

South Australian Arid Lands **Districts and bioregions**



CONTENTS

South Australian Arid Lands districts and bioregions	3
Marree-Innaminka district	4
Marla-Oodnadatta district	5
Kingoonya district	6
Gawler Ranges district	7
North Flinders district	8
North East Pastoral district	9
Port Augusta Quorn district	10
Channel Country bioregion – a snapshot in time	11
Stony Plains bioregion – a snapshot in time	14
Simpson-Strzelecki Dunefields bioregion – a snapshot in time Flinders Lofty .	17
Block bioregion – a snapshot in time	20
Broken Hill Complex bioregion – a snapshot in time	23
Gawler bioregion – a snapshot in time	26
Finke bioregion – a snapshot in time	29
EPBC Threatened Ecological Communities	32
Endangered Ecological Community – Mound Springs of the Great Artesian Basin	33
Ramsar Wetland – Coongie Lakes	34
EPBC Threatened Fauna	35
EPBC Threatened Flora	36
Threatened Species Strategy Priority Species	37

SOUTH AUSTRALIAN ARID LANDS districts and bioregions

The SA Arid Lands landscape region is comprised of seven districts, which form the planning units for the Board.

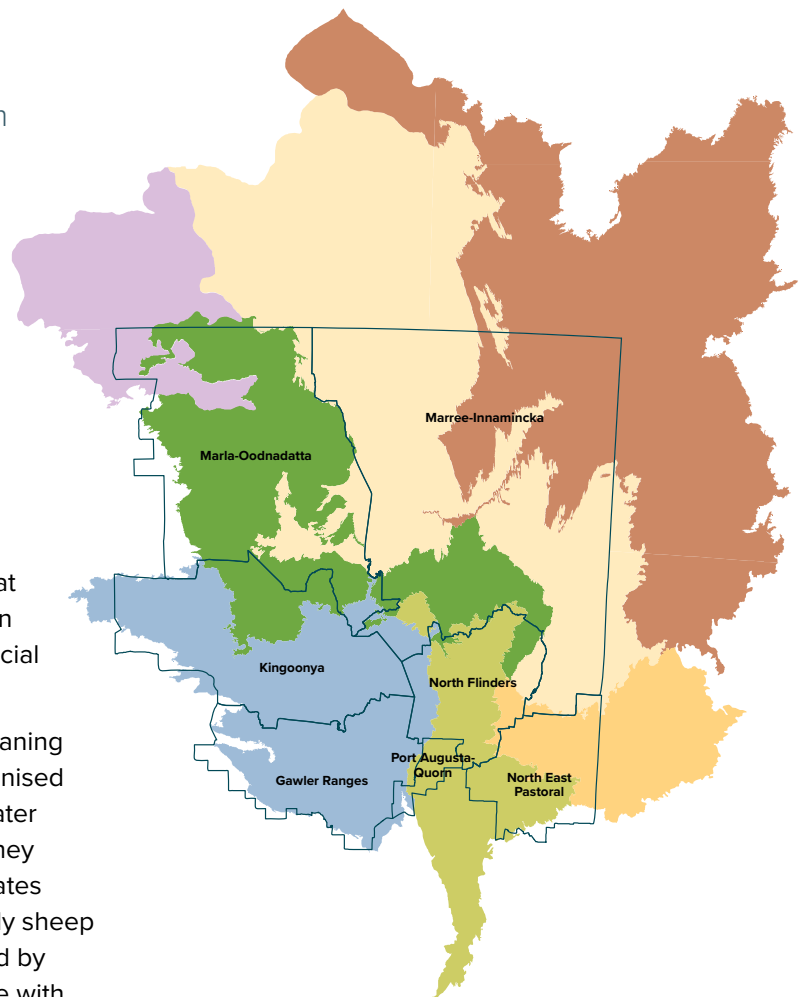
- **Marree-Innaminka**
- **Marla-Oodnadatta**
- **Kingoonya**
- **Gawler Ranges**
- **North East Pastoral**
- **North Flinders**
- **Port Augusta-Quorn**

These represent socio-economic systems – that is, areas characterised by a unique combination of geographic, demographic, economic and social features.

District boundaries have a long history and meaning for much of our community, having been recognised since the days of the Arid Areas Catchment Water Management and Soil Conservation Boards. They broadly align with the dog fence, which delineates mainly cattle enterprises in the north and mainly sheep enterprises in the south. Districts are supported by Landscape Groups which play a key liaison role with the local community.

The region (and its districts) is also overlaid by seven major bioregions¹:

- **Channel Country**
- **Stony Plains**
- **Simpson Strzelecki Dunefields**
- **Flinders Lofty Block**
- **Broken Hill Complex**
- **Gawler**
- **Finke**



BIOREGIONS:

- are characterised by distinctive interactions of climate, geology, landform, native vegetation and species which have strong influences on land use and management, offer different challenges and opportunities, and respond differently to influences from drivers of change
- are useful units for broad landscape planning.

¹ Small parts of the Great Victoria Desert, Eyre York Block and Murray-Darling Depression overlap relatively small areas within the Marla Oodnadatta, Kingoonya, Gawler Ranges and North East Pastoral districts. Descriptions of these bioregions are not included in this document.

MARREE-INNAMINCKA DISTRICT

The Marree Innamincka district lies in the north-east corner of South Australia. Table 1 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *Marree-Innamincka District Plan*.

LINKED BIOREGIONS

The district is comprised of two major bioregions:

- Channel Country
- Simpson-Strzelecki Dunefields

Smaller areas of four bioregions are also present:

- Stony Plains
- Flinders Block
- Gawler
- Broken Hill Complex



TABLE 1: MARREE-INNAMINCKA SNAPSHOT

Size	203,174 km ² (39% of SAAL)
Towns (population)	Innamincka – 131 (increased since 2001) Marree – 70 (decreased since 2001) Lyndhurst – ~20 (no trend information) Moomba – no permanent residents – fly-in, fly-out only
Aboriginal people	Wangkangurru / Yarluyandi (northern), Yandruwandha / Yawarrawarrka (north-east), Arabana (south-west), Dieri (east), Adnyamathanha (south), Malyankapa (south-east)
Land use	Aboriginal land, pastoralism (predominantly cattle), mining, tourism, conservation (public and private lands), energy exploration, service centres, towns, recreation
Catchments and key waterways	Lake Eyre Basin (LEB). Cooper, Kallakoopah, Strzelecki and Warburton Creeks, Georgina and Diamantina Rivers
National Parks and Reserves	Innamincka Regional Reserve, Malkumba-Coongie Lakes National Park, Strzelecki Regional Reserve – all Yandruwandha Yawarrawarrka Parks Advisory Committee ; Simpson Desert Regional Reserve; Simpson Desert Conservation Park; Kati Thanda-Lake Eyre National Park; Lake Torrens National Park, Malkumba-Coongie Lakes National Park; Elliot Price Conservation Park – Arabana Parks Advisory Committee

MARLA-ODNADATTA DISTRICT

The Marla-Oodnadatta district lies in the north-west corner of South Australia. Table 2 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *Marla-Oodnadatta District Plan*.

LINKED BIOREGIONS

The district is comprised of one major bioregion:

- Stony Plains

Smaller areas of four bioregions are also present:

- Simpson-Strzelecki Dune-fields
- Finke
- Great Victoria Desert (predominantly located out of SAAL region, so description not included in this document)
- Gawler



TABLE 2: MARLA OODNADATTA SNAPSHOT

Size	124,508 km ² (24% of SAAL)
Towns (population)	Coober Pedy – 1695 (decreased since 2001) Marla – 72 (decreased since 2001) Oodnadatta – 166 (increased since 2001) William Creek – ~10 (no trend available)
Aboriginal people	Arabana (south-eastern and eastern portion of district); Antakirinja Matu – Yankunytjatjara (western); Wangkangurru/Yarluyandi (north-east); Eringa (northern); Tjajiwara Unmuru (north-west); Irrwanyere Mt Dare (northern)
Land use	Aboriginal land, pastoralism (predominantly cattle), mining and energy, tourism, conservation (public and private lands), recreation, service centres, towns
Catchments and key waterways	Lake Eyre Basin (LEB). Neales, Alberga and Finke River systems. Margaret River and Chambers and Warriner Creeks feeding into Lake Eyre (Kati Thanda) South.
National Parks and Reserves	Witjira National Park – Witjira National Park Co-management Board ; Kan̩ku-Breakaways Conservation Park – Kan̩ku-Breakaways Conservation Park Co-management Board ; Kati Thanda-Lake Eyre National Park (lake portion), Wabma Kadarbu Mound Springs Conservation Park – both Arabana Parks Advisory Committee

KINGOONYA DISTRICT

The Kingoonya district lies in the central-west area of South Australia. Table 3 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *Kingoonya District Plan*.

LINKED BIOREGIONS

The district is comprised of one major bioregion:

- Gawler

Smaller areas of two bioregions are also present:

- Stony Plains
- Great Victoria Desert (predominantly located out of SAAL region, so description not included in this document)



TABLE 3: ABOUT THE KINGOONYA DISTRICT – SNAPSHOT

Size	76,394 km ² (15% of SAAL)
Towns (population)	Roxby Downs – 4702 (increased since 2001) Andamooka – 528 (decreased since 2001) Woomera – 215 (increased since 2001) Kingoonya – ~10 Glendambo – 77 (increased since 2001) Tarcoola – 38 (increased since 2001)
Aboriginal people	Arabana (north-east), Kokatha (south-east), Gawler Ranges (south-west) and Antakirinja Matu – Yankunytjatjara (north-west).
Land use	Pastoralism (predominantly sheep), mining and energy, military, tourism, conservation (public and private lands), recreation, service centres, towns
Catchment and key waterways	Lake Eyre Basin (LEB) and part Lake Torrens catchment. Minor drainage into Lake Gairdner and other salt lakes to south. Very few waterways. Upper portions of Margaret River and Chambers Creek feeding into Lake Eyre (Kati Thanda) South.
National Parks and Reserves	Part of Lake Gairdner National Park – Lake Gairdner National Park Co-management Board ; part of Lake Torrens National Park

GAWLER RANGES DISTRICT

The Gawler Ranges district is located in the central southwestern area of South Australia. Table 4 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *Gawler Ranges District Plan*.

LINKED BIOREGIONS

The district is comprised of one major bioregion:

- Gawler

Smaller areas of two bioregions are also present:

- Great Victoria Desert (predominantly located out of SAAL region, so description not included in this document)
- Eyre Yorke Block (predominantly located out of SAAL region, so description not included in this document)



TABLE 4: ABOUT THE GAWLER RANGES DISTRICT – SNAPSHOT

Size	50,017 km ² (10% of SAAL)
Towns (population)	Iron Knob – 166 (decreased since 2001)
Aboriginal people	Kokatha (north-eastern part of district); Gawler Ranges (western); Barngarla (south-eastern); Adnyamathanha (eastern)
Land use	Pastoralism (predominantly sheep), mining and energy, tourism, conservation (public and private lands), recreation, service centres, towns
Catchment and key waterways	Part Lake Torrens catchment. Minor drainage into Lake Gairdner and other salt lakes and towards Spencer Gulf. Very few waterways.
National Parks and Reserves	Parts of Gawler Ranges National Park – Gawler Ranges National Park Advisory Committee ; part of Lake Gairdner National Park – Lake Gairdner National Park Co-management Board ; part of Lake Torrens National Park, Lake Gilles Conservation Park and Pureba Conservation Park

NORTH FLINDERS DISTRICT

The North Flinders district is located in the central eastern area of South Australia. Table 5 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *North Flinders District Plan*.

LINKED BIOREGIONS

The district is comprised of one major bioregion:

- Flinders Lofty Block

Smaller areas of three bioregions are also present:

- Stony Plains
- Gawler
- Broken Hill Complex



TABLE 5: ABOUT THE NORTH FLINDERS DISTRICT – SNAPSHOT

Size	35,543 km ² (7% of SAAL)
Towns (population)	Leigh Creek – 505 (increased since 2001) Copley – 104 (increased since 2001) Blinman – 151 (increased since 2001) Beltana – 83 (increased since 2001) Parachilna – ~15 (no trend information)
Aboriginal people	Adnyamathanha (majority of district); Kokatha (portions of Lake Torrens)
Land use	Aboriginal land, pastoralism (predominantly sheep), mining and energy, tourism, conservation (public and private lands), recreation, service centres, towns.
Catchments and key waterways	Predominantly Lake Torrens and Lake Frome catchments but some linkage to Lower Murray and Willochra Creek. Numerous ephemeral creeks and waterways. Several permanent springs and waterholes in Ranges.
National Parks and Reserves	Ikara-Flinders Ranges National Park – Ikara-Flinders Ranges National Park Co-management Board ; Vulkathunha Gammon Ranges National Park – Vulkathunha-Gammon Ranges National Park Co-management Board ; Lake Frome Regional Reserve; part of Lake Torrens National Park

NORTH EAST PASTORAL DISTRICT

The North East Pastoral district is located in the central eastern area of South Australia. Table 6 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *North East Pastoral District Plan*.

LINKED BIOREGIONS

The district is comprised of two major bioregions:

- Flinders Lofty Block
- Broken Hill Complex

A smaller area of one bioregion is also present:

- Murray-Darling Depression. As this bioregion is predominantly located out of the SAAL region, a description is not included in this document. Note, however, that any ground and surface water resources management occurring with SAAL region's portion of the Murray Darling Depression bioregion must be compliant with the Murray Darling Basin Plan, as per the *SAAL NRM Business Plan* (Volume 2).



