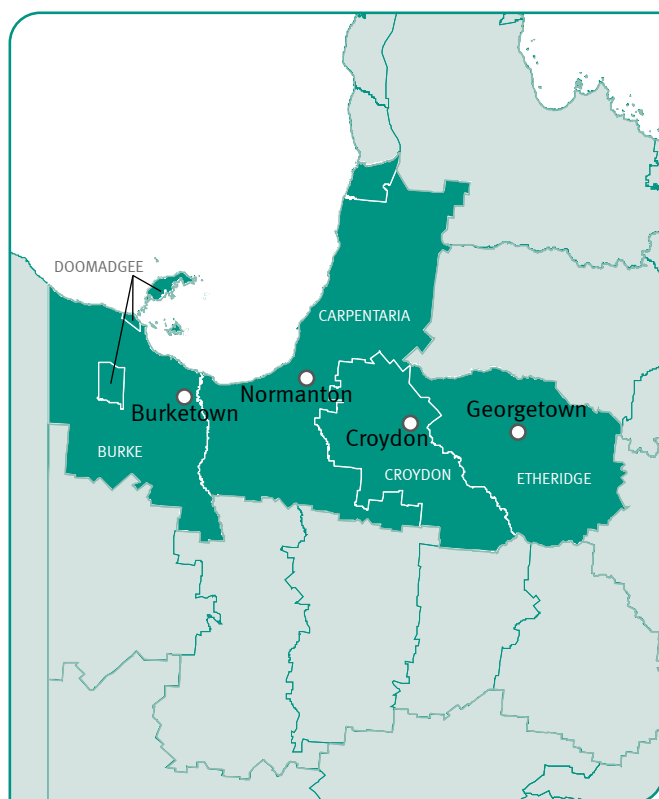


# Climate change in the Gulf region

VERSION 1



UNDERSTAND | ADAPT









## Gulf region snapshot

The Gulf region extends from the Northern Territory border in the west to the Charters Towers Regional Council area in the east, and around the Gulf of Carpentaria as far north as the Coleman River. The sparsely populated region occupies 10% of the total area of the state but includes just 0.2% of the population. More than half of the region's residents are of Aboriginal and Torres Strait Islander descent.

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).

## How will climate change affect the Gulf region?

In the future, the region can expect:

-  higher temperatures
-  hotter and more frequent hot days
-  more intense downpours
-  less frequent but more intense tropical cyclones
-  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.



# Looking to the future

## Our current climate

The Gulf region is in the wet-dry tropics (savanna) and is generally hot to very hot throughout the year. The average annual temperature is 26°C. The December to February average temperature is 30°C; for July to August the average is 22°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 751mm. There is a distinct hot and humid wet season (November–March) in which rainfall is generated by heavy thunderstorms, monsoonal lows or tropical cyclones.

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 Gulf region is projected to rise by 2.6°C (1.8 to 3.7°C). In this case, the middle temperature rise determined by all the models is 2.6°C. The range is between 1.8°C and 3.7°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 3.7°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).

## Burketown 2030

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

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.



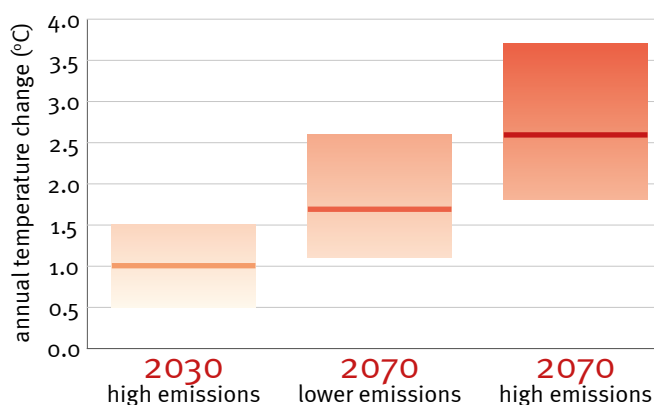
# Climate projections for the Gulf region



## 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 1.5°C above the climate of 1986–2005. By 2070, the projected range of warming is 1.1 to 3.7°C, depending on future emissions.

The region's current summer average temperature is 30°C. This could rise to over 31°C by 2030 and to over 33°C by 2070.



Projected annual average temperature changes for the Gulf 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.



## Uncertain changes to fire frequency

Change to fire frequency depends on the spatial variability of future rainfall. However, when and where fire does occur, its behaviour is likely to be more extreme.

