BLUESALT
Consulting

Kimberley Regional Drought Resilience Planning 2024

Background and Context

Prepared for Kimberley Development Commission

Acknowledgements

We respectfully acknowledge the traditional custodians throughout the Kimberley region and recognise their connection to land, waters and community. We pay our respects to the region's Traditional Owners, their elders past present and emerging.

Jointly funded through the Australian Government's Future Drought Fund and the WA Government through the Department of Primary Industries, the Regional Drought Resilience Planning program for the Kimberley is a locally led project that champions drought resilience and preparedness in the region.

Led by the Kimberley Development Commission, in partnership with the Department of Primary Industries and Regional Development, this project is supported by the Shires of Broome, Derby-West Kimberley, Halls Creek, and Wyndham-East Kimberley.

Kimberley Drought Background & Context Report

Version	Date	Prepared by	Approved by
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Contents

Defining Drought

Although droughts are experienced in countries around the world, an agreed universal definition has not been established due to the complexities around measurement, its relatively slow onset, the different types of droughts, and variabilities in geographical contexts.[1] The way that drought is defined has policy implications and important consequences for Australian farmers[2] and pastoralists.

The need for a regionally appropriate definition of drought was raised several times during the stakeholder consultation process for Western Australia's pilot Regional Drought Resilience Planning (RDRP) program in 2022.[3]

Meteorological definitions of drought focus on rainfall deficiencies or shortages, compared to average rainfall over a preceding period.[4] The Australian Bureau of Meteorology provides a general definition of drought as "*…a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use.*"[5] This is not simply about low rainfall but refers to how conditions in a given season or year compare to normal conditions. Meteorological definitions are quantifiable and can be analysed against historical trends and future climate projections,[6] and therefore are considered suitable for the purposes of the RDRP process.

> A prolonged period of abnormally dry conditions that impacts negatively on water availability and agricultural production in a region and, consequently, impacts negatively on the economy and environment of the region and the health and well-being of its residents.
>
> Mid West Technical Working Group – pilot RDRP program WA 2022

Because drought is also defined in terms of its impact on primary production, surface and groundwater levels, and regional communities, the following expanded definition of drought was developed by the Mid West region's Technical Working Group as part of the pilot RDRP process in WA: *"A prolonged period of abnormally dry conditions that impacts negatively on water availability and agricultural production in a region and, consequently, impacts negatively on the economy and environment of the region and the health and well-being of its residents."*[7] This definition merits consideration within the context of the Kimberley region.

Strategic Context

This literature review provides an overview of the current policy and planning landscape relating to drought resilience at a national, state and regional level. It also presents a high-level summary of insights from existing research regarding drought in Western Australia, and particularly the Kimberley region.

The purpose of this review is to assist with informing the Kimberley region stakeholder engagement process, to be undertaken as part of the 2024 Regional Drought Resilience Planning program. Its intention is to present what is occurring in the drought resilience space nationally, regionally, and locally whilst identifying gaps, challenges and opportunities.

Documents included in this review were obtained from a range of sources including policy documents, plans, frameworks, strategies, and reports (Table 1). In addition, a range of data and statistics have been sourced to inform the subregional and local government profiles. A pragmatic approach has been used to provide insights that are relevant, concise and of value to the Kimberley RDRP stakeholder engagement process.

Table 1: Documents included in this review.

NATIONAL
Drought Response, Resilience and Preparedness Plan 2019 (Australian Government)
National Climate Resilience and Adaptation Strategy 2021-25 (Australian Government)
State of the Climate 2022 (Bureau of Meteorology)
Our North, Our Future 2021-2026 Targeted Growth (Australian Government)

STATE
Climate Adaptation Strategy 2023 (DWER)
Climate Health WA Inquiry Final Report 2020 (WA Health)
Foundations for a Stronger Tomorrow: State Infrastructure Strategy 2022 (Infrastructure WA)
Regional Planning and Infrastructure Framework (DPLH)
State Planning Strategy 2050 (DPLH)
WA Climate Change Policy 2020 (DWER)

STATE
WA Natural Resource Management Framework 2018 (DPIRD)
WA Primary Industries Plan 2020-24 (DPIRD)
WA Regional Development Framework 2023 (DPIRD)

REGIONAL
Kimberley Needs Assessment 2022-2024 (WAPHA)
Kimberley Regional Planning and Infrastructure Framework (RPIF) 2015 (DPLH)
Kimberley Development Commission Strategic Plan 2019-2021 (KDC)
RDA Kimberley Strategic Regional Plan (RDA)
Our North, Our Future 2021-2026 Targeted Growth (ONA)
2036 and Beyond: A Regional Investment Blueprint for the Kimberley
Kimberley Regional Water Plan 2010-2030
Rangelands NRM Regional Plan 2017-2022
East Kimberley Tourism Plan 2021 (East Kimberley Marketing Group)

SUB-REGIONAL
Broome – A Future, For Everyone: Strategic Community Plan (2023-2033)
Shire of Broome Corporate Business Plan (2023-2027)
Shire of Broome Economic Development Strategy (2021-2026)
Shire of Broome Local Planning Strategy (2023)
Shire of Derby-West Kimberley Strategic Community Plan (2021-2031)
Shire of Derby-West Kimberley Local Planning Strategy (2013)
Shire of Halls Creek Strategic Community Plan Review (2020)
Shire of Halls Creek Local Planning Strategy (2016)
Connecting our cultures, striving for prosperity, celebrating the spirit of country and community: Shire of Wyndham-East Kimberley Strategic Community Plan (2023-2033)
Shire of Wyndham-East Kimberley Corporate Business Plan (2022-2025)
Shire of Wyndham-East Kimberley Local Planning Strategy (2019)

NATIONAL RESEARCH, POLICY AND PLANNING INSIGHTS

National Research

Australia's rainfall is more variable than many other countries around the world, largely due to El Niño Southern Oscillation, making it more vulnerable to wet and dry extremes. Drier conditions and changing rainfall patterns have had impacts on Australia's water supply with alternative sources needing to be accessed.[8]

A decrease in annual rainfall of 10-20% in South Western Australia has led to Perth becoming increasingly reliant on groundwater and desalination. Notably, North West Australia experienced unusually dry summers in 2018–19 and 2019–20. It's important to understand how Australia's rainfall will be affected by climate change in the future in order to make well-informed decisions relating to water management and agriculture.[9]

Due to Australia's variable climate, the drought risk for farmers and pastoralists is high, particularly for those engaged in a high level of cropping activity in regions with variable climates. This includes New South Wales, Northern Victoria, South Australia Eyre Peninsula and Western Australia's Northern and Eastern Wheatbelt regions.[10]

Australia has been slow in its climate change action, with 80% of people in 2020 believing the country is currently experiencing climate change impacts, compared to 66% in 2013.[11]

> Australian agriculture has a track record of capacity to adapt and respond to risks.
>
> ABARES (2017)

However, a review of the literature reveals that Australian agriculture does have a track record of capacity to adapt and respond to risks. The sector is engaging in measures that involve increased non-farm income, diversified agricultural activities and written farm plans with business objectives. Specific drought resilience practices include de-stocking early in low rainfall periods to preserve groundcover (68%), improving soil water retention (64%), and increasing fodder and grain storage (58%). However, the greatest barrier to changing farming practices was time, followed closely by funds.[12]

The literature suggests that, with access to more innovative technologies and a sound knowledge base, the agricultural industry is well-positioned to respond to risks in the future. However, the success of this will depend on adoption of viable alternatives, social capital, willingness to change, and a commitment to innovation.[13]

Although Australia has a strong reputation in terms of drought research and development, the system for managing this information is complicated and includes many players. In particular, the body of research on drought resilience is limited.[14]

Notably, science is playing a key and ongoing role in the collection, maintenance, distribution and analysis of climate data and is shifting towards developing science-based measures that encourage adaptability and risk management.[15]

At a general level, national science-based drought initiatives include:

- Provision of training for strategic business planning and decision making.
- Methods of managing uncertainty.
- Delivery of climate data and methods to integrate into meaningful information.
- Increasing fodder and grain storage.
- Water use efficiency strategies.

National Policy and Planning

National drought policy in Australia has shifted from crisis management and financial assistance to preparedness, risk management, and supporting the agricultural sector to become more self-reliant in dealing with the effects of drought.[16]

In Australia, drought programs currently in place support preparedness and resilience or encourage re-examining operating models and risk management approaches. Underpinning most of this work is the government's $5 billion Future Drought Fund (FDF), supported by the Drought Resilience Funding Plan.[17]

The FDF is an investment by the Australian Government to build drought resilience in Australia's agriculture sector, landscapes, and communities. Providing $100 million a year in secure, continuous funding for drought

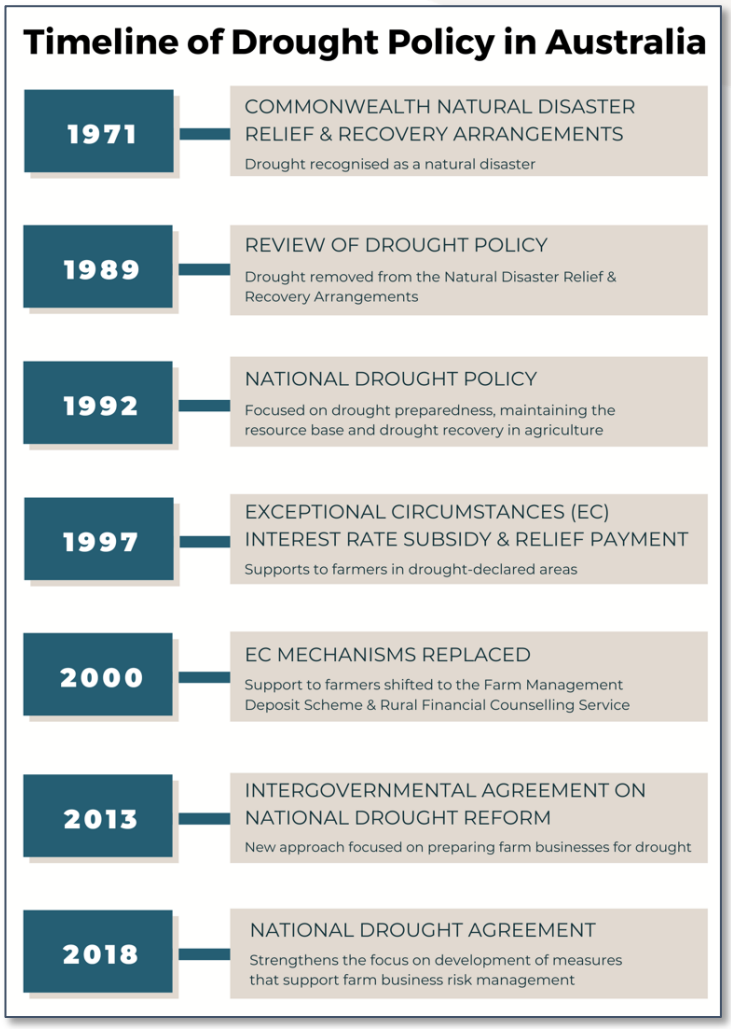


Figure 1: Timeline of drought policy in Australia, 1971-2018

resilience initiatives, the FDF helps farms and communities prepare for the impacts of drought.[18]

Drought Response, Resilience and Preparedness Plan 2019

The Australian Government's 2019 Drought Response, Resilience and Preparedness Plan describes its strategies for helping farming communities prepare for and manage drought. Stakeholder feedback for this plan was provided as part of a review completed in May 2023. This review is informing the development of a new Australian Government drought plan, expected to be finalised in 2024.[19]

National Climate Resilience and Adaptation Strategy 2021-2025

Based on the principles that successful adaptation relies on science and information, partnerships, investments, and effective governance and coordination, this strategy has been developed to support governments, communities and businesses to successfully adapt to climate change. The strategy is structured around natural, built, social and economic domains, with a view to supporting climate change adaptation.[20]

STATE RESEARCH, PLANNING, AND POLICY INSIGHTS

State Research

The Western Australian Government's policy decisions focus on improving preparedness through business training, risk management tools and improved social support for farm families. WA's drought assistance measures have also been developed within the context of the Pilot of Drought Reform Measures - a project undertaken in partnership with the Australian Government.