TABLE 6: ABOUT THE NORTH EAST PASTORAL DISTRICT – SNAPSHOT

Size	31,445 km ² (6% of SAAL)
Towns (population)	Yunta – 104 (increased since 2001) Mannahill – ~8 (no trend information available) Olary – ~8 (no trend information available) Cockburn – 90 (increased since 2001)
Aboriginal people	Adnyamathanha (north-west); Wilyakali (south-east); Ngadjuri (south-west)
Land use	Pastoralism (predominantly sheep), mining and energy, conservation (public and private lands), recreation, service centres, towns
Catchments and key waterways	Water resources are not a particular feature of the North East District. In the range country within the area are fractured rock groundwater aquifers with some spring outlets between Yunta and Olary. For the most part, however, there are very few reliable natural waters. The southern area falls within the Murray Darling catchment.
National Parks and Reserves	Bimbowrie Conservation Park

PORT AUGUSTA-QUORN DISTRICT

The Port Augusta-Quorn district is located at the top of the Spencer Gulf and is the transition from the Mid North to the Far North of South Australia. Table 7 provides a snapshot of some of the district's key geographic and demographic characteristics. More information is available in the *Port Augusta Quorn District Plan*.

LINKED BIOREGIONS

The district is comprised of one major bioregion:

- Flinders Lofty Block

A smaller area of the Gawler bioregion is also present.



TABLE 7: PORT AUGUSTA-QUORN SNAPSHOT

Size	5,380 km ² (1% of SAAL)
Towns (population)	Port Augusta – 13,862 Quorn – 1,230
Aboriginal people	Nukunu (along the eastern coast and ranges); Barngarla (along the western coast)
Land use	Grazing, marginal cropping, mining and renewable energy, tourism, horticulture, conservation (public and private lands), recreation, service centres, towns
Catchments and key waterways	Saltia Creek and catchment, Willochra Creek and catchment, salt lakes around Port Augusta including Bird Lake. Minor drainage into the Upper Spencer Gulf. Murray River water is the main water supply for the Port Augusta and Quorn townships, while some rural properties utilise groundwater from bores.
National Parks and Reserves	Upper Spencer Gulf Marine Park, Winninowie Conservation Park, Mt Brown Conservation Park, Dutchman's Stern Conservation Park, Buckaringa (Australian Wildlife Conservancy)

CHANNEL COUNTRY BIOREGION

– a snapshot in time

Quick facts

The Channel Country is located in the far north-east corner of the SA Arid Lands region extending into Queensland, New South Wales and the Northern Territory.

Associated landscape districts

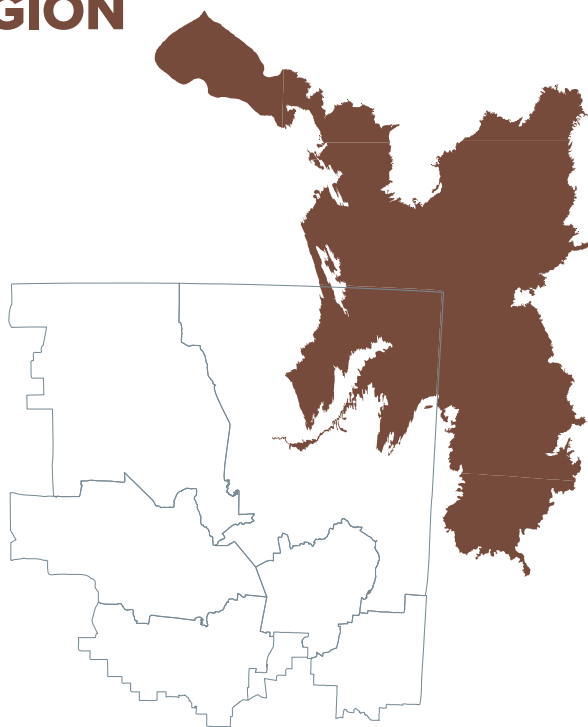
– Marree-Innaminka district (see p. 4); the Desert Channels region of Queensland; the Western Local Land Services region of New South Wales; Territory NRM region in the Northern Territory

Size 51,745 km² (10% of SAAL)

Key waterways

Lake Eyre Basin (LEB): Cooper, Kallakoopah, Strzelecki and Warburton Creeks, Georgina and Diamantina Rivers

Climate – arid with very dry, hot summers and short, dry winters. Monthly average temperature ranges between 8-41°C. Rainfall is unpredictable and variable across the bioregion, but generally summer dominant. Average rainfall is 175 mm (1984-current).



Some^c of our community values

SOCIAL – Innaminka, Mungeranie and Public Access Routes (Warburton Crossing, Walkers Crossing and Mungeranie Bore)

CULTURAL – Birdsville Track, Burkes Memorial, Cordillo Downs Woolshed, Elizabeth Symons Nursing Home, Grays Tree, Horse Capstan Pump and Well, Howitts Depot Memorial, Kings Marker, Koonchera Dune, Mona Downs Homestead, Wills grave, ruins (Cadelga Outstation, Clifton Hill, Miranda and Mulka)

ECONOMIC – Birdsville Track, Cooper Basin, Innaminka Regional Reserve, Lake Hope, Moomba, The Outback Loop

ENVIRONMENTAL – Rivers, creeks, waterholes, swamps, lakes (all), National Parks and Reserves (all), *Acacia pickardii* sites, land systems (Bloodwood, Kunchera and Diamantina), Cordillo Downs, Mungeranie, Sturt Sandy Desert

^c Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

How the Channel Country system looks and operates...

Two rich picture maps (Figure 4) highlight how environmental, cultural, social and economic aspects of the Channel Country system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

It can be seen in Figure 4 that Channel Country features extensive drainage systems, braided channels, vast floodplains and terminal lakes, with highly variable flow patterns, inundation frequency, salinity and vegetation communities. Gibber plains, low hills and mesas, and vegetated, relatively stable, high sand dunes with swale wetlands

separate the major drainage basins/channels. This bioregion contains several nationally important wetlands (eg Coongie Lakes Ramsar, Goyder Lagoon) which offer key habitat for waterbirds and other biodiversity.

Boom – (unpredictable)



Bust

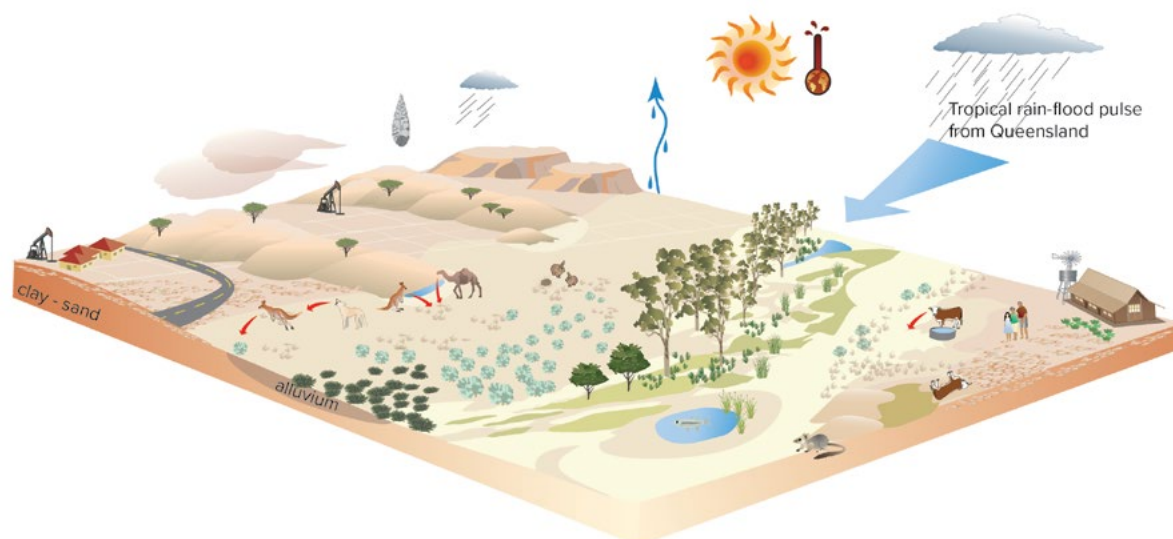
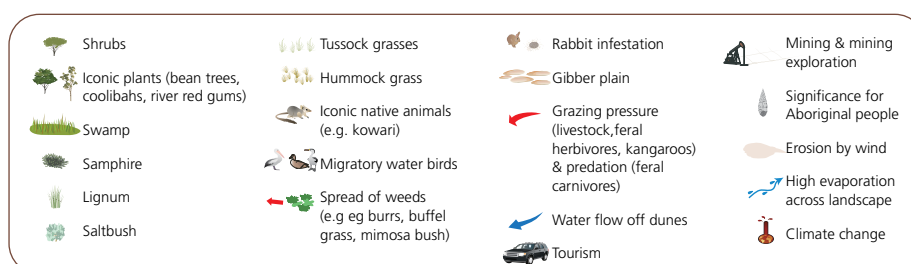


FIGURE 4: Channel Country characteristics during extreme boom and bust periods



...in boom periods Local and/or interstate rainfall fills the extensive network of main channels (eg Cooper Creek, Diamantina River), waterholes (eg Goyder Lagoon), and wetlands on the floodplains and between dunes. This brings an influx of nutrients, triggering germination and a burst of fresh growth in native vegetation (eg tussock grasses, saltbush, lignum and cane grass) and invasive weeds (eg Mimosa Bush, Noogoora Burr and Buffel Grass). Populations of native and non-native, aquatic and terrestrial animals (fish, frogs, birds, livestock, camels, rabbits and pigs) can significantly increase, and migratory birds, flock to the area, taking advantage of the resource-rich conditions to breed. Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

...in bust periods The system is less productive. Vegetation cover has decreased overall and the remaining perennial vegetation may be well-browsed. Animal populations have declined and withdrawn to landscape refugia from which they can rapidly re-colonise when conditions are suitable. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils. Reduced vegetation cover combined with high winds characteristic of the region can lead to wind erosion and dust storms. Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

Examples of change – challenges and opportunities

There are a number of processes driving change in the Channel Country system that may bring positive and negative changes to the features of this system – economic, social, cultural and environmental – that we value.

For example, while local rainfall contributes to local productivity, a full boom period in the South Australian Channel Country relies on monsoon rain falling high up the Queensland portion of the vast inland catchment of the Lake Eyre Basin (LEB). This is a highly unpredictable, episodic process, strongly influenced by local, interstate, national and global climatic influences.

Historically it is also a highly active water and wind erosion area.

Climate change will therefore have special implications here. Local temperatures are projected to increase along with evapotranspiration, while local and upstream rainfall is likely to be increasingly variable, with longer periods of below average rainfall punctuated by above average, intense rainfall events. These factors will strongly influence this already highly variable system, necessitating adaptation by land managers and native animals and plants.

This will also have implications for the values our community identified. Tourism, oil and gas exploration and cattle enterprises will all need to be highly adaptive, flexible and responsive to favourable times to endure. The role of local permanent waterholes (refugia) will also be central in sustaining aquatic, and associated riparian ecosystems for potentially longer periods of time, making it particularly important to maintain the current connectivity, persistence and water quality of aquatic systems so that the natural environment has the capacity to cope and adapt over time to the new conditions.

There are other drivers at play too, which can further exacerbate the climate change driver influences.

During extended dry times, the system's plants and animals are more vulnerable to competition by unmanaged feral and domestic animals. For example, the concentration of animals within the vicinity of watered areas can lead to over-grazing, trampling and compaction by hard hooved animals, and a decrease in water quality. The recent arrival of Sleepy Cod into this system from upstream also has potential to highly impact local native species, particularly during dry times, and may affect the viability of the Mulka fishery if its range expands to the lower Cooper.

Changes in water management, such as an increase in water capture occurring upstream arising potentially as a result of the repeal of the Wild Rivers legislation, or over extraction of groundwater by industry (eg mining, pastoral) from aquifers in the upper Cooper catchment, could lead to lowering the local water table and a reduction of bore pressure.

Ongoing monitoring and maintenance of bore infrastructure and licensing of water supply will be key to maintaining a sustainable supply.

Other drivers of change include inappropriate management of weed invasions, such as species which can obstruct watercourses (Mimosa Bush) and change fire regimes (Buffel Grass); or tourism impacts on environmental and cultural features arising from harvesting of firewood, physical damage and rubbish disposal.

In combination, these pressures have a range of influences, such as reducing vegetation cover and/or changing composition from desirable to less palatable species; impacting soil profiles and increasing the risk of wind and water erosion. Ultimately, we need to manage the drivers that influence our environment to maintain what we value the Channel Country for – our pastoral industry, permanent waterholes, cultural sites and generally the features of the Channel Country that appeal to travellers.

With challenges come opportunities, however, for communities and industries to be both innovative and sustainable in their practices so that they remain resilient in the face of change.

STONY PLAINS BIOREGION

– a snapshot in time

Quick facts

Stony Plains extends across the centre and far north-west of the SA Arid Lands region and slightly beyond into the Northern Territory NRM region. Of all the bioregions, the Stony Plains includes the most country on both sides of the Dog Fence.

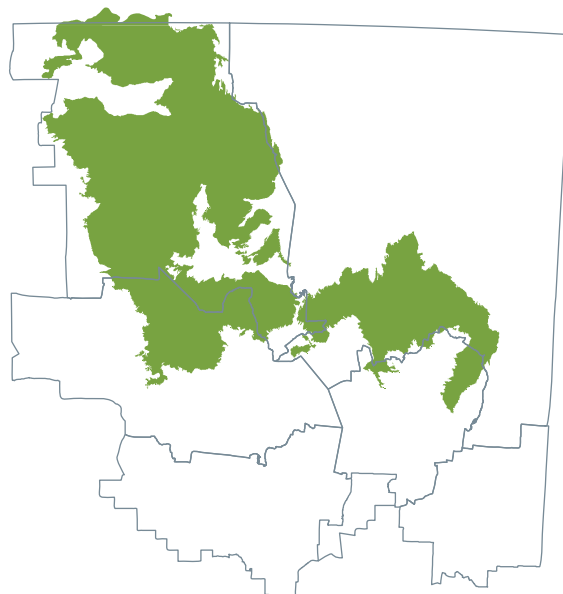
Associated landscape districts

Primarily Marla-Oodnadatta district (see p. 5) and Marree-Innaminka district (see p. 4); Kingoonya district (see p. 6); North Flinders district (see p. 8).

