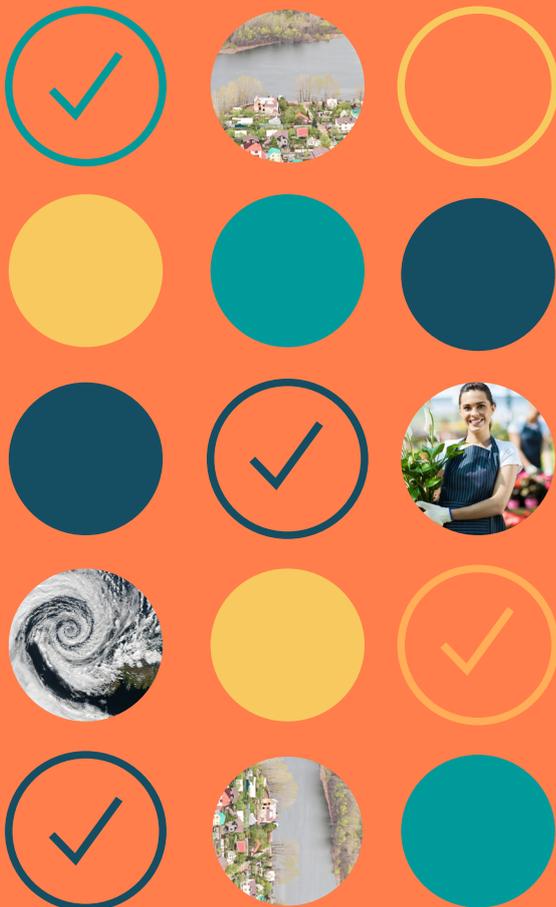
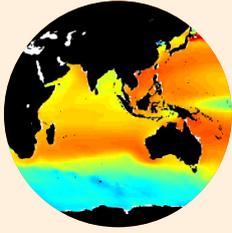




Information Booklet



Some basic definitions



Climate change impacts

Changes that occur as a result of future climate.

For example, reduction in average rainfall in the future will increase dry conditions, which will impact the way we conduct our agriculture in certain areas.



Climate change adaptation

Steps governments, businesses, communities and individuals take to deal with risks from climate change impacts.

For example, an agricultural business at risk of drought can plant crops that can survive with low moisture content.



Climate change risks

What a given climate change impact will mean for your business and operations.

For example, if you are an agricultural business, increased dry conditions in some areas of Queensland will increase the risk of losses in production or increases to the cost of production (as cost of irrigation will increase) leading to less profit for your business.



Relationship between climate change impacts, risks and adaptation

Climate change is likely to increase the frequency and intensity of extreme events (flooding, heatwaves, bushfires, cyclones, extreme rainfall, droughts, etc.).

These changes can result in different impacts for sectors within which small businesses operate (e.g. agriculture, tourism, construction and trade, retail, hospitality, food and beverage, etc.). At an individual business scale, these impacts will be contextualised differently which cause business specific risks. Risks are based on factors such as:

- how exposed a business is to extreme events
- the likely consequences for the business if a potential risk eventuates
- how capable the business is to deal with risks

For some businesses new risks may emerge as a result of climate change, but for some there might be new opportunities as well.

What is in the Booklet?

This booklet contains background information to help you prepare a climate change resilience plan for your business. It sets out to answer the following questions:

What is climate change and sea-level rise?

What does the future climate look like in Queensland?

What are some of the impacts of climate change on small business?

What options do I have for managing my climate change risks?

What is climate change and sea-level rise?

