Wet Tropics Regional Drought Resilience Plan 2024–2030

Australian Government
Department of Agriculture, Fisheries and Forestry

Future Drought Fund

Queensland Government

Rural Economies
Centre of Excellence

The Wet Tropics Regional Drought Resilience Plan has been developed as a partnership between the Rural Economies Centre of Excellence and the Far North Regional Organisation of Councils (FNQROC), Terrain NRM, and James Cook University (JCU).

The Regional Drought Resilience Planning program is jointly funded through the Australian Government's Future Drought Fund and the Queensland Government. Development of the plan has been supported by the Australian Government (Department of Agriculture, Fisheries and Forestry) and the Queensland Government (Department of Primary Industries).

Acknowledgement of Country

We pay our respects to the Aboriginal and Torres Strait Islander ancestors of this land, their spirits and their legacy. The foundations laid by these ancestors – our first Australians – give strength, inspiration and courage to current and future generations, both Indigenous and non-Indigenous, towards creating a better Queensland.

We recognise it is our collective efforts and responsibility as individuals, communities and governments to ensure equality, recognition and advancement of Aboriginal and Torres Strait Islander Queenslanders across all aspects of society and everyday life.

On behalf of the Queensland Government, we offer a genuine commitment to fearlessly represent, advocate for, and promote, the needs of Aboriginal and Torres Strait Islander Queenslanders with unwavering determination, passion and persistence.

As we reflect on the past and give hope for the future, we walk together on our shared journey to reconciliation where all Queenslanders are equal.

Contact us

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Monday, Tuesday, Wednesday and Friday: 8am to 5pm
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Interpreter statement

The Queensland Government is committed to providing accessible services to Queenslanders from all culturally and linguistically diverse backgrounds. If you have difficulty in understanding the regional drought resilience plan, you can contact us for assistance and we will arrange an interpreter to effectively communicate the plan to you.

Cover image: Ellis Beach, near Palm Cove, Australia.
Source: Shutterstock.

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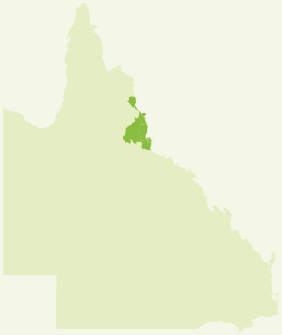


The Wet Tropics region is a unique and tropical landscape of remarkable diversity. It may seem off considering drought as an issue in the wettest part of Australia. Many across the nation would think that the Wet Tropics does not face drought. Every year, however, there is a long dry season of variable intensity. Sometimes, the wet season comes late or finishes early, and consequently, the dry season can be very long. On rare occasions, the wet may fail all together. Parts of our region have been drought declared over the last several decades.

Image: Cairns. *Source: Freepik*

The impacts of these long dry spells can be devastating, and they have a high cost for our communities. There can be water security risks and heat wave-based challenges in the built environment (including infrastructure, mental and physical health impacts). Drought can also have a devastating effect on key industries such as agriculture, tourism and the pastoral industry. As a globally recognised World Heritage Area, our ecosystems are fragile and wetlands, rivers, coastal plains and lagoons are challenged with significant stressors for wildlife and flora. These ecosystems also have cultural significance to Rainforest Aboriginal People and communities in our region.

Our region is familiar with natural disasters and hardship. Cyclones, floods, and economic downturns are regular events in our history and have created a resilient and adaptable culture. Being resilient and adaptable is critical to us as the region offers many opportunities. There is new potential for green economies including renewable energy and ecosystem services and emerging new industries in education, defence and maritime industries. These complement and are additional to our long-standing industries of tourism, agriculture, construction, health and social services.

The Wet Tropics is a dynamic region, adapting to and transitioning in the face of future climate challenges. In recent times the FNQROC has undertaken projects such as the Rivers to Reef Resilience Alliance Project through the Queensland Climate Resilient Councils program delivered by the Local Government Association Queensland. Following on from these projects in 2022, our Climate Resilience Technical Committee was established as part of Far North Queensland Councils and organisations working together to manage risks and develop opportunities for a climate-resilient and low-carbon future. The Committee comprises of local governments in the FNQ region, environment and natural resource management groups, Queensland Reconstruction Authority, National Emergency Management Agency, Wet Tropics Management Authority, and Bureau of Meteorology.

We are keen to be proactive in the mitigation of climate risk as well as supporting transition and adaption opportunities that deliver social, environmental, and economic benefits to our region. Being resilient in the face of drought is a key component of this work. This Plan, with its strategic actions, will enable us to be resilient to drought and be innovative in addressing the challenges it brings to ensure prosperous economies and vibrant communities and environments.

Mayor Angela Toppin
Chair
Far North Organisation of Councils

Acronyms

ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
ARENA	Australian Renewable Energy Agency
BoM	Bureau of Meteorology
CASS	Cairns Alliance of Social Services
CQU	Central Queensland University
CRTC	Climate Resilience Technical Committee
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPI	Department of Primary Industries
DETSI	Department of the Environment, Tourism, Science and Innovation
DRAMP	Drought Resilience, Adaptation and Management Policy
FDF	Future Drought Fund
FNQ	Far North Queensland
FNQROC	Far North Queensland Regional Organisation of Councils
FRRR	Foundation for Rural and Regional Renewal
JCU	James Cook University
LGA	Local Government Area

Image: Yarrabah. *Source: Shutterstock.*

LGAQ	Local Government Association of Queensland
NAMAC	Natural Asset Management Advisory Committee (FNQROC)
NIEIR	National Institute of Economic and Industry Research
NRM	Natural Resource Management
PHN	Primary Health Network
QLD	Queensland
QPWS	Queensland Parks and Wildlife Service
QRA	Queensland Reconstruction Authority
QSDR	Queensland Strategy for Disaster Resilience
RDA	Regional Development Australia
RDRP	Regional Drought Resilience Planning
RECoE	Rural Economies Centre of Excellence
SEIFA	Socio-Economic Indexes for Areas
TNQ	Tropical North Queensland
TTNQ	Tropical Tourism North Queensland
UNDRR	United Nations Office for Disaster Risk Reduction
WTMA	Wet Tropics Management Authority

Introduction

Background

The Regional Drought Resilience Planning (RDRP) program is jointly funded through the Australian Government's Future Drought Fund and the Queensland Government.

The Queensland Department of Primary Industries (DPI) has partnered with the Rural Economies Centre of Excellence (RECoE) with the purpose to have an impact on how regions can survive and thrive into the future.

The RDRP process will:

- foster learning and build social capital
- foster co-designed, community-led planning and collective ownership of the resulting plan and its implementation
- leverage existing local, regional and state strategic planning
- recognise the diversity of people, businesses and landscapes involved in agricultural production
- provide linkages with the Future Drought Fund (FDF) Drought Resilience Adoption and Innovation Hubs.

Five regions produced RDR plans in the foundational year. In the second round, the remaining nine regions developed RDR plans to prepare for future droughts, with a sharp focus on the agricultural sector and allied industries.

Each plan will build upon the Regional Resilience Strategy as part of the Queensland Government's Strategy for Disaster Resilience, led by the Queensland Reconstruction Authority. Based on evidence and collaboration though partnering with local councils, regional stakeholders and other organisations, the plans – led and owned by the community – aim to drive decisions, actions and investments to proactively manage drought risk.

Regional Drought Resilience Planning

Australia, and particularly the State of Queensland, is no stranger to drought. First Nations traditional stories of drought go back thousands of years and European settlers have officially recorded drought in Australia since the late 1700s. Droughts have been officially 'declared' in Queensland since 1897[1].

The economic, social and environmental costs of drought in Queensland are very significant and diverse. The toll taken on regions and their communities is high and the impacts often linger for decades. So, in recent years there has been a growing emphasis on the importance of drought resilience planning. This means planning now for the next drought and considering how to do things better or differently to make our communities more resilient.

Alignment with the Queensland Strategy for Disaster Resilience and Regional Resilience Strategies

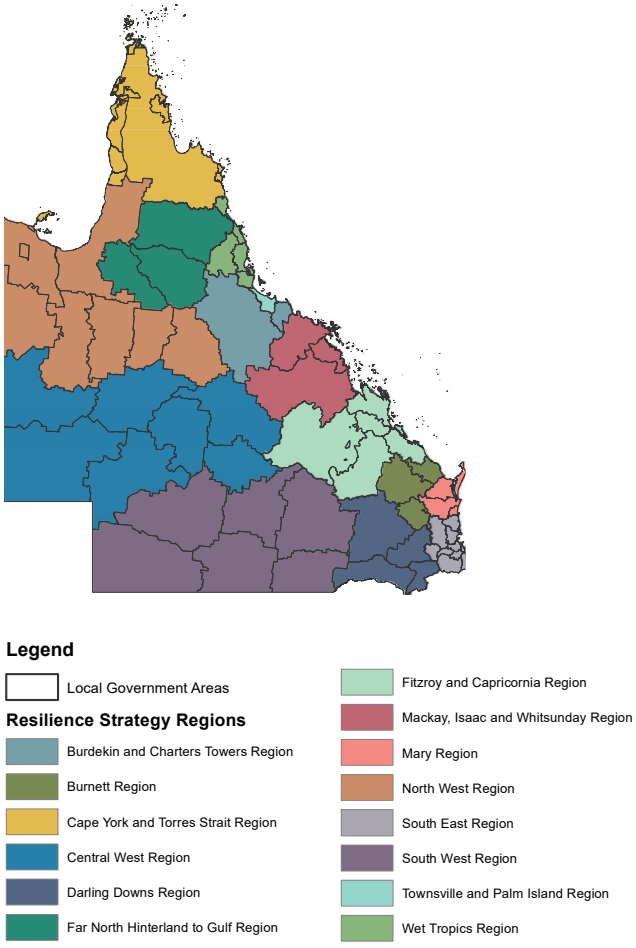
Queensland is the most disaster impacted state in Australia, and Queenslanders are susceptible to a variety of hazards. We are facing unprecedented change in both our current and future operating environment with a dynamic political, social, economic and policy landscape surrounding disaster risk reduction and resilience. This is being amplified by natural hazards becoming more frequent and intense due to a changing climate.

The Queensland Strategy for Disaster Resilience 2022-2027 (QSDR) promotes a systems approach to resilience that connects with a range of agencies and sectors to deliver improved outcomes for Queensland.

Queensland's suite of Regional Resilience Strategies ensures every region across Queensland is now part of a locally led, regionally-coordinated and state-facilitated blueprint to strengthen disaster resilience.

It is often agreed that resilience planning for disasters and resilience planning for drought should be aligned. The Queensland RDRP program builds on the work completed under the QSDR, led by the Queensland Reconstruction Authority (QRA). The RDRP program provides the opportunity to have a clear focus on drought risk in the context of regional resilience, addressing the unique challenges it poses and the need for setting out drought-specific priorities and actions at a regional and local level.

Figure 1: Queensland's Regional Resilience Strategies (Regions and Local Government Areas), Queensland Strategy for Disaster Resilience 2022–2027.[56]



Regional planning and engagement

This RDR plan was developed through collaboration between Far North Queensland Organisation of Councils (FNQROC), Gulf Savannah NRM, Regional Development Australia (TNQ), James Cook University (JCU) and key regional stakeholders.

The engagement model was developed from earlier work undertaken by RECoE, Red Cross Queensland[2], the Queensland Reconstruction Authority (QRA)[3], CSIRO[4] and was informed by international best practice from the World Bank[5] and the UNDRR[6]. The plan has been reviewed by an independent assessor appointed by the Australian Government, and their feedback has been incorporated into the final plan.

The RDR Plans were formulated through a strategic **three-phased co-design and engagement process**. This process involved:

Phase One
Initial consultation interviews with local and regional stakeholders from across industries and organisations representing the natural environment, community, culture and people, local economy, governance and built environment and infrastructure. Together with a literature review on regional profile, historical impacts of drought, future climate trends and existing initiatives, policies and strategies, preliminary insights on themes and actions for resilience were gathered.

Phase Two
The Regional Drought Resilience Forum facilitated workshops with key stakeholders identified through the first round of engagement to explore preliminary findings and highlight gaps and needs for resilience in the context of future climate scenarios.

Phase Three
The final phase encompassed the Regional Drought Resilience Online Forum, where key stakeholders across various sectors convened to deliberate on the pathways and actions, offer feedback, and pledge support for the collaborative implementation of the identified actions.

The Climate Resilience Technical Committee (CRTC) played an instrumental role in the development of RDR Plan pathways and actions. Representing Far North Queensland government and non-organisations, the CRTC contributed to review and feedback at two stages of the plan's development. The first review was conducted before the Regional Drought Resilience Forum where members of the technical committee reviewed summaries of impacts and actions providing feedback on gaps, needs and resilient actions. During the engagement process, feedback from stakeholders and a preliminary draft outlining over 60 actions were reviewed by the Climate Resilience Technical Committee. Through a dedicated workshop, these actions were refined and structured into six distinct pathways, each with corresponding actions.

Key stakeholders identified as leaders for the implementation of each pathway were pinpointed and engaged from the outset. Their involvement was instrumental in shaping the RDR Plan's pathways and actions, with a majority participating from the initial round of engagement.

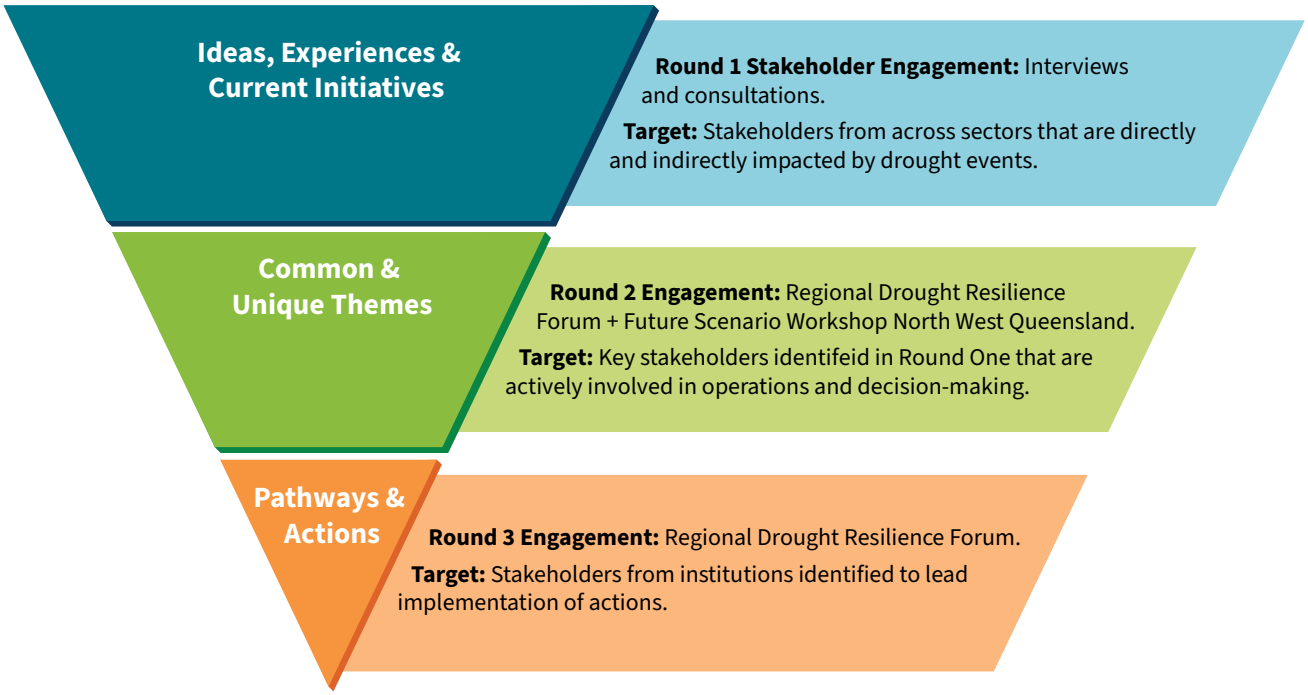
An engagement methodology diagram (Figure 2) is provided to illustrate the comprehensive engagement process employed. This visual representation aids in understanding the collaborative efforts that underpinned the co-design of the RDR Plan's pathways, actions, and the identification of leading stakeholders

The RDRP engagement process was reiterative and involved a systems approach highlighting local voices and ownership – combining diverse perspectives with a respect for local, including First Nations peoples, as well as 'scientific' knowledge. The Climate Resilience Technical Committee of FNQROC – a multistakeholder Committee of government and non-government organisations – provided a sounding board with input at regular intervals.

Alignment with existing resilience strategies was vital, including the QRA Regional Resilience Plan and FNQOC Climate Alliance Action Plan. Throughout the engagement process, key stakeholders had the opportunity to review emerging strategies.

The engagement process sought to build upon significant engagement already in progress across the region, dealing with broad issues of resilience and disaster response. Engagement was undertaken at both the local government and whole of region levels. Stakeholders from across the economic, social, and environmental domains were consulted via interviews and group discussions – their input and feedback informing this plan. There was attendance at special events or formal meetings to capture particular groups of people.

Figure 2: Co-design engagement methodology with key stakeholders.



Consultations and engagement have been undertaken with over 140 individuals and agencies in the Wet Tropics region, including:

- local government organisations
- groups of local government agencies e.g. Natural Assets Management Advisory Committee, FNQ Water Alliance Group, FNQ Regional Roads and Transport Group
- Climate Resilience Technical Committee
- not for profit health and community service agencies
- industry bodies e.g. tourism, agriculture
- regional development bodies e.g. Regional Development Australia Tropical North
- state government representatives
- economic or regional development bodies
- Aboriginal and Torres Strait Islander organisations/leaders or Traditional Owners
- Natural Resource Management groups
- water management agencies
- Emergency Service agencies
- Universities e.g. James Cook University and Central Queensland University researchers
- Other drought projects e.g. Tropical Drought Hub, Gulf Savannah, Cape York peninsula

To capture adequate First Nations input, a session was held with the Rainforest Aboriginal People's Forum supported by the Wet Tropics Management Authority, Terrain NRM and Queensland Parks and Wildlife. Approximately 50 Traditional Owners/ leaders were in attendance at this forum.

Key principles and concepts: drought and resilience

Whilst there is no universally accepted definition of drought, in Australia, the Bureau of Meteorology (BoM) states, *"drought, in general, means acute water shortage"*.[7]

In Queensland, drought is 'declared' for a local drought area and/or individual properties. Local drought areas are drought declared *"when the rainfall recorded during the previous 12 months (minimum) is in the lowest (or driest) decile or below the 10th percentile when compared to the long-term historical rainfall"*.[8] This is the technical definition of drought utilised in this plan.

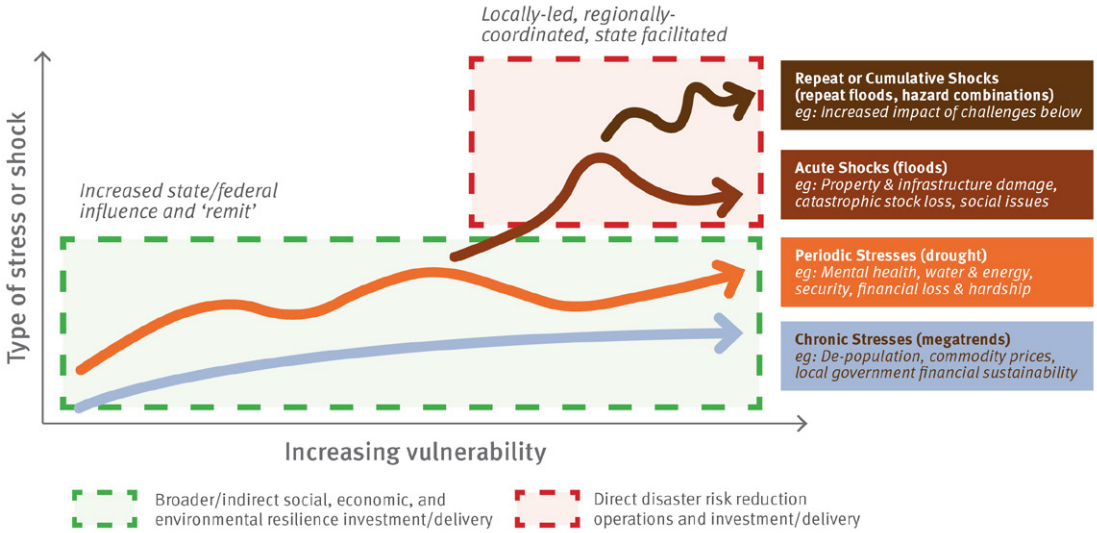
'Resilience' is harder to define. The World Bank has defined resilience as the ability *"… to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner"*.[9]

Australia's CSIRO perhaps more specifically states:

"drought resilience will result in a regional Australia that can endure deeper, longer droughts, and recover from them sooner. This will allow our food and agribusinesses to boost national farm income, increase food security, and protect the regional jobs that rely on agriculture. It will increase the resilience of rural and regional communities that depend on agriculture and improve environmental outcomes".[10]

Figure 3: Four key objectives of the Queensland Strategy for Disaster Resilience 2022–2027.[57]

Figure 4: How resilience is affected by stresses and shocks, adapted from the Queensland Strategy for Disaster Resilience 2022–2027.[58]



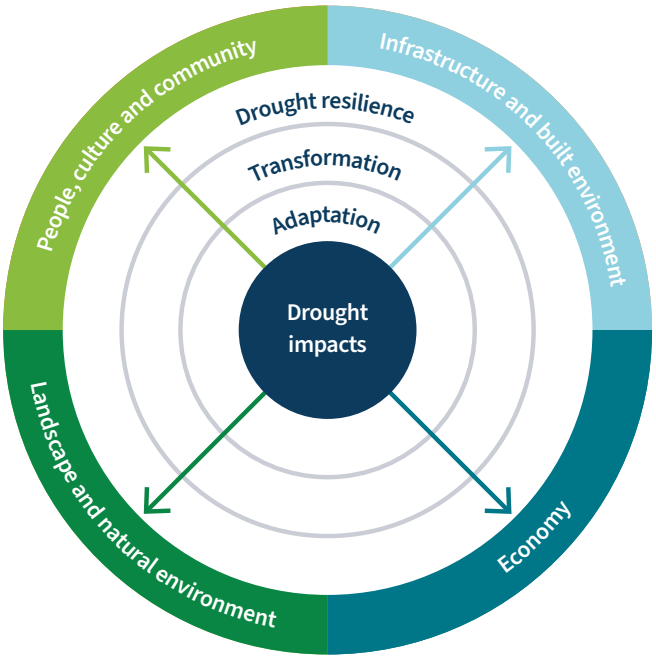
This plan uses drought resilience objectives that broadly align with the four key objectives underpinning the Queensland Strategy for Disaster Resilience.

