

A COMMUNITY INFORMATION PAPER FOR THE QUEENSLAND SECTION OF THE LAKE EYRE BASIN

Prepared by

DESERT CHANNELS GROUP

for

THE COMMUNITY OF THE REGION

June 2014

How to use this document

This document is a redevelopment of the original Community Information Paper prepared in 2004 to support the first Desert Channels Queensland natural resource management plan. It incorporated community consultation and a detailed literature review to highlight the current position of the region, its issues and community aspirations. The original material prepared for that document has been revised, updated and reformatted into this version.

This version details the natural resources of the region, the community that lives within it and the issues they face, as well as development and industries that influence the use of natural resources.

The key addition to this version of the Community Information Paper is the insertion of callout boxes under each section to highlight future directions for the DCQ region. These boxes include keys points from that section, consideration around future drivers of change that may influence that section, as well as any updates from recent community consultation. Community consultation has occurred through targeted meetings with key stakeholders through the first half of 2014. It was also conducted through a community workshop conducted in May 2014.

This Community Information Paper has been updated for use as an information resource, and to inform the next version of the NRM plan, which will be released at the beginning of 2016. The new plan will be effective for five years from 2016 to 2020.

You can view and comment on the draft of the next NRM Plan at www.dcq.org.au/plans.



Photo: Emu wandering past the DCQ office in Longreach (DCQ).

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PART 1 – INTRODUCTION TO THE DESERT CHANNELS REGION

BACKGROUND

The Queensland section of the Lake Eyre Basin has changed less since European settlement than most other parts of Australia. Its rivers are unfettered, its soils untilled, its beauty untamed. At over half a million square kilometres, or 30 percent of the State, it is the largest natural resource management planning area in Queensland.

The ecosystems that underpin all life in this semi-arid land are both robust and fragile: robust enough to thrive in the boom and bust cycles of flood and drought, yet fragile and sensitive to change brought by human activity, such as pest and weed species.

The Desert Channels region is a land of wide horizons, big skies and few people. It saw the birth of Waltzing Matilda, Qantas and the union movement; the demise of Burke and Wills, and the rise of cattle legends like Sir Sidney Kidman and Harry Redford.

The predominant land-use is rangeland grazing of cattle and sheep that sustains a decreasing population in the rural areas. Town communities are increasingly sustained by tourism, government and other service industries. Mining and gas extraction are small but growing parts of the economy.

KEY ISSUES

The key natural resource management issues for the DCQ region, as identified by the community, are:

1. **The control and protection of land from the threat of weeds and feral animals – these pose ongoing threats to managing productive rangelands;**
2. **The ability to have sustainable pastoral industries with sustainable management of pastures and soils;**
3. **Concerns about emerging mining and coal seam gas industries that may affect groundwater hydrology and disrupt grazing operations;**
4. **The protection of water resources to ensure they are healthy and are maintained in their natural form;**
5. **A population that is aging and has declined in recent years in certain centres; and**
6. **A more variable climate that may cause warmer temperatures and influence patterns of rainfall.**

All of these issues, through coordinated planning and funding, can be addressed to support the natural resources of the region. Responses to them are detailed in the updated version of the DCQ Natural Resource Management Plan that will be in effect from 2016-2020.

PART 2 – NATURAL ASSETS OF THE REGION

LANDSCAPE

The Desert Channels region is that part of Queensland where the rivers run inland to Kati Thanda-Lake Eyre. It is an ancient weathered landscape, ranging in elevation from 850 metres above sea level (ASL) in the northeast to only 15 metres ASL in the salt lakes of the Simpson Desert at Poeppel Corner in the southwest. Its two major river systems, the Georgina-Diamantina, and the Cooper, are the most variable major rivers on the planet.

Rising in the north and east of the region they are often no more than a string of waterholes, but when they do run their low gradients and slow flows give rise to the complex systems of braided channels, wetlands and waterholes of the Channel Country. Many of the wetlands they feed are ephemeral – a characteristic of the boom and bust natural cycles of much of inland Australia.

Seven biogeographic regions (distinguished by their geology, climate and major groups of native plants and animals) are found in the Desert Channels region, making it one of the most naturally diverse areas in the State. This diversity ranges from the eucalypt woodlands of the Desert Uplands along the Great Dividing Range, through to the rolling plains of the Mitchell Grass Downs and the vast floodplains of the Channel Country, to the Simpson/Strzelecki Dunefields in the western edge of the region, one of the driest parts of Australia.

Most natural systems in the region are still relatively intact. Fragmented landscapes are the exception, rather than the norm, occurring mostly in the more densely populated eastern parts of the region.

GEOLOGY

The geology on the northern edge of the Lake Eyre Basin includes some of the oldest and most mineral rich rocks in Queensland. This area of rugged mountain ranges, known as the Mt Isa Inlier, is around 1800 million years old. To the west of the Mount Isa Inlier is the Georgina Basin, an area of limestone and other sediments laid down in shallow seas around 600 million years ago, while to the east are the uplifted sediments of the Desert Uplands and the Carnarvon Ranges.

The rest of the region is a series of huge sedimentary basins laid down around 200 million years ago, notably the oil, gas and coal-rich Eromanga, Cooper and Galilee basins. Most of these are underlain by the water bearing rocks of the Great Artesian Basin. A large part of this area was flooded between 140 and 100 million years ago, and more sediments, mainly mudstones and sandstones, were laid down during this time.

As the climate changed from wet to arid over the last 60 million years, periods of alternating deposition and exposure continued. It was at this time that silcretes formed in the landscape as a result of chemical weathering, becoming hard cap rock on top of softer sedimentary layers. As these eroded they formed the characteristic mesas and escarpments, such as we see around Winton today, and in several other parts of the region.

From 10 million years ago, conditions became much drier and the region's current lakes and dune fields began to take shape. Since that time, periodic flooding on a huge scale and windy dry conditions have shaped the dunes of the region into their current forms.

SOILS

Soils are quite varied, in line with the vast size of the region and diverse nature of the landscape. They range from the dune sands of the Simpson Desert, grey and brown clays typical of the Mitchell Grass Downs, heavy grey clays on the flooded areas of the Channel Country to the duplex soils and red earths and sands of the Mulga Lands and the Desert Uplands.

Generally the most fertile soils are those of higher clay content with a tendency to cracking, as characterised by the Channel Country and the open downs. Poorer soils tend to have higher sand content and have been leached over a considerable time span as characterised by the sand dunes in the west of the region and some of the deeper sandier soils in the Desert Uplands. These areas are often recharge zones for groundwater.

Across the region there are also large areas with shallow or stony soils where a lack of moisture-holding ability is a bigger constraint than fertility. These soils, characteristic of the dissected residual mesas of the Channel Country and some of the range country in the Desert Uplands, often have low levels of vegetation cover.

There is little cropping in the region and discussion of soil issues has focussed on the suitability of soils to support improved pastures in the eastern part of the catchment, particularly where buffel grass has been introduced. Buffel grass establishes well on freshly cleared loam soils but may become less dominant as soil fertility declines.

Other concerns about soil have generally centred on soil loss due to overgrazing and loss of desirable pasture species or inappropriate road and track construction.

The region is naturally saline, a legacy of its time as part of the vast inland sea, with the natural vegetation evolving to cope with these salinity levels. Man-made salinity, however, is not a significant issue in the region.

Carbon sequestration in soils

Recent studies have focussed on the ability of soils to sequester carbon as part of the Commonwealth Government's 'Carbon Farming Initiative' (DAFF 2014). Current proposals are being investigated by the Government and, if approved, will provide opportunities for landholders to scope out potential carbon credits through certain soil management techniques, providing potential for extra income. Such techniques involve careful pasture management to ensure that the amount of carbon in soils increases. A number of issues are still being determined to manage soil carbon. Some of these are:

- the ability to quickly and cheaply measure and monitor carbon stocks over a long period (greater than 20 years);
- difficulties in distinguishing the effects of managed change from natural fluctuations in carbon stocks;
- the need for landholders to persist with specific management practices over extended time; and
- the risk of soil carbon being carried 'off site' by erosion, making it difficult to monitor carbon stock.

For more information on soil carbon sequestration, see: http://www.csiro.au/Portals/Publications/Research--Reports/Soil-Carbon-Sequestration-Potential-Report.aspx

Soils are the key determinant of the type and health of pastures in the region. More information on pastures can be found in the pastures section.

Detailed land resource surveys by the Queensland Government have been completed for most of the region. For details on these studies, see the reference list for QDPI 1974, QDPI 1977, QDPI 1980, QDPI 1990, **Error! Reference source not found.** and Lorimer 2005.

ASSET ISSUE: LAND DEGRADATION

Degradation through soil loss can be from obvious gully erosion or more subtle and gradual sheet erosion, and can occur through changing vegetation cover or composition. This may be triggered through the dominance of weeds, encroachment of native vegetation or through excessive total grazing pressure. Degradation also occurs as a natural process through erosion by water and wind.

Soils most predisposed to erosion usually have low surface cover levels, shallow depth, high slope, high inherent salinity and specific textures that make them more susceptible. Additionally, long periods of drought and increasing tree and shrub densities impact heavily on the level of effective soil surface cover, which can amplify erosion.

There has been no systematic study of land degradation across the whole of the Desert Channels region and available studies within the region have often found varying results. For example, the Western Arid Region Land Use Study Part 6, which surveyed the lands of the Diamantina and Georgina rivers, concluded that most land types in the region were in good condition, but there was a need to understand the relationship between variable climatic and land conditions to maintain the land in a stable condition (QDPI 1990). Three years later the Georgina catchment was reviewed by the Queensland Government and found that that the dunes were extensively eroded where they occur near the better frontage country, which was usually overgrazed QDPI 1993a.

Climate variability impacts on land degradation

In a grazing risk analysis in relation to future climate variability by Cobon et al. 2009, it was found that with the potential for greater storm intensities and more single events of rainfall, there will be impacts on erosion and subsequently pasture growth.

This may require further strategies to continue to reduce total grazing pressure and ensure that cover is left to protect soils and reduce land degradation in a future with more variable climate.

Other broad findings on land degradation within the region were:

- Poor road placement and associated drainage issues can lead to significant degradation on the deep sandy earths of the Desert Uplands and the heavy clay soils of the stony downs in the Channel Country;
- The red earth soils of the Desert Uplands have been recognised as having degradation potential through sheet erosion;
- Mitchell Grass Downs soils may be susceptible to water erosion when they have poor groundcover;
- Channel Country soils are generally in a soil build up phase rather than an erosion phase because of their very low slopes – the greatest risk to these soils is from wind erosion; and
- The more arid areas in the west of the region are at higher risk from wind erosion; this risk increases with soils of higher clay content and poor surface structure characteristics; similar risk also occurs for certain parts of the Desert Uplands.

Maintaining the land in good condition through understanding the nature of the soils, total grazing pressure management and applying best practice development such as for road placement are seen to be the most effective strategies to reduce the impacts of land degradation.

SUMMARY

KEY POINTS

- The planning region is the Queensland section of the Lake Eyre Basin, covering almost a third of Queensland
- The major river systems of the region have highly variable flows, supporting boom and bust natural cycles
- Soils of the region are varied and range from heavy clay soils, to deep sands.
- Land degradation occurs in the region and has been reported at differing levels. The potential for land degradation is impacted by shallow soil depth, steep slopes, inappropriate management or certain soil chemistry.

COMMUNITY FEEDBACK

- Soils, landscape and land degradation have not been major concerns in community feedback in 2014.
- The concerns that were raised have been in relation to total grazing pressure and the impact on soil health, including the loss of microbes and invertebrates in the soil.

DRIVERS OF CHANGE

- Carbon farming has potential to impact on the future management of soils but there are currently significant issues in measuring and monitoring rangeland soil carbon levels.
- Land degradation may increase if in a more variable climate, rainfall occurs in more intense, single events and ground cover is in low condition.
- Future remote sensing or satellite imagery may be configured to detect areas of land degradation by measuring change in vegetation or change in surface cover. This may be valuable information to assist with landholder pasture monitoring over a large scale and at regular intervals.



Photo: Waddy tree (Acacia peuce) near Boulia (DCQ).

CLIMATE

The DCQ region has a climate ranging from dry monsoonal in the north to temperate arid in the south. The region typically has a hot, dry climate with highly variable rainfall.

Temperatures in the region are amongst the highest recorded in Australia. Most centres in the catchment have recorded maxima in excess of 45°C, with Birdsville recording maxima in excess of 49°C. Although frost is comparatively rare, centres have recorded minima as low as -2°C (BOM data).

Annual rainfall in the Cooper catchment varies from around 550mm at Torrens Creek in the north east of the region to 172mm at Innamincka just over the border in South Australia. The Georgina/Diamantina catchment is drier with Camooweal in the north having an average of 394mm and Birdsville 165mm. The wettest part of the catchment is probably in the White Mountains north of Torrens Creek with an annual rainfall of more than 600mm. The driest is probably around Poeppel Corner in the Simpson Desert where the annual rainfall may be only 100mm.

While a summer dominated rainfall pattern is experienced over all of the area, with either January or February being the wettest month, there is a slight trend towards more winter rainfall in the south. The region is characterised by high variability of rainfall with Torrens Creek having a coefficient of variation of around 40 percent, while downstream at Innamincka Station it reaches 90 percent, one of the most variable rainfalls in Australia. A good example of this variability was exhibited when Winton recorded its wettest year with 1,171mm of rain in 2000. Two years later in 2002 only 55 mm fell in the gauge, the lowest in 119 years of records.

Although the north of the region may occasionally experience the monsoon from the north, the bulk of the region experiences rain events which are most often connected with an inland trough. This trough generally travels west to east and separates warmer, moist air to the east from drier, cooler air to the west. Slower moving troughs, sometimes moving back to the west and fed by moisture from a belt of low pressure in the summer produce the most significant and useful rains. Daily falls in excess of 150mm have been recorded in most centres in the region. Cold front activity in winter tends more to change the temperature but may bring some rain to the far south. Cyclonic activity, most often originating from the Gulf of Carpentaria is capable of delivering significant rain bearing depressions but these are not a reliable source of rain in most years.

Evaporation is very high, with most of the catchment experiencing more than 2800mm of evaporation a year. The lower parts of the region have evaporation of over 3200mm and summer evaporation peaks at over 450 mm per month, amongst the highest in Australia (BOM data).

This highly variable climate is reflected in an environment where the flora and fauna are adapted to irregular rainfall and flooding events. The floodplains of the lower parts of the catchments are uniquely adapted to having much of the moisture provided by stream flows from further up the catchment rather than local rain.

Living with a highly variable climate is one of the major challenges for both the pastoral industry and urban communities in the catchment. Even the supposedly more reliable rainfall parts of the region in the east have been significantly impacted by drought. There has been a change in emphasis in recent years for government to provide more resources to landholders to manage for drought rather than deal with the consequences of drought as a natural disaster. A key part of this approach is to improve the capacity of the community to understand climate prediction as an essential tool of land management. Examples of this are provided in the Agricultural section.

ASSET ISSUE: INCREASING CLIMATE VARIABILITY

A number of studies have been investigating the future impacts of climate change or climate variability. A study prepared by CSIRO in relation to the rangelands of Australia has been the one most dedicated to how the future climate may change within the region. However, at the time of finalising this document (September 2014), the CSIRO report was not available. This paper will be updated once the CSIRO report is released.

SUMMARY

KEY POINTS

- The climate of the region is very diverse. Rainfall varies from 800mm per year to as low as 100mm per year. Temperatures are some of the hottest in Australia, regularly exceeding 45 degrees through summer.
- The highly variable climate triggers boom and bust periods, driving natural fluctuations in the ecosystems and agricultural production.

COMMUNITY FEEDBACK

- Community concerns have been raised about the impact on livestock of extreme temperatures.
- Concerns have also been raised about the impacts from climate change on native species fluctuations. For example, changes in timeframes between boom times, or the intensity of boom times may affect native species like the bilby.

DRIVERS OF CHANGE

- The changing climate will be a significant driver of change for the region, influencing natural systems, agricultural production and communities. It is difficult, however, to accurately predict the future climate and how it will actually impact on the region.
- A number of programs are being developed to plan, adapt and mitigate impacts on the changing climate. These programs are subject to regular change through government policy amendments, but have wide-ranging implications for natural resource management into the future. At the time of writing some of these are:
    - Carbon Farming Initiative (CFI), a Commonwealth Government scheme that allows farmers and land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land; and
    - Commonwealth Government's proposal to establish a 'Green Army' that will provide opportunities for young Australians aged 17-24 to participate in environmental projects until 2017 – this may provide future opportunities to carry out on ground activities to support NRM projects.

BIODIVERSITY

The unique semi-arid rangeland landscapes of the Desert Channels region are rich in natural assets which have shaped the way of life of human and natural communities, and underpin local industries. The tapestry of interacting ecosystems, plants and animals is delicately balanced, and well adapted to the boom and bust cycles created by the highly variable rainfall and flooding events. Linked by the inward flowing rivers of the Lake Eyre Basin, most natural systems in the region are still relatively intact, demonstrating that well-managed local enterprises can successfully co-exist with natural values.

The Desert Channels region has a published biodiversity plan title 'Managing for Resilience, DCQ's Biodiversity Plan 2012-2017', produced in consultation with a broad range of regional stakeholders and scientific experts (DCQ 2013a). The following information summarises the key points of that document, which can also be viewed on the DCQ website.

ECOSYSTEMS

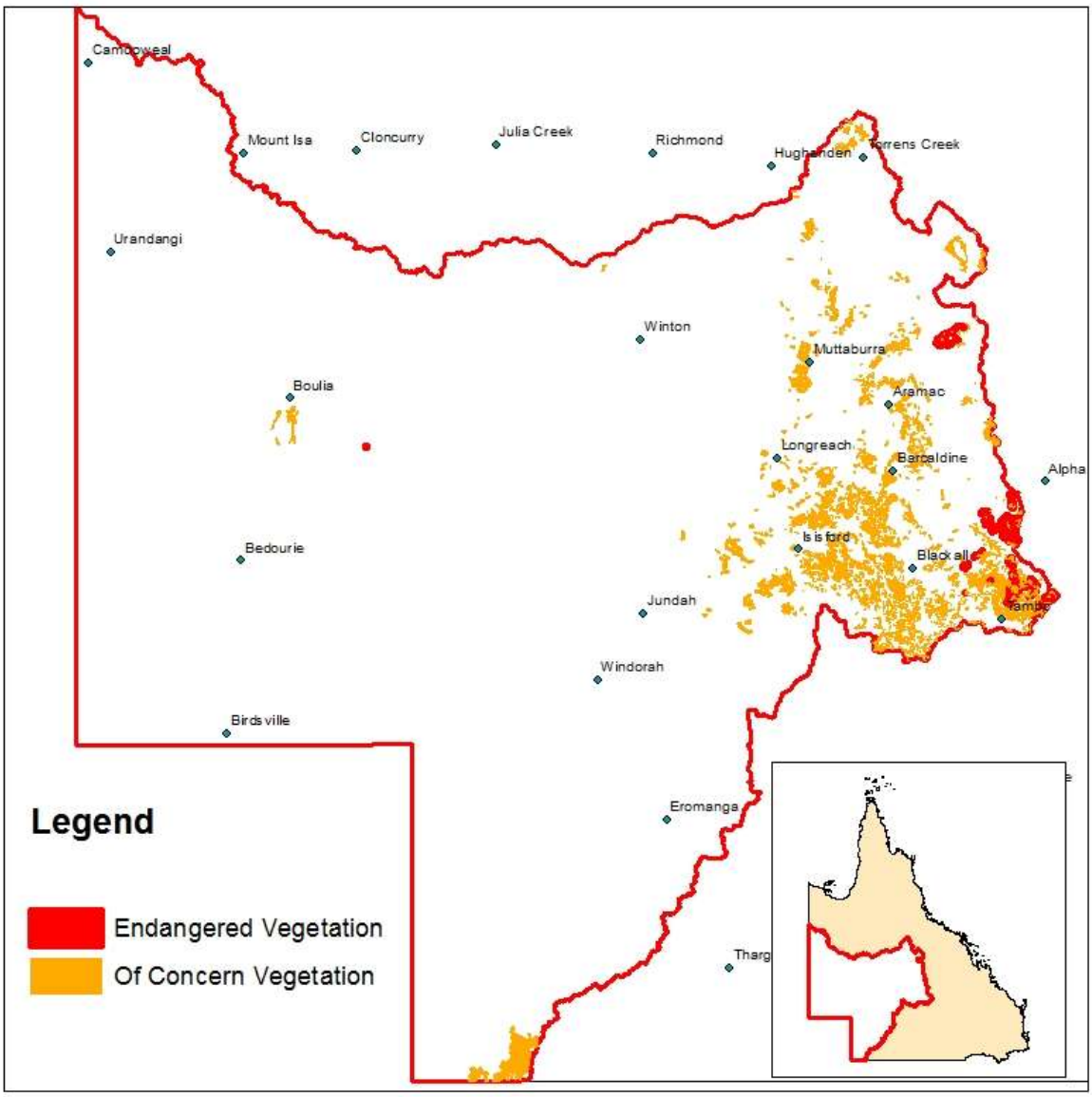
Vegetation communities that are consistently associated with a particular combination of geology, landform and soil in a bioregion are called regional ecosystems. They have been mapped and described in detail for most of Queensland, and each one has been given a ranking, or biodiversity status, which shows the current and potential threats to its long term viability (DEHP 2014a).

For the Desert Channels region, 298 regional ecosystems have been described based on 2012 data. Ten percent of these have a biodiversity status of 'endangered', 27 percent 'of concern' and 63 percent 'least concern' under the Queensland *Vegetation Management Act 1999*. Some examples of regional ecosystems with endangered status in the region include river red gum, mound springs and brigalow communities.

The distribution of 'endangered' and 'of concern' ecosystems across the region is very uneven, with most falling in riparian and other wetland habitats, and also in the productive grassland clay plains of the region – indicating the need for mapped and prioritised strategic action in the region. Below is a map showing the distribution of threatened ecosystems, occurring mostly in the more fragmented eastern part of the region.



Photo: Eastern Grey Kangaroos in the region (DCQ).



Map 1: Distribution of Endangered and Of Concern regional ecosystems listed under State Legislation

Regional ecosystems have also been evaluated in more detail, on a bioregional basis, for their rarity, diversity, fragmentation, habitat condition, resilience and ecosystem processes through a biodiversity assessment and mapping methodology (DEHP 2014b).

