

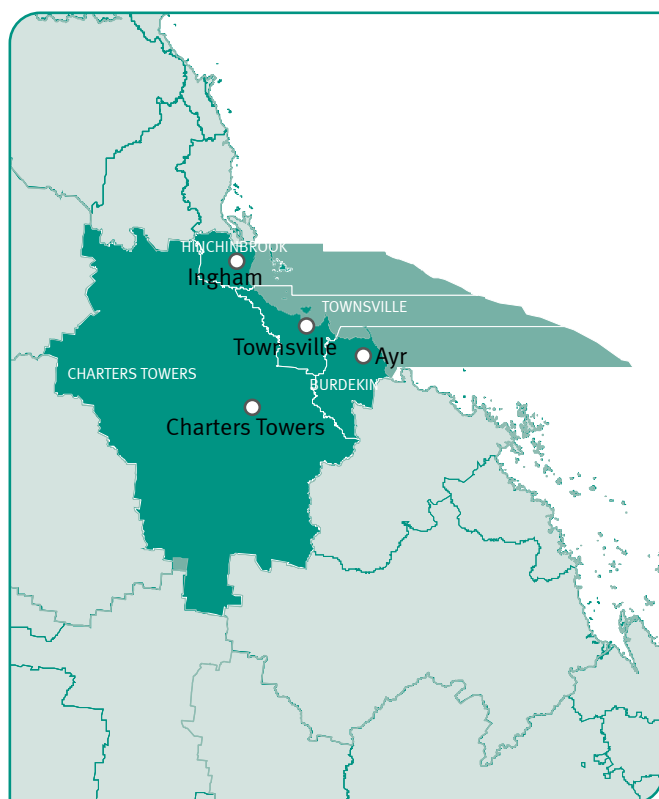
# Climate change

## in the Townsville–Thuringowa region

VERSION 1



UNDERSTAND | ADAPT



### Townsville–Thuringowa region snapshot

Townsville–Thuringowa is an environmentally diverse region, with the Brigalow Belt in the south, the Einasleigh Uplands in the west and the Wet Tropics in the north. Townsville is the main urban centre and Charters Towers is the main regional centre. The region occupies 5% of the state's total area, and is home to 5% of the state's population.

### How will climate change affect the Townsville–Thuringowa 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

The region's tropical climate is characterised by relatively high temperatures throughout the year and pronounced wet and dry seasons and high-intensity tropical storms.

High summer temperatures generally peak in January and are usually accompanied by high humidity. The average annual temperature is 23°C. The summer average temperature is 28°C, and the winter average temperature is 18°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 661mm, occurring predominantly between November and April, mainly in the form of short duration, intense tropical storms which can cause flooding. The region is occasionally affected by tropical cyclones, flooding, storm tide inundation and strong winds.

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 Townsville–Thuringowa region is projected to rise by 2.6°C (1.8 to 3.6°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 3.6°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).

## Charters Towers 2030

In 2030, under a high emissions scenario, the climate of Charters Towers will be more like the current climate of Barcaldine.

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.



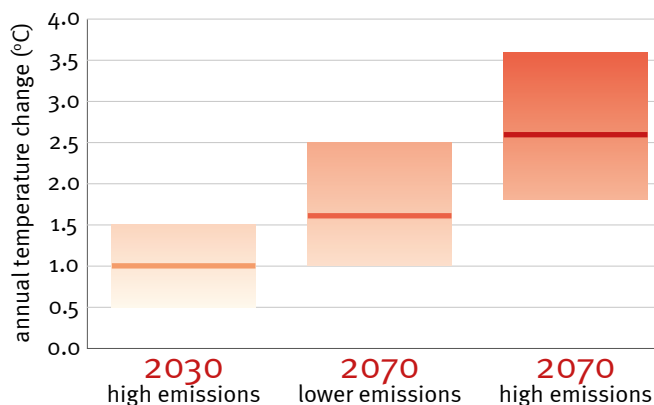
# Climate projections for Townsville–Thuringowa



## 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 1.0 to 3.6°C, depending on future emissions.

The region's current summer average temperature is 28°C. This could rise to over 29°C by 2030 and to over 31°C by 2070.



Projected annual average temperature changes for the Townsville–Thuringowa 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).