Experience from earlier works on resilience has highlighted the crucial importance of community and regional resilience, sometimes referred to as 'societal' resilience. For instance, work by QRA has revealed that community stakeholders report that their 'societal resilience' is significantly affected by chronic and enduring stresses (long-term megatrends such as ageing populations, fluctuating commodity prices), periodic stresses (such as drought) that are often cyclical, acute shocks (such as rapid-onset disasters), cumulative shocks (often a rapid succession of shocks or the increased impacts of the combined stresses and shocks).

Whilst drought has been often referred to as "an enduring feature of the Australian landscape", when viewed in this context of community resilience, drought is also understood as a periodic stress that comes and goes. However, it is now evident that the warming caused by climate change has added to the variability in Queensland's weather and "increased the severity of drought conditions during periods of below-average rainfall".[11]

Importantly, our approach and engagement processes encouraged community and regional stakeholders to express their own observations of 'drought' and 'resilience'. We have combined the 'local' with 'outside' definitions to produce the regional understanding that underpins this plan and identifies drought impacts, risks and pathways to resilience.

Figure 5: Queensland RDRP elements of drought resilience.[59]



Understanding drought in the Wet Tropics

While the term 'drought' is generally not used widely in the Wet Tropics, regional stakeholders have identified significant impacts of drought-like conditions with extensive dry periods.

Through vast stakeholder engagement, a regional drought narrative has been identified as being unique to the Wet Tropics. The key features of this narrative include:

- Variability in seasonal patterns of the wet and dry season – changing the distribution of rainfall which can result in a late, reduced or failed wet season across part or all of the region, resulting in drier than normal conditions.
- Higher temperatures and heatwave conditions.
- Reductions in rainfall with high fluctuation in rainfall patterns.
- Increased evaporation and precipitation deficit.
- Linkages with pre and post disaster events including floods, cyclones, fire and other severe weather events.

Figure 6 illustrates some of the comments from regional stakeholders illustrate their perception of drought in the Wet Tropics.

Based on existing supply capacity within the Cairns Water Supply Scheme and future population growth projections, Cairns will be at risk of drinking water shortfall by 2026 – **Cairns Regional Council**.

Figure 6: Comments from regional stakeholders in the Wet Tropics

How to use this plan

The purpose of the plan

The Wet Tropics Regional Drought Resilience Plan (RDRP) has been developed in accordance with guidelines distributed by the Australian Government's Future Drought Fund (FDF) program. It also has been shaped by inputs from key stakeholders along with the voices and experiences of the region's people.

The purpose of this RDRP is to:

- Express the outcomes of the RDRP process and the aspirations and commitments of the region's people.
- Identify and establish critical networks and partnerships to inform and support drought resilience planning and actions.
- Combine the best of local and traditional knowledge with best practice data and information to make informed decisions.
- Clearly identify and plan for the ongoing and future impacts of drought across the region.
- Highlight pathways that the region can use to adapt to changes and build drought resilience.
- Specify key actions (regional and local) that can be implemented to build drought resilience in the region.

The plan could be considered relevant to charities, non-government organisations, not-for-profits, businesses, and government agencies with an interest in responding to the effects of drought in the region.

The RDRP process is intended to be practical, implementable and ongoing. As the region undertakes the specified actions, this plan will assist with monitoring progress and future learning.

Key inputs

This plan draws from and builds upon many important works. Some key plans, projects and studies used to inform the development of this plan include:

- Queensland Strategy for Disaster Resilience 2022–2027
- Wet Tropics Regional Resilience Strategy (QRA)
- Wet Tropics NRM Plan for People and Country
- TNQ Economic Development Strategy
- RDA TNQ Regional Strategy
- RDA TN Regional Water Summit 2020
- FNQROC River to Reef Climate Action Plan 2021–2026.

The local government plans informing the Wet Tropics RDR Plan include:

- **Cairns Regional Council**
  - *Cairns Water Supply Scheme Drought Response Plan*
  - *Cairns Regional Council Water Security Strategy*
  - *Water Demand Management Strategy*
  - *Local Disaster Management Plan*
  - *Cairns Climate Change Strategy 2023*
  - *Designing for Density in the Tropics*
  - *Cairns Regional Council Operational Fire Strategy*
  - *QRA Resilience Local Action Plan*
- **Cassowary Coast Regional Council**
  - *Water Restrictions Policy*
  - *Sustainability Policy*
  - *Local Disaster Management Plan*
  - *QRA Resilience Local Action Plan*
- **Douglas Shire Council**
  - *Regional Water Supply Security Assessment*
  - *QRA Resilience Local Action Plan*
- **Hinchinbrook Shire Council**
  - *Local Disaster Management Plan*
  - *QRA Resilience Local Action Plan*
- **Tablelands Regional Council**
  - *Climate Risk Management Strategy*
  - *Water Supply Strategy 2020–2069*
  - *QRA Resilience Local Action Plan*
- **Yarrabah Aboriginal Shire Council**
  - *Strategic Framework (Part 3)*
  - *QRA Resilience Local Action Plan*

Other important linkages

It is the intention of this plan that it be considered and factored into a range of other strategies and plans, including (but not limited to):

- regional plans
- regional economic development strategies
- regional transport and infrastructure plans
- natural resource management plans
- water resource plans
- local and district disaster management plans
- local asset management and capital works plans
- local corporate and community development plans
- land use planning schemes
- local and regional health strategies.

Image: Kuranda train station. *Source: Freepik.*

Regional profile

The Wet Tropics RDRP region comprises six Local Government Areas (LGAs) managed by the Cairns Regional Council, Cassowary Coast Regional Council, Douglas Shire Council, Hinchinbrook Shire Council, Tablelands Regional Council and Yarrabah Aboriginal Shire Council. The region has a total land area of 23,064km2 (2,306,400ha), about 1.3% of Queensland. Yarrabah is the largest Aboriginal Shire and community (by population) in the State.

In 2021, there were 248,106 people living in the region. There is a relatively high (10.3%) Aboriginal and Torres Strait Islander population (Figure 8), with almost all residents living in the Yarrabah Aboriginal Shire identifying as either Aboriginal or Torres Strait Islander.

The largest population centre is Cairns, which is the fifth largest city in Queensland and the 15th largest in Australia. Cairns is the major service centre of the much wider FNQ and Torres Strait region, with a port and international airport. It also sits at the end of the main railway line from Brisbane, with both modes of transport facilitating international and domestic visitation. Figure 10 provides an overview of community characteristics, including population and growth statistics.

Figure 7: Wet Tropics regional map.[60]

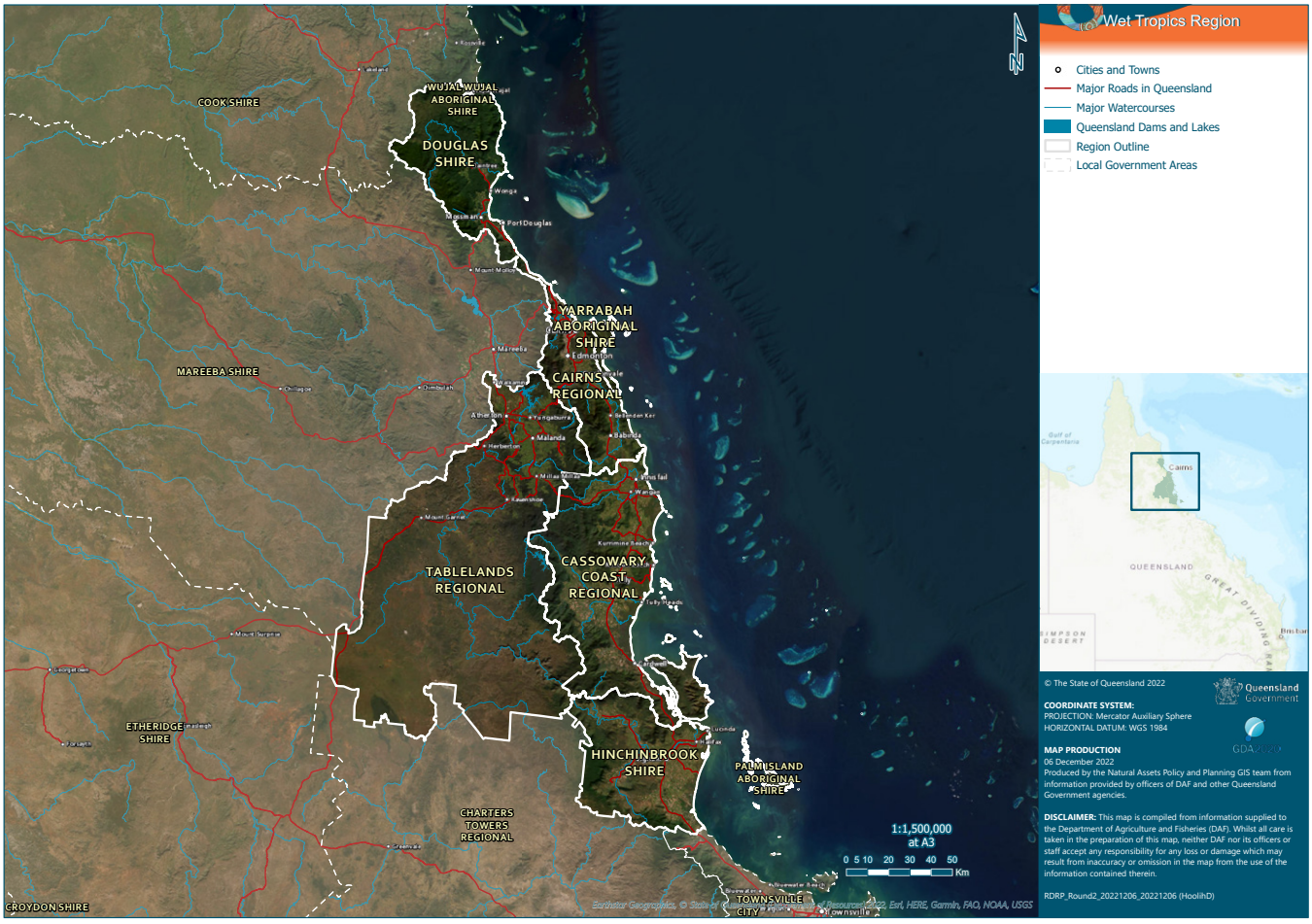


Figure 8: Local Government Areas and population.[61]

Yarrabah	Douglas	Cairns
Cassowary Coast	Hinchinbrook	Tablelands
Population (2022)		
2,505	12,693	172,272
29,651	11,090	26,844
% identifying as Aboriginal and/or Torres Strait Islander		
98.2%	8.4%	9.7%
11%	6.9%	7.9%
Area (km²)		
158.8km²	2,400km²	1,700km²
4,700km²	2,800km²	11,000km²

The Bruce Highway runs north to south and carries large volumes of travellers and goods to and from Cairns, as it is the primary supply chain route. There are four main roads crossing the coastal range, the Rex Highway near Port Douglas, the Kuranda Range Road from Cairns, the Gillies Highway from Gordonvale and the Palmerston Highway just north of Innisfail – all providing access and connectivity for the myriad of people and activities across the region (Figure 9).

The residential population is diverse and comprised of many ethnicities with varying levels of education and skills. Figure 11 summarises a range of relative socioeconomic indices across the LGAs, providing information about the economic and social conditions of people and households in the region.

Figure 9: Wet Tropics population centres and main roads.[62]

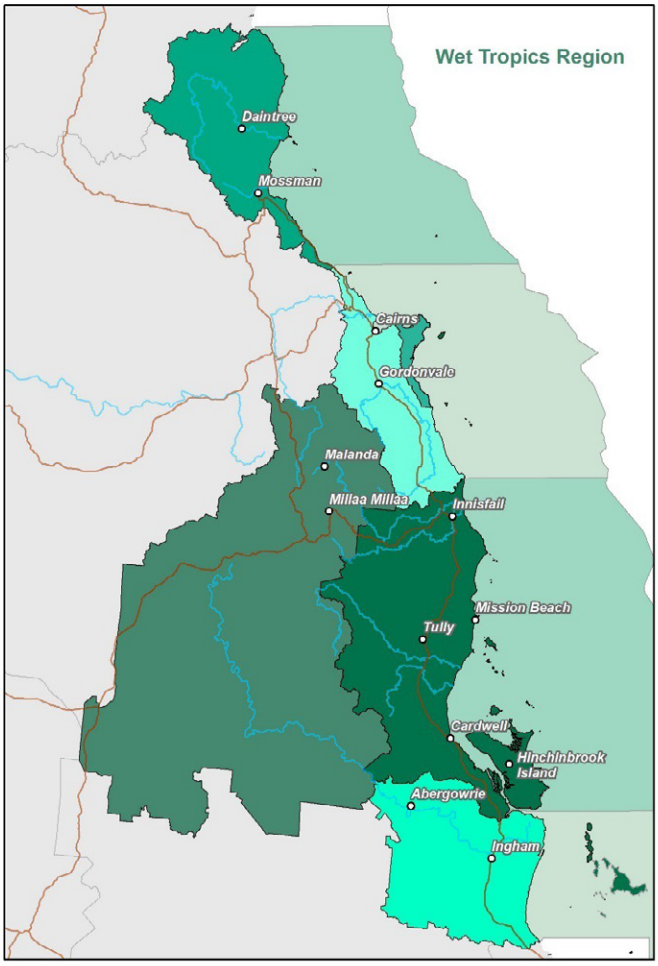
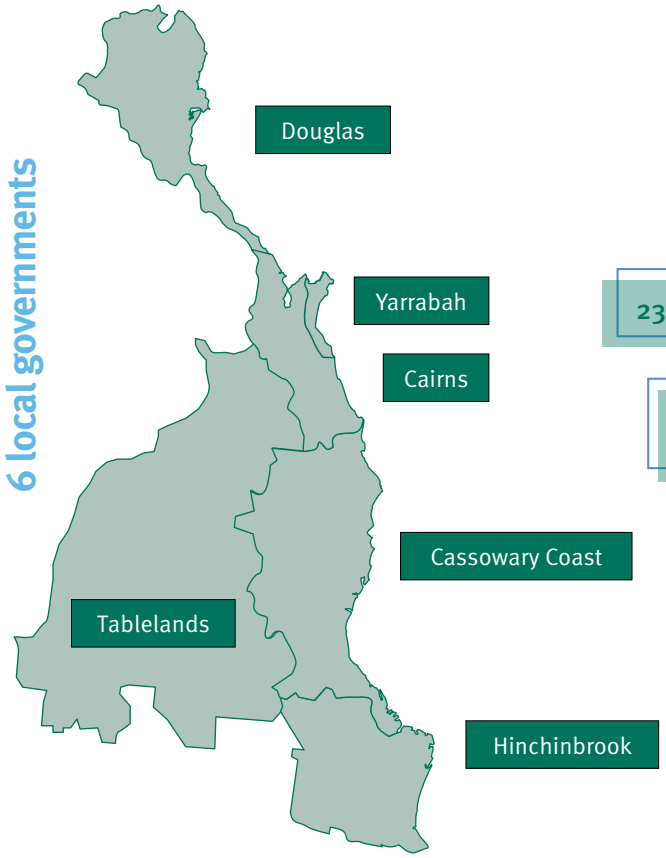


Figure 10: Regional snapshot of Wet Tropics RDRP region.[63]

A snapshot of community characteristics



Population: 248,186 (4.9% of Queensland population)

23,052km2 1.3% of Queensland's land mass

Over the next 25 years the average annual growth rate is expected to increase by 1.2%

Over the next 25 years the average annual growth rate is expected to increase by 1.2%

40.9% migration rate

31.2% in the most disadvantaged SEIFA quintile

9.7% Aboriginal and/or Torres Strait Islander Peoples

19.5% under 14 years old

16.4% over 65 years old

Median age 39.8 years

Top five employing industries:

- Health care and social assistance (13.2%)
- Retail trade (10.3%)
- Accommodation and food services (9.8%)
- Education and training (8.8%)
- Construction (7.7%)

Figure 11: Regional socioeconomic profile.[64]

	Yarrabah	Douglas	Cairns	Cassowary Coast
Population (people) as at 30 June 2021	2,402	12,693	172,272	29,651
Australian Digital Inclusion Index (2021)	N/D	66%	72%	64%
Projected population as at 30 June 2041 (medium projection)	N/D	15,059	236,593	32,198
Unemployment rate (% persons aged 15 and over, 2021)	37.2%	4.2%	5.7%	5.3%
Median age of residents as at 30 June 2021	25	46	39	46
SEIFA 2016 Socio Economic Index of Social Disadvantage	518	981	980	931
% Aboriginal or Torres Strait Islander Peoples (2016)	98.2%	8.4%	9.7%	11%
LGA Area (ha)	15,880	240,000	170,000	470,000
Persons with a profound disability needing assistance (2021)	N/D	4.9%	5.4%	6.8%
Protected area – parks, forests, reserves area (Feb 2023) (ha)	10,798.7	218,227.5	85,837.2	290,967.5

	Hinchinbrook	Tablelands	Queensland
Population (people) as at 30 June 2021	11,090	26, 844	5,322,058
Australian Digital Inclusion Index (2021)	62%	63%	71%
Projected population as at 30 June 2041 (medium projection)	8,780	30,127	7,161,661
Unemployment rate (% persons aged 15 and over, 2021)	4.2%	5.0%	5.4%
Median age of residents as at 30 June 2021	51	49	38
SEIFA 2016 Socio Economic Index of Social Disadvantage	960	949	996
% Aboriginal or Torres Strait Islander Peoples (2016)	6.9%	7.9%	4.6%
LGA Area (ha)	280,000	1,100,000	–
Persons with a profound disability needing assistance (2021)	8.3%	6.5%	6.0%
Protected area – parks, forests, reserves area (Feb 2023) (ha)	104,579.8	321,564.4	14.2 million

The unemployment rate in 2021 varied from 4.2% to 5.7%, but in some sub-demographic groups ranged from 11–37%. The median age of residents in most LGAs was listed as 40+, except for Cairns and Yarrabah, and this median age is slowly increasing at a rate of 3–5 years over the last 10 years. The SEIFA (2016) index of social disadvantage showed five of the six LGAs as being in quintile 2 (of 4), with 1 being the least disadvantaged. Scores ranged from 949 to 980, however Yarrabah is the fifth most disadvantaged LGA in Queensland with an index score of 518. Across the region, 17.3% of the total Indigenous population have a long-term health condition (e.g. diabetes, respiratory or cardiac system conditions) compared to 19.4% of the non-Indigenous population and the state average of 8.2%. Of these health conditions, 6.8% of the Indigenous population has a profound or severe disability (needing assistance) which is slightly higher than 6.1% of the region's non-Indigenous population and 6.2% for the whole of Queensland. People who are in the lower socioeconomic sector are also more vulnerable to disease, due to poorer living conditions and diet. The chronic disease burden is increasing exponentially beyond current capacity[12].

Natural landscape

The great diversity in the rainfall, geology, soils, topography, drainage and altitude of this region has resulted in a complex and exceptionally varied spectrum of plants and animals. Although the Tablelands and coastal plains have been severely modified by human activity, there remains many unique landscapes crafted by nature. The protected area estate, including World Heritage, National Parks and Conservation Areas, comprise almost 37% of the region.

The Wet Tropics is an iconic part of Australia and is the only place in the world with two adjoining World Heritage Areas – the Wet Tropics of Queensland rainforests and the Great Barrier Reef. These World Heritage rainforests are recognised internationally for their ancient ancestry and many unique plants and animals which have evolved with, and are dependent on, the region's high rainfall. The Wet Tropics of Queensland World Heritage Area has Australia's greatest diversity of animals and plants. Many of these species are found nowhere else in the world. It is a region of outstanding natural beauty with elevated tablelands, green coastal floodplains nestled between the foot of the highest peaks in Queensland and the Coral Sea. It extends from the iconic Daintree forests of the north to the sugarcane covered delta of the Herbert River catchment in the south, and then west to the Atherton and Evelyn Tablelands.

A dominating feature of the landscape is the Great Dividing Range, and subordinate ranges separating the humid but rich coastal floodplains from the cooler elevated Tablelands. There are many islands, continental and coral cays, close offshore in the Coral Sea. These include the iconic Hinchinbrook Island off Cardwell, Green and Fitzroy Islands off Cairns and Low Isles off Port Douglas. A number of these islands include tourist enterprises and many experience high daily visitation by both tourists and locals.

The landscape has a myriad of waterways and waterfalls and there are many small ephemeral creeks that are short and fast flowing. There are also larger perennial rivers that flow east from the elevated coastal ranges and tablelands, draining to the Coral Sea and the Great Barrier Reef lagoon. There are numerous wetlands with many locations identified as high ecological value. All these waterways sustain the natural flora and fauna of the many ecosystems, as well as providing recreational opportunities and essential water supplies for domestic, agricultural and industry use.

Indigenous culture

The region is home to a rich, vibrant and enduring Rainforest Aboriginal People's cultural heritage, handed down since millennium within the many different Traditional Language Groups. These comprise at least 20 Traditional Owner Tribal groupings with over 100 clans and family groupings (Figure 12). Each group has customary obligations for management of their country under Aboriginal lore. Over 80 legal entities represent Land, People and Culture. In November 2012, the Wet Tropics World Heritage Area was relisted to formally include its cultural values. This listing recognises that Rainforest Aboriginal People's cultural heritage is unique to the Wet Tropics and is a remarkable and continuous connection with a tropical rainforest environment. Native title and other Rainforest Aboriginal People's land interests cover 87.5% of the Wet Tropics World Heritage Area[13]. Effort is also now progressing towards the development of a Cultural Values Management Plan for the Wet Tropics.