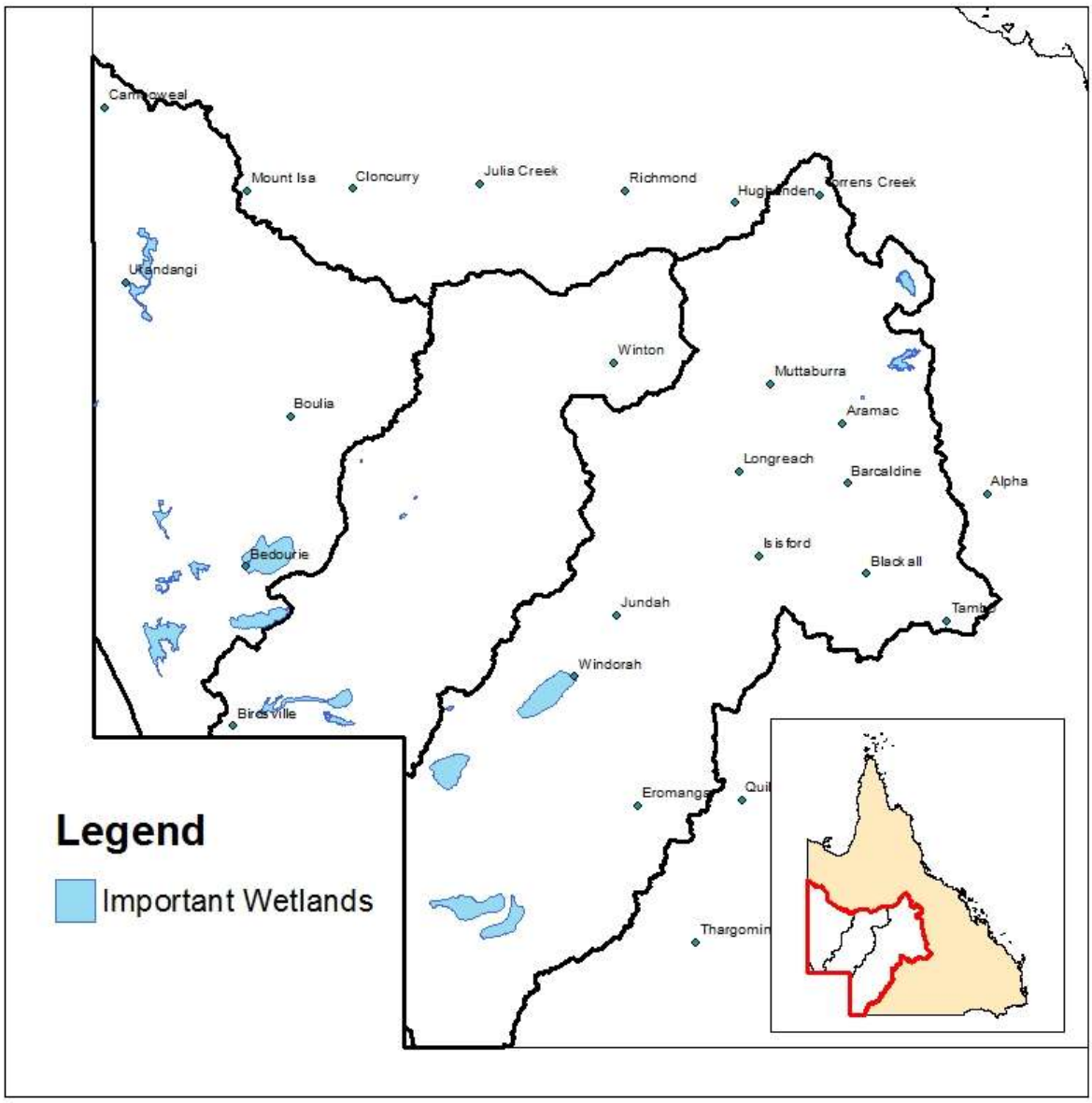
Some of the most significant areas for maintaining biodiversity across the region are:

- rivers and their corridors of vegetation
- permanent and ephemeral wetlands and waterholes
- springs
- deserts and stony plains
- escarpments and jump-ups
- remote and low disturbance areas away from artificial waters and grazing pressure
- the regional ecosystems with 'endangered' or 'of concern' biodiversity status.

Further information about the region's ecosystems and their biodiversity status can be found in Appendix 1.

At a national level, under the *Environmental Protection and Biodiversity Conservation Act 1999* (DoE 2014a, DoE 2014b), the region's mound spring ecological communities are listed as endangered, as are the highly fragmented remnants of some brigalow communities.

Wetland ecosystems are critically important in the semi-arid rangelands as they sustain the seeds of life through the bust cycle, ready to boom again when good conditions return. The biodiversity value of the region's wetlands has been recognised in the listing of 24 wetlands in the national Directory of Important Wetlands (DoE 2014c), shown in Map 2 below. See the Water Resources section for more information, and Appendix 3 for Directory of Important Wetlands listings.



Map 2: Directory of Important Wetlands in the Desert Channels region.
(see Appendix 3 for a full listing of the wetlands)

PLANTS AND ANIMALS

The Desert Channels region is relatively unsettled and generally has poorly detailed site data about native plants and animals. Many areas are still under-surveyed due to the size of the region, its remoteness and extreme climate. High densities of records have been collected in more heavily sampled, usually more accessible areas such as along roads or in national parks, whilst harder to access areas such as ranges and escarpments, and private lands, are under-represented.

From the data that has been collected about species in our region, 748 species of native animals and 2,554 native plant species have been recorded. Of these, 5.6 percent or 42 animal species and 1.3 percent or 33 plant species are listed as rare or threatened under Queensland's *Nature Conservation Act 1992* (DEHP 2013), or under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2014d). See Appendix 2 for a detailed listing of all the threatened species within the region.

Compared to the rest of Australia parts of the region have a high level of species richness for certain families of animals. This includes the wallabies and kangaroos, swallows and martins, babblers, dragon lizards, skinks, pythons, sheath-tailed and free-tailed bats, geckos, snails, water beetles and water bugs (DoE 2011).

Levels of endemism, where species are found in a particular area and nowhere else, are high for some fauna families including small marsupials, native rats and mice, fairy-wrens and grass wrens, babblers, sheath-tailed and free-tailed bats, gobies, blue-eyes, eel-tailed catfish, skinks, blind snakes, snails, water beetles and water bugs (DoE 2011).

The region is also recognised as having national and international significance for marine, terrestrial and wetland species of migratory birds (DoE 2014e). Some of these, whilst considered to be common, are of conservation concern and are listed under international conventions such as the Japan-Australia Migratory Bird Agreement (JAMBA), The China-Australia Migratory Bird Agreement (CAMBA) and The Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). It is crucial to protect habitat for these and other migratory species (DoE 2014f).

There is high species richness for native grasses and sedges, with more than 400 species described. In addition, families of plants with high levels of endemism in the region include grasses, pigweeds, bindweeds, pipeworts and wild tomatoes (DoE 2011).

For certain species in the region, there are statutory conservation plans to aid in their recovery. Under the Commonwealth's EPBC act, the following species have currently have dedicated plans:

- greater bilby (*Macrotis lagotis*);
- Julia Creek dunnart (*Sminthnopsis douglasi*);
- Native species dependent on natural discharge of groundwater from the Great Artesian Basin;
- Black throated finch (*Poephila cincta cincta*);
- Bridled nailtail wallaby (*Onchogalea fraenata*);
- Marsupial mole (*Notoryctes* spp.); and
- Threatened acacias including the waddy tree (*Acacia peuce*).

(DoE 2014e)

Recovery plans under the EPBC can be found here at http://www.environment.gov.au/biodiversity/threatened/recovery-plans

Further targeted management planning is needed to include those species requiring recovery plans, and additional investment is needed to better understand the spatial aspects of species distribution and their specific ecosystem and habitat needs. As our understanding of the habitat requirements of these species improves, it may be necessary to provide protection from threatening processes. In some areas this may simply be a voluntary change in land management practices. Threats to the natural environment are outlined in the following box.

Pressures and threats on the natural environment

The development pressures that exist on the natural environment are broad and can dramatically influence the ability of species and ecosystems to persist and provide services. Below is a summary of key pressures and threats.

1. **Total grazing pressure**

Total grazing pressure is the pressure exerted by all animals (domestic livestock, native species and introduced feral species) on natural ecosystems (Fisher et al. 2005). The development and spread of artificial waters has led to increased grazing pressure across the region as grazing species are able to spread further across what were once remote and dry landscapes. There is the potential for long term total grazing pressure to gradually impact on large areas, resulting in soil erosion, changed vegetation composition, increased weed infestations, and degraded water supplies. Riparian frontage, alluvial plains, waterholes, sand plain and desert landscapes are particularly vulnerable to this threat.

2. **Pests and weeds**

Pest animals and plants are a major natural resource management issue for the region. Pest plant infestations and threats are centred on the north and east while feral animal impacts are felt more widely. See the 'Pest Animal and Weed Species' section for further information.

3. **Altered fire regimes**

Fire is a vital part of the functioning of many rangeland ecosystems and is an important management tool. Appropriate fire regimes can help to conserve and improve biodiversity and production values (Myers 2005). The pre-settlement burning regime has changed significantly both in timing and intensity with consequent affects on natural systems.

4. **Pressure on water resources**

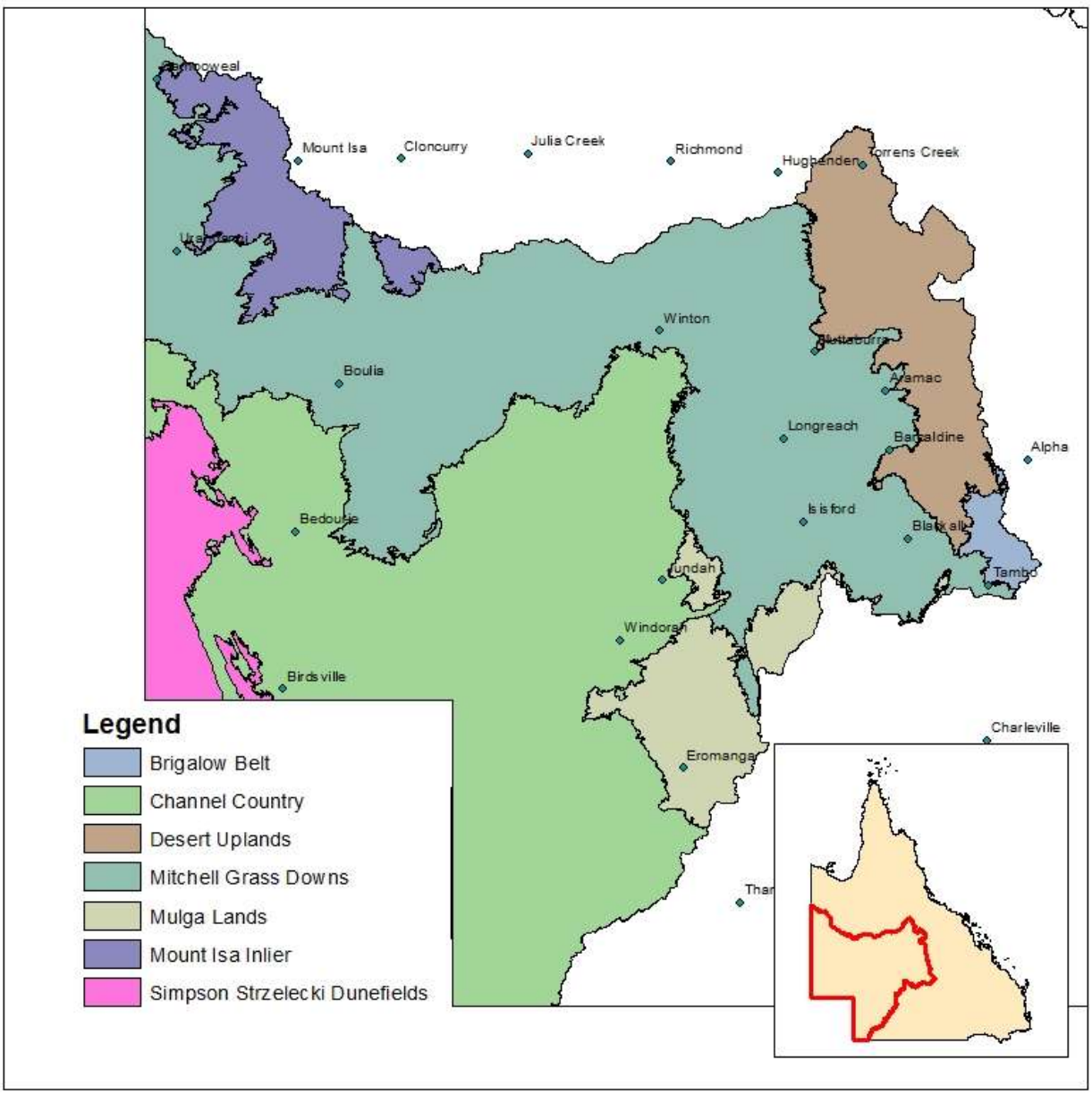
The extraction of water from rivers, or changes in flow, can reduce the quality and quantity for aquatic ecosystems. Local impacts on waterholes from excessive livestock or human activity can also influence the ability of a system to function properly. The maintenance of river flow regimes and the integrity of groundwater are key community concerns for the region. Resource exploration and mining has the potential to impact on underground water systems.

5. **Increasing climate variability**

The impacts of climate change will place new and additional stresses on the ecology and productivity of the region. Warmer temperatures and changes in rainfall events may cause ecosystems and species to shift in distribution, particularly southward and towards the coast (Low 2011). Weed and pest animals may also respond to the different environment increasing their potential distribution (Cobon et al. 2009). One key issue for the region is to identify refugia that may provide stable environments in a more variable climate. This will include key aquatic systems that contain permanent water, and large diverse areas, such as ranges, that can buffer temperature changes (Cobon et al. 2009).

BIOREGIONS

Seven biogeographic regions, or bioregions, are represented in the Desert Channels region, with the two major areas being the Mitchell Grass Downs and the Channel Country, covering 81 percent of the region. Smaller areas of the region are covered by the Simpson Strzelecki Dunefields, Desert Uplands, Mulga Lands, Mount Isa Inlier and Brigalow Belt South (Sattler and Williams 1999). These bioregions delineate the major differences in geology, climate, and native flora and fauna across the region, and are a useful framework for thinking and planning for good biodiversity outcomes in a landscape that also supports sustainable industries.



Map 3: Bioregions of the Desert Channels Region. (detailed descriptions in box on next page)

Bioregion descriptions for the Desert Channels Region

Mitchell Grass Downs (38 percent of the region)

- predominantly treeless undulating downs interspersed with drainage lines, and isolated remnant plateaus
- deep, fertile grey and brown clay soils with high moisture retention capacity
- smaller areas of less fertile calcareous desert soils, red earths and sands
- dominated by Mitchell grass, sometimes with a low tree layer of gidgee and other trees

Channel Country (37 percent of the region)

- vast braided flood plains surrounded by gravel or gibber plains, dune fields and low ranges
- heavy grey clays on the flooded areas, shallow calcareous soils, loams
- predominantly forb and grasslands with sparse shrublands and woodlands
- includes the Simpson Desert dune fields

Desert Uplands (8 percent of the region)

- dominated by sandstone ranges and sand plains – remnants of ancient deeply weathered plateaus
- on the eastern margin of the Great Artesian Basin, important uptake areas for the aquifers of the basin
- sandy, infertile, poorly structured soils
- wide diversity of plant species including dense eucalypt and acacia woodlands, and spinifex grasslands

Mulga Lands (6 percent of the region)

- flat to undulating plains and low ranges supporting a range of mulga shrublands and woodlands
- infertile sandy soils

Simpson Strzelecki Dunefields (5 percent of the region)

- dominated by high linear dunes of red sand
- ranges from cracking brown or grey clay to sandy red earth

Mount Isa Inlier (5 percent of the region)

- rugged hills, ranges and outwash with undulating valleys
- caves and sinkholes
- skeletal soils
- predominantly low open woodland over spinifex

Brigalow Belt South (1 percent of the region)

- predominantly young deposits of the Great Artesian Basin
- woodlands and open forests of eucalypt, brigalow
- areas of high fertility clay plains

ASSET COMMENT: CONTRIBUTION TO ECOSYSTEM SERVICES

Ecosystem services are the benefits provided to humans through the transformations of environmental assets into goods and services; they are vital for our existence, our health and our prosperity. Healthy landscapes maintained to provide ecosystem services assist in the sustainability of our lifestyles and communities, including providing options for our future. In the Desert Channels region for example, ecosystem services are at the core of our rangelands grazing industry and are important for our rapidly developing tourism industry.

Some ecosystem services are easy to see, such as the provision of food and fresh water, while others are less tangible and more complex, for example, climate regulation or provision of spiritual values.

The maintenance of biodiversity is crucial to ensuring that ecosystems continue to function well. Humans often tend to modify natural systems to achieve direct benefits (such as agricultural production) but, at the same time, may not see, or undervalue, other essential ecosystem services (erosion control, pollination) that cannot be replaced once lost. A useful framework for thinking about biodiversity and ecosystem services is shown below in Figure 1 (DEWHA 2010).

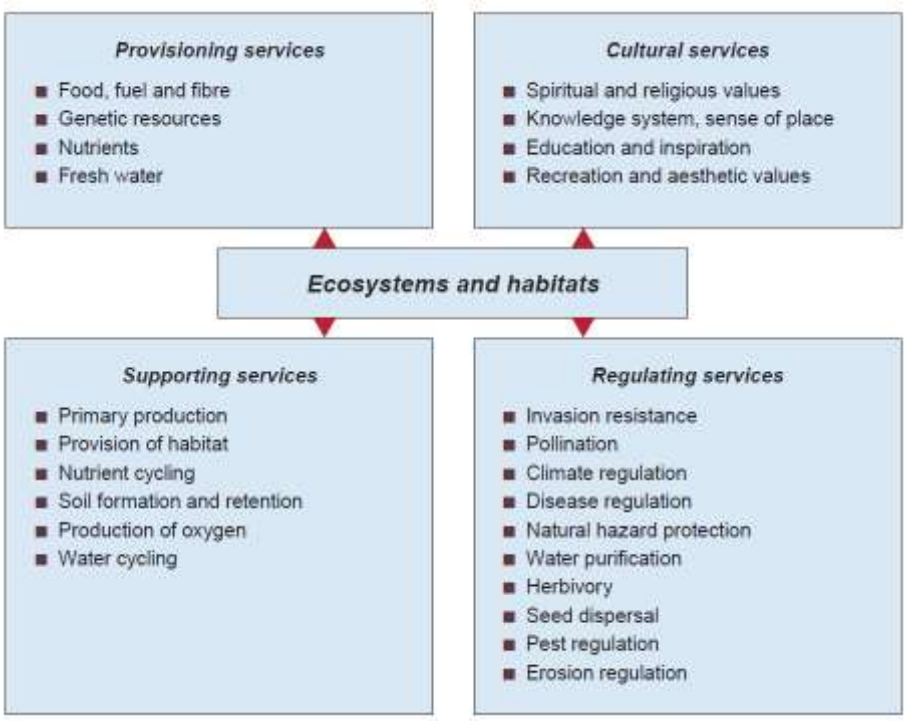


Figure 1: Biodiversity's contribution to ecosystem services

Ecosystems function by moving energy and materials through living organisms in cycles of growth, reproduction and death, which are influenced by disturbances such as floods and fires, stresses such as droughts, and ecological interactions such as competition and predation. Ecosystems evolve in response to these factors over time, but there is a danger that they can unexpectedly collapse if certain thresholds are exceeded. To add further challenges to sustainable management, most ecosystems are extremely complex and it is difficult to measure their health.

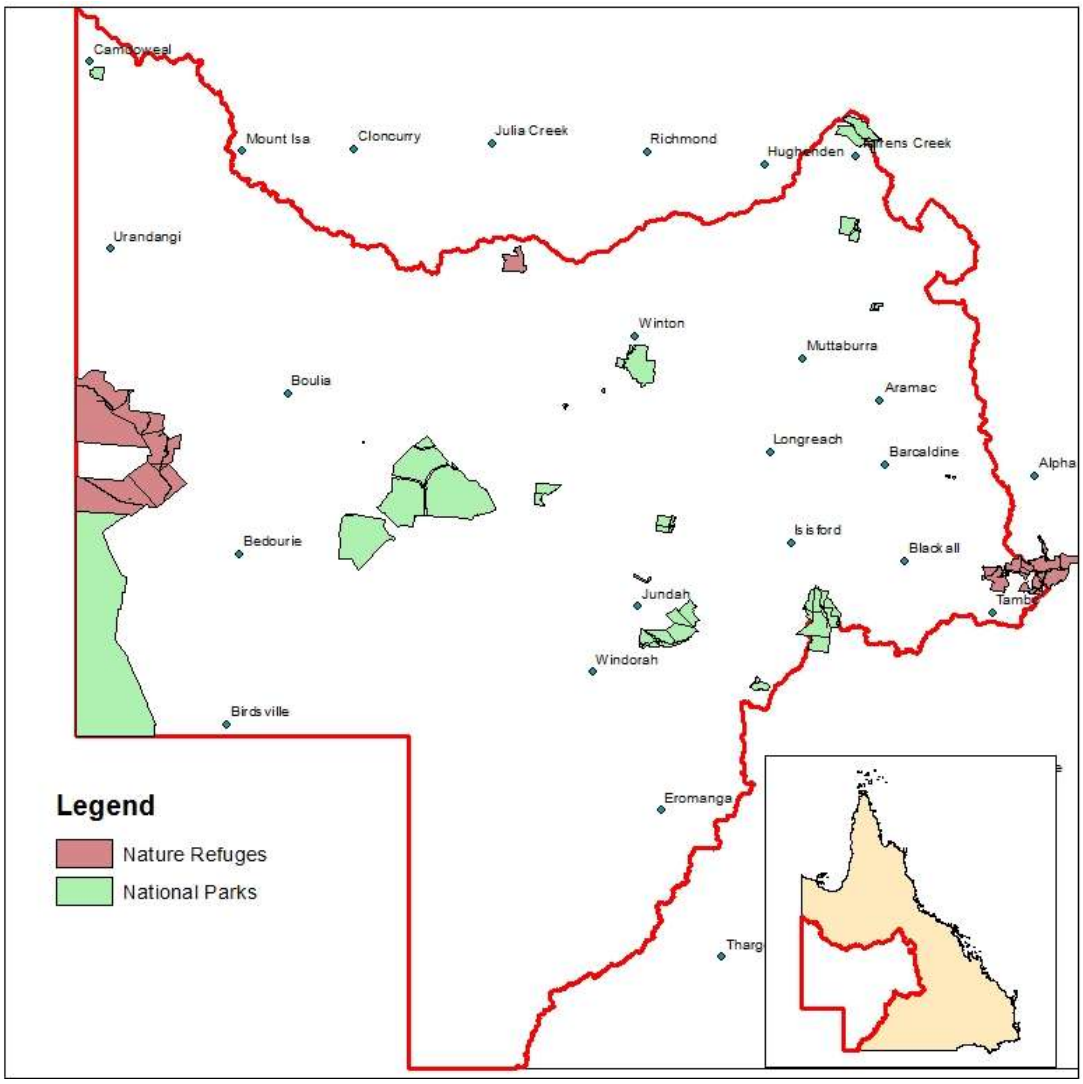
Resilient systems can maintain themselves when they are subject to external changes from natural or human-induced events, while ecosystems that have been degraded or modified are generally simpler and less resilient to pressures than complex ones. The key to maintaining resilient ecosystems is to ensure that natural landscapes retain their connectivity and vegetation structure so that biodiversity can function across all habitats. Restoring connectivity and degraded ecosystems is also vital.

The identification and management of threats to biodiversity in our region is an essential part of maintaining our ecosystem services.

ASSET COMMENT: PROTECTED AREAS

To contribute to the conservation of natural and cultural heritage, the State has established and manages a number of state-owned areas that are dedicated to the protection of biodiversity and conservation of natural areas.

Parks dedicated under the *Nature Conservation Act 1992* (NCA) are the cornerstones of an integrated strategy to conserve areas of high nature conservation value. The Desert Channels region contains 13 national parks covering just over 4 percent of the region, and 9 nature refuges under voluntary protection covering a further 2.2 percent. Below is a map showing the distribution of national parks and nature refuges.



Map 4: Protected Areas of the DCQ Region

Reserves for Environmental Purposes, Camping and Water Reserves also contribute to protecting biodiversity. Approximately 12,000 kilometres of active and inactive stock routes dedicated under the *Land Act 1994* also traverse the region.

However, many regional ecosystems, plants and animal species are not well represented in the protected area estate, making the conservation of biodiversity on leasehold and freehold lands in the region an important priority.