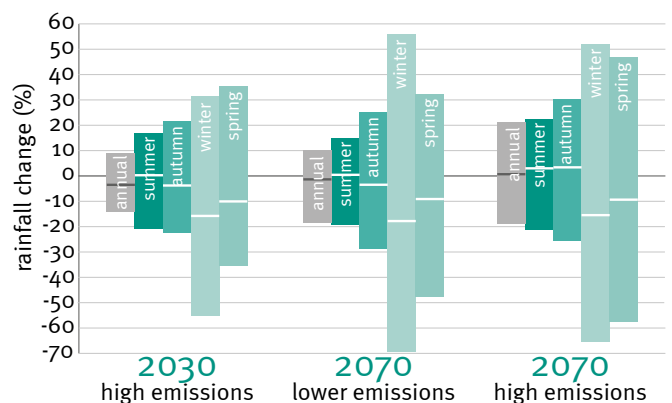
Climate change projections are based on Climate Change in Australia data from CSIRO and the Bureau of Meteorology. More detailed information on these and other climate variables is available at [www.qld.gov.au/environment/climate/climate-change/resources/science](http://www.qld.gov.au/environment/climate/climate-change/resources/science).



## More intense downpours

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

Rainfall changes for 2070 continue to show a large amount of variability. However, there may be slight declines in winter and spring rainfall by the end of the century.



Projected annual and seasonal rainfall changes for the Gulf 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>↑ heatwaves</li> <li>↑ tropical cyclone intensity</li> <li>↑ inundation and flooding</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>↑ sea level</li> <li>↑ fire weather</li> <li>↑ inundation and flooding</li> <li>↑ heatwaves</li> <li>↑ tropical cyclone intensity</li> </ul>	<ul style="list-style-type: none"> <li>Increased flood damage</li> <li>Increased maintenance costs</li> <li>Increased disruption to water supplies</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 critical assets</li> <li>Implement water management planning</li> </ul>
	<ul style="list-style-type: none"> <li>↑ heatwaves</li> <li>↑ flooding</li> <li>↑ fire weather</li> <li>↑ sea level</li> </ul>	<ul style="list-style-type: none"> <li>Damage to cultural sites</li> <li>Loss of significant ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>Identify cultural sites at risk and mitigate impacts</li> <li>Review and document cultural practices</li> <li>Increase cultural activities and ceremonies to transfer knowledge</li> </ul>
	<ul style="list-style-type: none"> <li>↑ temperature</li> <li>↑ heatwaves</li> <li>↑ fire weather</li> <li>↑ drought risk</li> <li>↑ tropical cyclone intensity</li> <li>↑ sea temperature</li> </ul>	<ul style="list-style-type: none"> <li>Increased pest and diseases</li> <li>Increased risk of damage from cyclones</li> <li>Possible decline in pasture growth</li> <li>Increased heat stress</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>↑ hot days</li> <li>↑ sea level</li> <li>↑ tropical cyclone intensity</li> <li>↑ sea temperature</li> </ul>	<ul style="list-style-type: none"> <li>Cyclone and storm tide inundation damage to landscapes and natural systems</li> <li>Coral bleaching</li> <li>Existing threats to flora and fauna are exacerbated</li> </ul>	<ul style="list-style-type: none"> <li>Develop strategies to respond to new and emerging diseases and pests</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>↑ tropical cyclone 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>↑ tropical cyclone intensity</li> </ul>	<ul style="list-style-type: none"> <li>Increased fire intensity will affect rural 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 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 Gulf region's population of around 8,000 is dispersed in small towns and settlements across the region. These communities are regularly exposed to climate extremes, and therefore may be better able to adapt to a changing climate better than other communities. However, if extreme conditions become more frequent and of longer duration, there will be greater challenges and energy demands for creating a comfortable environment in which to live.

Flooding, due to more intense storms and sea-level rise, could affect water, sewerage, stormwater, transport and communications infrastructure. Damage may be exacerbated by flash flooding and wind. Sea-level rise is a major risk for low-lying coastal communities in the region, such as Burketown and Karumba. The cost of insurance may rise as a result.

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

### 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, tropical cyclones and sea-level rise.
- Develop a Coastal Hazard Adaptation Plan.



## Business and industry

The Gulf region has significant fisheries, including crayfish and rock lobster, Spanish mackerel, barramundi, threadfin, shark and grey mackerel.

Degradation of reef habitats may lead to a decrease in small reef fish, which may also impact higher trophic level species that are important for recreational and commercial fisheries.

Ocean acidification may affect the senses of tropical fish species, including their ability to smell, which they rely on for mating and migration.

Some species may shift their range southward as ocean temperatures rise, which may increase the risk of competition between resource users.

### 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.





## Indigenous communities and culture

The Gulf region comprises a patchwork of ancestral countries associated with traditional owner or Indigenous language-based areas. These areas are home to sites of rich Indigenous cultural significance and cultural practices that existed prior to, and have continued since, European settlement.

Significant Indigenous cultural values are attached to the natural environments of the region and strong links have been maintained by the Indigenous community to country and wildlife, with access to land and its resources crucial for cultural value maintenance. Changes in natural systems resulting from climate change will compromise these values.

Higher temperatures and more hot days can result in heat exhaustion and increased mortality among vulnerable sectors of the community, such as the very young or old.

Malaria and other mosquito-borne diseases are likely to be affected by changing temperatures, humidity and rainfall.

Sea-level rise will pose a particular challenge for the coastlines and communities in low-lying areas. During inundation incidents, when a disruption of the water supply may occur, the short-term risk of communicable disease transmission increases.