Figure12: Traditional Owner Tribal Groups in the Wet Tropics region.[65]

Climate

There are two very distinct seasons across the region – summer wet season (November to April) and winter dry season (May to October) – which are largely driven by the monsoon. During the dry season there is reduced rainfall, but rarely none, for extended periods. The prevailing moist onshore southeast winds combined with the coastal ranges leads to high rainfall, with the greatest intensity and volume during the tropical monsoon period in the summer months (wet season). This combination of winds and topography can lead to extreme rainfall variability over relatively short distances.

The region has an annual average rainfall of just over 2,000mm and an average daily temperature range of 17.9°C to 26.9°C. The wet season summers are hot and humid with temperatures ranging from 28°C to 36°C. Although some areas, particularly in the far west of the Tablelands, experience hotter days of more than 40°C. Humidity is greatest on the coast with an average range of around 60–70%, but during the wet season can occasionally exceed 90%. Annual average rainfall is highly variable across the region with the area around Queensland's highest mountain, Mt Bartle Frere (1622m), in the Cassowary Coast region receiving around 4,000mm/year. This area has recorded in excess of 12,000mm/year[14] while the Tablelands region regularly averages around 1,350mm/year. Tully, in the Cassowary Coast region, has the distinction of being recognised as the wettest town in Australia.

Tropical cyclones are a typical feature of the wet season and can have devastating impacts on the natural, social and economic environments. Climate forecasts advise the region can expect hotter temperatures, hotter and more frequent hot days, more intense downpours, less frequent but more intense tropical cyclones as well as several impacts on our seas.

Employment

Livelihoods and lifestyle are closely linked to the climate. For many years agriculture was the dominant industry across the Wet Tropics, but this dominance has shifted in recent times (Figure 13). Employment sectors vary across the local government areas (Figure 14), but the Health Care and Social Assistance sector is now the highest overall employer across the region and, except for Douglas, provides approximately 10–20% of the region's employment. There are many smaller townships dotted throughout the region and while many of these have small hospitals, Cairns has the major hospital providing services to the Wet Tropics region as well as the Gulf and Cape regions.

Figure 13: Combined regional employment by industry time series.[66]

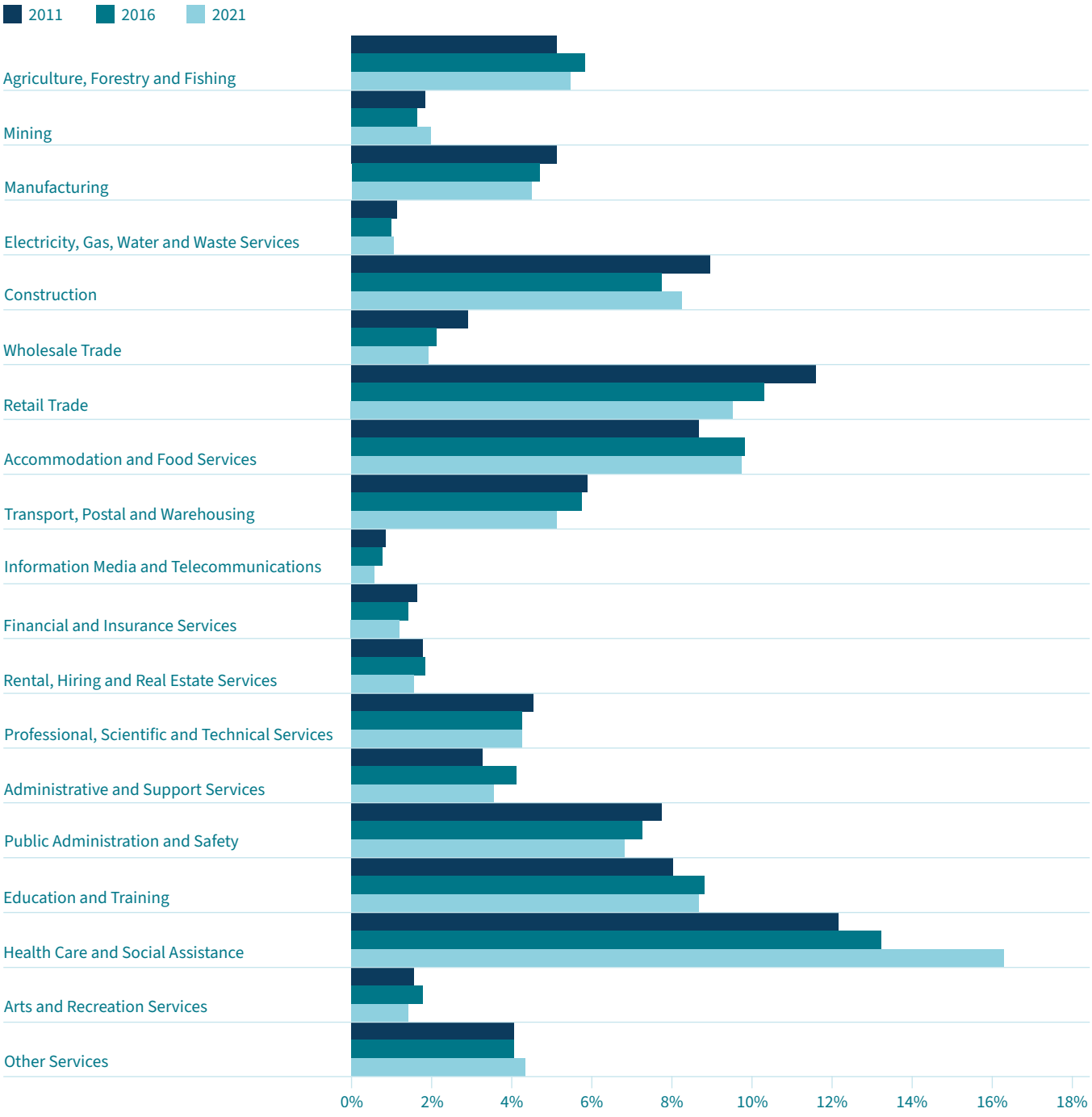
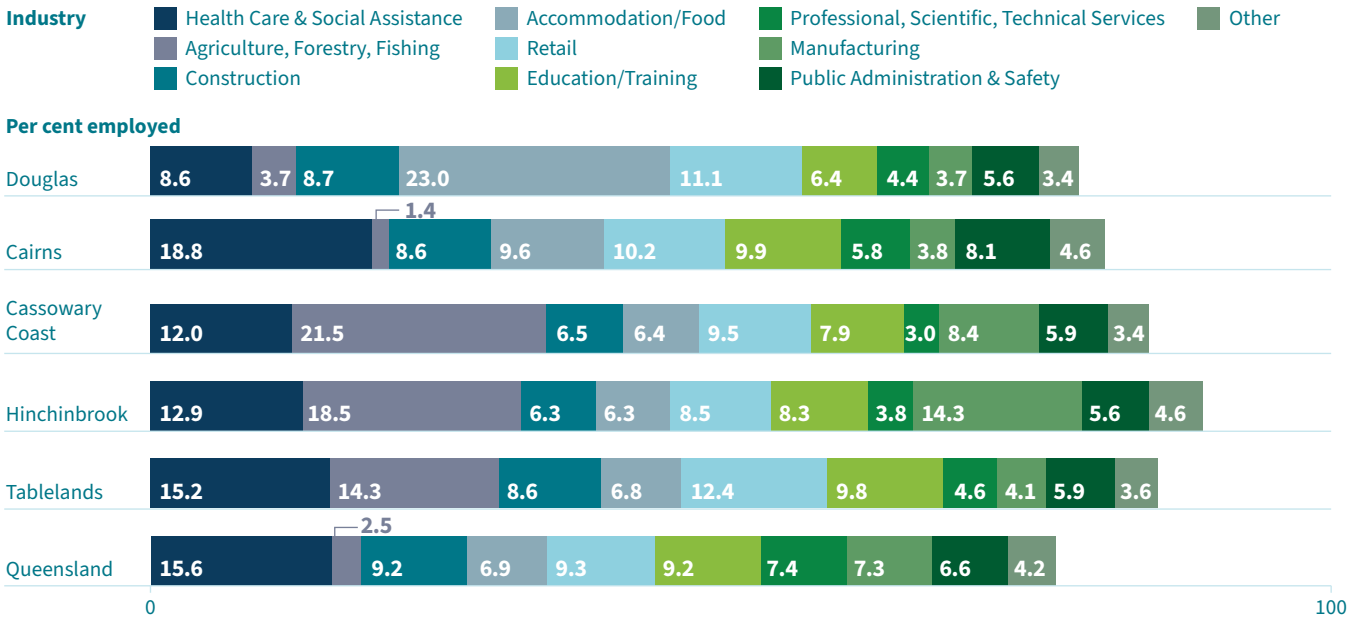


Figure 14: Breakdown of % employment by industry and LGA (FTE 2021/22).[67]



Economy

Tourism is a major contributor to the regional economy and employment levels, especially in the Cairns and Douglas LGAs (Figure 15). From March 2020 to late 2022, travel restrictions and border closures due to COVID severely impacted the local economy. Recent data shows the industry is recovering, however is not back to "pre-COVID times". Tropical Tourism North Queensland (TTNQ) is up 18.8% from 2019, with the domestic visitor spend per night up 23.3% from pre-COVID figures. However, the region is still $500 million short of pre-pandemic levels because the $1 billion international visitor market is yet to return.

The latest figures from Cairns Airport show domestic passenger numbers are above pre-COVID levels and there were more than 2,400 international passengers through the airport in June 2023, the most since March 2020[15].

Agricultural production from the region totalled ~$1.214bn[16] incorporating a variety of agricultural land uses (horticulture, cropping, grazing and dairy). The region's high rainfall and fertile soils have seen intensive agricultural development since European settlement and agriculture continues to be the predominant industry for many of the smaller coastal and hinterland townships. The different soils, topography and climate influence the predominant agricultural commodity across the local government areas (Figure 17). Sugar cane and bananas provide the greatest agricultural economic contribution on the coastal plains whereas other fruit, tree crops, bananas, livestock and milk production dominate the Tableland's agricultural economy.

Production systems for fruit require a significant contribution by a seasonal labour workforce, and they are heavily reliant on the Pacific Labour Force initiatives set in place by the Australian Government. Prior to COVID restrictions, they also utilised the overseas backpacker industry. The Atherton Tablelands with its cooler climate and rich pastures, has a significant livestock industry – predominantly cattle for slaughter, but also a substantial (although much reduced) dairy industry – as well as some poultry production. Tree crops including mangoes, avocados, bananas and berries also comprise a significant portion of the Tablelands industry.

Apart from the constantly varying weather conditions, all these industries are subject to the vagaries of economic fluctuations, including the sale price and input costs. Inputs include fertilisers, machinery, electricity and irrigation infrastructure, as well as costs to manage pests and diseases. These costs vary hugely from year to year, impacting on net income. Smaller enterprises are most commonly family run and while they do not have the benefit of economy of scale, frequently a family member will also engage in off-farm work to support the enterprise. It is not uncommon for smaller properties, particularly sugar cane, to also diversify income streams by growing another fruit or vegetable crop to supplement income. Tablelands agriculturalists also tend to have a variety of tree/fruit crops rather than a single commodity.

Figure 15: Value of tourism and tourism sales to the LGAs.[68]

	Value of Tourism sales 2021/22	Total value added	% Employment of total industry
Douglas	$318.99 million	$150.88 million	30.9
Cairns	$1681.5 million	$826.19 million	14.2
Cassowary Coast	$98.62 million	$49.94 million	6.1
Hinchinbrook	$33.56 million	$15.85 million	5.0
Tablelands	$100.32 million	$46.16 million	6.5

**Yarrabah is not included as there is very limited data, although the township has an arts centre and a museum showcasing the history of the settlement.*

Figure 16: Land-use across the Wet Tropics RDRP region.[69]

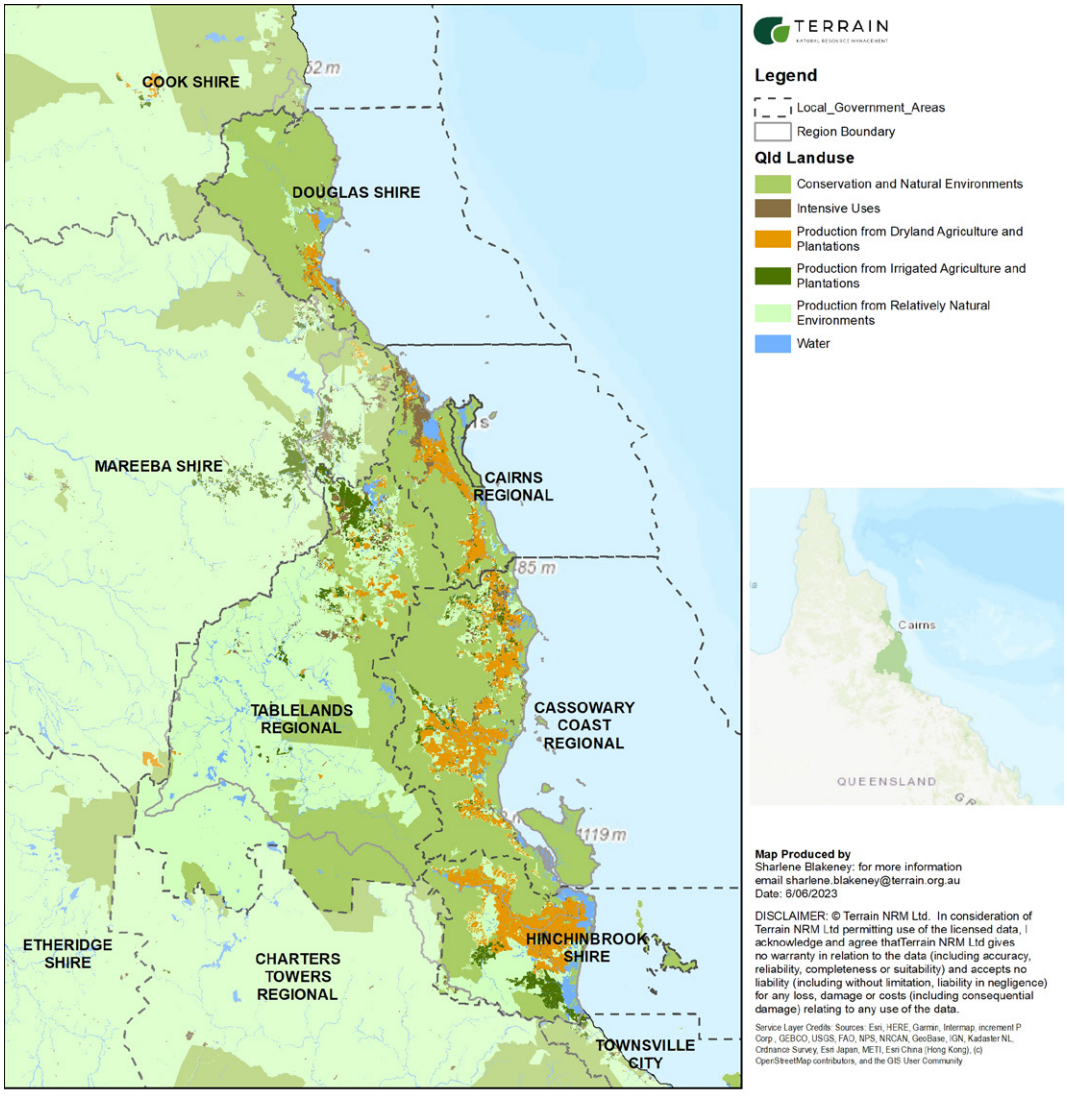
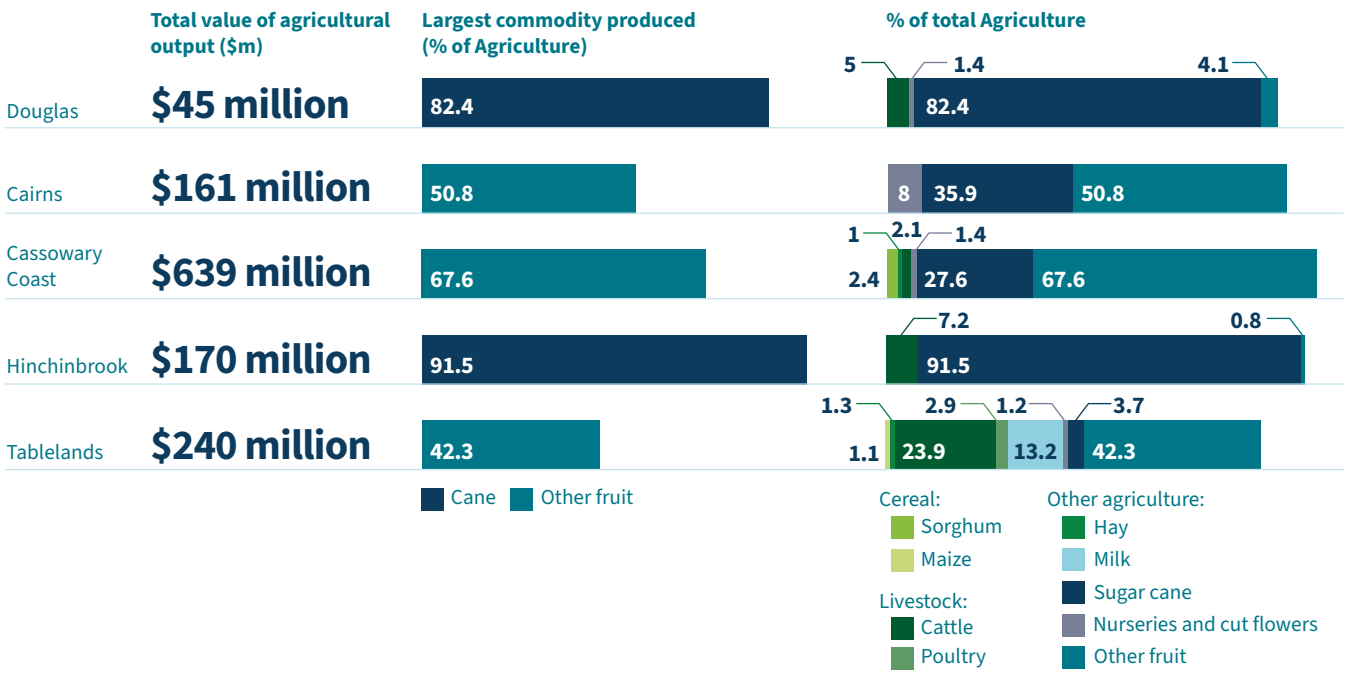


Figure 17: Value of agricultural commodities by LGA 2020/21.[70]



Water sources

There are many water resources in the study area, including wetlands, water courses, floodplains, aquifers and major rivers with many smaller creeks and rivers. These are the cultural and environmental lifeblood of many communities. The major catchment areas are Daintree, Barron, Mulgrave, Russell, Johnstone, Tully, Murray and Herbert. Several of these catchments include other smaller waterways. The Barron Water Plan was revised in 2023 and some key changes made including:

- maintaining the ability to buy and sell water, either permanently or temporarily, through the water trading market
- identifying an additional 20,550ML of unallocated water to meet new and emerging demands
- recognising and respecting the cultural and spiritual connection to water of First Nations Peoples by incorporating traditional knowledge into the water plan
- enhancing our protection of the Great Barrier Reef with updated objectives for testing the impacts of decisions on environmental water flow requirements
- considering the effects of climate change on future water availability[17].

There are several significant water storages in the region. Lake Morris (Copperlode Dam) was specifically designed for Cairns' water supply and feeds Freshwater Creek down into the increasingly populated Redlynch Valley. Tinaroo Dam on the Tablelands section of the Barron River was developed to service the Mareeba-Dimbulah Water Supply scheme for agricultural irrigation, but also provides a water allocation for Cairns, as well as providing water to the Barron Gorge Hydro-electric Power Station. Koombooloomba Dam on the upper reaches of the Tully River was built for hydro-electric power generation through Kareeya Hydro Power Station.

History of drought in this region

Weather conditions related to drought – such as temperature, evaporation and rainfall – are considered equally significant, as their influence in the Wet Tropics region more closely aligns with the regional concept of drought.

