

# Climate change

in the Whitsunday, Hinterland and Mackay region

VERSION 1



UNDERSTAND | ADAPT



## Whitsunday, Hinterland and Mackay region snapshot

Centrally located on the Queensland coastline, the Whitsunday, Hinterland and Mackay region occupies around 5% of the state's area and extends from the Styx River in the south to Cape Upstart in the north, and west beyond the Gregory Highway. The region is home to approximately 4% of the state's population, the majority living on the coastal plain between Bowen and Sarina.

## How will climate change affect the Whitsunday, Hinterland and Mackay region?

In the future, the region can expect:



higher temperatures



rising sea level



hotter and more frequent hot days



more frequent sea-level extremes



more intense downpours



warmer and more acidic seas



less frequent but more intense tropical cyclones

## 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

Summers are generally hot and wet, while the coast has the benefit of regular afternoon sea breezes. The tropical cyclone season is from December to April. The average annual temperature is 22°C. The summer average is 27°C, and in winter it is 17°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.

The annual average rainfall is 689mm, occurring predominantly between November and April.

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 Whitsunday, Hinterland and Mackay region is projected to rise by 2.7°C (1.8 to 3.6°C). In this case, the middle temperature rise determined by all the models is 2.7°C. The range is between 1.8°C and 3.6°C, meaning 95% of model results indicated a rise of at least 1.8°C and 95% of the model results indicated a rise of 3.6°C or less.

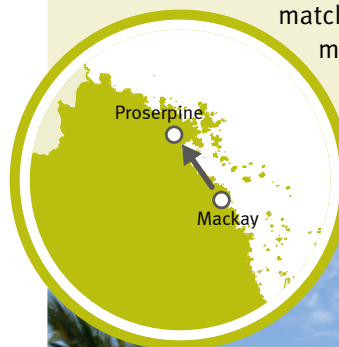
The Queensland Climate Transition Strategy outlines how we will transition to a zero net emissions future that supports jobs, industries, communities and the environment. Find the strategy at [www.qld.gov.au/environment/climate/climate-change/response](http://www.qld.gov.au/environment/climate/climate-change/response).

## Mackay 2030

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

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.



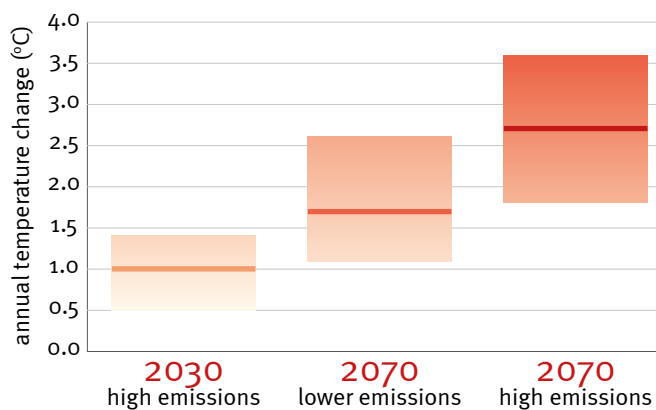
# Climate projections for Whitsunday, Hinterland and Mackay



## 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 1.4°C above the climate of 1986–2005. By 2070, the projected range of warming is 1.1 to 3.6°C, depending on future emissions.

The region's summer average temperature is 27°C. This could rise to over 28°C by 2030 and to over 30°C by 2070.



Projected annual average temperature changes for the Whitsunday, Hinterland and Mackay 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.



## Little change to fire frequency

There is likely to be little change to fire frequency. However, when and where fire does occur, its behaviour is likely to be more extreme.

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).