Size 129,240 km² (25% of SAAL)

Key waterways – Neales River, Peake Creek (also see Simpson-Strzelecki Dunefields, p. 17), Macumba River, Alberga Creek (also see Finke, p. 29)

Climate – very arid climate with extreme temperatures. Monthly average temperatures range from 9-42°C. Rainfall is summer dominant and averages between 174mm (north) and 224 mm (south) (1939-current).



Some^d of our community values

SOCIAL – Public Access Routes, small towns, waterholes, Lake Frome shoreline on 'Plains Block'

CULTURAL – creeks, waterholes and springs; historic railway sidings, lines and bridges; historic ruins, woolsheds and repeater towers; pastoral stations; small towns; Finniss Springs Aboriginal Land, Lake Cadibarrawirracanna, Oolgelima Creek, Painted Desert, Painted Hills, Simpson Desert, Stuart Creek Opal Diggings, Kaṅku-Breakaways Conservation Park

ECONOMIC – roads, tracks and highways; mining ventures; opal mining; historic railway stations/sidings; small towns; Coward Springs, GAB, GAB springs, Mt Dare, Ghan Railway, Painted Hills, Stuart Creek, Kaṅku-Breakaways Conservation Park, Witjira National Park, Wootana geothermal exploration licenses

ENVIRONMENTAL – Watercourses, springs, lakes, waterholes, rockholes (all), National Parks and Reserves (all), land systems (Arrowie, Breakaways, Paisley), Crispe Bore, Davenport Range, Dickinna Hill area, Finke Floodout, Floodout country, Gregory Overflow, Moon Plain, Painted Desert, Painted Hills, Kaṅku-Breakaways Conservation Park, The Dismal Plain.

^d Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

Two rich picture maps (Figure 5) highlight how environmental, cultural, social and economic aspects of the Stony Plains system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

It can be seen in Figure 5 that Stony Plains contain undulating stony and gypsum plains covered with ephemeral species, shrubs and grasslands, with more diverse vegetation on ranges.

...in 'boom' periods Higher levels of local and interstate rainfall fill channels and waterholes before flowing towards salt lakes and salt pans, triggering a burst of germination and fresh growth in native vegetation (eg tussock grasses, salt bush, mulgas) and invasive species (eg Buffel Grass, Mimosa Bush). Populations of native and non-native, terrestrial and aquatic animals (native mammals, livestock, donkeys, horses, feral camels, feral goats, wild dogs, cats and foxes) can significantly increase. Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

The top diagram shows a healthy landscape with a river, green vegetation, and various animals (cattle, sheep, kangaroos). The bottom diagram shows the same landscape after climate change, with a dry, cracked riverbed, sparse vegetation, and a large area of dead, brown trees. A blue arrow labeled "Flow to salt lakes" points from the top diagram to the bottom one, indicating the direction of the change.

	Mulga		Spread of weeds (buffel grass, mimosa bush, date palms around springs)		Township (e.g. Coober Pedy)		Transport of mine products
	Iconic plants (coolibahs)				Cracking clay		Erosion by wind
	Gilgai		Gibber stones on the surface of soil		Grazing pressure from stock & feral pests, predation from feral pests		Erosion of bank by water
	Saltbush		Breakaways		Tourism		High evaporation across landscape
	Samphire		Significance for Aboriginal people		Mining & mining exploration		Climate change
	Tussock grasses						
	Dog fence						

...in 'bust' periods The system is less productive. Vegetation has decreased overall with the remaining perennial vegetation possibly well-browsed. Animal populations have declined and withdrawn to landscape refugia (eg permanent waterholes) from which they can rapidly re-colonise when conditions are suitable. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils. Reduced vegetation cover, combined with mechanical damage to the stony mantle, can lead to wind erosion and associated dust storms, as well as accelerated water erosion when rain does fall. Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

Examples of change – challenges and opportunities

There are a number of processes driving change in the Stony Plains system that may bring positive and negative changes to the features of this system – economic, social, cultural and environmental – that we value.

Stony Plains is well-serviced through its network of smaller towns, primarily through the opal mining town of Coober Pedy. This bioregion has well-diversified enterprises such as mining (eg copper-gold, iron, precious stones); pastoral (sheep wool and meat, and cattle); nature-based and cultural tourism (eg The Breakaways, Witjira National Park, Algebuckina), as well as a rich service industry which offers diverse employment opportunities.

This improves the system's ability to respond positively to economic changes such as those driven by fluctuations in price or demand for tourism; iron ore, copper, gold, opal, coal; beef and sheep meat; and wool; or renewable energy sources like geothermal, solar and wind.

This resilience will likely be bolstered further following construction of an improved road north of Coober Pedy, from Marla to the Anangu Pitjantjatjara Yankunytjatjara Lands, which is expected to reduce wear and tear on vehicles; improve access to services; increase visitor numbers; improve economic opportunities and generally improve the overall standard of living in this area.

Also, exploration interest in the gas and petroleum reserves of the Arkaringa Basin may further improve the region's economic opportunities. However, associated risks to Aboriginal cultural artefacts and sites, as well as to groundwater and associated surface water aquatic ecosystems, particularly GAB mound springs must be understood and mitigated.

Also, as the mining and pastoral industries both rely on GAB bores; ongoing monitoring and maintenance of bore infrastructure and licensing of water supply will be key to maintaining a sustainable supply.

Associated with this are the bore-fed wetlands in this and other systems which present a complex interaction between economic, social and environmental values as they result from uncontrolled, free-flowing bores, are often highly valued for their recreation amenity and as wildlife refuges but significantly impact other values by reducing nearby artesian and bore pressure, affecting other water users and GAB mound springs, for example (eg North Freeling Springs and Big Blythe).

Similarly, although valued for their economic potential, Date Palms have become an environmental weed (eg Dalhousie Springs) reducing or even ceasing water flow in GAB mound springs, causing significant impacts to water-dependent species.

Also, while increasing nature-based tourism brings significant opportunity it will also require additional infrastructure (eg tracks, serviced camping areas and signage) to avoid impact and maintain the natural, historic and cultural values of sites such as GAB springs, Breakaways, Painted Desert and Witjira National Park. Likewise, at a local level, impacts may be felt through the additional burden on Coober Pedy's desalination plant, which currently produces water at a cost significantly higher than for other areas in Australia.

Climate change is also already a significant driver of change in this system. While Coober Pedy has historically adapted to extreme summer heat by building underground dwellings, other towns are more susceptible to heatwaves. Anecdotal evidence identified Oodnadatta as experiencing power losses during heatwaves. Lack of air conditioning can cause significant stress, particularly on vulnerable community members. To ensure the survival of this town with its historic, social and tourism values, it may need assistance in preparing and adjusting to this change.

Likewise, the semi-permanent and permanent waterholes (eg Algebuckina) of this system are valued for their provision of ecosystem services, such as safe harbour to wildlife and livestock during extended dry times. However, the frequency of waterhole-filling events are likely to decrease through climate change; to ensure they are able to persist as refugia, remaining healthy and connected, this must be considered in future management scenarios.

Changes in rainfall seasonality and volume, increases in temperature and high evapotranspiration rates may also have implications for the emergence of the perennial grasses that underpin pastoral enterprises; the carpets of wildflowers that are a drawcard for tourists; the spread of Buffel Grass and its link to changed fire regimes; and overall increase system vulnerability to droughting and erosion.

SIMPSON-STRZELECKI DUNEFIELDS BIOREGION

– a snapshot in time

Quick facts

The Simpson Strzelecki Dunefields extends across the centre and north-east of the SA Arid Lands region and beyond into the Northern Territory NRM region.

Associated landscape districts

Primarily in the Marree-Innaminka district (see p. 4), with smaller areas in the Marla-Oodnadatta (see p. 5), North Flinders (see p. 8) and North East Pastoral (see p. 9) districts.

Size 136,822 km² (26% of SAAL)

Key waterway/s Cooper Creek, Warburton Creek, Strzelecki Creek, Kallakoopah Creek. Lake Eyre Basin. All ephemeral.

Climate – very arid climate that includes the driest area of Australia. Monthly average temperature ranges between 8-42°C. Rainfall is unreliable but usually occurs during summer storms. Median rainfall is 125mm (averaged across whole bioregion).



Some^e of our community values

SOCIAL – Bore track, Public Access Routes (Lake Cadibarrawirracanna, Lake Eyre (Kati Thanda) – Halligan Bay, Lake Eyre – Level Post Bay), Montecollina Bore and wetland

CULTURAL – Boorthanna Siding ruins, Box Creek Siding, Killalpaninna Mission, Lake Eyre North, Kati Thanda-Lake Eyre National Park, Lake Eyre (Kati Thanda) South, Lake Frome, Neales River System, Oasis Bore, Tinga Tingana Homestead ruin

ECONOMIC – GAB BHP Wellfield A, GAB BHP Wellfield B, Innaminka area geothermal exploration licenses, Kati Thanda-Lake Eyre National Park, Lake Frome, Moomba gas pipelines, Oodnadatta Track, Simpson Desert Conservation Park, Simpson Desert Recreational Reserve, Strzelecki Track

ENVIRONMENTAL – Watercourses, springs, lakes, waterholes (all), National Parks and Reserves (all), Green Gully, Kalamurina Station, Lake Frome tertiary deposits, Montecollina Bore and wetland, Moppa-Collina Channel, Oasis Bore

^e Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

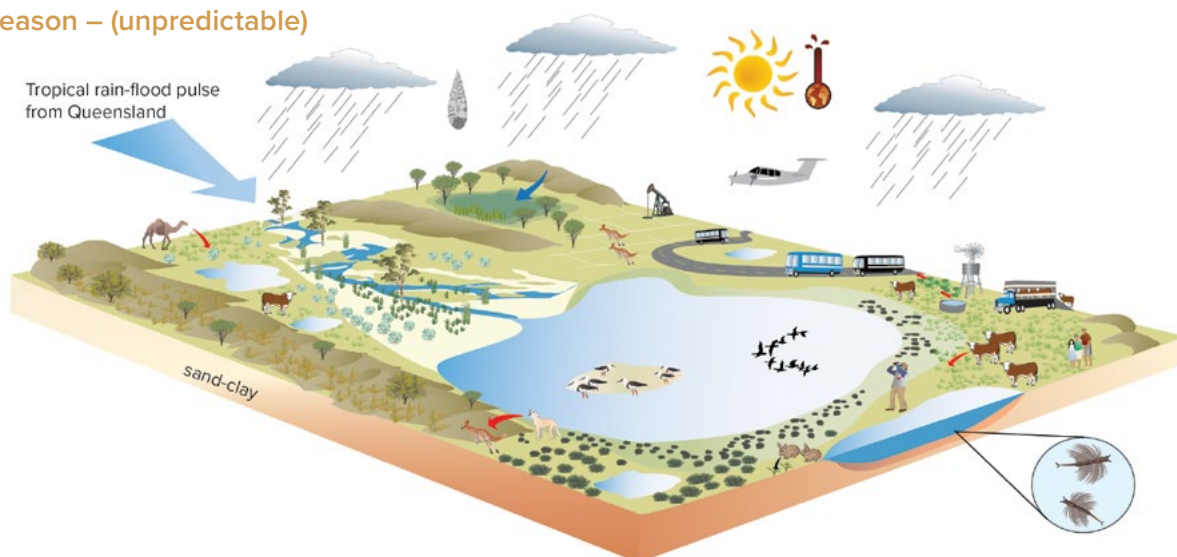
How the Simpson-Strzelecki Dunefields system looks and operates...

Two rich picture maps (Figure 6) highlight how environmental, cultural, social and economic aspects of the Simpson-Strzelecki Dunefields system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

It can be seen in Figure 6 that Simpson-Strzelecki Dunefields feature a complex of relatively high, parallel sand dunes, interspersed with salt lakes, salt pans, sand drinks and sand plains. This system responds prolifically to rain, which collects in highly productive swale swamps and is a key factor in determining which plants and animals are present.

...in boom periods High volumes of water falling as local and interstate rainfall (Queensland and Northern Territory) fill channels, waterholes and dune swales, before collecting in salt lakes and salt pans, triggering a burst of germination and fresh growth of native vegetation (eg spinifex hummock grasslands and acacia), particularly in dune swales, as well as weed invasion (eg Mimosa Bush and Buffel Grass).