SUMMARY

KEY POINTS

- The region has a relatively intact natural vegetation cover and is very rich in biodiversity values.
- A range of processes threaten parts of the landscape and its plants and animals.
- If biodiversity is impacted it can affect the ecosystem services that nature provides, such as fresh water and food.
- Land managers hold the key to biodiversity conservation in the region, as only a small percentage of the region is protected under legislation for conservation purposes.
- The key to managing natural systems in a changing climate is to ensure the long term resilience of the landscape and its flora and fauna by maintaining good vegetation cover, structure and condition.

COMMUNITY FEEDBACK

Community feedback includes the following concerns about biodiversity:

- Protection of vulnerable species;
- Maintaining the health of aquatic fauna;
- Protection of artesian springs as sites of high biodiversity; and
- The impact of grazing of high kangaroo numbers on the natural environment.

DRIVERS OF CHANGE

- The impacts of climate change will place new and additional stresses on the ecology and productivity of the region, and these stresses are not yet well understood. Climate change may lead to accelerated and broader spread of weed species, introduced animals and diseases. Increased fire severity may be an issue, particularly in areas with introduced pasture species such as buffel grass.
- Key refugia in the landscape will be important to provide suitable locations for species to adapt and persist in the face of a more variable climate.
- Pests and weeds will continue to impose high pressures on native species and ecosystems, resulting in changes to the natural environment.
- Future extraction of groundwater may influence the water pressure that is required for high biodiversity sites such as the artesian springs.
- Commonwealth programs, such as the Green Army, may provide community projects to reduce impacts on the natural environment.

WATER RESOURCES

There are three broad types of water resources in the region: surface water, shallow aquifers, and deep aquifers associated with the Great Artesian Basin (GAB). While the DCQ community uses all three sources, availability, access, water quality and cost of supply are factors that determine which source is used.

Surface water was the first and most obvious water source for Aboriginal people and also determined patterns of early European settlement, which centred on the larger permanent waterholes. While weirs were later constructed for some town water supplies, away from the major waterholes, smaller settlements relied principally on surface water from dams or smaller waterholes.

In some parts of the region groundwater comes to the surface as springs. Historically these have also been highly significant areas for human use, as well as providing unique habitats for plants and animals.

When underground water resources were discovered by drilling bores into the aquifers in the late 1800s, townships could be located out of the flood zone. Today the region still relies heavily on groundwater for human use, industry, recreation and primary production, often supplemented by surface water assets which are subject to erratic and unpredictable rainfall and flooding events.

Towns throughout the region continue to develop their water assets for urban domestic and industrial use and to cater for the increasing tourist market (DCQ 2012).

Twenty four wetland areas in the region have been described in the national Directory of Important Wetlands (DEHP 2014c). These cover a wide range of springs, swamps, lakes, flood outs and river environments across the Desert Channels area. See Appendix 3 or Map 2 for further details.

The following sections summarise the distribution, use and issues associated with water across the region.

SURFACE WATER

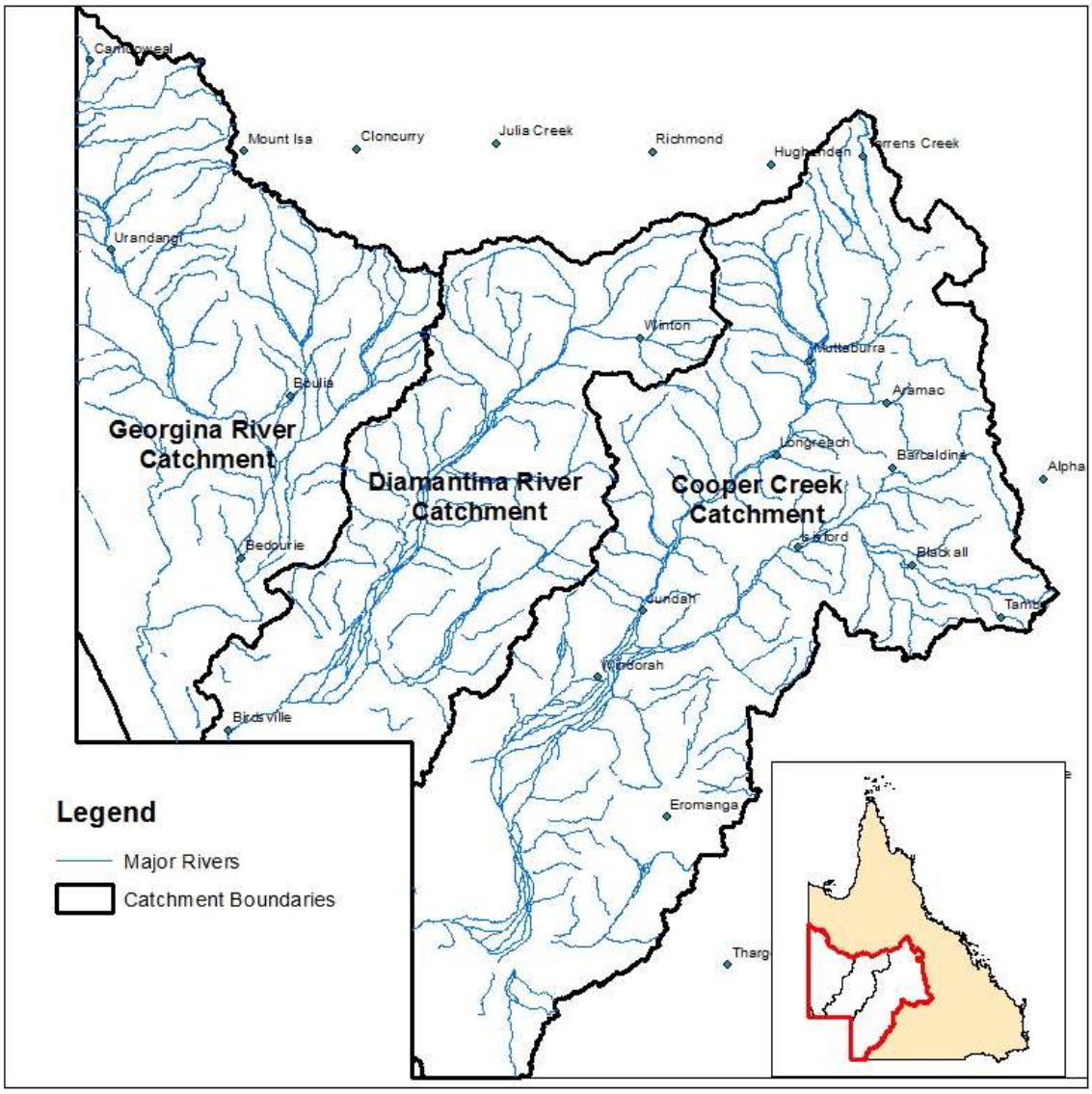
DCQ catchments and rivers

The DCQ region is the inland one-third of Queensland, the more than half a million square kilometres of the Queensland section of the Lake Eyre Basin. The catchments drain inland towards Kati Thanda-Lake Eyre itself, the continent's lowest point at 15.2 metres below sea level.

Lakes Galilee and Buchanan in the far northeast of the region have their own small terminal catchments, but are still part of the Lake Eyre Basin: if either ever got enough water in it to overflow, it would be inland into the Cooper Creek catchment and on to Kati Thanda-Lake Eyre.

The Desert Channels region makes up over 40 percent of the Lake Eyre Basin. Water from these northeast catchments is the major contributor to Kati Thanda-Lake Eyre but, in most years, doesn't reach the lake due to erratic rainfall and high evaporation rates.

The river systems have their highest elevation at 850m above sea level at White Mountains in the region's northeast, and their lowest at 15m ASL in the salt lakes of the Simpson Desert at Poeppel Corner in the southwest.



Map 5: The major catchments and river systems of the DCQ region

Rising in the north and east of the region, two major river systems, the Georgina-Diamantina and the Cooper, dominate the landscape, and have been described as the most variable major rivers on earth. They are both subject to highly erratic and irregular rainfall and flooding events (Kingsford 2002) with many years with little or no flow. The high variability of flow generates the boom and bust life cycles of native plants and animals typical of the Desert Channels region.

The rivers have low gradients and are generally slow flowing with increasingly braided channels toward their mid reaches. They are usually ephemeral, depending on seasonal conditions, but flood intermittently when there is good rainfall to the north. Unpredictable rainfall in the lower reaches contributes little in the way of runoff; consequently, these rivers tend to have a net flow loss from about their mid-point onward.

Waterholes
In a major study on water bodies within the Lake Eyre Basin, Silcock 2009) found the following in relation to the region:

- 551 waterholes in the Cooper Creek Catchment
- 197 waterholes in the Diamantina River Catchment
- 127 waterholes in the Georgina River Catchment

These waterholes can vary greatly in size with some up to several kilometres long, but rarely over 10m deep. Given the more reliable rainfall, the highest number and density of permanent water bodies are found in the Cooper Creek system. In contrast, the Diamantina Georgina systems have only a small number of widely-spaced permanent waterholes and long sections of channels with no reliable water at all. The influence of groundwater is significant in maintaining many truly permanent water bodies in the region (Silcock 2009).

Permanent waterholes are critical assets to both the community and the environment (DCQ 2012). They are biological refuges in times of drought: a source for recolonisation of native plant and animal species. As critical support for some of the region's major communities, as well as visitors, these waterholes have strong cultural and social histories.

Lakes and swamps
More than 22,000 ephemeral lakes and swamps are mapped and described for the region, linked and sustained by the creeks and river networks draining inland to Kati Thanda-Lake Eyre (DEHP 2014c).

The unique terminal lakes Galilee and Buchanan in the far northeast, with their associated saline-adapted ecologies, are associated with regional ecosystems with endangered biodiversity status. The lakebeds themselves also provide valuable grazing resources when managed well.

Springs
Springs in the region are the surface manifestation of groundwater from sub-artesian and artesian sources. They are highly significant points in the landscape for both native plants and animals, and human use, and are discussed more fully in the groundwater section below.

Surface water planning
The Georgina-Diamantina and Cooper systems are recognised as amongst the last unregulated dryland river systems in the world (AG 2014). They feed the wetlands and waterholes of the Channel Country, as well as the Ramsar listed Coongie Lakes and Kati Thanda-Lake Eyre itself. Less than one percent of the rivers and wetlands in the region have been modified in any way (DEHP 2014c). Maintaining near natural flows in the basin has been the focus of the cross-border arrangements put in place by the Lake Eyre Basin Intergovernmental Agreement (DoE 2000).

Both the Georgina-Diamantina and Cooper Creek catchments are water resource planning areas, with detailed plans in place. The Georgina and Diamantina water resource plan was approved in August 2004. The first Cooper Creek water resource plan, released in 2000, was replaced by a new plan in November 2011. The intent of the plans is to define the availability of water in the catchments for current and future users and the environment, to provide a framework for sustainable surface water management by preventing the over allocation of water, encouraging water use efficiency, and by preserving water flows which drive key ecological processes. The plans also provide for the management of overland flow water as well as water in a watercourse, lake or spring, and set out monitoring and reporting requirements for the plan area (DNRM 2014a, DNRM 2014b).

The first Cooper Creek water resource operations plan commenced on 29 November 2013. It provides a process for releasing up to 2200 megalitres of unallocated water to allow for future growth and economic opportunities. An Indigenous reserve of 200 megalitres is also available. The plan supports additional small-scale irrigation opportunities, enabled by the permanent and seasonal transfer of water licences located on the Longreach Waterhole and the permanent transfer of irrigation licences located on the Currareva Waterhole (DNRM 2014a).

The Georgina and Diamantina water resource operations plan commenced in July 2006. Up to 13,500 mega litres of unallocated water is available for future use in the Georgina and Diamantina catchments. This is made up of 12,000 mega litres of water for 'any' purpose and 1,500 mega litres reserved for 'projects of state significance' (DNRM 2014b).

Changes in Legislation to Protect Rivers in the Lake Eyre Basin

In 2009 the Queensland Government announced the extension of the *Wild River Act 2005* to protect the natural values of the Lake Eyre Basin river systems. After extensive public consultation the declarations for the Cooper Creek and the Georgina-Diamantina rivers were gazetted in December 2011. In 2012 the incoming government indicated its lack of support for the Wild Rivers declarations and the need to develop an alternative framework for the protection of the LEB rivers. The Western Rivers Wild Rivers declarations will not be repealed until the alternative framework is agreed and put in place (DNRM 2014d).

A Western Rivers Advisory Panel (WRAP) was established by the Minister to provide ongoing community input to developing these alternative strategies. The WRAP provided a report to government in May 2013, with advice and recommendations about protection of the natural values and assets of the Lake Eyre Basin (WRAP 2013).

In July 2013 the Minister announced a set of core principles for a management framework, including no additional water released for irrigation from these systems, no open cut mining in the Channel Country, strict control of oil and gas development and the creation of a Channel Country protection area (DNRM 2014e).

At this time there is incomplete information about the proposed Channel Country protection area and the repeal of the Wild Rivers declarations. A legislative head of power for the Channel Country protection area appears in the Regional Planning Interest Bill 2013, which could potentially facilitate progress of state development projects in the area and reduce opportunities for appeals (AFA & CCPG 2013).

GROUNDWATER

Sub-artesian and artesian water

Groundwater in the DCQ region can be described as sub-artesian or artesian. Sub-artesian water does not flow to the surface under its own pressure when its aquifer is tapped by a bore, whereas artesian water does as seen in the thousands of bores drilled into the Great Artesian Basin (DNRM 2014c).

Limited volumes of groundwater in the DCQ region come from shallow unconfined and semi-confined aquifers, and the greatest volumes and most reliable supply come from within the deeper confined strata of the Great Artesian Basin (GAB). The GAB underlies most of the Lake Eyre Basin and is the world's largest and deepest artesian groundwater basin. In the absence of permanent surface water resources across much of the region, the GAB provides most of the stock and domestic water supply, and is the only reliable water source for many communities (DNRM 2014c).

Shallow aquifers are recharged locally during rain events through creek flow and direct infiltration into the ground, whereas the GAB is recharged from infiltration where the sandstone outcrops along the eastern margin of the basin, on the northwest slopes of the Great Dividing Range (DCQ 2013b).

There are more than 3,000 active bores in the region (Silcock 2009). When first drilled, many bores flowed freely at rates up to 80 litres a second, but the flow rate has reduced significantly over time due to the large number tapping the aquifers. Many bores flow into open bore drains, often tens of kilometres long with high evaporation and seepage rates wasting most of the available water. Bore drains are also hard to maintain and provide an ideal habitat for feral animals and weeds.

Concerns about decline in pressure and the wastage of water has prompted a whole of GAB approach to upgrading the infrastructure through rehabilitation of bores and replacement of open bore

Threats and pressures to water resources

A range of activities have been identified as having the potential to exert pressures on the water resources of the region (Landsberg et al. 1999, Silcock 2009, LEBRA 2014 and DCQ 2012). These are described below.

Surface water

- Intensified surface water extraction for major water development proposals including mining and irrigation.
- Cumulative impacts of minor water developments and diversions.
- Intensified land use and total grazing pressure around natural water features.
- Modification of basin catchments by vegetation clearance, and inappropriate soil management and cropping practices.
- The spreading of artificial waters contributing to increased total grazing pressure around artificial water sources.
- Growth in unmanaged tourism.
- Poorly located and designed roads, tracks and other infrastructure that disrupt shallow but widespread overland flows and impact on the biodiversity of very large areas.
- Contamination of waterholes and riverine wetlands - as these are flushed by ephemeral flows, dilution of contaminates may not occur quickly.
- Presence and spread of introduced pest plants and animals.
- Stocking rivers and waterholes with non-local fish.
- Impacts of climate change.

Ground water

- Resource exploration and mining.
- GAB springs are highly vulnerable to drilling activity.
- Lack of knowledge of aquifers.

drains with piped water reticulation systems and troughs. Through a number of programs since 1989, most recently the Great Artesian Basin Sustainability Initiative (GABSI) (DoE 2014h), several hundred bores have now been upgraded to improve water use efficiencies. Many others, however, still require remedial action.

Springs

Springs occur where natural pressure pushes groundwater to the surface. In the Desert Channels region, most springs are fed by Great Artesian Basin water; these are known as 'mound springs' after the mounds built by millennia of deposited minerals and sediments. The region's major mound spring clusters are the Mulligan River, Springvale and Barcaldine 'supergroups'. GAB springs, particularly in the west of the region, provide permanent freshwater in a harsh desert environment. The Mulligan River and Springvale supergroups are especially significant, as they occur in otherwise waterless areas. The springs were significant to Aboriginal inhabitants and many played a role in early European settlement and travel patterns.

Springs support rich and specialised ecosystems including endemic plants, fish and invertebrates (Silcock 2009). Mound springs and their associated communities of plants and animals were listed as nationally endangered in 2001 under *the Environmental Protection and Biodiversity Conservation Act* (DoE 2014a).

Groundwater planning

In the Great Artesian Basin, artesian water, and sub-artesian water connected to artesian water, is managed under the Water Resource (Great Artesian Basin) Plan 2006 and the Great Artesian Basin Resource Operations Plan. The plans include a listing of the GAB springs that support significant cultural and environmental values, and measures to protect the flow of groundwater to those springs. A five year review of the Great Artesian Basin water resource plan was completed in March 2013 to assess whether the plan was fulfilling its objectives; no changes were made to the plan at that time (DNRM 2014d).

ASSET COMMENT: WATER MONITORING

Water monitoring across a vast catchment like the Lake Eyre Basin, with highly variable flows and naturally variable water quality, is a major task with considerable costs and logistical challenges (Bailey 2001).

River health and water quality in the region are generally perceived to be good, in keeping with the relatively undisturbed catchments. Times are changing fast, however, with increasing development, visitation and gas and mineral exploration, and the region has inadequate systems in place to monitor changes in hydrology or water quality.

There is a lack of gauging stations on the region's rivers, with many stations only operating for a short time and now removed from service. Currently there are 12 real time stations documented for the region, with eight in the Cooper catchment, and two each in the Diamantina and Georgina (DNRM 2012). Community consultation has frequently identified the need to restore key stations.

In a recent study, DCQ noted that the current state of many water assets (for example springs) cannot be determined as there is no consistent monitoring program in place to record asset condition on a regular basis (DCQ 2012).

Some excellent studies, like the Australian Arid Zone Rivers (ARIDFLO) project (Costelloe et al. 2004, on aspects of water health in the region have been undertaken in the past. The Lake Eyre Basin Rivers Assessment (LEBRA) is a program set up through the Commonwealth and State governments (Queensland and South Australia) to review the condition of all watercourses and catchments within the Basin (LEBRA 2014). The program has identified the importance of gaining a comprehensive baseline understanding of the condition of the catchments of the Lake Eyre Basin. It stressed the need for collection of broad scale and integrated information across the region, and proposed a whole-of-basin approach to assessing the condition of its aquatic systems. Several key state and pressure indicators have been identified for monitoring, which take into account the scale of the Basin and its inherent flow variability. They propose that these indicators can be used to identify thresholds of potential concern in river ecosystem structure and function which can help guide the required actions and outcomes of management. Recommended areas for monitoring include fish assemblages, waterbirds, riparian and wetland vegetation, water quality, hydrology, land use changes, total grazing pressure, tourism impacts, invasive species and climate change. Community concerns include the need for ongoing and comprehensive monitoring program for the region.

SUMMARY

KEY POINTS

- In the arid and semi-arid environments of the Desert Channels region, water is a valuable asset and resource.
- Surface water resources are often ephemeral and subject to unpredictable climate and flooding regimes. The pastoral industries of the region are reliant on access to reliable artesian water to maintain their operations.
- With largely free-flowing natural rivers, and an annual evaporation rates exceeding three metres, the potential use of surface water on a scale beyond stock and domestic supply in the region is limited.
- With river systems in other areas of Australia and the world significantly compromised by the regulation of water flows, those of the Lake Eyre Basin are critical free-flowing natural environments.
- Permanent wetlands and waterholes are important refuge points for biodiversity in the landscape in times of drought and changing climate.
- River health and water quality in the region are still relatively good in most places, however, times are changing with increasing pressures of development and visitation.
- The increase of artificial waters across the region in recent decades has a negative effect on the functioning of the natural environment and grazing production.
- The region has inadequate systems in place to monitor changes in hydrology and water quality.
- Likely Government action in relation to some regional water resource management is currently unclear.

DRIVERS OF CHANGE

- Future climate variability (e.g. more single rainfall events) may impose different flow regimes on the rivers.
- Government legislation on the protection of the rivers within the region is continually changing, and some changes may influence how rivers are managed.
- Future pressures from coal seam gas operations may affect groundwater hydrology.
- Continual pressure from grazing, tourists, community, pest animals and weeds will concentrate on areas with permanent water, and continue to influence the natural values.

COMMUNITY FEEDBACK

- The most recent documented community consultation process involved the Water Resource Advisory Panel, who provided advice to the current State Government on the natural assets and values which the Lake Eyre Basin community would like to see protected, particularly with the likelihood of the repeal of the Wild Rivers legislation. It also included the community's views on the potential expansion of 'small scale' irrigation in the Queensland part of the Lake Eyre Basin (WRAP 2013). The highest values worthy of protection were placed on the following:
    - a weed and pest-free environment
    - access to surface water
    - access to groundwater
    - natural flows
    - river connectivity
    - groundwater quality
    - surface water quality
    - wetlands and lakes
    - artesian springs
    - health of aquatic fauna
    - health of riparian and terrestrial vegetation
    - connectivity of riparian and basin vegetation
    - floodplain river connectivity
    - health of native pastures
    - Indigenous heritage
    - European Heritage

- The most significant issues of concern in relation to water resources were:
    - large scale mining
    - conventional petroleum and gas
    - unconventional petroleum and gas
    - irrigated agriculture
    - weeds and pests
    - major weirs
    - large overland flow storages
    - industrial development
    - obstruction by major roads across the floodplains
    - in-stream quarry material extraction
    - the need to map those areas which are the focus of protection
    - the need for consultation
    - general issues such as terms and definitions

- Large scale mining, unconventional and conventional petroleum and gas and 'small scale' irrigation were identified as areas with the highest levels of interest and sensitivity in the Basin.
- A full copy of the consultation report can be found at the following website: http://www.dnrm.qld.gov.au/__data/assets/pdf_file/0015/82500/wrap-report.pdf
- Other community consultation raised in other forums outside the WRAP includes:
    - future transfers of irrigation licences
    - reducing pressures on waterholes
    - further support to the GABSI program
    - the prospect of dams and irrigation
    - the need for a better understanding of ground water use
    - potential for accidents that contaminate water supplies

PEST ANIMAL AND WEED SPECIES

Pest animals and weeds are major natural resource management issues for the DCQ region. Weed infestations and threats are centred on the north and east, while feral animal impacts are felt more widely.

Control of feral animals and weeds, as defined by the *Land Protection (Pest and Stock Route Management) Act 2002*, is primarily the responsibility of the landholder. Failure to do so can result in penalties under the Act as well as contravention of lease conditions under the *Land Act 1994*.

The State Government department responsible for land protection is the Department of Agriculture, Fisheries and Forestry, through Biosecurity Queensland. Local government works in cooperation with this department to liaise with, and assist, landholders in meeting their obligations to manage declared pests. Shires are required by the Act to develop local government area pest management plans which determine resources and priorities for action in their area. Increasingly these plans are taking a strategic approach to pest problems in order to make the most of their limited resources, which may include subsidies for weed or feral animal control under certain conditions.

PEST ANIMALS

The Desert Channels region has a range of pest animals, from fish and amphibians through to birds and large herbivores. It is important that the community and visitors to the region are aware of the potential impact on this part of the world by behaviour that either encourages or introduces species that do not belong in our environment.