Findings from the Natural Resource Management Drought Resilience survey, conducted by ABARES in 2021,[21] reveal the types of farm management practices currently being undertaken by WA farmers. With over half of survey respondents stating that they had adopted new land management practices, it is evident that farmers are employing best practice in land and business management, and this is becoming an essential part of most farming businesses.

However, it is worth noting that use of water efficient crops or pasture varieties, planting/maintaining deep-rooted perennial pastures, and carbon farming/sequestration

> "…water efficient crops or pasture varieties, planting/maintaining deep-rooted perennial pastures and carbon farming/sequestration are the least used practices."
>
> ABARES (2021)

are the least used practices. This suggests the need for more support in the way of training and education around these practices, as well as additional research.[22]

From a climate perspective, the State Government is investing in clean energy infrastructure to support its commitment to net zero emissions by 2050. It is also developing climate change legislation to support the reduction of emissions and increase WA's climate resilience, acknowledging that adaptation is essential in mitigating the impacts of climate change.[23]

State Policy and Planning

WA Climate Change Policy 2020

This policy[24] outlines the WA Government's commitment to climate change adaptation and achieving zero greenhouse gas emissions by 2050. Several climate resilience activities have been undertaken as part of this policy, including:

- Climate Resilience Action Plan 2022-25
- Climate Science Initiative
- Climate Risk Framework
- Pilot Sectoral Adaptation Plans

In the Kimberley, early dry season savanna burning is presented as a way to reduce emissions and deliver economic opportunities for traditional owners as well as biodiversity benefits.

Foundations for a Stronger Tomorrow: State Infrastructure Strategy

Representing Infrastructure WA's (IWA) assessment of the state's significant infrastructure needs and priorities, this strategy makes recommendations to address these and provides a framework for improving the state's public infrastructure system.[25] Climate change is addressed as a high priority and critical long-term issue particularly for the water, transport and energy sectors. A focus of this strategy is to reduce carbon emissions and improve the resilience of infrastructure to address the impacts of climate change.[26] It outlines strengths in the Kimberley region as:

- Tourism, agriculture and food, and resources
- Significant Aboriginal population, culture and heritage
- Natural environment (including a World Heritage area).

The Kimberley region (including Broome) is listed as one of the four 'jewels in the crown' of WA's tourism offering.

Climate Adaptation Strategy 2023 – Building WA's Climate Resilient Future

This most recent strategy[27] identifies four directions the government will take, along with specific actions, to increase climate adaptation across the state. To inform the stakeholder engagement process, the following infographic provides a high-level overview.

1 **Produce and communicate credible climate information and resources.**	• Expansion of the Climate Science Initiative. • Model the Urban Heat Island Effect to provide better data. • Investigate impacts of marine heatwaves. • Upgrade weather stations in Southern Rangelands. • Collaborate with researchers, community organisations and private sector to establish a Climate Adaptation Research Hub. • Develop a prioritised research program to address challenges for the WA water sector.
2 **Build public sector climate capability and strengthen accountability.**	• Develop climate change legislation. • Implement a Climate Risk Framework. • Incorporate climate adaptation into the State Planning Framework and policies. • Explore regional water supply options. • Establish robust metrics to measure progress.
3 **Enhance sector-wide and community partnerships to unite and coordinate action.**	• Evaluate outcomes of the Regional Climate Alliance Pilot Program and strengthen LG capacity. • Delivery of a Climate Adaptation Toolkit, training program and science and innovation funding. • Expand the Rangelands Revitalisation Project. • Support WaterSmart farms. • Deliver a Sector Adaptation Plan Program for WA to identify sector specific climate impacts and priority adaptation actions.
4 **Empower and support the climate resilience of Aboriginal people.**	• Engage with Aboriginal organisations and academics on the Adaptation Research Hub. • Investigate climate adaptation practices and identify future opportunities. • Engage with Aboriginal leaders and regional communities on a First Nations Climate Resilience Fund. • Collaborate with the Aboriginal Health Council of WA to support health adaptation measures. • Deliver improved and more climate resilient water and power services to remote communities through the Transfer of Essential Services program. • Deliver the Remote Communities Fund to support appropriate housing in remote communities. • Evaluate climate risk to airport infrastructure in remote communities.

Figure 2: Climate Adaptation Strategy overview

WA Natural Resource Management Framework 2018

This framework[28] was developed in 2018 and focuses on partnerships that protect and manage WA's natural resources. Six key priorities were identified for coordinating NRM in WA (relevant to drought resilience):

- Sustainable management of land resources.
- Maintenance and enhancement of water assets.
- Protection and enhancement of the marine and coastal environment.
- Biodiversity conservation and recovery.
- Enhancement of skills, capability and engagement.
- Delivery of high-quality planning that leads to effective action.

Regional Planning and Infrastructure Frameworks (RPIFs)

As well as the State Planning Strategy, Regional Planning and Infrastructure Frameworks (RPIFs)[29] have been developed for each of WA's regions and are undergoing review. RPIFs are developed through a partnership between the WA Planning Commission, Regional Development Commissions, Regional Development Australia and local governments and are important in the context of future drought resilience planning and identifying key issues associated with climate change and variability.

Western Australia Primary Industries Plan 2020-24

Designed to guide the development of WA's primary industries, this document identifies the following strategic initiatives that are specifically relevant within the context of drought resilience planning:[30]

1 **Protect and enhance the condition of our natural resources.**	• Sustainable management of land and soil resources. • Systems based agriculture. • Climate change strategy.
2 **Maintain and build competitiveness.**	• Applied research to maintain and increase productivity. • Growth through Ag-Tech and digital connectivity. • Building business resilience. • Primary industries workforce.
3 **Differentiate, value add and diversify primary industries.**	• Expand value-add agribusiness sector. • Agrifood cluster development program. • Diversification of agribusiness opportunities.

Figure 3: Western Australia Primary Industries Plan Strategic Initiatives

Climate Health WA Inquiry Final Report 2020[31]

Research undertaken as part of this report highlights that the level of understanding of the link between climate change and health appears to be much lower than the environmental impacts. Whilst a moderate amount of research on the link between climate change and health exists, there are large gaps in knowledge about local and regional challenges and how positive change can be achieved.

The significant flow-on effects for health from climate change are emphasised in this report. Water supply is of critical importance to the delivery of critical health services and health care systems and hospitals use significant quantities of water for essential patient care, hygiene and infection control. From March 2018 to February 2019, the WA health system spent approximately $17.2 million on water.

Other health impacts of climate change cited as most relevant to WA include:

- Injury or death
- Heat-related illness
- Mental health impacts
- Asthma or respiratory distress
- Impacts of air pollution including lung disease, cardiovascular disease, cancer, pregnancy complications
- Mosquito borne disease
- Infectious diseases such as rotavirus, gastroenteritis, and diseases of the soil
- Food quality and security (nutrition)
- Water quality and water availability which can have serious impacts on critical services such as renal dialysis
- Population displacement.

> The impacts of reduced availability of high-quality food for regional and remote communities were made repeatedly at the Inquiry's public forums, where access to healthy, affordable food is already a challenge for communities.
>
> Climate Health WA Inquiry Final Report 2020

This report provides a blueprint for the next 10 years with recommendations for the WA health system to respond to climate change and its health impacts, with a view to improving health service planning and services for those most vulnerable and building community resilience. Recommendations include enhancing resilience measures through the application of a health impact and vulnerability assessment based on WA data, that could subsequently inform a new state adaptation plan for climate change and health.

WA Regional Development Framework 2023[32]

This framework outlines the government's approach to regional development, with a particular focus on building climate resilience, maintaining biodiversity and environmentally sustainable development.

REGIONAL INSIGHTS

Regional Research

The intricate relationship between climate change and drought resilience, and its associated impacts are areas that have been increasingly explored in the literature in recent years. As a region, the Kimberley faces a number of social, economic and environmental challenges that merit consideration within this context.

The Ngurrara people in the desert region have ascertained that the seasonal indicators of their native title lands are changing, evidenced by the drying of water sources and a shift in traditional plant blooming and animal breeding times.[33]

The following pressing economic, environmental and social challenges for this region have been identified:

- Low critical population mass with difficulty attracting and retaining population.
- High cost of living compared to State and National averages.
- Underdeveloped built economic and social infrastructure.
- Projected increase in extreme weather events.[34]
- Boom bust cycles impacting the workforce, housing and population stability.
- High levels of social disadvantage and disengagement.[35] [36]

> More than 91.4% of the Kimberley is comprised of Native Title lands. The Traditional Owners of those lands play a critical and proactive role in the development of the region and its industries, infrastructure and services.
>
> Kimberley Development Commission Strategic Plan 2019-2021

Despite these challenges, the region has distinct advantages that position it well for future drought resilience planning:

- Vast land, water, mineral resources.
- Globally recognised clean environmental profile.
- Strong potential to build human and cultural capital.
- Both East and West Kimberley locations, especially those with access to plentiful water, offer the ability to produce multiple crops throughout the year. [36]

However, leveraging these advantages to mitigate the effects of climate change will require collaborative, community-based approaches, investment in infrastructure and services, harnessing of Indigenous knowledge, and sustainable land management practices.[37]

The state government's Climate Adaptation Strategy highlights that climate resilience for Aboriginal people can be achieved through empowerment of local decision making and integration of local knowledge.[38] The following high-level summary provides a snapshot of recent initiatives that have been undertaken to address climate change in the region.

Indigenous Knowledge

Several Indigenous groups in the Kimberley (Yawuru, and Mirrawong Gujerong people in the East Kimberly and others) have used their cultural knowledge to enhance activities around the identification of seasonal conditions and undertake comparisons with traditional indicators.[39]

As part of the state government's Climate Adaptation Strategy, a $1.86m project has been initiated to deliver a co-designed West Kimberley Climate Adaptation Strategy. This project aims to build resilience among Traditional Owners in the West Kimberley by creating a body of evidence that combines Aboriginal scientific knowledge with western science. This project will run over 3 years through a partnership between the Nulungu Research Institute at the University of Notre Dame Australia and the Department of Water and Environmental Regulation.[40]

> "Across the Kimberley, Aboriginal people are well placed to understand the effects of climate change on the land.
>
> Kimberley Land Council (2018)

Infrastructure Planning and Advocacy

Vital economic and community infrastructure projects have been identified by the 4 Kimberley LGAs through the Kimberley Regional Group and include:

- Tanami Road Upgrade
- East Kimberley Regional Airport Runway Extension
- Derby Wharf Precinct Masterplan and Redevelopment
- Great Northern Highway to Looma Road Reconstruction and Seal
- Ewin Early Learning Centre Expansion.[41]

Australian Government Initiatives

To drive new agricultural activity, the Australian Government has invested more than $500 million to support water infrastructure projects in the north through the $3.5 billion National Water Grid Fund.[42] Additionally, it has established the Northern WA/NT Innovation Hubs that will work to transform drought resilience and agricultural innovation in these regions, with a particular focus on pastoral, broadacre, horticulture and forestry systems, and water management.[43] In 2021, the Indigenous Rangers program received an

additional $746 million over 7 years to expand its reach and increase strategic land and sea country management initiatives.

