



# South Australian Arid Lands Biodiversity Strategy



**Volume 4** Gawler Conservation Priorities

## **SOUTH AUSTRALIAN ARID LANDS NATURAL RESOURCES MANAGEMENT REGION**

A partnership between

**The Department for Environment and Heritage and  
South Australian Arid Lands Natural Resources Management Board**



Australian Government



Government  
of South Australia

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# Introduction

*The **South Australian Arid Lands Biodiversity Strategy** has been developed by the South Australian Arid Lands Natural Resources Management Board (SAAL NRM Board) and the South Australian Department for Environment and Heritage (DEH).*

The South Australian Arid Lands Natural Resources Management Region covers over 520,000 km<sup>2</sup>, almost 53% of the State. The landscapes and biodiversity of this huge region are diverse and complex. Planning for biodiversity conservation at such large scales requires a landscape-based system of classifying the land. The classification system used for this strategy is the Interim Biogeographic regionalisation for Australia (IBRA) regions. The IBRA bioregions of in the SAAL NRM region are the Stony Plains, Flinders Lofly Block, Broken Hill Complex, Channel Country, Simpson–Strzelecki Dunefields, Finke and Gawler.

The Strategy consists of six documents. Volume one is the South Australian Arid Lands Natural Resources Management Region Biodiversity Strategy: Region-wide Priority Actions. It identifies the region-wide goal for biodiversity conservation and sets resource condition targets that will enable us to measure our success in achieving this goal, and details a comprehensive suite of management action targets and strategies that must be implemented regionally to achieve this goal.

The five bioregional documents are separate volumes, and identify conservation priorities for each of the bioregions in the South Australian Arid Lands. These are the:

- *Volume 2 Channel Country Conservation Priorities*
- *Volume 3 Flinders and Olary Ranges Conservation Priorities*
- *Volume 4 Gawler Conservation Priorities*
- *Volume 5 Sandy Deserts Conservation Priorities*
- *Volume 6 Stony Plains Conservation Priorities*

This document, **South Australian Arid Lands Biodiversity Strategy – Gawler Conservation Priorities** has two sections. Section one describes the bioregion's natural attributes, land uses and the major threats to biodiversity. Section two sets out the priority actions for biodiversity conservation for the bioregion in the next five years. This document is one of five bioregional biodiversity strategies that, together, contribute to the South Australian Arid Lands Biodiversity Strategy

The Conservation Priorities described here have been identified in the SAAL portion of the Gawler bioregion. The Gawler bioregion stretches north-west from Spencer Gulf, incorporates the Middleback and Gawler Ranges, and extends north towards Tallaringa Conservation Park. Lake Torrens is on the eastern boundary, that stretches to just south of Port Augusta.



# Bioregional framework

The Interim Biogeographic Regionalisation of Australia (IBRA) establishes a hierarchy of ecosystem classification for which the physical, climatic and biological characteristics are described.

## Bioregions:

are continental scale (1:1,000,000) ecosystems that range in size from one to 20 million hectares. They are distinguished from adjacent regions by their broad physical and biological characteristics. They may include more than 30 landforms and 50 vegetation associations. Seven bioregions, or parts thereof, occur in the SAAL NRM Region.

## Subregions:

are sub-continental scale (1:500,000) ecosystems that range in size from 100,000 to seven million hectares. They occur within IBRA bioregions and may include up to 15 landforms and 30 vegetation associations.

## Landsystems:

are regional scale (1:250,000) ecosystems that range in size from 2,000 to five million hectares. They occur within IBRA subregions and may include up to five landforms and 10 vegetation associations.

## Vegetation communities:

are local scale (1:100,000) ecosystems that range in size from five to 5,000 hectares and are based on a single landform and vegetation community.



### Continental ecosystem:

Gawler IBRA – Extensive plains overlain by dunes in the north and interrupted by granite and rocky hills and large salt lakes.

IBRA Bioregion  
Continental Ecosystem  
1:1,000,000



### Sub-continental ecosystem:

Myall Plains IBRA subregion – Undulating, sand-covered calcareous plains interrupted by quartzitic hills and salt lakes

IBRA Subregion  
Sub-continental Ecosystem  
1:500,000



### Regional ecosystem:

Thurlga landsystem – String of salt lakes with fringing woodland and bladder saltbush shrubland.

Landsystem  
Regional Ecosystem  
1:250,000



### Local ecosystem:

Samphire low open shrubland over grasses in slightly saline areas around lake fringes.

Vegetation Community  
Local Ecosystem  
1:100,000



## Who is this strategy for?

This strategy is designed to address the needs of three main stakeholder groups:

- The SAAL NRM Board, Government and other investors
- Scientists, technicians, and NRM support staff
- Land managers

### **SAAL NRM Board, Government and other investors**

The focus audience for this strategy is the SAAL NRM Board, State and Federal Government Departments with responsibility for biodiversity conservation, and other organisations currently investing, or wishing to invest, in conserving the biodiversity of the South Australian Arid Lands. The 20-year targets represent clear statements of intent about biodiversity conservation priorities in the Gawler bioregion and how they will be managed. Monitoring and evaluating progress against the identified performance criteria will contribute to regional reporting on biodiversity conservation efforts.

The five-year actions provide specific direction for targeting investment. In most instances, the actions can be implemented as new projects, or as part of existing projects currently undertaken by the SAAL NRM Board, Government Departments and other stakeholders. Responsibility for delivering each action has not been detailed. Ultimately, the SAAL NRM Board and Government are responsible for the ongoing process of working with other stakeholders to deliver each action.

### **Scientists, technicians, and NRM support staff**

The strategy also has two main uses for biologists, ecologists, NRM support staff and others involved in biodiversity conservation and NRM projects and programs.

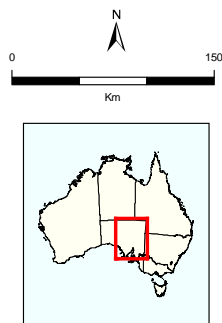
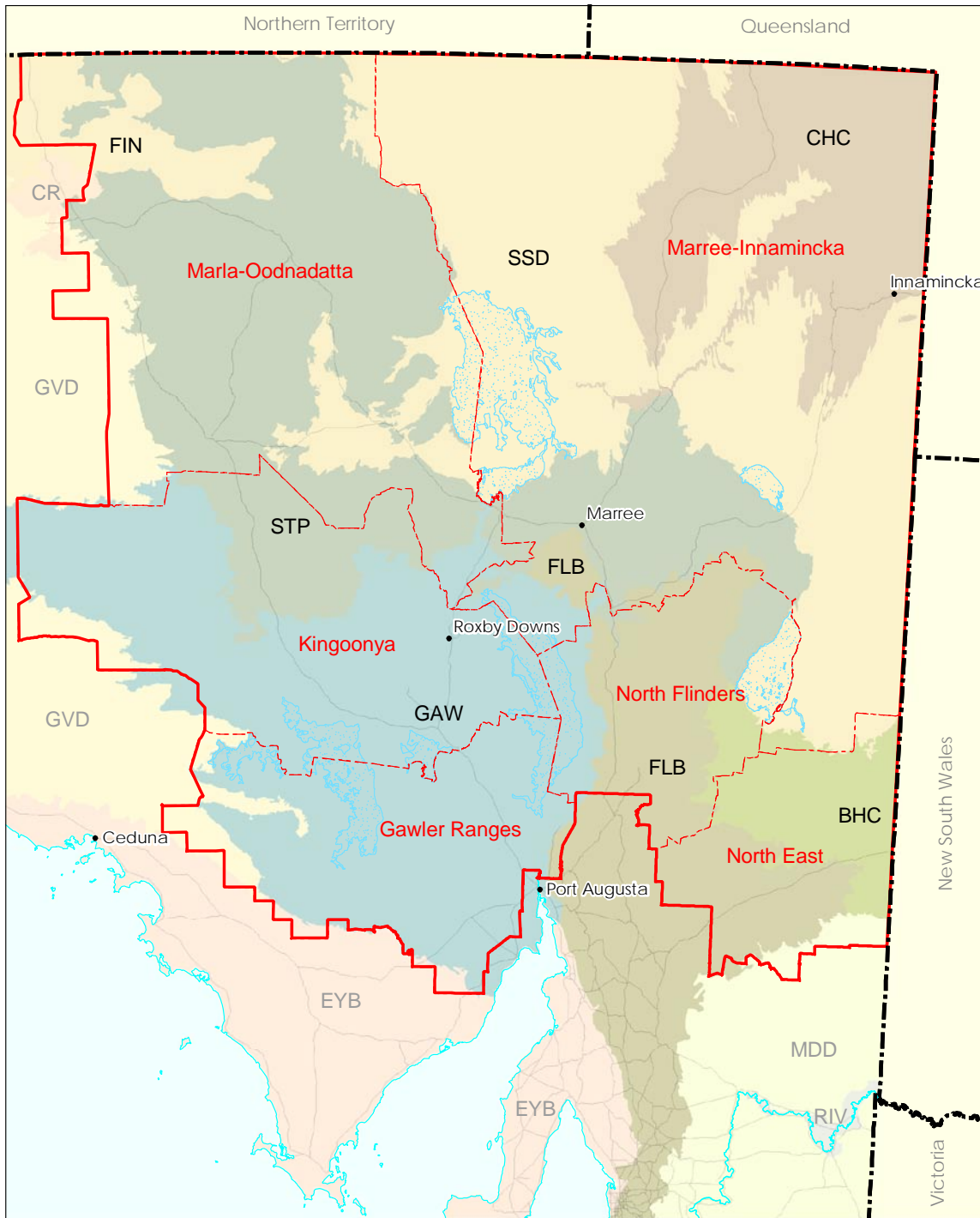
1. It provides a set of priorities for biodiversity conservation in the Gawler bioregion. Technical staff can confidently structure existing or new projects to deliver the actions identified for each conservation priority.
2. It identifies practical strategies for direct involvement by land managers. Technical staff can use these strategies to structure and develop engagement and extension programs to build capacity of land managers to achieve effective biodiversity conservation goals.

### **Land managers**

For the land managers of the Gawler bioregion, this document clearly sets out biodiversity conservation priorities for the bioregion, and describes the activities that need to be undertaken to address these priorities. The document also suggests practical strategies and actions that land managers can undertake, as part of their day-to-day operations, to maintain and improve biodiversity.



# South Australian Arid Lands NRM region – IBRA bioregions



## Bioregion

- |                            |                                     |  |
|----------------------------|-------------------------------------|--|
| Broken Hill Complex (BHC)  | Gawler (GAW)                        | South Australian Arid Lands NRM Region         |
| Channel Country (CHC)      | Great Victoria Desert (GVD)         | South Australian Arid Lands NRM Group Boundary |
| Central Ranges (CR)        | Murray Darling Depression (MDD)     | Salt Lake                                      |
| Eyre Yorke Block (EYB)     | Riverina (RIV)                      | Major Road                                     |
| Finke (FIN)                | Simpson-Strzelecki Dunefields (SSD) | State Border                                   |
| Flinders Lofty Block (FLB) | Stony Plains (STP)                  | Locality                                       |



## SECTION 1

# GAWLER DESCRIPTION

IBRA subregions

Major landforms

Major land uses

Threats to biodiversity

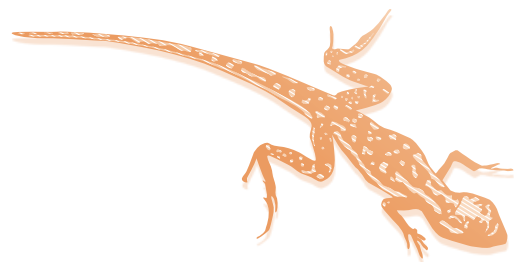


Photo: Mallee, Lake Gilles CP





# Gawler description

*Covering an area of 120,688 km<sup>2</sup> of South Australia, the Gawler bioregion represents 12.30% of the State\*.*

The Gawler bioregion covers over a quarter of South Australia's pastoral rangelands. It is bounded in the north by the Stony Plains, in the south by the higher rainfall agricultural areas of Eyre Peninsula, the west by the Great Victoria Desert, and the east by the Flinders Ranges. The Gawler bioregion is in the west of the state and lies on a climatic gradient between the temperate agricultural regions of the south and the semi-arid and arid pastoral regions of the north. This bioregion is a transition zone for numerous South Australian and Western Australian species of flora and fauna that are either at the limit of their range, or have some close affinities with species to the west or the east.

Landscapes in the bioregion are diverse. In the central and southern parts, immediately north of the agricultural area, are extensive areas of mallee and the distinctive granite rocky hills of the Gawler Ranges, surrounded by large salt lakes. The Mulga sand plains and dunes to the northwest are an extension from the Great Victoria Desert bioregion, and are a stark contrast from the undulating stone-covered Arcoona Tablelands west of Lake Torrens. Calcareous plains with chenopod shrubland occur across the central and northern parts of the bioregion, while similar country in the southeast supports open Western Myall shrubland with Bluebush.

The geology of the bioregion gives rise to a wide range of different soil types and landscapes, and supports variety of habitats. The arid north is underlain by basement rock up to 2,000 million years old, and is covered by sand plains and dunes that support Mulga woodlands and chenopod shrublands. The neighbouring undulating, gibber-covered Arcoona tablelands are much younger in comparison. The granite hills of the Gawler Ranges were formed about 1,600 million years ago during a period of volcanism and ash and lava flows. Amongst the granite ranges are a series of low-lying salt lakes including Lakes Gairdner, Everard, Island Lagoon, MacFarlane, Acraman and Gilles.

Outcropping iron-rich rocks north-east of Tarcoola are remnants of a younger sedimentary phase, and further south, abutting the higher rainfall agricultural area, the calcareous loamy plains support open Myall woodlands with chenopod shrublands of Bluebush and Saltbush. Geologically, most recent of all are the wind-blown longitudinal dunefields and sand spreads south-west of Coober Pedy that formed less than 15,000 years ago.

\*Bioregions and subregions are the reporting unit for assessing the status of native ecosystems, their protection in the national reserve system and for use in the monitoring and evaluation framework in the Australian Government's current Natural Resource Management initiatives. The IBRA boundaries presented in this report are provisional and unpublished and will not be officially recognised until IBRA version 7 is released in 2009. Monitoring and evaluation on the Gawler bioregion will be consistent with national guidelines and fit the national monitoring and evaluation framework.

The complexity of the landscape is enhanced further by the rainfall variation. The bioregion is influenced by the weather of the mid latitudes from the south as well as the monsoonal tropical systems from the north. There appears to be little seasonality to the weather patterns, and most of the country usually responds quickly to rain at any time of the year. In the north, annual rainfall can be less than 150 mm, whilst the rocky hills of the Gawler Ranges often receive over 300 mm. These rugged ranges are the most biologically significant and diverse part of the bioregion, with the western part of the Gawler Ranges around Scrubby Peak recognised as a unique and key biological area. There are at least eight endemic plants in the Gawler bioregion, one of which is nationally threatened. There are two flora and seven fauna species that are recognised as nationally threatened. One of the fauna species is also endemic to the region.

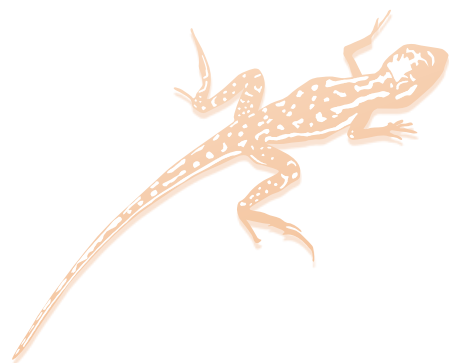


Photo: Pearl Bluebush *Maireana sedifolia*

# IBRA subregions

*Eight IBRA subregions occur within the Gawler bioregion. Detailed descriptions of the landsystems of the Gawler bioregion can be found in the District Plans published by the Kingoonya and Gawler Ranges Soil Conservation Boards.*

## Gawler bioregion

### Myall Plains (GAW1)

Undulating, sand-covered calcareous plains of northern Eyre Peninsula, covered with mallee and Western Myall shrubland, interrupted by quartzitic hills with mallee and heathy shrubs.