Introduced animal species in the region are of two kinds: those from outside of Australia (e.g. pigs, cane toads), and native species which have been translocated from other parts of Australia (e.g. red-claw crayfish, Murray cod).

Introduced animal species compete with native fauna for food, shelter and habitat. They also put additional pressure on the land and waterways of the region and can degrade and destroy vegetation and native fauna populations. These species generally have few or no natural predators and their populations can expand rapidly in the right conditions. They may also be significant vectors for diseases that threaten native wildlife, domestic livestock and humans.

Eradication of most introduced species is not feasible due to the size and remoteness of the region, and the costs involved. The focus is generally on management and control, with highest priority given to the most strategic areas. Control methods include trapping, shooting (aerial and on-ground), baiting, fencing and biological control. An important issue is that some introduced species, like wild goats and pigs, while detrimental to biodiversity, may be seen as an economic resource when markets are suitable.

How will pest animals likely be influenced by climate change in the rangelands.

In a recent study by CSIRO on ten significant pest species in the rangelands and the influence of climate change, only 2 species were found to potentially increase in abundance and/or distribution. This includes the dingo and the fox. Species expected to decrease in abundance or distribution include the cat, goat, pig, rabbit and cane toad. Finally, the camel, horse and donkey were found to have no predicted changes to abundance or distribution as a result of climate change.

To read the full report, you can download it from the following website: http://www.nintione.com.au/resource/AustralianRangelandsAndClimateChange_InvasiveAnimals.pdf

The following table shows the most common pest animals, plus some lesser known intruders.

Table 1: Established pest animal species in the Desert Channels region

Species	Issues	Control techniques	Distribution and priority areas for control
Dingo and wild dog (Class 2)[1]	Wild dogs are a significant issue and go beyond the immediate impacts on individual grazing enterprises. The inability to control wild dogs is seen by many as helping to drive a major land-use change in the region, particularly on the fringes of the established sheep areas in the north and east of the region. Dingoes, although also targeted for control, play a role in controlling other animals such as kangaroos, foxes and cats, thereby reducing their impacts.	Baiting using 1080 Shooting Fences Trapping	Distributed throughout the region. Priority areas are those impacting pastoral activities, particularly sheep.
Fox (Class 2)	Foxes can be a major problem during lambing and have also been identified as a major issue in national parks in the area where there is a focus on managing endangered species. The introduction of the bridled nail-tail wallaby to Idalia National Park, southwest of Blackall, has only been made possible by a coordinated fox-baiting program in selected areas of the park and surrounding properties.	Baiting using 1080 Shooting Trapping	Distributed in the majority of the region except for Boulia LGA. Priority areas are in and around national parks and other areas containing endangered wildlife.
Feral cat (Class 2)	Feral cats are highly adaptable animals that can survive and reproduce in all habitats. Few environmental factors limit their distribution. They are opportunistic predators and studies of their diet have shown that they prey on many native animals including small mammals, birds, reptiles, amphibians, insects, and fish. Through predation, feral cats can cause disruption to ecosystems and are implicated in the elimination of some species from areas such as islands. They can increase in numbers quickly, averaging three litters a year with up to 5 kittens in each.	Baiting although not particularly effective Shooting Trapping	Distributed throughout the region. Priority areas are in and around national parks and areas containing endangered wildlife. A coordinated control campaign on Astrebla National Park between 2009 and 2012 controlled approximately 2600 cats.
Rabbit (Class 2)	Their pest status is mostly due to their enormous breeding capacity (18–30 young per female per year), which enables them to repopulate rapidly after droughts or control campaigns. By competing for food and burrow space, they have contributed to the reduction in number and extinction of many native animals. They also reduce the quantity and quality of pasture for grazing animals, and are a primary cause of soil erosion by preventing the regeneration of native vegetation.	Baiting using Pindone Shooting Trapping Biocontrol such as calicivirus.	Distributed mainly in the eastern part of the region, but includes patchy locations in the western part. Priority areas include those which contain significant numbers not affected by the biological control.
Feral pig (Class 2)	The river channels and floodplain areas favour pigs which breed up readily in better seasons. Pigs cause considerable environmental damage by rooting up plants and making areas susceptible to erosion and can be significant predators of young livestock. There is evidence that pig numbers have been increasing in some parts of the region; they have been observed moving further down Cooper Creek and Diamantina River since the 1990s. Small numbers of pigs have made it as far down as the Innamincka Regional Reserve. Control of these scattered populations has recently been undertaken using predominantly aerial shooting. Pigs also pose a threat by being a vector for the spread of exotic diseases.	Baiting using 1080 Shooting Trapping	Distributed throughout the region, particularly along watercourses. Priority areas are those that relate to pastoral activities and along waterholes within river channels.

[1] Qld Class 2 A species declared as a pest under the *Land Protection (Pest and Stock Route Management) Act 2002*

Species	Issues	Control techniques	Distribution and priority areas for control
Wild goat (Class 2)	Goats prefer hill and scrub country but can also be found moving across open downs. Unmanaged goats can be a serious pest because of their ability to severely affect native flora and fauna. They have been listed as a threatening process under the Commonwealth Government's *Environmental Protection and Biodiversity Conservation Act 1999.*	Trapping Shooting	Found mainly in the south eastern part of the region in Longreach and Blackall-Tambo LGAs. Scattered outlier populations are also found in other parts of the region.
Deer (Chital Deer – Class 2) (Red Deer – Class 3)	Red and chital deer species have established small feral populations in the Barcaldine LGA, having escaped from failed deer farming enterprises. Deer impose extra grazing pressure on pastures.	Shooting	Found mainly in Barcaldine LGA with scattered populations in Winton LGA. Priority areas would be those that are disrupting pastoral activities or areas that contain threatened species.
Cane toad (not declared under Qld Legislation)	Cane toads are poisonous at all stages and can result in rapid death if ingested by most animals. Cane toads are also voracious predators and can displace native animals and may transmit disease such as salmonella in areas of low hygiene. They are spreading rapidly south throughout the region, and can be unintentionally transported by travellers.	Trapping Physical control	Found mainly in eastern parts of the region (Longreach, Barcaldine and Blackall-Tambo LGAs) but are moving south-westwards along the Thomson and Barcoo rivers Priority areas include those that are likely to affect sensitive native species such as springs and other aquatic refugia.
Mosquito fish (not declared under Qld Legislation)	Found in waterholes, dams, ornamental ponds, and bore-drains across much of the region. This prolific breeder displaces native fish through its aggressive behaviour and competition for food. Where they find their way into sensitive artesian spring habitats, some endangered, locally endemic species disappear.	Trapping Physical control	Found throughout the region. Priority areas include those within artesian springs that contain threatened fish species.
Horse and donkey (not declared under Qld Legislation)	Unmanaged horse and donkey numbers pose threats mainly to biodiversity through additional grazing pressure.	Trapping Shooting	Donkeys are found in scattered populations in the Barcoo LGA. Horses are found in scattered populations throughout the region. Priority areas are unidentified.
Camel (not declared under Qld Legislation)	With their soft pads, camels are regarded as less damaging to the soil than other large herbivores that have hard hooves. They also range over great distances, not needing to return as regularly to water, and as browsers, do not impact much on pasture plant cover. Nonetheless they damage trees and shrubs and may selectively reduce some species such as the sandalwoods. Camels have sometimes been used for certain weed control, such as browsing of prickly acacia.	Trapping Shooting	Found mainly along the western edge of the region in the Simpson Desert area. Populations are also known in the junction of the Winton, Longreach, Barcoo and Diamantina LGAs. Priority areas include threatened species habitat and sensitive areas.

Table 2: Present but isolated pest animal species in the Desert Channels region

Species	Issues caused	Control techniques	Distribution and priority areas for control
Starling (not declared under Qld Legislation)	The common starling has colonised south-eastern Australia and is spreading into the centre of the continent. Equally at home in urban or rangeland environments, it competes with native birds for nesting sites.	Trapping	Mainly in urban centres within the region
Goldfish (not declared under Qld Legislation)	Goldfish found in the upper reaches of the Cooper Creek system are the result of careless aquarium cleaning or thoughtless disposal of unwanted fish. The effect they will have on native aquatic life is unknown.	Physical control	Certain sites within the Cooper Catchment
Red claw (not declared under Qld Legislation)	Native to the northern Cape York, Gulf and Top End rivers, red claw has been introduced to many other catchments in Australia. The introduction into other catchments of red-claw, with its superior reproductive rate, may eventually displace endemic species.	Physical control	Certain sites within the Cooper Catchment
Murray cod (not declared under Qld Legislation)	Nationally, the Murray cod is listed as threatened and a species of national significance. Its numbers have dwindled to less than 10 percent of pre European numbers across its natural range of the Murray Darling Basin. Introduced into the Cooper Creek system in the late 1980s, it is not known if it will establish a self-sustaining population. Being a 'top predator' and eating almost anything that fits into its sizeable mouth, the impact of a permanent population could be significant.	Physical control	Certain sites within the Cooper Catchment

WEEDS

There are a number of serious weed infestations and weed threats to the Desert Channels region, as summarised in the tables below. Some are identified as Weeds of National Significance (WONS) under national legislation, while others are classified under Queensland legislation (DCQ 2011, DSEWPAC 2012, DAFF , DEHP 2014d).

Weeds often rank as the most important community concern to the values of the region. This was documented in the initial DCQ NRM plan in 2004, community consultation in May 2014, and was also recently captured through the Western Rivers Advisory Panel (WRAP 2013).

There is a large part of the region, mostly in the Channel Country, where there are few weed species. However, given the established species in the upper catchments there are major concerns about the ability to control potential spread southwards and westwards through the region and beyond, including into South Australia and Kati Thanda-Lake Eyre itself.

Economics of weed control in the Lake Eyre Basin

A recent study by CSIRO documented the economics of controlling weeds in the basin. A full copy of the report can be found at www.csiro.au/en/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/CAF-working-papers/CAF-working-paper-17.aspx.

It found the following most cost effective control programs for the DCQ region:

- Parkinsonia control in the Channel Country bioregion
- Parkinsonia control in the Desert Uplands
- Mesquite control in the Mitchell Grass Downs
- Parkinsonia control in the Mitchell Grass Downs
- Mother of millions control in the Desert Uplands

Given the relatively sparse population and resources of the region it is imperative that there is a high awareness of the threat of weed spread and that control efforts are timely and strategic.

Weeds are a serious threat to both biodiversity and production values, impacting on land and waterways. They reduce biodiversity by competing with and displacing native species. As with introduced animal species, weeds often have very few natural control mechanisms and seeds can be rapidly spread by wind, water, humans, vehicles and animals.

Weeds thrive in disturbed and degraded landscapes. Some species, for example the woody weeds, have the capacity to completely alter the vegetation structure, drainage regimes and even the soils of natural systems. Eradication of some weed threats is a possibility in the region but at huge cost and effort due to the broad geographic spread of many species and the difficulty of the terrain and climate. Other species are targeted for management and control, with the highest priority given to the most strategic areas.

Weeds in Queensland are classified under the *Land Protection (Pest and Stock Route Management) Act 2002* as follows:

Class 1	Potential to be a serious weed in Queensland
Class 2	Established as a serious weed in Queensland
Class 3	Established in Queensland and has, or could have, an adverse economic, environmental or social impact.
WONS	Weed of national significance

Table 3:Established weed species with potential for further spread in the region

Species	Issues	Control techniques	Distribution
Prickly acacia (WONS + Class 2)	A very serious weed for the region and is easily spread by cattle. The trend to more cattle in the last few decades from sheep has seen a major increase in infestations.	Best practice involves a mixture of mechanical and chemical control Biocontrol has not established in areas where it has been released.	Worst infestations are around Winton, Muttaburra, Aramac and Barcaldine. Also present in the upper Diamantina.
Mesquite (WONS + Class 2)	Another prickle bush that can form dense infestations and hinder mustering, pasture growth and affect biodiversity.	Best practice control is by a mixture of mechanical and chemical techniques.	Located in the upper Diamantina and scattered infestations in the Thomson catchment.
Parkinsonia (WONS + Class 2)	Mainly present along streamlines, seed is readily spread by water. Impact of this weed has been underestimated due to it often being hidden by other riparian vegetation.	Best practice control is by a mixture of mechanical and chemical techniques.	Widely distributed in all the upper catchments. Mainly along riparian areas.
Invasive cactus, including the species of Austro-cylindropuntia, Cylindropuntia and Opuntia (WONS + Class 2)	Opuntioid cacti present a threat to grazing industries through their ability to form dense infestations that can reduce access to feed and hinder mustering activities. Their spiny habit can injure stock, damage fleeces and hides and affect the safe handling of affected animals for shearing purposes. The risk of spine injury also applies to native wildlife, either through impalement or the lodgement of spiny segments in limbs, hides and mouths, leading to immobilisation and a painful death. Dense infestations of cacti can impede movement of native wildlife through corridors and limit access to refuges. Competition from opuntioids can also limit the growth of native vegetation, including small shrubs and groundcovers.	Chemical control. Mechanical control can also be used in certain situations.	Coral cactus infestations occur in Ilfracombe, Longreach, Flinders, Quilpie & Blackall Shires. Devils Rope Pear is found on the Longreach Town Common. Snake Pear is found north of Longreach.

Species	Issues	Control techniques	Distribution
Rubber vine (WONS + Class 2)	A riparian based weed that grows as a vine and smothers native vegetation. Also hinders mustering, stock access to water and pasture growth.	Combination of mechanical and chemical control. A biological control rust can also impede growth. Fire is also an effective control tool.	Established in the upper Thomson along sections of Tower Hill and Reedy Creeks.
Mexican poppy, Noogoora burr and Bathurst burr (not declared under Qld Legislation)	Predominantly grows in riparian areas with the burrs impacting on the production and quality of wool.	Mainly chemical control.	Scattered through the upper catchments. Limited infestations occur in the Channel Country.

Table 4:Weeds present but localised or isolated weed species in the region

Species	Issues	Control techniques	Distribution
Parthenium (WONS + Class 2)	Low growing weed that invades degraded pastures. Difficult to control and can impact on human health. Is easily spread through stock feed or vehicle movement.	Chemical control is important. Prevention is also vital, requiring careful weed seed movement controls.	Infestations in Blackall, Jericho, Longreach, Flinders, Barcaldine shires. Mainly occurs along roadsides or areas that may have brought in feed from coastal areas.
Bellyache bush (WONS + Class 2)	Low growing shrub that can dominate particularly in riparian areas or degraded pastures.	Chemical control.	Infestations in Barcaldine, Jericho, Flinders & Dalrymple shires; has been reported in household gardens in Barcaldine and stables in Longreach.
Mother of millions (Class 2)	Succulent weed that invades degraded pastures. Often escapes from gardens.	Chemical control	Infestations are present in Ilfracombe, Jericho, Blackall and Barcaldine Shires.
Chinee apple (Class 2)	Small tree that can invade areas, reducing pasture growth and hindering mustering. Very dense infestations occur in the Dalrymple Shire.	Chemical and mechanical control.	A small infestation is present near Corfield in the northern part of the Winton Shire.
Athel pine (Class 3)	Does not show similar weedy properties as in the Northern Territory. Commonly planted in homesteads gardens and for shade in stock yards.	Chemical and mechanical control.	Found in most shires.

Table 5:Weeds with further potential to spread or cause issues in the region

Species	Issues
Balloon vine (Class 3)	A creeper that can smother native vegetation. The only known infestation is located on Cooper Creek, near Windorah, in the Barcoo Shire.
Florestina (not declared under Qld Legislation)	An established infestation is situated between Barcaldine and Blackall on the Landsborough Highway and two neighbouring properties. The species is not known to grow anywhere else in the Lake Eyre Basin. As an annual weed there have been concerns that it may be another parthenium. It can invade rangelands and pastures and is toxic to stock.
Lippia weed (not declared under Qld Legislation)	Common in household gardens in towns; reported to have escaped onto the Longreach Town Common. More likely to occur in temperate areas of southern Australia.

Species	Issues
Leucaena (not declared under Qld Legislation)	Common in townships. Has spread from town gardens to creeks of the Thomson River in Longreach.
African love grass (not declared under Qld Legislation)	Infestations south of the region in Murweh Shire along roadsides. Possibly infestations along roadsides in Tambo, Blackall and Barcaldine shires – awaiting positive identification. Serious weed of roadside verges and some cultivars are low palatability, outcompeting other grasses. Can be used for soil conservation measures.
Thornapples or datura spp. (not declared under Qld Legislation)	Very small, isolated infestations have been reported on roadsides and in paddock situations, usually following rain. Not common. Able to produce a lot of seed that can remain dormant for a number of years. It is poisonous to stock. Able to tolerate a wide range of conditions.
Lions tail (not declared under Qld Legislation)	Recent discovery. Only known infestation is in Jericho Shire (contained). Likely to invade degraded pastures and affect pasture quality.
Giant rat's tail grasses (Class 2)	Giant rat's tail grasses have the potential to invade the eastern parts of the region. By displacing desirable grasses this species can lower carrying capacity substantially, and is difficult to identify and control.
Water lettuce (Class 2)	Water lettuce has been brought into the region from coastal nurseries and has been introduced to ornamental ponds. From the experience of the substantial infestation on the Warrego River at Cunnamulla this species has the potential to be a very serious aquatic pest requiring considerable resources to control.
Neem (not declared under Qld Legislation)	Native to India, this woody tree may reduce diversity and abundance of native species when growing in dense stands.
Calotrope procera (not declared under Qld Legislation)	Introduce as an ornamental shrub it can form dense thickets in pastures and rivers reducing pasture and mustering access. It can also be toxic to stock.
Water hyacinth (Class 2)	Native to Brazil, this water weed can be a major pest of creeks, rivers and dams reducing aquatic values.
Salvinia molesta (Class 2)	Salvinia is a free floating aquatic fern that can form thick mats over water storage areas, degrading habitat and water quality.

The introduced pasture species, buffel grass, presents special management challenges as it displaces native species, but also grows so densely that it poses a significant fire threat which can result in the death of native tree and shrub layer species.

SUMMARY

KEY POINTS

- Weeds and pest animals are the key community concerns for the region in relation to natural resource management. They affect natural systems by degrading habitat and affect agricultural production through reduction in pasture, restricting mustering and influencing risk of disease. They can also affect the community more broadly by impacting on human health.
- Weeds and feral animals are continuing to spread and new threats are emerging.
- The lower river systems of the region are generally weed free with the major infestations occurring in the northern and eastern part of the region. With downstream spread, the lower reaches are under continual threat.
- The prickle bushes including prickly acacia, mesquite and parkinsonia are major issues for agricultural producers.
- Pest animals are spread over the majority of the region with significant impacts caused by feral pigs and wild dogs.

COMMUNITY FEEDBACK

- Weeds continually emerge as the chief concern among community.
- Prickly acacia and wild dogs emerge as key concerns for their influence on agricultural production.
- There is a need for a 'good neighbour policy' to ensure that one property does not continually infest neighbouring properties with weed species.
- Buffer programs are seen as important to protect the lower reaches of the rivers from being infested with weeds present in the top of the catchment. These include:
    - Prickly acacia buffer control between Stonehenge and Longreach and along the mid reaches of the Georgina and Diamantina rivers.
    - Control of parkinsonia in the Windorah area along the Cooper Creek and control south of the junction of the Hamilton and Georgina rivers.
- A recent State-wide feral animal summit in 2013 found the following community concerns that relate to the region:
    - The need for long term programs
    - Understand the implications of dingoes and the impacts on cats/foxes to improve biodiversity outcomes

DRIVERS OF CHANGE

- New legislation is planned for the management of weeds and pest animals through the Biosecurity Act. This is expected to come into effect on 1 July 2016. For more details, see http://www.daff.qld.gov.au/biosecurity/about-biosecurity/Biosecurity-Act-2014
- A number of community groups are pushing to increase fencing within the region to reduce impacts on wild dogs, including check fences and cluster fencing.
- New forms of control for certain pest species, such as future bait controls, will provide additional management options.
- Climate variability may provide increased advantages for certain pest and weed species.
- The Queensland Government is conducting a 'War on Western Weeds' program to increase the ability to successfully manage prickly acacia.

VEGETATION MANAGEMENT

The management of native woody vegetation is a significant issue for areas in the east of the region. It is in these areas that clearing of acacia and eucalypt woodlands has occurred to allow pasture development, often using improved grasses such as buffel (*Cenchrus ciliaris*).

Approximately 2 million hectares, or 4 percent of the region, has been cleared. Most of this clearing has occurred within the two eastern bioregions, the Mitchell Grass Downs and the Desert Uplands. Only minor areas of the Channel Country, North West Highlands and the Mitchell Grass Downs have been cleared. Clearing in the Mulga Lands bioregion has been mainly limited to fodder harvesting of mulga. Fodder permits do not allow development of improved pastures and the mulga must be allowed to grow back. The small areas of the Brigalow Belt in the region have been significantly cleared and have limited potential for further development.

Rates of clearing as measured by the Statewide Landcover and Trees Study (SLATS) show that in the period 2009-10, the rate of woody vegetation clearing rate decreased by 26% from the previous period to 10,195ha for that year. Of this amount, approximately 4,893ha involved clearing of remnant vegetation or vegetation that has not been cleared before. Most clearing in the 2009-10 period occurred in the eastern part of the region, particularly the Barcoo and Thomson catchments, largely to convert areas of woody vegetation to pasture (DSITIA 2012). This is a significant reduction in clearing from previous periods of high clearing in 2000, when approximately 80,000 hectares per year was recorded.

Vegetation mapping and change detection is conducted by the Department of Science, Information Technology, Innovation and the Arts. This provides an analysis of which regional ecosystems are present and how much has been cleared. The DCQ region's vegetation communities and their status, based on regional ecosystem mapping Version 8.0, are shown below.

Table 6:Clearing and regional ecosystem statuses in the region

Status	Area in DCQ Region
Cleared or non-remnant	2,175,042 ha
Endangered (less than 10% remnant)	9,978 ha
Of Concern (10-30% remnant)	713,457 ha
Least Concern (greater than 30% remnant)	40,277,170 ha
Remnant vegetation not subject to regional ecosystem mapping	7,802,549 ha
High Value Regrowth	21,709 ha

Some regional ecosystem mapping for the region is still to be completed; this includes the areas listed in Table 6 as remnant vegetation. For more information on the regional ecosystems of the region, the biodiversity section includes a map showing the distribution of endangered and of concern regional ecosystems.

Some of the notable trends for clearing within the region include the following:

- Within the Barcoo catchment, in a belt from Yaraka through to Blackall, significant areas of gidgee (*Acacia cambagei*) have been cleared. Further upstream, in the catchments of the Alice and Jordan tributaries, there has been clearing of large areas of eucalypt woodland, brigalow (*Acacia harpophylla*) and gidgee scrubs. At the headwaters of the Barcoo there is a small area

of the Southern Brigalow Belt bioregion where brigalow has been cleared (Qld Herbarium mapping).

- In the Thomson catchment gidgee woodland has been cleared in the areas west of Longreach in the Vergemont, Katherine and Darr tributaries. Areas of gidgee and eucalypt woodlands have been cleared in the Tower Hill and Cornish Creek tributaries. Smaller areas of black gidgee (*Acacia argyrodendron*) woodland have been cleared along the Torrens Creek.
- Clearing in the Diamantina catchment has been limited to areas of gidgee west and south of Winton. There has been no significant clearing in the Georgina catchment.

An emerging vegetation management issue in the Channel Country is the burning of lignum swamp communities to facilitate mustering and increase pasture extent. There is no information available on the impacts of this practice on floodplain biodiversity.