Northern Hub – Projects

Covering the tropical Top End and Rangelands, the Northern Hub supports farmers and communities prepare for drought through the leveraging of expertise and fostering innovation and new practices.

Recent projects include:

- 30 Year Review (Rangelands NRM) - Evaluating Ecologically Based Rehydration Works in WA's pastoral Stations
- Ord Water (DPIRD) - Investigating Water Use and Efficiency in the Ord River Irrigation Area
- Coordinated Dry Season Response (KPCA) - Enhancing climate Resilience for Pastoralists
- Improving Water Management at Bullara Station (RDA Pilbara) - Improving Water Management for Sustainable Tourism at Bullara Station
- Building Drought Resilience in Irrigated Horticulture (SWWA Hub) - Northern Hub and Vic Hub combined project
- Coordinated Dry Season Response (KPCA) - Enhancing Climate Resilience for Pastoralists
- Forage Management WA – new project to extend Rangelands work to Kimberley and Pilbara Regions in WA
- Spinifex Dominated Pastures (KPCA) - Importance During Drought & Knowledge Collation Project (KPCA).

> "Drought is an unpredictable driver of productivity in the cattle industry.
>
> Preparation for it, and resilience to it, offer real value to the northern regional and remote economies.
>
> Kimberley Pilbara Cattlemen's Association (Our North, Our Future White Paper)

Regional Policy and Planning

There is widespread consensus regionally for the development of integrated policies and governance frameworks that address both short and long-term drought responses and consider social, economic and environmental factors in the face of changing climate conditions.

WA Primary Health Alliance - Kimberley Needs Assessment 2022-2024[44]

The Kimberley region has the highest levels of socioeconomic disadvantage in WA, with social determinants of health being a key issue. Chronic disease, mental health, alcohol

and drug use are the dominant health concerns in this region. Depression, self-harm, and suicide are issues impacting particularly male and youth cohorts. The region has the state's highest rates of self-harm, suggesting a lack of access to appropriate mental health services.

Kimberley Regional Planning and Infrastructure Framework (RPIF) 2015[45]

Regional Planning and Infrastructure Frameworks (RPIFs) provide a foundation for future decision making, outlining key planning initiatives. These frameworks are important in the context of future drought resilience planning and identifying key issues associated with climate change and variability.

The Kimberley Regional Planning and Infrastructure Framework 2015 emphasises the importance of water infrastructure in supporting the region's growth and development.

It outlines strategies to capitalise on the Kimberley's comparative advantages and promote economic diversification, which are essential for facilitating population and economic growth to 2025.

The framework recognises the need for sustainable management of water resources to support various sectors, including agriculture, tourism, and mining, while ensuring the protection of significant environments and the preservation of Aboriginal culture and heritage.

> The Kimberley has significant known ground water sources located along the Fitzroy River, in the Dampier Peninsula and in the La Grange area.
>
> Kimberley Regional Planning and Infrastructure Framework (RPIF) 2015

Whilst it recognises water resources as a strategic regional advantage in terms of capacity to support future development, it also acknowledges the need to consider climate change on a risk management basis, and the impact of future development on the total water cycle. Actions should focus on stormwater management, monitoring of water resources, establishment of buffers to sensitive water resources, and sustainable water usage.

Additionally, the State Planning Strategy 2050 has identified several environment-related objectives to guide future planning in the Kimberley region:

- Environment - to conserve biodiversity and manage the State's natural resources in a sustainable manner.
- Tourism - to access and enhance a range of experiences unique to the State.

- Water – to support WA's growth and development by sustainably managing the availability and quality of water while maintaining a healthy, diverse and well-managed water environment.

Kimberley Development Commission Strategic Plan 2019-2021[46]

The Kimberley Development Commission (KDC) continues to actively seek new opportunities to support vibrant and sustainable communities that are inclusive, diverse, accessible, healthy and safe. The KDC Strategic Plan addresses the challenges faced in the Kimberley region and highlights the opportunities that these can present, along with the value of collaborative partnerships and the region's strengths and advantages. These include:

- Proximity to global markets.
- Climate and seasonality opportunities for tourism and agriculture, favouring peak production and visitation.
- Access to plentiful water in some areas of the East and West Kimberley.
- The ability to produce multiple crops throughout the year.
- Cultural diversity and strength.
- Biological diversity.
- Strong brand recognition internationally.
- Opportunities in cultural/eco-tourism, bush foods, environmental, and human services.

KDC is committed to a triple bottom line approach to regional development in the Kimberley based on People, Place, and Prosperity. Its plan is structured around 5 Strategic Themes for Regional Development in Western Australia, summarised in Figure 4.

Figure 4: Strategic Themes identified in the Kimberley Development Commission's Strategic Plan 2019-2021

RDA Kimberley Strategic Regional Plan 2022-25[47]

In addition to identifying direction, actions and initiatives that advance socio-economic outcomes for the Kimberley region, this document highlights regional advantages in terms of future drought resilience, summarised in Figure 5.

Emerging industries in land management, carbon farming, niche bush foods, and nutrition are gaining traction in the region. Development opportunities are vast, with growing global demand for niche products, clean and green protein, and the potential to value add with downstream processing and intensification. However, this plan highlights several critical challenges that are impacting delivery and development in some sectors. These challenges are presented in Figure 6.

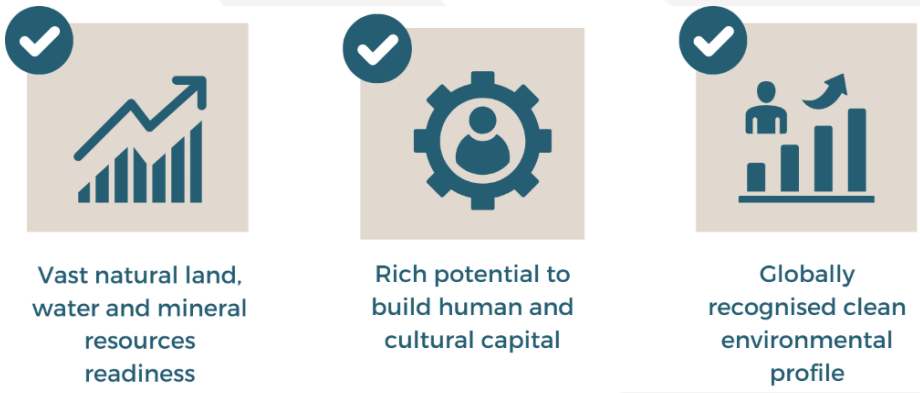


Figure 5: The Kimberley region's key advantages as identified in the RDA Kimberley Strategic Regional Plan 2022-25

Risks associated with climate change and resource scarcity include increased risk of crop failure, widespread flooding, destroyed habitats and energy shortages. Innovation in food, water for food, and consumer attitudes will be important drivers of change moving forward.

Figure 6: Critical challenges facing the Kimberley region identified in the RDA Kimberley Strategic Regional Plan 2022-25

Our North, Our Future 2021-2026 Targeted Growth[48]

From 2021-2026, the Australian Government will invest in transformational and enabling projects through a whole-of-government approach, in partnership with state and territory governments. Priorities relevant within the context of drought resilience and planning are listed in Figure 7.

Broome to Kununurra to Darwin has been identified as one of three priority Master Plans which will set out the strategic direction for efficient economic development. Business grants are also available to enable Northern Australia based businesses, including Indigenous businesses, to grow and diversify.

A $75 million Cooperative Research Centre for Developing Northern Australia (CRCNA) has been funded to invest in research and programs related to agriculture and food, health service delivery, and Traditional Owner-led agricultural and health service business and enterprise development.

Indigenous economic growth	Building capacity and supporting business and entrepreneurs
Energy	Affordability and supporting infrastructure
Supply chain infrastructure	Roads, rail, airports, storage, and logistics
Communications	Black spots and bandwidth
Water Infrastructure	To support agriculture, industry development & water security
Affordable insurance	To support households and businesses
Critical minerals	Value-add and diversification
Tourism recovery	Bouncing back after COVID-19
Workforce training and education	Addressing critical skills shortages and labour supply
Social services	Focusing on housing, health, and aged care

Figure 7: Relevant priorities from Our North, Our Future

2036 and Beyond: A Regional Investment Blueprint for the Kimberley[49]

A guide for the Kimberley's future development, this document sets measurable targets across key strategies, highlighting the fact that the region's human and social capital, economy and infrastructure are still very much in the early stages of development. In terms of climate, at the time this document was developed it concluded that, despite hotter and drier climate trends in other parts of Australia, the Kimberley had become wetter and cooler, placing it in a unique position relative to trends elsewhere.

Noted is the opportunity to develop its Rangeland and agricultural resources with a vision of becoming one of the world's most successful and sustainable regions. To achieve this vision, 6 transformational agendas are identified, summarised in Figure 8.

Figure 8: Six transformational agendas required for realising the vision - 2036 and Beyond Regional Investment Blueprint for the Kimberley

Evidence of this vision and transformational targets identified in the Blueprint are identified in Figure 9.