**Total Area:** 12,038 km<sup>2</sup>.

**Landsystems:** Bittali; Ebunbanie; Hesso; Iron Knob; Jungle Dam; Oxys; Pandurra; Peter Pan; Peterlumbo; Roopena; Thurlga; Weednanna; Yarlerberrie; Yorkey and Yudnapinna.

### Gawler Volcanics (GAW2)

Undulating plains with some gypsum crusting, low hills with silcrete gibbers and low gypcrete escarpments.

**Total Area:** 25,927 km<sup>2</sup>.

**Landsystems:** Baltana; Koonchera; Oodnadatta and Paisley.

### Gawler Lakes (GAW3)

Extensive undulating calcareous plains north of the Gawler Ranges, including Lake Gairdner, Lake Torrens, Lake Acraman and Island Lagoon complexes. Plains of Western Myall, Mulga and Bluebush, with saline plains of samphire and chenopod shrubland.

**Total Area:** 20,377 km<sup>2</sup>.

**Landsystems:** Acraman; Arcoona; Beacon; Bowen; Ebunbanie; Gairdner; Glendambo; Hesso; Horseshoe; Kolendo; Labyrinth; Mendea; Roxby; Torrens; Vivian; Waulalumbo; Yathong and Yorkey.

### Arcoona Plateau (GAW4)

Dissected stony tablelands and plains underlain by sediments of Stuart Shelf. Saltbush low shrublands on gilgai soils with mixed tall shrublands on sand mantles of more recent age.

**Total Area:** 10,845 km<sup>2</sup>.

**Landsystems:** Arcoona; Bowen; Douglas; Gairdner; Lookout; Roxby; Tent Hill and Yorkey.

### Kingoonya (GAW5)

Low stony hills of the Mulgathing Complex with ancient alluvial plains. Low hills and rises of Mulga and Sandhill Wattle shrublands or Bluebush shrublands with calcareous plains of Western Myall shrublands over Bluebush and Saltbush.

**Total Area:** 19,144 km<sup>2</sup>.

**Landsystems:** Buckshot; Christie; Commonwealth; Dingo; Ebunbanie; Gairdner; Gina; Glendambo; Indooroopilly; Labyrinth; Mailgate; Paisley; Phillipson; Tallaringa; Vivian; Wynbring and Yarna.

### Torrens (GAW6)

Lake Torrens and alluvial plains derived from erosion of the Flinders Ranges. Diverse chenopod low shrublands on alluvial soils with low woodlands and tall shrublands on sandy plains.

**Total Area:** 14,329 km<sup>2</sup>.

**Landsystems:** Arcoona; Kallioota; Myrtle; Parachilna; Stuarts Creek and Torrens.

### Roxby (GAW7)

Sand sheets and dunefields over partly exposed alluvial plains covering the Gawler Craton and Stuart Shelf sediments. Mulga grassy woodlands on sand sheets grading to Sandhill Wattle and Northern Cypress-pine linear dunes with Western Myall woodlands over chenopods on calcareous plains.

**Total Area:** 14,035 km<sup>2</sup>.

**Landsystems:** Arcoona; Christie; Coward; Dingo; Emu; Glendambo; Labyrinth; Lookout; Mudla; Phillipson; Roxby; Torrens and Vivian.

### Commonwealth Hill (GAW8)

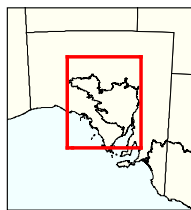
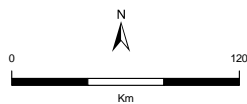
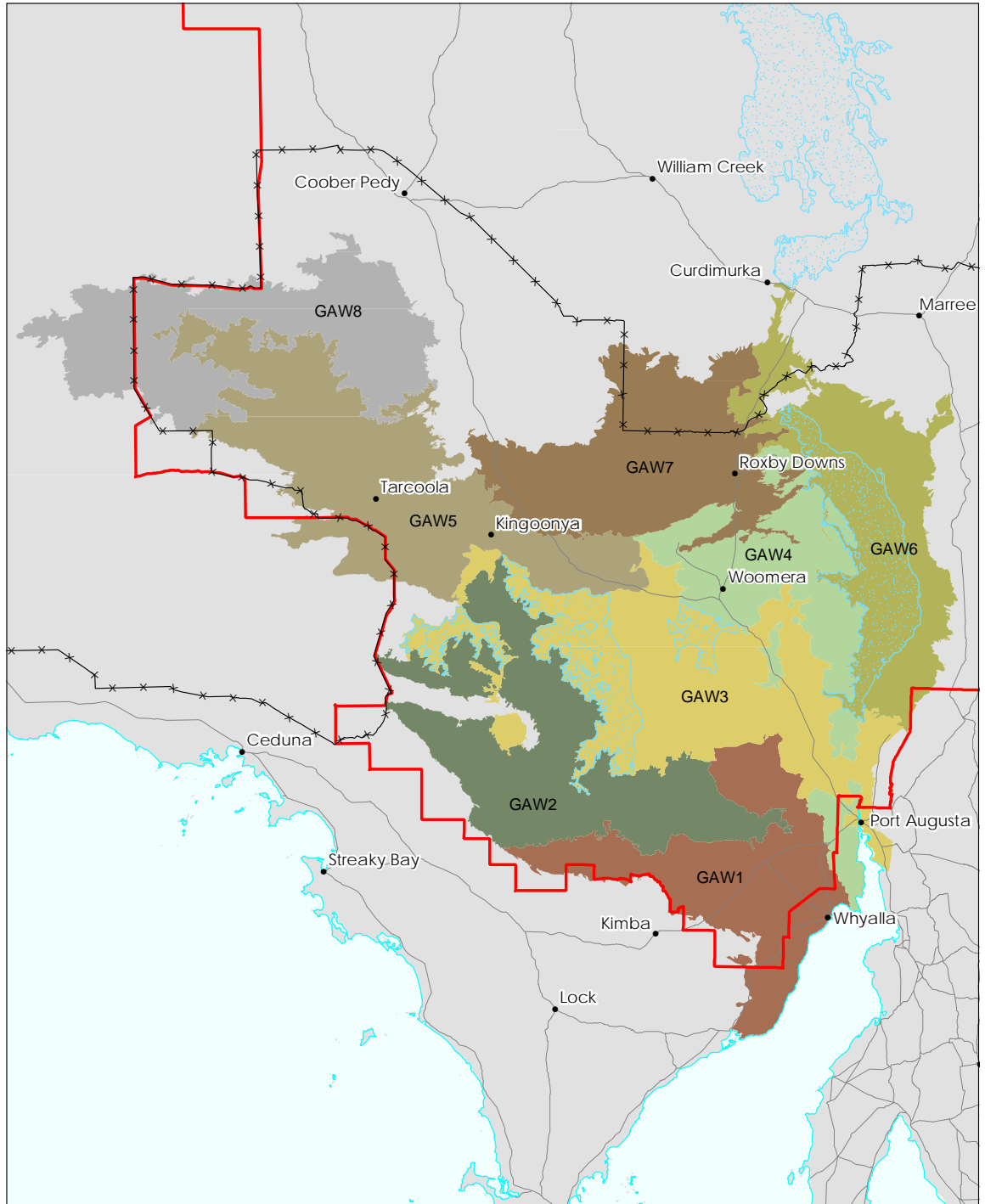
Flat sandy plain of northern and western margins of the Gawler Craton covered with sand sheets and dunefields. Mulga low woodlands and Western Myall tall shrublands over perennial and annual grasses or chenopods. Isolated complexes of salt lake and lunette systems.

**Total Area:** 14,432 km<sup>2</sup>.

**Landsystems:** Carringallana; Christie; Commonwealth; Gina; Glendambo; Indooroopilly;



## Gawler – IBRA subregions



### Subregion

- Myall Plains (GAW1)
- Gawler Volcanics (GAW2)
- Gawler Lakes (GAW3)
- Arcoona Plateau (GAW4)
- Kingoonya (GAW5)
- Torrens (GAW6)
- Roxby (GAW7)
- Commonwealth Hill (GAW8)

South Australian Arid Lands NRM Region

Salt Lake

Dog Fence

Major Road

Locality



# Major landforms

*There are five major landforms in the Gawler bioregion.*

## **Drainage lines, floodplains and salt lakes**

Ephemeral watercourses and floodplains draining into six main surface-water basins; Lakes Torrens, Gairdner, Gilles, Harris, Everard and Acraman, which are all part of a complex of saline lakes with shoreline dunes, lunettes and saline deltas.

Subregions: GAW2; GAW5; GAW6; GAW7 and GAW8.

## **Sand dunes and sand plains**

Characterised by parallel dunes of varying spacing, and sand plains of varying depths, over underlying heavier soils, which are sometimes exposed.

Subregions: GAW1; GAW2; GAW3; GAW4; GAW5; GAW6; GAW7 and GAW8.

## **Stony plains**

Low plateaux on sandstone and quartzite with an undulating surface of wind-blown sand, with a cobble and gibber cover, characterised by a dense cover of small pebbles.

Subregions: GAW4; GAW6 and GAW7.

## **Plains and rises**

Relatively flat to gently undulating areas, characterised by alluvial plains and plains of sandy red duplex soils, red cracking clays and calcareous soils. When associated with ranges, deeper duplex soils are more common. To the north are rises with shallow loamy soils underlain by quartzite and sandstone. In the south are gently undulating calcrete plains with occasional quartzite or granite hills.

Subregions: GAW1; GAW2; GAW3; GAW4; GAW5; GAW7 and GAW8.

## **Ranges and hills**

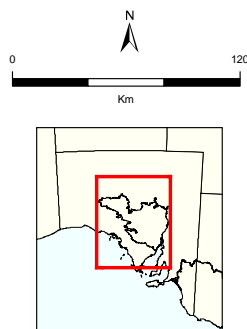
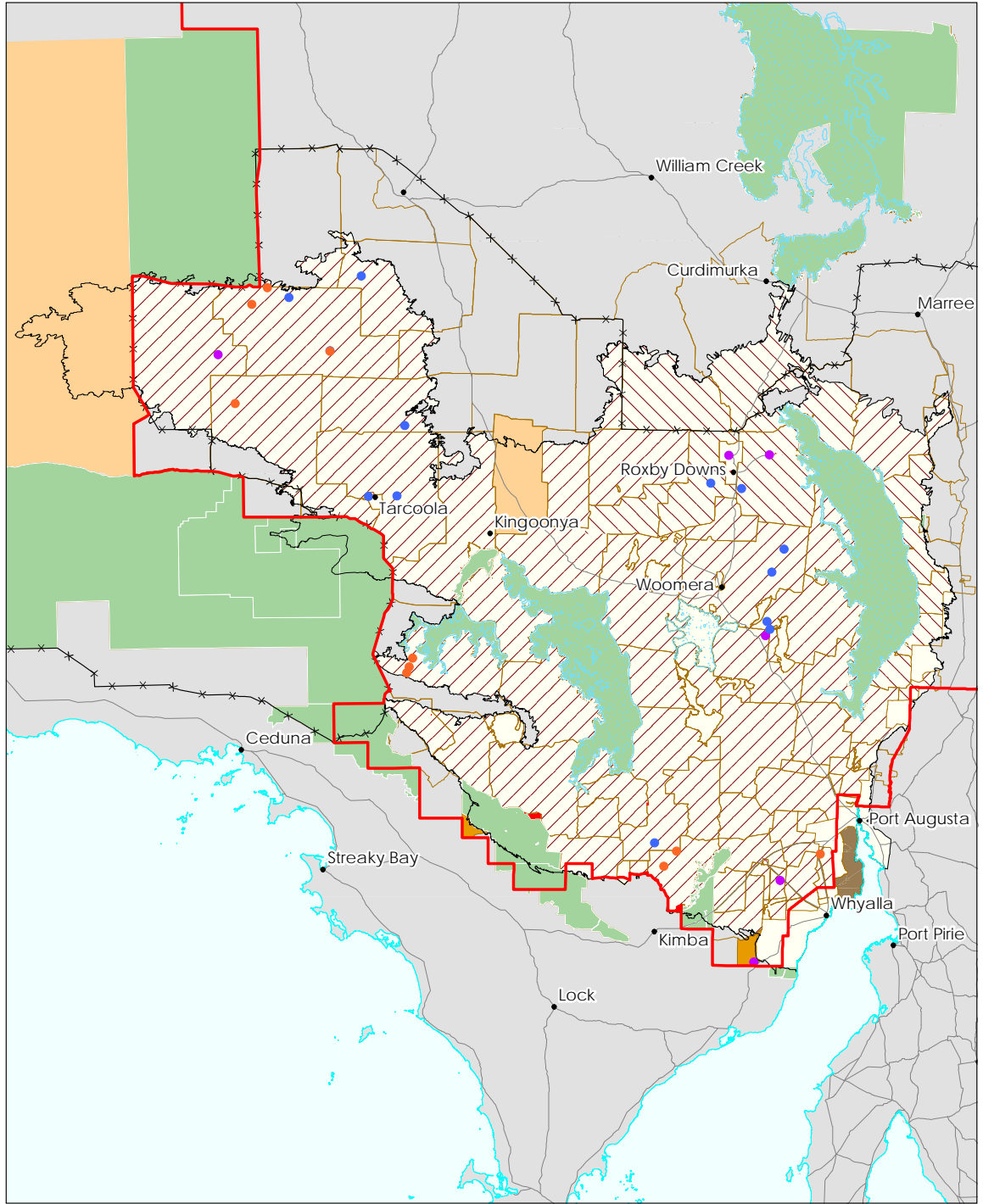
Ranges and hills generally below 700 m altitude with vegetation cover dominated by semi-arid species. Steep hogback ridges are representative of the Middleback Ranges, and Volcanic and Proterozoic sediments make up the Gawler Ranges.

Subregions: GAW1; GAW2; GAW3; GAW4; GAW5; GAW7 and GAW8.

Conservation priorities have been grouped under each landform.



# Gawler – land use



## Land use

- Pastoral Station
- Mainly Cattle
- Mainly Sheep
- DEH Managed Area
- Indigenous Protected Area
- Pastoral lease managed primarily for conservation

## Major Mining Activity

- Operating
- Prospect
- Resource
- Crown Lands Act Reserves
- ADF Military Land

- Gawler Bioregion
- South Australian Arid Lands NRM Region
- Salt Lake
- Dog Fence
- Major Road
- Locality





# Major land uses

*There are five major land uses in the Gawler bioregion.*

## **Pastoralism**

There is a long history of pastoralism in the Gawler bioregion, with sheep being grazed in the Gawler Ranges as early as the 1850s. Sheep grazing for wool and meat production is the primary land use, however some leases also run cattle. Due to the low rainfall (annual average 125 mm to 175 mm) the country can only sustain relatively low stocking rates. Low rainfall coupled with high evaporation rate means there is no permanent surface water, making the provision of water a limiting factor for stock distribution.

## **Conservation**

Conservation reserves in the bioregion include three National Parks, two Conservation Parks and numerous small reserves. The Myall Plains subregion has the largest number of conservation reserves, including Lake Gilles and Whyalla Conservation Parks (CP), the northern part of Munyaroo CP, and the southern half of the Gawler Ranges National Park (NP). The northern part of the Gawler Ranges NP is in the Gawler Volcanics subregion. Lake Gairdner NP is a prominent landscape feature of the Gawler Lakes subregion, as is Lake Torrens NP in the Torrens subregion. The western edge of the Kingoonya subregion is encroached by the north eastern tip of Yellabinna Regional Reserve.