Boom Season – (unpredictable)



Bust Season

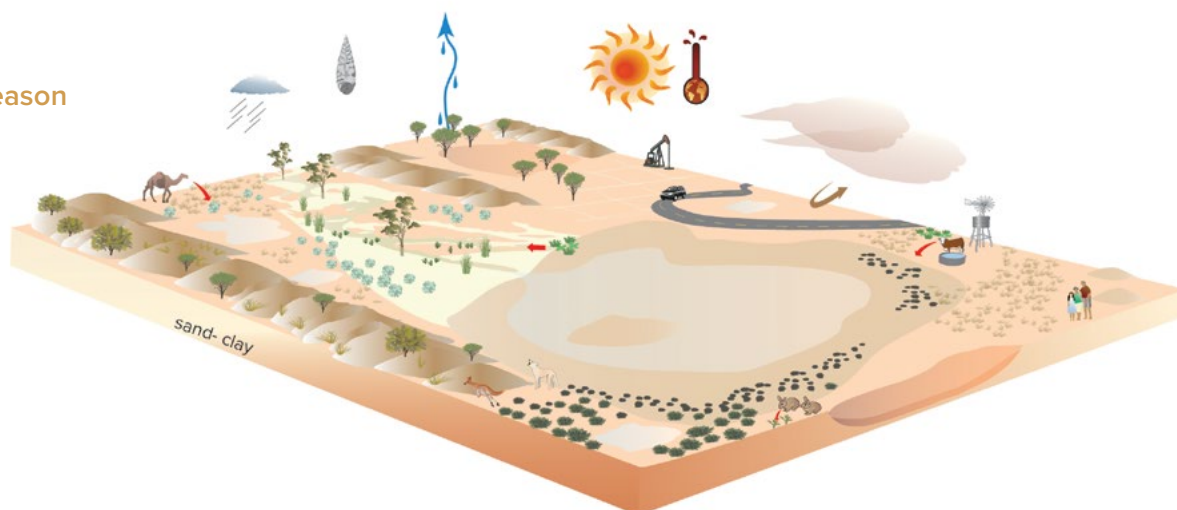
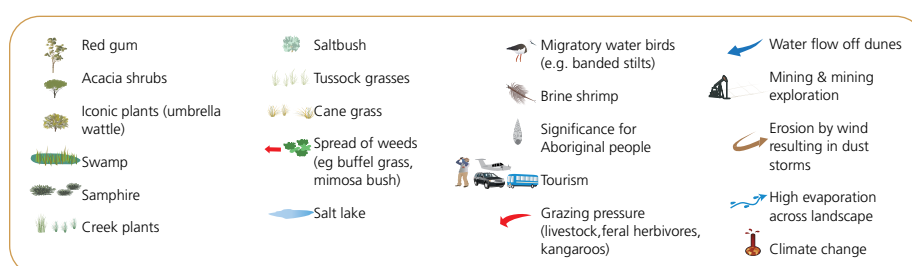


FIGURE 6: Simpson-Strzelecki Dunefields during extreme boom and bust periods



Populations of native and non-native, aquatic and terrestrial animals, including migratory birds, fish, shield shrimp (in salt lakes), livestock, rabbits, feral camels, donkeys, horses, kangaroos and wild dogs can significantly increase. Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

...in bust periods The system is less productive. Vegetation has decreased overall with the remaining perennial vegetation possibly well-browsed. Animal populations have declined and withdrawn to landscape refugia from which they can rapidly re-colonise when conditions are suitable. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils. Reduced vegetation cover combined with high winds can severely increase wind erosion and associated dust storms in this bioregion. Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

Examples of change – challenges and opportunities

There are a number of processes driving change in the Simpson-Strzelecki Dunefields that may bring positive and negative changes to the features of this system – economic, social, cultural and environmental – that we value.

One example of a major economic driver that has implications for this very remote system is the proposed sealing of the Strzelecki Track between Lyndhurst and Innamincka. An historic Aboriginal trade route and a key exploration and stock route, the Strzelecki Track is a significant icon in the SA Arid Lands region, passing through three other bioregions – starting from Flinders Lofty Block, through the Stony Plains and Simpson- Strzelecki, and terminating in the Channel Country.

Like many other unsealed roads in the region, however, the track is frequently closed due to floodouts, leaving the few towns and associated people and services stranded and closed for tourists and freight delivery.

Its sealing was identified as a priority project by the South Australian Government in 2016 in order to improve access to the oil and gas reserves at Moomba. This will safeguard against road closures due to wet weather and flooding, providing an improved access road for local townsfolk, pastoralists, tourists and services; reduce transport wear and tear and travel times; increase safety; and reduce transport operating costs.

It is highly likely to also bring benefit to potential expansion of the geothermal energy around Innamincka.

There will be trade-offs, however.

Many people value the track for its links to history and memory, its 'outback experience' and its environmental values; while this is likely to bring benefits, there will also be increased pressure on the environment due to increased numbers of people passing through these systems.

Climate change has implications here too.

The Simpson Strzelecki system relies primarily on local rainfall that is occasionally supplemented by floodwaters driven through its rivers from upstream rainfall in the northwest (Finke bioregion and the Northern Territory), the northeast (Channel Country bioregion and Queensland) and the south-east (Flinders Lofty Block bioregion) towards the vast

inland catchment of the Lake Eyre Basin, a key but unpredictable process that can give rise to a highly productive 'boom' period.

More variable regional rainfall, reductions in winter rainfall (in the southern portion), or reductions in interstate rainfall are highly likely and may impact the persistence, connectivity and water quality of the semi-permanent and permanent waterholes which help sustain aquatic and associated riparian ecosystems. Improving the capacity of the natural environment to cope and adapt over time to new conditions is central to reducing impact to native flora and fauna and pastoral productivity.

A reduction of water in terminal lakes such as Lake Eyre (Kati-Thanda) may also impact the tourism industry, given its popularity with tourists and birdwatchers.

Higher temperatures and extended heat waves associated with climate change will also have likely implications for infrastructure (eg generators, air conditioners) and outdoor work, energy supplies as well as increasing the rate by which water disappears from the landscape through evapotranspiration.

Also, as the gas and petroleum and pastoral industries both rely on GAB bores in this system; ongoing monitoring and maintenance of bore infrastructure and licensing of water supply will be key to maintaining a sustainable supply.

Historically the Simpson Strzelecki has been a highly active wind erosion area and source of continent-wide dust storms. To reduce the likelihood of increased dust storms, land managers will need the capacity, knowledge and flexibility to respond to loss of vegetation cover by timely reduction of grazing pressure of livestock and feral herbivores.

There will also be implications for the values our community identified including the Simpson Strzelecki's wildlife refuges and conservation reserves (eg Kalamurina Station, Munga-Thirri Simpson Desert National Park, Kati-Thanda Lake Eyre National Park), social and recreation locations (eg Montecollina Bore and wetland), cultural locations (eg Kilalpaninna Mission, Lake Frome), and the system's two major industries (petroleum and gas and cattle).

FLINDERS LOFTY BLOCK BIOREGION

– a snapshot in time

Quick facts

Flinders Lofty block is located in the south east of the SA Arid Lands region extending south beyond our region and into the Northern and Yorke Landscape region in South Australia.

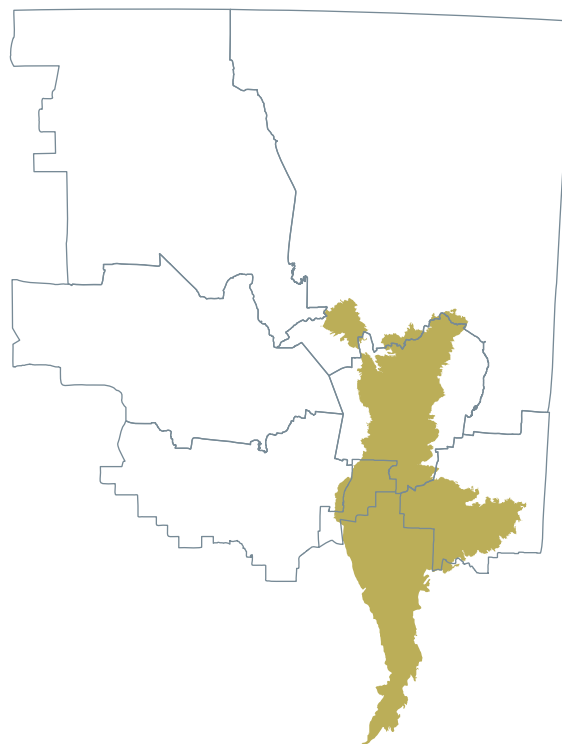
Associated landscape districts

Primarily North Flinders (see p. 8) and North East Pastoral districts (see p. 9); Marree-Innaminka district (see p. 4) and Gawler Ranges district (see p. 7); Northern and Yorke landscape region, Port Augusta-Quorn district (see p. 10)

Size 45,329 km² (9% of SAAL)

Key waterways – Hookina, Brachina and Moralana Creeks

Climate – semiarid to arid climate with unreliable and erratic, winter-dominant rainfall. Average temperature ranges between 6-40°C. Median rainfall (1882-current, averaged across entire bioregion) is 295 mm.



Some^f of our community values

SOCIAL – Small towns, Public Access Routes, pastoral stations, Chambers Gorge, Iga Warta, Moro Gorge, Nepabunna, Nuccaleena Mine PA, Olary, Red Gorge, Beltana, Stirrup Iron land system

CULTURAL – Ruins, homesteads, Blinman, Bolla Bollana Smelters, Chambers Gorge, Copley Dam, Moro Gorge, Mount Fitton area, Mt Deception, Mt Rose Mine, Mt Serle Station, Nantiwarrina IPA, Nuccaleena, Paralana Hot Springs, Prism Hill, Radium Hill Mine, Red Gorge, Sacred Rocks, Sliding Rock and Cadnia, goldfields, Vulkathunha-Gammon Ranges National Park Cultural Use Zone

ECONOMIC – Small towns, roads, pastoral stations, Arkaroola, Aroona Dam, Chambers Gorge, Iga Warta, Nepabunna, Olary Ranges, Beverley uranium mine, Teetulpa goldfield, Wilpena Pound, Wilpena Resort, Sacred Rocks, Heysen Trail

ENVIRONMENTAL – Creeks, rivers, rockholes and springs; significant plant communities; land systems, gorges, stations; National Parks and Reserves; Arcoona Bluff, Arkaroola, Aroona Dam, Blue Wren Fissure, Bunyip Chasm, Dutchman's Stern foothills, Flinders Ranges, Gammon Plateau, Mt Gee, Mt Painter, Nantawarrina IPA, Olary Ranges, Pinda Springs, Razorback Ridge, The Armchair, The Skull, Wilpena Pound

^f Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

How the Flinders Lofty Block system looks and operates...

Two rich picture maps (Figure 7) highlight how environmental, cultural, social and economic aspects of the Flinders Lofty Block system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

It can be seen in Figure 7 that Flinders Lofty Block features plains, rises, steeper ranges and hills offering a range of habitat supporting a rich diversity of

species. Higher elevations result in faster-flowing creeks, with permanent springs associated with fractured sedimentary rock at the bottom of slopes. Rockholes are also present.

...in 'boom' periods The system features more water, predominantly from local rainfall which runs off the ranges collecting in waterholes, rockholes and channels which flow out of the region. This triggers a burst of germination and fresh growth of native vegetation (eg chenopods, mallee, tussock grasses) particularly on the lower

slopes, valleys and riparian areas, as well as weed invasion (eg Cactus, Pepper Tree and Oleander). There are also larger populations of native and non-native, terrestrial and aquatic animals including birds, mammals, livestock, rabbits, kangaroos, feral goats, foxes and wild dogs.

Rainfall run-off from the ranges can cause gully and sheet erosion in the lower slopes and plains, particularly if vegetation cover is insufficient to slow and spread the water across the landscape.

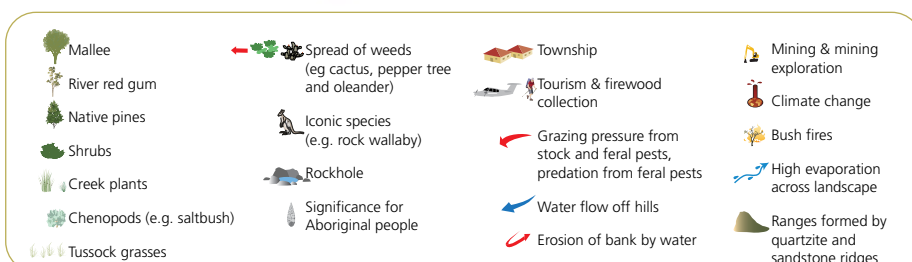
Boom – (unpredictable)



Bust



FIGURE 7: Flinders Lofty Block during extreme boom and bust periods



Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

...in 'bust' periods The system is less productive. Vegetation has decreased overall and the remaining perennial vegetation may be well-browsed. Animal populations have declined and withdrawn to landscape refugia from which they can rapidly re-colonise when conditions are suitable. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils.

Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

What's driving change? Challenges and opportunities for management

There are a number of processes driving change in the Flinders Lofty Block bioregion that may bring positive and negative changes to the features of this system – economic, social, cultural and environmental – that we value.

This system is well-recognised for its rich biodiversity, scenic landscapes, mineral and coal deposits, and numerous parks and reserves. It is relatively populated with many small towns offering services and other employment opportunities, as well as a diverse industry base of tourism; pastoralism (mainly sheep/wool); and mining and exploration which are the origin of many of the social and cultural values that our community identified (eg hiking, fishing, geology, Aboriginal and European historical and cultural sites).

However, small towns rely on the local industries that support them, and declines or closures of local industry such as the Port Augusta power station and the Leigh Creek coal mine have significant implications for local residents who must seek new opportunities.

Potential economic opportunities that might be developed further here include renewable energy, like geothermal (current licenses exist at Woottona), solar and wind; organic beef and sheep meat and nature-based tourism.

Already a major economic driver in this region catering to local, national and international tourism markets, nature-based tourism offers the opportunity to diversify and improve economic resilience, particularly during extended dry periods.

There are challenges however.

In reaping economic benefit, the cultural and biodiversity values that our community identified must carefully managed. For example, uncontrolled tourism in sensitive areas of the Flinders Ranges has damaged vegetation through four-wheel drive use and removal of tree branches for firewood, defaced Aboriginal rock art sites, and generally impacted habitat for biodiversity.

Also, early European settlement of this region has left an historical legacy with pest plant (cactus, oleander and Pepper Tree) and pest animal (feral goats, rabbits, foxes and cats) introductions which continue to cause significant competitive pressure to native plants and animals.

Extensive gully erosion and landscape droughting are another legacy of historical management practises, including inappropriate stocking rates, inadequate control of feral herbivores, removal of trees for buildings, firewood and fencing, and inappropriate placement of infrastructure such as railways, roads and buildings interfering with the natural flow of water across the landscape.