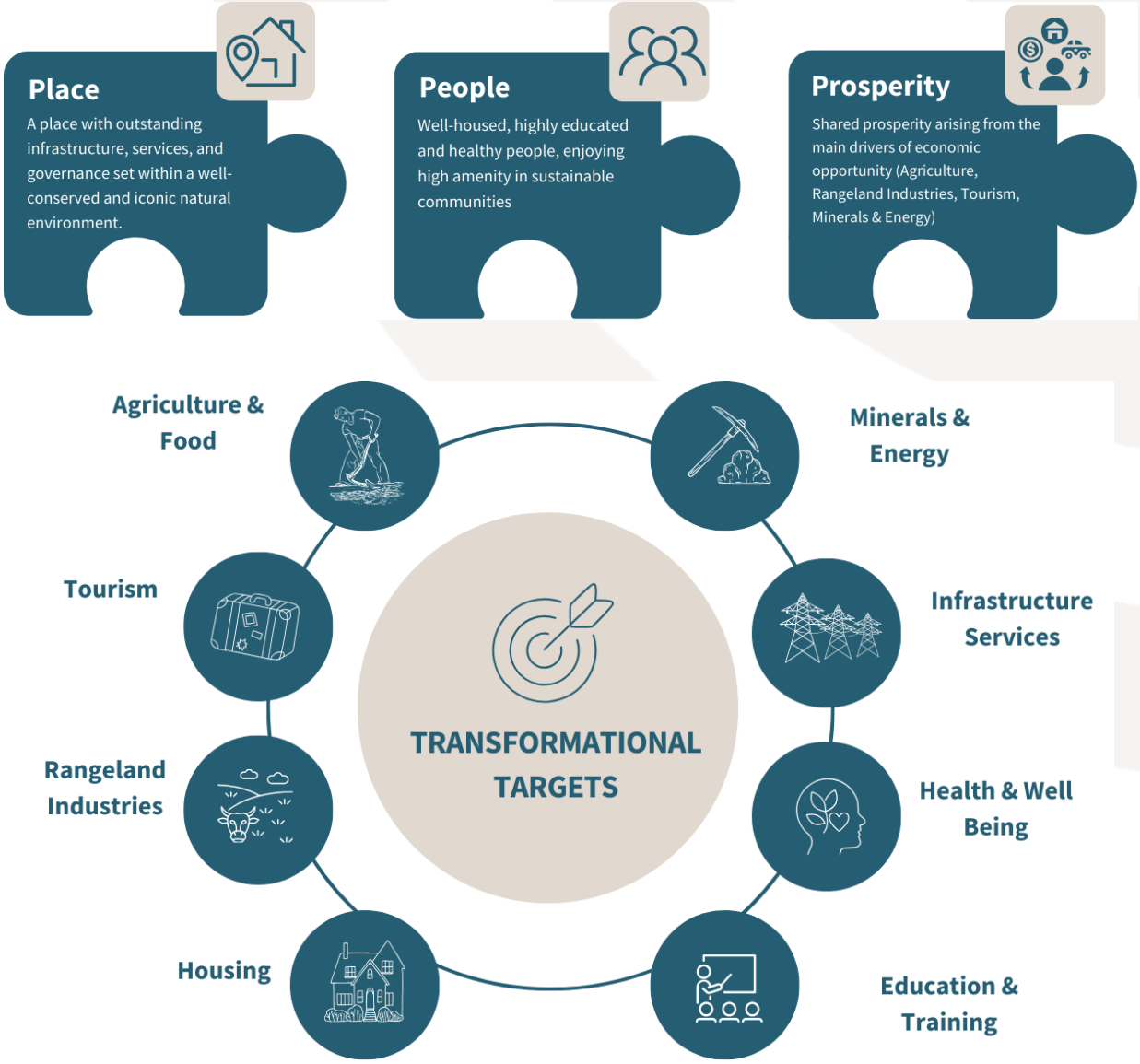


Figure 9: Vision and Transformational targets identified within the 2036 and Beyond: Regional Investment Blueprint for the Kimberley region

Kimberley Regional Water Plan 2010-2030[50]

The Kimberley Regional Water Plan 2010 is a strategic document that outlines the direction for water resource management in the Kimberley region over a 20-year period. The plan aims to:

- Provide a clear position on strategic water issues in the Kimberley, considering a broad range of stakeholder input.
- Address the growth in water demand and the balance with water availability.
- Identify threats to water resources and community-identified water management issues.
- Establish strategic objectives and position statements for water management in the region.

The plan acknowledges the cultural and social values of water to the local communities, especially indigenous populations, and emphasises the need for ongoing research to understand water-dependent values for better planning and management. It serves as a framework for ensuring sustainable water use that supports the environmental, cultural, and economic needs of the Kimberley region.

Rangelands NRM Regional Plan 2017-2022[51]

Rangelands NRM work at the landscape scale and the region falls under the Kimberley and Desert (southern parts) subregions in the Plan. The highest risk area for the Kimberley is fire management, with fires contributing to greenhouse gas emissions and late dry season fires altering the vegetation structure. The Plan was reviewed in September 2022.

Priorities across the region include:

- Building on a landscape-scale fire program across pastoral properties in the East Kimberley, currently managed in a Culturally Informed Fire style by the Kija Rangers.
- Engaging pastoralists and ranger groups in the East Kimberley to protect critical habitat and encourage regenerative pastoral management.
- Work with traditional owners and new pastoral interests to manage Lake Gregory (Paraku in Walmajarri language) sustainably.
- A focus for fire, weed and feral management at 80 Mile Beach, assisting with building collaborations and partnerships to diversify learning and opportunities.
- Build relationships between traditional owners and pastoralists along the coastal belt to link 80 Mile Beach with Roebuck Bay and develop holistic property plans fostering a landscape scale perspective on sustainable grazing practices.
- Reduce and manage fire across the Dampier Peninsula (uncontrolled fires burn extensive areas of country). The focus will grow to include management of weeds and ferals and linking with sustainable grazing practices.
- Facilitating collaboration in the Fitzroy River area to assist in exploring opportunities to work together towards shared goals. There is also an opportunity for improved employment opportunities for Aboriginal Corporations and Ranger Groups on pastoral properties to meet a workforce gap in the area.

East Kimberley Tourism Plan 2025

The East Kimberley has considerable natural tourism assets and iconic experiences, and the East Kimberley Tourism Plan identifies the significance of the tourism industry to the East Kimberley economy. Under the pillar of 'awe inspiring wilderness experiences', the sustainable planning and activation of destinations including Purnululu National Park, Gibb River Road, Lake Argyle, Ord River, Mitchell River National Park and Mirima National Park is a priority, as is experience development, indigenous tourism, events, agritourism and service hubs. The East Kimberley Marketing Group (EKMG) has responsibility for the Plan.

Local Government Strategic Context

At the local government level, the following strategic documents contain relevant information relating to drought preparedness and climate adaptation and are important to informing future drought related stakeholder engagement and planning.

Shire of Broome:

- Strategic Community Plan (2023-2033)
- Corporate Business Plan (2023-2027)
- Economic Development Strategy (2021-2026)
- Local Planning Strategy (2023)

Shire of Derby-West Kimberley:

- Strategic Community Plan (2021-2031)
- Local Planning Strategy (2013)

Shire of Halls Creek:

- Strategic Community Plan Review (2020)
- Local Planning Strategy (2016)

Shire of Wyndham-East Kimberley:

- Strategic Community Plan (2023-2033)
- Corporate Business Plan (2022-2025)
- Local Planning Strategy (2019)

Drought Impacts

GENERAL IMPACTS

The impacts of drought can be significant and serious, and have interconnected environmental, economic and social aspects.

Environmental impacts are among the most noticeable effects of drought and can be widespread and long-lasting. They include:

- Contributing to land degradation processes.
- Significant impact on natural resources, including irreversible damage to water quality, soil and vegetation.
- Dust storms and a loss of topsoil, soil nutrients, organic matter and soil carbon.[52]

The environment can also be a major determinant of our health.[53]

Economic impacts of drought commonly include:

- Sharp falls in the volume of agriculture production, particularly crops.
- Reduced herds or flocks.
- Reduced operating surplus.[54]

Social impacts are primarily driven by the effects on financial security (income and employment), as well as indirect effects on regional communities, including:

- Hardship and stress of lost productivity.
- Declining population (out-migration).
- Disruption of social connections.
- Loss of services to the community.
- Trauma associated with witnessing damage to livestock, crops, soil and native vegetation.[55]
- Increased suicide rates in male farmers and farmworkers.[56]

For Aboriginal Australians the land and sea and all that connects them are the source of identity, spirituality, culture, economy and wellbeing.[57] Aboriginal Australians are also likely to be disproportionately affected by drought because of pre-existing health and social disadvantage.[58]

For pastoralists, a close relationship has been found between environmental conditions and emotional wellbeing, with water insecurity leading to extreme worry and fatigue among the studied population, especially in the dry season.[59] Broader climate change will also lead to a range of impacts, as discussed this Background & Context Report.

LOCALISED IMPACTS

In contrast to the South West of WA, annual rainfall variability from year to year ranges from moderately low to moderately high in the Kimberley region, see Figure 10. This increases to extreme variability in months such as March to July, though this also reflects the very low rainfall at this time most years.[60]

The Madden-Julian Oscillation(MJO) can increase the variability of moisture in the area during an MJO 'wet' phase and varies from season and location.[61] It can lead to the formation of cyclones or tropical lows which bring widespread rain to northern Australia.

Over the past 24 years, rainfall deciles per calendar year demonstrate differing rainfall patterns across Western Australian regions.[62]

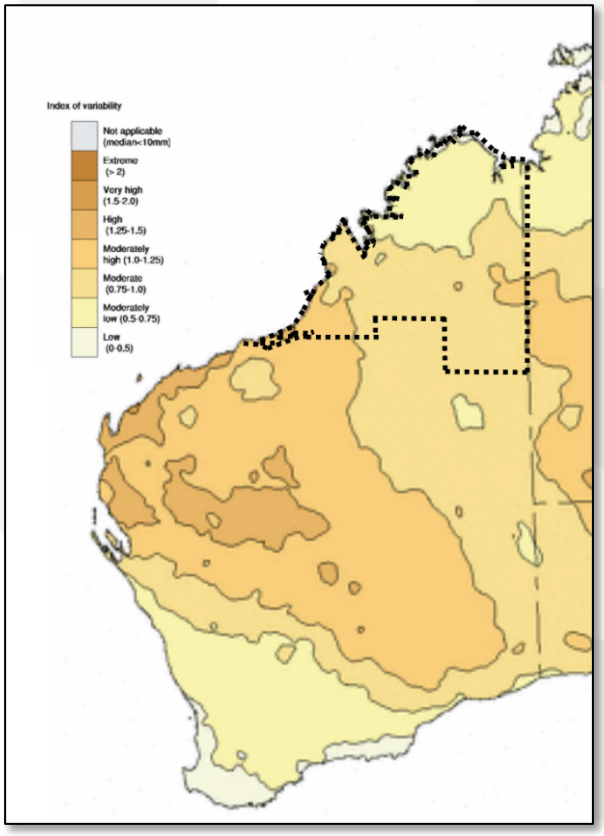


Figure 10: WA Rainfall Variability Annual 1900-2019, Kimberley highlighted.

Reflecting the localised nature of drought, 2002, 2006, 2010 and 2019 are recognised as drought years in Western Australia based on dry conditions, but only 2019 resulted in widespread drought in the Kimberley. Over the past 24 years, highly localised areas of the region have experienced below average rainfall, see Figure 11 for a snapshot. A more detailed analysis will be provided in the Drought Vulnerability Assessment.

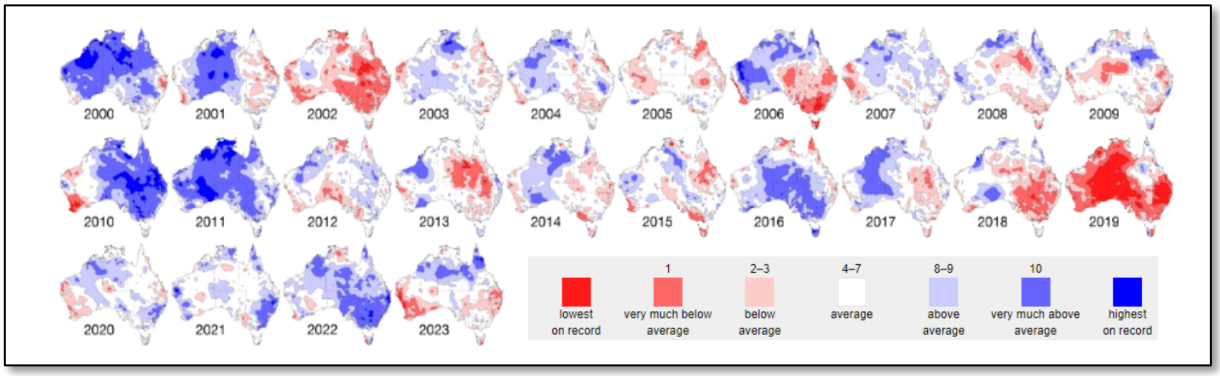


Figure 11: Snapshot of Australian rainfall deciles 2000-2023.