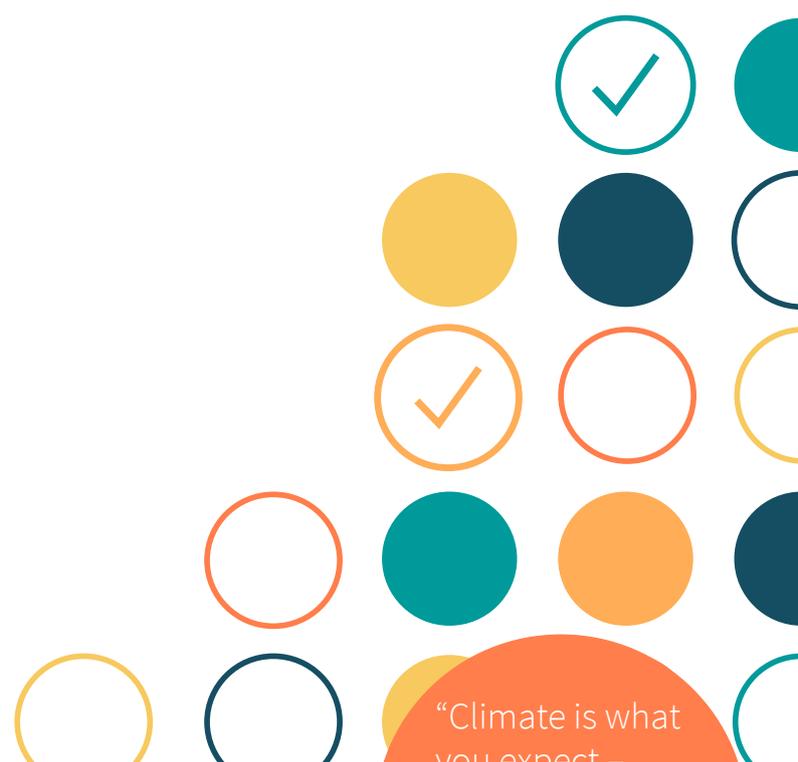
Climate and sea-levels change over timescales from decades to millions of years, in response to solar variations, changes in the Earth's orbit around the Sun, volcanic eruptions, movement of the continents and natural variability such as El Niño and La Niña events.

However, since the start of the Industrial Revolution, human activities have added significantly to greenhouse gases (e.g. carbon dioxide, methane, nitrous oxide, ozone, etc.) in the atmosphere. Greenhouse gases are transparent to much of the radiation from the sun and allow it to pass through the atmosphere to warm the Earth. Some of the outgoing radiation from the Earth is absorbed by the greenhouse gases, warming both the atmosphere and the Earth's surface. This is known as the greenhouse effect and it contributes towards global warming and potentially other effects on our climate such as changes in rainfall distribution and storm intensity.

Around 93% of the additional heat created by global warming has so far been absorbed into the oceans. As water warms, it expands. This expansion has been the major cause of sea-level rise, with a smaller contribution from land-based glacier and ice sheet melt. In the twentieth century, global average sea-levels increased by 19 cm. Over time, the contribution from ice melting is expected to increase substantially. A rise in sea level can provide storm surges a higher base and can allow the sea to come further inland causing inundation of low lying areas.



Some of the additional carbon dioxide in the atmosphere (around 30-40%) dissolves into the oceans, where it decreases the alkalinity of the water (an effect known as *ocean acidification*). The effects have been minimal so far, but will intensify in the future unless action is taken to reduce carbon dioxide emissions. Ocean acidification has the potential to make it more difficult for coral and some plankton to form calcium carbonate, the material used for shell making. There are potentially knock-on effects for marine food chains, for tourism and fishing industries.



“Climate is what you expect – weather is what you get”

R.A. Heinlen, 1973

The difference between weather and climate



Weather is what we experience daily. It varies over the seasons and from year to year. It varies through the day.



Climate is the average weather over time – usually climate is determined by looking at weather patterns over long periods, 30 years or more. Trends are easier to spot and different parts of the country and world have different climates.

The weather is naturally variable but climate is now also changing as a result of greenhouse gas emissions. Although weather events are not in themselves evidence of climate change, exploring the business consequences of extreme weather events can help build an understanding of vulnerability to weather and climate. This is important in helping to inform efforts to adapt to future climate change.