More recently, south of the dog fence, wild dogs have been identified as a major cause of the contraction of the sheep industry. Anecdotal evidence indicates that predation on sheep flocks by wild dogs may have been exacerbated in this bioregion due to historical in-breeding with domestic dogs. However, conflicting evidence identifies the wild dog as an apex predator which provides potentially useful ecological and economic benefits in cattle rangelands.

Decreasing returns on wool have led some pastoral properties to alternative breeds (eg Dorper and Damara) produced only for meat. These sheep breeds are less labour intensive than Merinos, which require shearing; they have a higher rate of fecundity and fertility; a high growth rate; and are well-adapted to rangelands.

There are challenges too with anecdotal evidence suggesting that these alternative breeds may bring new management issues associated with risks of inter-breeding with Merino's and contamination of Merino wool crops. There is also some potential for generalist grazing habits to lead to a more rapid onset of overgrazing in some circumstances.

Some land managers have benefitted from feral goats for a supplementary income source during dry seasons but they are also known to degrade many of the landscapes and habitats that we value in this region due to their high fertility and fecundity and browsing habits.

Also, as climate change progresses, declines in winter rainfall may place further pressure on pastoral productivity if it falls below the level required to trigger pasture growth.

Increasing temperatures are also likely to affect the persistence and water quality of springs in this system, impacting cultural values. Tourism numbers may decline and services (eg health, emergency) may also be impacted during hotter, drier weather.

Adjusting to these historical, landscape-scale influences is complex, and will require multi-generational effort over time. With challenges come opportunities, however, for communities and industries to be both innovative and sustainable in their practices so that they remain resilient in the face of change.

BROKEN HILL COMPLEX BIOREGION

– a snapshot in time

Quick facts

The Broken Hill Complex is located in the south-east of the SA Arid Lands region. The boundaries of this system extend east beyond our region and into New South Wales.

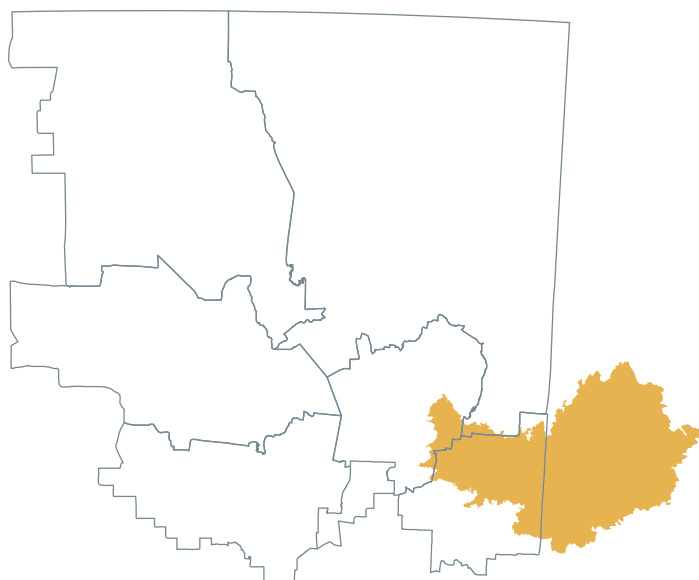
Associated Landscape districts

Primarily North East Pastoral district (see p. 9); North Flinders district (see p. 8); Marree-Innaminka district (see p. 4); the Western Local Land Services region of New South Wales

Size 18,700 km² (4% of SAAL)

Waterways – no significant permanent waterways

Climate – arid with slightly summer-dominant rainfall. Average temperature ranges between 6-35°C. Median rainfall (1890-2005, averaged across entire bioregion) is 174 mm



Some^g of our community values

SOCIAL – Cockburn

CULTURAL – Bimbowrie Woolshed, Erudina Woolshed, Mount Victoria Hut, Old Curnamona Homestead

ECONOMIC – Honeymoon mine

ENVIRONMENTAL – Creeks, rivers and springs (all), National Parks and Reserves (all), Boolcoomatta Station, ranges and hills, Barrier Range outwash, Bimbowrie subregions, Cinnamon Quail-thrush, Desert Sneezeweed

^g Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

How the Broken Hill Complex system looks and operates...

Two rich picture maps (Figure 8) highlight how environmental, cultural, social and economic aspects of the Broken Hill Complex system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

It can be seen in Figure 8 that this system features low ranges and hills and extensive alluvial plains and swamps, terminating in clay and salt pans. Water,

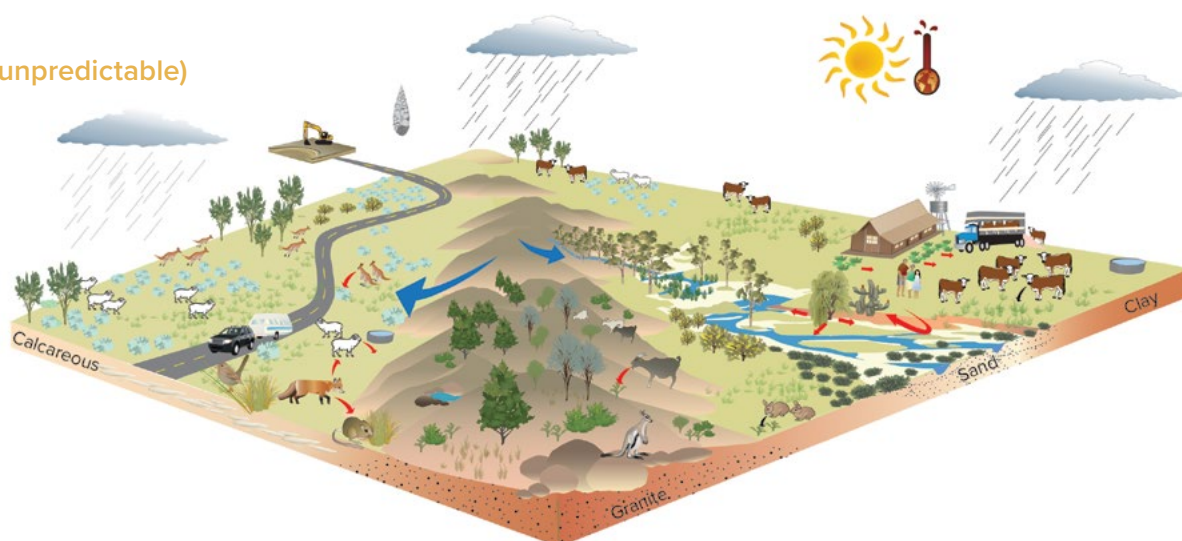
sediment and nutrients are transported across this system from higher adjoining ranges of the Flinders Lofty Block to floodplains and swamps, which support herbfields, grasses, and shrubs. Shale dominated hills and granite hills are also a feature.

...in 'boom' periods The system features more water, predominantly from local rainfall which runs off the adjoining ranges collecting in waterholes, rockholes and channels which flow out of the region.

This triggers a burst of germination and fresh growth of native vegetation (chenopods, samphire) particularly on the lower slopes, valleys and riparian areas, as well as weed invasion (eg African Boxthorn, Bathurst Burr, Noogoora Burr and cactus).

There are also larger populations of native and non-native, terrestrial and aquatic animals including birds, livestock, rabbits, kangaroos, donkeys, cats, feral goats, foxes and wild dogs.

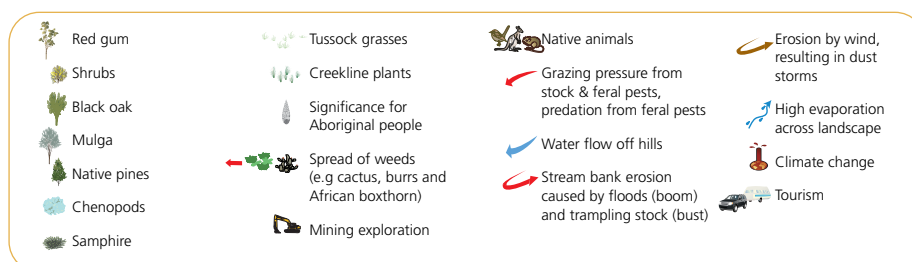
Boom – (unpredictable)



Bust



FIGURE 8: Broken Hill Complex during extreme boom and bust periods



Rainfall run-off from the ranges can cause gully and sheet erosion in the lower slopes and plains, if sufficient vegetation cover is not present to help slow and spread the water across the landscape.

Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

...in 'bust' periods The system is less productive. Vegetation cover has decreased overall with the remaining perennial vegetation possibly well-browsed. Animal populations have declined and withdrawn to landscape refugia from which they can rapidly re-colonise when conditions improve. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils. Fire is common in this system.

Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

Examples of change – challenges and opportunities

There are a number of processes driving change in the Broken Hill Complex bioregion that may bring positive and negative changes to the features of this system – economic, social, cultural and environmental – that we value.

Climate change, for example, has potential implications for this system.

Summer rainfall is slightly dominant in the Broken Hill Complex and important for supporting the bioregion's natural ecological cycles and pastoral industry.

Any increases in temperatures over summer will increase the rate at which water is removed from the landscape through evapotranspiration. This may reduce water available for triggering pasture plant productivity.

Higher temperatures and evapotranspiration may also result in hotter, more frequent summer fires.

Historical land management practises have also left a legacy for this system with pastoral properties relatively small and developed early in European settlement, including extensive soil erosion, and weeds (Cactus, African Boxthorn, Noogoora Burr and Bathurst Burr) and pest animals (feral goats, foxes, cats, wild dogs) that are well established and competing with native plants, animals and livestock. Feral pigs have also been entering from New South Wales, following rainfall.

More recently, south of the dog fence, wild dogs have been identified as a major cause of the contraction of the sheep industry. Anecdotal evidence indicates that predation on sheep flocks by wild dogs may have been exacerbated in this bioregion due to historical in-breeding with domestic dogs. However, conflicting evidence identifies the wild dog as an apex predator which provides potentially useful ecological and economic benefits in cattle rangelands.

Decreasing returns on wool have led some pastoral properties to alternative breeds (eg Dorper's and Damaras) produced only for meat. These sheep breeds are less labour intensive than Merinos, which require shearing; they have a higher rate of fecundity and fertility; a high growth rate; and are well-adapted to rangelands.

There are challenges too with anecdotal evidence suggesting that these alternative breeds may bring new management issues associated with risks of inter-breeding with Merino and contamination of Merino wool crops. There is also some potential for generalist grazing habits to lead to a more rapid onset of overgrazing in some circumstances.

Some land managers have benefitted from feral goats for a supplementary income source during dry seasons but due to the high fertility, fecundity and browsing habits of goats they are also known to degrade many of the landscapes and habitats that we value in this region, such as the National Parks and Reserves, Curmona and Bimbowrie subregions.

In combination, these factors need to be considered when making property management decisions, particularly during dry times. However, many of these historical, landscape-scale issues are complex and expensive to address, and will require multi-generational effort over time.

Economic drivers are also bringing about other changes.

The pastoral (cattle, sheep) and mining industry (eg Honeymoon uranium mine) are highly valued as the key contributors to the region's economy. Any changes to these enterprises will have implications for the relatively few, small towns servicing the Broken Hill Complex, such as Yunta and Olary.

Other economic opportunities for the region include renewable energy, such as solar and wind, and organic beef and sheep meat. Also, the cultural history embodied in sites such as Old Curnamona Homestead and woolsheds scattered across the region as well as the unique geology of the Olary Ranges are attractive to tourists and passing traffic as people travel to locations in the eastern states (eg Sydney and Broken Hill) and may offer some additional potential.

It is important to manage any development to ensure that the region's natural resources can support these often competing land uses.

GAWLER BIOREGION

– a snapshot in time

Quick facts

Gawler country is located in the south-west of the SA Arid Lands region, extending south beyond our region and into the Eyre Peninsula and Northern & Yorke landscape regions of South Australia.

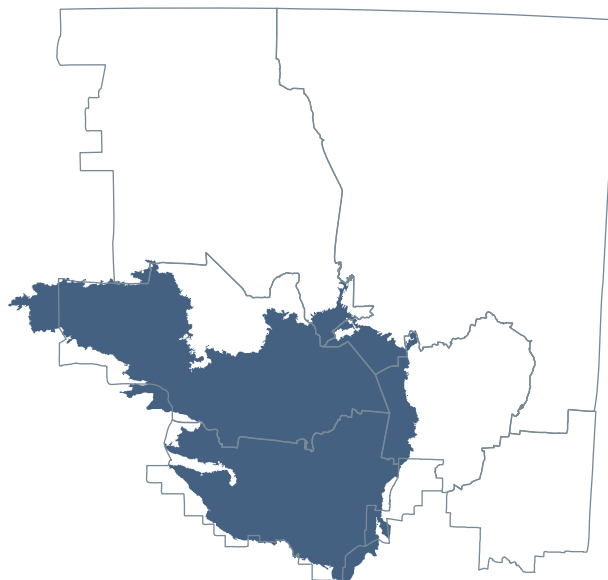
Associated landscape districts

Primarily Gawler Ranges (see p. 7) and Kingoonya district (see p. 6); Marla Oodnadatta district (see p. 5); Marree-Innaminka district (see p. 4); North Flinders district (see p. 8); Port Augusta-Quorn district (see p. 10).

Size 120,688 km² (23% of SAAL)

Key waterways – no significant permanent waterways

Climate – arid climate with predominantly winter rainfall in the south, little seasonality elsewhere. Average temperature ranges between 6-40°C. Median rainfall (1890-2005, averaged across entire bioregion) is 169 mm.



