



Carnarvon bioregion

Description

Area: 83 747 km²

The Carnarvon bioregion has a low and gently undulating landscape with open drainage. Vegetation is mainly acacia shrublands and saltbush/bluebush shrublands, with areas of tussock grassland in the north. Major land tenure is pastoral leasehold, with some conservation reserves, such as the Cape Range National Park. The bioregion has a range of industries, including extensive cattle and sheep grazing, salt mining, tourism and fishing. Major population centres are Carnarvon, Denham, Exmouth and Coral Bay.

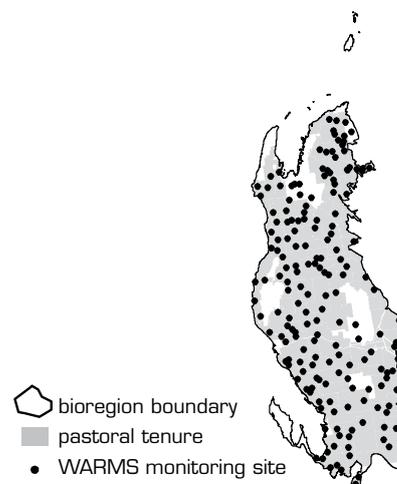
Location

The Carnarvon bioregion is located on the west coast of Western Australia (see Figures 1 and 2).

Figure 1 Location of the Carnarvon bioregion



Figure 2 Western Australian Rangeland Monitoring System monitoring sites and pastoral tenure



Data sources available

Data sources include:

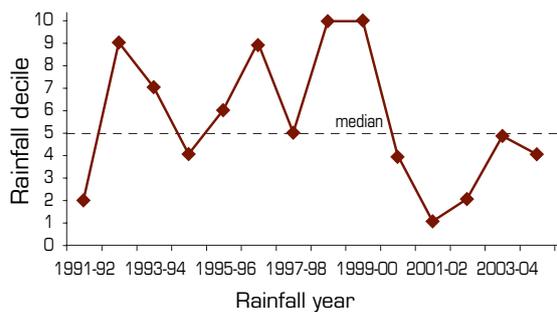
- Western Australian Rangeland Monitoring System (WARMS), which provides high reliability for reporting change, due to a large number of well-distributed sites, quantitative data, and focus on longer-lived plant species, which helps to filter short-term seasonal variability
- domestic stocking density, which provides moderate reliability
- fire extent, intensity and frequency, which provides high reliability
- dust
- distance from water
- distribution and relative abundance of invasive animals and weeds
- land use
- conservation estate
- land values.



Climate

The climate of the Carnarvon bioregion is semi-arid to arid with predominantly winter rainfall. Spatially averaged median (1890–2005) rainfall is 208 mm (April to March rainfall year; see Figure 3).

Figure 3 Decile rainfall for the period 1991–1992 to 2004–2005



Annual rainfall is for the 12-month period 1 April to 31 March.

Decile rainfall fluctuated considerably during the reporting period. *Seasonal quality* was generally above average until 1999–2000 and then deteriorated markedly to 2001–2002. The rainfall decile then remained below the median after this time. Much of this extended period was characterised by higher summer rainfall and lower winter rainfall than long-term records suggest.

Note that regional averaging of rainfall conceals spatial variability. Some parts of the bioregion may have experienced better *seasonal quality* and others worse during the 1992–2005 period.

Landscape function

Change in landscape function can be reported in a number of ways using WARMS data. Data in the following sections are based on the resource capture index and population growth rate (for consistency with reporting by other jurisdictions).

Resource capture index

The majority of sites were reassessed following average seasonal conditions. Low reliability associated with the small number of sites assessed following above- and below-average *seasonal quality* means that it is not possible to report change under these conditions.

<i>Seasonal quality</i>	Number of sites	Decline: RCI < 0.90	No change: RCI < 1.10	Increase: RCI ≥ 1.10
Above average	5	n/a	n/a	n/a
Average	25	88%	8%	4%
Below average	2	n/a	n/a	n/a

RCI = resource capture index

Population growth rate

Within the Carnarvon bioregion, 5% of sites showed a decline when *seasonal quality* was above average. It is not possible to report change following below-average *seasonal quality* because of low reliability associated with the very small number of sites (seven sites) assessed at this time.

<i>Seasonal quality</i>	Number of sites	Decline: density < 95%	No change: density between 95% and 105%	Increase: density ≥ 105%
Above average	61	5%	3%	92%
Average	59	36%	22%	42%
Below average	7	n/a	n/a	n/a

Sustainable management

Critical stock forage

Decreaser shrubs declined in density at 9% of sites following above-average *seasonal quality*. It is not possible to report change following below-average *seasonal quality*.

Seasonal quality	Species group	Number of sites	Decline: density < 0.95	No change: 0.95 ≤ density < 1.05	Increase: density ≥ 1.05
Above average	Decreaser	57	9%	11%	81%
	Intermediate	51	12%	22%	67%
	Increaser	37	14%	19%	68%
Average	Decreaser	57	39%	25%	37%
	Intermediate	54	30%	24%	46%
	Increaser	42	26%	29%	45%
Below average	Decreaser	7	n/a	n/a	n/a
	Intermediate	7	n/a	n/a	n/a
	Increaser	5	n/a	n/a	n/a

Plant species richness

Three per cent of sites had decreased plant species richness of native perennial plants following above-average seasonal quality. It is not possible to report change following below-average seasonal quality.