Observations show a significant increase in Australian summer monsoon (AUSM) rainfall since the mid-twentieth century[63] and the region has also experienced an overall trend of increasing maximum temperatures since 1970.[64]

Water Corporation supply in the Kimberley is primarily from groundwater, with Wyndham also drawing water from Moochalabra Dam. Water Corporation customers in the North

West are reported as some of the highest users per capita in WA. Around 42% of treated wastewater is recycled in the North West and this will play an increasingly important role to support economic activity and population growth.[65]

Commencing July 2023, the WA Government transferred responsibility for water and power services in 101 Aboriginal communities in the Kimberley from the Department of Communities to Water Corporation and Horizon Power. Through this program, Mowanjum (near Derby) became the first Aboriginal community in WA to have a licensed wastewater treatment plant. The Water Corporation Essential and Municipal Services Upgrades Program is due for completion by 2026.[66]

Water holds significance to Aboriginal Australians and in the Kimberley has been framed around co-management and co-existence, entwining with ethics, values, custom, law, language and inter-generational obligation.[67] In the Living Waters model developed for waters of the Martuwarra (Fitzroy River), all relationships are mutual (two-way) and also include a dimension that does not appear in modern water resource models – that of ancestral beings (see Figure 12).[68]

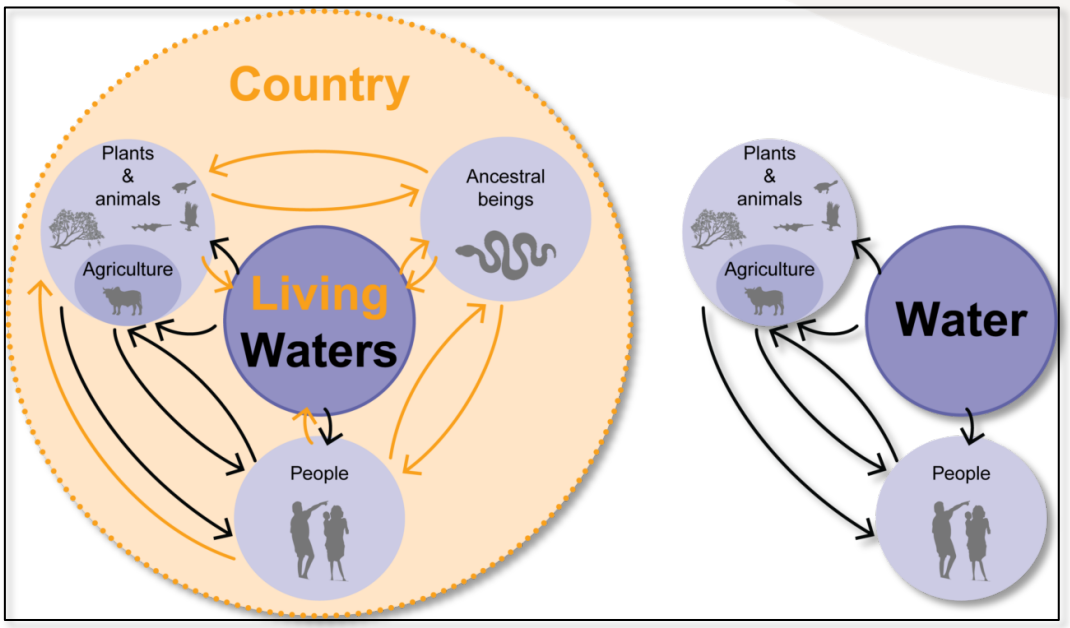


Figure 12: Orange arrows in the Living Waters model represent connections not generally considered by modern water resource models

Practice-led research in other regions has found that prolonged drought conditions alter the landscape and negatively affected place-identity, place attachment and wellbeing of pastoralists.[69] Operational impacts on pastoralists in northern Australia include:

- Destocking (need and timing)
- Controlling mating to avoid out of season calves
- Deciding whether to cull or retain breeders
- Determining a 'green date' and 'production date'
- When and where to implement prescribed burns
- If and when to supplement cattle

- When to start staff.[61]

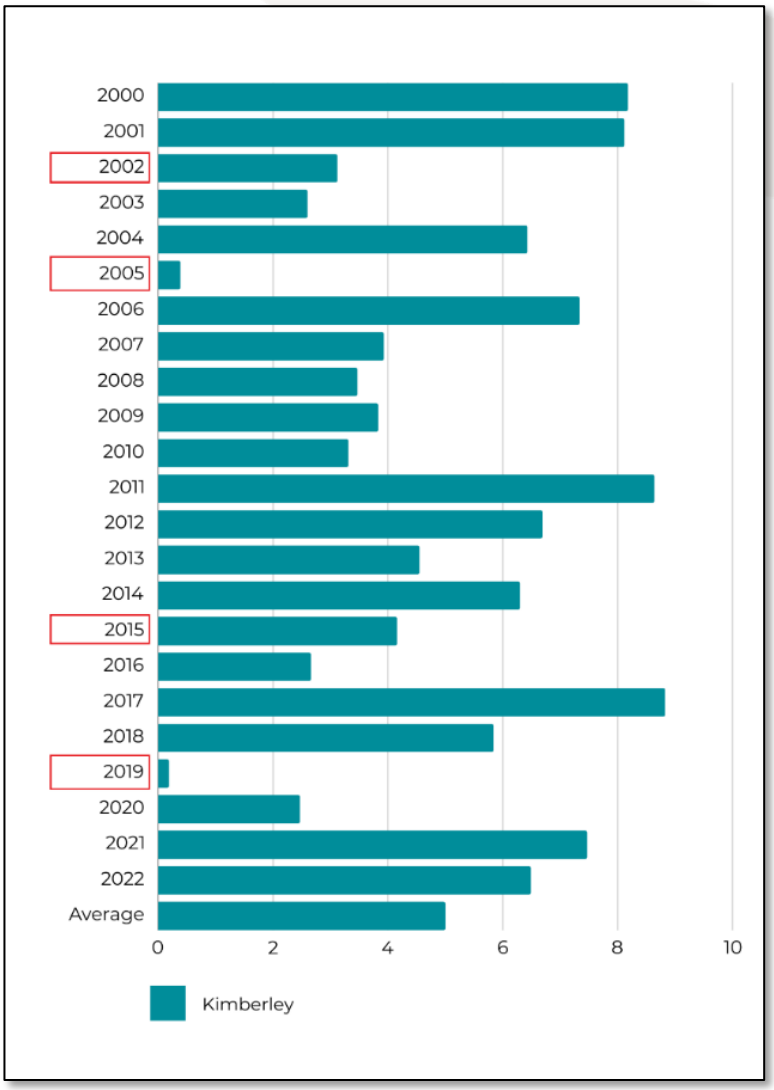
Observations on native title lands include the shifting of seasonal indicators, with the drying of water sources and a shift in seasonal fruit blooming and animal breeding times.[70]

The average environment condition score for the Kimberley varied significantly between 2000-2022, however years with widespread or localised below average rainfall show a correlation with poor environmental conditions, see Figure 13. Localised scores are shown in the Regional Profile.

Based on past research in WA it is assumed that existing vulnerabilities will be exacerbated by drought.[71] [72] Existing vulnerabilities which may be exacerbated by drought, are highlighted in the Regional Profile section.

As part of the RDRP process, the vulnerability of this subregion will be explored in more detail through a Drought Vulnerability Assessment (DVA).

Figure 13: Environment Condition Score in the Kimberley, years of widespread below average rainfall highlighted.



Regional Profile

LOCATION

This profile covers the Kimberley region of Western Australia. This region includes four local governments: Shire of Broome, Shire of Derby-West Kimberley, Shire of Halls Creek, and Shire of Wyndham-East Kimberley, as shown in Figure 14.

The region covers 419,245km^2 and supports a population of approximately 38,706. Key population centres are Broome, Derby, Fitzroy Crossing, Halls Creek, Kununurra and Wyndham. The Broome LGA has the largest population, accounting for around 47% of the region's population. The Kimberley also has the majority of WA's Aboriginal communities,[73] both permanent and seasonal.

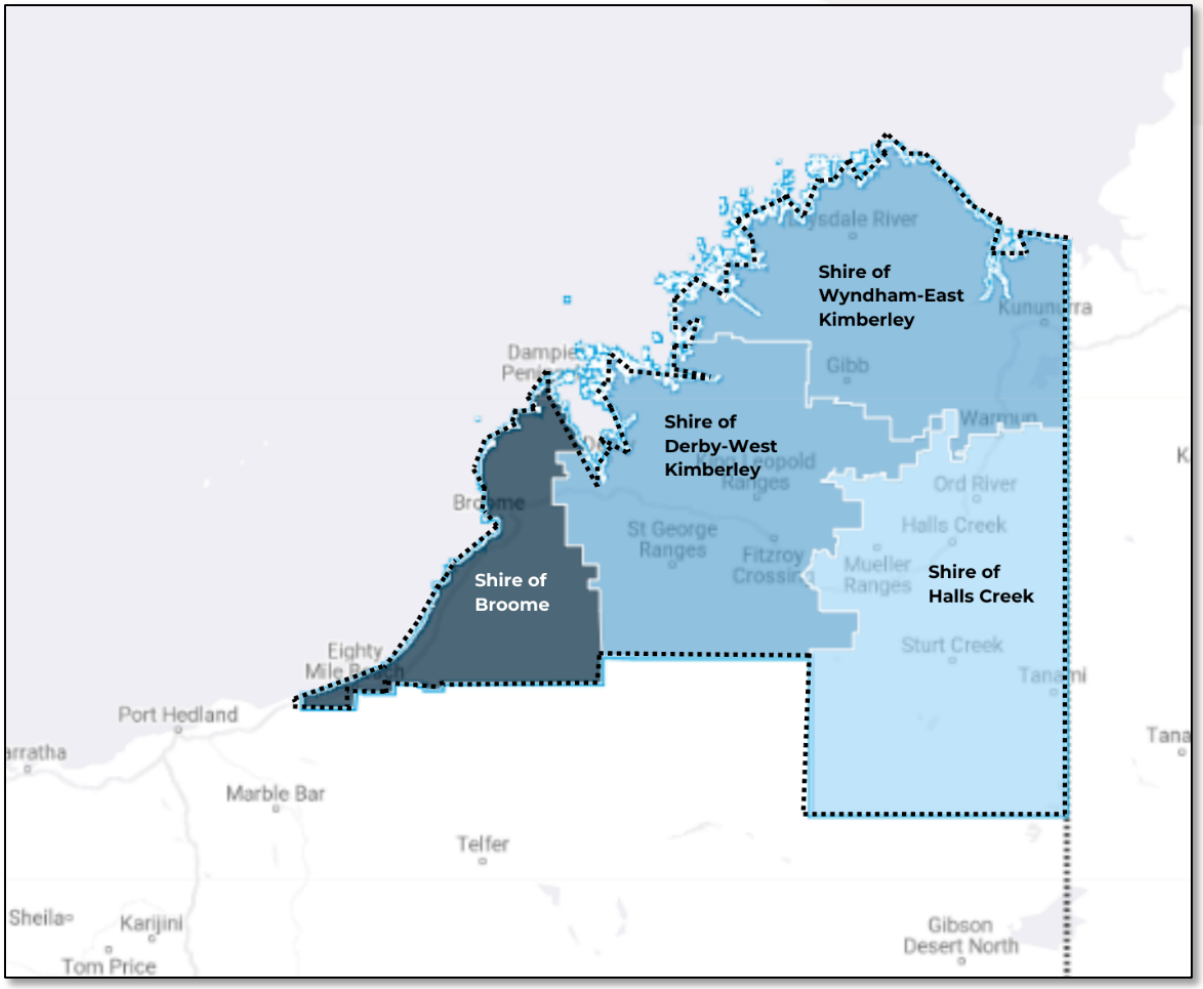


Figure 14: The region and LGA covered by this plan highlighted in blue.