Some^h of our community values

SOCIAL – Pimba, Woomera, Roxby Downs

CULTURAL – Skull Camp Tanks, Tarcoola, Wartaka Outstation

ECONOMIC – Gawler Ranges, Gawler Ranges National Park, Iron Duke-Whyalla Railway, Iron Knob Mine, Iron Knob Water Pipeline, Island Lagoon, Lake Torrens geothermal exploration licenses, Lincoln Gap, Lincoln Highway, Middleback Ranges, Mt Ive station, Olympic Dam, Parakylia Station, Roopena, sheep grazing, Tregalana, Woomera Prohibited Area, Roxby Downs, Kokatha area, roads (Iron Knob-Whyalla, Roxby Downs, Peculiar Knob Haul)

ENVIRONMENTAL – Watercourses, springs, lakes, waterholes (all), National Parks and Reserves (all), Atriplex kochiana site, Buckleboo granite outcrops, Coralbignie Rocks, Gawler Ranges, groundcover, Kokatha area, Kokatha Hills, Moonabie Range, Oakden Hills, The Organ Pipes, land systems (Centre, Eucaro, Pandurra, Roxby), stations (Bon Bon, Hiltaba, Middleback, Mt Ive, Witchelina)

^h Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

How the Gawler system looks and operates...

Two rich picture maps (Figure 9) highlight how environmental, cultural, social and economic aspects of the Gawler system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

It can be seen in Figure 9 that the Gawler bioregion features calcareous plains, gypsum dunefields and ranges, draining into

terminal salt lakes. Stony plains occur on elevated plains and tablelands. Rockholes feature in the southern half of the bioregion, with waterholes along drainage lines in the north.

...in boom periods The system features more water, predominantly from local rainfall which feeds local rockholes, runs off the ranges and terminates internally in salt lakes and pans. This triggers a burst of germination and fresh growth of native vegetation (chenopods, samphire, tussock

grass) particularly along riparian areas and the plains, as well as weed invasion (eg Buffel Grass and Cactus).

There are also larger populations of native and non-native animals including birds, livestock, feral goats, foxes and wild dogs.

Rainfall run-off from the ranges can cause gully and sheet erosion in the lower slopes and plains if vegetation cover is insufficient to slow and spread the water across the landscape.

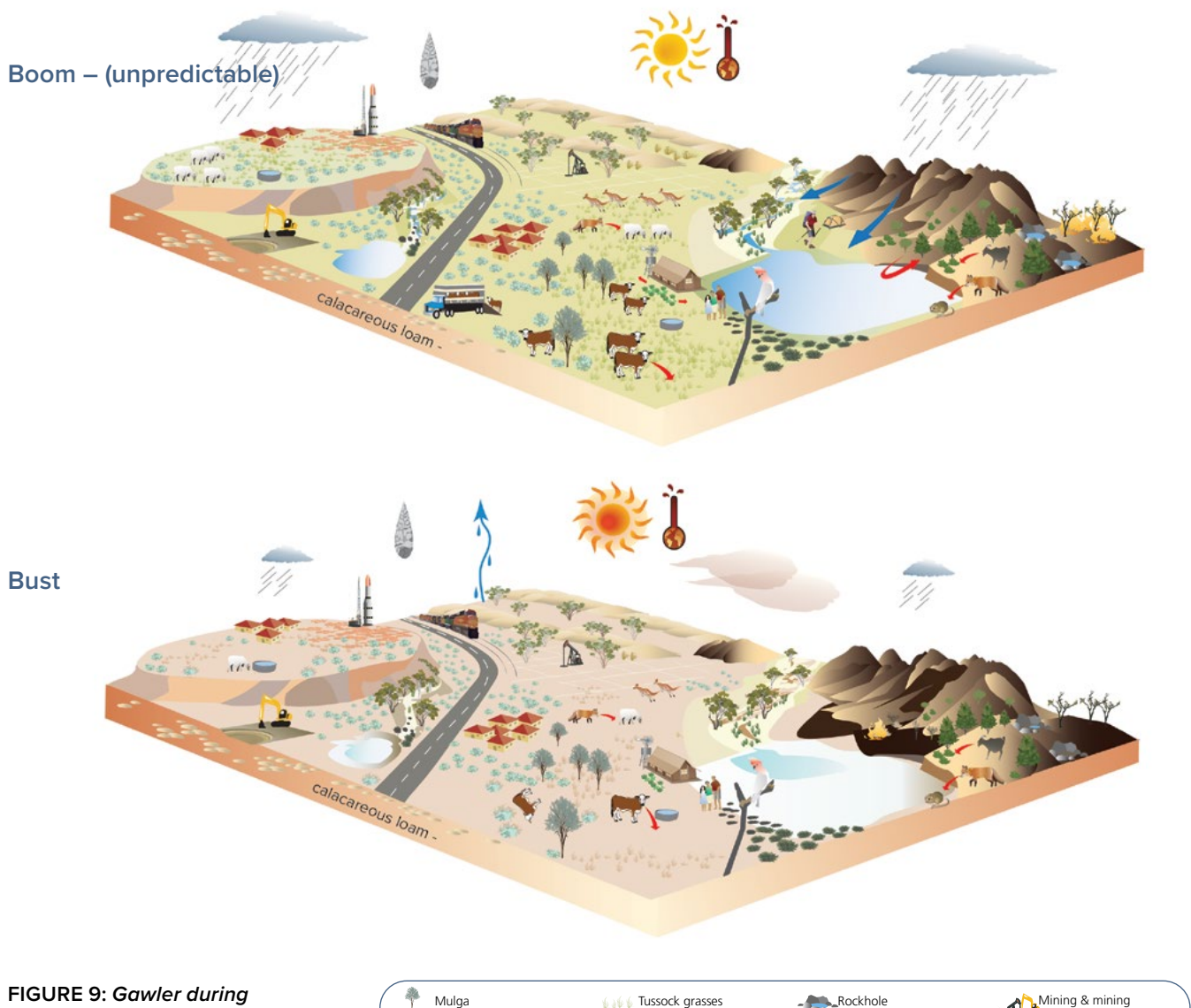
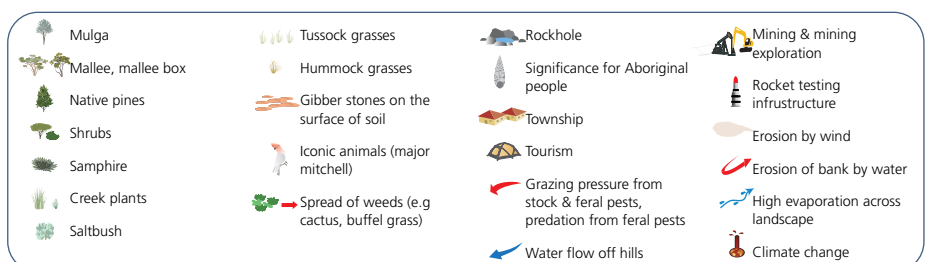


FIGURE 9: Gawler during extreme boom and bust periods



Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

...in bust periods The system is less productive. Vegetation has decreased overall and the remaining perennial vegetation may be well-browsed. Animal populations have declined and withdrawn to landscape refugia from which they can rapidly re-colonise when conditions improve. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils. Reduced vegetation cover combined with high winds can lead to wind erosion and associated dust storms. Fire is also common in this system.

Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

Examples of change – challenges and opportunities

There are a number of processes driving change in the Gawler bioregion that may bring positive and negative changes to the features of this system – economic, social, cultural and environmental – that we value.

A mining town supporting the Olympic Dam copper, gold and uranium venture, Roxby Downs is supported by a local council which offers a wide range of services to the town and local area and provides for a relatively large population of permanent and fly-in, fly-out residents.

The Gawler bioregion therefore has good access to employment opportunities in Roxby Downs and smaller towns and through its relatively well diversified mining (eg Iron Knob mine, Andamooka and Challenger Mine), pastoral (sheep wool and meat, and cattle), environmental and cultural tourism (Gawler Ranges National Park, Ediacara Conservation Park, historic railway sidings) and associated service industries.

As such, its communities are likely to be more resilient to change driven by global commodity price fluctuations, or climate change impacts on specific industries, for example.

The future of Olympic Dam and, to the south, the Arrium steelworks in Whyalla combined with the closure of the Port Augusta power station have major implications for employment and services in this bioregion as well as for the wider SA Arid Lands region and South Australian economy.

Climate change is also a significant driver.

Climate change projections indicate that winter rainfall is likely to decrease over time; this could be a significant issue for the future sustainability of the pastoral industry, if it falls below the level required to trigger pasture growth.

This is particularly so for the southern parts of the Gawler bioregion where groundwater resources are unsuitable for human and stock use, although they have potential for use by the mining and energy industry.

As well as dams, pastoralists have developed an innovative water collection system around granite rock outcrops for station and stock use but otherwise there is a heavy reliance on local rainfall, particularly in winter, for station supplies.

Economic drivers have also brought about change.

Decreasing returns on wool have led some pastoral properties to alternative breeds (eg Dorper and Damara) produced only for meat. These sheep breeds are less labour intensive than Merinos, which require shearing; they have a higher rate of fecundity and fertility; a high growth rate; and are well-adapted to rangelands.

There are challenges too with anecdotal evidence suggesting that these alternative breeds may bring new management issues associated with risks of inter-breeding with Merino and contamination of Merino wool crops. There is also some potential for generalist grazing habits to lead to a more rapid onset of overgrazing in some circumstances.

With the cultural history, ecology and unique geology of the Gawler Ranges attractive to tourists, tourism offers additional opportunity to the Gawler country along with renewable energy, such as geothermal (eg Lake Torrens) solar and wind, and organic beef and sheep meat.

The area also hosts Department of Defence activity at Cultana Station Training Area and Woomera Prohibited Area (Royal Australian Air Force) which may bring some economic benefit to the region.

It is important to manage any development to ensure these often competing land uses can sustainably co-exist with the full range of community values.

FINKE BIOREGION

– a snapshot in time

Quick facts

The Finke country is located in the north-west of the SA Arid Lands region. The boundaries of this system extend beyond the region to the north-west in South Australia and into the Northern Territory.

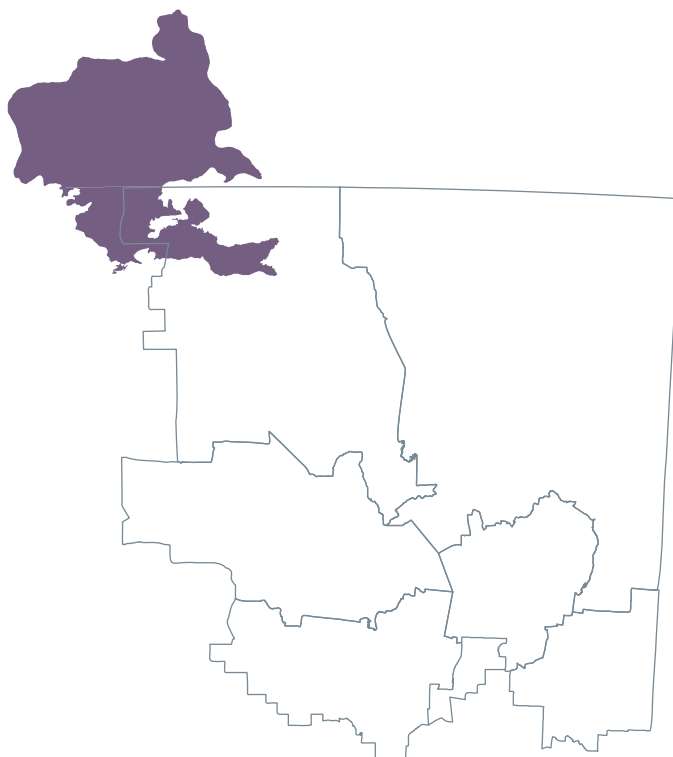
Associated landscape districts

Marla-Oodnadatta district (see p. 5); Alinytjara Wilurara region in South Australia; and Territory NRM region in Northern Territory

Size 13,719 km² (3% of SAAL)

Key waterways – Alberga River, Hamilton Creek

Climate – arid and hot, with very low rainfall and high evaporation. Average temperature ranges between 6-38°C. Median rainfall (2890-2005, averaged across entire region) is 152 mm.



Someⁱ of our community values

SOCIAL – GAB (drinking water for town supplies)

CULTURAL – Innoina Soakage, Treloar Soakage,

ECONOMIC – GAB (stock and mining)

ENVIRONMENTAL – Watercourses, springs, lakes, waterholes (all), National Parks and Reserves (all), Moorilyanna land system granite hills near Tieyon

ⁱ Values were submitted by some community members in the development of the former NRM Plan – they are not representative of priority or importance and may omit locations that other community members value.

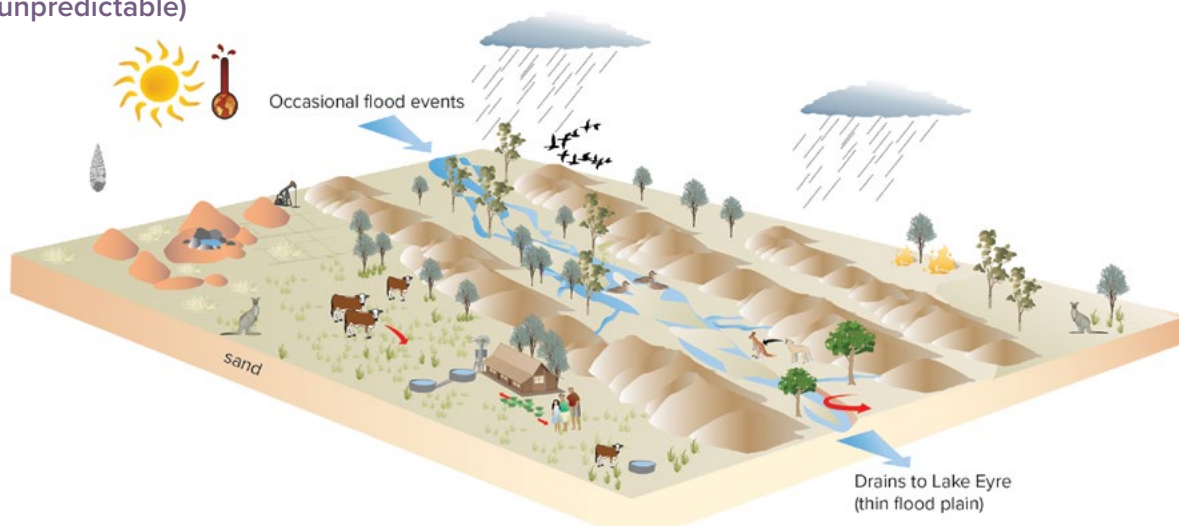
How the Finke system looks and operates...