In the Roxby subregion, north of Olympic Dam, is the internationally renowned Arid Recovery reserve. Arid Recovery is an ecosystem restoration initiative working towards the restoration of Australia's arid lands. Established in 1997, the program is based on a 86 km<sup>2</sup> fenced reserve from which all feral cats, rabbits and foxes have been eradicated. This provides a safe haven for native fauna, and has also enabled the reintroduction of a number of critically endangered native animals.

## **Tourism**

The Gawler Ranges are the main tourist destination in the bioregion, particularly since the southern part of the Ranges became a National Park in 2002. Nature-based tourism is becoming a significant land use in the bioregion, and is promoted through both public and private enterprises.

Port Augusta and Whyalla are important regional centres for promoting tourism in the Gawler region. As well as natural attractions, the bioregion has a number of industry tourism attractions including Olympic Dam mine and Andamooka Opal Fields. Port Augusta is a major crossroad for tourists travelling in and through the Gawler bioregion. With the Stuart Highway running north, and the Eyre Highway west, these major arterial routes provide easy access for large numbers of tourists each year.

## Mining

There is a long history of small-scale mining in the bioregion, with gold mining beginning around Tarcoola as early as 1893. The Gawler bioregion is a major focus for mineral exploration, and petroleum resources, particularly coal bed methane, is a new focus. Exploration for geothermal resources is active in the eastern part of the region. Opal mining at Andamooka began in the 1930s and continues as a collection of small mines over a small area dug using backhoes and bulldozers. It is one of the world's major sources of opal. In recent years there have also been a small sand mining operation on Purple Downs, a small slate quarry on Andamooka Station, copper at Mt Gunson, gold at Glenloth (west of Lake Harris) and salt at Whyalla.

Large-scale mining came to the bioregion with the discovery of the Olympic Dam ore body in the 1970s. The Olympic Dam operation is the most significant mining activity in the bioregion, extracting copper, uranium, gold and silver, and currently is one of Australia's largest underground mines. The mine has a highly mechanised modern plant, and is serviced by the purpose-built town of Roxby Downs nearby. Expansion of the mine and township is expected as the mine increases production in the coming years. The Middleback Ranges, west of Whyalla are the focus of major iron ore extraction from the Iron Duke, Iron Knob and Iron Baron open cut operations.

## Military

The remote wide open spaces, accessible rail and road networks and established support services of the Gawler bioregion has made it the ideal location for a range of defence and aerospace related training and testing facilities. The Gawler bioregion boasts two of the Defence Department's most important land-based assets, the Woomera Prohibited Area (WPA) and the Cultana Training Range.

The WPA covers 127,000 km<sup>2</sup>, with almost a third of this area in the Gawler bioregion, stretching across the subregions of Arcoona Plateau, Kingoonya, Roxby and Commonwealth Hill. It is the largest land-based rocket launching and testing range in the western world, and has the advantage of being located in a vast area of land and air space with extremely low population density, favourable year-round desert climate and flat, easily accessible topography.

The Cultana Training area south of Port Augusta in the Arcoona Plateau subregion, provides facilities for all-season Army training and equipment testing. It comprises around 500 km<sup>2</sup> of rugged country suitable for both land and shore line operations between Port Augusta and Whyalla. Use of the Cultana facility is growing and is expected to expand in the next few years making it a significant land use in the Gawler bioregion.



Photo: Western Grey Kangaroo *Macropus fuliginosus*

# Threats to biodiversity

*There are many threats to biodiversity in the Gawler bioregion. Some are specific to particular areas, or act primarily within the Gawler bioregion, whilst others extend across multiple bioregions or jurisdictions.*

*The impacts of these threats also vary with time. The main threats to biodiversity in the Gawler bioregion include:*

## **Excessive total grazing pressure**

The combined effects of excessive grazing pressure from domestic stock, feral and native herbivores.

**Impact:** Reduction in recruitment of some native plant species (decreasers); increase in recruitment of some unpalatable native plant species (increasers); loss of native animals due to competition for resources; reduction in habitat quality; increased soil erosion and increased spread of weeds and disease.

## **Alteration to natural water flows**

Restrictions to natural flow and/or flooding regimes of a watercourse due to diversions or the construction of artificial flow barriers and storage areas, including tracks, roads, borrow pits, dams and other infrastructure.

**Impact:** Change in ecosystem structure, disruption of dispersal mechanisms of aquatic species; loss of refuges and increased soil erosion and salinity.

## **Competition for resources by pest plants and animals**

Introduced fauna and flora species compete with native species for resources.

**Impact:** Reduction in recruitment and density of native plants and animals; change in species composition of ecosystems and potential loss of native plants and animal species.

## **Excessive predation**

Hunting and consumption of native animals by introduced carnivores.

**Impact:** Change in species composition of ecosystems and potential loss of native animals.

## **Altered fire regimes**

Changes to intensity, season and frequency of fire from the previous regime under which the ecosystem evolved.

**Impact:** Change in ecosystem structure and habitat value; loss of local populations of plants and animals.

## **Mechanical disturbance**

Changes to the vegetation cover as a consequence of human activity that leaves the soil exposed.

**Impact:** Loss of habitat and reduction in habitat value for native species; increased potential spread of weeds increased soil erosion.

## **Pollution**

Reduction in quality of ground and/or surface water as a consequence of human activity.

**Impact:** Loss of native species; decline in habitat value in and surrounding waterholes; nutrient enrichment from stock faeces impacting fish and amphibian habitat quality.

## **Climate change**

Changes in rainfall patterns and increase in temperature.

**Impact:** Reduction in the geographic range of species, changes in the location, structure and composition of habitats and ecosystems, increased risk of extinction of already vulnerable species and expansion of invasive species.





## Section 2

# CONSERVATION PRIORITIES

### Identifying conservation priorities

Biodiversity exists at three levels - genes, species and ecosystems - and occurs at a variety of scales, from square metres to thousands of square kilometres. At each of these levels, it is necessary to identify thresholds where species, ecosystems or landscapes are recognised as priorities for targeted investment. Conservation priorities addressed by this strategy include:

**Threatened species;** Identified as Critically Endangered, Endangered or Vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

**Endemic species;** Identified as occurring only within a single bioregion.

**Threatened ecological communities;** Identified as Critically Endangered, Endangered or Vulnerable under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999, or identified in Neagle (2003) An Inventory of the Biological Resources of the Rangelands of South Australia.

**Significant ecological processes;** Significant ecological processes are those identified as being significant in maintaining the viability of species, communities, ecosystems or landscapes.

**Other species or communities considered to be at risk** but not currently listed under the Commonwealth Government's Environment Protection and Biodiversity Conservation Act 1999.

Conservation priorities have been presented within this strategy as either significant ecological processes or groupings of species and ecological communities that share a common set of conservation requirements at similar spatial scales. Individual conservation priorities have been grouped under the major landforms in the region.

### Mapping conservation priorities at multiple scales

This strategy follows the method of Brandle (1998), and uses broad landform patterns to group vegetation communities and categorise the landscape. Vegetation communities, land systems, subregions and IBRA bioregions are all categorised by the dominant landform at their respective scales. Whilst the distribution of biodiversity correlates strongly with landforms within bioregions, ecological processes, disturbance regimes and land use influence the distribution of biodiversity within the landscape.

Photo: Lake Gairdner

Landform	Conservation priority	
Drainage lines, floodplains and salt lakes	Ecological response to water flows in the landscape	<b>Significant ecological process</b> <ul style="list-style-type: none"> <li>Significant breeding events on inland saline lakes</li> </ul>
	Significant threatened and endemic flora species on gypseous soils in and around saline areas	<b>Endemic flora</b> <ul style="list-style-type: none"> <li>Lake Acraman Button-daisy (<i>Leptorhynchos melanocarpus</i>)</li> </ul> <b>Nationally threatened flora</b> <ul style="list-style-type: none"> <li>Club Spear Grass (<i>Austrostipa nullanulla</i>)</li> </ul>
Sand dunes and sand plains	Pernatty Knob-tail on sand dunes	<b>Nationally threatened fauna</b> <ul style="list-style-type: none"> <li>Pernatty Knob-tailed Gecko (<i>Nephrurus deleani</i>)</li> </ul>
	Mulga low woodlands on sand plains	<b>Threatened ecological community</b> <ul style="list-style-type: none"> <li>Mulga low woodland on sand plains</li> </ul>
Stony plains	Significant fauna species on cracking clay plains and stony plains with gilgais	<b>Nationally threatened fauna</b> <ul style="list-style-type: none"> <li>Plains Rat (<i>Pseudomys australis</i>)</li> <li>Thick-billed Grasswren (eastern) (<i>Amytornis textilis modestus</i>)</li> </ul>
Plains and rises	Bullock Bush tall shrubland on alluvial soils of plains	<b>Threatened ecological community</b> <ul style="list-style-type: none"> <li>Bullock Bush tall shrubland</li> </ul>
	Significant bird species in chenopod shrublands	<b>Nationally threatened fauna</b> <ul style="list-style-type: none"> <li>Thick-billed Grasswren (eastern) (<i>Amytornis textilis modestus</i>)</li> <li>Slender-billed Thornbill (western) (<i>Acanthiza iredalei iredalei</i>)</li> </ul>
	Significant species in mallee habitat	<b>Nationally threatened fauna</b> <ul style="list-style-type: none"> <li>Mallefowl (<i>Leipoa ocellata</i>)</li> </ul> <b>Nationally Threatened Flora</b> <ul style="list-style-type: none"> <li>Yellow Swainson-pea (<i>Swainsona pyrophila</i>)</li> </ul>
Ranges and hills	Significant and endemic plant species on ranges and hills	<b>Nationally threatened flora</b> <ul style="list-style-type: none"> <li>Corunna Daisy (<i>Brachycome muelleri</i>)</li> <li>Desert Greenhood (<i>Pterostylis xerophila</i>)</li> <li>Ooldea Guinea-flower (<i>Hibbertia crispula</i>)</li> </ul> <b>Endemic flora</b> <ul style="list-style-type: none"> <li><i>Acacia toondulya</i></li> <li>Gawler Ranges Greenhood (<i>Pterostylis ovata</i>)</li> <li>Gawler Ranges Hop-bush (<i>Dodonaea intricata</i>)</li> <li>Gawler Ranges Grevillea (<i>Grevillea parallelinervis</i>)</li> </ul>
	Yellow-footed Rock-wallaby on ranges and hills	<b>Nationally threatened fauna</b> <ul style="list-style-type: none"> <li>Yellow-footed Rock-wallaby (<i>Petrogale xanthopus xanthopus</i>)</li> </ul>



## Drainage lines, floodplains and salt lakes

Drainage lines and floodplains, though scattered across all eight of the subregions, make up only a minor component of the Gawler bioregion landscape. Even in the outcropping hills of the Gawler Ranges, there are few permanent streams, with the drainage patterns consisting largely of intermittent streams carrying relatively small amounts of rainfall into the lakes. In a low rainfall area like the Gawler Ranges and surrounds, there are few shallow, freshwater aquifers, and no true riverine systems. The rounded hills of the ranges are defined by fractures in the volcanic rock, and drainage is mostly impeded resulting in many large salt pans.

Salt lakes and claypans are prominent drainage features of the bioregion, and mainly occur at the ends of drainage lines, or as a series of depressions along ancient river channels that have been in-filled by river sands or gravels, and are now covered by more recent sediments.

Catchment for the lakes is from minor creeks, significant rainfall events, and run-off from adjacent mountain ranges including the Stuart Range in the north and the Flinders Ranges to the east. The larger salt lakes like Gairdner and Torrens generally hold some surface water after heavy winter rains, but are usually dry during summer. Lake Gairdner also has occasional springs where saline groundwater discharges onto the lake surface forming low, gypseous mounds.

Vegetation includes both salt tolerant plants and those able to survive extended periods of inundation. Lake shores are usually bare, but sometimes support low samphire shrublands. Deep sands of the dunes are dominated by Northern Cypress-Pine, Mulga and Horse Mulga. Saline sandy, silty and clayey soils of swamps and drainage areas support either tall shrublands of Tea-Tree or Mulga, or low shrublands of Nitre Goosefoot, Bladder Saltbush, Lignum and samphire.

Minor drainage lines around Lake Phillipson and the northern part of the Arcoona Plateau are lined with Coolibah or sometimes River Red Gum woodland.

### Significance of drainage lines, floodplains and salt lakes

The inland saline lakes, when in flood, provide suitable habitat for numerous wader species. When inundated, these lakes are highly productive, and support significant breeding events for waterbirds including the Silver Gull (*Larus novaehollandiae*), Australian Pelican (*Pelecanus conspicillatus*), Black Swan (*Cygnus atratus*), Caspian Tern (*Sterna caspia*), Red-necked Avocets (*Recurvirostra novaehollandiae*), Red-capped Plover (*Charadrius ruficapillus*) and Banded Stilt (*Cladorhynchus leucocephalus*). The Banded Stilt, a long-lived species with a reproductive cycle that largely reflects the infrequency of flooding events has been recorded breeding once on Lake Torrens.





The islands in the larger lakes contain a remarkable diversity of environmental associations and plant communities. Whilst drainage lines themselves are zones of higher productivity, the high salinity and gypsum levels of the lakes and their margins are less hospitable. These areas play an important role in providing refuge and feeding areas for migratory and wetland birds and a buffer to threats that often exist in more diverse landscapes.

There are some species that rely completely on the salt lakes systems for survival, including some endemic spiders and scorpions. The tiny Lake Eyre Dragon (*Ctenophorus maculosus*) makes its home amongst the cracks in the salt crust, and the Lake Acraman Button-daisy (*Leptorhynchos melanocarpus*) has been found growing only on gypseous mounds that form islands in Lake Acraman. Club Spear Grass (*Austrostipa nullanulla*) is a small, perennial spear-grass that occurs on the gypseous lunettes or sandy loams, often in pure kopi (flour gypsum) around salt lakes in South Australia, New South Wales and Victoria. In the Gawler bioregion it is found only around the shores of Lake Gilles.

## Major vegetation communities

### Woodland

River Red Gum (*Eucalyptus camaldulensis*) tall open woodland over chenopods, grasses and ephemeral herbs in drainage lines in the far north.

Coolibah (*Eucalyptus coolabah*) low woodland over lignum (*Muehlenbeckia florulenta*) and ephemeral herbs in drainage lines in the far north.

Mallee Box (*Eucalyptus porosa*) mallee over Curry Bush (*Cassinia laevis*), Mealy Saltbush (*Rhagodia parabolica*), Clammy Daisy Bush (*Olearia decurrens*), grasses and herbs on minor drainage lines in the far south adjacent to the agricultural area.

### Shrubland

Samphire (*Tecticornia halocnemoides/Sclerostegia tenuis*) +/- Bristly Sea Heath (*Frankenia serpyllifolia*) low open shrubland in saline depressions and around lake fringes.

Bladder Saltbush (*Atriplex vesicaria*) +/- Samphires (*Sclerostegia spp./Tecticornia spp.*) low open shrubland over Bindyi (*Sclerolaena spp.*) and grasses in slightly saline areas around lake fringes.

### Grassland

Swamp Cane-grass (*Eragrostis australasica*) +/- Lignum (*Muehlenbeckia florulenta*) tall grassland over annual saltbushes, chenopods, and ephemeral herbs and grasses in non-saline swamps.

## Managing the biodiversity of drainage lines, floodplains and salt lakes – practical ways that land managers can help

The main driver of biological activity in the arid areas is water. When the amount or intensity of rainfall over the Gawler bioregion results in water run-off, surface water converges into drainage lines and eventually, if flows are large enough, onto floodplains and finally salt lakes. All salt lakes in the South Australian arid lands only contain water episodically and have widely variable salinities.

