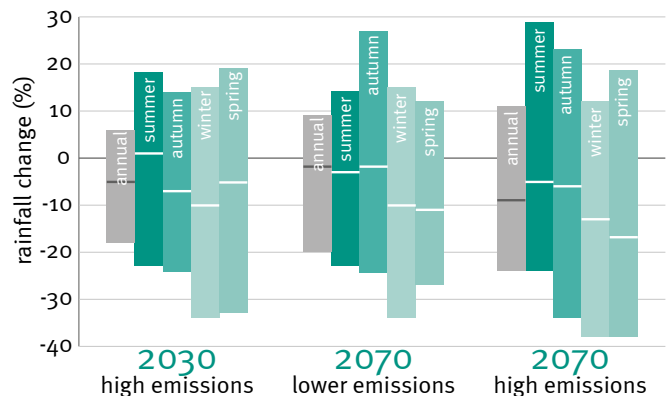


## Natural climate variability will dominate rainfall patterns

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

By 2070, projections of total rainfall show little change or a decrease, particularly in winter and spring. Rainfall is naturally highly variable and this will continue to be a major factor in the next decade.

However, the intensity of heavy rainfall events is likely to increase.



Projected annual and seasonal rainfall changes for the South East Queensland 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

By late this century, under a high emissions scenario, it is likely that the region will experience more time in drought.



## Sea level will continue to rise

Sea level is projected to rise by 0.8m above present day levels by 2100.



## More frequent sea-level extremes

Higher sea levels will increase the risks of coastal hazards such as storm tide inundation.



## Warmer and more acidic ocean

Sea surface temperature has risen significantly across the globe over recent decades and warming is projected to continue.

The ocean will become more acidic due to dissolved carbon dioxide, with acidification proportional to emissions growth.



# 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>↑ sea level</li> <li>↑ fire weather</li> <li>↑ heatwaves</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and infrastructure damage along the coastline</li> <li>Increased maintenance costs</li> <li>Increased disruption to services</li> <li>Increased energy and water usage</li> </ul>	<ul style="list-style-type: none"> <li>Consider future climate and sea-level rise when locating and constructing new developments and infrastructure</li> <li>Increase road heights</li> <li>Insure public assets</li> <li>Design buildings to accommodate changing climate</li> </ul>
	<ul style="list-style-type: none"> <li>↑ temperature</li> <li>↑ fire weather</li> <li>↑ sea level</li> <li>↑ sea temperature</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> <li>↑ tropical cyclone intensity</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> <li>Increased costs (e.g. energy for cooling people or products)</li> </ul>	<ul style="list-style-type: none"> <li>Business continuity planning</li> <li>Shifting 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>↑ sea temperature</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>↑ sea level</li> <li>↑ fire weather</li> <li>↑ temperature</li> <li>↑ ocean acidification</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 vulnerable populations to new areas</li> </ul>
	<ul style="list-style-type: none"> <li>↑ heatwaves</li> <li>↑ fire weather</li> <li>↑ solar radiation</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>Undertake 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 sea level and storm intensity will affect coastal communities and increase inland 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

With the majority of the state's population located in the region, there is extensive existing infrastructure providing water, power, communications and transport services. Climate change impacts, including rising sea levels, increased risk of storm tide inundation, coastal flooding and increased coastal erosion are likely to affect property and infrastructure along the highly developed coast.

Low-lying coastal communities will be at risk of inundation from sea-level rise. Coastal inundation and erosion events caused by storm tides could become more frequent, resulting in high clean-up, recovery and asset maintenance costs.

Flooding, due to more intense extreme storms, could affect infrastructure such as water, sewerage, storm water, transport and communications. The riskiest areas are those closest to the coast, where there can be flash flooding and wind damage affecting industry, infrastructure and roads. This may increase the cost of insurance to business and the community. Inland areas are likely to face increased bushfire risk.

The rapid population growth of South East Queensland combined with any reductions in rainfall will make the long-term adequacy of water supplies especially challenging.

## Adaptation measures

- Consider how to adapt existing homes and communities to deal with projected inundation from sea-level rise and storm tide inundation.
- Plan for new developments and infrastructure to take into account climate impacts and extreme events such as flooding, tropical cyclones and sea-level rise.
- Develop a Coastal Hazard Adaptation Plan.

**Local councils** throughout South East Queensland have released interactive flood awareness mapping to identify the flood risk to each property, including helpful guides to help residents prepare for and respond to floods. Further information is available on your local council's website.

## Tourism

The region contains world-class tourism attractions. There is much to offer visitors with diverse natural assets such as warm sandy beaches and sub-tropical rainforests, and many built attractions including theme parks.