Two rich picture maps (Figure 10) highlight how environmental, cultural, social and economic aspects of the Finke system interact and respond to the episodic, irregular, extreme boom and bust periods that are a feature of the SAAL region. Normal seasonal influences trigger a similar response generally of less magnitude, but also highly variable.

As can be seen in Figure 10, an extensive dune/swale system dominates the Finke, along with sand plains with granitic inselbergs, swale swamps and major drainage lines. Redgum, coolabah and gidgee are common along channels and mulga woodlands are dominant. Waterholes are relatively short-lived. Granitic inselbergs or isolated rocks are a feature.

...in boom periods The system features more water, predominantly from local rainfall but also from large flood events fed by upstream rainfall in the Northern Territory. This triggers a burst of germination and fresh growth of native vegetation (spinifex, tussock grass, mulga) particularly along rain run-on areas and sandy plains, as well as minor weed invasion around homesteads and tracks, where there is greater likelihood of the introduction of weed seeds. There are also some rain-fed rockholes present.

Boom – (unpredictable)



Bust

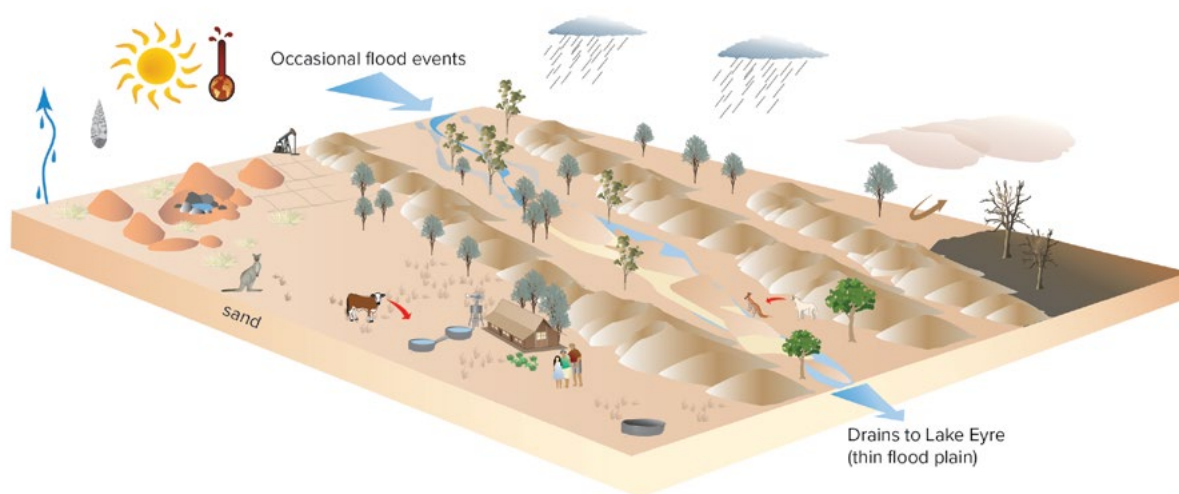
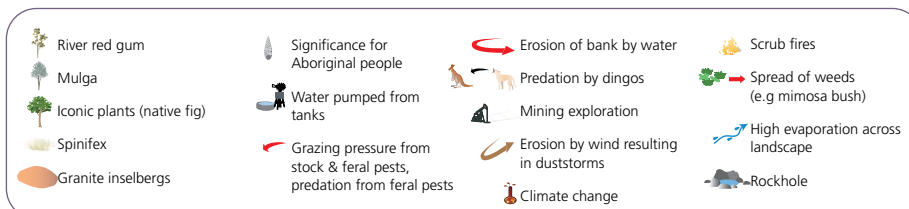


FIGURE 10: Finke during extreme boom and bust periods



There are also larger populations of native and non-native animals including birds, livestock (cattle), feral camels, cats and wild dogs.

Tourism and stock mustering activity signifies a generally higher level of economic activity associated with boom times.

...in bust periods The system is less productive. Vegetation has decreased overall and the remaining perennial vegetation may be well-browsed. Animal populations have declined and withdrawn to the refuges in the landscape, such as run-on areas, from where they can rapidly recolonise when conditions are suitable. Higher temperatures increase evapotranspiration, drying out vegetation, waterways and soils. Fire is also common in this system.

Tourism and mustering activity has declined, indicating the generally lower levels of economic activity associated with drier conditions.

Examples of change – challenges and opportunities

While there is still much that is not known about the biophysical characteristics of the Finke system, we do know that there are processes with the potential to drive change to the country. These may bring positive and negative change to the features of the system – economic, social, cultural and environmental – that we value.

For example, the Finke is extremely remote, with no nearby towns offering services and other opportunities to the local population residing on pastoral properties and at mining sites. Residents must instead travel long distances on largely unsealed roads (with the exception of Stuart Highway which passes through this system) which are often closed during wet weather in order to access locations offering only basic and expensive services, and rely on school of the air and flying doctors for basic education and emergency medical services. Living in such remote areas can add significant expense to the cost of living, as well as reducing access to opportunities such as alternative employment, ready markets for business diversification and advanced education.

Climate change will have implications here too.

Any changes in rainfall upstream in the Northern Territory may also vary the frequency and amount of flooding through this system. In turn, this may impact cultural values associated with the Innionna and Treloar soakages, local biodiversity reliant on the safe harbour offered by waterholes; and the profitability of the pastoral industry which relies on the availability of floodplain pasture.

Rainfall north of the Northern Territory border also contributes to local groundwater recharge, so the rate of groundwater accumulation may be impacted affecting the system's industries, communities and biodiversity.

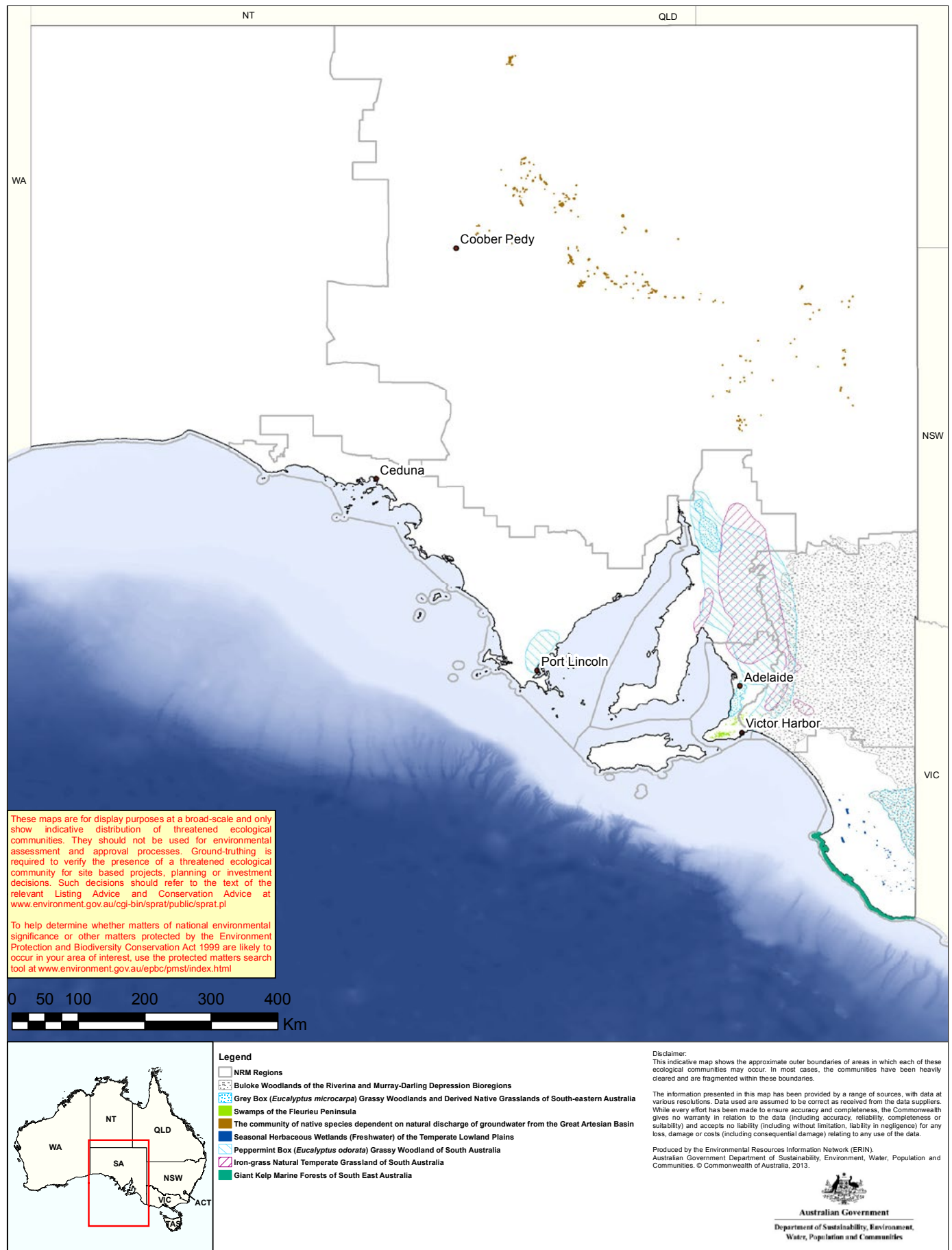
Higher temperatures, particularly during 'bust' periods, will also have likely implications for infrastructure (eg air conditioners) and outdoor work, energy supplies and fire frequency as well as increasing the rate by which water disappears from the landscape through evapotranspiration.

Increased evapotranspiration may lead to reduced vegetation cover; wind erosion; dust storms; and fire frequency and intensity. The Northern Territory also has large infestations of Athel Pine upstream along the Finke River. A 'weed of national significance', Athel Pine forms dense stands along watercourses, reduces water availability for stock and native fauna, concentrates soil salt content, and can change river flow patterns, causing flooding. This would represent a significant land management issue should it enter the region through floodwaters from the Northern Territory.

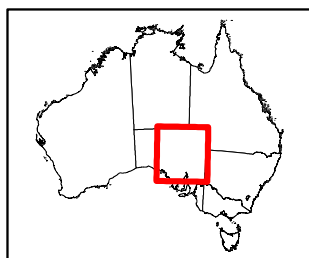
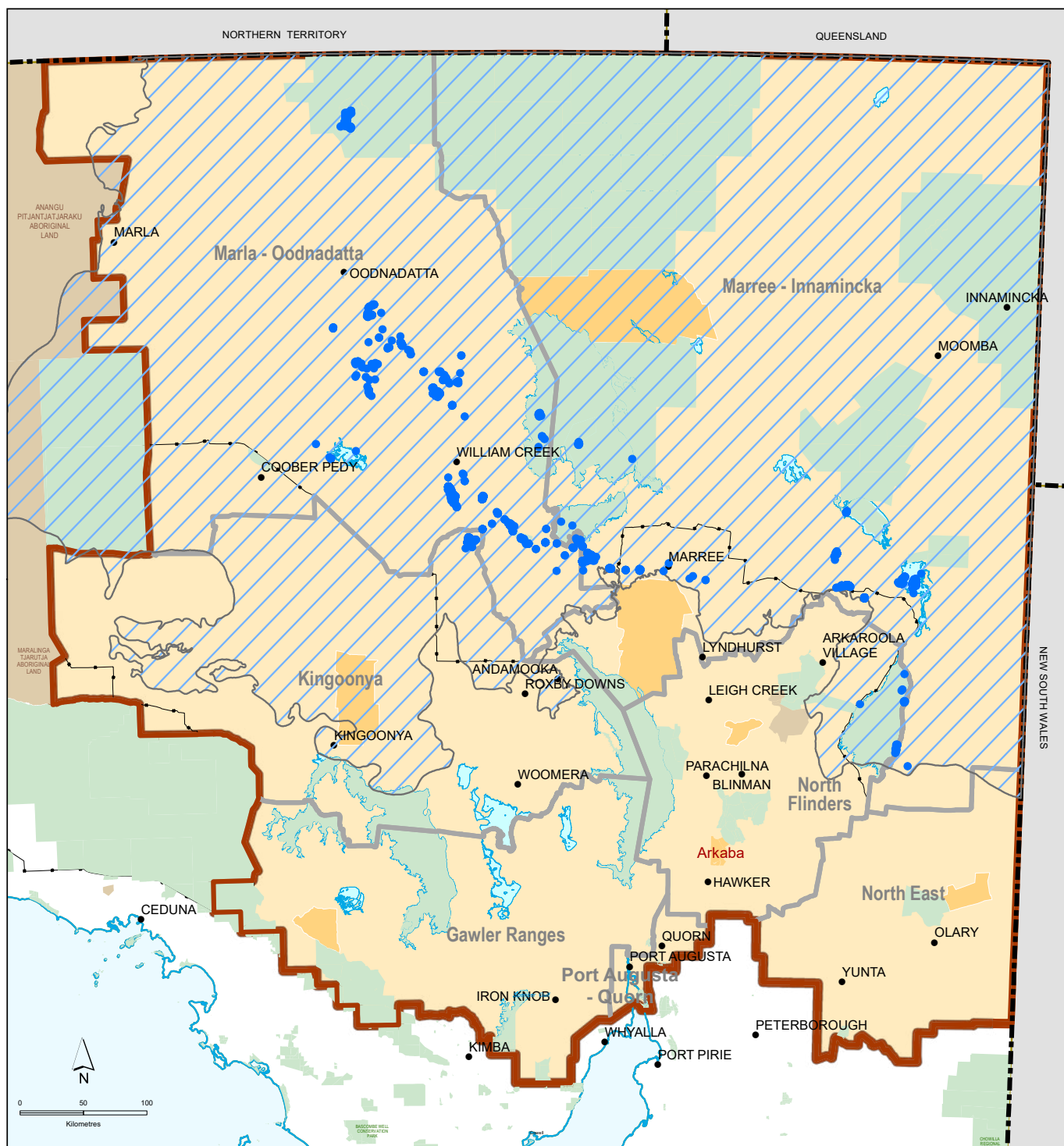
There may be opportunity in this country too.