Drought, as it is traditionally defined, has not been a regular feature of the Wet Tropics region[18] shown in Figure 18. None of the five coastal local government areas in the Wet Tropics region have ever been officially drought declared. The only LGA in the region to have experienced drought declarations is the Tablelands Regional Council, which has been at least partially drought declared a total of 12 times since 1965. Even within this shire, many areas have not been officially affected, with drought most common in areas to the west of the Great Dividing Range. Figure 19 shows an example from 2017 of the section of the Tablelands Shire in the Wet Tropics region that is typically affected by drought. Although much of the region has never been officially drought declared, there have been periods when significantly lower than average rainfall was received, including in 2002–2003 during the Millennium Drought (Figure 14). Historically, the Wet Tropics experienced prolonged periods of extensive drying in the early 20th century, but annual rainfall shows no long-term trend between 1910 and 2013.[19]

Figure 18: Time drought declared since 1964.[71]

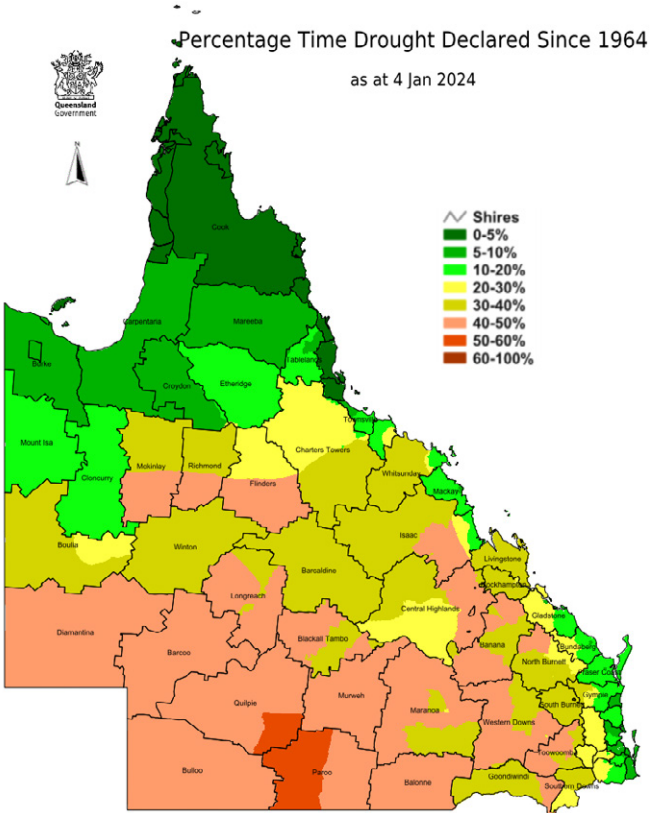


Figure 19: Queensland drought situation 2017, including drought declaration in Tablelands Regional Council local government area.[72]

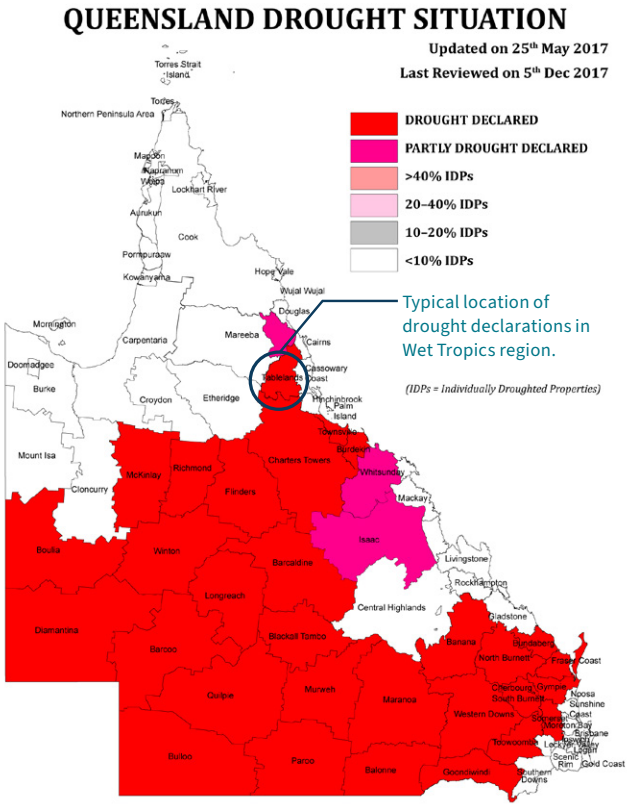
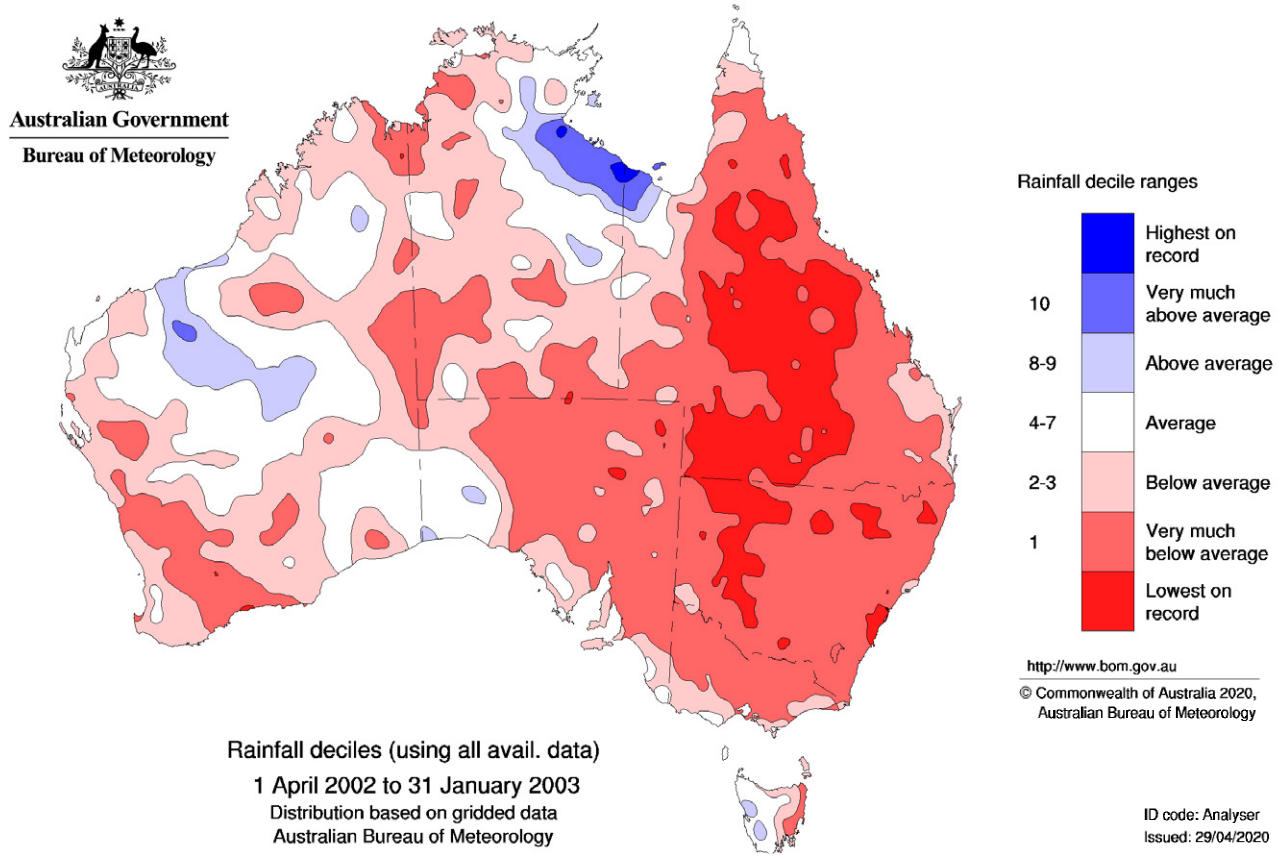


Figure 20: While drought declarations in the region are rare, extremely dry periods are more common.[73]



Across Australia, climate change is driving an increase in the intensity and frequency of hot days and heatwaves in Australia, exacerbating drought conditions[20] as shown in Figure 20.

Temperatures have increased over the past century, with the rate of warming higher since 1960. Mean temperature increased between 1910 and 2013 by around 1.1°C. Daily minimum temperatures increased by slightly more than daily maximum temperatures[21]. For example, Figure 22 shows the observed maximum temperature variation from the 50-year average in Cairns since 1969.

The rainfall patterns for the Wet Tropics are illustrated by LGAs from 2000–2022 in Figure 23.

Figure 21: Average sea surface and surface air temperature in Australia.[74]

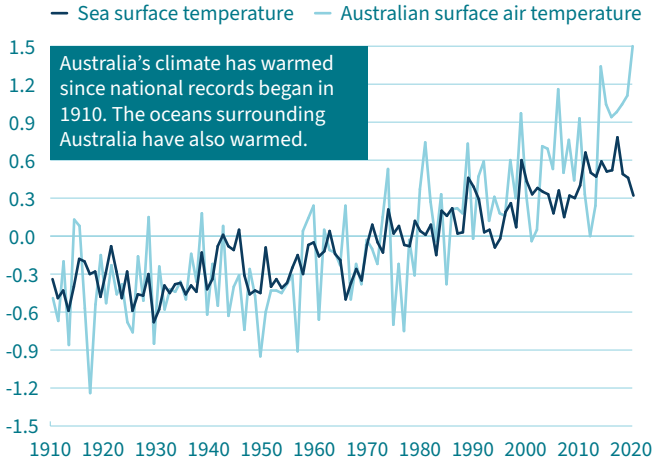


Figure 22: Observed maximum temperature variation from the 50-year average for Cairns.[75]

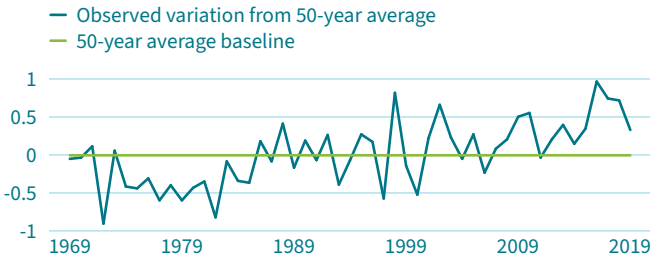
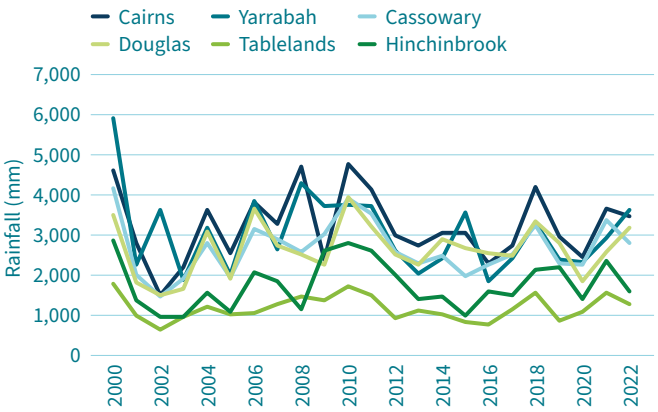


Figure 23: Annual rainfall by LGA, 2000 to 2022.[76]



A relatively new understanding of drought in the region is 'flash drought'[22]. While typical droughts result in the lack of water over months or years, flash drought can develop in weeks to months. They are characterised by sudden onset and rapid intensification of drought conditions with potential severe impacts on agriculture. The Bureau of Meteorology does not define drought but characterises low rainfall data in terms of rainfall deciles – Serious Deficiency of Rainfall (lowest 10 percentile of records, ~1:10yr return cycle), or Severe Deficiency of Rainfall (lowest 5 percentile of records, ~20yr return cycle). For the purpose of this study, drought is within the 10 percentile of median annual rainfall. This assumes deficiencies with these long return cycles translate into a stress in the system (e.g. agricultural production, community water supply, environment) which would fit the general perception of drought. In the Wet Tropics context, it is important to recognise while an area in "drought" may still receive large amounts of rain relative to other areas of Australia, it is a much lower percentage of that area's "typical" rainfall. Applying this parameter to one weather station in the region indicates the deficiency of rainfall as illustrated in Figure 24.

Applying BoM's criteria, the annual rainfall totals for an Analysed Rainfall Station (e.g. Tully Sugar Mill) indicates the drought criteria (10 percentile of all median data approximating to Serious Rainfall Deficiency) is 3,807mm. Years recording less than 3,807mm annual rainfall would meet the drought criteria.

Evapotranspiration is a collective term for the transfer of water, as water vapour, to the atmosphere from both vegetated and unvegetated surfaces. It is affected by climate, availability of water and vegetation[23]. The evapotranspiration for Australia is shown in Figure 25, with the Wet Tropics having 800–1300mm of evapotranspiration.

As the Bureau of Meteorology notes, the coastal areas (particularly in northern Australia) with greater moisture levels and warmer temperatures lead to higher rates of evapotranspiration. The Queensland Government climate change for the FNQ region's annual average potential evaporation is more than 50% greater than the annual average rainfall, which contributes to the depletion of soil moisture".[24]

Figure 24: Frequency distribution of annual rainfall for Tully Sugar Mill Station 1925–2022.[77]

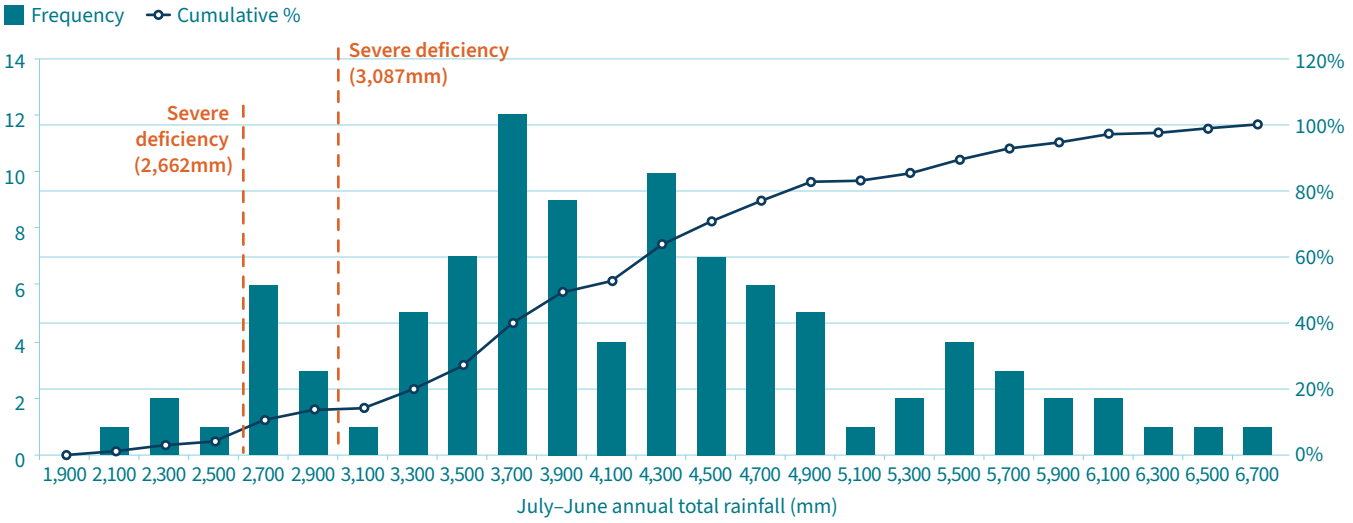
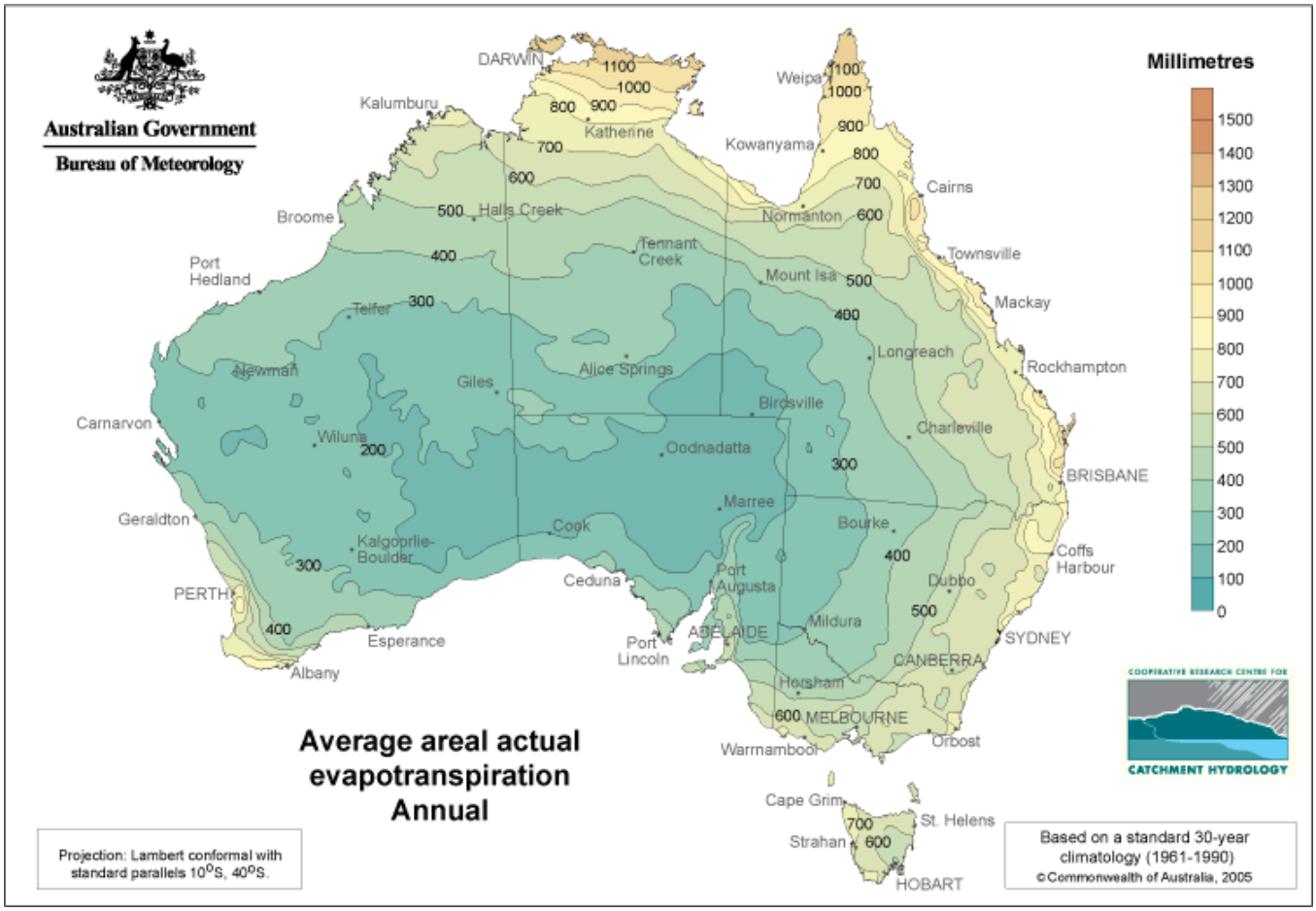


Figure 25: Average evapotranspiration.[78]



Past impacts of drought in this region

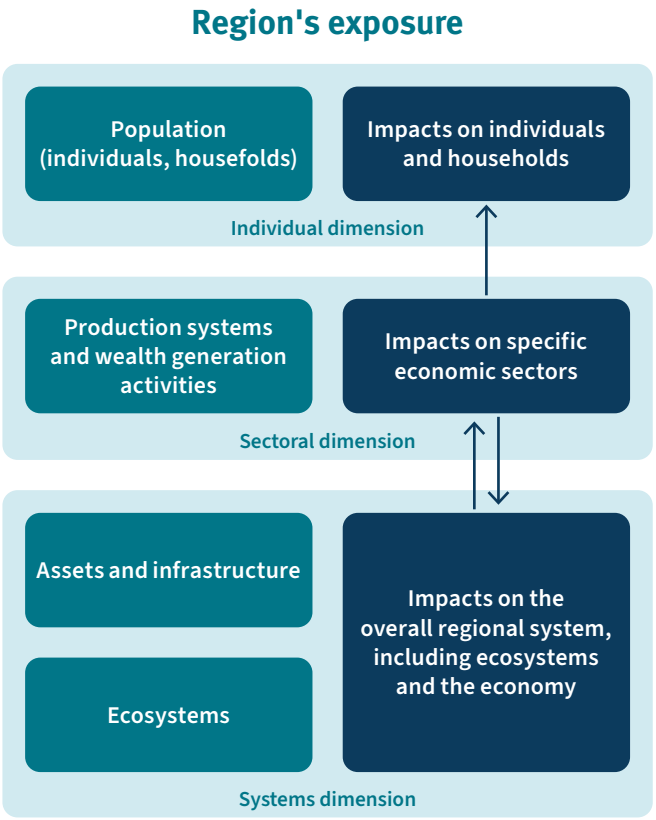
In context of the Wet Tropics, drought relates to the variability in seasonality and distribution of rainfall. This change can result in a late, reduced or limited wet season across part or all of the region. Importantly, the concept of drought in the Wet Tropics used in this plan also includes weather conditions that are strongly correlated with more typical drought. This includes higher temperatures and heatwave conditions, reductions in rainfall, increased evaporation and increased variability in rainfall patterns.

Drought in the Wet Tropics is experienced in a different way too many other parts of the country. The region experiences pronounced wet and dry seasons, with naturally high levels of rainfall variability[25]. There are reasonably regular rain-bearing systems for at least part of the year with annual rainfall heavily influenced by monsoon lows and tropical cyclones. Orographic sources of rain also influence moisture availability, particularly in the coastal and eastern parts of the region. Although the amount, timing and location of rain can be variable, rainfall totals in the region are generally amongst the highest in the country.

Evaporation plays an important role in the amount of available water in the Wet Tropics, with the annual average potential evaporation in the region more than 50% greater than the annual average rainfall, which contributes to depletion of soil moisture[26].

"We often get no rain or little rain from August right through to Christmas. Creeks run dry and rivers run low, the lawn dies off and trees get stressed – they lose their leaves. We don't get the traditional sort of drought, but we do get water stress."

Figure 26: Dimensions of cost of drought.[79]



When considering drought, there are quite distinct sub-regions within the Wet Tropics, largely affected by distance from the coast and elevation. These sub-regions can be broadly grouped into lowland coastal areas, eastern-facing ranges and Tablelands, high elevation mountain peaks and western areas of the Great Dividing Range. Each of these sub-regions experiences significant differences in climate – including temperature, evaporation and rainfall patterns. These factors result in western areas of the region experiencing vulnerability and exposure to drought quite differently than coastal locations, the eastern ranges and Tablelands and the higher mountain peaks.

Cairns has an annual average rainfall of 1,992mm, while Koombooloomba Dam, near Ravenshoe, has an annual average rainfall of 2,694mm. Further south, Cardwell has an annual average rainfall of 2,113mm. Consistent, long-term rainfall monitoring in more western locations is limited. Walkamin has an annual average rainfall of 1,018mm, while Mareeba (which is only 60km inland from Cairns, but in the Gulf Hinterland region), has an annual average rainfall of 836mm[27]. The higher elevation mountain top peaks are some of the wettest places in the world with the summit of Mount Bellenden Ker recording up to 12,461mm annually[28].

"Drought in the Wet Tropics is not in the traditional sense, it is around distribution rather than volume. We can still have a massive amount [of rain] but if there are long breaks in between, most of the rain won't be effective as it is lost in deep drainage or run-off. Wet Tropics 'drought' means we haven't got the right amount in the right place at the right time. That is, timing rather than total volume."

In considering the impacts of drought across different pillars, CSIRO[29] argues we must understand all potential aspects. CSIRO proposes a model for understanding the impacts at individual sectoral and systems dimensions.

It is critical to note there are compounding factors and events with multiple effects across the social, environmental and economic aspects.