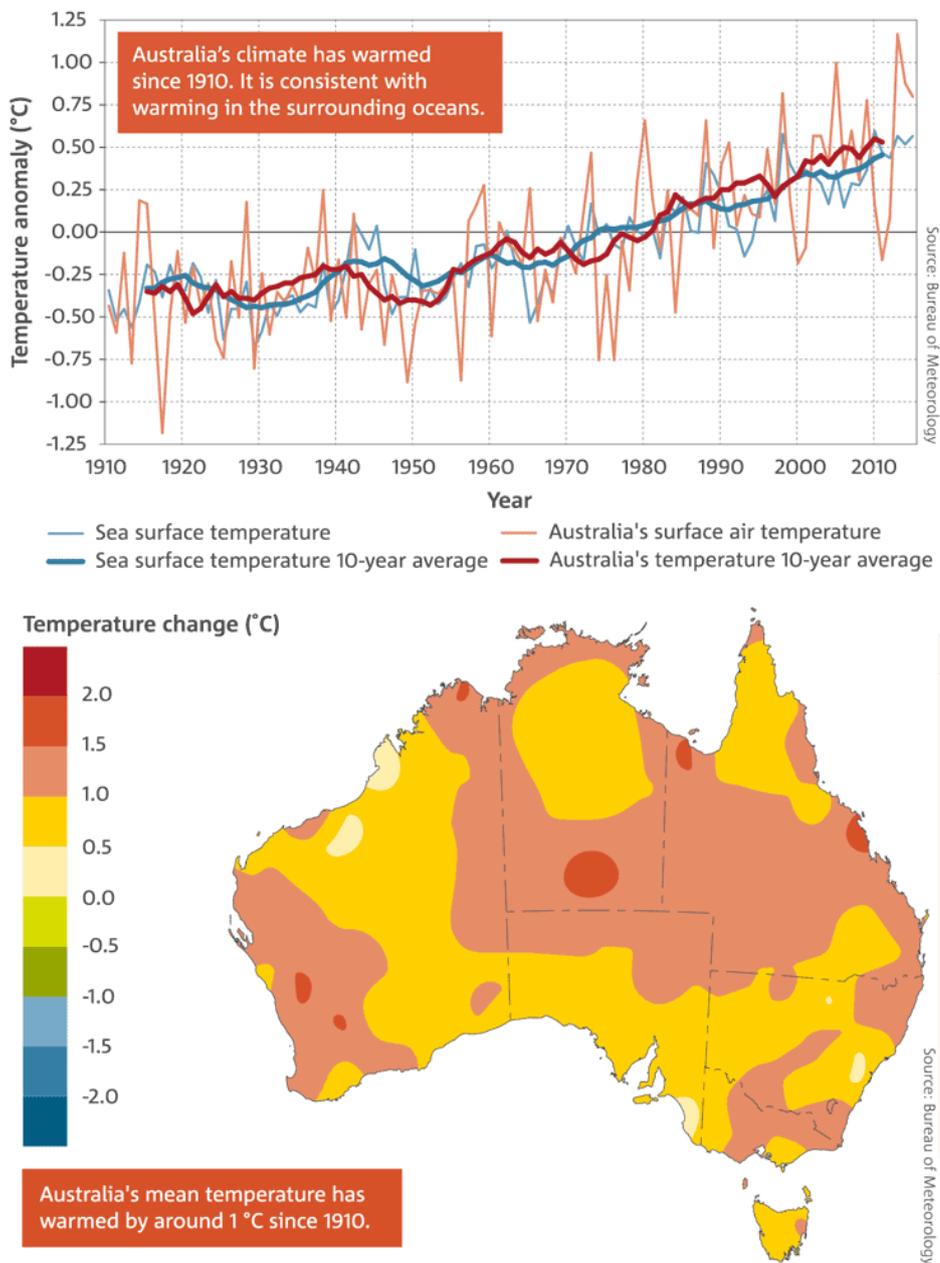


Figure 1: Top: Land and sea temperatures over Australia since the beginning of the twentieth century. Bottom: Map of annual average temperature change since 1910. Bureau of Meteorology and CSIRO Australia © 2017 Commonwealth of Australia and CSIRO.

What does the future climate look like in Queensland?

Recent climate trends in Queensland

The average surface temperature over Australia and the surrounding oceans have increased by around 1°C since the beginning of the twentieth century (Figure 1). Seven of the ten warmest years on record have occurred since 2005.

In 2017, Queensland had its warmest year on record in terms of mean temperature, and mean maximum temperature. Large areas of central and western Queensland had below average annual rainfall. Parts of the northern interior, the Gulf Country and east coast south of Bowen received above average rainfall. Severe Tropical cyclone Debbie made landfall near the Whitsunday Islands on 28 March.

One of the outcomes from global warming is sea-level rise, caused by thermal expansion and melting of ice caps and glaciers. Since 1955, more than 90% of the excess heat produced by global warming has gone into the oceans, so thermal expansion is an important component of sea-level rise. Over the period 1901 to 2010, global mean sea-level rose by around 0.19 m. Sea-levels have risen around Australia since the beginning of the twentieth century, with a faster rate (partly due to natural variability) since 1993. There are geographical variations, with higher sea-level rise observed in the north.

Fire threats to tropical and subtropical Queensland have been increasing over the years. Weekly bushfire frequencies in Australia increased by 40 per cent between 2008 and 2013, with tropical and subtropical Queensland the most severely affected regions. Towards the end of 2018, severe bushfires damaged parts of Queensland, resulting in damage to property and infrastructure.