Another issue for vegetation clearing is the thickening of woody vegetation in certain vegetation communities such as on grasslands. Examples in the region include acacia woodlands in the Mitchell Grass Downs and Channel Country and eucalypt woodlands in the Desert Uplands. These were once open woodlands and have been significantly altered to thickets of regrowth which reduce pasture plant cover and, in some cases, kill the older trees. Causes put forward for these changes include altered grazing patterns and fire regimes.

Future income from carbon forestry

With the current carbon farming initiative in effect, landholders may be able to receive additional income by protecting and managing regrowth vegetation to secure carbon credits (DAFF 2014).

A number of approved methodologies exist to allow landholders into this scheme. One involves the regeneration of native vegetation through a range of activities such as:

- Exclusion of livestock;
- Management of the timing and extent of grazing;
- Management of plants not native to the area; and
- Cessation of further clearing.

This initiative will provide further opportunities to vegetation management for the region, particularly in the woody eastern part of the region. Further information can be found at http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative

Recent changes to the Queensland Government vegetation management framework in 2013 allow for easier clearing in these communities, particularly for clearing of woody vegetation encroachment onto grasslands.

Forestry has not been a big driver for vegetation clearing in the region. More recently timber getting has been restricted to cutting gidgee or boree fence posts with some interest shown in providing high-value craft timbers. Many species of local timber are regarded as having potential for woodturning. A sawmilling operation in Tambo existed for a number of years from 2001; however, it collected most of its timber outside the region. This sawmill has since closed.

Commercial sandalwood is found through much of region and has been harvested intermittently since early settlement, with the price fluctuating considerably during this time. Concerns have been raised within the community about the sustainability of this industry which largely harvests timber from riparian areas.

SUMMARY

KEY POINTS

- Clearing has predominantly occurred in the eastern part of the region where the majority of the woody vegetation communities exist.
- Thickening, or native woody vegetation encroachment, is impacting the integrity of the natural grasslands in the region.
- Forestry is not a big influence on vegetation management in the region.

COMMUNITY FEEDBACK

- Vegetation management has not been a key concern for the community; however, concerns exist about the encroachment of native vegetation onto grasslands.

DRIVERS OF CHANGE

- Amendments to the *Vegetation Management Act* in 2013 provide much easier ways to manage vegetation and to carry out clearing operations.
- Carbon forestry through the Carbon Farming Initiative may provide new income opportunities for landholders to manage woody vegetation.

PASTURES

Five major pasture types occur in the region as shown below:

Table 7: Pasture communities in the region

Pasture type	Area
Mitchell grassland	30,000,000 ha
Spinifex pastures	21,200,000 ha
Mulga woodland	19,100,000 ha
Channel Country floodplain pastures	5,400,000 ha
Gidgee woodland	4,800,000 ha

Mitchell grass (*Astrebla* species) is the most extensive and valuable of Queensland's inland pasture communities and occurs as tussock grasslands on heavy textured clay soils. They have high livestock carrying capacity compared to other native species, are long-lived and drought-resistant.

Spinifex plants (*Triodia* and *Plectrachne* species) are dense, slow-growing tussock-forming perennial grasses which are usually green for much of the year and seed in response to rain. In low-fertility soils they often make up the major pasture species available to grazing animals. Gummy spinifex (*Triodia pungens*) forms an important pasture in the Desert Uplands.

Significant areas of the region, mostly in the Channel Country, are subject to flooding. These floodplain areas produce abundant pasture growth when floodwaters recede, and are dominated by shallow-rooted annual herbage, notably Cooper clover (*Trigonix suavissima*), and grass species. They also support deep-rooted perennial shrub species such as Queensland bluebush (*Chenopodium auricomum*) and lignum (*Muehlenbeckia florulenta*).

Both localised rainfall and floods influence pasture production on the floodplains. The rivers of the Channel Country tend to have a net flow loss with floods waters coming from rainfall many hundreds of kilometres away rather than local inflows. The timing of floods with respect to seasonal temperature has a major bearing on the nature and composition of the resulting pasture. Local rainfall can also increase the growing period of pastures on the floodplains as the floodwaters recede.

Pasture response to these natural irrigation areas can be substantial both in area and amount, and has been utilised by a variety of grazing enterprises for over 130 years. These areas are the backbone on which breeding and growing-out operations of the large pastoral companies are based, and are also important for smaller, locally based graziers.

Away from the channels there are areas of Mitchell grass and seasonal herbage pastures. The latter is often found in stony country where runoff from small rains can result in reasonable pasture growth in depressions. Dunes scattered through the Channel Country, and on the fringes of the Simpson Desert to the west, can provide reasonable light grass and herbage in season, but carrying capacity is low.

Improved pastures of introduced buffel grass (*Cenchrus* spp.) have been established in the east of the region, usually where gidgee scrubs or eucalypt woodlands have been cleared. Not all areas cleared are suitable for the establishment of buffel, which does not tolerate flooding and does not establish on some clay soils. Landholders clearing stony gidgee woodlands in the region rely more on native pastures and herbage. There are concerns about buffel pastures in the region and how they are able to tolerate drought, with many areas showing less than 50 percent recovery in well-established pastures. Recovery from seed may be slow due to nutrient run down in such pastures: this has been recognised in several areas of the region.

The relationship between pasture type, condition and seasonal outlook is probably one of the most significant natural resource management issues for the grazing industry in the region. Understanding the long-term capacity of the land to be productive (safe carrying capacity over decades), combined with an appreciation of the short-term outlook (feed budgeting within a season), are the keys to sustainable grazing enterprises. These issues are covered by the grazing land management (GLM) materials developed by the Queensland, Northern Territory and Commonwealth governments in partnership with Meat and Livestock Australia (Futurebeef 2014).

A number of programs, such as Future Beef, are running to help graziers manage pastures. For more information on these programs, see http://futurebeef.com.au/topics/grazing-land-management/

SUMMARY

KEY POINTS

- Native pastures of the region are valuable and drive the grazing industry.
- New introduced pastures such as buffel grass are spreading widely and are seen by some as an important pasture species, while others view it as a weed.
- New tools to help manage pasture are vital to assist with decision making based on available feed budget and climate forecasting.

COMMUNITY FEEDBACK

- Economic pressures on landholders can influence grazing numbers and subsequently the pressure on pastures.
- There has been some call for the ability to have new ways to improve pasture productivity through using legumes.

DRIVERS OF CHANGE

- Climate variability may influence the growth of pasture through changes in rainfall and temperature.
- New tools to help make decisions with pasture budgeting and monitoring of pasture condition through satellite imagery.



Photo: Cattle grazing in the rangelands (Photo courtesy of the ABC).

LAND TENURE

TYPES AND DISTRIBUTION

Land tenure in Queensland is administered under the *Land Act 1994* by the Minister for Natural Resources and Mines. The Act requires land to be managed for the benefit of the people of Queensland in line with seven principles: sustainability, evaluation, development, community purpose, protection, consultation and administration (DNRM 2013a).

The two main types of tenure are freehold and leasehold, with the latter being under the control of the State Government which may issue a lease, permit or licence, create a reserve for a community purpose, dedicate a road, or leave as no tenure at all.

No dealings on leasehold land can be undertaken without satisfying the requirements of the Commonwealth and State *Native Title Acts* of 1993. Other legislation may also need to be considered, such as the *Local Government Act 2009*, *Nature Conservation Act 1992*, and the *Contaminated Land Act 1991*.

There are five types of leasehold tenure in Queensland:

- Term leases are issued for a specific purpose, such as agricultural or commercial use, and can only be used for that purpose. The maximum term of these leases is 50 years, except for State leases over reserves (30 years) and leases for a significant development or timber plantation (up to 100 years).
- Perpetual leases are held by a leaseholder in perpetuity.
- Freeholding leases are used when freehold title has been approved but the leaseholder is paying off the purchase price by annual instalments.
- When a road has been temporarily closed, a Road Licence can be issued to allow the licensee to use the land until such time as the licence is surrendered or cancelled.
- A Permit to Occupy can also be issued for short-term occupation of State controlled land.

Term leases on rural leasehold land over 100 hectares are currently subject to the Delbessie Agreement, formerly the State Rural Leasehold Land Strategy, which aims to secure the long-term environmental, social and economic sustainability of rural leasehold land and rural communities.

A recent parliamentary inquiry into the future and continued relevance of government land tenure across Queensland has resulted in the *Land and Other Legislation Amendment Bill 2014* which was passed in May 2014. This legislation include rolling leases to give lessees a greater level of tenure security and quicker renewal process, allowing a grazing or agriculture lease to be extended by a term equal to the original term of the lease, as long as the leaseholder has satisfied a limited number of requirements (such as payment of rent, and no outstanding notices). Land management agreements will no longer be required for rural leasehold land under these changes. Broader reforms of land legislation are proposed to be undertaken throughout 2015 (DNRM 2014f).

STOCK ROUTES

Stock routes are corridors for walking stock, and the Desert Channels region holds 12,000 kilometres of the State's 72,000 kilometres of declared stock routes.

They can be declared on roads, but have no separate title or tenure from the underlying road reserve. They can also be on reserves, pastoral leases, unallocated state land, or any route that has

traditionally been used for walking stock. Associated with the stock routes are designated reserves for travelling stock including camping and water, pasture, and trucking reserves (DNRM 2013b).

Traditionally, the only way to move livestock was on the hoof, and stock routes, logically, followed available water. Therefore, before the tapping of the Great Artesian Basin, stock routes duplicated Aboriginal trade routes and trails, following river systems and reliable waterholes.

In the late 1800s stock routes were recognised and dedicated as roads. Their use declined in the 1950s and 1960s when better roads, and the development of stock trucks, made road transport more convenient and efficient. However, increasing fuel prices and continued cycles of drought have seen the resurgence of the stock route network as a cost-effective alternative for moving stock, and a source of pasture for emergency grazing.

The advent of the water tanker and use of supplements has also given drovers greater options to seek out feed in areas of the routes that previously would not have been accessible.

Once common on stock routes, sheep are now rarely seen. The larger stock movements in recent years have generally been mobs of company-owned cattle moving from the north of the region down into the Channel Country or Brigalow regions, or to markets in Longreach or Roma.

Stock routes are increasingly seen by the community as a resource for conservation, heritage and recreation. The romance of droving, combined with tourists seeking access to camp on the routes and reserves, is presenting new challenges to the management of stock routes.

As well as their historic cultural values, stock routes have environmental values: they are vital corridors for the movement of native species across an increasing fragmented landscape. Many follow watercourses, and traverse areas which have not been cleared, making them particularly valuable refugia habitat for plants and animals.

Management of the stock routes is shared between State and local government, predominantly through the *Land Protection (Pest and Stock Route Management) Act 2002*. Local governments undertake day-to-day administration and management of the network, and some maintenance, while the State provides policy and legislative advice, operational guidelines, support with compliance, asset maintenance and training local government stock route officers. Under the legislation, local governments in the central and western regions of Queensland are required to have local management plans for their area of the stock route network.

Stock routes and the natural values.

In 2009 a project was undertaken to identify biodiversity hotspots on western Queensland's stock routes by a partnership of four natural resource management groups (Southern Gulf Catchments, Desert Channels Queensland, South West NRM and the Queensland Murray Darling Committee) and the Queensland Department of Environment and Resource Management, supported by funds from the Australian Government, to map and identify potential sites, carry out field visits to verify values and threats, and to make management recommendation for identified biodiversity hotspots (Walsh 2009).

The project identified ten biodiversity hotspots in the DCQ region, plus an area of high conservation value and areas for further research. It noted that resources were not available for a comprehensive survey due to the vast size of the region and the number of stock routes in question. For each hotspot, the biological values were identified, as well as threats (e.g. habitat degradation from weeds, competition and predation by introduced animals, inappropriate fire regimes, feral pig damage, overgrazing), current management, and recommended management actions.

Recommendations from the study included the need to increase awareness of the values and management needs of the sites by local stakeholders and increased coordination amongst stakeholders to make the greatest conservation gains with limited resources (see http://www.southwestnrm.org.au/sites/default/files/uploads/ihub/pages-final-draft-stock-route-hotspot-report-10-sep-09pt1.pdf)

Local governments, as the day to day managers of the stock routes, have been facing challenges in balancing the demands of local graziers, who see the route as a resource for survival in drought, with those of travelling stock. Local government is also struggling with funding the management of the routes while only getting a modest financial return which fails to cover the management and maintenance costs.

Managing the stock routes is guided by the Queensland Stock Route Network Management Strategy 2009–14. Further consultation is in progress with key stakeholders with a view to improving the way the network is managed. The strategy aims to ensure that the stock route network continues to be valued by the community as an important use of public lands, and recognises its contribution to Queensland's pastoral industry and economy. The focus will be on improving strategic direction and coordination of stock route management, enhancing knowledge about the stock routes' natural resources and values to improve sustainable management of the network, and ensuring that stock route managers and the broader community remain committed to retaining and wisely using the network into the future.

SUMMARY

KEY POINTS

- Freehold lands are small in area and predominantly in the north and east of the region.
- Land tenure is predominantly term leases for grazing and agriculture, with larger leases in the west and south of the region.
- Rural lease conditions are currently under review, with relaxing of requirements for lessees likely soon as legislation is reviewed.
- The role of stock routes in the region is significant from economic, cultural and environmental perspectives.
- The region's stock routes are important corridors connecting the landscape and providing valuable habitat for native plants and animals.
- Balancing the requirements of the various stakeholder groups for stock route use is problematic. Local government often lacks the resources to carry out all the day to day management required.

COMMUNITY FEEDBACK

- Land tenure or stock routes have not been raised in community consultation as key concerns at the time of writing.

FUTURE DRIVERS

- Future price of fuel and access to road trains will be an influence on the use of stock routes as will be their use as emergency feed during droughts.
- The changes to the Land Act will significantly influence the way land tenure is managed and the ability to convert leasehold land to freehold.

PART 4 - THE DCQ COMMUNITY

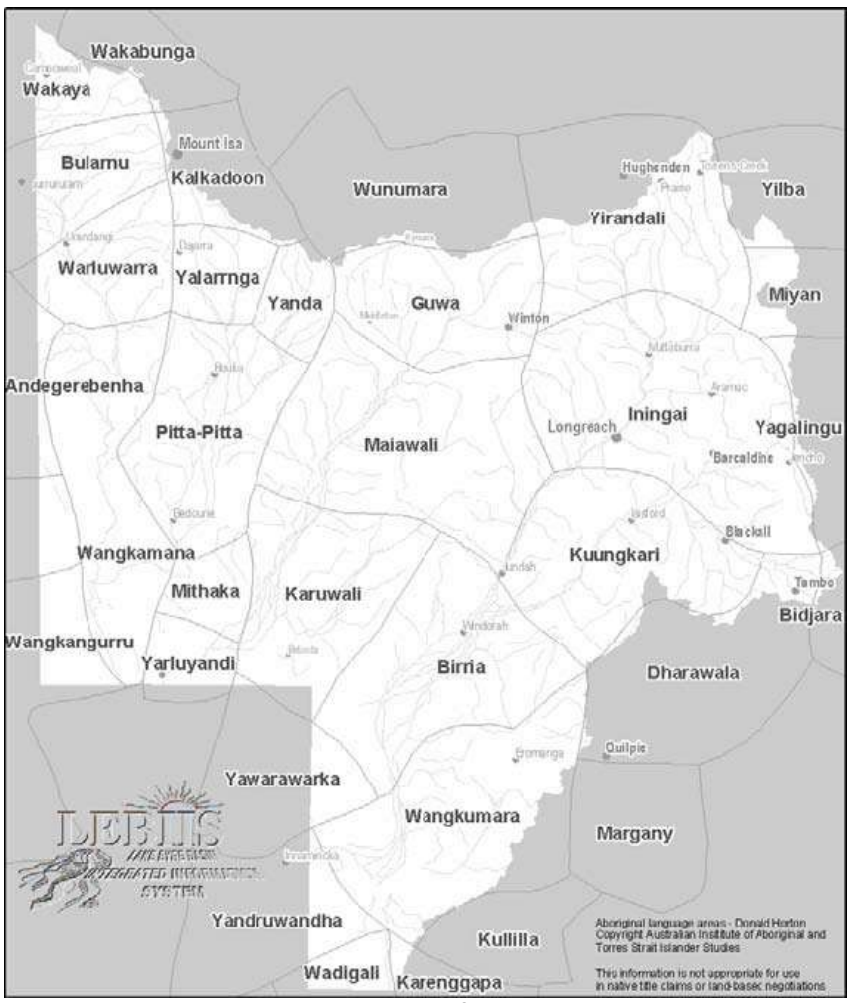
INDIGENOUS PEOPLES AND THEIR LAND MANAGEMENT

Indigenous or Aboriginal people came to Australian at least 60,000 years ago and throughout the DCQ region there are many sites with evidence of early Aboriginal culture. Around 22,000 years ago climatic conditions became much drier and would have impacted on Aboriginal life. There is evidence that Aboriginal people were using the country about 17,000 years ago and sites along the southern parts of Cooper Creek have been dated at about 12,000 years old (Ryan 2003). Aboriginal people developed the skills to adjust to changing environments and live within the capacity of the land.

Although the region is rich in cultural sites from the many stone scatters and limestone wells of the Simpson Desert to the shell middens and grinding stones of the lower Cooper and the rock art sites of the Desert Uplands, there has been limited systematic cultural heritage survey of the region.

Despite similarities in language and social organisation, Aboriginal groups throughout our region displayed considerable cultural variation. Around thirty language groups were thought to have covered the DCQ region (see Map 6 below); tragically most of these languages have been lost. Language dictionaries that cover a sample of Indigenous words of five of the region's groups, including the Pitta Pitta and Kalkadoon, have been developed. In addition, a traditional ecological knowledge-sharing project was completed in 2012. This project shares the traditional cultural processes Indigenous people have used for thousands of years.

The complex network of social and religious links was shattered with the advent of European settlement (Ryan 2003). This era brought harassment, violence and introduction of diseases for which Aboriginal people had no defence. Many survivors were moved to missions or Government settlements well away from their traditional lands. In many cases, station work was the only way Aboriginal people had of staying with their country.



Map 6: Aboriginal language groups of the Desert Channels region

Today, the Aboriginal population of the region is modest compared with many other parts of outback Australia. It is around 5 to 7 percent in the main population centres in the east of the Desert Channels region and 17 percent in the far west (

ABS 2013a).

Aboriginal people, through their affinity with their land, are today seeking to be involved with land management in the region. Several of the larger national parks have involvement with Aboriginal people through staffing and partnerships. Recently a Lake Eyre Basin Land and Sea Rangers program has commenced with Aboriginal participants receiving natural resource management training and carrying out activities such as weed control and biodiversity surveys.

Recognition of Native Title has provided many families, not only the rights to their country, but also the capacity to negotiate over the future of that country (Ryan 2003). As at December 2013, there are approximately 11 native title applications and determinations which cover most of the region (National Native Title Tribunal 2014).

A major stakeholder representing Indigenous views on natural resource management within the region is the Georgina Diamantina Cooper Aboriginal Group or the GDCAG. This group, established under the auspices of DCQ, is now an independent body providing sectoral input to DCQ's natural resource management in the region.

DCQ is currently refreshing its Indigenous Engagement Strategy to outline the opportunities for our Indigenous program to continue into the future. It reconfirms DCQ's ongoing desire of working together with Traditional Owners for successful outcomes in natural resource management.

SUMMARY

KEY POINTS

- Indigenous land management is a significant part of natural resource management; it has unique values relating to the country.
- Indigenous populations have been significantly affected since European settlement; however, the region contains a rich history of Indigenous communities.
- New opportunities exist to foster Indigenous land management including working with National Parks and the establishment of the Land and Sea ranger program.

COMMUNITY FEEDBACK

- Community feedback from the GDCAG in 2014 raised the following concerns:
    - Feral animals and weeds were the chief concern, with a special mention of cane toads.
    - The potential impacts of mining and coal seam gas.
    - The influence of rivers changing course.
    - The impacts of tourism, with camping being too close to waterholes, the cutting of trees and sites being too close to culturally sensitive areas.
    - The influence of warm temperatures and extreme heat on bush tucker and bush medicine (particular mention was made of the conker berry, bush banana and the coral bats wing tree).
    - The influence of kangaroos, particularly in the north west of the region and their ability to tolerate changes in temperature.
    - How to maintain permanent water holes with more variable climate.

FUTURE DRIVERS

- Future Land and Sea Ranger opportunities and how they can influence natural resource management outcomes.
- Future opportunities for Indigenous tourism such as promotion of significant sites.
- Building on the traditional ecological knowledge database.

EUROPEAN SETTLEMENT

In 1845 Edmund Kennedy was second-in-command to Thomas Mitchell, when Mitchell discovered the rich grasslands of central Queensland and named the Victoria River. Kennedy returned the following year to rename the river 'Barcoo' and follow it, naming the Thomson River as he went to the south of present-day Windorah. Here he realised it was the same stream that Charles Sturt had named Cooper's Creek a few years previously.

The ill-fated Burke and Wills expedition set off from Melbourne in 1860 to cross Australia from south to north. It traversed the DCQ region to the Gulf and back before coming to grief on the lower Cooper.

Alfred Howitt, William Landsborough, John McKinlay, and Frederick Walker all mounted separate rescue expeditions for Burke and Wills. Howitt subsequently found John King, the only survivor, and the bodies of Burke and Wills.

Unlike the Burke and Wills expedition, which found little of value, the rescuers discovered a good deal of new pastoral country, particularly Landsborough who crossed the Barkly Tableland (Wadley and King 1993). McKinlay charted Kati Thanda-Lake Eyre's northern shores and after receiving word of the deaths of Burke and Wills decided to press on and explore the country in the northeast. Favoured by exceptionally good conditions he was the first explorer to survey Queensland's central western region in detail and report on its abundant Mitchell grass plains.

William Landsborough, Augustus Charles Gregory and Frederick Walker all visited different parts of the region in different seasonal conditions. They had a poor understanding of the boom and bust cycles in the outback and gave different descriptions of the country they saw. Some saw a pastoralist's dream of lush grasslands and plentiful water, while others saw a barren wasteland of little or no use.

Rural settlement in the region began with vast holdings granted by provisions of the *Unoccupied Crown Lands Occupation Act 1860*. The region was pioneered by a number of prominent pastoral families, including the Duracks, Costelloes, Kidmans, Duncan-Kemps and Tullys. Descendants of these families are still present in the region, either with continued family property ownership or as managers for the larger pastoral companies.

The 1880s saw the resumption of areas from the original vast sheep and cattle runs with aim of promoting closer settlement. Even so, in the 1890s properties such as Wellshot, south of Ilfracombe still shore more than 400,000 sheep. The development of the region for wool production extended far out into the Channel Country. This brought a need for a substantial labour force and towns and settlements sprang up as the railway line extended west to Barcaldine in 1886 and Longreach in 1892.

Barcaldine was the scene of one of the most significant events in the political life of Australia when, during the Shearer's Strike of 1891, the Australian Labor Party and Union movement was born. This history is celebrated in that town at the Worker's Heritage Centre and the 'Tree of Knowledge'.

The expansion of the wool industry brought a boom in employment with thousands of shearers, shedhands and jackaroos employed. Shearers swelled the population of towns such as Barcaldine and Blackall whilst wool scours in centres like Ilfracombe and Blackall operated into the second half of the 1900s. This shearing heritage is celebrated in Blackall where the wool scour is preserved along with the story of Jackie Howe, the legendary blade shearer who gave his name to the blue singlet worn by shearers to this day.