People, culture and community

The social impacts of drought in Australia are widely known and documented. Evidence suggests there are cumulative impacts of disasters on social wellbeing. For example, The 2023 National Farmers Wellbeing Report highlighted the cumulative impact of disasters on farmers' wellbeing[30]. The consultations held in the Wet Tropics region identified a range of social impacts of past droughts including:

- Acute and chronic physical impacts e.g. dust and air quality.
- Increased mental health impacts, including suicide.
- Impacts on vulnerable individuals and communities (e.g. elderly, First Nations, remote, people with disabilities, low socioeconomic, and the homeless).
- Increased burden on social and primary health care networks.
- Impacts on liveability e.g. recreation areas and parks, housing.
- Hardship, trauma and stress.
- Higher levels of isolation and social disconnection.
- Reduced vibrancy of rural businesses and towns.
- Cost of living expenses e.g. purchase of potable water.
- Depletion of social capital.

The drier western parts of the region are more susceptible to drought. In addition, there are fewer industries in this region, which increases the vulnerability of communities to drought. With limited alternatives beyond cattle grazing for business or economic opportunities, severe or prolonged dry conditions have had significant historical impacts in this region.

The impacts of drought on coastal communities and areas of higher or more reliable rainfall in the region have not been as severe. Extended dry periods can result in reduced availability of fresh water to meet urban and rural needs and place pressure on water supplies. However, multi-year episodes of water shortages are rare and hence these parts of the region experience relatively less severe impacts than many other parts of the country.

Vulnerable people and communities, including First Nations people, are often disproportionately affected during periods of hardship – including drought and related weather events such as higher temperatures and heatwaves.

"The biggest risk or vulnerability for health services is access to clean drinking water. Services have already experienced disruptions due to lack of clean water."

In comparison to other cultural groups in the region, Indigenous communities are more likely to experience reduced access to healthcare, fresh food, water and sanitation and economic opportunities. Heatwave conditions associated with drought will exacerbate health problems like asthma, diabetes, cardiovascular and transferrable diseases[31].

"First Nations people are a large proportion of the vulnerable population and the largest proportion of the population accessing health services."

The close connection between healthy country and healthy people in First Nations culture has even greater significance when considering the increased likelihood of extreme climate conditions such as drought and the impacts this is likely to have on natural systems.

"Culturally, water plays a big part. The rainbow serpent lives in waterholes, and he looks after the waterways. As Traditional Owners we're always working within the environment that we've been given. You learn from your elders and stories that have been passed down. It's survival in drought. Streams and story places could suffer."

Economy

Changing climate conditions results in inevitable economic impacts, with the effects more severe in years of extreme climatic events in the region[32]. Direct and indirect effects of drought, including increasing temperatures and prolonged heat waves, will affect key regional industries, with flow-on effects to regional employment.

Consultation identified a range of economic impacts of past droughts including:

- Higher cost of running businesses (e.g. additional water costs for horticultural and grazing industry, increased power costs).
- Reduced productivity e.g. soil/land conditions.
- Vulnerability of workforce to heat stress.
- Loss of viability of businesses with flow on impacts across the supply chain (e.g. employment, income, transport).
- Impacts of heatwaves on tourists and reduced tourism.
- Infrastructure and ecosystems repair costs.
- Animal welfare, particularly in grazing industries.
- Regional ripple effects in Wet Tropics and surrounding regions affecting industries, income, and employment.

Key economic industries in the Wet Tropics region – like agriculture and tourism – are heavily reliant on and impacted by weather conditions, including rainfall and temperature. Drought has had significant impacts on the grazing industry in the western parts of the Tablelands LGA, including reductions in productivity, income and land condition. Drought impacts on agriculture in many ways including access to water for crops, soil conditions, erosion, impacts on livestock, additional water storage infrastructure costs, increased pests and diseases and overall reduced productivity.

"In the millennial drought, we ran out of water, we had to buy 11,000 gallons and farms around us didn't have money to do that. Those that had cattle needed a lot more water and either sold, killed, or let their cattle roam free."

Other parts of the region, which have historically been less impacted by drought, are still affected by associated weather conditions like increasing temperature and reduced rainfall. The dwindling dairy industry on the southern Atherton Tablelands is vulnerable to drying conditions affecting pasture quality; planting on cane farms can be delayed due to lack of rainfall to sustain the plants and other dry conditions.

"Feed based security [for the dairy industry] builds drought security. Drought impacts the cost of feed inputs in dairy and adds to financial pressure. If a business is struggling to be profitable, drought adds to the level of hardship. It affects farming families and rural communities socially, financially and emotionally."

Even if the Wet Tropics region itself is not experiencing official forms of drought, it can be impacted by drought in surrounding regions, particularly to the west in the Gulf Hinterland. Higher numbers of cattle from further west are often transported to the Wet Tropics region to be closer to the coast when drought and feed shortages are experienced in neighbouring regions. Costs of inputs for a range of industries can also increase because of drought in areas where the inputs are produced. There are regional ripple effects affecting income, employment and business viability.

Landscape and natural environment

The Wet Tropics region is one of the most biodiverse in the world, supporting complex assemblages of plants and animals that have evolved over millions of years in relatively stable climatic conditions. Two adjoining World Heritage Areas, the Wet Tropics and Great Barrier Reef, are found here. There has been significant interest and study on the impacts of climate change on these systems, including the effects of hotter temperatures and more frequent hot weather associated with drought conditions.

The consultations identified a range of environmental impacts of past droughts including:

- Biodiversity impacts (distribution and number), particularly on endemic species (e.g. cassowaries, bats, fish).
- Heat stress on natural assets (e.g. Millaa Millaa falls evaporation and flow) and wildlife (e.g. Spectacled flying fox, *Pteropus conspicillatus*).
- Increased fire risks and changes in fire behaviour.
- Increased invasive pests and weeds.
- Degradation of land and water assets.
- Impacts on acidity of oceans and endangering tidal mangroves and subsequently impacting fish reproduction and abundance.

Endemic species are highly vulnerable to extreme climate events due to high habitat specificity. Already, mass deaths in Spectacled Flying-fox colonies have been recorded in Cairns because of high temperatures. In a single episode in 2018, a series of hot days resulted in the death of over 23,000 Spectacled Flying-foxes, thought to represent 30% of the entire population[33].

"Twice now we've watched bats dropping out of trees because of hot weather. The colony does what they can to protect the vulnerable individuals, like females with young, but large numbers still die."

The typically moist conditions and more fire-resistant rainforest ecosystems found over much of the region means wildfires are not a regular feature of these areas. However, there are also parts of the region which have drier forest types, more susceptible to uncontrolled burning and even areas of rainforest that have burnt in particularly dry years. For example, sections of Cardwell National Park experienced crown fires in rainforest vegetation communities during one of these intense dry periods, which is very unusual for the Wet Tropics.

"Droughts coupled with heatwaves really kills the natural landscapes up here."

During a very dry time in the 1980s in Hinchinbrook Shire, river levels became so low that trees and vegetation were established in the riverbed. When the river started to flow again, the water flow changed significantly because of the vegetation.

"And then we have the mass fish kill at Mulgrave, where hundreds of fish died because of low saturated [dissolved] oxygen which was both because there was not enough flow in the river because there wasn't enough water, but also because the temperature was high."

Some LGAs also identified fire risks associated with low rainfall and dry vegetation. Fire regimes are a major determinant of vegetation (e.g. grasses, trees, ground cover) and extreme fire events alter the fire regimes. They can also have detrimental impacts on the environment and the economy, which could have a significant impact for the Wet Tropics.

Infrastructure and built environment

The impact of drought on infrastructure in the Wet Tropics region is considered as part of the broader suite of related weather conditions – including hotter temperatures, more variable rainfall and increased fire weather. Consultations identified a range of infrastructure and built environment impacts from past droughts including:

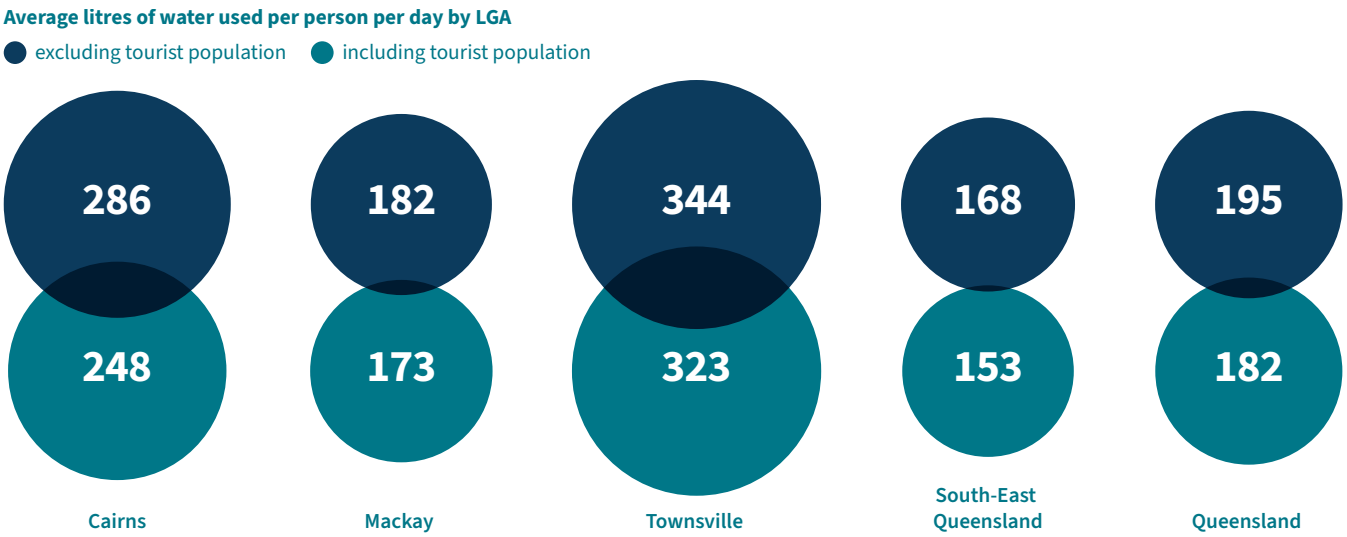
- Impacts on roads, bridges and transportation networks (e.g. major beef roads cracking, surface melting, increased dust and danger).
- Adverse impacts on recreational areas (e.g. sports fields, parks and water parks).
- Damage to digital connectivity and disruption of service (e.g. fire affecting power lines).
- Increased maintenance and repair costs of existing infrastructure.
- Potable water supply deterioration.
- Use of equipment and air conditioning.
- Increased precipitation in water sources and dams.

Potable water supplies within the townships across the region are provided by the various local government authorities. In June 2023, the water supply for Yarrabah was found to have high levels of lead and subsequently bottled water was provided to the community. Lack of clean water has many flow-on effects beyond provision of safe drinking water, particularly in Yarrabah, which also has a renal dialysis unit requiring clean water. Without an adequate water supply, this service is unable to operate. This creates even further disadvantage for local residents dependent on this critical service, resulting in an increased burden on the health system by needing to transport people to Cairns Base Hospital for treatment.

The catchments and waterways in the Wet Tropics are very dependent on high rainfall. Any alteration to the timing or amount of rain can quickly bring about drought like conditions. In a particularly dry period in 2018, many local creeks in the Cassowary Coast region ran dry and there was fire in the catchment surrounding the town water storage areas. This impacted on town supply which led to the Council introducing water restrictions.

A comparative analysis was used to better understand water use in Cairns compared to Townsville, Mackay and South East Queensland (SEQ). Compared to SEQ, residents within Cairns use around 70% more water daily. Measures of per capita water consumption (including and excluding tourist equivalent populations) show water consumption per capita in Cairns and Townsville is significantly higher than Mackay, SEQ and Queensland (Figure 27). Tourists typically use more water per person than local residents and the tourist equivalent population as a proportion of standard population is considerably higher for Cairns, which may partially explain its high per capita water usage rates. Cairns has recorded the highest annual rainfall in recent years. However, if the Wet Tropics region experiences a (low rainfall) dry season, there is pressure on councils and water authorities to manage supply and demand more precisely. The predicted reduction in levels of precipitation resulting from climate change are likely to decrease water supply, exacerbating existing water management issues.

Figure 27: Average residential water consumption with and without tourist population.[80]



Most of the Cairns Region LGA is supplied by two main water sources – Behana Creek and Copperlode Falls Dam (Lake Morris). Followed by extensive consultations by the Water Security Advisory Group, Council adopted the Cairns Water Security Strategy with a focus on emergency water supply in 2020. Drought provisions were also adopted for one of the main town water supplies, Copperlode Falls Dam. Applying disaster principles, the Council determined triggers based on storage volume as shown in Table 1.

The Drought Response Plan provides Cairns Regional Council the framework to effectively manage any minor or extreme drought affecting water supply availability, and communicate with and manage the provision of water services to its customers.

Table 1: Trigger levels for drought and emergency for Copperlode Falls Dam.[81]

CFD Volume		Activation Level		
Storage Volume (ML)	**Percent of Full Supply Volume**	**Trigger Level**	**Water Restriction**	**Emergency Water Supply**
38,475	100%	NA	Permanent Conservation Measures	Normal Operations
30,780	80%		Level 1 Restrictions	
26,932	70%		Level 2 Restrictions	
23,085	60%	1	Level 3 Restrictions	Alert
19,238	50%	2	Level 4 Restrictions	Lean Forward
12,000	32%	3		Stand-up
175	0.5%		Essential minimum Supply	

Image: Smoke haze of a sugarcane fire near Mossman Gorge. *Source: Shutterstock.*

Likely future impacts (risks) of drought in this region

Climatic conditions around the world are changing, largely because of increasing greenhouse gases in the atmosphere – trapping heat, warming the air and oceans, and impacting precipitation. The climate of the Wet Tropics region is experiencing the effects of these conditions. Even if significant reductions are made to global greenhouse gas emissions now, we are still likely to experience changing climatic conditions for many years to come.

In addition to changes in weather variables, climate change is likely to exacerbate the frequency and severity of extreme events – such as flood, drought, heat and bushfires[34]. The cumulative effect of these changes, along with increased variability and less predictability in our weather patterns, will have significant impacts on the resilience of the region's communities, industries and natural systems and their ability to recover between events.

Consideration of future impacts of drought in the Wet Tropics is again discussed in the context of related weather conditions – particularly temperature, rainfall and evaporation. Projected climate changes in the region include the following:

- Higher temperatures, with increases in maximum, minimum and average temperatures.
- Hotter and more frequent hot days.
- Uncertain changes to fire frequency, with fire weather conditions likely to worsen and more extreme fires likely to occur.
- Changes to rainfall are uncertain, but more intense downpours are likely and dry seasons may be longer.
- Increased evapotranspiration.
- Less frequent but more intense tropical cyclones.
- Continued sea level rise and more frequent sea level extremes.
- Warmer and more acidic ocean[35].

Drought will continue to be a feature of the regional climate variability, but projected changes are uncertain, and drought is unlikely to be the main feature of regional climate variability.

"Water is one of our most valuable resources and I don't think people are treating it as such."

Temperature

Temperature predictions in the Wet Tropics for the near future (2030) show an average increase of 0.3 to 1.1°C above the climate of 1986–2005. By 2090 under a high emissions scenario (RCP8.5), temperatures are predicted to warm by up to 3.9°C[36].

"More people die from heat related issues than any other natural disaster – this is especially an issue for First Nations people."

In Figure 28, the horizontal line on each bar is the middle (median) projected temperature change. The extent of each bar indicates the range of projected changes.

In Cairns – the main urban centre of the Wet Tropics region – average maximum temperatures are projected to increase over time (Figure 29), with predictions of more than 60 days a year reaching 35°C or more by the year 2090. This is up from a historical average of four days per year[37].

"People get hot under the collar in hot weather. They don't want to go outside from their air con. Alcohol consumption increases in hot weather and people get dehydrated."

Figure 28: Projected annual average temperature changes for the region.[83]

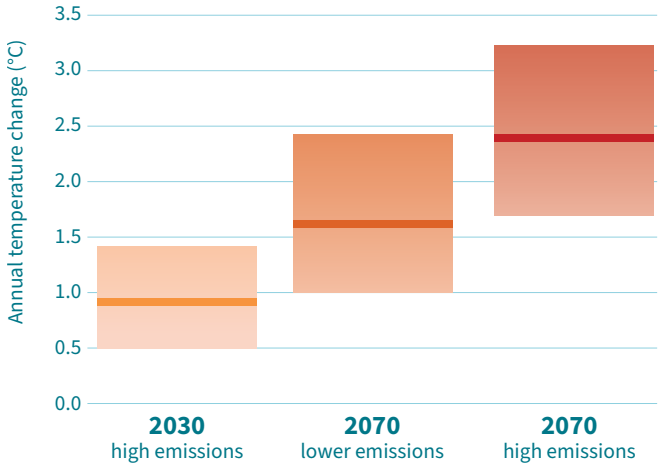
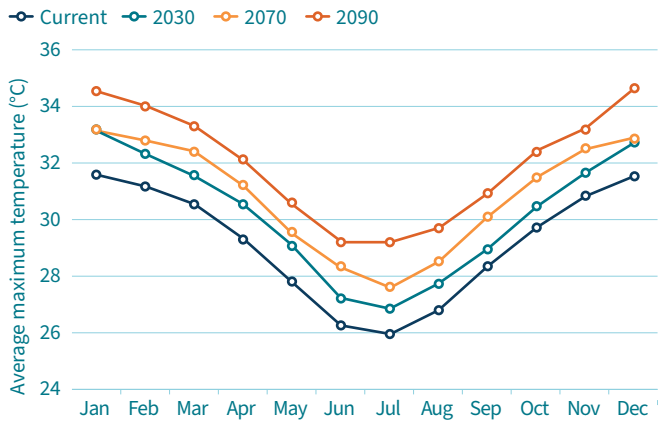


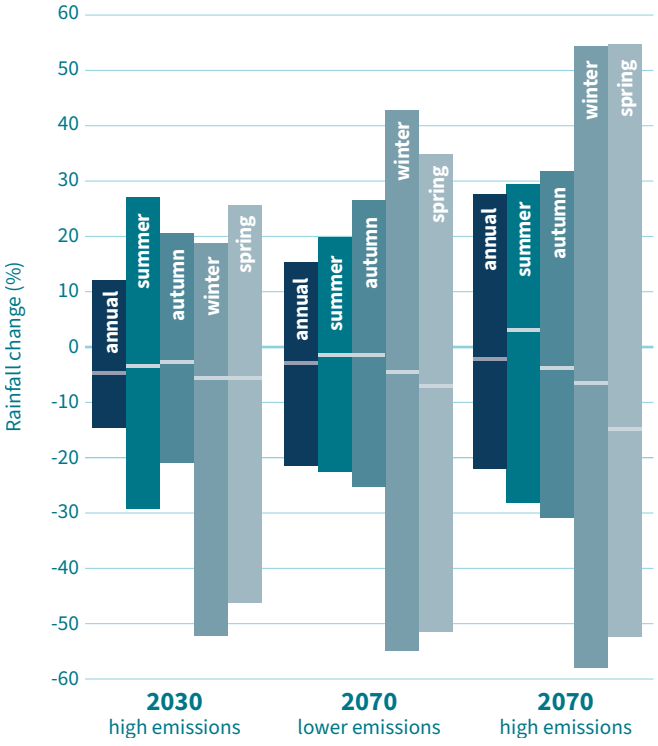
Figure 29: Projected temperature increase for Cairns.[84]



Evaporation and Rainfall

As noted above, evaporation for the region is already relatively high, but is projected to increase by 4% under a low emissions scenario and 5% under higher emissions by 2050. There is a lower level of confidence in the projected changes to rainfall for the region, with higher variability in the models. While total rainfall may not change significantly, there may be more intense downpours and longer dry seasons[38].

Figure 30: Projected annual and seasonal rainfall changes for the region.[82]



Drought

While drought has not been a regular feature of the Wet Tropics region historically, analysis of future drought trends for the region[39] show an increase in the duration (Figure 31) and frequency (Figure 32) of droughts and the percentage of time in drought (Figure 33). This change has implications for the way the region plans, prepares for and responds to drought.

"Climate change will influence drought. We're very used to dealing with cyclones, perhaps in the future we'll need to consider how we deal with droughts."

People, culture and community

Even if rainfall continues to be higher than other areas of the country, the combination of more variable rainfall patterns, increased evaporation and higher temperatures is likely to reduce the availability and predictability of fresh water supply. This reduction has implications for town and agricultural water supplies in the region.

Projected changes to climate indicate periods of extreme heat will become more common and hotter. Increasing maximum temperatures associated with drought conditions will mean more people will be vulnerable to heat-related illnesses and stress – especially sick, elderly and very young people, and people living without air-conditioning and outdoor workers. The increasing pattern of temperatures will also affect overnight temperatures, which will remain above 20°C for more months of the year. This will potentially affect sleep quality, especially for households without air conditioning, and increase the use of air conditioning in households with it. The concurrent events of drought and extreme heatwaves present increased health risks to vulnerable community members thereby increasing demand from healthcare services.

Water carries significant cultural values for First Nations people. Changes to rainfall patterns affecting the health and availability of fresh water will impact on these cultural values. Some participants raised concern about the connection between health of country and the physical and mental wellbeing of First Nations communities.

"The cultural values of water are very important. Lots of women's stories about water. Every time there's a drought it impacts on cultural values. Some trees with cultural values are dying. Where we have rock art in the basalt, that changes too because when it dries out it starts to fissure and crumble. All you can do is photograph it, so you have a record."

"That [dry weather] affects bush tucker availability, like fish and eels. If there's less rain, it can affect bush tucker calendar seasons. When we go out on country, we see the bush tucker and the size of the fruit aren't normal. Some of them were smaller and the amount was less than before."

Economy

Despite uncertainty in future rainfall levels, there is a high level of certainty the Wet Tropics region will experience higher temperatures and more evaporation – meaning less water in dams, irrigation channels and soils. Increased evaporation of moisture from crops and pastures during the drier times of year will lead to an increased need for irrigation water, at a time when there is less fresh water available.

Specific risks to primary industries include direct loss of crops and livestock, reduced production and profitability, increased competition or cost for available water and changes to pollination, growth, and flowering or fruiting patterns. In some cases, it may be necessary to assess the long-term viability of particular crops or livestock breeds and either switch management practices, cultivars or breeds.