Future climate outlook for Queensland

The impacts of climate change will vary across large areas. Regional projected changes are available for thirteen climate regions across Queensland (figure 4). Visit [this link](#) for an interactive map that will help you understand climate change projections for your region. Additionally, you can download the regional projections by clicking on the relevant links on figure 4. If you are interested in further detailed climate change projections, you can visit [Queensland Future Climate Dashboard](#).

Future sea-level rise in coastal areas

Sea-levels are projected to rise by 0.8 m above present day levels by 2100. However this rise will vary locally. In order to find local variations in sea-levels and inundation hazard maps visit www.coastadapt.com.au or www.coastalrisk.com.au.

How will climate change affect Queensland?

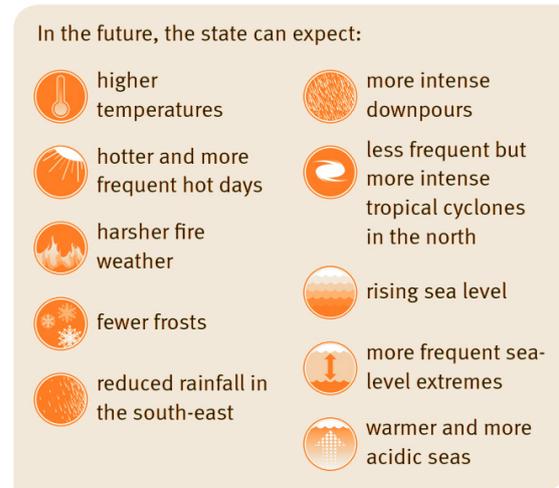


Figure 3: Summary overview of climate change in Queensland. From [Queensland Government](#). For more information visit [Queensland Future Climate Dashboard](#).

Making sense of climate change information

Climate change is primarily caused by increasing amounts of greenhouse gases in the atmosphere, which are trapping heat and 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 do not 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 range from a lower emissions future, where greenhouse gas emissions are substantially reduced (this pathway is termed RCP4.5), to a high emissions future, where high levels of greenhouse gas emissions are set to continue (this pathway is termed RCP8.5).

These scenarios allow us to consider a range of climate futures when thinking about how climate change may affect us.

Thirteen climate regions of Queensland

Click on a region below to visit a website which has a climate change summary for that region.

[Cape York](#)

[Townsville-Thuringowa](#)

[Central Queensland](#)

[North West Queensland](#)

[Central West Queensland](#)

[South East Queensland](#)

[Eastern Downs](#)

[South West Queensland](#)

[Far North Queensland](#)

[Whitsunday, Hinterland and Mackay](#)

[Gulf Region](#)

[Wide Bay - Burnett](#)

[Maranoa and District](#)



Figure 4: Thirteen climate regions of Queensland

What are some of the impacts of climate change on small business?

Table B1: Broad impacts of climate change on small businesses. Note these are indicative only.

Impacts of Climate Change	Impacts on Small Businesses
 <p>Temperature increase</p>	<p>Businesses may require cooling equipment for employees and to maintain stable temperatures for climate sensitive industrial processes.</p> <p>Changes in the ability to work outdoors.</p>
 <p>Precipitation change impacting agricultural yields</p>	<p>Change in availability and quality of climate-sensitive natural resources as input materials for production resulting in increased competition and cost of resources.</p>
 <p>Sea-level rise and extreme weather events including flooding</p>	<p>Risk of damage to assets (buildings and equipment), interruption to water and energy supplies, supply chain and logistics, increased costs to weatherproof buildings and storage facilities and higher costs of insurance policies.</p> <p>Changes to customer base.</p>
 <p>Water stress</p>	<p>Increased competition for and cost of water resources.</p>
 <p>Biodiversity loss</p>	<p>Change in availability of natural resources as input materials.</p> <p>Impacts on tourism related activities.</p>
 <p>Human health and increased incidence of disease</p>	<p>Health of employees and workers in supply chain compromised, and rising costs of healthcare.</p>
 <p>Changing socio-cultural preferences</p>	<p>Changes in consumer behaviour and demand for specific products and services.</p>



Table B2: Sector specific climate change impacts.

Note that this is not a comprehensive list and the extent of these impacts will vary depending on sector and geographic location.