The potential biological impact of physical disturbance to dry salt lake beds is unknown, though any activity that affects the free movement of water across lakes can significantly impact upon the aesthetic appeal of these areas. Any activity on or around the fragile salt lake surface should be minimised or avoided. Activities which disturb native vegetation within catchments lead to increased soil erosion, and sediment loads in waters entering salt lakes. Drainage lines and floodplains within the catchment are often the focus for pest plant species, camping and grazing pressure from native and introduced herbivores.

Practical strategies that land managers can use on drainage lines, floodplains and salt lakes to help retain biodiversity include:

- Grazing intensity should be dependent on the type of flooding event. Local floods resulting from local rainfall will trigger a different vegetation response to flood events from rainfall in the upper catchment.
- After heavy rains, reduce total grazing pressure to enable recruiting or emerging perennial shrubs and trees to establish.
- Maximise vegetation cover to help slow water runoff and promote water infiltration after rains. This has other flow-on benefits including:
  - Increased vegetation cover assists water infiltration and nutrient cycling.
  - Greater infiltration of water into the soil increases plant growth and biodiversity
  - Increased vegetation cover protects the soil from erosion and reduces sediment in runoff waters,
  - Lower flows along drainage lines are less likely to scour and erode banks of watercourses.
- Control feral herbivores and pest plants in collaboration with neighbours and the SAAL NRM Board.





## Conservation priority

### Ecological response to water flows in the landscape

When in flood, the inland saline lakes in the Gawler bioregion provide suitable habitat for over 40 wader species. They are highly dynamic systems that when inundated become very productive and support breeding of over 10 species. Species able to take advantage of these temporary wetland conditions include the Silver Gull (*Larus novaehollandiae*), Australian Pelican (*Pelecanus conspicillatus*), Caspian Tern (*Sterna caspia*), Red-necked Avocets (*Recurvirostra novaehollandiae*), Red-capped Plover (*Charadrius ruficapillus*), and Banded Stilt (*Cladorhynchus leucocephalus*).

One of these, the Banded Stilt is endemic to Australia, and generally breeds only on inland salt lakes. Such breeding events occur irregularly and infrequently in response to rains and flooding sufficient to fill these inland lakes.

The Banded Stilt is known only to have bred in South Australia six times in the past 70 years; at Lake Callabonna in 1930, Lake Eyre North in 1984, on Stilt Island in Lake Torrens in 1989, Hughes Island in Lake Eyre North in 1997, Ibis Island in Lake Eyre North in 2000, and in 2006 Banded Stilt bred south on the increasingly saline Coorong.

The most recent major water flow into Lake Eyre was in February 2000 following cyclonic rainfall in northern Australia. Water persisted in the lake long enough to facilitate four breeding episodes within six months. During these breeding events, Silver Gulls, another species that responds to available water heavily predated on Banded Stilt eggs and young ultimately causing all nesting to fail. Though Banded Stilts may live for 20 to 25 years, large scale breeding events are driven by the infrequent filling of inland lakes and so, over its lifetime, a Banded Stilt may only have the opportunity to breed two or possibly three times.

The maintenance of a healthy population of Banded Stilts is very much dependent on achieving outstanding breeding success whenever the opportunity arises. The infrequency of reproduction events means that any failed attempts to breed may significantly affect the age structure eventually resulting in population collapse. The heavy predation by Silver Gulls represents the greatest threat to reproductive success of Banded Stilts.

### 20-year target

The success of significant breeding events on inland saline lakes is maintained or improved.

### 5-year performance information

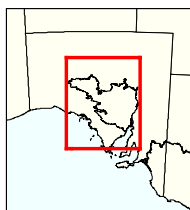
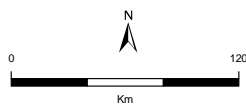
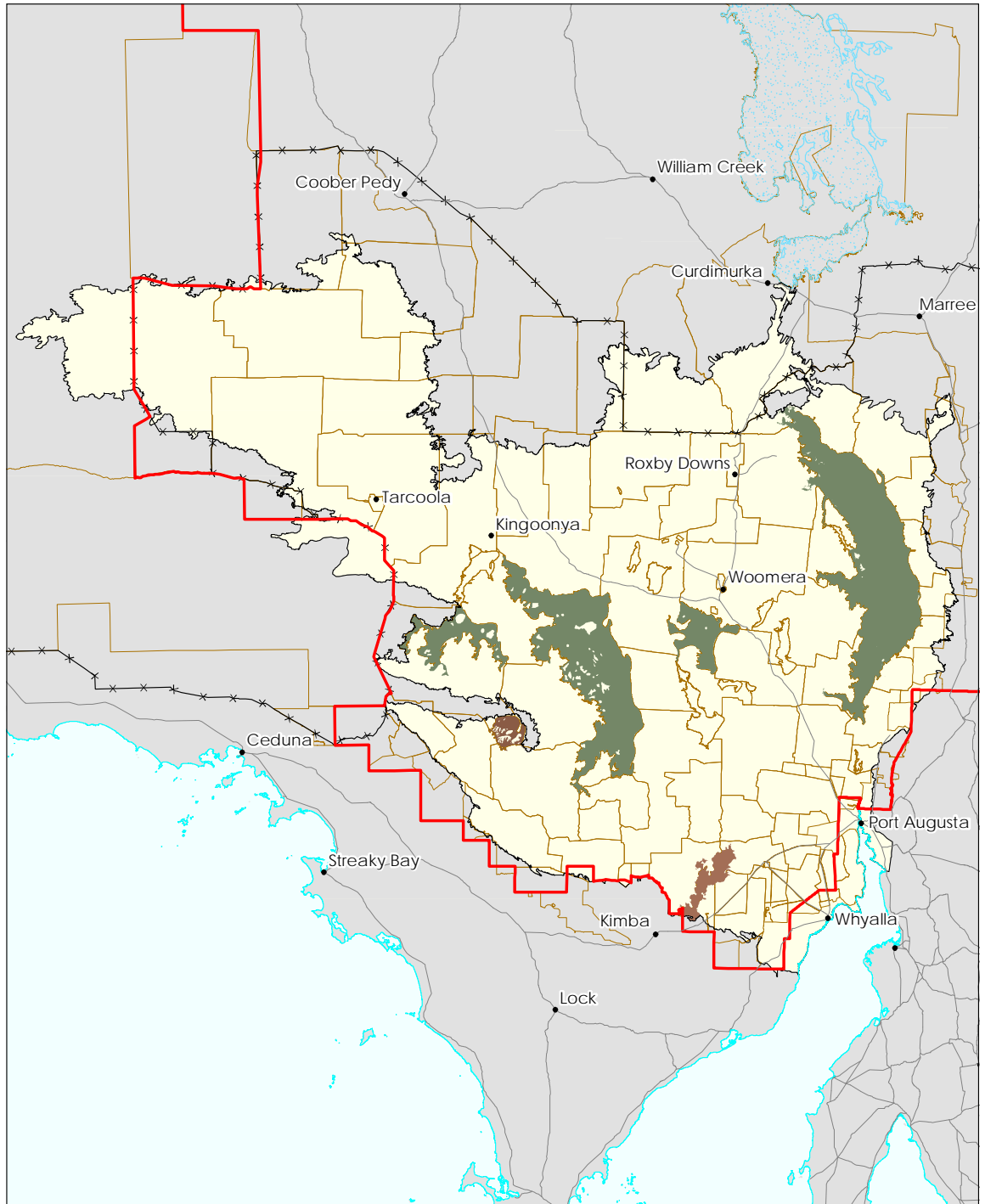
- Nest abandonment of the Banded Stilt not exceeding 30% due to Silver Gull interaction during breeding episodes.

### 5-year actions

- Determine the non-breeding distribution and habitat of the Banded Stilt and evaluate relationship between breeding success and habitat occupancy.
- Identify the source populations of Silver Gulls and work with the relevant agencies to implement gull management strategies.
- During breeding events, monitor breeding species/Silver Gull interactions and implement Silver Gull baiting program as required.
- Undertake audit of infrastructure limiting, and with the potential to limit, environmental flows into inland saline lakes.
- Reduce the impact of infrastructure on ecological flows into inland saline lakes.



## Conservation priorities for drainage lines, floodplains and salt lakes



Mapped conservation priorities provide an indication of the potential distribution

### Conservation priorities

- Ecological response to waterflows in the landscape
- Significant threatened and endemic flora species on gypseous soils in and around saline areas

- Gawler Bioregion
- South Australia Arid Lands NRM Region
- Pastoral Station
- Salt Lake
- Dog Fence
- Major Road
- Locality

Photo: (left) Still Island - Lake Torrens



# Sand dunes and sand plains

Sand dunes and sand plains are spread throughout all eight IBRA subregions of the Gawler bioregion, being more prevalent in the northern parts. Dunes are generally dominated by various forms of Mallee, Broombush and Tea Tree over chenopod shrubs, and overlay older alluvial plains or limestone.

In the drier, far eastern part of the bioregion, is an extensive dune system between Lake Torrens and the Flinders Ranges with Mulga and Northern Cypress Pine covered dunes similar to those found occasionally on the stony Arcoona Tablelands west of Lake Torrens. These orange dunes in the east of the bioregion do not support any mallee vegetation.

Widespread across the northern part of the bioregion are sandy plains dominated by Western Myall, either on red duplex soils or on firm calcareous sands over limestone. Sandy plains in this northern part can also be dominated by Mulga woodland with Bullock Bush and chenopod low shrublands on deeper sands. Chenopod low shrublands, particularly of Pearl Bluebush, Low Bluebush and Bladder Saltbush often dominate the firm calcareous sandy rises.

## Significance of sand dunes and sand plains

After rain, the dunefields become a mass of colour with the opportunistic germination and flowering of many plants that remain dormant during the dry times. The Pernatty Knob-tailed Gecko (*Nephrurus deleani*) is endemic to the Gawler bioregion, with a distribution restricted to a small area of sandhills adjacent to Pernatty Lagoon. Mulga (*Acacia aneura*) low woodland occurs on low dunes and sand plains throughout the central and northern parts of the Gawler bioregion, and to the west and south of Lake Torrens.

The Ooldea Guinea-flower (*Hibbertia crispula*) is a small wiry almost hairless shrub, endemic to South Australia. Information about the species and its habitat is limited, being known only from two widely separated locations, one near Ooldea in the Great Victoria Desert, and the other in sandhills in the western Gawler Ranges & Lake Everard region. The limited distribution and small population size of Ooldea Guinea-flower makes it highly vulnerable to extinction. Three of the subpopulations in the Lake Everard area have not been relocated in the last 25 years and are possibly extinct. The most recent record of this species was in 1992 west of Lake Gairdner.

## Major vegetation communities

### Mallee

Red Mallee (*Eucalyptus oleosa*) +/- Gilja (*Eucalyptus brachycalyx*) +/- Yorrell (*Eucalyptus gracilis*) mallee over False Bluebush (*Cratystylis conocephala*), Bladder Saltbush (*Atriplex vesicaria*) +/- Broom Emu Bush (*Eremophila scoparia*), Bindyi (*Sclerolaena* spp.) and grasses on dunes in the far south.

Ridge-fruited Mallee (*Eucalyptus incrassata*), Red Mallee (*Eucalyptus socialis*) mallee over Mallee Broombush (*Melaleuca uncinata*), sclerophyllous shrubs and grasses on dunes in the far south.

Great Victoria Desert Mallee (*Eucalyptus concinna*), Large-fruited Mallee (*Eucalyptus youngiana*) open mallee over Cactus Pea (*Bossiaea walkeri*), Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*), Pituri (*Duboisia hopwoodii*) +/- *Triodia irritans* on dunes in the far northwest, extending into the Great Victoria Desert.

### Woodland

Mulga (*Acacia aneura*) low open woodland over Sandhill Wattle (*Acacia ligulata*), Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*) and grasses on sandy plains and rises.

Southern Cypress Pine (*Callitris gracilis*) +/- Northern Cypress Pine (*Callitris glaucophylla*) +/- Mallee Cypress Pine (*Callitris verrucosa*) open woodland on lunette dunes near Lake Acraman.

Mulga (*Acacia aneura*) open low woodland over Pearl Bluebush (*Maireana sedifolia*) +/- Mulla Mulla (*Ptilotus obovatus*) +/- Mulga Grass (*Aristida contorta*) +/- *Sclerolaena obliquicuspis* on sandy plains and rises in the northern parts.

### Shrubland

Sandhill Wattle (*Acacia ligulata*) tall open shrubland over Sandhill Cane-grass (*Zygochloa paradoxa*), Lobed Spinifex (*Triodia basedowii*), grasses and ephemeral herbs on dunes.

Sandhill Wattle (*Acacia ligulata*) tall open shrubland over Wild Turnip (*Brassica tournefortii*), Buckbush (*Salsola tragus*), Poached Egg Daisy (*Polycalymma stuartii*), grasses and ephemeral herbs on dunes.

Bladder Saltbush (*Atriplex vesicaria*), Low Bluebush (*Maireana astrotricha*), +/- Black Bluebush (*Maireana pyramidata*), +/- Spiny Saltbush (*Rhagodia spinescens*) low open shrubland over grasses and Bindyi (*Sclerolaena* spp.) on extensive sandy plains.

Pearl Bluebush (*Maireana sedifolia*), Bladder Saltbush (*Atriplex vesicaria*) low open shrubland over Mulla Mulla (*Ptilotus obovatus*), grasses and ephemeral herbs with emergent Western Myall (*Acacia papyrocarpa*) on extensive sandy plains.



## Managing the biodiversity of sand dunes and sand plains – practical ways that land managers can help

Strategies that land managers can implement for managing the biodiversity of the dunefields and sand plains of the Gawler bioregion focus largely on total grazing pressure management.

Sandy areas are prone to wind erosion and once an area begins to drift, the process of re-stabilisation can take considerable time. Recruitment of palatable perennial plants requires a series of rainfall events at just the right time to allow germination, seedling establishment, flowering and seed set. These recruitment events occur very infrequently - for many species only once every 30 to 50 years. It is critical to carefully manage grazing pressure on dunes and sand plains following these events to maximise the likelihood of successful recruitment of perennial plants.

The variety of vegetation types found in the dunes and sand plains also provide valuable habitat for a wide range of native animals. Excessive total grazing pressure and weed infestations are a significant risk to these habitats.

Practical strategies that land managers can use on sand dunes and sand plains to help retain biodiversity include:

- Spelling of dune systems in dry times and not restocking immediately following a rainfall event is important to promote the recovery of perennial grasses which help stabilise dune crests.
- Avoiding locating livestock watering points on or near areas that might be prone to drifting such as dune crests. Wide open swales are preferable sites for water points to minimise livestock traffic across nearby dunes and encourage the movement of livestock out along the swales.
- Conservative stocking strategies, in particular the timely reduction in stock numbers with the onset of extended dry periods.
- Regular spelling of these systems following major rainfall events.
- Protect sand plains by not burning to provide green shoots for stock feed.
- Targeted rabbit control in areas where recruitment of perennials has occurred to ensure seedlings are not pruned off.
- Ongoing rabbit control in all areas – dry periods are especially good times to rip rabbit warrens – this ensures that if they return during wetter times they must dig new warrens to breed in.
- Control feral herbivores and pest plants in collaboration with neighbours and the SAAL NRM Board.

## Conservation priority

### Pernatty Knob-tail on sand dunes

The Pernatty Knob-tailed Gecko (*Nephurus deleani*) is a ground-dwelling, nocturnal lizard that has only been recorded in the Acacia-vegetated sand ridges adjacent to Pernatty Lagoon in the Gawler bioregion. The Pernatty Knob-tailed Gecko more commonly inhabits sand dunes dominated by Sandhill Wattle (*Acacia ligulata*), but has been recorded in a variety of dune vegetation types, including hummock grasslands, hopbush and other shrublands and Mulga woodlands.