Qantas, the world's second oldest airline was registered in 1920 as the Queensland and Northern Territory Aerial Service Ltd in Winton. Not long after the company headquarters were moved to Longreach. Today the Qantas Outback Founder's Museum in Longreach preserves the history of these early aviation pioneers.

Another icon of the outback, 'Waltzing Matilda', was penned by Banjo Patterson at Dagworth Station near Kynuna in 1895. It was first performed at the North Gregory Hotel in Winton later that same year.

Local government was achieved about this time across most of the region by way of Divisional Boards. These transitioned to shires and shire councils in the early part of the 20th century.

The period between the World Wars (1918-1939) saw closer settlement, with many parts of the downs country split into 20,000 acre or even 10,000 acre blocks, which at that time could sustain a family. Further west in the Channel Country holdings did not change much in size, and the few attempts at closer settlement had ended in failure - the Carcoory ruins north of Birdsville, still stand as testament to these efforts.

Gradually a new policy of regionalisation occurred in which larger towns, such as Mt Isa (which, while just outside the region, services the far north-west) and Longreach became centres for business, government administration, education services, health and welfare. Tourism has added to the local communities with a number of popular attractions and events being developed throughout the Desert Channels region.



Photo: Mitchell grass downs representative of the region (DCQ).

OUR COMMUNITY TODAY

POPULATION

The population of the Desert Channels region is sparse, with less than one person per 10 square kilometres outside of regional settlements (

ABS 2013a). Two thirds of the region's 14,700 inhabitants live in 25 towns which vary in size from 15 to 3,000 people. The rest are widely scattered across half a million square kilometres of extensive pastoral country, most of these in the more densely settled pastoral areas of the northeast of the region.

In common with other parts of Australia's rangelands, our rural and remote population has been in historical decline. However, when comparing figures from recent census data, the region's overall population declined between 2001 and 2006, but has picked up again to 2011. This is likely to be a result of recent exploration, mining and associated business interests that have increased the more closely settled population of some of the regional centres. Most of the data available for this section has been pulled from the principal local governments in the region – Barcaldine, Barcoo, Blackall-Tambo, Boulia, Diamantina, Longreach and Winton. It is important to note, however, that the DCQ region also covers parts of other local government areas – Flinders, McKinlay, Mt Isa, Cloncurry, Bulloo and Quilpie.

Table 8: Population of Desert Channels region by local government area (ABS 2013a)

	2001	2006	2011
Barcaldine LGA	3,536	3,492	3,583
Barcoo LGA	587	425	509
Blackall Tambo LGA	2,450	2,144	2,331
Boulia LGA	666	508	588
Diamantina LGA	442	412	534
Longreach LGA	5,037	4,805	5,296
Winton LGA	1,957	1,685	1,871
TOTAL POPULATION	**14,675**	**13,471**	**14,712**

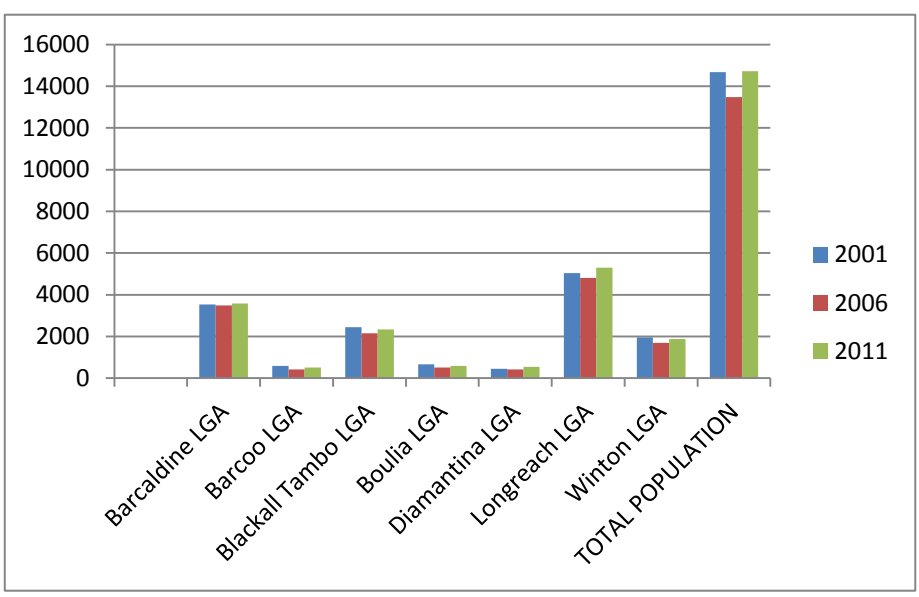


Figure 2: Population change of certain Local Government Areas in DCQ region

In the last 12 years, the average age of the Desert Channels population has continued to rise, with the average age (median) increasing from 33 in 2001 to 38 in 2012. Table 6 and Figure 2 highlight that the population is ageing more in some locations – for example Winton, Barcaldine and Diamantina shires. Boulia and Longreach however have consistently lower average ages.

Table 9: Average (median) age of population by local government area (ABS 2013a)

YEAR	Barcaldine LGA	Barcoo LGA	Blackall – Tambo LGA	Boulia LGA	Diamantina LGA	Longreach LGA	Winton LGA	Median age for the region
2001	34.5	32.4	35.9	28.8	29.5	32.5	35.5	**33**
2002	34.9	33.4	36.4	29.6	30.9	33.3	36.2	**34**
2003	35.4	34.2	36.9	29.8	31.3	33.9	37.2	**34**
2004	35.9	35.3	38.1	30.3	32.6	34.4	38	**35**
2005	36.4	36.8	40.2	30.6	33.2	34.5	38.8	**36**
2006	37.1	36.5	41.1	32.1	33.5	34.9	39.6	**36**
2007	37.5	37.4	40.8	31.9	33.9	34.8	40.2	**37**
2008	38.2	38.3	40.2	32.6	36.2	34.7	41	**37**
2009	38.2	40.3	40.4	31.7	34.9	34.7	41.7	**37**
2010	39	40.4	40.6	31.3	36.7	34.7	42.8	**38**
2011	39.7	40.9	41.2	29.6	36	34.2	43.4	**38**
2012	40.2	40.5	41	30.4	38.8	34.1	43.6	**38**

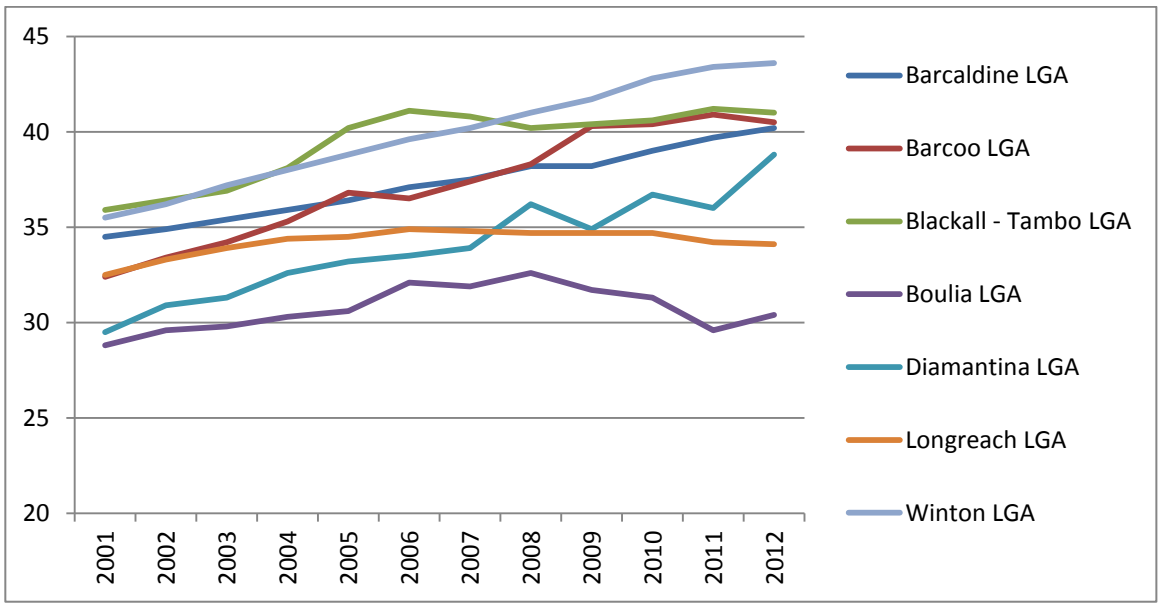


Figure 3: Changes in Median age of certain Local Governments in the DCQ region

EMPLOYMENT

The town communities, around two-thirds of the people in the region, are firmly connected both socially and economically to the natural resources of the region. Providing services to rural industry is a significant employer in all the towns of the region, with Longreach also an important regional centre for public services and education.

Unemployment rates average around 3 percent across the region and are lower than the State average of around 5.5 percent. The participation rate in employment is also high, at approximately 70 percent.

Table 10: Employment by sector in Desert Channels region 2011 (ABS 2013a)

Employment sector	Number of people employed	%
Agriculture, forestry and fishing	1721	29%
Mining	99	2%
Manufacturing	151	3%
Construction	505	9%
Wholesale trade	123	2%
Retail trade	527	9%
Accommodation and food services	345	6%
Transport, postal and warehousing	290	5%
Information media and telecommunications	38	1%
Financial and insurance services	62	1%
Rental, hiring and real estate services	38	1%
Professional, scientific and technical services	121	2%
Administrative and support services	83	1%
Public administration and safety	695	12%
Education and training	448	8%
Health care and social assistance	582	10%
Arts and recreation services	62	1%
TOTAL	**5890**	**100%**

Of the approximately 6,000 strong workforce of the region, 29 percent are employed in agriculture compared to the State average of 2.7 percent. Agricultural workers are an ageing population – as reflected across Australia, where the median age of "farmers" was 53 years in 2011, compared with 40 years for all other occupations (ABS 2013b). This is partially because "farmers" are more likely to work well beyond the age at which other workers retire, often because there are no younger family members or others to take over family farms.

EDUCATION

The education needs of the region are met by 26 State-run schools (4 are schools of distance education servicing the remote areas; 3 of these are situated outside the region) and 4 Catholic schools. Most remote area students complete their secondary studies at boarding schools on or near the coast with many having to travel 1,500 kilometres or more to do so. Longreach has a District Office for Education Queensland and also has a Special Education Unit based at the Longreach Primary School.

Four non-State schools service the region for Preschool to Year 7. They are Our Lady's School (Longreach), St Joseph's School (Barcaldine), St Joseph's School (Blackall) and St Patrick's School (Winton) (Education Queensland Schools Directory Website).

Central Queensland University is the closest tertiary education provider to most of the region, with campuses in Rockhampton, Gladstone and Emerald; however, for James Cook University in Townsville is closer for residents in the north and north-west of the region. The Central Queensland Institute of TAFE is the major vocational education provider for the area, with campuses in Rockhampton, Gladstone, Yeppoon, Barcaldine, Longreach and Emerald. This is augmented by specialist rural training colleges at Emerald and Longreach.

Presently Longreach Pastoral College is the only Queensland institution providing extensive training in cattle, horse, sheep and goat grazing in semi-arid conditions. Longreach Pastoral College is a branch of TAFE and provides a range of training opportunities including apprenticeship support.

Based on ABS data in 2011, the Queensland Outback area has less than 40% of the population with non-school qualifications such as tertiary education.

HEALTH

The DCQ region, despite its scattered population has an extensive health network. Most of the region comes under the Central West Health Service District, which has its main office in Longreach, plus offices in Winton and Barcaldine. Queensland Health has six hospitals servicing the region: Alpha, Barcaldine, Blackall, Longreach and Winton. Primary Health Care Centres are located at Aramac, Boulia, Isisford, Jundah, Muttaburra, Tambo and Windorah.

Apart from the conventional health services mentioned above, the region comes under the 'mantle of safety' of the Royal Flying Doctor Service. Doctors and aircraft at bases in Mt Isa, Charleville, Broken Hill, and Port Augusta provide regular medical clinics and emergency evacuations to the more isolated parts of the region.

Climate variability and country towns

A report from a climate change research organisation found a number of future concerns for outback communities with a more variable climate. These include the ability to respond to future health issues or natural disasters. A number of findings were important for communities within the region which were found to have a high risk. A copy of the report can be found at www.nccarf.edu.au/sites/default/files/attached_files_publications/Beer_2013_Australia_country_towns_2050.pdf

COMMUNICATIONS

Despite the fact that the population of the remote parts of the region has declined, communications is now better than ever. Most areas that are not connected to landline communications or mobile phone coverage are likely to have satellite based access.

Satellite television came to the outback in the 1980s and, in the past decade, telecommunications for rural residents has progressed from party lines and manual exchanges to automatic telephones and, in many cases, broadband satellite internet services and mobile phone coverage. With the rapid expansion of internet usage, having such a communication portal has made it much easier for people to access information on natural resource management. Based on 2011 ABS census data, within the region, most communities are averaging between 50-60 percent of homes connected to the internet.

There is also a large UHF (Ultra High Frequency) radio network across the region. Most properties use this system for internal and inter-property communication and syndicates of landholders have been formed to install repeaters to extend coverage.

ABC Radio Western Queensland is the mainstay of rural broadcasting in the DCQ region. Longreach is also home to 4LG, which prides itself as being one of the smallest commercial broadcasters in Australia. In contrast with much of commercial radio 4LG is still independently owned. The daily North-West Star out of Mount Isa and the weekly Longreach Leader enjoy wide circulation in the region and are supported by a number of small local papers and newsletters. The Brisbane-based Queensland Country Life is the rural issues paper of choice for most of the region.

This communication, information and entertainment revolution has permanently altered the amount and type of social interaction. Nowadays, people in the bush are only out of contact through choice and without leaving your home you can be informed, entertained or transported to a world far away from the everyday. This is expected to only increase with the future uptake of high speed broadband.

TRANSPORT

The quality of the road network across the region has improved despite a declining rural population. Much of this improvement has been driven by increased tourist traffic.

The road from Longreach to Windorah is completely sealed and provides an all-weather loop from Charleville, through Windorah to Longreach. There is a push on for a sealed road into Birdsville which currently receives 50,000 plus visitors per year.

A recent funding announcement has provided $11 million to the Queensland section of the Outback Way. Billed as Australia's 'longest shortcut', the Outback Way runs from Winton in Queensland, through Boulia and Alice Springs, to Laverton in Western Australia, and will provide for new tourist access and provide additional support to the beef industry.

Over the last 10 to 15 years, most shires have made a concerted effort to upgrade major shire roads. Many have been gravelled, which has not only helped cope with increased traffic in dry times, but ensured a degree of passability during moderate rain.

Improved roads have facilitated the transportation of stock to and from properties, to market, and away to agistment when drought conditions set in. This gives a greater flexibility to property managers in maintaining healthy pastures and livestock.

In addition to improved roads, advances in vehicle design have meant a greatly increased ease of covering the vast distances of the region. Today people are far less likely to be confined to their immediate community as access to larger regional centres with a wide range of entertainment, sporting and social activities is now quicker and more comfortable.

WASTE MANAGEMENT

The region is characterised by a lack of heavy industry so there are few major waste disposal issues other than urban. Local government is slowly improving its waste management, moving away from burning rubbish towards separating waste. For example Longreach Council has set up specific bays for materials such as green waste, recyclable building materials, steel and white goods. It has also put in place a waste oil recovery facility. Recycling of materials such as cardboard (estimated to comprise more than 30 percent of the waste stream) and plastics is still difficult due to the high cost of freight to recycling plants in comparison with the value of the material.

Recent state legislation including the *Waste Reduction and Recycling Act 2011* includes a range of provisions to reduce waste generation. This includes a requirement for all local governments to prepare waste management plans and the introduction of product stewardships for any identified waste products.

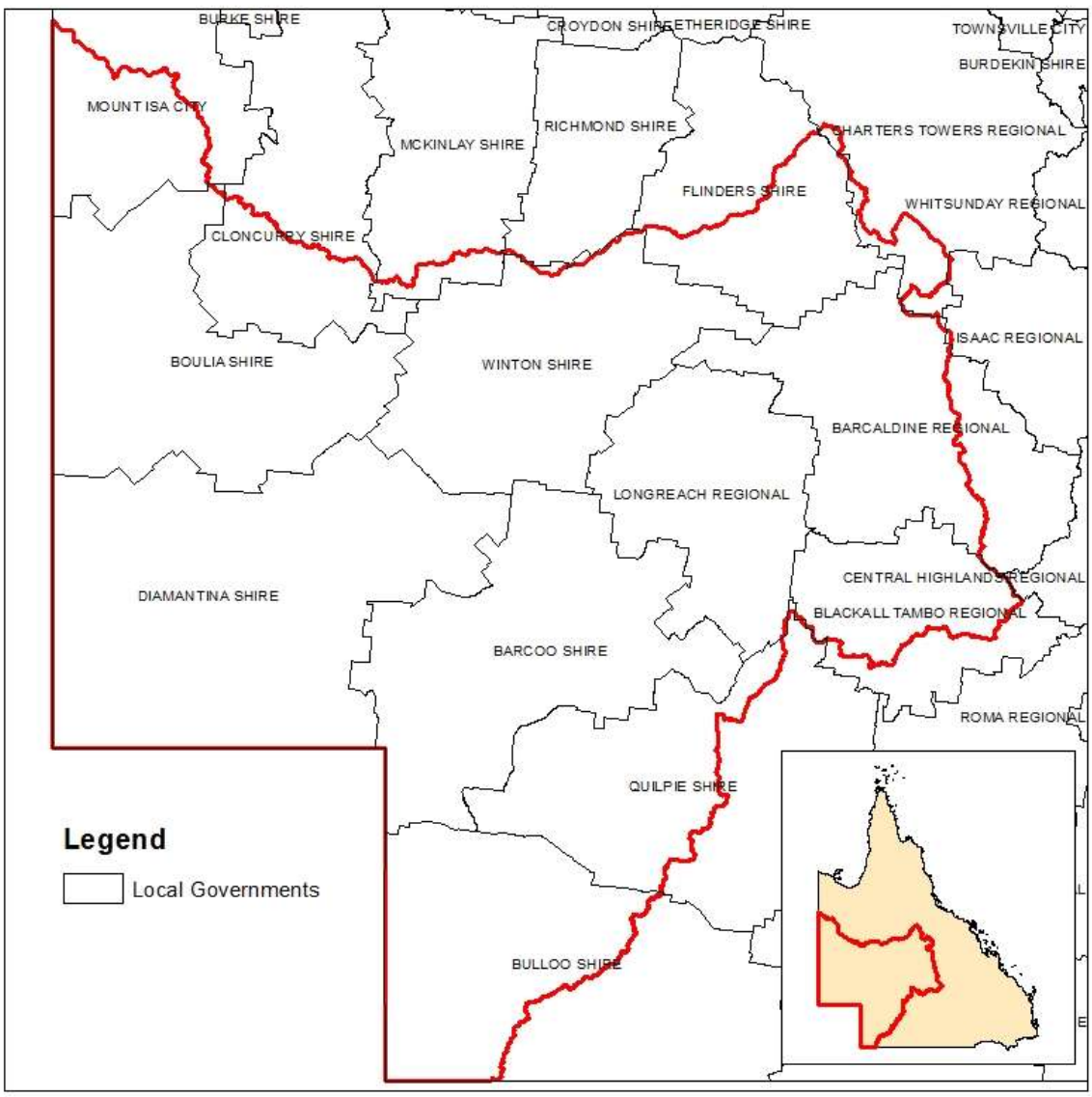
Contaminated soil on pastoral properties is an ongoing issue and is regulated under the *Environmental Protection Act 1994*. Within the region, the long term use of residual chemicals such as DDT, dieldrin and arsenic in sheep dips and stock yards can result in the land being contaminated. A contaminated land register records where action needs to be taken to remediate or manage the land. Development approvals require special consideration of areas that may be listed on the contaminated land register.

LOCAL GOVERNMENT

Following reforms in 2007 and 2008, the number of local governments within the region has been reduced. The Desert Channels region contains all or parts of the following local government authorities:

- Mt Isa City
- Boulia
- Cloncurry
- Diamantina
- Winton
- McKinlay
- Flinders
- Barcoo
- Barcaldine Regional Council
- Longreach Regional Council
- Blackall Tambo Regional Council
- Quilpie
- Bulloo

Those that fully or predominantly fall within the DCQ region are Boulia, Diamantina, Winton, Longreach, Barcaldine, Blackall-Tambo and Barcoo. Concerns are still felt by the community about the reduction of local governments in the area during the 2008 reforms, and its impact on community viability. Local governments can have a key influence on natural resource management through developing their own programs and policies. This is particularly important in the management of weeds and feral animals, as well as the promotion of water efficiencies. Unique programs can also be valuable to educate the community, such as walks that promote natural species. Good examples are walks in Tambo and Longreach displaying information on native species. Below is a map showing the Local Government boundaries within the DCQ region.



Map 7: Local Government Boundaries in the Desert Channels Region

SUMMARY

KEY POINTS

- The community of the area has developed a strong and vibrant agricultural industry.
- Changes in the value of agricultural commodities has affected communities and required adaptation, such as the shift from wool growing to beef production.
- The population of the region is relatively stable, coming from a period of decline in the mid 2000s. The median age however is increasing, resulting in an older community.
- The area, although quite remote, is serviced with various health and education providers located throughout the region.
- Transport and communications are vital to the region and are being continually upgraded.
- Local government has been reduced in recent years through forced amalgamations.

COMMUNITY FEEDBACK

- Viability of towns and the maintenance of services is a key issue for the community.
- There is a push for new infrastructure to enhance social outcomes and regional sustainability.
- Concerns about how to build skills and maintain relationships with stakeholders.
- There is a need for community to build skills with stakeholders and maintain relationships

FUTURE DRIVERS

- New high speed internet such as the national broadband network will allow for much easier ways to communicate and interact in remote areas.
- The population may continue to age and/or decline, potentially affecting the viability of some communities.
- Climate variability may require communities to adapt to events such as being able to respond to natural disasters, or respond to increases in heat waves.



Photo: DCQ staff undertaking prickly acacia control along a bore drain (DCQ).

PART 5 - INDUSTRIES RELIANT ON NATURAL ASSETS

PASTORAL AND AGRICULTURAL

Similar to the boom and bust nature of the natural environment in the DCQ region, the pastoral and agricultural industries have also been through many cycles. This includes the wool boom of the 1950s, a cattle boom and bust in the 1970s, the peak of wool in the 1980s, the collapse of the sheep industry and resurgence of beef at the turn of the new century, and recent impacts on the cattle industry from uncertainty of live exports and the harsh drought conditions of 2013-14.

This has brought considerable change in both the rural and urban parts of the region. Graziers have largely moved from 'riding on the sheep's back', with its high labour requirements, to running cattle, with lower input costs and potentially higher returns. Drought has always been part of life and landscape; it has always been felt economically in the towns although not as severely as in the bush. These days the economic contribution from tourism has provided some opportunities to take the edge off rural downturns for some businesses. Recent coal, gas and mineral exploration have also provided a similar function.

The Desert Channels region contains the largest area of primary production land use in Queensland, with 31 million hectares (29 percent of Queensland's total) used for livestock grazing (ABS 2013b).

Agriculture, resources, construction and tourism are the foundations of the Queensland Governments "four pillar" economy. The current State agricultural strategy aspires to double Queensland's agricultural production by 2040. This is to occur by securing and increasing resource availability, driving growth in productivity, securing and increasing market access and minimising the costs of production (DSDIP 2014).