The characteristics of each LGA are summarised below, with a more detailed description of key indicators to follow.

Table 2: High level summary of the Kimberley LGAs, compared to Western Australia

	Shire of Broome	Shire of Derby-West Kimberley	Shire of Halls Creek	Shire of Wyndham-East Kimberley	Kimberley (Region)	Western Australia (State)
Population (ABS, 2021 and comparison to 2016)	18,204 ↑	8,414 □	4,038 ↑	8,050 ↑	**38 706**	
Median Age (ABS, 2021)	33.6	31.7	28.8	33.3	**32.6**	**38**
SEIFA IRSAD Score (Remplan, 2024) **& (Quintile)** ABS, 2021	962 (4)	734 (1)	540 (1)	899 (4)	**859**	
Land Area (km²) (ABS, 2021)	54,401	119,730	133,046	112,066	**419,245**	
Environment Score (ANU, 2022)	7.0	7.2	5.3	7.4	**5.0**	**6.0**
Annual economic output ($mill) (Remplan, 2024)	3,462	1,856	680	1,746	**7,744**	**819,345**
Output from Ag (%) (Remplan, 2024)	4.6	4.1	4.2	11	**5.9**	**1.8**
Jobs in Ag (%) (ABS, 2021)	4.5	4.5	4.9	11.8	**6.3**	**2.3**


Lake Argyle

CLIMATE AND NATURAL ENVIRONMENT

Climate and Landscape

The Kimberley is classified as Hot (Humid Summer) along the coast and Warm (Humid Summer) inland, or Climate Zone 3 (Hot Dry Summer, Warm Winter) in Halls Creek LGA and Climate Zone 1 (High Humidity Summer, Warm Winter) in remaining LGA.[74] [75] During most months, evaporation exceeds precipitation.[76]

Under the Köppen classification system it is classified as a mix of Equatorial Savanna (Aw) in the north, Subtropical steppe (BSh) and Subtropical desert (BWh) in the south and southeast.[77] The region is within the Rangelands Natural Resource Management zone and sits across seven IBRA7 regions with 3 represented in full in the region (as shown in Figure 15).[78] These will be detailed in the region's Drought Vulnerability Assessment.

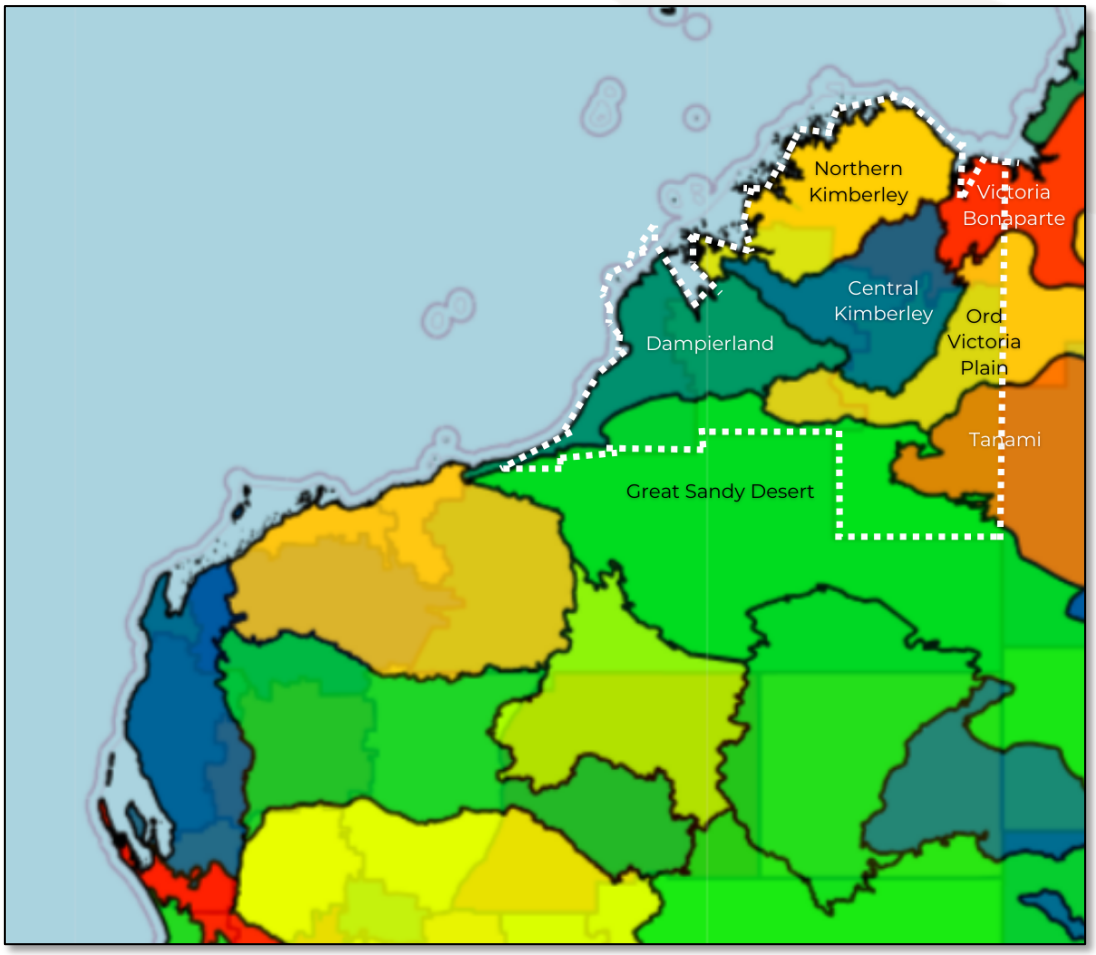


Figure 15: IBRA 7 Regions shown with Kimberley Region boundary.

The Kimberley has an extensive network of rivers and streams influenced primarily by monsoonal rainfall. They are highly seasonal and few flow perennially. The region also has two of Western Australia's largest rivers – the Fitzroy River (700km long) and the Ord River (588km long).[79]

Protection and Condition

The area of land protected totals 140,432.84km^2 in the Kimberley statistical area (SA3) which includes 23.6% indigenous protected land, 5.3% national parks and 0.4% nature reserves.[80] The area of land protected varies across LGAs, from 20.5% in Derby-West Kimberley to almost half the land area in Broome (48%) and Wyndham-East Kimberley (49%).

There are four Ramsar Convention listed wetlands in the region – Ord River Floodplain, Lakes Argyle and Kununurra, Roebuck Bay and Eighty-mile Beach.[81] The Purnululu National Park (including the Bungle Bungle Range) is recognised internationally for its exceptional natural beauty and is on the UNESCO World Heritage List.[82]

The region currently has 11 listed threatened ecological communities, all with a strong connection to, or reliance on, water systems. They are:

- Six critically endangered organic mound spring assemblages or communities (Big Springs, Bunda Bunda, Dragon tree Soak, Mandora Marsh area, Black Spring, North Kimberley bioregion) - Derby-West Kimberley and Broome LGA.
- Endangered monsoon thicket (Dampier Peninsula) - Broome LGA.
- Three vulnerable assemblages of rainforest swamp (Roe River, Theda Soak, Walcott Inlet) in Wyndham-East Kimberley and Derby-West Kimberley.
- Vulnerable faunal community of Roebuck Bay – Broome.[83]

In the 2022 Australia's Environment Report, the Kimberley statistical region had an environmental condition score of 6.4, less than the previous year, but above the average of 5.0 since 2000.[84] The score for Western Australia was 6.0.

High score variability has been experienced over the past 23 years. While the average from 2000-2022 was 5.0, this includes a low of 0.19 (2019) to a high of 8.83 (2017), see Figure 13.

Years with below average rainfall appear to correlate with lower scores. All LGAs except for Wyndham-East Kimberley experienced a decline in environmental condition from 2021 to 2022.

KEY:

↙ reduced/ declined ↗ increased/ improved

PROTECTED LAND (NATIONAL PARK / NATURE RESERVE (ABS, 2021)	ENVIRONMENTAL CONDITION SCORE (ANU, 2022)
BROOME 48%	BROOME ↙ 7.0
DERBY - WEST KIMBERLEY 20.5%	DERBY - WEST KIMBERLEY ↙ 7.2
HALLS CREEK 26%	HALLS CREEK ↙ 5.3
WYNDHAM - EAST KIMBERLEY 49%	WYNDHAM - EAST KIMBERLEY ↗ 7.4

COMMUNITY AND BUILT ENVIRONMENT

Demographics

The Shire of Broome is a major commercial centre for the region and has the largest population, just over 47% of the Kimberley population. The population in all LGAs grew between the 2016 and 2021 Census, however growth in Derby-West Kimberley was minimal. The median age across the Kimberley (32.6) is lower than WA (38) and is lowest in Halls Creek at 28.8.

Housing and Health

Across the region, approximately 560 households were in mortgage or rental stress in 2021 (where repayments are 30 percent or more of income), the majority of these renting households.* Relative to population, rates of housing stress were highest in Wyndham-East Kimberley at 9.5%. Dwellings with no internet access ranged from 18% in Broome to 44% in Halls Creek, against 12.5% in WA. Around 60-64% of the population in in all LGAs reported no long-term health condition in 2021, similar to WA (61.2%).

HOUSEHOLDS IN RENT OR MORTGAGE STRESS (ABS, 2021)

BROOME
180

DERBY - WEST KIMBERLEY
125

HALLS CREEK
53 *

WYNDHAM - EAST KIMBERLEY
202

INTERNET NOT ACCESSED FROM DWELLING (ABS, 2016)

BROOME
18%

DERBY - WEST KIMBERLEY
35%

HALLS CREEK
44%

WYNDHAM - EAST KIMBERLEY
26%

NO LONG TERM HEALTH CONDITION (ABS, 2021)

BROOME
64%

DERBY - WEST KIMBERLEY
60%

HALLS CREEK
63%

WYNDHAM - EAST KIMBERLEY
60%

OFFENCES PER 1,000 PEOPLE (WAPOL, 2023)

BROOME
302

DERBY
1,043

HALLS CREEK
797

WYNDHAM
336

KUNUNURRA
830

* In Halls Creek only renters shown due to negligible number of households owned under a mortgage.