Sector	Broad likely impacts
<p>Agriculture</p> 	<ul style="list-style-type: none"> • Changes to crop growing season as well as type of crops that can grow in a certain area • Drought conditions can impact livestock • More refrigerated distribution and storage required and problems with livestock transportation during heatwaves. • Damage to transport infrastructure or disruptions to services due to flooding, etc., creating problems with transport of raw materials • Limited availability of water and potential interruption of supply to irrigation systems • Equipment and other investments, as well as expertise of farmers and workforce, are often linked to specific crops, which may become unprofitable or may no longer be viable • Quality issues: overheating of grain, or availability of water for pre-washed products • Access to land during flood or extreme rain conditions • Less frequent frosts will affect quality of certain crops and reduce kill-off of pests/disease • Exposure of workforce to increased heat • Farm buildings may be affected by extreme wind, heat and/or rain. This may also be an animal welfare issue <p style="text-align: right;">More information</p>



Sector	Broad likely impacts	More information
<p data-bbox="217 264 341 327">Food & Beverages</p> 	<ul data-bbox="464 264 1225 869" style="list-style-type: none"> • Risk of food supply and operation interruptions due to extreme weather events • Loss of power can result in loss of produce and inability to serve customers • Longer term weather trends may affect reliability (and quality) of fresh produce supply • Physical risk to water supply and raw materials • Greater risk of animal infections (e.g. avian flu), insect infestation, plant disease, etc. • Disruption of plant operation due to decreased water availability during drought • Increased heat or storms can deter customers from exposed shops and businesses. Increased exposure to these hazards, specifically to heat can also negatively impact staff and customer health and well-being 	More information
<p data-bbox="217 913 368 1010">Building Design and Construction</p> 	<ul data-bbox="464 913 1230 1256" style="list-style-type: none"> • Extreme weather events may disrupt transport for site deliveries and affect site work (e.g. muddy site conditions), restricting work-days • Infrastructure (e.g. drainage) affected by extreme weather events • Excessive heat in summer will affect some construction processes and onsite workforce leading to reduced worker productivity • Design standards may need to be clarified or upgraded in response to changing climate • Insurance may be more expensive 	More information
<p data-bbox="217 1301 288 1335">Retail</p> 	<ul data-bbox="464 1301 1225 1682" style="list-style-type: none"> • Extreme weather events may disrupt supply chains of small businesses including supply of raw materials, distribution of products and services • Extreme weather events can affect sales as customer behaviour varies based on weather conditions (i.e. reduced sales on extreme hot or wet days in street-side shops) • Physical assets such as store, warehouse and equipment can be affected by extreme events such as flood, cyclones, bushfire, heatwave, etc. • Increased energy requirement and cost for cooling due to increased heat. 	More information
<p data-bbox="217 1733 389 1796">Rental, hiring and real estate</p> 	<ul data-bbox="464 1733 1225 1883" style="list-style-type: none"> • Disturbance to infrastructure and business operations due to more frequent and intense natural disasters • Extreme events may cause delays in construction of new real estate projects leading to financial loss 	More information

What options do I have to manage my climate change risks?

Identifying risk management options is an important step in the adaptation process. This step involves considering what your business is doing at present to manage climate related risks (and other pressures), and investigating whether any changes are warranted or any new management options are required to address future risks.

There are many potential options for adapting to climate change and it is important to identify a wide range of options that may suit your business circumstances and resources. Some options may help to cope with present climatic extremes, while others will help once effects of climate change become greater. A good way forward is to develop a sequence of options that can be implemented as effects of climate change become more apparent.

At the early stage it is not necessary to consider detailed sequencing or the costs and benefits of possible actions, but it is an opportunity to build a list of possible management options that may be useful, or would be acceptable to your business circumstances and stakeholders (staff, clients, investors, etc.). Identifying a wide range of management options enables you to consider their interactions (i.e. how best to achieve multiple benefits and to consider sequencing of actions) which then can be linked to trigger levels (i.e. when to activate a given management option).

Selected options should match the broader goals of the business and its stakeholders. It is important to consider any opportunities and co-benefits that might result from the selected options. In determining responses to address climate risk it is important that actions do not increase emissions and further exacerbate the issue.

In this tool we have focused on actions that are relatively easy for a business to achieve, tackling issues that are within your control or influence.

However, for managing your climate risks, it is critical to engage and collaborate with all your business stakeholders (staff, customers, investors, owner of the premise where you operate your business etc.). For example, engaging with landlords and building strong relationships with nearby businesses can help you manage climate risks by facilitating cost and resource sharing after disasters.



Table B3: A list of indicative adaptation options and opportunities (not an exhaustive list).