Figure 31: Duration of severe drought in the Wet Tropics over 4 time periods – 2030, 2050, 2070 and 2090 (under high emissions scenario).[85]

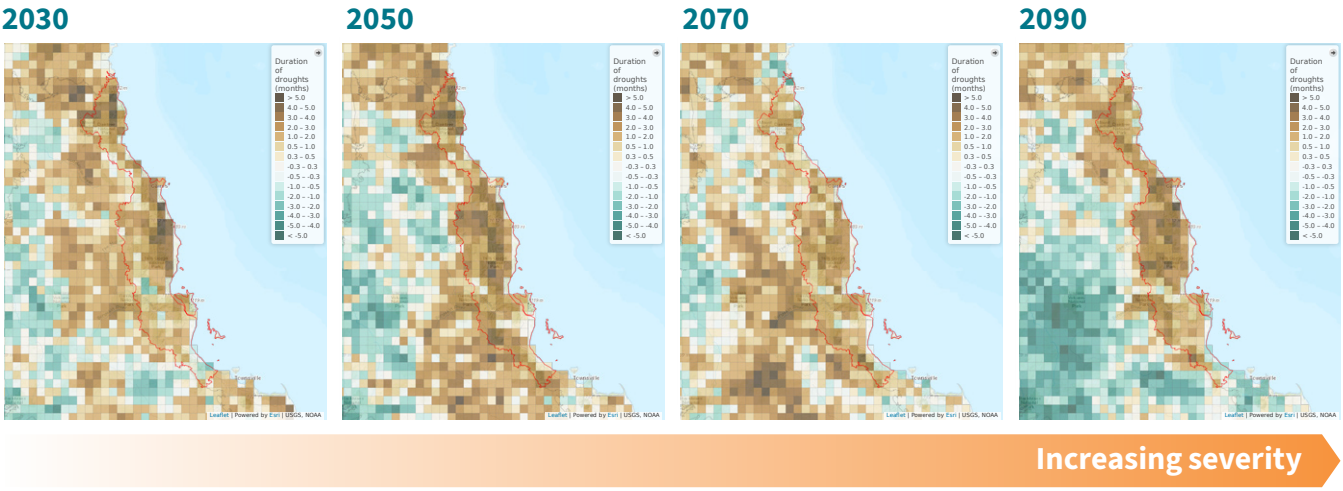


Figure 32: Frequency of severe drought in the Wet Tropics over 4 time periods – 2030, 2050, 2070 and 2090 (under high emissions scenario).[86]

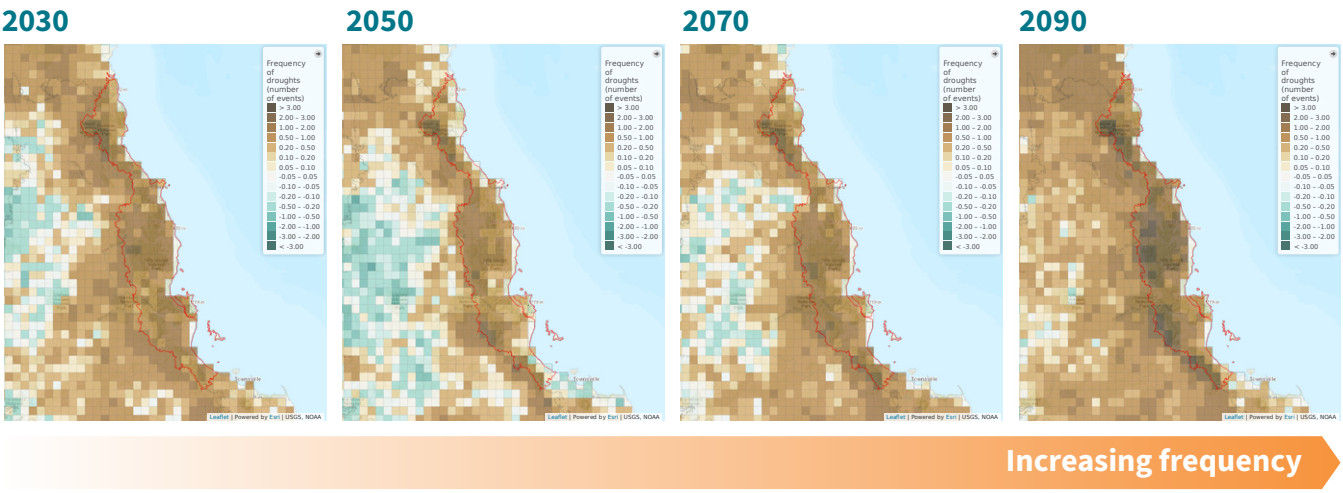
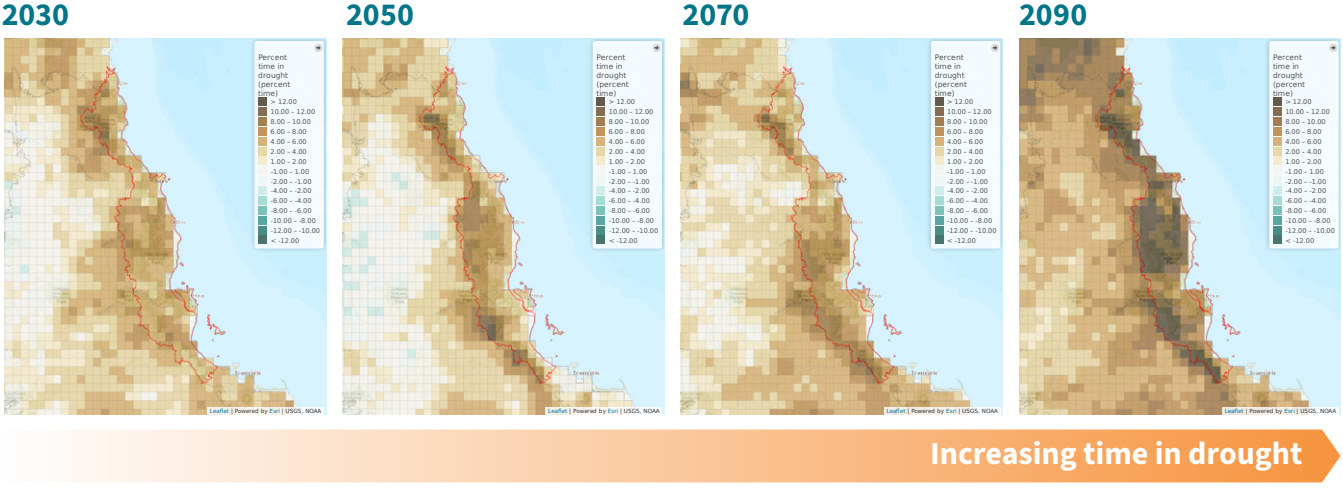


Figure 33: Per cent time in severe drought in the Wet Tropics over 4 time periods – 2030, 2050, 2070 and 2090 (under high emissions scenario).[87]



Many agricultural industries in the region, particularly in coastal locations, do not have irrigation systems or water distribution networks. Crop selection and farm management in these areas is based on an understanding of historic weather patterns. Changes to rainfall patterns and temperature may mean adjustments are necessary to the management of farming enterprises. The particularly vulnerable include businesses with longer-lived horticulture crops, where it may not be cost effective or feasible to switch crops or cultivars quickly in response to drier weather associated with drought. Areas in the south and west of the region, which already experience higher variability in rainfall patterns and have a high dependence on a small number of economic industries, are also particularly vulnerable.

The production of hydro-electric power from Barron Falls and Kareeya Hydro stations may also be impacted by changing rainfall patterns and water use.

Tourism in the Wet Tropics is already very seasonal, so prolonged hot weather and less predictable rainfall may affect visitation patterns, while more extreme weather may influence tourists' perception of their safety in the region.

Drought and more extreme weather events in the region have a significant impact on business confidence. Water security issues could influence the number and types of businesses willing to operate in the region. For areas like Hinchinbrook, where 95% of the local economy is connected to cane farming, a reduction in cane production will have significant impacts on the region's economy and the communities who live there.

There are indirect impacts of concurrent drought-heatwave events on the local economy. Outdoor workers within the agriculture and construction industries are at risk of heat-related health issues during drought-heatwave events. To minimise risk, changes to operating hours from daylight to twilight or night works will impact local businesses, depending on the morning tea and lunchtime rush hour.

Landscape and natural environment

The rainforests of the Wet Tropics region are relics of what was once a widespread vegetation community across the continent. As the rest of the continent dried and rainfall became more seasonal, vegetation communities in those areas evolved to cope with the changing conditions. The rainforests of the Wet Tropics are some of the oldest in the world, surviving and evolving in relatively stable climatic conditions over millions of years. Changing drought frequency, duration or severity in the Wet Tropics will fundamentally affect the biodiversity of the region. Associated weather conditions, particularly temperature and rainfall, significantly affect the distribution, growth and survival of plants and animals. Changing temperature and rainfall may affect the fruiting patterns of plants and the climatic suitability of current habitats or ranges for some species. For example, the endangered northern bettong depends on complex relationships between truffles (fungi), trees and fire, which could be altered with changing climatic conditions such as increased temperature, reduced rainfall or changes to fire.

The entire Wet Tropics region is known for its incredibly high biodiversity values. Biodiversity hotspots occur within the region – notably the higher elevation mountain ranges and peaks – which contain a significant proportion of species of high conservation significance and endemic, rare, ancient and threatened species[40]. These montane ecosystems are particularly vulnerable to changing climate, with predictions of cloud cover shifting upwards, significantly reducing moisture input from 'cloud stripping'. This will have flow on effects in downstream areas, affecting stream flow in lower altitude ecosystems, as well as towns and farms[41].

Unfortunately, some areas of the Wet Tropics region will become too hot for the existing plants or animals. Many species have a narrow climate tolerance, especially endemic species that are unique to a particular habitat and climate. With changes in the temperature, rainfall, evaporation and humidity, some species may no longer be able to survive in their current locations. Animals and plants particularly vulnerable to increasing temperatures, include some of the high-altitude rainforest specialists and some threatened and iconic species like the Spectacled Flying-fox and Lumholtz's Tree Kangaroo.

Fire weather is likely to increase in the region due to the combination of increased evaporation, higher average temperatures, and more frequent and hotter heatwaves. This change will impact whole groups of terrestrial plants and animals, such as grassy woodlands and open forests, as well as the seed-eating birds and other wildlife that live or feed there. In addition, increasing temperatures and changes to rainfall patterns may impact on the fruiting patterns of some plant species, affecting the availability of food sources for nectar- and fruit-eating species. Higher temperatures and longer dry seasons, combined with increased fire risk, could change the structure and density of forests toward more open vegetation communities[42].

On a national scale, the Wet Tropics region is recognised by scientists as being one of the most important climate refugia for many animals currently living in neighbouring regions where it is hotter and drier.

Although drought has traditionally been perceived as an issue in terrestrial environments, marine ecosystems are not immune to the impact of drought. Marine health is closely associated with land-based impacts, particularly the quality and quantity of fresh water entering the marine system. Drought can affect the concentration and type of nutrients and sediment entering freshwater systems and ultimately marine areas. Higher temperatures associated with drought can lead to bleaching of coral reefs, which will continue to be more widespread as average temperatures increase and heatwaves become hotter and more common. As hot spells occur more frequently, reefs won't have time to recover from previous bleaching episodes. Reef systems will also be affected by more acidic sea water (caused by higher CO2), more intense cyclones and freshwater pulses associated with heavy rainfall events.

Infrastructure and built environment

Most existing infrastructure, including buildings and transport, power and water networks, has been designed to suit historic climate conditions. As new design specifications come online, many are now identifying risks from changing climatic conditions and incorporating updated design requirements. Many regional areas, including the Wet Tropics, have aging public and private infrastructure which has not been designed to meet future climate conditions.

Local planning for development and housing design will be affected by projected changes in fire conditions. Fire weather is likely to increase in the region due to the combination of increased evaporation, higher average temperatures, and more frequent and hotter days and nights. These conditions are likely to be exacerbated during times of drought. It's possible the changing climatic conditions will promote more intense, frequent and extensive bushfires. Areas that are not currently considered to be at risk of severe bushfire may become more vulnerable as fire weather increases and vegetation changes.

Hot, dry weather can impact council road maintenance and construction. Low water availability in waterways may require a change in roadworks practices – such as grading without water or travelling further to fill water trucks to use during roadworks – impacting efficiency and effectiveness. Increased temperatures could affect the binding material used for bitumen roads, affecting surface quality and maintenance requirements.

Higher temperatures may mean staff who work outside – such as in roadworks, construction and agriculture – may need to switch to night work during hotter months. These changes would also have many other flow on impacts across society.

Higher temperatures associated with drought will increase demand for air conditioning and energy use in homes and business. This will place pressure on power generation and transmission during times of peak demand and could result in widespread power failures, with associated disruptions to people and businesses and the possibility of heat-related health impacts. Addressing passive cooling in buildings and greening streetscapes to reduce urban heat will be an important measure to address higher temperatures.

The concurrent events of drought, heatwave and bushfires pose a risk to the quality of potable water. If bushfire events occur close to water intakes, there may be impact on water quality and therefore require changes to water treatment. With increased temperatures there is a risk of micro-bacterial growth (e.g. increase in algal blooms) requiring alternative water treatment processes.

Severe drought can lead to soil cracking, increasing the risk of subsidence and building damage. Historical records from very dry periods over many years show an increase in serious landslips in the region. Recent extreme weather events in the region from Tropical Cyclone Jasper demonstrated the outcome of severe downpours following extend dry periods – where dry and cracked soil turned into landslips, damaging highways.

Despite the high annual average rainfall, with the forecast climate changes and population increases, water security is a major concern for the region. The highest risk period for water supply is during the drier months from October to December, which coincides with the continuing tourism season (when water usage peaks). Water shortages place pressure on local government authorities to maintain sufficient potable water supplies. Extensive education on water efficiency measures is required in the region, due to the current perception that water is always abundant.

Drought reduces the availability of fresh water supplies for urban and rural uses and may also affect water quality. Infrastructure for water storage and distribution networks may need to incorporate ways to reduce evaporation to make the most of available water supplies. Greater diversification of water sources and storage may be needed if water supply becomes less reliable. If alternative water sources are required, water treatment options may need to change to maintain quality. Current water infrastructure will also need to address issues with water leakages and find solutions to improve detection.

Cairns Regional Council is pursuing water security solutions with a focus on water infrastructure, particularly augmentation of supply. Existing water management data shows per capita water usage rates are relatively high and therefore demand management may also be an option to pursue water security solutions. Council has a Water Demand Management Strategy[43] but has indicated the efforts for demand management have been exhausted, and further options need to be pursued. Despite this, without action addressing augmentation of supply or high per capita water usage rates, modelling suggests Cairns could face the risk of reaching a drinking water supply shortfall by 2026.[44] The Cairns Regional Council has adopted the Drought Response Plan and water security processes as outlined above. This involves The Emergency Water Supply Plan with actions to be undertaken under extreme drought conditions, providing water security to the community through activating the emergency water supply infrastructure. This means extracting groundwater from the Mulgrave River Aquifer through water pumping bores with treatment at a temporary short-term plant.

Image: Cassowary, Etty Bay Beach. *Source: Shutterstock.*

Scenarios of potential future impacts of drought

A regional forum was held in late November 2023, bringing together key stakeholders including representatives from the neighbouring Gulf Hinterland and Cape York regions. After presentations on key findings from interviews during the first round of engagement, participants at the forum filled in the gaps and discussed "what if" drought scenarios for the Wet Tropics.

The three drought scenarios were:

- What will be the impact of a major heatwave?
- What will be the impact of a precipitation deficit?
- What will be the cumulative impact of (before or after incidents) multi-hazard disasters (e.g. cyclones, floods) combined with either heatwave or low precipitation?

Stakeholder feedback on these scenarios is outlined in Table 2.

Table 2: Stakeholder feedback to drought scenarios.[45]

What will be the impact of a major heatwave? Depending on severity, frequency and duration.	• Increased vulnerability to fire. "The rainforest can burn" and capacity to manage fire will be challenged. • Increased pressures and demand on energy and water supplies • Increased cost of power and fuel increased. • Vulnerability of disadvantaged populations to heat stress. Potential deaths due to heat stress. • Lack of access to heatwave safe resources and buildings e.g. shopping centres, libraries. • Lack of preparedness of people not from the region e.g. backpackers, temporary workers, subcontractors, tourists. • Unequal service responses e.g. health, social support. Burden of response by social and health services. • Lack of understanding and knowledge of how to manage heatwaves in the house. • Impacts on infrastructure e.g. roads, bridges, freight systems, digital assets, power, water supply, sewerage. • Impacts on workforce e.g. people working outdoors. Changes in working hours to accommodate heatwave can impact on family life (e.g. road crews working at night instead of day), impacts of businesses reliant on workforce (e.g. cafes). • Systemic challenges across several areas including infrastructure, health, business, emergency services. Reduced capacity to respond and inadequate policy and resources responses. • Algal blooms affecting water supplies, increased dust and air pollution. • Stresses on the environment, threatened species face existential threat. • Stress on built up areas (e.g. heat island effects). • Flow on impacts across economy. • Fire risks, greater resources needed for prevention and firefighting.

What will be the impact of a precipitation deficit?	• Water storage capacity challenged. • Competition for water e.g. irrigators, councils. • Poor soil and pasture conditions, potential salinity, moisture loss, plant stress and reduced nutritional quality of grasses. • Erosion, loss of ground cover and dust. • Health impacts, e.g. dust, heat stress, mental health. • Fire risks, greater resources needed for prevention and firefighting. • Underground aquifers may dry up or be contaminated with sea water (salinity). • Damage to aquatic water ecosystems. • Altered migration patterns and refugia for fauna and flora. • Reduced productivity and income. • Magnifies existing problems e.g. poor soil conditions, poor infrastructure, underlying physical and mental health challenges. • Potential for increased disaster events linked with precipitation e.g. floods.
What will be the cumulative impact of (before or after incidents) multi-hazard disasters with heatwave or low precipitation?	• Erosion and land slips. • Flooding and drought. • Water quality and security including impacts on rivers and the Great Barrier Reef. • Debris, pollution and dust. • Food security, particularly for First Nations communities. • Challenging land management outcomes, and greater vulnerability of natural assets to major damage or unprecedented occurrences (such as fires in rainforest after cyclones). • Economic impacts e.g. crop and animal loss, tourism visitation rates reduced, business workforce challenges. • Infrastructure damage and access to freight systems and connectivity. • Potential health risks to humans and animals e.g. dengue, parasites and other diseases. • Increases in cost of fuel, power and water. • Supply chain challenges. • Lack of digital connectivity. • Increased vulnerability for particular groups of people to access basic needs. • Challenges of providing support and capacity of services. • Intertidal waves cause inundation in coastal and mangrove areas, impacting fish stocks. • Management of storm and hazardous wastes. • Social isolation, lack of support. • Population impacts e.g. outmigration from the region.

Image: Wallaman Falls, Girringun National Park, Ingham. *Source: Shutterstock.*

Lessons from scenarios – resilience to concurrent events

The exploration of potential future drought impacts allowed stakeholders to consider concurrent disaster events and revealed insights for drought resilience. Across three scenario workshops, stakeholders identified the significance of combined heatwave and drought scenarios. This highlighted concerns about heat stress on human health, wildlife, ecosystems, and cultural ties to the land, along with economic risks due to the impact on outdoor workforce and agriculture. These findings shaped the strategic actions under various pathways, emphasising the need for heatwave risk assessment, cost evaluation, and sector-specific resources to support transformation practices.

Recognising the interplay between drought and other climate-driven hazards, insight from stakeholders during the 'what if' events emphasised the need for a holistic approach to drought resilience. Multiple hazard events, such as drought followed by extensive rainfall, lend themselves to increased erosion, landslips, water quality issues and damaged roads impacting supply chains. The insight leads to the inclusion of a climate risk assessment action and the overarching principle of the RDR Plan – actions must enhance climate resilience, avoid maladaptation, and leverage mitigation outcomes.

Building drought resilience in our region

Lessons learnt from the past – stories of resilience

Multiple stakeholders have provided input about what made the region more resilient to drought:

- Drought is understood in complex ways and shows variability across the region including micro drought and flash drought.
- Existing vulnerabilities may compound the severity of drought impacts including social, economic, and environmental risks. Understanding the weaknesses and building preventative strategies based on strengths gain critical importance. Recovery in the aftermath of drought is integrally linked to how well the vulnerabilities are addressed and needs to be supported by best practice transition programs and activities.
- There is a need to take a multi-hazard approach to drought, as it is linked with other forms of climate and disaster events.
- Many resilience skills are transferrable. Lived experience and planned resilience building strategies for disasters such as floods/cyclones etc. help to build resilience for drought or economic downturn. The community is generally resilient and this needs to be recognised.
- There is a need for an integrated approach to drought resilience from the micro enterprise level to regional and macro level strategies. Effective use and resourcing of existing planning and coordination mechanisms at the local level is a game changer and leads to quicker recovery.
- Alignment across complex planning strategies of different agencies relating to resilience, disaster management, and economic and social development is needed.
- Encouraging mental wellness and supporting mental health is very important. Mental health resilience activities need to be proactive and not just reactive. Recognising the need for appropriate outreach and services is critical. People in remote parts of the region are particularly disadvantaged in terms of accessing vital services.
- Community connectedness on all levels is critical from neighbours to service providers, and for integrated planning across agencies to build social capital and cohesion.
- Knowledge and community education is of utmost importance – having current, comprehensive information and good communication channels helps communities to prepare and cope with disasters and drought events.
- The use of technology and the internet has contributed to increased productivity and profitability. However the reliability of the infrastructure and skills to use technology are factors that challenge utilisation.
- Community led initiatives are more successful – building capacity of local organisations and empowering the local leaders, produces better outcomes.
- Build the capacity of local business owners/managers in areas such as financial skill development, debt management, cash flow planning, succession planning and business collaboration facilitation.