Seasonal quality	Number of sites	Decline: richness index < 0.80	No change: 0.80 ≤ richness index < 1.20	Increase: richness index ≥ 1.20
Above average	61	3%	66%	31%
Average	59	5%	86%	8%
Below average	7	n/a	n/a	n/a

Change in woody cover

Crown cover of woody species increased on average, by 55%. Cover remained the same or increased on 94% of sites. On no sites did cover drop below 50% of the initially recorded value.

Distance from stock water

The percentage area of pastoral lease country within three kilometres of permanent and semipermanent sources of stock water for each sub-**Interim Biogeographic Regionalisation for Australia (IBRA)** is:

Cape Range (CAR1)	33.4% (77.0% of sub-IBRA analysed)
Wooramel (CAR2)	36.1% (85.2% of sub-IBRA analysed)

CAR = Carnarvon; IBRA = Interim Biogeographic Regionalisation for Australia

Note that this analysis does not include the locations of natural waters. These can provide significant additional sources of water for stock, particularly after substantial rainfall. It is not possible to report change in watered area for the 1992–2005 period.

Weeds

Weeds known to occur in the Carnarvon bioregion include:

Common name	Scientific name
African boxthorn	<i>Lycium ferocissimum</i>
Athel pine	<i>Tamarix aphylla</i>
Mesquite	<i>Prosopis</i> spp.
Mexican poppy	<i>Argemone ochroleuca</i>
Parkinsonia	<i>Parkinsonia aculeata</i>

See www.anra.gov.au for distribution maps

Components of total grazing pressure

Domestic stocking density

Most (90%) of the Carnarvon bioregion was grazed in the period 1992 to 2001. This area reduced to approximately 83% of the bioregion area in 2005. Based on data from the Australian Bureau of Statistics, and taking account of the reduced area grazed, domestic stocking density remained similar to the 1983–1991 average until 1998 and then decreased to approximately 87% of this value in 1999 and 2000. Stocking density remained below the 1983–1991 average until 2004, when it was 82% of the baseline value. The decline from 1998 onwards was partly related to declining seasonal quality but the stocking trend does not closely match decile rainfall shown above. It is probable that there was variation in stocking density across the bioregion that is concealed by the spatially averaged data presented here.

Kangaroos

There are no suitable data for reporting change.

Invasive animals

Invasive animal species known to occur in the Carnarvon bioregion include:

Common name	Scientific name
Feral goat	<i>Capri hircus</i>
Fox	<i>Vulpes vulpes</i>
Rabbit	<i>Dryctolagus cuniculus</i>
Wild dog	<i>Canis spp.</i>
Feral cat	<i>Felis cattus</i>
Camel	<i>Camelus dromedaries</i>
Donkey	<i>Equus asinus</i>
Horse	<i>Equus caballus</i>
Feral sheep	<i>Ovis spp.</i>

See www.anra.gov.au for distribution maps

Products that support reporting of landscape function and sustainable management

Fire

Fire was insignificant during the 1997–2005 period, with a maximum of 3.4% of the Carnarvon bioregion burnt in 2000.

The fires that were recorded were a mixture of both hot burns (occurring in the summer months so therefore likely more intense) and cool burns (during the cooler months of the year).

The frequency of fire between 1997 and 2005 was very low, with a mean frequency (\log_{10} transformed) of 0.02.

Dust

The mean Dust Storm Index value (1992–2005) was 1.47, which is considered low. The spatial distribution map shows less dust observed near the coast (at Carnarvon) than further east (at Gascoyne Junction).

Biodiversity

For the Biodiversity Working Group indicator: Threatened species (see **Section 7 of Chapter 3** of *Rangelands 2008 — Taking the Pulse*), there are:

- 16 threatened mammal species
- 3 threatened bird species
- 6 threatened reptile species
- 2 threatened fish species.

Socioeconomic characteristics

Land use and value

Most (90%) of the Carnarvon bioregion was grazed in the period 1992 to 2001. This area decreased to approximately 83% of the bioregion area in 2005.

The average 'lease and improvement' value of pastoral land in the Carnarvon–Gascoyne–Murchison region increased by 230% over the period 1992 to 2005.

Key management issues and features

Key features and issues of the Carnarvon bioregion are:

- Over approximately the past decade, the cover and density of shrubs and trees on WARMS sites increased.
- Grazing-sensitive species were not adversely affected on WARMS sites over approximately the past decade.
- Native shrub species richness on WARMS sites increased slightly over approximately the past decade.
- About 6% of the pastoral leases are under Indigenous ownership.

- There is a strong trend in enterprise type away from merino sheep to cattle, meat sheep and rangeland goats. This is due to low wool prices, high meat prices, difficulty in finding labour for wool enterprises and wild-dog predation on sheep. Infrastructure on many stations, especially fencing, is not being maintained. This is partly the result of the move away from merino sheep.
- Tourism, particularly in coastal areas, is providing a substantial proportion of pastoralists' income.
- Particularly in the north of the bioregion, the spread of introduced buffel grass has stabilised many degraded areas and colonised some of the sandier soils. This has allowed stocking rates to increase in these areas.
- Unmanaged goats contribute a large proportion of the total grazing pressure, and their contribution to station income can be high. A large number of trap yards have been built in the past 10 years, as a way of lowering the cost of mustering and for better controlling total grazing pressure.
- About 11.4% of the bioregion is within the conservation estate.
- While the early 1990s were very dry, the mid- to late 1990s represented an exceptional sequence of above-average years, particularly in terms of summer rainfall. For much of the bioregion, the period since mid-2001 has been very dry.
- The bioregion was declared for exceptional circumstances (drought) in 2003, with extensions in southern areas in 2006.