Rabbits pose some threat to these small lizards, grazing on low vegetation vital for providing cover and protection for geckos when foraging above ground. During the day, the Pernatty Knob-tail shelters in a burrow at the base of low vegetation, where it backfills the entrance with sand for protection. Evidence suggests that these geckos can tolerate some level of disturbance from stock and rabbits, with some known populations within five kilometres of stock watering points. Trampling by stock or off road vehicle use can damage their burrows, lead to soil compaction, accelerate erosion and destroy dune vegetation.

Whilst fox and cat predation occurs, the greatest threat to this species stems from its extremely restricted range. Although it is thought that there may be other areas in the Gawler bioregion with habitat capable of supporting these geckos, they remain vulnerable to catastrophic events.

### 20-year target

The viability of the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes within the Gawler bioregion is maintained or improved.

### 5-year performance information

- Percentage of potential area occupied by the Pernatty Knob-tailed Gecko within IBRA subregions.
- Number and viability of populations of Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes within IBRA subregions.

### 5-year actions

- Determine area of occupancy and relationship between habitat and distribution and abundance of the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes.
- Identify and where possible quantify the disruption, and sources of disruption, of key ecological processes supporting individual populations of the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes.
- Identify potential habitats in the Gawler bioregion for the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes.
- Rank populations of the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes within IBRA subregions for viability based on size, threats and landscape context.
- Support land managers to improve the viability of the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes.

## Conservation priority

### Mulga low woodlands on sand plains

Mulga low woodland occurs on the Commonwealth and Indooroopilly landsystems in the north-western part of the Gawler bioregion in the Kingoonya and Commonwealth Hill subregions. The Commonwealth landsystem has Mulga on sands over perennial grasses or chenopods. The Indooroopilly landsystem further west, commonly has less chenopods and more grasses, with many low dunefields dominated by Horse Mulga (*Acacia ramulosa*). Smaller areas of this variable community are also found in Gawler Lakes, Arcoona Plateau and Roxby subregions, and the Hesso, Mendea, Roxby and Vivian landsystems.

Mulga is essentially dormant during drought but revives quickly after rain, producing seed only in relatively wet years. Understorey is variable, often being dominated by perennial grasses and chenopods. A variety of middle level shrubs may be sub-dominant in this community, particularly Sandhill Wattle (*Acacia ligulata*), Desert Senna (*Senna artemisioides*) and Narrow-leaf Hop-bush (*Dodonaea viscosa* ssp. *angustissima*), while the ground layer usually comprises tussock grasses and ephemerals.

The role of fire in the natural maintenance of Mulga populations on sandy plains is not well understood. Seedlings proliferate after fire, but almost any fire will kill mature trees that take many years to replace. Fires burning over large areas are usually intense, and carried by the more-than-usual grass cover promoted by high rainfall seasons. Whilst cattle do graze mature Mulga, this woodland community is primarily threatened by inhibited regeneration due to excessive total grazing. The reduction in rabbit numbers from Rabbit Haemorrhagic Disease (RHD) has resulted in an apparent improvement in the condition of Mulga communities. However, the extent and significance of this improvement is unknown.

### 20-year target

The viability of Mulga low woodlands on low dunes and sand plains within the Gawler bioregion maintained or improved.

### 5-year performance information

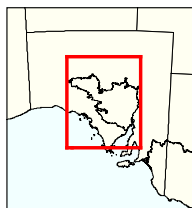
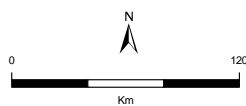
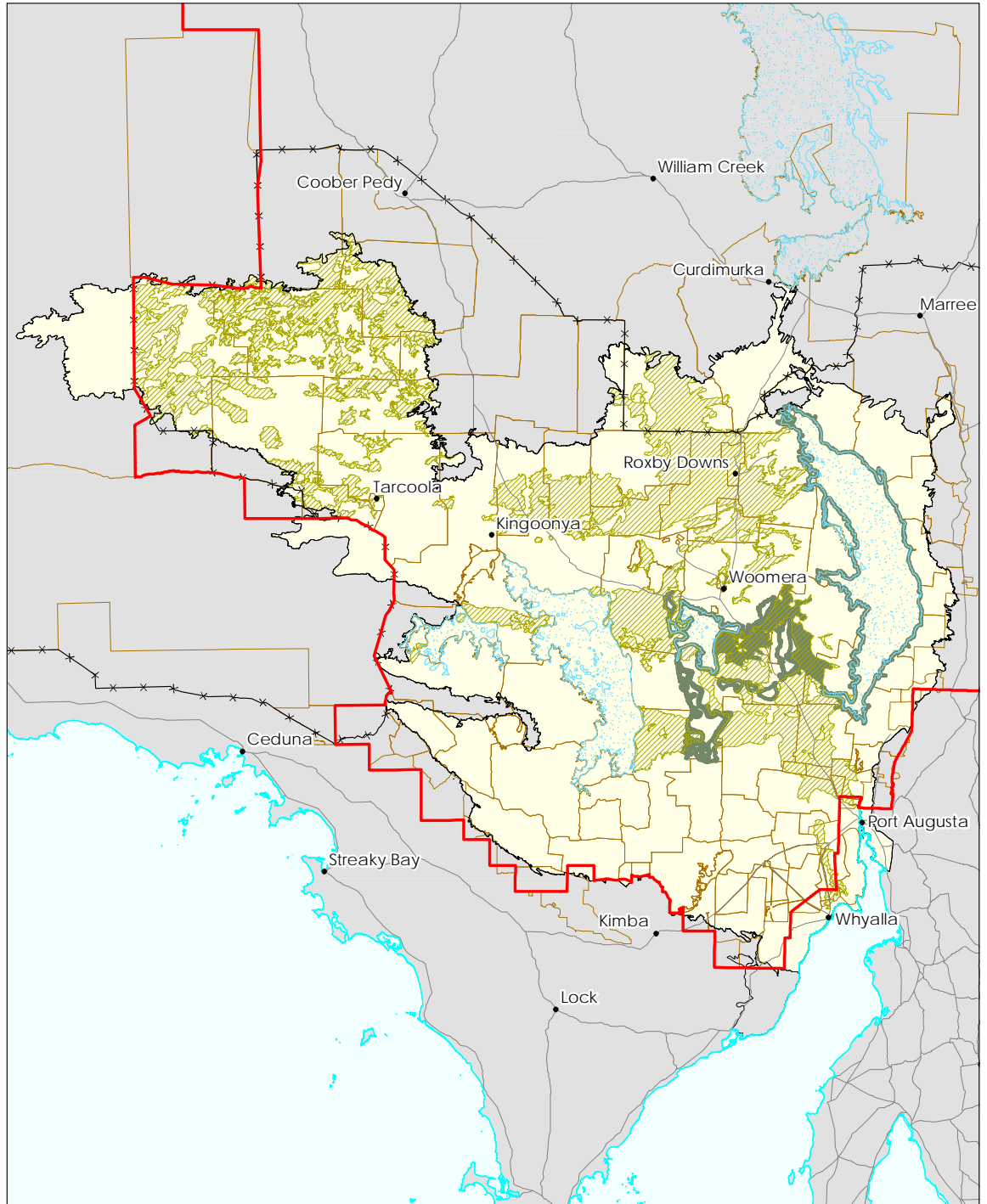
- Percentage of potential area occupied by Mulga low woodland on low dunes and sand plains within IBRA subregions.
- Condition class of individual occurrences of Mulga low woodland on low dunes and sand plains within IBRA subregions.

### 5-year actions

- Determine the current extent and condition of Mulga low woodland on low dunes and sand plains in the Gawler bioregion.
- Identify the potential area of occupancy of Mulga low woodland on low dunes and sand plains within the Gawler bioregion.
- Identify and where possible, quantify the disruption and sources of disruption of key ecological processes supporting individual populations of Mulga low woodland on low dunes and sand plains within the Gawler bioregion.
- Rank individual occurrences of Mulga low woodland on low dunes and sand plains within IBRA subregions for viability based on size, condition and landscape context.
- Develop and implement support mechanisms to assist land managers to improve Mulga low woodland on low dunes and sand plains.



## Conservation priorities for sand dunes and sand plains



Mapped conservation priorities provide an indication of the potential distribution

### Conservation priorities

- Mulga low woodlands on sand plains
- Pernatty Knob-tail on sand dunes

- Gawler Bioregion
- South Australian Arid Lands NRM Region
- Pastoral Station
- Salt Lake
- Dog Fence
- Major Road
- Locality



# Stony plains

Occupying about a fifth of this bioregion, stony plains stretch along the western side of Lake Torrens, extending from Whyalla to north of Woomera. The stony plains landscape is varied and includes gently sloping gibber plains with a cobble-sized stone cover and gibber pavements characterised by a dense cover of small pebbles.

This gently undulating gibber plain habitat is typical of the Arcoona Plateau subregion. The patchy landscape supports low chenopod shrubs in the small gilgais and very sparse hardy Bindyi with low shrubs in between. Small areas of cracking clay are a significant feature and are the most productive and biologically diverse areas in this landscape. The gilgais support Mitchell Grass, Katoora and Bladder Saltbush. After rain, annual saltbushes germinate profusely both in gilgais and between them.

The extensive and generally flat expanse of stony chenopod plains is interrupted occasionally by run-on depressions and swamps with Cottonbush, Swamp Cane-grass and Neverfail. There are also occasional Lignum or Cane-grass swamps and scattered long red sand dunes covered by Sandhill Wattle or Sandhill Cane-grass. Drainage areas are usually minor, lined with Coolibah, River Emubush, River Cooba, or sometimes Inland Paper-bark.

## Significance of stony plains

Stony deserts and gibber plains are characterised by a high proportion of ephemeral species, with short lifecycles, which enables them to exploit irregular rainfall. The most productive areas of this landscape are the gilgais and minor drainage depressions, which support most of the perennial vegetation. As these drainage areas dry out, cracks appear and by catching seeds, holding moisture and providing shelter, supporting the opportunistic breeding of small fauna species. Significant fauna species that depend on this stony plain and chenopod habitat include the Plains Rat (*Pseudomys australis*) and Thick-Billed Grasswren (*Amytornis textilis modestus*).

## Major vegetation communities

### Shrubland

Cottonbush (*Maireana aphylla*) +/- Bladder Saltbush (*Atriplex vesicaria*) low open shrubland over Neverfail (*Eragrostis setifolia*), Mitchell Grass (*Astrelba pectinata*) and Bindyi (*Sclerolaena* spp.) in gilgais, run-on areas and minor depressions.

Bladder Saltbush (*Atriplex vesicaria*), Low Bluebush (*Maireana astrotricha*), Black Bluebush (*Maireana pyramidata*), Spiny Saltbush (*Rhagodia spinescens*) low open shrubland over Bindyi (*Sclerolaena* spp.) and Neverfail (*Eragrostis setifolia*) in slightly saline areas between gilgais.

### Grassland / herbland

Ward's Weed (*Carrichtera annua*) +/- Wallaby Grass (*Austrodanthonia caespitosa*) +/- Spear-fruit Bindyi (*Sclerolaena patenticuspis*) low open herbland on plains.

Mitchell Grass (*Astrelba pectinata*), Rat's Tail Couch (*Sporobolus actinocladus*) and Bindyi (*Sclerolaena* spp.) low open grassland on gilgais.

Swamp Cane-grass (*Eragrostis australasica*) +/- Lignum (*Muehlenbeckia florulenta*) tall grassland over annual saltbushes, chenopods, and ephemeral herbs and grasses in minor non-saline swamps.

Photo: Bladder Saltbush *Atriplex vesicaria* on stony plains

## Managing the biodiversity of stony plains – practical ways that land managers can help

Stony plains cover a small proportion of the Gawler bioregion, occurring mainly across the Arcoona Plateau and north of Lake Gairdner. These areas are highly utilised by the pastoral industry for their grazing value, and for the productivity of their watercourse and floodplain country. The gibbers that cover much of the soil surface of the stony plains are extremely important for soil protection. If the gibber cover is removed, even slightly, the exposed soils are easily eroded, often resulting in dramatic gully erosion, sometimes metres deep. Once this erosion starts it is very difficult to stop. Erosion gullies redirect water flows from existing drainage lines where there is often a comparatively high level of biological activity and diversity. The various types of vegetation found on the stony plains provide valuable habitat for a wide range of native animals. Gilgais, drainage lines and sand spreads are particularly important habitat areas. Excessive total grazing pressure and weed infestations are a significant risk to these habitats.

Practical strategies that land managers can use on stony plains to help retain biodiversity include:

- When installing tracks, fence lines and other infrastructure, ensure wherever possible that the gibber cover is retained by rolling or compacting rather than mechanical disturbance (e.g. grading).
- Locate stock water points well away from slopes to minimise the risk of erosion developing on stock pads.
- Avoid soil erosion by aligning access tracks and fence lines across slopes rather than up and down, onto less erosion prone soil types wherever possible.
- Avoid creating drains, by redirecting water off tracks rather than along them. Build up roads and avoid grading tracks lower than the surrounding soil surface, or grading windrows along tracks. Install water diversion bars across tracks at strategic locations.
- Implement conservative total grazing management strategies, to avoid over utilisation of gilgais to the point where they lose perennial vegetation and become silted over. High stock numbers and intense trampling on gibber can also lead to increased erosion.
- Avoid re-stocking country immediately after good rains to allow for recruitment of perennial vegetation.
- Control feral herbivores and pest plants in collaboration with neighbours and the SAAL NRM Board.

### Arid Recovery

Arid Recovery is an ecosystem restoration initiative working to restore some of the biodiversity of Australia's arid lands. The program is the result of years of dedication and hard work by volunteers from the local and wider community, in addition to the support of the four partners; BHP Billiton, the Department for Environment and Heritage, University of Adelaide, and the community group Friends of Arid Recovery.

Established in 1997, the program comprises a 86 km<sup>2</sup> fenced reserve from which all feral cats, rabbits and foxes have been eradicated, providing protection for viable populations of native animals. It is in the Roxby subregion, just north of Olympic Dam.