Exploration interest in the gas and petroleum reserves of the Pedirka Basin – a portion of which underlies the Finke country – and in the development of coal, may bolster the system's economic resilience. Any potential economic benefits will need to be balanced with potential impact to community values, such as Aboriginal cultural artefacts and sites associated with the area; and to the groundwater and associated surface water aquatic ecosystems.

EPBC Threatened Ecological Communities



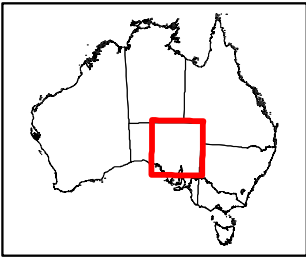
Endangered Ecological Community – Mound Springs of the Great Artesian Basin



- GAB Springs
- ▨ Great Artesian Basin
- ▭ SA Arid Lands Region
- ▭ Landscape District
- ▭ NPWSA Reserve
- ▭ NGO Conservation Property
- Dog Fence

Produced by SA Arid Lands Landscape Board
PO Box 297, Port Augusta, 5700
landscape.sa.gov.au/saal/
Data Source Science, Information & Technology, DEW
Compiled 3/11/2022
Projection Lambert Conformal Conic
Datum Geocentric Datum of Australia, 2020

Ramsar Wetland – Coongie Lakes

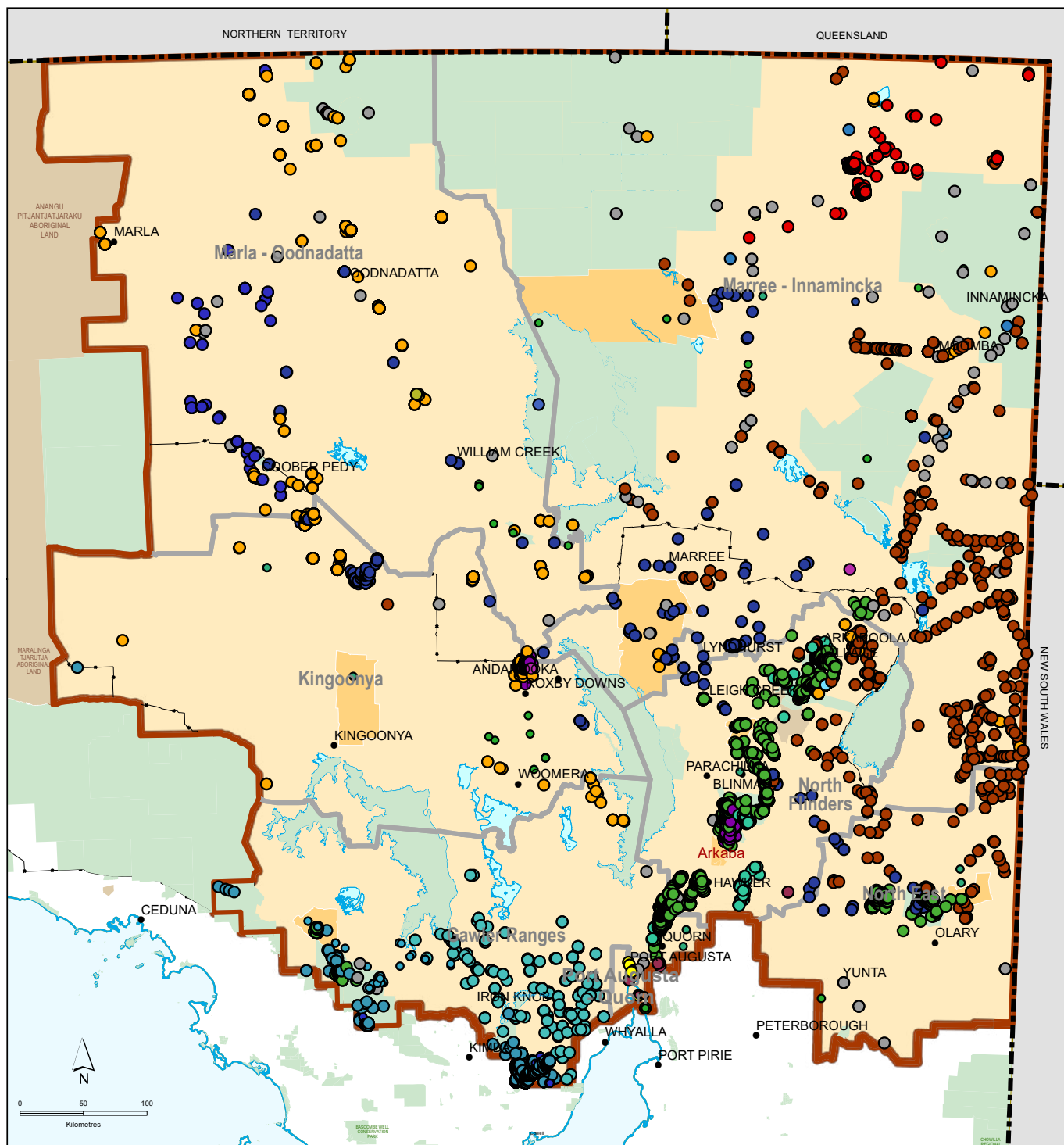


-  RAMSAR Reserve
-  Malkumba-Coongie Lakes NP

Produced by SA Arid Lands Landscape Board
 PO Box 297, Port Augusta, 5700
landscape.sa.gov.au/saal/
 Data Source Science, Information & Technology, DEW
 Compiled 2/11/2022
 Projection Lambert Conformal Conic
 Datum Geocentric Datum of Australia, 2020



EPBC Threatened Fauna



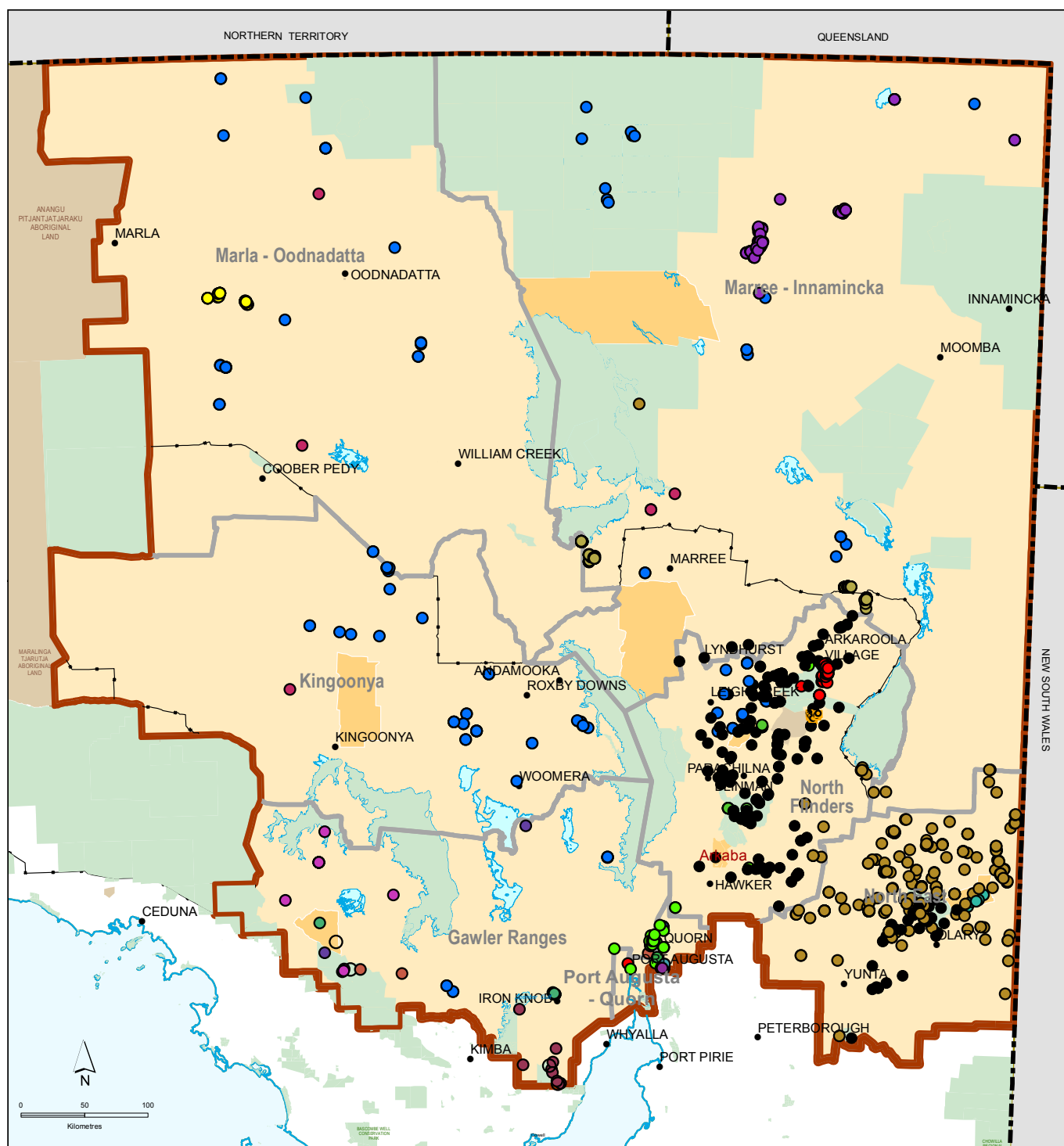
- Australian Painted-snipe, EN
- Bronzeback Legless Lizard, VU
- Curlew Sandpiper, CR
- Dusky Hopping-mouse, VU
- Fairy Tern, VU
- Far Eastern Curlew, CR
- Flinders Ranges Purple-Spotted Gudgeon, VU
- Flinders Ranges Short-tailed Grasswren, VU
- Flinders Worm-lizard, VU
- Gawler Ranges Short-tailed Grasswren, EN

- Greater Bilby (Bilby), VU
- Greater Stick-nest Rat, VU
- Grey Falcon, VU
- Kowari, VU
- Malleefowl, VU
- Night Parrot, EN
- Numbat, EN
- Orange-bellied Parrot, CR
- Painted Honeyeater, VU
- Plains Mouse, VU

- Plains-wanderer, CR
- Sandhill Dunnart, EN
- Silver Perch, CR
- Thick-billed Grasswren, VU
- Warru (Central Australian Rock-wallaby), VU
- Western Barred Bandicoot (Shark Bay), EN
- Western Grasswren, VU
- Western Quoll, VU
- Yellow-footed Rock-wallaby, VU

Produced by
SA Arid Lands Landscape Board
PO Box 297, Port Augusta, 5700
landscape.sa.gov.au/saal/
Science, Information & Technology, DEW
3/11/2022
Lambert Conformal Conic
Geocentric Datum of Australia, 2020

EPBC Threatened Flora

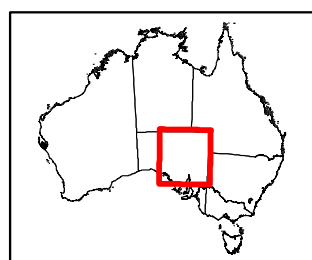


- | | | |
|--|------------------------------------|---|
| ● <i>Brachyscome muelleri</i> , EN | ● <i>Acacia araneosa</i> , VU | ● <i>Olearia pannosa</i> ssp. <i>pannosa</i> , VU |
| ● <i>Caladenia gladiolata</i> , EN | ● <i>Acacia carneorum</i> , VU | ● <i>Prasophyllum pallidum</i> , VU |
| ● <i>Caladenia tensa</i> , EN | ● <i>Acacia menzelsii</i> , VU | ● <i>Prasophyllum validum</i> , VU |
| ● <i>Eriocaulon carsonii</i> ssp. <i>carsonii</i> , EN | ● <i>Acacia pickardii</i> , VU | ○ <i>Pterostylis xerophila</i> , VU |
| ● <i>Frankenia plicata</i> , EN | ● <i>Eleocharis papillosa</i> , VU | ● <i>Senecio megaglossus</i> , VU |
| ● <i>Olearia arckaringensis</i> , EN | ● <i>Hibbertia crispula</i> , VU | ● <i>Swainsona murrayana</i> , VU |
| ● <i>Codonocarpus pyramidalis</i> , VU | ● <i>Limosella granitica</i> , VU | ● <i>Swainsona pyrophila</i> , VU |
| | | ■ <i>Xerothamnella parvifolia</i> , VU |

Produced by SA Arid Lands Landscape Board
PO Box 297, Port Augusta, 5700
landscape.sa.gov.au/sa/ll
Data Source Science, Information & Technology, DEW
Compiled 2/11/2022
Projection Lambert Conformal Conic
Datum Geocentric Datum of Australia, 2020



Threatened Species Strategy Priority Species



- Flora**
- ▲ Arckaringa Daisy, EN
- Fauna**
- Plains-wanderer, CR
 - Night Parrot, EN
 - Malleefowl, VU
 - Western Quoll, VU

Produced by SA Arid Lands Landscape Board
PO Box 297, Port Augusta, 5700
landscape.sa.gov.au/saal/
Data Source Science, Information & Technology, DEW
Compiled 21/11/2022
Projection Lambert Conformal Conic
Datum Geocentric Datum of Australia, 2020