A vision of our drought resilient region

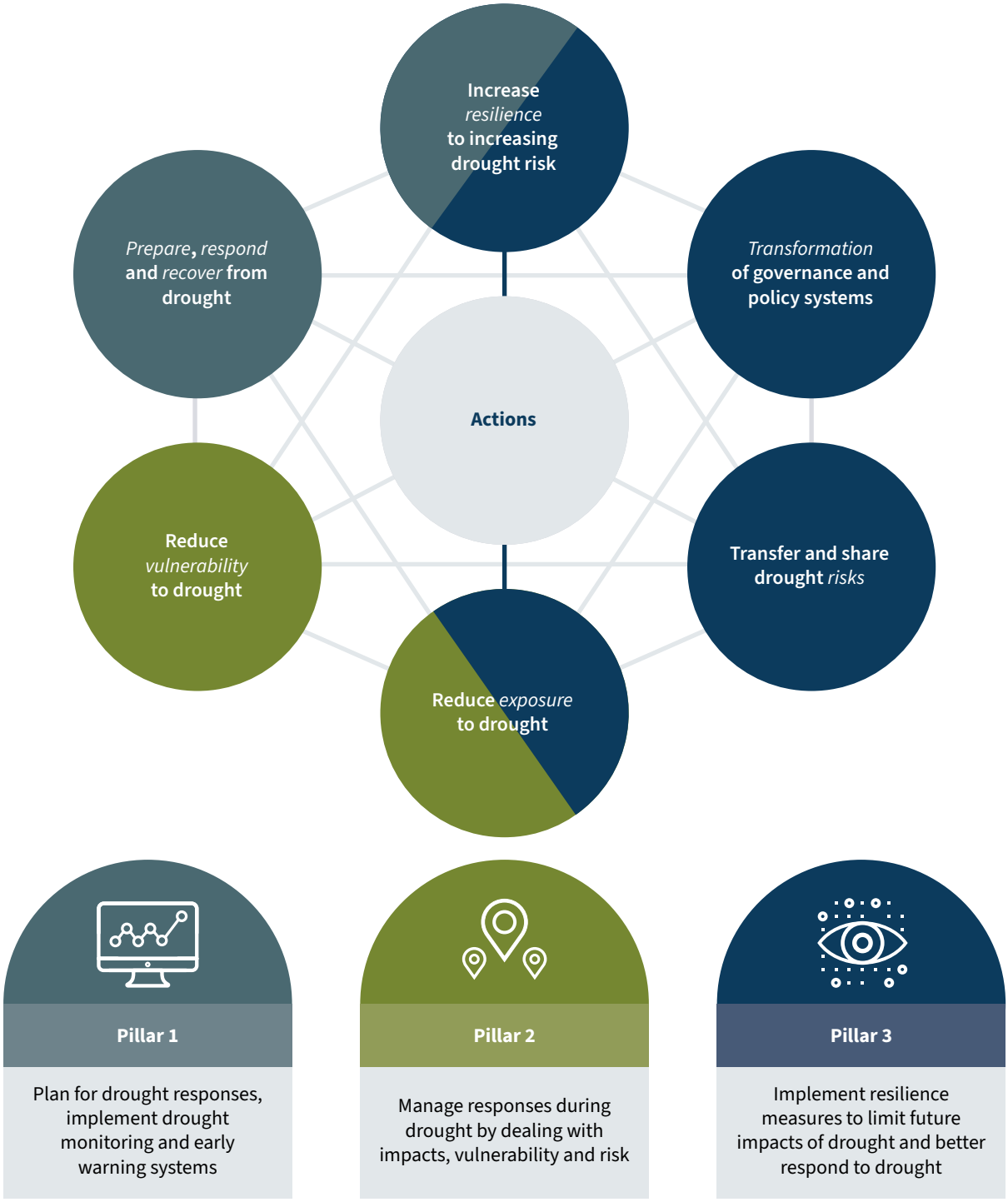
The Wet Tropics region is resilient by managing risk and developing opportunities for a climate-resilient and low-carbon future.

Key foundations of our vision comprise:

- Recognising the diversity of drought impacts in the region
- preparing for, responding to and recovering quickly from droughts
- building capacity of individuals, businesses, communities and organisations for drought resilience
- taking a strengths-based approach – building on the economic, cultural, social and environmental strengths of the region and reducing vulnerabilities
- effectively working together.

This vision aligns with the Drought Resilience, Adaptation and Management Policy (DRAMP) as illustrated in Figure 34.

Figure 34: Key pillars and actions of the Drought Resilience, Adaptation and Management Policy (DRAMP) framework.[88]



Key aims and objectives

To ensure a balanced quadruple bottom line approach, each strategy denotes an influence on economic, environmental, social and cultural priorities. Each strategy reflects the Drought Resilience, Adaptation and Management Policy (DRAMP) Framework outlined by Crossman[46]. This summarises practical actions to prepare for and deal with drought through three pillars[47];[48]:

- Implement drought monitoring and early warning systems.
- Assess drought vulnerability and risk.
- Implement measures to limit the impacts of drought and better respond to drought.

These strategies have been developed to both reflect the globally recognised DRAMP Framework and address economic, ecological, social and cultural benefits.

To ensure each action is delivered in an equitable, culturally safe and just way, all the strategic pathways will be delivered based on the following interlinked principles:

- Solutions are climate resilient, avoid maladaptation and leverage mitigation opportunities.
- Solutions acknowledge climate justice and are equitable, and sustainable across the environment, economy and society.
- Implementation is delivered as a collaboration across sectors within the Wet Tropics and surrounding Regions.
- Integrates and respects First Nations knowledge and aspirations.
- Aligns with existing Climate Resilient and Disaster Management Strategies.

Figure 35 provides a high-level summary of the objectives of the Wet Tropics RDRP.

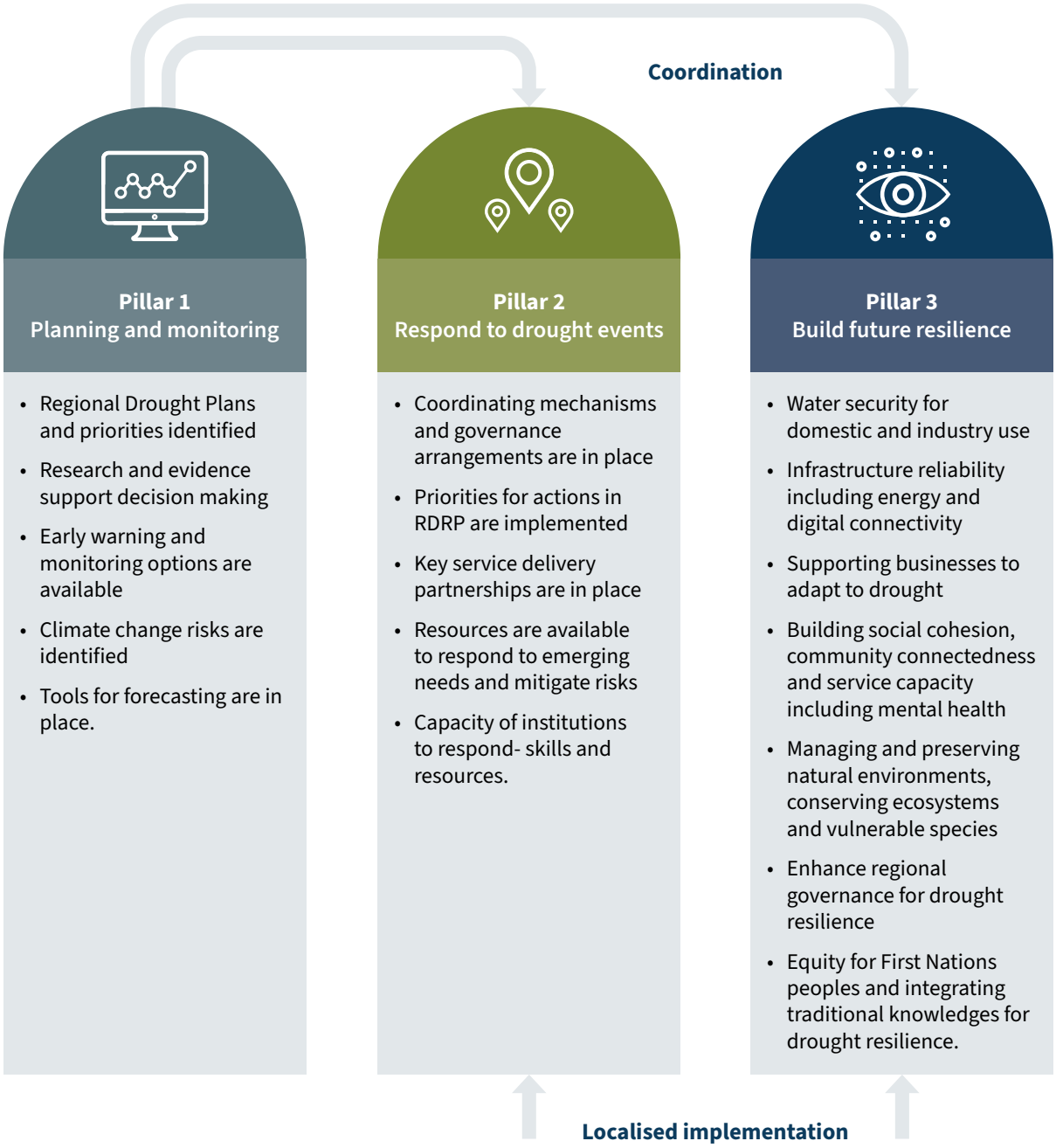
Priorities

The drought resilience strategies for the Wet Tropics region were identified through a series of engagement sessions – including interviews, workshops and discussions. A Regional Drought Resilience Forum was held where the actions were discussed, particularly considering three potential scenarios for drought:

(i) increased temperatures
(ii) precipitation deficits
(iii) drought with other natural disasters.

The emerging strategies were analysed and prioritised. The strategies reflect a cross-sectoral collaboration with perspectives from local communities, businesses, government and non-government organisations. The final strategies were workshopped with the FNQROC Climate Resilience Technical Committee – a multistakeholder regional committee providing an overarching cross-sectoral platform for review of the strategies and RDR Plan development. This involved significant research and analysis (as outlined earlier in the Plan). By integrating evidence with the priorities identified through deep engagement, six key regional drought resilience pathways were identified for the Wet Tropics RDR Plan.

Figure 35: Three pillars for the Gulf Hinterland Regional Drought Resilience Plan.



The Regional Strategy

Regional actions and initiatives

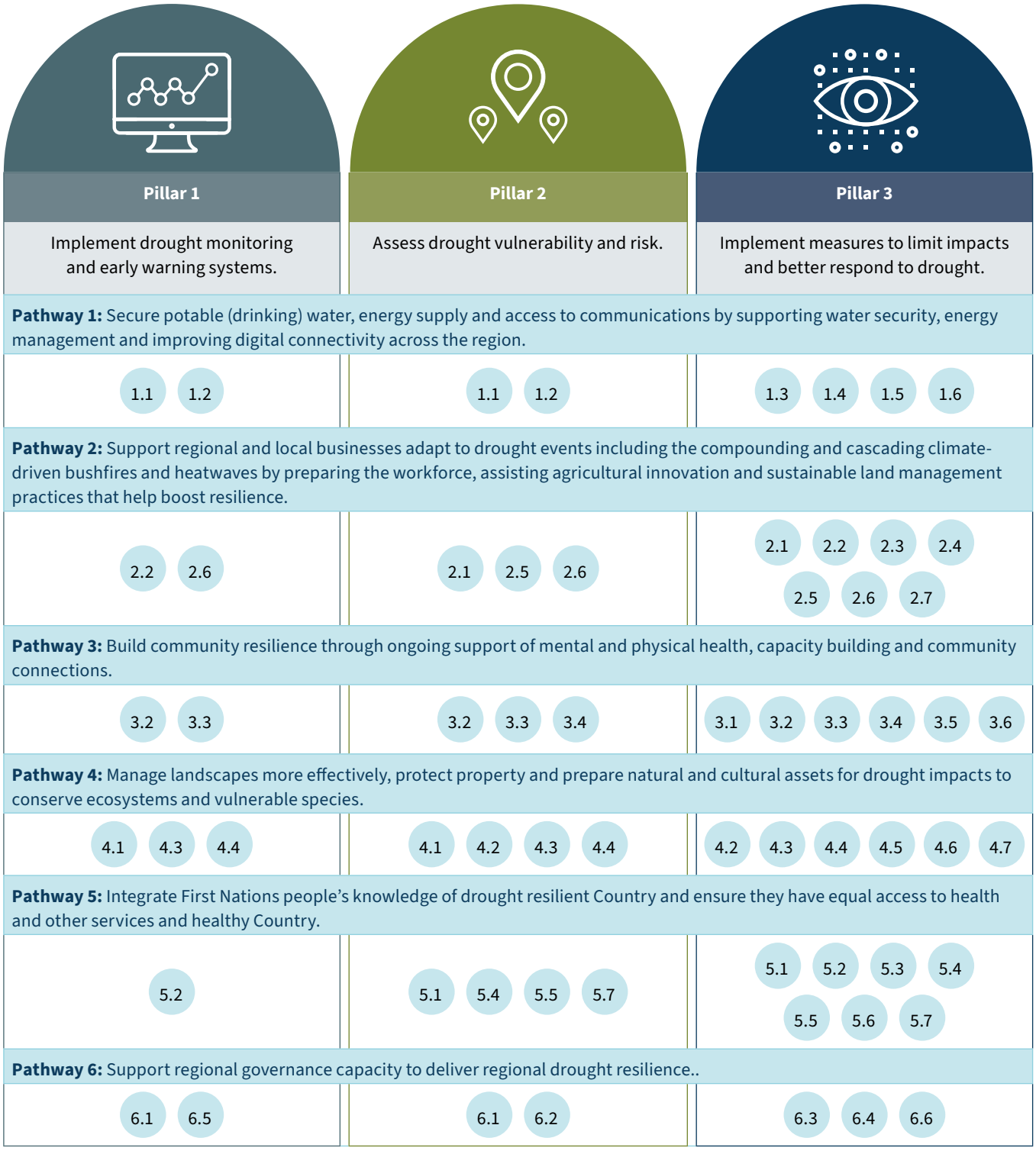
The identified six pathways align with existing local and regional climate-resilient strategies, including the Queensland Reconstruction Authority's *Wet Tropics Regional Resilience Strategy*. This Wet Tropics RDR Plan outlines actions and pathways to mitigate and adapt to the unique drought impacts in the region. The actions are aimed to facilitate transformational change and increase resilience in the region – addressing the quadruple bottom lines of economic, cultural, environmental and social outcomes.

The following matrix identifies and maps the pathways and actions to key pillars, to prepare for and deal with drought. Outcomes for each pathway are articulated for the quadruple bottom line in Figure 36.

Pillar 1	Implement drought monitoring and early warning systems.
Pillar 2	Assess drought vulnerability and risk.
Pillar 3	Implement measures to limit the impacts of drought and better respond to drought

Image: Commercial plantation of bananas near Innisfail. *Source: Shutterstock.*

Figure 36: Pathways, actions and DRAMP pillars matrix.



Pathway 1: Secure available agricultural and potable (drinking) water, energy supply and access to communications across the region.

Drought impacts can be accentuated by a lack of basic infrastructure and services. Numerous areas within Wet Tropics communities grapple with water security, energy provision, and telecommunication access challenges. Drought events, along with compounding heatwave and bushfire events can collectively contribute to the risk of reduced available industrial and drinking water, hindered community connectivity, and unreliable access to electricity. This trifecta of water, energy, and communication insecurities intensifies physical and mental health concerns in regional and indigenous communities, placing further strain on health services.

Both irrigation and potable water availability in many regional communities in the Wet Tropics hinges on surface water, linked to generally high average rainfall. Diminished rainfall during dry seasons increases the risk of waterways drying up and water restrictions implemented. Misguided assumptions about continual water abundance exacerbate unsustainable water usage behaviours, aggravating water security issues.

Achieving basic water security, electricity access, and digital connectivity are pivotal for the region's economic, cultural and societal growth.

Actions

1.1	Building on the CRC WSAG process, develop a regional water usage audit to understand current and future water demands and associated water security strategy – identifying high-priority areas for achieving water efficiency and water security during dry spell or drought scenarios.
1.2	Through active implementation of the Tablelands Regional Water Assessment, explore priority new water developments – including infrastructure technologies (e.g. underground dams) and water trading platforms that may deliver innovative and improved water security solutions within the region.
1.3	Across the region, promote water conservation and efficiency by supporting existing education initiatives, developing regional water-wise messaging, and conducting campaigns to educate both the community and visitors on water flow dynamics and the impacts of reduced water during the dry season.
1.4	Collaboratively advocate the region's water security needs on a state and national stage (e.g. funding to fix existing infrastructure leakage issues).
1.5	Work collectively to develop a regional partnership to improve the reliability of telecommunications infrastructure, service expansion, technical support, connectivity literacy and digital literacy – ensure the link between community capacity and reliable infrastructure for resilience is made explicit.
1.6	Work with power utilities to develop wider energy security and supply reliability, address energy access in rural/remote communities, affordability and a transition strategy for the region.

Lead institutions

- FNQROC
- Water Alliance Committee
- Local Governments
- Queensland Reconstruction Authority
- Rural Development Australia
- Tropical North Queensland

Key partners

- Department of Local Government, Water and Volunteers
- Queensland Treasury
- Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development
- Department of State Development, Infrastructure and Planning
- National Water Grid Authority
- Utilities (water, energy)
- ARENA
- AEMO
- Infrastructure Australia
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts
- CAFNEC
- Other local community groups

Investment targets

- National Water Grid Fund
- Preparing Australia Fund
- Future Drought Fund
- Building regions funds
- Digital connectivity funds

Economic outcomes

Reduced cost risks to councils and water service providers. MO

Environmental outcomes

Improved water quality across the region and increased protection of water through sustainable water practices. Sustainable energy development benefits to the environment. TR

Social and cultural outcomes

Improved accessibility to clean water, electricity and the telecommunication network thereby improving health outcomes. MO

Governance outcomes

Improved coordination and collaboration across governments to achieve security in water, energy and digital connectivity. MO

Outcomes to: MA (maintain), MO (modify), TR (transform).

Pathway 2: Support regional and local businesses adapt to drought events including compounding bushfires and heatwaves by preparing the workforce, assisting agricultural innovation and sustainable land management practices.

The Wet Tropics economy is heavily influenced by the agricultural and tourism industries with many employees working outdoors. Agricultural industries including sugar cane, banana farms and cattle depend on adequate soil moisture. The ability to keep moisture in the ground for longer during prolonged dry/drought conditions will increase the availability of crops and help maintain continual economic flow.

The compounding climate events of drought and humid heatwaves threaten the workforce's health and therefore productivity. The Wet Tropics is expected to experience increased heatwave events and during drought events, when water availability is low, this exacerbates health risks to the outdoor workforce and therefore productivity. For the tourism industry, drought-heatwave events impact the visitation rates. With numerous local tourism businesses relying on the tourism season for their viability, limited water coupled with heatwave and bushfires decreases the attraction for visiting and participating in outdoor activities.

Heatwave management for the outdoor workforce along with innovative solutions driving drought-resilient land management practices are necessary to maintain the region's local economy and ensure a healthy place to work and play.

Actions

2.1	Develop a Regional Heatwave Risk Management strategy to address workforce issues and identify and manage the impacts of heatwaves on human health of outdoor staff.
2.2	Undertake a cost-benefit analysis of the impacts of drought events, including concurrent bushfire and heatwave events on current vs future business practices. Identify strategies to mitigate impacts and costs on key industries such as tourism, agriculture, and local businesses.
2.3	Through a coordinated extension of business resilience plans, increase businesses' accessibility to additional support during recovery between drought and other natural disaster events, and implement preparedness.
2.4	Provide regionally coordinated support for businesses to pilot diversification for resilience to climate variability, through devolved or direct funding or incentive programs.
2.5	Develop a fit-for-purpose Wet Tropics awareness and education program for drought, heat wave and bushfire preparedness for diverse audiences – including tourists, promoting water conservation practices, bushfire safety and heatwave health practices.
2.6	Develop a Wet Tropics Regional Heatwave and Fire Management Strategy and identify the resource and capacity gaps required to deliver proactive and future-ready regional climate risk management.
2.7	Promote the incorporation of best practice technologies and processes for drought resilience in industry – including water conservation in soil and drought-resilient crops/animals, the construction of infrastructure and buildings, roads and transport.
2.8	Support the integration of urban greening initiatives into planning schemes, strategic frameworks and development guidelines.

Lead institutions

- FNQROC
- Climate Resilience Technical Committee
- Queensland Fire Department
- Local Governments
- TTNQ
- Queensland Workplace, Health and Safety
- TNQ Drought Hub

Key partners

- QRA
- Regional Planners Group
- DSDIP
- Department of Local Government, Water and Volunteers
- Department of Trade, Employment and Training
- Infrastructure and Planning sections of local government
- Queensland Parks and Wildlife Service
- Terrain NRM
- Economic Development bodies
- Queensland Health
- Local Disaster Management Group
- RDA
- LGAQ
- TNQ Drought Hub
- NRM
- Ranger Programs

Investment targets

- Department of Environment grants
- Workforce and skills development grants
- Tourism grants
- FRRR drought and community grants

Economic outcomes

Improved resilience of local businesses to the impacts of drought and compounding events including bushfires and heatwaves.

TR

Environmental outcomes

Improved wildlife and ecosystem protection for drought, heatwave and bushfire events.

TR

Social and cultural outcomes

Access to a healthy Country and improved health outcomes during drought and compounding heatwave and bushfire events.

TR

Governance outcomes

Integrated urban greening initiatives into planning schemes and incorporated proactive cultural fire management practices into local government processes.

MO

Outcomes to: MA (maintain), MO (modify), TR (transform).

Pathway 3: Build community resilience through ongoing support of mental and physical health, capacity building and social connections.

Drought events intensify health concerns, particularly affecting the mental wellbeing of those in agriculture. The scarcity of water significantly impacts agricultural industries, compelling farmers to make difficult choices for survival – these decisions reverberate through local businesses and community. Droughts, bushfires and heatwaves exacerbate physical stress, leading health services to witness an upsurge in vulnerable individuals seeking assistance for heat-related health issues. Raising community level awareness about vulnerable populations and the effects of drought and heatwaves on their mental and physical health, coupled with a community capable of recognising and supporting individuals, can alleviate pressures on health services. This collective effort contributes to building a resilient community capable of responding to and recovering from the challenges posed by drought events.