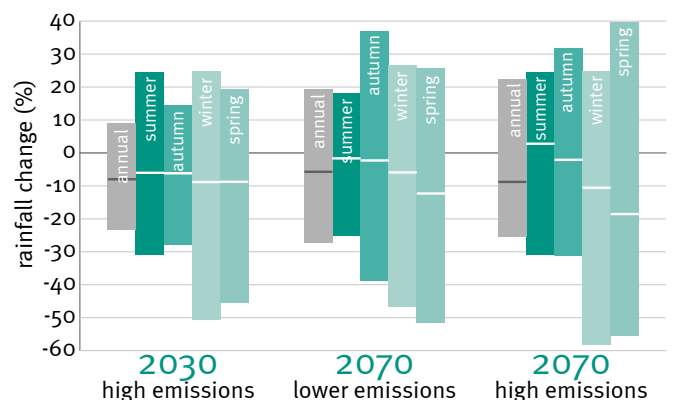


## More intense downpours

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 spring rainfall by the end of the century.

The intensity of heavy rainfall events is likely to increase.



Projected annual and seasonal rainfall changes for the Townsville–Thuringowa 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 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>↑ 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, e.g. for cattle</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>↑ 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>↑ solar radiation</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> </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

Around 80% of the region's population of 236,000 live in Townsville, the largest city in northern Australia. The Port of Townsville services the region's mining industry and fishing fleets. Charters Towers is the main regional centre.

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

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

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

## 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.

The **Townsville City Plan** sets out the vision and guide for the city's growth over the next 25 years and includes climate change adaptation measures. The plan ensures appropriate development occurs outside high-risk areas subject to sea-level rise or erosion-prone areas in the coastal zone. The plan is available at [www.townsville.qld.gov.au](http://www.townsville.qld.gov.au).



## Tourism

The Townsville–Thuringowa region is a tourism hub with the Great Barrier Reef, Magnetic Island and other nearby islands and resorts.

Increased flooding and cyclone risk 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

Fisheries and mining resources make a substantial contribution to the regional economy. Townsville is the main service centre for the mining activities in the extensive hinterland, which includes the north-west minerals province around Mount Isa and gold mine at Charters Towers. There is a copper refinery at Townsville.

More frequent flooding and inundation and heatwaves may disrupt business and industry 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.

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.

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

Irrigated sugarcane farming and extensive beef cattle grazing are important in the region. Other major industries include horticulture and cropping.

Overall conditions may become more favourable for an increase in plant diseases, weeds and pests. Increasing evaporation will also 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.

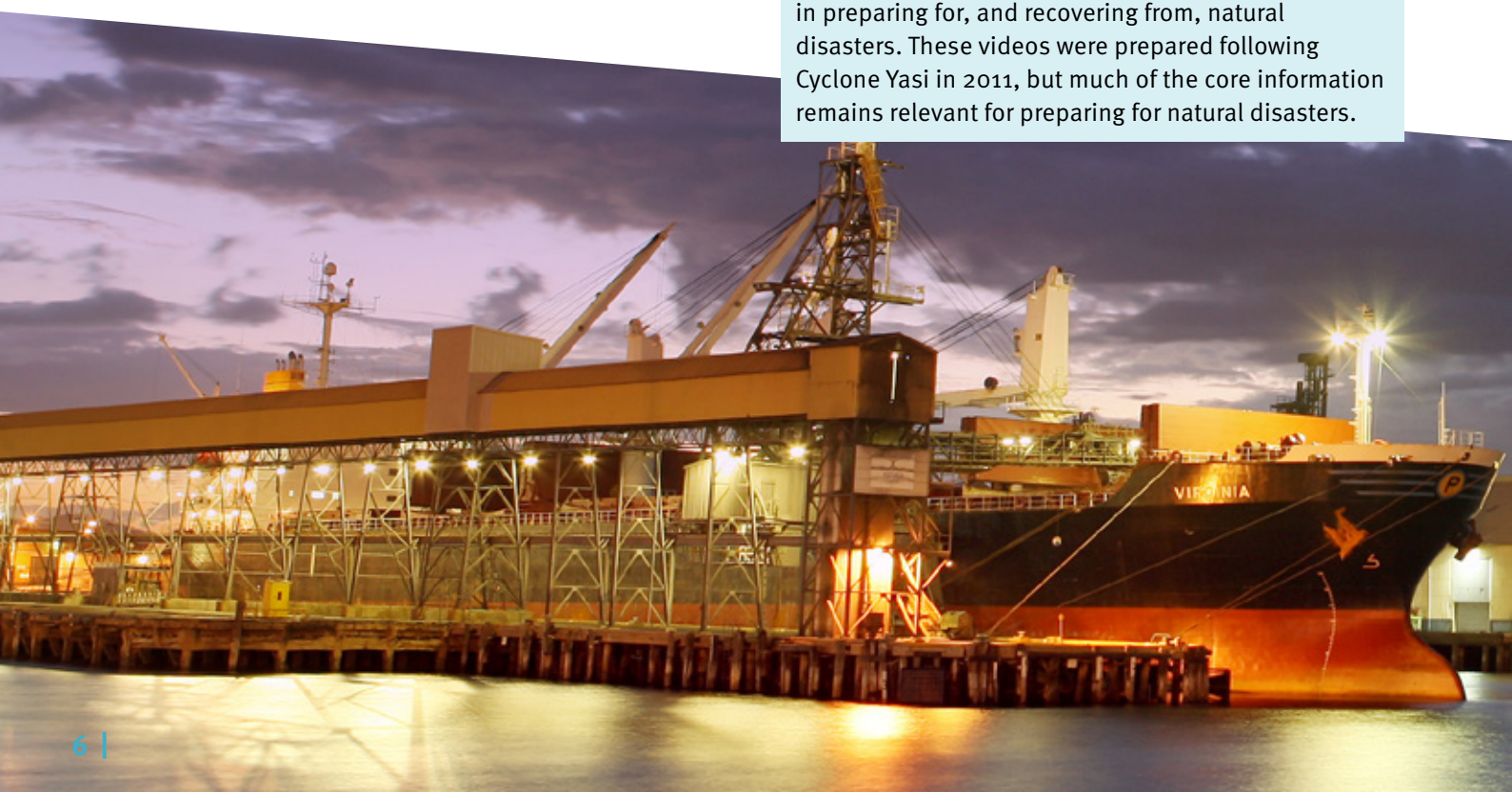
Increased animal heat stress is likely, particularly away from the coastline. This can reduce animal production, reproductive performance and increase mortality.