Ongoing challenges for primary producers include:

- continuing global economic uncertainty and the high Australian dollar;
- increased borrowings and interest burden;
- increasing production costs (such as freight, labour, energy, supplements, fodder);
- declining rates of productivity gains;
- competition for natural resources;
- continuing biosecurity risks;
- increasing climate variability;
- the adverse effects of natural disasters;
- the ageing demographic and low recruitment of next generation of producers; and
- in some parts of the region, kangaroos are a large competitor for feed resources.

Future impacts on pastoral production

A recent study by CSIRO outlined the impacts of pastoral production and possible adaptation in relation to climate change. Some of the key findings from this study include:

- Hotter maximum temperatures, heatwaves, continuing highly variable rainfall and probable occurrence of drought and intense rainfall are the most adverse factors affecting future pastoralism.
- Longer term adaptation will require conservative approach to stocking rates and encouraging the regeneration of good pastures.
- Planning for human and animal welfare during heatwaves through property management.
- Investing in robust stock water supply to persist during long periods of dry or heat.
- Investigating new forms of stock breed that may be better suited to more variable conditions.
- Maintaining critical levels of ground cover on vulnerable soil types to reduce erosion risk during high intensity rainfall.

A full copy of this report and more detailed adaptation strategies can be found at http://www.nintione.com.au/resource/AustralianRangelandsAndClimateChange_PastoralProduction.pdf

Queensland's agriculture industry grew by 1.2 per cent in 2012–13, compared to a 5.5 per cent decline recorded for Australia as a whole (DSDIP 2014). The role of the Desert Channels region as a producer of food, fibre and other products is vital, and will continue to be so into the future. The region's reputation for clean, safe and high quality agricultural commodities is a valuable advantage.

Industry leaders are doing many things to achieve profitability, including:

- Rigorous selection and management of the herd;
- Upgrading waters and fencing for improved grazing regimes;
- Using low-stress, stock handling techniques;
- Matching stocking rate to carrying capacity; and
- Destocking when there is no feed.

Rainfall reliability is a strong driver of profit in most of the region. Unreliable seasons pose great difficulties to maintaining breeding herds, causing a shift away from breeding into more trading, agisting and backgrounding (MLA 2010).

Tools to help deal with risk and climate variability for agriculture

1. A comprehensive study into the risks for the grazing industry and climate variability was compiled by Cobon et al. 2009. This risk approach identified vulnerabilities to the grazing industry in Northern Australia and what might be some adaptation responses. The study found that there is likely to be detrimental impacts on pasture growth, surface water availability, increased competition from woody vegetation and declines in production. Adaptations included ways to reduce total grazing pressure, ways to forecast climate more accurately and maintain total surface cover. The study prepared a range of easy to use materials to help undertake an individual risk analysis with change climate. These resources can be found here: http://www.longpaddock.qld.gov.au/products/matrix/index.html

2. More tools have also been developed through a Climate Champion program run by the Commonwealth Government. This program aims to help landholders manage climate risk by given them tools to help with outlooks and their business, as well as combining researchers with landholders' need. More information on this program can be found at the following website: http://www.managingclimate.gov.au/climate-champion-program/

CATTLE

The beef industry in Queensland is the backbone of many rural and regional communities and delivers more than $4.5 billion per year to the Queensland economy (AgForce 2014).

In the early years of settlement, the lush Channel Country pastures were a critical link in the vast cattle empire of Sir Sidney Kidman, who built a chain of cattle properties from northern Australia to the Murray River in South Australia. The cattle enterprises of the Channel Country are still an important part of the beef industry, but methods of management and cattle genetics have changed how the industry operates since the early days.

The industry was once dependent on European breeds but many enterprises now have Brahman bloodlines, and some are developing their own composite breeds. Steadily improving road transport has enabled cattle to be moved from breeding properties, often north and west of the region, to properties in the Channel Country where they are grown out to feedlot weight or fattened.

The Desert Channels region has one of the highest populations of cattle in Australia, with 1.73 million recorded in 2011, which was almost 14 percent of the Queensland herd. The region ranked as the third largest cattle producing NRM region in Australia in that year (MLA 2014a).

Many of the top beef producers in Australia have Channel Country holdings with substantial areas of floodplains. A large area of the Channel Country is dedicated to organic beef production enterprises, which are a major contributor to the 2.3 million hectares of certified organic production land in Queensland, the most of any State in Australia. This growing organic beef industry is worth over $52 million a year to Queensland (DAFF 2013a).

Improvements in cattle genetics, land development and water infrastructure, along with better control of grazing, nutritional supplementation and breeding have changed the face of the less productive Desert Uplands country in the northeast of the region.

SHEEP

In the heyday of the wool industry, the sea of grass in the Mitchell Grass Downs gave rise to hundreds of smaller sheep holdings and many famous merino studs such as Isis Downs, Terrick Terrick and Portland Downs.

The decline in the sheep industry since the wool crash at the end of the floor price scheme, combined with the drought of the 1990s, made sheep in many parts of the region almost worthless. The Queensland sheep flock declined from 19 million to fewer than 6 million in the space of a dozen years. In the DCQ region, this was marked by an initial retreat of sheep from the north, followed by a shift from sheep to cattle in the Barcaldine/Blackall area, once the heart of the Queensland merino flock.

The shift in land use has been most pronounced in the north and west of the region, but the one-time sheep heartland of Blackall, which had been heavily reliant on servicing the wool industry, has also felt the move away from sheep and continuing cycles of dry years in the region.

Despite the pick-up in prices and the improved outlook for the industry at the end of the 1990s, flock numbers continued to decline due to competition for land from beef producers, good live export prices, good mutton prices, wild dogs and low reproductive rates exacerbated by frequent drought conditions.

The Desert Channels region had almost 1.5 million of the national herd of 73 million sheep in 2011, more sheep than any other NRM region in Queensland at around 40% of the Queensland flock (MLA 2014b).

The strong market for sheep meat has been one glimmer of hope in the industry during a time of great changes, with mutton and lamb being valuable restaurant products from the region. Complementing this has been the development of a modest industry based on purely meat-sheep breeds such as the Damara and Dorper, which are well adapted to difficult conditions.

OTHER AGRICULTURAL ACTIVITIES

There are a few people in the region working in other agricultural activities such as small-scale irrigated agriculture.

Goat production has also risen in the area with a move away from harvesting feral goats to managed herds. The goat industry has been assisted by a reliable market and the construction of a goat meat abattoir at Charleville. However, for most current landholders the future focus is on opportunities to market traditional beef and sheep produce innovatively.

SUMMARY

KEY POINTS

- Grazing is the predominant agricultural activity for the bulk of the Desert Channels region.
- The industry has changed dramatically in the last few decades from sheep to cattle enterprises.
- The region has a strong reputation for healthy and environmentally sustainable food production systems.
- Profitability of the sector is impacted by a wide range of factors and issues.
- The most successful enterprises are evolving their practices to maintain viability.
- Recent economic and climatic conditions continue to put high pressure on the sector.

COMMUNITY FEEDBACK

- Concern about the impacts of extreme temperature events on livestock health and performance.
- The ability to make decisions on feed budgeting in seasons that may become more variable.
- The need for more extension to help with pastoral activities.
- The ability to enforce compliance of land condition on grazing properties.
- The influences of macropods on total grazing pressure.

FUTURE DRIVERS

- Future changes to climate variability including warmer temperatures and rain that falls in fewer events are going to affect agricultural production.
- Increasing threats from woody vegetation competition, weeds and feral animals will continue to undermine agricultural productivity.
- Managing total grazing pressure with new tools that can detect changes in pasture cover through satellite imagery and forecasting climate outlooks.
- New opportunities for income from sources such as the carbon farming initiative.
- State Government policy to double agricultural production by 2040.

TOURISM

Tourism is a seasonal industry largely driven by the 'grey nomads' (retired, 50 plus age group) who journey through the area in the cooler months. These visitors are very cost conscious and are becoming selective as to which attractions they visit. Increases in fuel costs have impacted on this market in the past and are a potential threat to future growth in the industry. The proportion of international or younger visitors to the region is small.

There are a number of significant tourist attractions in the region. These include:

- Blackall Woolscour (Blackall);
- Australian Worker's Heritage Centre (Barcaldine);
- The Australian Stockman's Hall of Fame and Outback Heritage Centre (Longreach);
- Qantas Founders Outback Museum (Longreach;
- Waltzing Matilda Centre (Winton);
- The Age of the Dinosaurs (Winton);
- Lark Quarry dinosaur tracks (Winton);
- Min Min Encounter Centre (Boulia); and
- Various National Parks including Diamantina, Bladensburg, and Simpson Desert.

Tourism is a significant part of the local area economy. Within the Outback Queensland area (Mt Isa, Longreach and Charleville areas), domestic visitors alone resulted in a $236.6 million input, involving approximately 352,000 visitors and 119,000 holiday makers in the year ending September 2013 (Tourism and Events Queensland 2013). The growth in outback travel, fuelled by burgeoning recreational vehicle ownership, better roads and a love affair with the outback has also benefited smaller communities. A number of touring routes have been established, taking tourists through the Channel Country to Birdsville and across the Simpson Desert.

Findings from a significant report on tourism in the Lake Eyre Basin found that tourism is rapidly emerging as a major form of land use alongside more traditional practices such as pastoralism and mining (Schmiechen 2003). Natural and cultural heritage assets are seen by some as commodities with commercial value. This report also found that significant challenges need addressing in the planning for the sustainable use of many of the natural heritage attractions of the Channel Country.

Examples of environmental issues include the damage that uncontrolled vehicle access and camping can do to the fragile banks of the waterholes. This report also raised a range of issues that need to be addressed if tourism is to be sustainable in the region into the future, including:

- Protect water quality to maintain and conserve water-dependent ecosystems and preserve heritage values – this will ensure that outback communities have adequate systems to provide water for increasing tourist use;
- Integrate tourism as a major consideration in all natural resource management processes;
- Raise awareness and minimise noxious weeds spread by travellers through the region;
- Develop a strategic approach to waste disposal and management in outback areas; and
- Establish clearer protocols and a sustainable management approach to campfire use in outback areas.

In the current Central West Outback Queensland Tourism Association Action Plan for 2013-2015 (CWOQTA 2013), a number of nature based actions were identified. These include:

- Identifying wildlife species watching areas such as certain bird or macropod sites and host them as an online tool; and
- Identify opportunities for infrastructure upgrades.

SUMMARY

KEY POINTS

- Tourism is an important industry for the region, complementing the major agricultural industries.
- Tourism relies on a number of natural resource assets such as waterholes and other natural features.
- Pressures from tourism can impact natural resources such as localised pressure on waterholes, inappropriate use of fire, inappropriate firewood collection, weed seed spread and irresponsible driving on sensitive areas.

COMMUNITY FEEDBACK

- Concerns include the impacts on key waterholes and damage to significant sites from tourist activity.
- Tourists that are not educated about some of the natural features and using them irresponsibly.

FUTURE DRIVERS

- Fuel prices will influence the volume of tourists that undertake driving holidays throughout the region.
- Increases in mobile communication such as 'apps' provide unique portals to educate tourists in spatially specific ways. For examples, some apps can provide tailored information based on the geographic location of the tourist.
- State government policy to increase tourism as part of the four pillar policy.



Photo: Jabiru on the Thomson Waterhole, near Longreach (DCG).

WILD ANIMAL HARVESTING

The game meat industry, which harvests kangaroos and pigs across much of the region, is a significant employer.

PIGS

The feral pig issue is complex. On one hand they cause serious economic and environmental damage, as well as acting as vectors for diseases, while on the other hand they are an important economic commodity and a recreational and cultural resource for some communities. This income stream, although often limited, can come through recreational hunting and commercial harvesting (Choquenot et al. 1996, feral.org.au 2014).

Because feral pigs in Australia are free of foot and mouth disease, they are highly prized for export. Australia provides 20 to 30 percent of the international trade in wild meat, an industry worth $20 million a year. Hunting of feral pigs is also an important component of rural-based tourism opportunities in some areas (
Feral Focus 2014).

Recent research suggests that at current harvest rates, commercial harvesting is ineffective for the landscape-scale control of feral pig populations. Unless harvest rates can be significantly increased, commercial harvesting should be used as a supplement to, rather than as a substitute for, other damage-control techniques (Gentle and Pople 2013). Feral pigs in the region impact particularly on wetland values and biodiversity, and also prey on newborn lambs. They damage fences and contaminate water sources by rooting up vegetation and wallowing, and compete with livestock by eating or damaging pastures.

KANGAROOS

The issue of kangaroo numbers and their management in the region is a subject of much debate. Kangaroos can become pest species and are also a valuable resource for commercial harvesters. High kangaroo numbers are often a concern, particularly in the Mitchell Grass Downs and parts of the Mulga Lands, especially following good seasonal conditions. The total grazing pressure from domestic livestock and kangaroos combined can cause great difficulty in being able to effectively spell country.

The kangaroo industry is worth more than $270 million a year to Australia, and employs over 4,000 people (Kelly 2013), with the vast bulk of these jobs in remote rural communities. Australia's commercial kangaroo harvest is a world best practice operation, driven by sustainability goals.

Queensland has an approved management plan for the harvesting of three species: red kangaroos, eastern greys and common wallaroos (euros). The aim is to conserve each species over their entire range.

Queensland is divided into three zones for monitoring and quota setting, with the Desert Channels region falling in both the central and western zones. Annual quotas are set based on population surveys, natural mortality rates, rainfall trends and previous harvests. Scientists and managers believe that a sustainable harvest is around 15 percent of the population for grey kangaroos and wallaroos, and 20 percent for red kangaroos. Survey data for the last 25 years demonstrates that

this rate of harvest appears not to have impacted the kangaroos' natural ability to recover quickly following drought conditions (DoE 2014i).
The commercial kangaroo industry has had many ups and downs through recent years. The commercial harvest is usually much lower that the approved quota because the harvest is affected by seasonal conditions, market demand and the ability of the kangaroo industry to harvest the quota. Figure 4 shows the difference between the yearly quota allocation and the actual harvest.

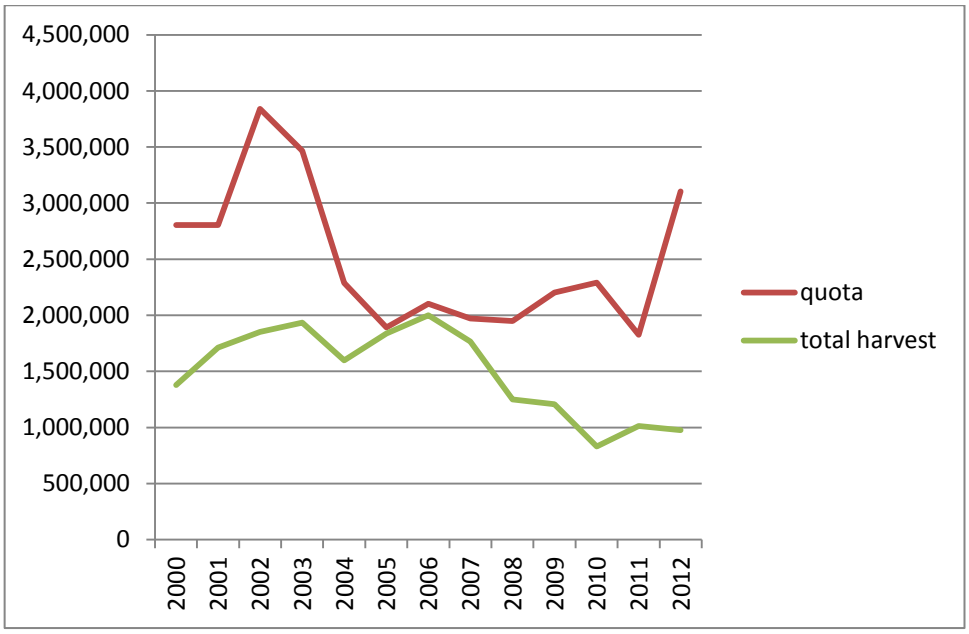


Figure 4: Queensland commercial kangaroo industry - quota and harvest statistics (DoE 2014i)

Kangaroo numbers across Queensland vary dramatically from season to season, largely in response to rainfall conditions, with numbers rising rapidly in the 2011-2013 period, as shown below in Figure 5.

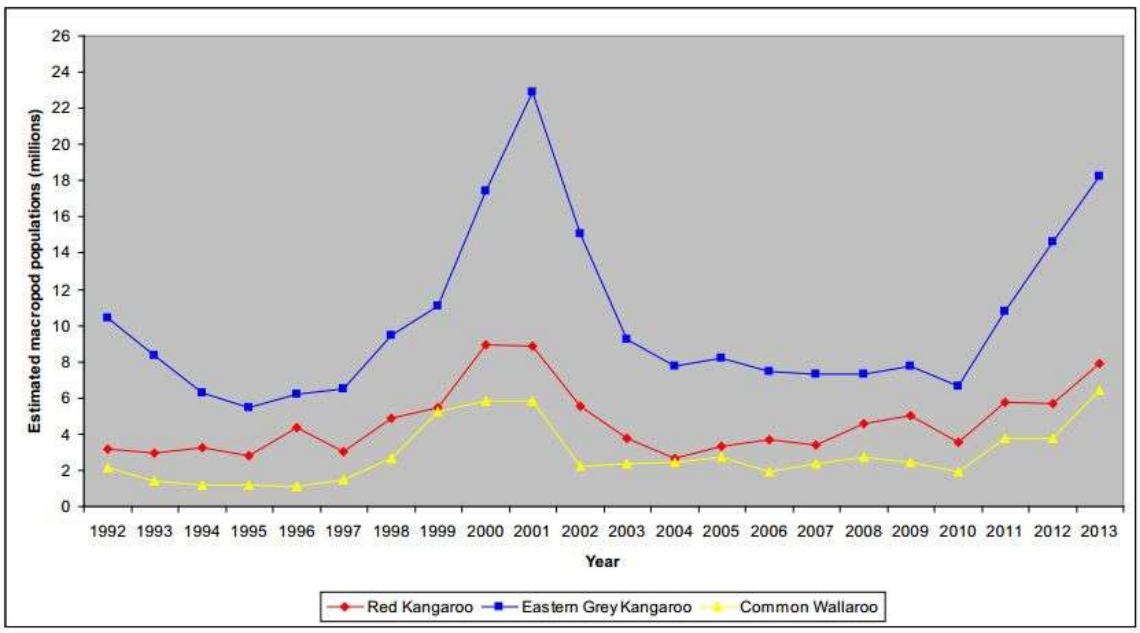
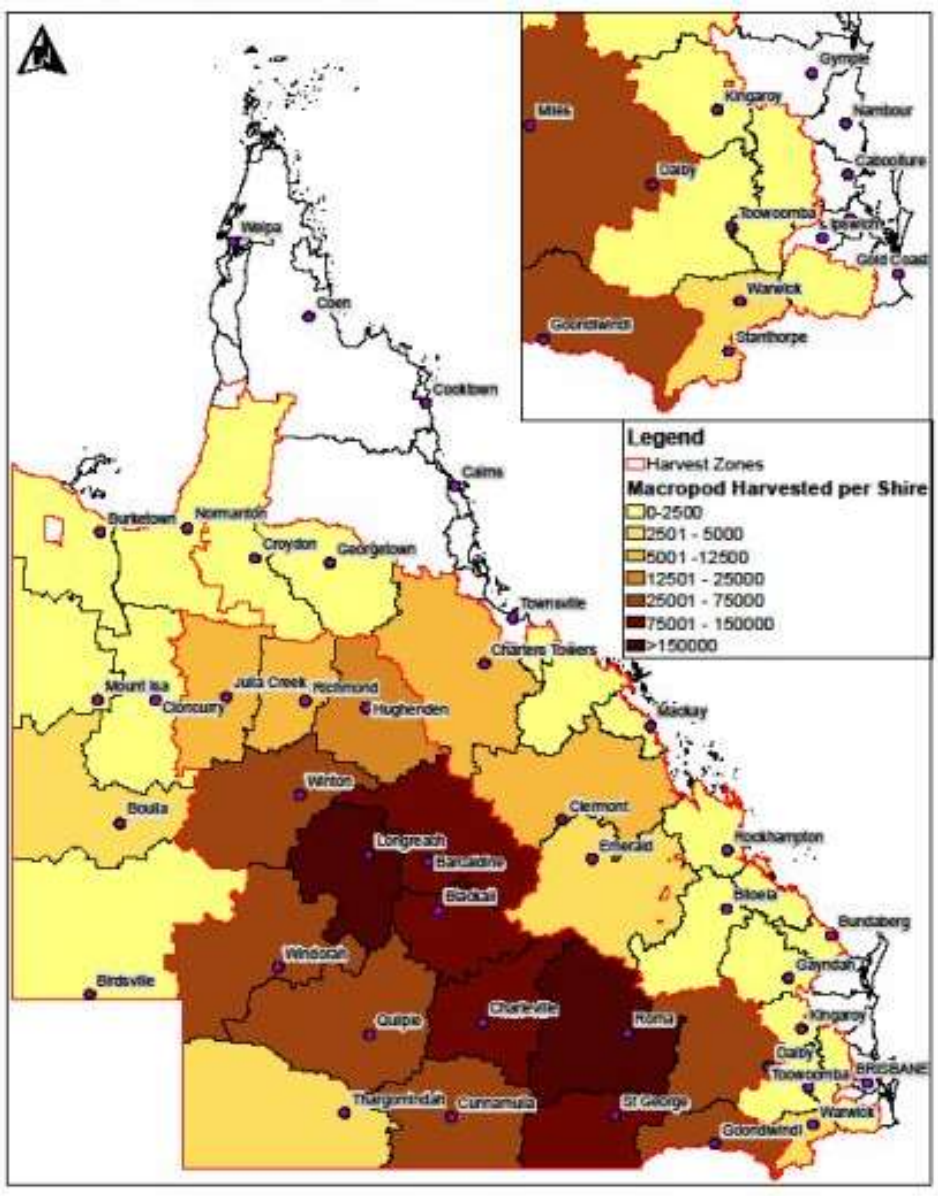


Figure 5: Estimated macropod populations in the Queensland commercial harvest zones (DEHP 2014e)

Longreach and adjacent local government areas are at the centre of the kangaroo harvesting industry in Queensland. The map below shows harvest totals for the 2013 season. Across Queensland the 2013 harvest was 4.7 percent of the total estimated 2012 kangaroo population.

Increases in kangaroo numbers have been enabled by greater water availability and permanence in the landscape, and as the control of dingoes, a key macropod predator, has become a regular practice.

Current commercial harvesting practices also affect population dynamics by removing the largest dominant males, which in turn encourages an increase in the number of younger females reproducing, increasing population density. A decade ago, around 70 percent of the commercial harvest was large males, and this has increased annually, to reach 96 percent in 2013 (DEHP 2014e).



Map 8: Queensland harvest zones showing relative amount of commercial harvesting in each local government area during the 2013 harvest period (DEHP 2014e)

SUMMARY

KEY POINTS

- The game meat industry, which harvests kangaroos and pigs across much of the region, is a significant employer and generator of income and helps to support rural and remote communities.
- Feral pigs are economic and environmental pests, and can carry and spread disease.
- Feral pigs also have economic, recreational and cultural values for the community.
- Feral pig harvesting is ineffective for the landscape-scale control of pig populations.
- Kangaroos, even though a native species, can become a pest that needs to be managed.
- The impact of unmanaged kangaroos on the grazing resource can be very high.
- Commercial harvesters do not take the full quota of kangaroos for a range of reasons. As a result, harvesting is not an effective method of controlling high kangaroo populations.

COMMUNITY FEEDBACK

- Any moves to develop strategies to manage total grazing pressure must closely involve the kangaroo industry.
- Region wide projects to manage feral pig numbers must involve the people who gain a livelihood from harvesting pigs.