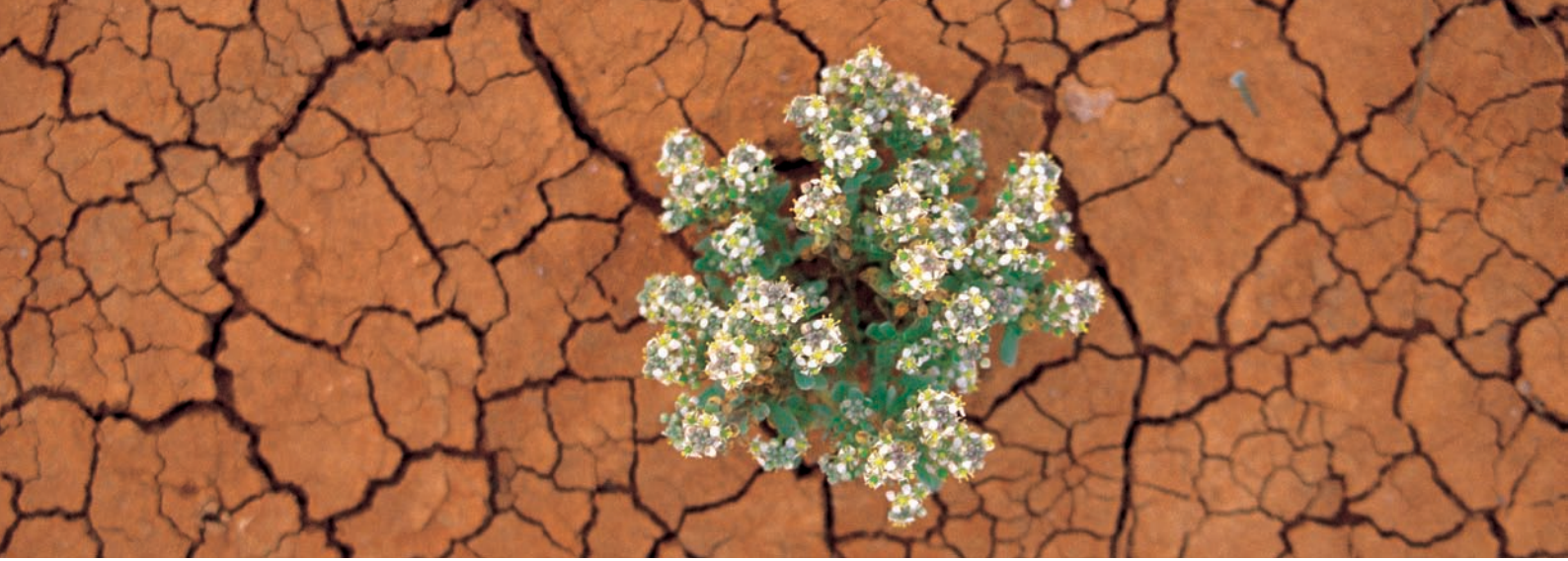
At least 27 species of native mammal once inhabited the Roxby Downs area but over 60% have become locally or completely extinct since European settlement. Some bird populations have also declined and many plant species are now rare. Arid Recovery aims to restore as much of the original fauna and flora as possible to the fenced area, through natural re-establishment and planned re-introductions. Reintroductions are research-based, to obtain information on biology of arid zone animals, the best methods for reintroduction, and whether long term re-establishment is possible.

So far, five locally extinct mammals have been reintroduced. They are the Greater Stick Nest Rat (*Leporillus conditor*), Burrowing Bettong (*Bettongia lesueur*), Greater Bilby (*Macrotis lagotis*), Western Barred Bandicoot (*Perameles bougainville*) and Numbat (*Myrmecobius fasciatus*). Woma Pythons were also released in 2007.

The Arid Recovery reserve is the largest enclosure in Australia that is completely free of feral cats, rabbits and foxes, and is specifically dedicated to arid zone conservation.

Arid Recovery is an example of how a highly successful partnership between industry, government, education and the community has encouraged conservation in a challenging environment.





## Conservation priority

### Significant fauna species on cracking clay plains and stony plains with gilgais

The Plains Rat (*Pseudomys australis*) and the Eastern Thick-billed Grasswren (*Amytornis textilis modestus*) inhabit cracking clay plains and gilgais on the Arcoona Plateau in the Gawler bioregion. Thick-billed Grasswrens depend on chenopod shrublands surrounding the cracking clay plains and gilgais, particularly those dominated by Saltbush (*Atriplex* spp.) and Bluebush (*Maireana* spp.). The Plains Rat habitat is generally associated more with low lying patches of deep cracking clay with minor drainage features and small depressions of cracking clay gilgai, common in gibber plains. These areas are more productive as they receive and retain water and nutrients from the surrounding landscape, even in relatively minor rainfall events. Plains Rats and Thick-billed Grasswrens rely on good stands of chenopod shrubland and breed opportunistically after significant rains and the flush of ephemeral vegetation.

The range of both species has declined significantly since European settlement due to habitat alteration through extensive grazing and predation from introduced carnivores. Populations of the Plains Rat and Thick-billed Grasswren are now restricted mainly to the Stony Plains bioregion.

A major threat to Thick-Billed Grasswrens is the loss of shrub cover, leading to a reduction in food and safe breeding and roosting sites. For Plains Rats, the trampling of burrows and gilgais by stock and disturbance from mining activities are potential threats. The expansion of water pipeline networks to previously unwatered country may also threaten Plains Rat populations by destroying core habitat. Cattle can trample the shallow burrow systems and compact the soil cracks in the gilgai which form an important feeding area. Predation from cats and foxes is a threat to both species.

### 20-year target

Secure the viability of significant fauna species on cracking clay plains and stony plains with gilgais.

### 5-year performance information

- Percentage of potential habitat occupied by significant fauna species on cracking clay plains and stony plains with gilgais.
- Number and viability of populations of significant fauna species on cracking clay plains and stony plains with gilgais.

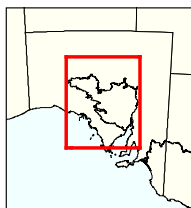
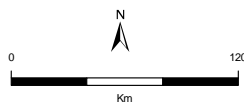
### 5-year actions

- Verify existing populations and undertake surveys for new populations.
- Identify critical and potential habitats.
- In conjunction with land managers, develop strategies to protect 30% of critical habitat from threatening processes.
- Reduce stock grazing pressure on actual and potential habitat.
- Reduce predation by foxes and cats below the dog fence.
- Undertake actions in line with and complementary to the Plains Rat Recovery Plan 2006.

Photo: Cracking clay











## Conservation priority for stony plains



Mapped conservation priorities provide an indication of the potential distribution

### Conservation priority

 Significant fauna species on cracking clay plains and stony plains with gilgais

-  Gawler Bioregion
-  South Australian Arid Lands NRM Region
-  Pastoral Station
-  Salt Lake
-  Dog Fence
-  Major Road
-  Locality



## Plains and rises

This landform is relatively flat to undulating, and is characterised by alluvial plains with sandy red duplex soils, red-cracking clays, or calcareous soils with low rocky rises and the occasional low sandy rise and saline sandy plain, these are generally associated with ranges. This landform is the most extensive in the bioregion and is represented in seven of the eight subregions.

Chenopod shrublands are common and extensive in this landform, variously dominated by Pearl Bluebush and Bladder Saltbush. These chenopod shrublands often form a mosaic with other communities such as low woodland, low shrublands and ephemeral grassland. The distinctive tall open shrubland of Western Myall commonly forms an overstorey over much of the chenopod-dominated plains across the bioregion.

The slightly elevated plains are mostly covered with Western Myall tall open shrubland over Bladder Saltbush and Pearl Bluebush, while Peppermint Box forms open mallee on the footslopes of lower hills in the southwest of the bioregion. South of the Gawler Ranges are important stands of Bullock Bush tall shrubland, which favours areas with more sandy or alluvial soils.

### Significance of plains and rises

Plains and rises are highly productive areas supporting predominately chenopod shrublands that respond to rain at any time of the year. Historically, extensive long-term pastoral use has modified vegetation composition through preferential grazing by sheep. Though highly productive, these areas generally have low species diversity. The plains and rises provide critical habitat for a number of threatened plants and animals, including the Yellow Swainson-pea (*Swainsona pyrophila*), Malleefowl (*Leipoa ocellata*), Slender-billed Thornbill (western) (*Acanthiza iredalei iredalei*), and the Gawler Ranges subspecies of Thick-billed Grasswren (*Amytornis textilis myall*). The alluvial plains of the bioregion also support stands of the threatened Bullock Bush tall shrubland ecological community.

Listed as threatened under State legislation, Sandalwood (*Santalum spicatum*) used to occur extensively throughout the Gawler bioregion. Its threatened status is largely due to past intensive harvesting for export. This threat still exists, and Sandalwood has very limited recruitment throughout the bioregion. Sandalwood also has significance for providing valuable habitat for native fauna.

Little is known about the small perennial *Swainsona dictyocarpa*. Endemic to the Gawler bioregion, the only records of the species have been at Bitter Well, Coondambo (north of Lake Gairdner) in 1929 and in 1954 at Tarcoola. Due to the limited information available on the species and the lack of recent records, *Swainsona dictyocarpa* has not been included as a conservation priority at this time.

## Major vegetation communities

### Mallee

Red Mallee (*Eucalyptus oleosa*) +/- Mallee Box (*Eucalyptus porosa*) +/- Gilja (*Eucalyptus brachycalyx*) +/- Yorrell (*Eucalyptus gracilis*) mallee over False Bluebush (*Cratystylis conocephala*), Bladder Saltbush (*Atriplex vesicaria*) +/- Broom Emu Bush (*Eremophila scoparia*), Bindyi (*Sclerolaena* spp.) and grasses on sandy plains and rises in the far south.

### Woodland

Black Oak (*Casuarina pauper*) low open woodland over Pearl Bluebush (*Maireana sedifolia*), Bitter Saltbush (*Atriplex stipitata*), Satiny Bluebush (*Maireana georgei*) low open shrubland over Bindyi (*Sclerolaena* spp.) on loamy plains.

Black Oak (*Casuarina pauper*) +/- Western Myall (*Acacia papyrocarpa*) +/- Sugarwood (*Myoporum platycarpum*) low open woodland over Pearl Bluebush (*Maireana sedifolia*), Bladder Saltbush (*Atriplex vesicaria*), Ruby Saltbush (*Enchylaena tomentosa* var. *tomentosa*) on extensive loamy plains.

Mulga (*Acacia aneura*) low open woodland over Sandhill Wattle (*Acacia ligulata*), Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*), Spiny Saltbush (*Rhagodia spinescens*), Ruby Saltbush (*Enchylaena tomentosa*), Black Bluebush (*Maireana pyramidata*) and Mulga Grass (*Aristida contorta*) on sandy plains.

Peppermint Box (*Eucalyptus odorata*) open mallee over Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*), herbs and grasses on loamy plains in the far south.

### Shrubland

Western Myall (*Acacia papyrocarpa*) tall open shrubland over Pearl Bluebush (*Maireana sedifolia*), Bladder Saltbush (*Atriplex vesicaria*), Bitter Saltbush (*Atriplex stipitata*), Ward's Weed (*Carrichtera annua*) and Bindyi (*Sclerolaena* spp.) on extensive loamy plains.

Low Bluebush (*Maireana astrotricha*) +/- Black Bluebush (*Maireana pyramidata*) +/- Bladder Saltbush (*Atriplex vesicaria*) low open shrubland over Bottlewashers (*Enneapogon avenaceus*) and Bindyi (*Sclerolaena* spp.) on extensive plains.

Bladder Saltbush (*Atriplex vesicaria*), Low Bluebush (*Maireana astrotricha*), +/- Black Bluebush (*Maireana pyramidata*), +/- Spiny Saltbush (*Rhagodia spinescens*) low open shrubland over grasses and Bindyi (*Sclerolaena* spp.) on extensive plains.

Black Bluebush (*Maireana pyramidata*), Bladder Saltbush (*Atriplex vesicaria*) +/- Pearl Bluebush (*Maireana sedifolia*) low open shrubland over Bindyi (*Sclerolaena* spp.) and grasses on extensive plains.

Pearl Bluebush (*Maireana sedifolia*) +/- Bladder Saltbush (*Atriplex vesicaria*) low open shrubland over Woolly Bluebush (*Eriochiton sclerolaenoides*) on plains.

### Grassland

Swamp Cane-grass (*Eragrostis australasica*) +/- Lignum (*Muehlenbeckia florulenta*) tall grassland over annual saltbushes, chenopods, and ephemeral herbs and grasses in minor non-saline swamps.

Ward's Weed (*Carrichtera annua*), Wallaby Grass (*Austrodanthonia caespitosa*), Spear Grasses (*Austrostipa* spp.) low open grassland on plains.

## Managing the biodiversity of plains and rises – practical ways that land managers can help

The plains and rises of the Gawler bioregion provide a mosaic of habitat for a wide range of native animals. Due to their extensive nature, plains and rises are also significant in supporting the pastoral industry in the region.

Practical strategies that land managers can use on plains and rises to help retain biodiversity include:

- Identify a threshold of grazing intensity that results in both perennial and annual plants not being grazed below a certain height or biomass. This will then enable plants to seed and also respond more quickly when beneficial rains fall.
- Manage total grazing pressure to maintain enough plant, lichen and litter cover to protect the soil surface. This includes the management of both domestic and feral animals.
- Align access tracks and fence lines away from slopes and onto less erosion prone soil types where possible.
- Avoid grading windrows along tracks, and install water diversion banks at strategic locations along tracks if necessary.
- Avoid locating water points on lighter sand plain areas that may have potential for instability. Try to locate water points on the leeward side of rises, to help decrease erosion potential.
- Control feral herbivores and pest plants in collaboration with neighbours and the SAAL NRM Board.







## Conservation priority

### **Bullock Bush tall shrubland on alluvial soils of plains**

Bullock Bush (*Alectryon oleifolius* ssp. *canescens*) tall shrubland on alluvial plains is widespread in semi-arid and arid regions of South Australia and western New South Wales. It has also been recorded in the Flinders and Olary Ranges. This ecological community occurs mainly in the Gawler Volcanics and to a lesser extent in the Myall Plains IBRA subregions. Bullock Bush generally appears as scattered trees or in small groups over a hugely variable understorey and soil type.

Despite its widespread distribution, most stands of the Bullock Bush have historically shown very little regeneration and a very degraded understorey. Bullock Bush is highly palatable, and excessive grazing primarily by rabbits, goats and domestic stock all contribute to the degradation of this ecological community. It is rare to see the bush without a browse line from sheep, cattle and goats. High grazing pressure not only inhibits the regeneration and recruitment, but also threatens the structure and composition of the ecological community.

The reduction in rabbit numbers from Rabbit Haemorrhagic Disease (RHD) has resulted in an apparent improvement in the condition of this community. However, the extent and significance of this improvement is unknown.

### **20-year target**

The viability of Bullock Bush tall shrubland on alluvial plains within the Gawler bioregion is maintained or improved.

### **5-year performance information**

- Percentage of potential area occupied by Bullock Bush tall shrubland on alluvial plains within IBRA subregions.
- Condition class of individual occurrences of Bullock Bush tall shrubland on alluvial plains within IBRA subregions.

### **5-year actions**

- Determine the current extent and condition of Bullock Bush tall shrubland on alluvial plains by IBRA subregion.
- Identify the potential area of occupancy of Bullock Bush tall shrubland on alluvial plains by IBRA subregion.
- Identify and where possible quantify the disruption, and sources of disruption, of key ecological processes supporting individual populations of Bullock Bush tall shrubland on alluvial plains.
- Rank individual populations of Bullock Bush tall shrubland on alluvial plains within IBRA subregions for viability based on size, condition and landscape context.
- Support land managers to improve Bullock Bush tall shrubland on alluvial plains in controlling feral animals and overabundant native herbivores and promoting appropriate grazing practices.

Photo: Bullock Bush *Alectryon oleifolius* ssp. *canescens*

## Conservation priority

### Significant bird species in chenopod shrublands

Two significant bird species rely on the chenopod shrublands of the Gawler bioregion; the Gawler Ranges subspecies of Thick-billed Grasswren (*Amytornis textilis myall*) and the western subspecies of Slender-billed Thornbill (*Acanthiza iredalei iredalei*).

The Gawler Ranges subspecies of the Thick-billed Grasswren is endemic to the Gawler bioregion, and has been recorded in the Myall Plains and Gawler Volcanics subregions. The western Slender-billed Thornbill inhabits chenopod shrublands dominated by samphires and saline flats around salt lakes, and occurs throughout the Myall Plains, Gawler Volcanics, Arcoona Plateau and Kingoonya subregions. The distribution of the western Slender-billed Thornbill formerly extended from south-western Western Australia to southern Northern Territory and south to Leigh Creek. There have been no recent records from any of these extremities, suggesting that the range has reduced significantly. In the arid lands region, this subspecies has also been recorded in the Flinders and Olary Ranges, Broken Hill Complex, and Stony Plains bioregions.