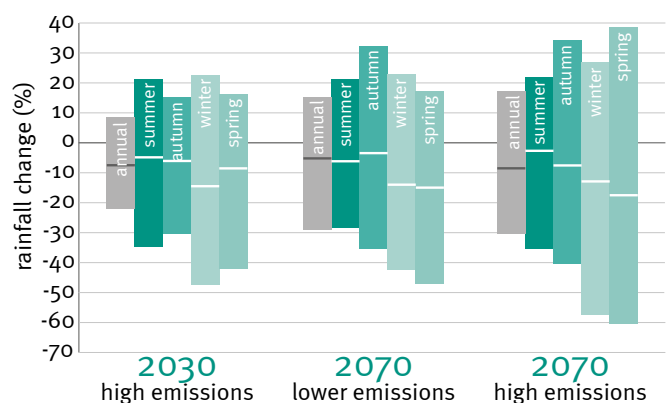


## More intense downpours

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

Total rainfall may change but the direction of change is currently unclear, highlighting the need to consider the possibility of both a drier and wetter climate in impact assessments.

The intensity of heavy rainfall events is expected to increase.



Projected annual and seasonal rainfall changes for the Whitsunday, Hinterland and Mackay 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.



## Less frequent but more intense tropical cyclones

Tropical cyclones are projected to become less frequent, but with increases in the proportion of the most intense storms.



## 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> <li>↑ tropical cyclone intensity</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 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>↑ sea level</li> <li>↑ fire weather</li> <li>↑ tropical cyclone intensity</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>Changes in fish stocks</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>↑ sea temperature</li> <li>↑ tropical cyclone intensity</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>Establish shelter belts to increase shade for livestock</li> <li>Consider different crop varieties, sowing times or production systems</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>↑ tropical cyclone intensity</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> <li>↑ storm intensity</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> <li>↑ storm intensity</li> <li>↑ tropical cyclone intensity</li> </ul>	<ul style="list-style-type: none"> <li>Increased 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>Increased 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

The regional population is approximately 180,000. The region's main centres are the towns of Mackay, Bowen and Proserpine on the coast and the inland mining towns of Clermont and Bowen. Mackay is a major centre servicing the Bowen Basin coal mining industry. Port facilities at Dalrymple Bay and Hay Point export the majority of coal from Central Queensland. Bowen is a major horticulture centre and Proserpine is a focus of the tourism industry.

On the coast, inundation and erosion events could become more frequent, resulting in high clean-up and asset maintenance costs.

Flooding, resulting from more intense storms could affect water, sewerage, stormwater, transport and communications infrastructure. Flash flooding and wind damage will exacerbate these impacts closer to the coast. The cost of insurance to business and the community may increase as a result.

Inland, the impact of hotter days and extreme heat events will affect infrastructure.

### Adaptation measures

- Consider how to adapt existing homes to deal with projected inundation.
- Plan for new 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.

**Mackay Regional Council** has established a climate adaptation policy, recognising the impacts climate change may have on council's operations, environmental and economic values throughout the region. Communities are becoming more resilient through improved planning, asset management, and accounting for the impacts of sea-level rise in new developments.



## Tourism

Tourism is based around the Great Barrier Reef, tropical rainforests, iconic beaches and islands. The tourism industry is reliant on the health of these environments, which are particularly vulnerable to the impacts of climate change. The degradation of the reef will not only be a loss of great intrinsic value; it will also come at a great cost to the tourism industry.

Increases in temperature could extend the season when the region is attractive to visitors. This will need to be balanced against increased 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.

Tourism operators in the far north are providing opportunities for visitors to protect the **Great Barrier Reef** while diving. By including activities such as coral surveys, removal of invasive seaweed, monitoring and data collection, tourists have been able to increase the resilience of the reef and play an essential role in maintaining reef water quality.





## Business and industry

The region's economy is driven by mining in the Bowen Basin and support industries, including export ports, agriculture, fisheries, retail and commercial activities.

An increase in the intensity of cyclones and flooding events will damage fish nurseries, and cause increased outflow of freshwater and sediment. Changes in sea temperature may cause the migration of key fishery species out of designated commercial catch zones, and alter reproduction and sex ratios of target species.

More intense extreme storm events are expected to cause increases in flooding with impacts on infrastructure, roads and industry. This may increase the cost of insurance to the minerals sector.