Both Broome are Kununurra are considered very walkable (both 72 out of 100) as most errands can be accomplished on foot and they are the most walkable centre / townsites in the region. Derby is considered somewhat walkable (53) as some errands can be accomplished on foot. Other townsites are considered car dependent to varying degrees based on access to services, with scores of Fitzroy Crossing (41), Wyndham (33) and Halls Creek (22)[85]

Safety

The crime rate for the Kimberley district in 2022-23 was 446 per 1,000 population.[86] In the same period the crime rate per 1,000 was calculated as:

- 302 in Broome
- 1,043 in Derby
- 797 in Halls Creek
- 830 in Kununurra
- 336 in Wyndham

The most common offence types for the WA Police Kimberley District in 2022-23 were family assault (4,090) and burglary (2,205). Family assault was also the most common offence type in broader regional WA, but not metropolitan WA.

The main offence type in 2022-23 in Broome, Derby, Halls Creek, Kununurra and Wyndham (combined) was family assault, accounting for one quarter to a third of all offences. [87]

Income and Wealth

In WA 78% of people rely on employee income as their main source of income. Across the Kimberley there is a higher reliance on employee income, being the main source of income for 88.6% overall. Reliance on employee income was highest in Halls Creek LGA (94.4%), followed by Derby-West Kimberley (91.1%). Other sources of main income across the region were investments (5.7%) or business (4.6%).

In the Kimberley the top 5% of earners have a 16.7% income share, compared to 22.5% in WA. The share of the top 5% was highest in Halls Creek LGA (18.2%), with remaining LGAs 16.2-16.8%. The region (SA3) has a Gini Index of 42.2, indicating less income equality than East Pilbara (38) and West Pilbara (40.9) but greater income equality compared to WA (48.7).

Disadvantage

By LGA SEIFA scores, the level of disadvantage varies across the region, with Halls Creek the highest disadvantage (540) and Broome the least (962). Both Broome and Derby-East Kimberley have less disadvantage overall compared to the broader Kimberley region (859). Using quintiles (1 to 5 with 5 the most advantaged) LGAs are 1 or 4, as shown in Table 2.

The region is made up of five Statistical Area 2 (SA2). Across a broad set of 37 social, economic and environmental indicators all SA2 in the Kimberley have an index score of 1

out of 5, 1 being the most disadvantaged. The areas of common high disadvantage (index score of 1) are highlighted in Figure 16.[88] Areas of existing disadvantage should be considered when developing the RDRP.

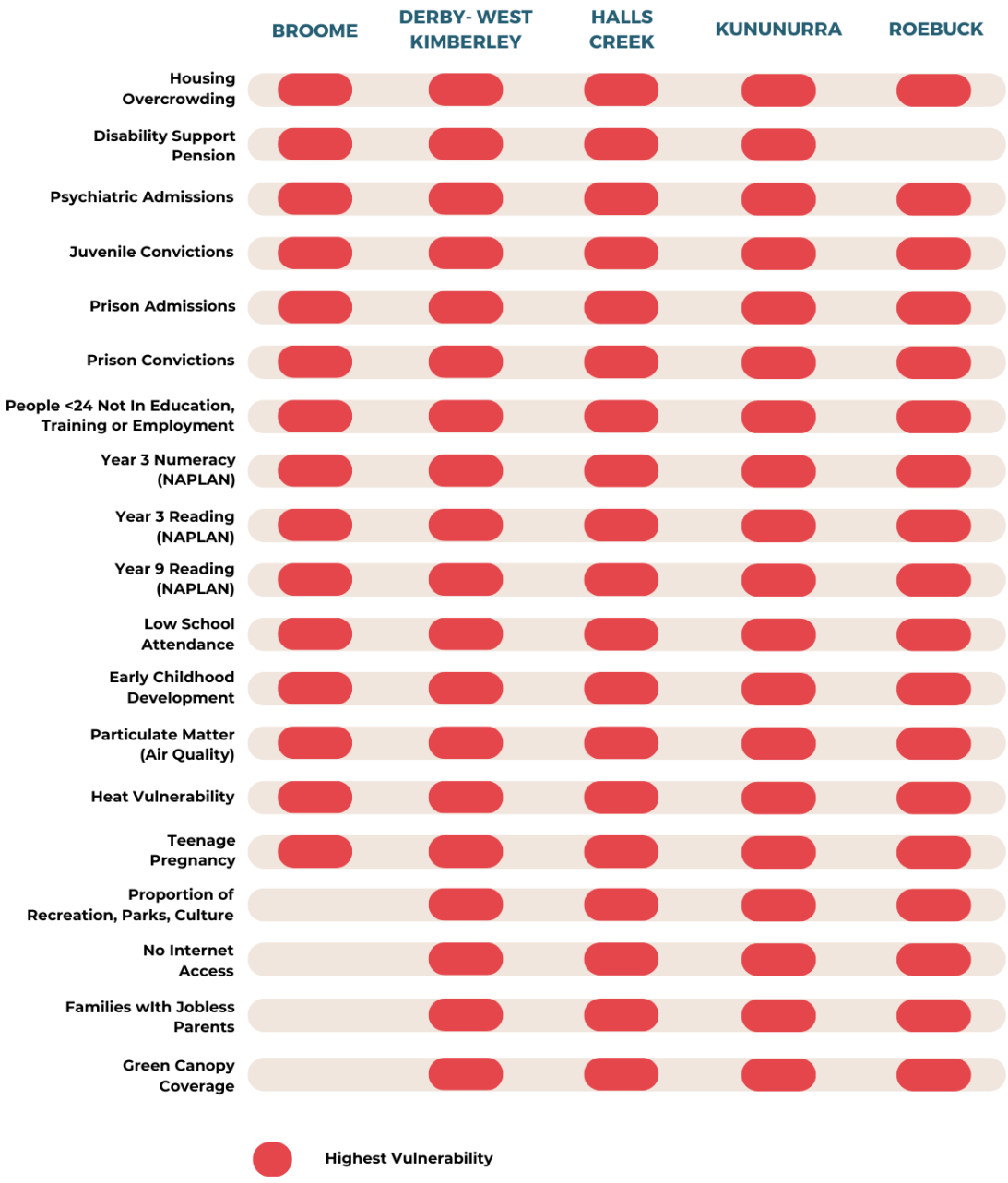


Figure 16: Areas of high disadvantage, Kimberley SA2.

Strengths

In contrast, the region had some areas which scored an index of 5, the least disadvantage, and are highlighted in Figure 17. Areas in common were a lack of long-term unemployment, lack of underemployment and lack of financial stress (proportion of people who cannot raise $2,000 in a week for something important), access to GPs in the

area and lack of housing stress (proportion of households in bottom 2 quintiles of income distribution (40%) paying more than 30% of their gross income on rent or mortgage).

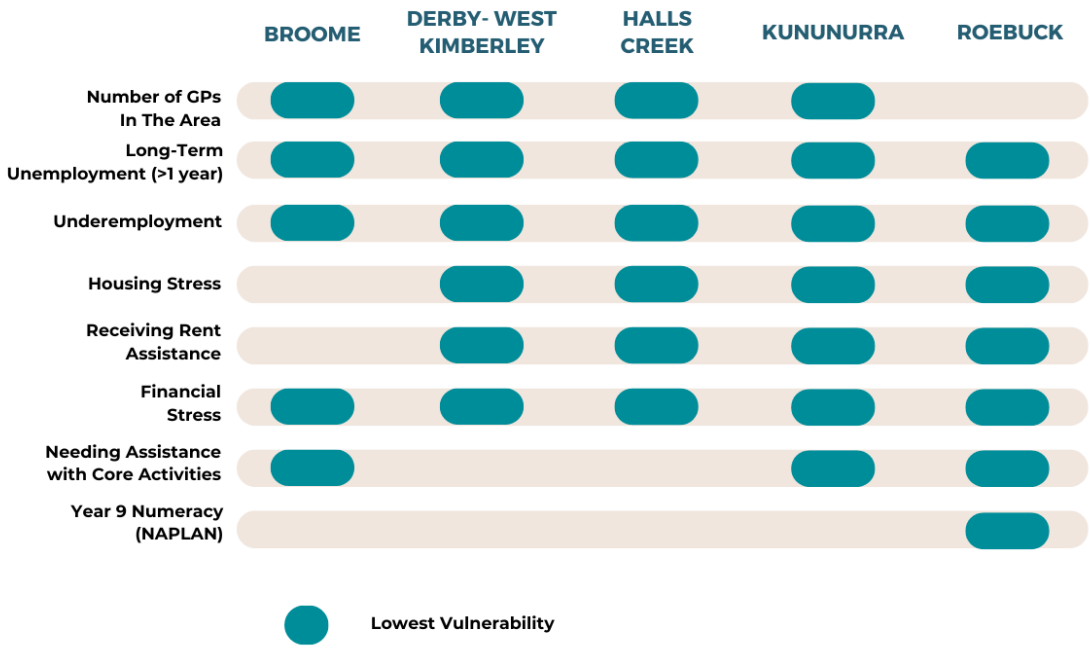


Figure 17: Areas of least disadvantage, Kimberley SA2.

ECONOMY AND AGRICULTURE

Economy

The region has a combined economic output of 7.744 billion, 0.9% of Western Australia's output ($819.3 billion). Broome LGA accounts for 44.7% of annual economic output for the Kimberley, with Derby-West Kimberley 24% and Wyndham-East Kimberley 22.5%.[89]

Mining has the largest economic output for the region, at 25.7%, also accounting for over half of output in Derby-West Kimberley (58.7%) and Halls Creek (54.75%).

Tourism in the Kimberley is highly reliant on the natural environment with action areas identified around natural experiences, indigenous tourism, heritage tourism and agri-tourism.[90]

Agriculture

The region has a total land area of 419,245km^2, with Broome the smallest LGA by land area. Agricultural land makes up 30% of land in Broome LGA and 31% in Wyndham-East Kimberley, 45% in Halls Creek and 57% in Derby-West Kimberley.

In 2020-21 the gross value of agricultural commodities was $374 million, with over a third of this ($135 million) in the Derby-West Kimberley LGA, followed by Halls Creek ($111 million). This included:

- 724,514 animals (meat cattle).
- 412,166 tonnes of production (predominantly beans, followed by melons, maize, silage, pumpkins, hay, sweet corn, bananas, other oilseeds).
- 27,130 trees (mango).[91]

Of the 15,650 jobs in the Kimberley region, 897 (5.7%) are in the agriculture sector, with 375 of these in Wyndham-East Kimberley and 302 in Broome LGAs.

Jobs in Australia data shows jobs in the Agriculture sector increased or were stable across all LGAs, making up 12% of jobs in Wyndham-East Kimberley, and less than 5% in all other LGAs.

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Appendix - Drought Actors

Some of the key actors in relation to drought in Australia are outlined in the following tables. Additional key actors involved in the drought space include rural consultants, private consultants, farming and grower groups, and agribusiness companies. Universities across Australia are also key players in drought related research.