Actions

3.1	Seek resources to fund the delivery of mental health initiatives (including training) across regional communities – enhancing the skills and confidence of individuals, empowering them to support each other during response and recovery to drought events. Include drought and climate resilience initiatives in programs and projects targeting physical wellbeing and recreation.
3.2	Develop and implement a heatwave-drought response framework that maps out key roles and responsibilities across sectors, to understand and deliver actions supporting community resilience. This includes delivery of proactive heatwave risk management plans for vulnerable cohorts.
3.3	Undertake a heatwave refugia analysis for regional and remote communities – addressing gaps in accessibility through infrastructure upgrades, retrofits and new facilities.
3.4	Develop and integrate local climate-resilient actions in partnership with established on-ground community-driven groups, building human and community capacity for multi-hazard resilience.
3.5	Provide devolved and direct funding to support local champions and community groups for resilience upskilling and knowledge sharing among community members (volunteers).
3.6	Build community capacity by strengthening local and regional institutions and increased activities – enhancing cohesion through support, sharing of knowledge, experiences and technologies.

Lead institutions

- FNQROC
- Climate Resilience Technical Committee
- QRA
- Local Government
- Cairns Alliance of Social Services

Key partners

- QLD Health
- Community groups and health and social services
- Local Disaster Management Group
- Department of the Environment, Tourism, Science and Innovation
- Department of Sport, Racing and Olympic and Paralympic Games
- Local Sport and Community Clubs
- Terrain NRM
- Primary Health Network
- TNQ Drought Hub.

Investment targets

- Mental health funding
- PHN Funding

Economic outcomes Reduced cost of health services due to proactive health initiatives and improved local business and community resilience.	MO
Environmental outcomes Increase sustainable land management practices that improve water quality and retention.	MO
Social and cultural outcomes Improved community mental and physical health during drought events by increasing individual and community capacity to support one another.	MO
Governance outcomes Improved collaboration across sectors for regional resilience.	MO

Outcomes to: MA (maintain), MO (modify), TR (transform).

Image: Skyrail Rainforest Cableway. *Source: Freepik.*

Pathway 4: Manage landscapes more effectively, protect property and prepare natural and cultural assets for drought impacts to conserve ecosystems and vulnerable species.

The Wet Tropics World Heritage region boasts ancient rainforests hosting a diverse array of endemic species and cultural assets. Currently facing threats that jeopardise ecosystems, drought events coupled with heatwaves, compound existing stresses. Bushfire risk becomes particularly significant in drought periods – threatening lives, property, environment and cultural values. Equally, these values are best protected through cohesive landscape scale management, including proactive fire management and cultural burning approaches. Heatwaves during drought events result in significant losses, affecting flying fox colonies and freshwater fish. Research into drought impacts is crucial for managing and fortifying natural and cultural assets. Our ecosystems – vital for clean water, air, and healthy soils – also drive tourism, supporting regional economies. As such, it is important to lift the capacity of key institutions within the landscape that manage these values, including rural fire brigades, traditional owner institutions, as well as grazing companies and families.

Actions

4.1	Manage and prepare natural assets for drought impacts to conserve ecosystems and vulnerable species through the incorporation of drought and heatwave events in regional climate risk assessment.
4.2	Support all land managers to develop and implement proactive multi-hazard management plans to address property scale issues – including property protection, high value assets and conservation of ecosystems and vulnerable species.
4.3	Provide incentives and programs to support the protection of habitat, essential for climate refuge on private land.
4.4	Develop rapid assessment and response mechanisms to identify and protect vulnerable wildlife during drought, fire and heatwaves. Develop indicators and deliver ongoing monitoring and reporting on the impacts of drought and heatwave events on ecosystems and vulnerable species.
4.5	Coordinate investment support for First Nations organisations to undertake country-based planning and manage land, waterways and cultural landscapes and sites (e.g. important springs).
4.6	Explore policy and investment mechanisms to lift the long-term capacity and resilience of Rural Fire Brigades.
4.7	Develop and implement cultural fire management programs led by local Indigenous knowledge and practices.

Lead institutions

- FNQROC
- Climate Resilience Technical Committee
- Terrain NRM
- WTMA

Key partners

- The Restoration Alliance
- Land Protection Fund
- NAMAC
- Agforce
- Growcom
- QPWS
- Ranger Groups
- Department of the Environment, Tourism, Science and Innovation
- First Nations organisations

Investment targets

- DETSI funding
- DCCEEW
- Federal government environment grants
- Philanthropic grants

Economic outcomes

Reduced risk of human impacts including tourism through conservation of world heritage sites. MO

Environmental outcomes

Improved ecosystem and wildlife resilience during drought and compounding heatwave and bushfire events. TR

Social and cultural outcomes

Improved health outcomes for local communities through management of essential services provided by ecosystems, e.g. clean water and air, and access to a healthy Country. MO

Governance outcomes

More capacity for communities to reside in outstations to meet cultural obligations. MO

Outcomes to: MA (maintain), MO (modify), TR (transform).

Pathway 5: Integrate First Nations people's knowledge of drought resilient Country and ensure they have equal access to health and other services and healthy Country.

First Nations peoples have interests and rights across the Wet Tropics landscapes. They also hold invaluable lived experiences with drought events, offering crucial insights into building resilience against impacts like water scarcity, bushfires, and heat-stressed conditions. Listening and fostering collaboration is essential for cultivating resilience and maintaining the well-being of both communities and the country. The region encompasses three Aboriginal Shire Councils, including Yarrabah, Australia's most disadvantaged area with a 37% unemployment rate. This economic disparity exacerbates challenges in accessing equal health and other services, electricity, and connectivity. Achieving equitable access for all First Nations people to health services and maintaining a healthy Country is imperative, particularly in the face of climate-driven events such as drought.

Actions

5.1	Support the region's traditional owner institutions to build their long term governing capacity – ensuring their active economic, social and cultural participation in the region, water planning and enhancing drought security.
5.2	Address policy and other barriers preventing First Nations peoples from participating in farm and other resilience programs.
5.3	Coordinate support for the delivery of First Nations health care services during natural disaster events.
5.4	Advocate for better housing conditions and support the implementation of cool housing designs to improve resilience.
5.5	Integrate Indigenous knowledge and practices to increase resilience to drought, heatwave and bushfire events.
5.6	Support the development of microgrid projects securing renewable energy supply in First Nations communities.
5.7	Protect culturally significant landscapes and the ability to access healthy Country. Support the inclusion of drought consideration in the emerging Wet Tropics Cultural Values Management Plan.

Lead institutions

- FNQROC
- Climate Resilience Technical Committee
- Rainforest Aboriginal People's organisations in the Wet Tropics

Key partners

- Queensland Health
- Qld Health and Wellbeing
- DETSI
- Relevant health and social services
- Local Disaster Management Group
- WTMA
- TNQ Drought Hub
- ARENA

Investment targets

- Queensland Health funding
- PHN commissioned grants
- DETSI funding
- DSDAATSIP funding
- National Indigenous Australians Agency

Economic outcomes

Reduced health care costs through increased proactive health initiatives, reliable infrastructure and access to healthy Country. MO

Environmental outcomes

Improved management of Country in culturally appropriate ways. MO

Social and cultural outcomes

Improved health and wellbeing outcomes and increased recognition of cultural connection to Country. TR

Governance outcomes

Improved coordination and collaboration with First Nations communities, thereby increasing drought resilience. TR

Outcomes to: MA (maintain), MO (modify), TR (transform).

Pathway 6: Support regional governance capacity to deliver regional drought resilience.

Achieving drought resilience in the Wet Tropics demands coordinated efforts across diverse organisational sectors. Essential governance actions include aligning with established climate-resilient strategies and plans, and strategically placing drought resilience within broader regional climate resilience goals. Establishing a dedicated partnership arrangement to manage and implement these actions is imperative. The sustained development of capacity for long-term drought resilience necessitates support from all levels of government. In fostering collaboration and strategic governance, the region can effectively address the multifaceted challenges posed by drought, ensuring sustained environmental, social, and economic wellbeing.

Actions

6.1	Establish a strong cross-regional drought partnership arrangement across TNQ facilitating collaborative approaches to the implementation, monitoring and review of RDR Plans.
6.2	Undertake a regional climate risk assessment and advocate for drought-related impacts in regional, state and national plans and strategies.
6.3	Continue collaboration with existing Climate Action Programs supporting climate resilience in individual councils – through resource sharing and networking, working towards regional guidelines for the inclusion of compounding, cascading and concurrent impacts from climate hazards in business continuity plans.
6.4	Secure resources to provide regional coordination and collaboration across key stakeholders to implement climate-resilient actions including drought-specific actions.
6.5	Support the development of a framework and incentives for organisations and businesses to report on the implementation of climate-resilient actions (e.g. star rating system, EcoBiz).
6.6	Develop an approach to advocate for the inclusion of drought resilience (particularly water security) in statutory regional planning and policy.
6.7	Support grassroots voice building through key partners – via arrangements to impact relevant decision-making, investment and policy outcomes.

Lead institutions

- FNQROC
- Climate Resilience Technical Committee

Key partners

- Terrain NRM
- TNQ Drought Hub
- Regional Planner groups
- NAMAC
- Eco Biz

Investment targets

- Local agencies contributing
- Staff time and resources
- Drought resilience funding
- RDRP grants

Economic outcomes

Reduced risk to local businesses and cost risk to local councils. MO

Environmental outcomes

Improved environmental resilience through coordination and collaboration across sectors. TR

Social and cultural outcomes

Improved social and cultural resilience outcomes through coordination and collaboration. TR

Governance outcomes

Improved coordination and collaboration across sectors and improved monitoring and reporting for regional resilience. TR

Outcomes to: MA (maintain), MO (modify), TR (transform).

Community partnerships and communication strategy

Our core approach for the implementation of this RDR Plan is based on the emergence and continued growth of several layers of partnership, ensuring a firm and continuing commitment to achieving impact. At the centre of these arrangements sits the commitment of several key regional partners to act as the long-standing owners of the RDR Plan. There are three layers of partnership that will be important in mobilising these arrangements.

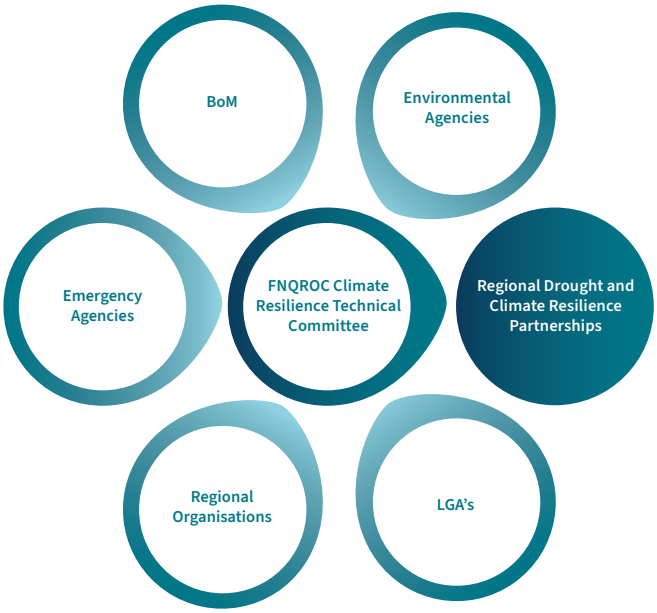
Figure 37: Community Partnerships

FNQROC Climate Resilience Technical Committee

The Climate Resilience Technical Committee was established as part of the Far North Queensland councils and organisations working together to manage risks and develop opportunities for a climate-resilient and low-carbon future. The Committee comprises local governments in the FNQ region, environment and natural resource management groups, the Queensland Reconstruction Authority, the National Emergency Management Agency, the Wet Tropics Management Authority, and the Bureau of Meteorology. This partnership is at the core of driving the Drought Resilience Regional planning and actions, bringing together key stakeholders and aligning drought planning to other initiatives in the region and LGA.

Resourcing FNQROC to have the capacity to lead drought resilience actions will be a critical aspect of the implementation of Regional Drought Resilience plans.

Figure 38: FNQROC Climate Resilience Technical Committee



Partnerships among key regional institutions

Active coordination is increasingly being developed in the region, which is intersectoral. These include:

- Wet Tropics NRM body, Terrain NRM
- Regional Development Australia – Tropical North
- Chambers of Commerce
- Cairns Alliance of Social Services (CASS)
- First Nations organisations, land trusts and prescribed bodies
- TNQ Drought Hub – hosted by JCU
- Health services.

As the key DPI-sponsored drought resilience planning agency, the Rural Economies Centre of Excellence (RECoE), with its local linkages and presence provides the overall planning and additional facilitation support, ensuring partnerships continue into the future.

Through the Climate Resilience Technical Committee, lead institutions identified under each of the six pathways have the opportunity to collaborate and share pathway-specific implementation outcomes. This will inform a review process and provide a platform for structured learning and ongoing implementation.

Partnerships with key federal and state agencies

Federal and state agencies are critical to progressing policy and bilateral budgetary and program solutions to the long-term drought-related issues facing the region. Combined federal interest in broader resilience building (for drought, flood, and other natural disasters) is led through the new Australian Government Recovery and Resilience Agency. This agency leads Australian responses to natural disasters and holds responsibility for the dispersal of the Future Drought Fund. Other key Australian Government agencies that need to be drawn into this response include the National Water Grid Authority; Department of Agriculture, Water and the Environment; Department of Infrastructure, Transport, Regional Development, Communications and the Arts; and Austrade.

At the State Government level, both councils have strong relationships with the QRA and the Queensland Fire Department (QFD) and are collaborating to build and implement the region's broad Resilience Strategy – of which, this RDR Plan is a component. However, the region's capacity to drive these partnerships is funding dependent. As the Queensland lead on drought response and recovery, DPI will need to increasingly partner the region in supporting responses to, and long-term monitoring of, this RDR Plan. Other key Queensland Government departments that need to be drawn into this response include Local Government, Water and Volunteers; State Development, Infrastructure and Planning; Employment, Trade, Employment and Training; Environment, Tourism, Science and Innovation; Transport and Main Roads; Housing and Public Works.

Monitoring, evaluation and learning (MEL)

The Future Drought Fund (FDF) represents the Australian Government's ongoing commitment to strengthen drought preparedness and resilience. Development and publication of Regional Drought Resilience Plans (such as this one) aims to identify and guide actions to build the region's resilience to future droughts. The overall benefits of regional planning are aimed to:

- Empower communities to identify the impacts of drought and develop regional drought resilience and response management plans.
- Support communities to consider the incremental, transitional and transformational opportunities needed to strengthen drought resilience and encourage innovative initiatives at the regional level.
- Facilitate increased community understanding of their resilience to drought, including encouraging communities to share their learnings with each other.
- Encourage improved natural resource management capability through planning.

MEL approach

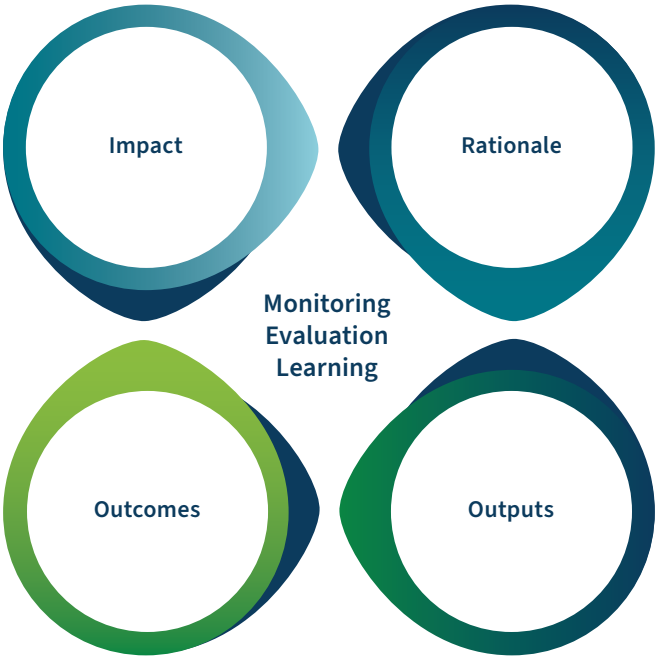
Any planning process requires a strong monitoring, evaluation and learning cycle. For the purposes of this plan, we adopt the framework of FDF for evaluation – with a focus on impact, effectiveness, appropriateness and efficiency – as shown in Figure 39.

Theory of Change

The core underpinning our rationale is that building regional resilience will improve capacities to respond and adapt to the impact of drought. Resilience is a multifaceted concept involving a range of views that combine resistance in the face of adversity, rebounding and transformation[49],[50]. Three common conceptualisations of resilience include an engineering resilience return to a point of stability following a disturbing event[51]; the amount of disturbance a system can absorb before changing to another stable state of equilibrium[52]; and a characteristic that allows members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise[53]. The theory of change adopted for this project incorporates dimensions of the wider context for drought and increased community capacity for planning and transformation in the face of drought. Drought resilience is more than susceptibility and vulnerability[54]. Resilience thinking addresses the dynamics and development of complex social-ecological systems[55]. Our theory of change commences with consideration of the wider context and addresses social and economic resilience, as well as the resilience of agricultural and environmental systems.

Figure 39: Adapted from Future Drought Fund (FDF) approach to Monitoring, Evaluation and Learning (MEL).

Impact
What signs of progress are there towards long-term drought resilience? What priorities and opportunities do the Fund and programs reveal for drought resilience policy, funding and programs?



Appropriateness
To what extent are the programs aligned with the strategic objectives of the Fund, and targeted at important needs? What can be done to improve the appropriateness of the investments?

Effectiveness
To what extent are programs achieving their intended outcomes (and any unintended outcomes)? What could be done to improve the outcomes of the investments?

Efficiency
To what extent are the Fund and program outputs being administered and delivered efficiently, and to the expected quality? What can be done to improve efficiency of the investments?

Overall Program Outcomes

While our pathways and strategies are derived from the above theory of change, this RDR Plan sets the intended quadruple-bottom line regional outcomes – including economic, environmental, governance and social and cultural outcomes (Figure 40).

Figure 40: Dimensions of RDRP program outcomes.[89]

Economic

Reduced economic costs arising from drought.

Social and governance

Increased general community as a key resilience factor.

Integration of cultural considerations in planning/delivery and inclusion of Traditional Indigenous knowledge.

Environment

Reduced environmental decline emerging from drought.

Cultural

Greater capacity for planning and delivery of drought resilience plans.

Enhanced coordination and partnerships for drought resilience.

Program Logic

The program logic of the RDR Plan identifies the outcomes from each of the activities in the plan, based on the theory of change and overall program outcomes.

RDRP Drought Resilience Vision

Activity	Outcome type	Outcome	Process indicator examples
Water and Infrastructure Security.	 **Economic**	• Reduced risks of water for domestic and industry use. • Reliability of infrastructure.	• Risks and vulnerabilities of water, energy and digital infrastructure assessed. • Infrastructure resilience, risk mitigation and redundancy options are identified. • Reduced costs of infrastructure maintenance and repair.
Supporting regional and local businesses adapt to drought events.	 **Economic**	• Resilience of local and regional businesses to the impacts of drought and compounding events, including bushfires and heatwaves.	• Regional heat management strategies are in place and implemented. • Cost-benefit analysis undertaken. • Business accessing recovery support. • Cultural fire management programs implemented. • Marketing information to visitors completed and disseminated. • Research and innovation projects undertaken. • Urban greening guidelines developed.
Build community resilience through ongoing support of mental and physical health, capacity building and community connections.	 **Social and governance**  **Cultural**	• Increased social capital. • Improved health and wellbeing.	• Heatwave drought response plan in place. • Improved access to mental and physical health services. • Improved evidence, research and gap analysis. • Partnerships in place to provide response. • Increase in social capital (volunteering levels, community engagement activities, information and resources, skill levels, capacity of institutions to respond).
Manage and prepare natural assets for drought impacts to conserve ecosystems and vulnerable species.	 **Environment**	• Improved environmental management, conservation of ecosystems and protection of vulnerable species.	• Drought included in natural ecosystems in regional climate risk assessment. • Cultural bushfire management plans in place. • Monitoring systems and indicators in place for vulnerable species. • Incentives program established for wildlife refuges.

Activity	Outcome type	Outcome	Process indicator examples
Support regional governance capacity to deliver regional drought resilience.	 Social and governance	• Protection of key cultural assets and continuation of cultural burning practices.	• Stronger regional approach to fire management developed.
Integrate First Nations people's knowledge of drought resilient Country and ensure they have equal access to health and other services and healthy Country.	 Cultural	• Equitable outcomes for First Nations people and improved management of Country in culturally appropriate ways.	• Inclusion of traditional knowledge in plans and practices. • Reduced social and health inequities (using a range of indicators). • Projects reducing the impact of drought on First Nation's communities.
Improved Regional Governance capacity.	 Social and governance	• Improved regional capacity to drive resilience strategies.	• Drought included as a multi-hazards approach in other strategies and plans. • Increased resources for drought resilience in the region. • Increase evidence base for regional action. • Level of and effectiveness of partnerships.

MEL data collection methods

Data will be collected at established points in the implementation of the RDR Plan. Collecting and collating data will interweave collaborative planning meetings, ongoing desktop analysis, review of existing data, surveys, interviews and focus groups, and case studies. The data collection process will balance qualitative and quantitative methods to enable deep data capture.

Overseeing implementation of the RDR plan and MEL framework

The FDF MEL plan identifies the need for strong monitoring, evaluation and learning processes. Through existing regional governance arrangements, project outcomes and indicators can undergo a review and reporting process, which in turn provides the platform for structured learning. The established Climate Resilience Technical Committee – which sits within the Far North Queensland Regional Organisation of Councils – will provide a platform for external stakeholders and lead institutions identified under strategic pathways, to review the FDF MEL if resourced appropriately. The outcomes of the review will allow for ongoing structured learning across the various regional stakeholders.

For this to take effect, the RDR Plan assumes regional stakeholders will have the capacity and capability to participate in the MEL process, are motivated to implement, are willing to cooperate and can share information to assist with implementation. Resourcing governance arrangements will support the coordination of the long-term implementation of the FDF MEL.

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Image: Daintree Rainforest. *Source: Freepik*.