### Adaptation measures

- Identify cultural sites at risk and mitigate impacts.
- Review and document cultural practices.
- Increase cultural activities and ceremonies to transfer knowledge.

The **Aboriginal and Torres Strait Islander Resilience Project** collaborates with Aboriginal and Torres Strait Islander communities and organisations, emergency services, disaster management agencies, emergency volunteers, local councils and elders, to share traditional knowledge about disaster resilience through culturally appropriate, localised engagement built on trust and respect. See [www.emergencyvolunteering.com.au](http://www.emergencyvolunteering.com.au).



## Agriculture

Pastoral land use, in particular beef production, is the main industry in the Gulf region, with more than 100 pastoral enterprises in operation and a live export facility in Karumba. Horticulture and neem tree farms exist in locations such as the Gilbert River in the Etheridge Shire and there are plans to expand intensive production in the area. The fisheries and aquaculture sectors (including the prawn industry) contribute more than \$40 million annually to the region.

Climatic changes could alter the distribution and incidence of weeds, pests and diseases. Long dry spells, followed by heavier precipitation events could lead to increased flood duration on the gulf plains. This may result in cattle and wildlife loss, widespread pasture death and weed invasion.

Gamba grass, a highly invasive, tall pasture grass, can provide up to 12 times the fuel load of native grasses and cause fires intense enough to kill trees.

More extremes of temperature and changes in rainfall variability could decrease crop production, forage production, surface cover, livestock carrying capacity and animal production, and cause major changes in plant and animal species composition.

Livestock will be exposed to a greater risk of heat stress. Animals are unlikely to travel as far to water, which concentrates grazing pressure and increases the risk of adverse pasture composition changes and soil degradation.

### Adaptation measures

- Arrange water points to reduce distance to water and even out grazing pressure.
- Select cattle lines with effective thermoregulatory controls, efficient feed conversion and coat colour.
- Incorporate greater use of prescribed burning to reduce the risk of wildfires and control woody thickening.
- Rotate paddocks of heavier grazing for use as fire breaks.
- Consider future climate risks in the selection of crops and production systems.
- Monitor the spread of pests, weeds and disease.
- Improve management of pests and disease by introducing more species of dung fauna (control of buffalo fly larvae), and promoting greater use of traps and baits (buffalo and sheep blowflies) and vaccines (cattle ticks and worms).

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.tsra.gov.au/the-tsra/programmes/env-mgt-program/adapting-to-climate-change](http://www.tsra.gov.au/the-tsra/programmes/env-mgt-program/adapting-to-climate-change).





## Biodiversity and iconic ecosystems

The Gulf of Carpentaria is one of the major tropical savannas of northern Australia with large areas of undisturbed habitat. The vegetation is mainly open eucalypt and tea tree woodlands and grasslands comprising predominantly blue grasses in the north and Mitchell grass in the south. The coastal estuaries have extensive mangroves and saline herb fields that do not occur anywhere else in Queensland. There are many rare, vulnerable and endangered species of flora and fauna.

The region also contains springs and spring-fed wetland systems providing significant water bird breeding and feeding areas. About 38 fauna species in the region are listed as rare and threatened.

The region will increasingly be subject to flooding events and inundation from sea-level rise.

### Adaptation measures

- Destock cattle after major floods to facilitate pasture recovery.
- Employ sustainable grazing practices in order to sustain riparian habitat.
- Employ active fire management.
- Employ aggressive weed and pest management.



## Human health

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

Weather extremes such as floods and cyclones can cause injury and death. Heatwaves affect especially the old and very young.

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

- Continue to adapt existing buildings and plan any new infrastructure to take into account climate change impacts and extreme events such as flooding, cyclones and sea-level rise.
- Implement control measures to reduce the impact of bushfires, heatwaves, mosquitoes, water-borne and food-borne diseases, infectious and contagious diseases and injuries.
- 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.

**Queensland Health** is aware of the impact that drought and disasters has on people and communities. The Tackling Adversity in Regional Drought and Disaster communities through integrating Health Services (TARDDiHS) grants program provides assistance to build community networks that foster social connectedness, improve help-seeking behaviour, build capacity for learning to live with change and uncertainty, and promote positive adaptability in response to adversity. More information is available at [www.health.qld.gov.au/clinical-practice/guidelines-procedures/clinical-staff/mental-health/grants/rural-remote-community](http://www.health.qld.gov.au/clinical-practice/guidelines-procedures/clinical-staff/mental-health/grants/rural-remote-community).



## Emergency services

Over the past few decades the region has experienced significant tropical cyclones and flooding events.

Higher temperatures and longer dry seasons could increase drought and bushfire risk, particularly for farming communities where natural ecosystems abut houses and businesses.

Increases in storm intensity will see a higher risk of flooding and inundation throughout the region, particularly in the Channel Country.

## Adaptation measures

- Improve bushfire safety standards for development.
- Increased focus on community preparedness.
- 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 are available from the Queensland Future Climate Dashboard at [www.qld.gov.au/FutureClimateDashboard](http://www.qld.gov.au/FutureClimateDashboard).

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