Tourism in South East Queensland contributes more than \$3.7 billion each year to Queensland's economy and directly employs more than 61,000 people. The number of international visitors is growing by almost 8% a year. Protecting the ecologically rich wilderness and natural attractions of the region is an important focus of sustainable tourism development.

Increases in temperature will potentially extend the season when the region is attractive to visitors. This will need to be balanced against increased bushfire risk 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.
- 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 is the powerhouse of the state's economy. Key industries include retail services, property and business services, health and community services, construction and agriculture, food and fisheries.

Climate change will potentially cause increased disruption to businesses and industry. 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. Higher temperatures may increase energy use and costs associated with cooling personnel or refrigerating products. Extreme events may also damage workplaces, equipment and facilities, especially if the businesses are unprepared.

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

The majority of South East Queensland's agricultural area is used for grazing of beef cattle, with some dairy farming located on productive grazing land. The rich alluvial soils along the valleys in the west and south of the region, including the Brisbane, Lockyer, Fassifern and Albert-Logan valleys, support a vast array of cropping industries. Close to the coast, horticulture and cropping industries thrive in the Gold Coast, Redlands and Sunshine Coast districts.

Increased temperatures may lead to heat damage to horticultural crops, difficulties in accessing sufficient water to meet demand, and stress on livestock. Conditions may lead to changes in plant diseases, weeds and pests. Lower rainfall and increasing evaporation will cause more frequent depletion of soil moisture, reduced ground cover and lower livestock carrying capacity.

There will be increased risk of storm damage and erosion, leading to greater nutrient runoff and loss of soil.

### 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.
- Provide more cooling mechanisms for livestock, such as shade and sprays.
- Investigate new crops or production systems better suited to expected climate conditions.
- Develop programs to restore and protect fish habitats, breeding grounds, nursery habitats and fish refugia.

The Queensland Government's **LongPaddock** website provides climate information, seasonal forecasts and a range of decision support tools to assist producers to improve their climate risk management. Visit [www.longpaddock.qld.gov.au](http://www.longpaddock.qld.gov.au).





## Biodiversity and iconic ecosystems

The South East Queensland region is rich in biodiversity with many species vulnerable to a changing climate, including some that reach their northern limits on mountains and plateaus, and some with small or fragmented populations. A warming climate may see some of these species disappear from the region as their ranges contract towards the south. Species endemic to the region include the satinay sand skink, the amorous skink, the Nangur spiny skink and the Australian lung fish. Wallum vegetation found on the coastal sand marshes is also rich in endemic plants and animals such as crustaceans, insects, fish, frogs and reptiles. The region is rich in eucalypts.

Significant environmental features of the region include the Gondwana Rainforests of the Australia World Heritage Area within the Gold Coast and Scenic Rim local government areas and the Moreton Bay Marine Park, which includes a Ramsar wetlands site of international significance.

Warming seas and increased storm tide inundation may harm coastal ecosystems, which have important recreation and biodiversity values.

### Adaptation measures

- Undertake weed management and rehabilitation of native 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.
- Consider future climate condition in planning the conservation estate.

The Queensland Government, in partnership with local government and the community, is committed to maintaining and enhancing the **Flinders Karawatha Corridor**, which is the largest stretch of open eucalypt forest in South East Queensland and is known refuge for threatened species under climate change. See [www.ehp.qld.gov.au/management/planning-guidelines/flinders-karawatha](http://www.ehp.qld.gov.au/management/planning-guidelines/flinders-karawatha).



## Human health

Higher temperatures and more hot days above 35°C could result in significant health impacts such as 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.

Rural, regional and remote communities are particularly sensitive to a changing climate, compounding existing difficulties and inequities. A changing climate will also increase the demand for social support, health and mental health services.

### 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.
- Use existing social networks to support vulnerable community members.
- Consider climate risks when developing emergency plans for schools, hospitals and services.
- Increase green spaces and cool zones to manage heat stress.





## Emergency services

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

The projected higher temperatures and longer dry seasons will increase bushfire risk, particularly for urban fringe communities where natural ecosystems abut houses and businesses.

Projected increases in storm intensity and sea-level rise will see a higher risk of flooding and inundation throughout the region, particularly for coastal communities.

## Adaptation measures

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

**Brisbane City Council** provides free early warning alerts for Brisbane residents and visitors. The alert service provides advance warning of a weather event to help prepare and protect people and property. The alerts are location-based, and provide warnings when a nominated address may be impacted by hail, severe thunderstorms, destructive winds and cyclones, or floods.

## 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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