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 spread of pests, weeds and disease.
- Provide more cooling mechanisms for livestock, such as shade and sprays.
- Select plant varieties and cropping systems that are more adaptable to a changing and variable climate.

**Queensland Farmers' Federation** has prepared a series of short videos with resilience tips for farmers in preparing for, and recovering from, natural disasters. These videos were prepared following Cyclone Yasi in 2011, but much of the core information remains relevant for preparing for natural disasters.







## Biodiversity and iconic ecosystems

The region has a diversity of landscapes including the interspersed rainforests of the Wet Tropics and Paluma including Crystal Creek, the drier sub-catchment area of the Burdekin River and the wet coastal plains of the lower Burdekin River. Major water systems in the region include the Burdekin and Cape Rivers and Lake Dalrymple, created by the Burdekin Falls Dam. The region also includes part of the Great Barrier Reef World Heritage Area.

Along the coastline, rainforests within the Wet Tropics bioregion may be threatened by rising temperatures, altered rainfall patterns, and tropical cyclones. Carbon dioxide fertilisation may alter competitive relationships.

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/).

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 are expected to increase in prevalence and range under climate change. Changes in rainfall, high tides and maximum temperatures have all been shown to affect 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

Over the past few decades there has been a significant increase in bushfires and flooding events in the region, and some severe cyclones.

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

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.
- Update risk management standards to account for increased risk from climate change.

## 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).

© State of Queensland, 2019.

Published by the Department of Environment and Science.

The Queensland Government supports and encourages the dissemination and exchange of its information. The copyright in this publication is licensed under a Creative Commons Attribution 3.0 Australia (CC BY) licence.



Under this licence you are free, without having to seek our permission, to use this publication in accordance with the licence terms. You must keep intact the copyright notice and attribute the State of Queensland as the source of the publication. For more information on this licence, visit <http://creativecommons.org/licenses/by/3.0/au/deed.en>.

### Acknowledgements

The Queensland Government acknowledges the use of data from the CSIRO and Bureau of Meteorology Climate Change in Australia website ([www.climatechangeinaustralia.gov.au](http://www.climatechangeinaustralia.gov.au)). It also acknowledges the World Climate Research Programme's Working Group on Coupled Modelling, which is responsible for Coupled Model Intercomparison Project (CMIP), and thanks the climate modelling groups for producing and making available their model output. For CMIP the U.S. Department of Energy's Program for Climate Model Diagnosis and Intercomparison provides coordinating support and led development of software infrastructure in partnership with the Global Organization for Earth System Science Portals.

### Disclaimer

The climate change data is sourced from existing Australian Government data and is distributed by the Queensland Government as an information source only. The regional climate change impact summary is published by the Queensland Government which also owns the copyright in it.

To the maximum extent permitted by law, the State of Queensland makes no statement, representation, or warranty about the quality, accuracy, context, completeness, availability or suitability for any purpose of, the data or the publication. Users of the data or the publication do so entirely at their own risk.

The Queensland Government disclaims, to the maximum extent permitted by law, all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you or any other person might incur for any reason in relation to the data or the publication.

Photo credits: John Skewes, Department of the Premier and Cabinet, Department of Tourism, Major Events, Small Business and the Commonwealth Games