Both the Thick-billed Grasswren and Slender-billed Thornbill are extremely shy, occupying chenopod shrublands, particularly those dominated by Saltbush (*Atriplex* spp.) and Bluebush (*Maireana* spp.). The major threat to these species is the loss of shrub cover from excessive total grazing pressure by domestic stock and rabbits. The reduction in vegetation cover and lack of recruitment may also result in increased predation from cats and foxes.

### 20-year target

The viability of significant bird species in chenopod shrublands in the Gawler bioregion is maintained or improved.

### 5-year performance information

- Percentage of potential habitat occupied by significant bird species in chenopod shrubland within the Gawler bioregion.
- Number and viability of populations of significant bird species in chenopod shrubland in the Gawler bioregion.

### 5-year actions

- Determine area of occupancy and relationship between habitat and distribution and abundance of significant bird species in chenopod shrubland.
- Identify and where possible, quantify the disruption and sources of disruption of key ecological processes supporting individual populations of significant bird species in chenopod shrubland.
- Identify potential habitats within the Gawler bioregion for significant bird species in chenopod shrubland.
- Rank populations of significant bird species in chenopod shrubland within IBRA subregions for viability based on size, threats and landscape context.
- Support land managers to improve the viability of significant bird species in chenopod shrubland in controlling feral animals and overabundant native herbivores and promoting appropriate grazing practices.

## Conservation priority

### Significant species in mallee habitat

The mallee belt that stretches across the southern part of the Gawler bioregion separates temperate Eyre Peninsula from the arid interior. This mallee area is also a transition zone for many flora and fauna species with affinities to communities in both eastern and western Australia. In the southern mallee zone of the Gawler bioregion, there are several species at the extreme edge of their natural distribution, including the Yellow Swainson-pea (*Swainsona pyrophila*) and Malleefowl (*Leipoa ocellata*).

The Yellow Swainson-pea is usually only found after fire, with adult plants only persisting for a few years. It is an early post-fire coloniser, only regenerating after a hot fire or soil disturbance, both of which stimulate germination of buried seed. It occurs in sandy or loamy soil in mallee, and has been recorded at Mount Finke on the edge of the Great Victoria Desert and at several sites in the far south of the Gawler bioregion, in the Myall Plains subregion.

Malleefowl are found in semi-arid to arid mallee and low woodlands across southern Australia. An abundance of leaf litter and sandy soil are necessary for the building of their large nesting mounds. Densities of bird populations are generally greater in higher rainfall country on more fertile soils, where there is more leaf litter and food plants are more abundant. In the Gawler bioregion, Malleefowl are scattered across the south through the Myall Plains and Gawler Volcanics subregions.

The most significant threat to Malleefowl is vegetation clearance and bush fragmentation, particularly in the agricultural areas. Broadscale clearance of mallee vegetation has fragmented suitable habitat, isolated populations and increased their vulnerability to predation from foxes and feral cats. Competition with introduced herbivores such as goats and rabbits is also considered a significant threat in some areas.

Both the Yellow Swainson-pea and the Malleefowl are threatened by inappropriate fire regimes, but their response to fire differs. For the Yellow Swainson-pea, declines in both frequency and extent of wildfires may deplete seed viability leading to a decline in germination events and subsequently the species' range and population size. Malleefowl on the other hand, are threatened directly by wildfire and indirectly through increased fire frequency, as it reduces leaf litter for nesting and shelter. Small fires can however provide some benefit to Malleefowl populations by helping to renew the structural diversity of their habitats and increasing the diversity of food sources available.

### 20-year target

The viability of significant threatened species in mallee habitat within the Gawler bioregion maintained or improved.

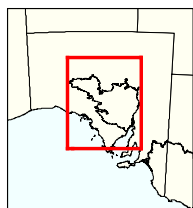
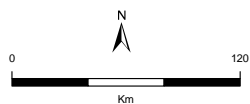
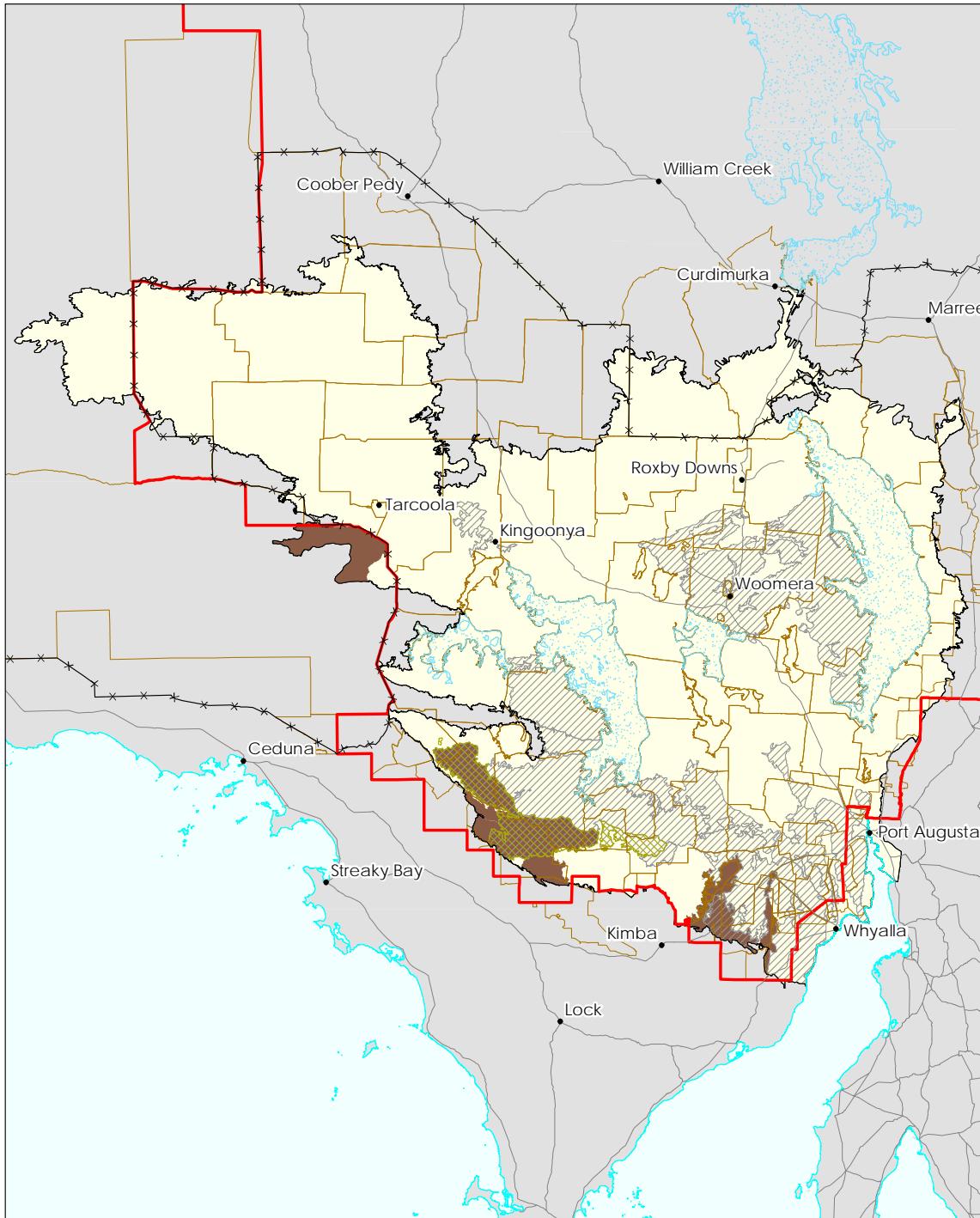
### 5-year performance information

- Percentage of potential habitat occupied by significant threatened species in mallee habitat within the Gawler bioregion.
- Number and viability of populations of significant threatened species in mallee habitat within the Gawler bioregion.

### 5-year actions

- Determine area of occupancy and relationship between habitat and distribution and abundance of significant species in mallee habitat.
- Identify and where possible, quantify the disruption and sources of disruption of key ecological processes supporting individual populations of significant species in mallee habitat.
- Identify potential habitats within the Gawler bioregion for significant species in mallee habitat.
- Rank populations of significant species in mallee habitat within IBRA subregions for viability based on size, threats and landscape context.
- Determine and implement fire regimes to improve long-term viability of significant species in mallee habitat.
- Support land managers to improve the viability of significant species in mallee habitat in controlling feral and overabundant native herbivores and promoting appropriate grazing practices.

# Conservation priorities for plains and rises



## Conservation priorities

- Bullock Bush tall shrubland on alluvial soils of plains
- Significant bird species in chenopod shrublands
- Significant species in mallee habitat
- Gawler Bioregion
- South Australian Arid Lands NRM Region
- Pastoral Station
- Salt Lake
- Dog Fence
- Major Road
- Locality

Mapped conservation priorities provide an indication of the potential distribution





## Ranges and hills

One of the most dominant features of the Gawler bioregion is the Gawler Ranges themselves. Situated in the central west of the bioregion in the Gawler Volcanics subregion, protrude the steep rounded granitic hills of the Gawler Ranges. In the east of the bioregion, in the Myall Plains subregion, are the narrow north-south series of low hills that make up the iron-rich Middleback Ranges. The rocky hills themselves, have been formed by volcanic activity followed by heavy weathering over almost 1,500 million years, and feature spectacular cliffs of columnar rhyolite known as organ pipe formations. These cliffs are the most significant topographic feature of the bioregion.

The Gawler Ranges create a locally higher rainfall environment and cast a rain shadow over the salt lakes to the north. The hilly terrain, with its unique range of mallee provides a very different range of habitats from those of the surrounding saline lakes, sand dunes and loamy Myall-covered plains. The footslopes, especially those with limestone close to the surface, support open woodlands of Black Oak over chenopod shrubs. The south-facing slopes are sparsely covered with Drooping Sheoak. Spinifex hummocks are common in the higher parts, and open shrublands are often dominated by Mallee Broombush, with or without mallee over it.

### Significance of ranges and hills

The Gawler Ranges provide habitat for many species that would otherwise not survive in the arid climate. The ranges are the most species-rich due to the higher rainfall and more complex physical structure. There are a number of species restricted to small niches within the hills and ranges. Across the Gawler and Middleback Ranges are six significant flora species; the Gawler Ranges Grevillea (*Grevillea parallelinervis*), Gawler Ranges Hop-bush (*Dodonaea intricata*), Gawler Ranges Greenhood (*Pterostylis ovata*), Corunna Daisy (*Brachycome muelleri*), Desert Greenhood (*Pterostylis xerophila*) and *Acacia toondulya*. The Gawler Ranges also supports an isolated population of Yellow-footed Rock-wallabies, representing the western limit of its range. Goats throughout the hills and ranges pose a severe threat to the survival of these significant flora and fauna species, as they compete for resources and degrade habitats through trampling, fouling and grazing.

In 2002, 1,661 square kilometres of the southern Gawler Ranges became the Gawler Ranges National Park to help preserve the unique habitats and species of the region. The Park has an abundance of native flora and fauna, including several significant species, and conserves key fauna habitat areas in mallee, chenopod shrublands, semi-arid rangelands and rugged hills.



## Major vegetation communities

### Mallee

Ridge-fruited Mallee (*Eucalyptus incrassata*) +/- Red Mallee (*Eucalyptus socialis*) open mallee over +/- Mallee Broombush (*Melaleuca uncinata*), *Leptospermum coriaceum*, *Calytrix involuocrata* and *Triodia lanata*.

Mallee Box (*Eucalyptus porosa*) mallee over Curry Bush (*Cassinia laevis*), Mealy Saltbush (*Rhagodia parabolica*), Winged Daisy Bush (*Olearia decurrens*), grasses and herbs in the far south adjacent to the agricultural area.

Peppermint Box (*Eucalyptus odorata*) open mallee over Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*), herbs and grasses on footslopes in the far south.

### Woodland

Black Oak (*Casuarina pauper*) open woodland over Pearl Bluebush (*Maireana sedifolia*), Bitter Saltbush (*Atriplex stipitata*), Satin Bluebush (*Maireana georgei*), herbs and Bindyi (*Sclerolaena* spp.) on rocky footslopes.

Drooping Sheoak (*Allocasuarina verticillata*) low woodland over Winged Daisy Bush (*Olearia decurrens*), Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*) and Spinifex (*Triodia irritans*) on south-facing hillslopes in the south.

Mulga (*Acacia aneura*) open woodland over Mulla Mulla (*Ptilotus obovatus*) +/- Tarcoola Wattle (*Acacia tarculensis*) +/- Dead Finish (*Acacia tetragonophylla*) +/- Spinifex (*Triodia irritans*) on rocky hillslopes in the more arid north.

### Shrubland

Tarcoola Wattle (*Acacia tarculensis*) tall sparse shrubland over Lobed Hopbush (*Dodonaea lobulata*) and Spinifex (*Triodia irritans*) on drier hillslopes in the north.

Mallee Broombush (*Melaleuca uncinata*), Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*) tall sparse shrubland over Spinifex (*Triodia irritans*) on sandy areas in the hills.

### Grassland

Spinifex (*Triodia irritans*) hummock grassland with emergent Red Mallee (*Eucalyptus socialis*), Narrow-leaved Hopbush (*Dodonaea viscosa* ssp. *angustissima*) +/- Beckler's Rock Wattle (*Acacia beckleri*) and ferns on rocky hillslopes.

## Managing the biodiversity of ranges and hills – practical ways that land managers can help

The ranges and hills of the Gawler bioregion are more species rich than other landscapes due to the higher rainfall and more complex physical structure. There are a number of species restricted to small niches in the hills and ranges. The hilly terrain, with its unique range of mallee vegetation provides a very different range of habitats from those of the surrounding saline lakes, sand dunes and loamy Myall-covered plains.

Practical strategies that land managers can implement in ranges and hills to help retain biodiversity include:

- Where possible, pipe stock water from major waterholes or springs away from the ranges and hills onto more accessible plains.
- Fence off springs to reduce total grazing pressure, promote vegetation recruitment and reduce impact of stock and feral herbivores.
- Locate stock water points well away from slopes to minimise erosion risk.
- Align access tracks and fence lines away from slopes and onto less erosion prone soil types where possible.
- Avoid grading windrows along tracks, and install water diversion banks at strategic locations along tracks if necessary.
- Implement conservative total grazing management strategies.
- Control feral herbivores and pest plants in collaboration with neighbours and the SAAL NRM Board.





## Conservation priority

### Significant and endemic plant species on ranges and hills

The rocky outcrops of the Gawler bioregion are an important niche for a number of significant flora species, including the Gawler Ranges Grevillea, Gawler Ranges Hop-bush, Gawler Ranges Greenhood, Corunna Daisy, Desert Greenhood and *Acacia toondulya*, that only grow on the rocky granite or quartzite outcrops of the Gawler Ranges.

The Gawler Ranges Hop-bush, Gawler Ranges Greenhood and the Desert Greenhood occur across the Myall Plains and Gawler Volcanics subregions, with the Hop-bush distribution extending north towards Lake Everard. The Gawler Ranges Grevillea and *Acacia toondulya* are restricted to the Myall Plains, and the Corunna Daisy to the Gawler Volcanics subregions.

Both the Gawler Ranges Greenhood and Desert Greenhood grow singly or in small populations on granite porphyry or quartzite outcrops. The Gawler Ranges Grevillea is restricted to the western end of the Gawler Ranges, from Yardea Station to Mt Wallaby. *Acacia toondulya* occurs on low rounded hills of granite and shale and red-brown loam, and is restricted to a small area of rocky hills on the southwest Gawler Ranges south of Lake Acraman. *A. toondulya* is closely related to *A. notabilis*, and there is evidence of some hybridised populations 10 km north of Toondulya Bluff. The Corunna Daisy also has a very restricted niche, on the south facing slopes of the Baxter Hills that remain shaded during winter for much of the day. It is currently known only from a single population of approximately 10,000 plants growing on a steep, shady, south-facing slope of a gorge on Corunna Station, north of Iron Knob.