Table 3: Snapshot of National-Level Drought Actors

ACTOR	ROLE
Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)	Focuses on understanding and measuring the effects of climate variability and change on agricultural industries with a focus on drought from the farmers' perspective.
Australian Centre for International Agricultural Research (ACIAR)	Fosters strategic partnerships with key research institutions to improve the productivity and sustainability of agricultural systems and the resilience of food systems in partner countries.
Australian Export Grains Innovation Centre (AEGIC)	An investment of the Australian Government through the Grains Research and Development Corporation and the WA Government through DPIRD, with the aim of increasing value in the Australian grains industry.
Australian Institute for Disaster Resilience	Develops, maintains and shares knowledge and learning to support disaster resilience in Australia.
Australian Institute of Family Studies (AIFS)	AIFS is the Australian Government's key research body in the area of family wellbeing. It's involved in research and provision of resources and publications relating to the effects of drought on families and communities.
Australian Research Council (ARC)	The ARC fosters excellence, partnerships and the highest ethical standards in research and research training in all fields of science, social sciences and the humanities.
Bureau of Meteorology (BoM)	The Bureau contributes to national social, economic, cultural and environmental goals by providing observational, meteorological, hydrological and oceanographic services and by

	undertaking research into science and environment related issues in support of its operations and services.
Centre for Australian Weather and Climate Research (CAWCR)	Established in 2007 - research partnership between CSIRO and the Bureau of Meteorology, focused on the Earth's climate system.
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Focus on broad megatrends, environmental resilience; farm resilience; forecasting and monitoring; smart agriculture; social and urban resilience.
Department of Agriculture, Water and the Environment (DAWE)	Supporting stewardship and sustainable management of Australia's environment and improving sustainable management of Australia's water resources for agriculture, the environment and communities.
Grains Research and Development Corporation (GRDC)	Involved in research and development to support Australian grain growers.
International Universities Climate Alliance (IUCA)	Represents the leading research universities in climate research with members from world-leading research institutions.
National Climate Change Adaptation Research Facility (NCCARF)	2008 – 2019 NCCARF - climate change adaptation publications, set up and supported national climate change adaptation networks, built a nation-wide website with countless resources of its own and held six national and international conferences.
National Drought and North Queensland Flood Response and Recovery Agency (NDNQFRRA)	Works hand-in-hand with communities, all levels of government, charities and agricultural organisations to support farmers and other rural and regional Australians living through the immediate and longer-term effects of drought and flood.
Natural Resource Management Regions Australia (NRMA)	Communicates with Australian Government Ministers (alongside other organisations) on behalf of all regional NRM bodies to help ensure that NRM policy is coordinated strategically and effectively.
Queensland Climate Change Centre of Excellence (QCCCE)	The only state-based climate science research centre in Australia.

Regional Development Australia (RDA)	The RDA network, shares information, and collaborates to develop innovations and solutions that can be adapted across the country.
Research and Adoption Innovation Hubs (RAIH)	Support farmers and communities to get ready for drought. They connect farmers with regional agricultural experts, innovation and new practices.
The Australian Research Council's Centre of Excellence for Climate System Science (CECSS)	International research consortium funded by the Australian Research Council and made up of five Australian universities and Partner Organisations with the aim of expanding on existing modelling of regional climates to improve adaptation to climate change.
The Future Farm Industries CRC (Cooperative Research Centre)	Took the place of the CRC for Plant-Based Management of Dryland Salinity (2001-2007) with a 7-year grant. Areas of expertise included farming systems research; research in crop and animal production; new industry development involving farm grown biomass; bioenergy and wood products, plant breeding; animal psychology; nutrition and behaviour.

Table 4: Snapshot of State-Level or Multi-Region Drought Actors

ACTOR	ROLE
Australian Association of Agricultural Consultants WA (AAAC)	Professional association providing representation, mentoring, professional development and resources for agricultural consultants working in Western Australia.
Pastoralists and Graziers Association (PGA)	WA based not for profit organisation representing primary producers of wool, grain, meat and livestock.
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Drought resilience research: • Environmental resilience • Farm resilience • Forecasting and monitoring • Smart agriculture • Social and urban resilience
Kondinin Group	Provides research findings and agricultural information on best farming practices.
Curtin University of Technology (CUT)	Focus areas: • Centre for Crop and Disease Management • Curtin Earth Dynamics Research Group • Remote Sensing and Geospatial Sciences Group • Centre for Digital Agriculture • Remote Sensing and Satellite Research Group

ACTOR	ROLE
Department of Primary Industries and Regional Development (DPIRD)	Committed to growing and protecting WA's agriculture and food sector. Focus areas related to drought: • Climate change • Dry seasons and drought • Land use planning • High rainfall pastures • Carbon farming • Water management • Assessment for agricultural expansion • Report card on conditions and trends • Managing soils
Department of Water and Environmental Regulation (DWER)	Supports Western Australia's community, economy and environment by managing and regulating the state's environment and water resource. Key roles: • EPA conducting environmental impact assessments and developing policies to protect the environment. • Environmental Regulation responsibility for all environment and water regulation. • Managing the availability and quality of water.
Department of Planning, Lands and Heritage (DPLH)	Focus areas (relevant to this report): • Aboriginal heritage and lands management. • Integrated land and infrastructure policy development. • Land use planning and policy development.
Edith Cowan University (ECU)	Climate Initiative Taskforce Report: includes recommendations and projections based on climate change research and trends and annual carbon footprint auditing. Centre for Ecosystem Management.
Grower Group Alliance (GGA)	Capacity building for grower groups and connecting WA grower groups, researchers, funding bodies and industry.
Murdoch University	Food Futures Institute: consolidates research to sustainably improve food production.
Regional Development Commissions	Common goal of long-term social and economic growth.
Rural Aid	A charity organisation that provides immediate relief and support for longer term resilience and preparedness against natural disasters in rural communities including counselling and wellbeing, financial assistance, sourcing and delivery, domestic water deliveries, domestic water tanks, Farm Army job platform, and educational resources.
Rural Business Development Corporation (RBDC)	Administers assistance schemes and other services for the rural industry on behalf of the State and other services for the rural industry.
North Regional TAFE	Provides important training and education in agriculture, conservation and land management and horticulture.
Society of Precision Agriculture Australia (SPAA)	Operating across Australia, this is a broad based organisation providing independent, objective precision ag information to the grains, sugarcane, horticulture, and livestock industries.

ACTOR	ROLE
The Western Australian Biodiversity Science Institute (WABSI)	Facilitates partnerships across industry, government, community and researcher to address science knowledge gaps, support decision making and improve biodiversity outcomes. With restoration of biodiversity in agricultural lands one of its key focus areas.
University of Western Australia (UWA)	UWA's Centre of Excellence in Natural Resource Management (CENRM): Based in Albany CENRM maintains networks in national natural resource management activities and has worked with regional organisations and communities on matters where evidence-based science is important to their policy and operation. Further details of its drought related programs are provided in Table in Section 2.62. Key Drought Actors Nationally. At a snapshot, UWA also lead or are involved in: ● Institute of Agriculture ● International Centre for Plant Breeding ● Centre for Legumes in Mediterranean Agriculture (CLIMA) ● Centre for Environmental Economics and Policy ● Inter-related regional health focus through the Western Australian Centre for Rural Health
Western Australian Livestock Research Council (WALRC)	Initiated by Meat and Livestock Australia (MLA) to improve consultation with levy payers and industry stakeholders for the WA agricultural region and southern rangelands.
WA No-Tillage Farmers Association (WANTFA)	The largest agronomic grower in Western Australia, WANTFA supports the adoption of sustainable and profitable broad acre cropping systems through shared experiences and innovative research. It is the only WA group focused on precision agriculture, endorsing the following principles: ● Limited soil disturbance; ● Precision agriculture; ● Permanent ground cover; ● Diverse rotations; and ● Reduced compaction.
Water Corporation	Key priorities: ● Waterwise Business Program; ● Waterwise Towns Program; ● Waterwise Councils Program; ● Undertaking large water integrated schemes to ensure a climate-resilient water supply. ● Have taken over responsibility for many Aboriginal communities (formerly Department of Communities REMS).
Western Australian Landcare Network	Not-for-profit organisation with a foundation membership of 10 community groups. It operates with an Executive Committee who work with part time staff to provide benefits to members and raise the profile of land care in WA.

Table 5: Snapshot of Regional-Level Drought Actors

ACTOR	ROLE
Kimberley Land Council (KLA)	Native Title Representative Body for the Kimberley region of Western Australia. The peak Indigenous body in the Kimberley region working with Aboriginal people to secure native title, conduct conservation and land management activities and develop cultural business enterprises.
Aboriginal Corporations within the region	Including but not limited to: • Centacare • Emama Nguda • Karajarri Traditional Lands Association • Kimberley Agriculture and Pastoral Company (KAPCO) • Mamabulanjin • Marra Worra Worra • MG Corporation • Mowanjum • Nirrumbuk • Nyunga Group Aboriginal Womens • Third Space • Wilinggin • Winun Ngari • Yawuru
Local Government Authorities	Responsible for infrastructure services, health services, community services, planning and development approvals, administration of facilities, and water services in some states.
Department of Agriculture, Fisheries and Forestry	Delivers community-based projects that address environmental degradation at a community level.
Department of Fire and Emergency Services	Supports the community to prepare for disasters and protect against unpredictability of natural hazards and emergency incidents.
Department of Primary Industries and Regional Development	Serves to cultivate and preserve WA's agriculture, food industry and aquatic resources and build regional communities and economies.
Department of Biodiversity, Conservation and Attractions	Fund the WA Aboriginal Rangers Program which operates in the region. The program aims to help Aboriginal organisations manage country and protect the environment across the State, in partnership with the public and private sectors.
Rural Business Development Corporation (RBDC)	Administers assistance schemes for the rural sector on behalf of the State and other services that benefit the industry.
Rural Edge	Not for profit organisation that designs and delivers training opportunities to businesses in the regional agricultural sector.
Society of Precision Agriculture Australia (SPAA)	Operating across Australia, this is a broad based organisation providing independent, objective precision ag information to the grains, sugarcane, horticulture, and livestock industries.

ACTOR	ROLE
Grower Group Alliance	Responsible for building innovative agricultural research, development and extension, capacity of the grower group network and connect the network with industry.
WA Lot Feeders Association	The leading representative body for WA cattle feedlot producers.
Kimberley-Pilbara Cattlemen's Association (KPCA)	Not for profit organisation that supports and promotes the beef industry through accessing innovation, building capacity and achieving industry influence.
Northern Western Australia and Northern Territory Drought Resilience Adoption and Innovation Hub (Northern Hub)	One of eight national Drought Resilience and Adoption Innovation Hubs as an initiative of the Future Drought Fund, committed to building resilience and sustainable prosperity for rural communities and industries. Core consortium partners from WA include Kimberly Pilbara Cattlemen's Association (KPCA), Rangelands NRM, Regional Development Australia and WA Department of Primary Industries and Regional Development.
Kimberley Regional Service Providers (KRSP)	Locally based regional service provider now working with Water Corporation (formerly Department of Communities) to service Aboriginal communities.
Rangelands NRM	Leads ecological preservation and sustainability activity across the Australia Rangelands in WA.
RDA Kimberley	Supports the growth and development of Australia's Kimberley region.
District Leadership Group	Explores local issues and initiatives, develops collective strategies to address local priorities, delivers collaborative initiatives, consultation and feedback, and shares expertise and resources.

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