FUTURE DRIVERS

- The future price of game meat will be the major driver of how these industries operate in the future.



Photo: Feral pigs being targeted in the Channel Country (DCQ).

MINING, GAS AND PETROLEUM

The mining and petroleum industry, while driving considerable economic activity in the south and the north, exports most of its products and income outside the region. Many of the large-scale operations employ fly-in-fly-out crews which limits the local flow-on employment and economic benefits. In addition, nearly all the production from these enterprises leaves the region. However some of the considerable gas production is used in the Barcaldine gas fired power station to supplement coal fired power from the national grid. Ironically, most of the liquid fuels produced in the Eromanga refinery leave the region only to be replaced with fuel from refineries in the east.

Some of the major mines located in the region include:

- The BHP Billiton Cannington Mine, about 135 kilometres south-southeast of Cloncurry, is just inside the Desert Channels region and extracts silver, lead and zinc. Most of the economic activity related to this mine flows through the Cloncurry and Townsville areas. Opened in 1997, it is expected to have a life of 25 years.
- About 50 kilometres west-south-west of Cannington is the Osborne Copper and Gold Mine, which employs 180 staff and is run as a fly-in fly-out operation. It operates both underground and open-pit operations.
- Western Mining Corporation (WMC) Fertilisers' Phosphate Hill project 150 kilometres south of Mt Isa is a combined open-cut mine and phosphoric acid, ammonia and fertiliser manufacturing plant.
- Santos, a major Australian energy company, has interests in the Cooper/Eromanga Basin oil and gas fields. Two main facilities exist in the Desert Channels region, at Ballera and Jackson. The Ballera gas plant is located in the central part of the Cooper/Eromanga Basin. Natural gas from surrounding fields is transported to the plant for processing. Gas liquids (condensate and liquid petroleum gases) are transported by pipeline to Moomba in South Australia. A gas pipeline also runs from Ballera to Mt Isa. The Jackson oil production facility, 70km southeast of Ballera processes oil from surrounding fields and pipes it to Brisbane.
- In addition, there are many small, private mining enterprises across the region. In contrast with the large mining corporations, the income generated from these small-scale operators tends to remain in the region.
- Opal mining occurs in the central part of the DCQ region from the Winton district south to the Quilpie area. Key areas include Middleton, Opalton, Kynuna, Opalville, Yaraka, Thomas Mountains, Mayneside and the Kyabra-Eromanga region.
- Gypsum is mined near Winton and transported by road and rail, mostly for use on Burdekin cane fields.

The future of mining and gas in the region is mixed. Large scale development is occurring in the Galilee Basin, which underlies much of the northeast of the region. The Galilee Basin is anticipated to contain approximately 10 coal mines involving a mix of underground and open cut operations. The impacts on the region could include large scale vegetation clearing, as well as disruptions to groundwater and surface hydrology. This is a particularly sensitive area as it is a major recharge zone for the Great Artesian Basin. It is expected as the mines go through their full Environmental Impact Assessments, a better picture of likely impacts will emerge.

The expansion of coal seam gas (CSG) from the Surat Basin into the eastern part of the region is also expected. Currently AGL Energy Ltd is exploring the tenement of ATP 529P, which is approximately 5,950 square kilometres. It is, however, expected that any full scale production will be from approximately 2018 onwards. Other companies linked to CSG exploration in the Galilee Basin include Galilee Energy Ltd, Origin Energy, Blue Energy Ltd and Comet Ridge Ltd.

The full impact of CSG on the region is currently unknown, but it is a major concern for the community, as identified in the recent Western Rivers Advisory Panel consultation (WRAP 2013). A recent report identifies the hazards to riverine ecosystems in the region from gas mining activities (Marshall et al. 2013). These include sedimentation of waterholes from construction, fragmentation of the floodplain from linear infrastructure, addition of waste water, declines in water quality, water extraction and a higher risk of introducing exotic species. Concern with CSG is focussed on the east of the region where there is a higher likelihood of gas extraction combined with the area being a significant recharge area for the Great Artesian Basin.

A future resources strategy, called Resources Q, is being developed by the Queensland Government. This strategy aims to generate a strategic 30 year vision for the resources sector. In addition, a statutory Central West Regional Plan is being developed that will provide certainty to land uses and allow for certain economic opportunities. This regional planning process will address land-use conflicts such as those between agricultural and resources sector. It will replace the current plan: http://www.dsdip.qld.gov.au/regional-planning/central-west-regional-plan.html.

Studies to help plan for the resources industry

The Lake Eyre Basin is currently the subject of a bioregional assessment program that has been developed in response to community concerns about the potential risks from CSG and coal mining operations. Science based studies are being completed that will include detailed records of the natural environment including the ecology, hydrology, geology and hydrogeology. This will be prepared with particular focus on the direct, indirect and cumulative impacts of CSG and coal mining operations. This information will be used to inform the Independent Expert Scientific Committee on CSG and coal mining. Expected completion date is by 30 June 2016. More information can be found at http://www.ga.gov.au/groundwater/our-projects/bioregional-assessment-program.html

SUMMARY

KEY POINTS

- Mining is a significant part of the economy but is very localised, with the majority of the outputs directly leaving the region.
- Future extractive activities, including large scale mines or coal seam gas operations, may have a large influence on natural resources, particularly underground and surface water hydrology.

COMMUNITY FEEDBACK

- The community has significant concerns about the impacts from coal seam gas operations and the influence on natural resources, in particular, influences on water quality and quantity.
- Coal seam gas operations are regularly raised in all forums for community consultation about the impacts on water resources and agriculture.

FUTURE DRIVERS

- Future resources strategies from the State Government will further promote the resources industry.
- The price of gas will influence the economics of future coal seam gas operations in the region.
- With increasing resource extraction in the region, a greater understanding of water hydrology will be required to ensure that the resource operations are sustainable.

ENERGY

Despite a range of energy sources in the region, the usability of energy is a significant economic cost in remote areas. Large parts of the region are beyond the electricity grid.

Solar power has increased in the region with a plant at Windorah using five concentrated solar dishes to support the town of 100 during daylight hours. This plant is expected to save up to 100,000 litres of diesel fuel per year. With increasing aspirations to reduce greenhouse gas emissions, more solar energy is expected for the region.

Hot dry rocks, or radiogenic granite, underlie large parts of the region. The proving of this potential geothermal energy source has been underway in the south of the region. This energy source has the potential to power the nation for several centuries and successful harnessing of this could be one of the region's major resource and economic developments over the next 10 to 20 years.

SUMMARY

KEY POINTS

- Providing affordable energy is difficult in remote areas, but successful projects have been initiated, including concentrated solar power at Windorah.
- Future energy production could include with new forms of geothermal energy.

COMMUNITY FEEDBACK

- Community concerns have not been raised in regards to energy production.

FUTURE DRIVERS

- A more variable climate is likely to increase energy usage in the region, and having forms of energy production that are efficient and local within the region will be a driver of change.
- New forms of energy production, such as geothermal energy need to be monitored to ensure impacts on water resources are not significant.



Photo: Solar farm at Windorah (Photo courtesy of the ABC).

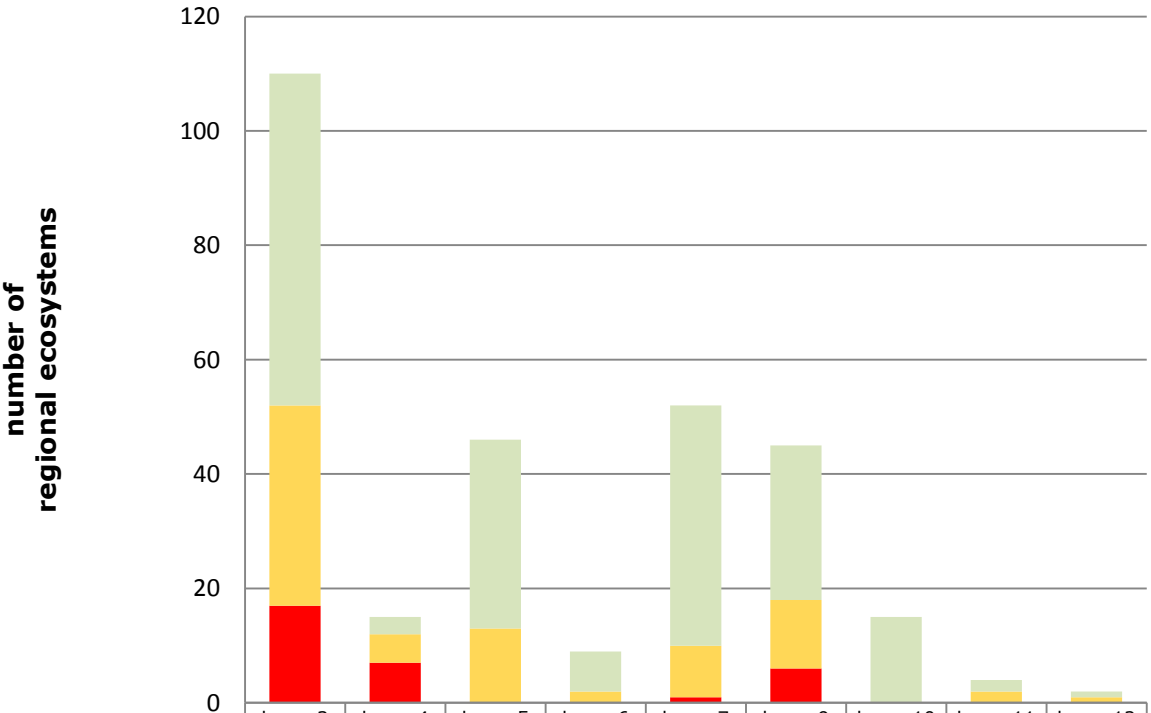
APPENDICES

APPENDIX 1: REGIONAL ECOSYSTEMS

Source: DEHP 2014d

Natural vegetation condition is widely acknowledged as a very good surrogate for biodiversity condition. In the absence of detailed data about biodiversity condition for all plants and animals in the region, an analysis of regional ecosystem variety and condition can be undertaken. From this analysis it is clear that certain types of country, or land zones, are under more pressure than others, as illustrated below.

Biodiversity status of regional ecosystems in the Desert Channels region



Land zone	lzone 3	lzone 4	lzone 5	lzone 6	lzone 7	lzone 9	lzone 10	lzone 11	lzone 12
No concern at present	58	3	33	7	42	27	15	2	1
Of concern	35	5	13	2	9	12	0	2	1
Endangered	17	7	0	0	1	6	0	0	0

Land zone	Description
3	Drainage lines with riparian habitats, waterholes, alluvial plains, floodplain habitats, artesian mound spring complexes
4	Clay plains not associated with current alluvium, with grasslands, and acacia/eucalypt woodlands
5	Old loamy and sandy plains with diverse eucalypt and acacia woodlands
6	Inland dune fields with hummock grasslands, open forblands and shrublands
7	Ironstone jump-ups and footslopes - isolated remnant plateaus and scarps with diverse open shrub and woodlands, caves and hollows
9	Undulating country with grasslands on deep cracking clay soils, and acacia woodlands
10	Sandstone ranges forming plateaus, scarps and hills, with shrublands and acacia/eucalypt woodlands
11	Hills and lowlands on metamorphic rocks with eucalypt woodlands
12	Hills and lowlands on granitic rock, with caves and crevices

Desert Channels regional ecosystems with endangered biodiversity status

ID	Description
Landzone 3: ***drainage lines with riparian habitats, waterholes, alluvial plains, floodplain habitats, artesian mound spring complexes***	
1.3.7	Red gum (Eucalyptus camaldulensis) woodland on channels and levees (south)
1.3.8	Red gum (Eucalyptus camaldulensis) woodland on channels and levees (north)
4.3.22	Springs on recent alluvia and fine-grained sedimentary rock
5.3.23	Springs on recent alluvia and fine-grained sedimentary rocks
10.3.5	Eucalyptus cambageana open-woodland on broad stream beds
10.3.16	Triodia longiceps hummock grassland, ephemeral open herblands, and Melaleuca bracteata low woodland on alluvial plains
10.3.17	Acacia excelsa and Grevillea striata low open-woodland on lake-fringing dunes
10.3.19	Acacia cambagei woodland on lakeside dunes
10.3.21	Acacia salicina and Grevillea striata low open-woodland on sandy alluvial plains
10.3.22	Clay pans, Fimbristylis sp. (Lake Buchanan) open sedgeland and spare-tussock grasslands on shallow alluvial plains (Lake Buchanan)
10.3.25	Eremophila mitchellii low open-woodland on alluvial plains
10.3.26	Lysiphyllum carronii low open-woodland on alluvial plains
10.3.29	Acacia torulosa shrubland or Triodia longiceps hummock grassland on weathered lake dunes
10.3.30	Casuarina cristata woodland on flood plains
11.3.1	Acacia harpophylla and/or Casuarina cristata open-forest on alluvial plains
11.3.17	Eucalyptus populnea woodland with Acacia harpophylla and/or Casuarina cristata on alluvial plains
11.3.21	Dichanthium sericeum and/or Astrebla spp. grassland on alluvial plains. Cracking clay soils
Landzone 4: ***Clay plains not associated with current alluvium, with grasslands , and acacia/eucalypt woodlands***	
10.4.3	Acacia harpophylla and/or Eucalyptus cambageana open-woodland on Cainozoic lake beds
11.4.3	Acacia harpophylla and/or Casuarina cristata shrubby open-forest on Cainozoic clay plains
11.4.5	Acacia argyrodendron woodland on Cainozoic clay plains
11.4.6	Acacia cambagei woodland on Cainozoic clay plains
11.4.7	Eucalyptus populnea with Acacia harpophylla and/or Casuarina cristata open-forest to woodland on Cainozoic clay plains
11.4.8	Eucalyptus cambageana woodland to open-forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains
11.4.9	Acacia harpophylla shrubby open-forest to woodland with Terminalia oblongata on Cainozoic clay plains
Landzone 7: ***Ironstone jump-ups and footslopes – isolated remnant plateaus and scarps with diverse open shrub and woodlands, caves and hollows***	
5.7.8	Acacia peuce low open-woodland between dunes
Landzone 9: ***Undulating country with grasslands on deep cracking clay soils, and acacia woodlands***	
10.9.3	Acacia harpophylla and/or Eucalyptus cambageana open-woodland to woodland on Mesozoic sediments
10.9.5	Eucalyptus melanophloia open-woodland or Lysiphyllum carronii low open-woodland on calcareous sandstones
11.9.1	Acacia harpophylla-Eucalyptus cambageana open-forest to woodland on fine-grained sedimentary rocks
11.9.5	Acacia harpophylla and/or Casuarina cristata open-forest on fine-grained sedimentary rocks
11.9.8	Macropteranthes leichhardtii thicket on fine-grained sedimentary rocks
11.9.10	Eucalyptus populnea, Acacia harpophylla open-forest on fine-grained sedimentary rocks

APPENDIX 2: PLANTS AND ANIMALS

Sources: Chapman 2009, DoE 2011, DoE 2014a, DoE 2014e, DEHP 2013

Plants of the Desert Channels region

Class	Number of species	Rare or threatened species	% of DCQ species rare or threatened	Introduced species
conifers	1	-	-	-
ferns	32	-	-	-
higher dicots	1958	26	1.32%	178
liverworts	7	-	-	-
lower dicots	14	-	-	2
monocots	531	7	1.32%	63
mosses	9	-	-	-
quillworts	1	-	-	-
uncertain	1	-	-	-
TOTAL	**2554**	**33**	**1.29%**	**243**

Vertebrates of the Desert Channels region

Class	Native	% of Australian species in DCQ region	Rare or threatened species	% of DCQ species rare or threatened	Introduced species
mammals	97	25%	18	18.5%	14
birds	372	45%	17	4.6%	7
reptiles	220	24%	2	0.9%	0
amphibians	34	15%	1	2.9%	1
bony fish	25	unknown	4	unknown	2
TOTAL	**748**	**31%**	**42**	**5.6%**	**24**

Rare and threatened plants of the Desert Channels region

NCA column indicates status under Queensland's Nature Conservation Act 1992, with
PE = presumed extinct, E = endangered, V = vulnerable, and C = common.

EPBC column indicates status under the national Environmental Protection and Biodiversity Conservation Act 1999, with
EX = extinct, CE = critically endangered, E = endangered, and V = vulnerable.

Class	Scientific Name	Common Name	NCA	EPBC
higher dicots	*Rhaphidospora bonneyana*		V	V
higher dicots	*Xerothamnella parvifolia*		V	V
higher dicots	*Ptilotus brachyanthus*		E	
higher dicots	*Eryngium fontanum*	blue devil	E	E
higher dicots	*Hydrocotyle dipleura*		V	
higher dicots	*Atriplex morrisii*		V	
higher dicots	*Maireana cheelii*		C	V
higher dicots	*Sclerolaena blakei*		V	V
higher dicots	*Sclerolaena walkeri*		V	V
higher dicots	*Austrobryonia argillicola*		E	E
higher dicots	*Euphorbia sarcostemmoides*	climbing caustic	V	
higher dicots	*Indigofera oxyrachis*		V	
higher dicots	*Myriophyllum artesium*		E	
higher dicots	*Nesaea robertsii*		E	
higher dicots	*Lawrencia buchananensis*		V	V
higher dicots	*Acacia ammophila*		V	V
higher dicots	*Acacia crombiei*	pink gidgee	V	V
higher dicots	*Acacia deuteroneura*		V	V
higher dicots	*Acacia peuce*	waddy	V	V
higher dicots	*Acacia ramiflora*		C	V
higher dicots	*Eremophila tetraptera*		V	V
higher dicots	*Kardomia squarrulosa*		V	
higher dicots	*Micromyrtus rotundifolia*		V	
higher dicots	*Hakea maconochieana*		V	V
higher dicots	*Cadellia pentastylis*	ooline	V	V
higher dicots	*Grevillea kennedyana*	flame spider-flower		V
monocots	*Eriocaulon aloefolium*	salt pipewort	E	
monocots	*Eriocaulon carsonii*		E	E
monocots	*Eriocaulon carsonii subsp. carsonii*		E	
monocots	*Eriocaulon carsonii subsp. orientale*		E	
monocots	*Eriocaulon giganticum*		E	
monocots	*Dichanthium setosum*		C	V
monocots	*Sporobolus pamelae*		E	

Rare and threatened vertebrates of the Desert Channels region

NCA column indicates status under Queensland's Nature Conservation Act 1992, with
PE = presumed extinct, E = endangered, V = vulnerable, and C = common.

EPBC column indicates status under the national Environmental Protection and Biodiversity Conservation Act 1999, with
EX = extinct, CE = critically endangered, E = endangered, and V = vulnerable.

Class	Common Name	Scientific Name	NCA	EPBC
mammals	ampurta	*Dasycercus hillieri*		E
mammals	bridled nailtail wallaby	*Onychogalea fraenata*	E	E
mammals	brush-tailed mulgara	*Dasycercus blythi*	V	
mammals	crest-tailed mulgara	*Dasycercus cristicauda*	V	V
mammals	desert rat-kangaroo	*Caloprymnus campestris*	PE	EX
mammals	dusky hopping-mouse	*Notomys fuscus*	E	V
mammals	ghost bat	*Macroderma gigas*	V	
mammals	greater bilby	*Macrotis lagotis*	E	V
mammals	Julia Creek dunnart	*Sminthopsis douglasi*	E	E
mammals	koala	*Phascolarctos cinereus*	C	V
mammals	kowari	*Dasyuroides byrnei*	V	V
mammals	northern quoll	*Dasyurus hallucatus*	C	E
mammals	orange leaf-nosed bat	*Rhinonicteris aurantia*	V	
mammals	plains rat	*Pseudomys australis*	E	V
mammals	purple-necked rock-wallaby	*Petrogale purpureicollis*	V	
mammals	south-eastern long-eared bat	*Nyctophilus corbeni*		E
mammals	southern marsupial mole	*Notoryctes typhlops*		E
mammals	water mouse	*Xeromys myoides*	V	V
birds	Australian bittern	*Botaurus poiciloptilus*		E
birds	Australian painted snipe	*Rostratula australis*	V	V
birds	black-throated finch (white-rumped subspecies)	*Poephila cincta cincta*	E	E
birds	Gouldian finch	*Erythrura gouldiae*	E	E
birds	Grey grasswren	*Amytornis barbatus barbatus*		V
birds	Herald petrel	*Pterodroma heraldica*	E	CE
birds	Major Mitchell's cockatoo	*Lophochroa leadbeateri*	V	
birds	night parrot	*Pezoporus occidentalis*	E	E
birds	painted honeyeater	*Grantiella picta*	V	
birds	plains-wanderer	*Pedionomus torquatus*	V	V
birds	powerful owl	*Ninox strenua*	V	
birds	princess parrot	*Polytelis alexandrae*	C	V
birds	red goshawk	*Erythrotriorchis radiatus*	E	V
birds	squatter pigeon (southern subspecies)	*Geophaps scripta scripta*	V	V
birds	star finch (eastern and southern)	*Neochmia ruficauda ruficauda*		E

Class	Common Name	Scientific Name	NCA	EPBC
birds	yellow chat	*Epthianura crocea*	V	
birds	yellow chat (gulf)	*Epthianura crocea crocea*	V	
reptiles	plains death adder	*Acanthophis hawkei*	C	V
reptiles	yakka skink	*Egernia rugosa*	V	V
amphibians	wallum froglet	*Crinia tinnula*	V	
bony fish	Edgbaston goby	*Chlamydogobius squamigenus*	E	V
bony fish	Elizabeth Springs goby	*Chlamydogobius micropterus*	E	E
bony fish	Murray cod	*Maccullochella peelii*		V
bony fish	redfin blue eye	*Scaturiginichthys vermeilipinnis*	E	E

APPENDIX 3: DIRECTORY OF IMPORTANT WETLANDS LISTINGS

SOURCE: DoE 2014c
Follow link to read full description

- Aramac Springs
- Austral Limestone Aggregation
- Birdsville - Durrie Waterholes Aggregation
- Cauckingburra Swamp
- Cooper Creek - Wilson River Junction
- Cooper Creek Overflow Swamps - Windorah
- Cooper Creek Swamps - Nappa Merrie
- Diamantina Lakes Area
- Diamantina Overflow Swamp - Durrie Station
- Elizabeth Springs
- Georgina River - King Creek Floodout
- Lake Buchanan
- Lake Constance
- Lake Cuddapan
- Lake Galilee
- Lake Mipia Area
- Lake Phillipi
- Lake Torquinie Area
- Lake Yamma Yamma
- Mitchell Swamp
- Moonda Lake - Shallow Lake Aggregation
- Mulligan River - Wheeler Creek Junction
- Muncoonie Lakes Area
- Toko Gorge and Waterhole

ABBREVIATIONS AND ACRONYMS

AG	Australian Government
ASL	above sea level
CAMBA	China-Australia migratory bird agreement
DCQ	Desert Channels Queensland
DAFF	Department of Agriculture, Fisheries and Forestry Queensland
DEHP	Department of Environment and Heritage Protection Queensland
DEWHA	Department of the Environment, Water, Heritage and the Arts, Australian Government
DoE	Department of the Environment, Australian Government
DNR	Department of Natural Resources Queensland
DSEWPAC	Department of Sustainability, Environment, Water, Population and Communities, Australian Government
GAB	Great Artesian Basin
JAMBA	Japan-Australia migratory bird agreement
LGA	Local Government Area
ROCKAMBA	Republic of Korea-Australia migratory bird agreement
WONS	Weeds of national significance

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