What	How	Benefits	Risks
Ensure that new physical assets of the business are not developed in hazard prone areas.	Access hazard maps available through local councils or state governments to check whether proposed assets fall inside the hazard area.	Reduces exposure to future disruption to business and loss of assets. If new assets are developed in hazard prone areas and are affected by climate change, shareholders can take legal action as a result of failure to manage duty of care.	May increase development costs.
Undertake business continuity planning accounting for likely increases in extreme weather and events.	Conduct a rapid risk screening using the checklists in this tool.	Allows businesses to bounce back quickly after extreme events.	Low risk
Shift existing assets out of current or future hazard zones.	Access hazard maps available through local councils or state government to check whether proposed assets fall inside the hazard area.	Reduces exposure to future disruption to business and loss of assets.	May cause temporary disruption to business operation leading to temporary impact on revenue.
Enable flexible working arrangements for employees during extreme weather such as heatwave.	Discuss contingency plans for extreme events with staff (i.e. how they plan to get to work during extreme events).	Reduces loss of staff time during extreme events. Makes the business more resilient to extreme events.	Low risk

What	How	Benefits	Risks
Diversify customer base and products so that risk of disruption to business due to extreme events can be limited.	Understand how sensitive your current products and services are to climate and consider how such sensitivity can be reduced or made more resilient. Also consider exploring new and less climate sensitive products and services for your business.	Having products and services with varying degree of sensitivity to climate will help diversify your products.	Low risk
Consider having appropriate insurance coverage for your business against extreme weather events.	Assess climate risks for your business and operations using the checklists in this tool and understand how sensitive your business is to current and future climate events. Aim to have appropriate insurance cover in place.	Increases the resilience of your business and assists you to bounce back quickly if affected by climate extremes.	May increase business operation cost
If any of the risks that you have identified are critical for your business, you may consider knowing more about these risks by discussing with experts.	Engage with experts and consultants to conduct a formal climate change risk assessment for your business and operations.	Helps you identify your critical risks, when they are likely to become critical, options you have to get prepared, your legal responsibilities or duty of care, etc.	Can be expensive



Case study

Construction of clear roofed compost shelter at Simon's farm

Rationale

Simon and his wife purchased a 225ha farm in 2010. With the help of 4 employees, they milk 560 cows (twice daily) and supply milk all year round. Simon wanted to protect his cows from harsh summers and winters. Therefore he built them a shelter that cost \$280,000. This shelter is rated to withstand 165kph winds, has a life of more than 10 years and will cost between \$12,000 to \$14,000 to replace its plastic roof. Having his cows in a shelter does not just protect his cows, but also his pasture stock. The shelter also has a compost bedding area of 4,000m².

Outcome

During hot weather, all cows use the shelter as it is cooler than the outside temperature. A cooling breeze generally keeps good air movement in the shelter and cows rarely pant from heat stress. In winter, the cows are not wet or cold. There is no slipping on bedding and cows feel safe, especially when on heat.

The new shelter has allowed Simon to better manage the farm during extreme weather events, particularly during hot summers and wet weather. Improved utilisation and reduced damage to pasture has allowed him to increase cow numbers from 420 (pre-shelter) to 560. This was achieved without a significant increase in land area or imported feeds. Since the construction of the new shelter there is a 10% increase in pasture growth and production of milk solids (dry milk) has improved from 200 tonnes to 315 tonnes in 2 years.



Available resources:

Climate change related resources for all sectors

[Climate change in Australia website for climate change projection across Australia](#)

[Queensland Government's Regional Climate Change Projections](#)

[Queensland Future Climate Dashboard](#)

[Queensland Government's Coastal Hazard Maps](#)

[NCCARF climate change and sea level rise projections and maps for coastal councils](#)

[CoastAdapt First-pass risk assessment guidelines and templates](#)

[Role of insurance in climate change adaptation](#)

[Reducing the risk of legal challenge](#)

Queensland Government's Sector Adaptation plan for Small and Medium Size businesses.

Present day hazard related resources

[Australian Flood Risk Information Portal](#)

[Bushfire prone area - Queensland series](#)

Disaster preparedness resources

[Guideline for preparing your business for natural disasters](#)

[Get Ready Queensland](#)

[Queensland Fire and Emergency Service Bushfire Survival Plan](#)

Sector specific resources

[Nursery and Garden Industry Queensland "Natural disaster preparedness manual"](#)

[Dairy Australia climate change tool](#)

[Dairy Australia climate change tool pasture predictions](#)