The Ooldea Guinea-flower (*Hibbertia crispula*) is known from only two separate locations, near Lake Everard and at Ooldea Soak, some 300 km apart.

Key threats to these seven significant plants include climate change, weed invasion and grazing, particularly by feral goats. Altered fire regimes may also be a threat, particularly in hilly areas where fire can move quickly up steep slopes, and small isolated populations are particularly vulnerable.

### 20-year target

The viability of significant and endemic plant species in the ranges and hills within the Gawler bioregion are maintained or improved.

### 5-year performance information

- Increased number and viability of populations of significant and endemic plant species in the ranges and hills within the Gawler bioregion.

### 5-year actions

- Determine area of occupancy and relationship between habitat and distribution and abundance of significant and endemic plant species in the ranges and hills.
- Identify potential habitats within the Gawler bioregion for significant and endemic plant species in the ranges and hills.
- Identify and where possible, quantify the disruption and sources of disruption of key ecological processes supporting individual populations of significant and endemic plant species in the ranges and hills.
- Determine and implement appropriate fire regimes that do not limit or inhibit the distribution or survival of threatened flora in the ranges and hills.
- Rank populations of significant threatened and endemic flora species in the ranges and hills within IBRA subregions for viability based on size, threats and landscape context.
- Support land managers to improve the viability of significant threatened and endemic flora species in the ranges and hills in controlling weeds, feral animals and overabundant native herbivores and promoting appropriate grazing practices.





## Conservation priority

### Yellow-footed Rock-wallaby on ranges and hills

The Yellow-footed Rock-wallaby (*Petrogale xanthopus xanthopus*) inhabits ranges and hills of the Gawler bioregion with populations within the Gawler Volcanics subregion. This species also occurs in the Northern, Central and Southern Flinders Ranges and Bimbowrie subregions, western New South Wales and central-western Queensland.

Once more widespread in suitable habitat throughout the Gawler bioregion, the Yellow-footed Rock-wallaby is now confined to several isolated colonies. Their preferred habitat is structurally and topographically complex, with caves and rocks that provide shelter from the summer heat and protection from predators.

This species has suffered serious decline in both distribution and abundance across much of its South Australian range. Although the Flinders Ranges provides the stronghold for this species, recent studies have shown that the Gawler Ranges animals are genetically distinct. Gene flow between colonies is important for long-term viability of these populations, and at present is extremely limited. The decline of this once widespread species has been linked to a combination of factors including excessive hunting prior to 1919 when it became formally protected. More recently, predation by foxes and competition from herbivores, particularly feral goats, have been identified as major threats. The diet of goats overlaps with that of Yellow-footed Rock-wallabies, especially during extended dry periods, when they also compete for and foul the scarce water resources. To a lesser extent, rabbits and Euros also compete for food. Some isolated populations comprise only a few individuals and are under extreme threat. The implementation of a landscape scale threat abatement program in the Flinders and Olary Ranges in 1992 and the Gawler Ranges in 2000 has improved population sizes of some colonies. However, this threat abatement program does not extend across the entire range of the Yellow-footed Rock-wallaby.

### 20-year target

Yellow-footed Rock-wallabies are present in no less than 75% of potential colony sites within all management units.

### 5-year performance information

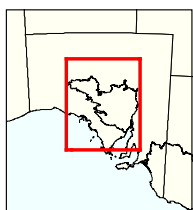
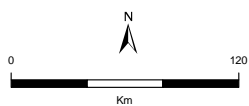
- Percentage of potential colony sites occupied per management unit.

### 5-year actions

- Undertake, in partnership and collaboration with land managers, targeted threat abatement activities in priority management units and review criteria for transition from recovery to maintenance of Yellow-footed Rock-wallaby populations within individual management units.
- Strategically sample the Yellow-footed Rock-wallaby population for genetic diversity and review management unit boundaries.
- Strategically sample priority Yellow-footed Rock-wallaby populations for demographic indicators of population viability.
- Conduct further broad scale surveys to determine the current distribution and potential Yellow-footed Rock-wallaby habitat across the Gawler bioregion.



Photo: Yellow-footed Rock-wallaby *Petrogale xanthopus xanthopus*








## Conservation priorities for ranges and hills



Mapped conservation priorities provide an indication of the potential distribution

### Conservation priorities

-  Yellow-footed Rock-wallaby on ranges and hills
-  Significant and endemic plant species in the ranges and hills

-  Gawler Bioregion
-  South Australian Arid Lands NRM Region
-  Pastoral Station
-  Salt Lake
-  Dog Fence
-  Major Road
-  Locality

## Bounceback

Bounceback is a major conservation project aiming to protect and restore the semi-arid environments of the Flinders, Gawler and Olary Ranges of South Australia.

Since the mid-1800s, excessive grazing, weed infestation and introduced predators have had a combined damaging effect on the fragile environment of semi-arid ranges of South Australia. As early as 1900, many small to medium sized mammals and some reptiles had all but disappeared. Even when stock was removed from the National Parks, threatened species continued to decline because there was little regeneration of native plant communities or improvement in soil conditions and animal habitats.

In response, National Parks and Wildlife South Australia initiated the Bounceback Program to protect the native species that have persisted in the region and to enable the reintroduction of some species that have become locally extinct. Activities in the National Parks include removal of foxes and feral goats, destruction of rabbit warrens, regeneration of native plant species, protection of habitats, and monitoring programs. In areas surrounding the parks, the focus is on control of wheel cactus, feral goats and rabbits, removal of foxes and protection of endangered species.

Since its inception in the early 1990s as a targeted operation focused on reducing threats to Rock-wallaby populations in the Gawler, Olary and Flinders Ranges, Bounceback has evolved into a broadscale recovery project incorporating specific conservation objectives across reserves, private landholdings and pastoral properties.

Ecological recovery in this semi-arid environment will be a slow process, but Bounceback is already showing some positive results. Within the national parks, achievements include a major reduction in the number of feral goats and rabbits, an increase in the number of Yellow-footed Rock-wallabies, a trial reintroduction of the Brush-tailed Bettong to the Flinders Ranges National Park, and land reclamation with saltbush.

Bounceback has grown significantly over the years, in both its geographic spread and the activities being undertaken. It brings together people managing National Parks, private sanctuaries, pastoral properties and Indigenous Protected Areas. In this way the program creates an integrated approach to restoring the fragmented ecosystems, controlling pest plants and animals, and increasing the diversity of species in the semi-arid ranges.

Bounceback is managed and delivered by the South Australian Department for Environment and Heritage in partnership with numerous individuals, agencies, organisations, volunteer groups and research institutions. Significant resourcing and support has been provided through the SA Arid Lands NRM Board with the incorporation of Bounceback into the NRM Plan and Investment Strategy as a key initiative for conservation in the region.

Many partnerships have been developed to help implement, guide or resource the Bounceback project, including:

- Landholders throughout the project area
- Rangelands INRM Group
- SA Arid Lands NRM Board
- Sporting Shooters Association of Australia (Hunting and Conservation Branch)
- Conservation Volunteers Australia
- Adnyamathanha community
- Greening Australia
- Arkaroola Sanctuary
- Warraweena Private Conservation Park (Wetlands and Wildlife)
- Adelaide Zoo
- Flinders University
- University of Adelaide
- University of South Australia
- Nature Foundation SA
- Scientific Expedition Group
- Rural Solutions South Australia
- Yellow-footed Rock-wallaby Preservation Association

# Monitoring and evaluation

The Gawler Conservation Priorities aims to facilitate conservation actions across the bioregion. The SAAL NRM Board and support partners will coordinate and support the delivery of these actions, guided by statutory mechanisms. The SAAL NRM Board will monitor and report on the implementation of the Gawler Conservation Priorities.

Both the SAAL NRM Board and the Department for Environment and Heritage are jointly responsible for evaluating the effectiveness of this plan which contributes to the SAAL NRM Plan and *No Species Loss – A Nature Conservation Strategy for South Australia*.

DEH will produce a public report on overall progress towards the conservation priorities as part of the five year review and evaluation of the South Australian Arid Lands Biodiversity Strategy in 2014.

## Monitoring and reporting information

Landform	Priority	Targets	Performance information
<b>Drainage lines, floodplains and salt lakes</b>	Significant breeding events on inland saline lakes	The success of significant breeding events on inland saline lakes is maintained or improved	<ul style="list-style-type: none"> <li>Nest abandonment of the Banded Stilt not exceeding 30% due to Silver Gull interaction during breeding episodes.</li> </ul>
	Significant threatened and endemic flora species on gypseous soils in and around saline areas	The viability of the Lake Acraman Button-daisy and the Club Spear Grass in the Gawler bioregion is maintained or improved	<ul style="list-style-type: none"> <li>Percentage area of potential habitat occupied by the Lake Acraman Button-daisy and the Club Spear Grass in the Gawler bioregion.</li> <li>Number and viability of populations of the Lake Acraman Button-daisy and Club Spear Grass in the Gawler bioregion.</li> </ul>
<b>Sand dunes and sand plains</b>	Pernatty Knob-tail on sand dunes	The viability of the Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes within the Gawler bioregion is maintained or improved	<ul style="list-style-type: none"> <li>Percentage of potential area occupied by the Pernatty Knob-tailed Gecko within IBRA subregions.</li> <li>Number and viability of populations of Pernatty Knob-tailed Gecko on sand dunes adjacent to salt lakes within IBRA subregions.</li> </ul>
	Mulga low woodlands on sand plains	The viability of Mulga low woodlands on low dunes and sand plains within the Gawler bioregion maintained or improved	<ul style="list-style-type: none"> <li>Percentage of potential area occupied by Mulga low woodland on low dunes and sand plains within IBRA subregions.</li> <li>Condition class of individual occurrences of Mulga low woodland on low dunes and subregions within IBRA subregions.</li> </ul>



Landform	Priority	Targets	Performance information
<b>Stony plains</b>	Significant fauna species on cracking clay plains and stony plains with gilgais	Secure the viability of potential habitat occupied by significant fauna species on cracking clay plains and stony plains with gilgais	<ul style="list-style-type: none"> <li>Percentage of potential habitat occupied by significant fauna species on cracking clay plains and stony plains with gilgais.</li> <li>Number and viability of populations of significant fauna species on cracking clay plains and stony plains with gilgais.</li> </ul>
<b>Plains and rises</b>	Bullock Bush tall shrubland on alluvial soils of plains	The viability of Bullock Bush tall shrubland on alluvial plains within the Gawler bioregion is maintained or improved	<ul style="list-style-type: none"> <li>Percentage of potential area occupied by Bullock Bush tall shrubland on alluvial plains within IBRA subregions.</li> <li>Condition class of individual occurrences of Bullock Bush tall shrubland on alluvial plains within IBRA subregions.</li> </ul>
	Significant bird species in chenopod shrublands	The viability of significant bird species in chenopod shrublands within the Gawler bioregion is maintained or improved	<ul style="list-style-type: none"> <li>Percentage of potential habitat occupied by significant bird species in chenopod shrubland within the Gawler Ranges bioregion.</li> <li>Number and viability of populations of significant bird species in chenopod shrubland within the Gawler bioregion.</li> </ul>
	Significant species in mallee habitat	The viability of significant threatened species in mallee habitat within the Gawler bioregion maintained or improved	<ul style="list-style-type: none"> <li>Percentage of potential habitat occupied by significant threatened species in mallee habitat within the Gawler Ranges bioregion.</li> <li>Number and viability of populations of significant threatened species in mallee habitat within the Gawler bioregion.</li> </ul>
<b>Hills and ranges</b>	Significant and endemic plant species on ranges and hills	The viability of significant and endemic plant species in the ranges and hills within the Gawler bioregion are maintained or improved	<ul style="list-style-type: none"> <li>Increased number and viability of populations of significant and endemic plant species in the ranges and hills within the Gawler bioregion.</li> </ul>
	Yellow-footed Rock-wallaby on ranges and hills	Yellow-footed Rock-wallaby are present in no less than 75% of potential colony sites within all management units	<ul style="list-style-type: none"> <li>Percentage of potential colony sites occupied per management unit.</li> </ul>

# Glossary

**Arid:** Refers to climates or regions that lack sufficient crop production or extensive sown pastures. Usually defined as a climate with annual average rainfall less than 250 mm (10 inches).

**Biodiversity:** The variety of life forms: the different plants, animals and micro-organisms; the genes they contain; and the ecosystems they form.

**Bioregion:** Extensive (continental scale) regions distinguished from adjacent regions by their broad physical and biological characteristics.

**Conservation:** The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment.

**Decreaser Species:** A species that decreases in abundance in areas of high grazing pressure, generally in proximity to water.

**Duplex:** Soils with abrupt and significant changes in texture (e.g. loam over clay) in their profile.

**Ecological Community:** A characteristic suite of interacting species that are adapted to particular conditions of soil, topography, water availability and climate.

**Ecological Processes:** Dynamic interactions that occur among and between biotic (living) and abiotic (non-living) components of the environment.

**Ecosystem:** A dynamic complex of plant, animal, fungal and micro-organism communities and the associated non-living environment interacting as an ecological unit.

**Endemic:** Exclusively native to a specified region or site.

**Feral:** A domesticated species that has escaped the ownership, management and control of people and is living and reproducing in the wild.

**Fire Regime:** The intensity, frequency and extent of fire.

**Gypseous:** Relating to, or containing Gypsum (Calcium Sulphate).

**Gene:** The functional unit of heredity; the part of the DNA molecule that encodes a single enzyme or structural protein unit.

**Habitat:** The physical place or type of site where an organism, species or population naturally occurs together with the characteristics and conditions, which render it suitable to meet the lifecycle, needs of that organism, species or population.

**IBRA Region:** Interim Biogeographic Regionalisation for Australia regions.

**IBRA Subregion:** A subdivision of a bioregion based on broad physical and biological characteristics; a system of related and interconnected landsystems within an IBRA region.

**Indicator:** A measure against which some aspects of performance can be assessed.

**Increaser Species:** A species that increases in abundance in areas of high grazing pressure, generally in proximity to water.

**Invasive Species:** Any animal pest, weed or disease that can adversely affect native species and ecosystems.

**Landform:** Any of the numerous features that make up the surface of the earth, such as plain, plateau and canyon.

**Landscape:** A heterogeneous area of land or sea that is of sufficient size to achieve positive results in the recovery of species or ecological communities, or in the protection and enhancement of ecological and evolutionary processes.

**Landsystem:** A group of local ecological communities derived from a landscape pattern of related and interconnected local ecosystems within a subregion.

**Native Species:** A plant or animal species that occurs naturally in South Australia.

**Protected Area:** An area of land and/or sea specifically dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

**Refuge:** A region, or habitat, where organisms are able to persist during a period in which most of the original geographic range becomes uninhabitable.

**Species:** A group of organisms capable of interbreeding with each other but not with members of other species.

**Sustainable:** The use of resources or components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

**Terrestrial:** Land-based biodiversity including inland aquatic ecosystems such as rivers, streams, lakes, wetlands, springs, groundwater and groundwater dependent ecosystems, and the native inland aquatic species in these areas.

**Threatened Species or Ecological Communities:** A species or ecological community that is vulnerable or endangered.

**Threatening Processes:** The dominant limiting factors and constraints to the ongoing conservation of biodiversity.

## Abbreviations

DEH	South Australian Department for Environment and Heritage
DWLBC	South Australian Department for Water Land and Biodiversity Conservation
EPBC	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
GAB	Great Artesian Basin
IBRA	Interim Biogeographic Regionalisation of Australia
NPW	National Parks and Wildlife
NRM	Natural Resources Management
PIRSA	Primary Industries and Resources South Australia
SAAL	South Australian Arid Lands

## Further reading

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