Reduced water availability for minerals processing and mine operations would create competition for water resources with other users, such as communities and farmers.

Businesses that 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

Livestock grazing and cropping of wheat and sorghum dominate the western areas of the region, while the region's coast is dominated by sugar and horticulture.

The beef cattle industry is the largest individual user of land. Cattle numbers can change significantly from year to year, mainly influenced by seasonal climate conditions and export prices.

Dryland farming of grain and sunflower occurs in the Central Highlands. The region has a large sugarcane growing area, mainly located in high rainfall areas, or in irrigated areas such as the Sarina, Mackay and Proserpine districts. There is a high value horticulture industry around Bowen, which produces approximately \$230 million worth of fruit and vegetables annually.

Conditions may become more favourable for an increase in plant diseases, weeds and pests. Increasing evaporation will result in more frequent depletion of soil moisture, reduced ground cover and lower livestock stock carrying capacity. Rising tree densities and declining pasture condition will raise the sensitivity of pastures to climate-induced water stress.

Increased animal heat stress is likely, particularly away from the coastline. This can reduce animal production, reproductive performance and increase mortality.

More frequent and intense extreme weather events will damage crops, particularly those grown close to the coast. Erosion risks are likely to increase due to greater year-to-year variability in rainfall.

### 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.
- Select plant varieties or production systems that are more adaptable to a changing and variable climate.

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

This region includes the Brigalow Belt and Central Queensland Coast bioregions, as well as parts of the Great Barrier Reef World Heritage Area. The Brigalow Belt is the largest bioregion in Queensland and is rich in species, including large numbers of plants and animals with small ranges that are particularly threatened by a more variable and changing climate.

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/).

There are small isolated populations of endangered native animals across the region, including the northern hairy-nosed wombat, Proserpine rock wallaby, yellow chat and the Eungella day frog. There are also endangered ecosystems in the region, including brigalow and bluegrass downs in the western parts, and microphyll vine forest in some coastal dune areas.

Increased sea surface temperatures are likely to cause more regular coral bleaching in the Great Barrier Reef. These bleaching events are very likely to become more severe as temperatures increase and such events could occur annually by 2050. Maintaining the health of reef water quality is paramount for coral recovery after a bleaching event.

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 plant species, including community education.
- Reduce vegetation clearing in critical habitats and maintain intact ecosystems.
- Continue to manage the impact of agriculture on nutrient runoff into the reef environment.

**Project Catalyst** is a partnership between more than 70 innovative Queensland cane growers, focused on improving the quality of water that flows from agricultural catchments into the Great Barrier Reef. It promotes practical solutions to increase water use efficiency, prevention of runoff, reduced application of nutrients and pesticides, and better management of soils. See [www.reefcatchments.com.au/land/project-catalyst](http://www.reefcatchments.com.au/land/project-catalyst).



## Human health

Tropical diseases such as Ross River fever and dengue fever are expected to increase in prevalence and range under climate change. Changes in rainfall, high tides and maximum temperatures have all been shown to be key determinants of Ross River virus transmission.

Weather extremes, such as floods and tropical cyclones can cause injury and death. Higher temperatures and more hot days can result in heat exhaustion and increased mortality among vulnerable people, including the very young and old.

Increases in extreme events can lead to increased pressure on health services, including an increased demand for health professionals, ambulance and hospital workers. Many parts of the country already find it hard 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

While the region is highly desirable for tourism and lifestyle, it is no stranger to extreme weather events. Over the past few decades there have been some severe cyclones and a significant increase in bushfire and flooding events.

Sea-level rise and increases in cyclone and storm intensity 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 for extreme weather events.
- Update risk management standards to account for increased risk from climate change.

**Local Emergency Alert** is a national telephone warning system used by emergency services, such as Queensland Fire and Emergency Services, to alert communities about a likely or actual emergency in your area. Local Emergency Alert sends a voice message to landlines and a text message to mobile phones, to increase community preparedness for extreme weather events and other emergencies.

## 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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