Australian Government

National Land & Water Resources Audit

Extract from Rangelands 2008 — Taking the Pulse
4. Focus Bioregions - Murchison bioregion (WA)

Disclaimer

This report was prepared by the ACRIS Management Unit and the ACRIS Management Committee. The views it contains are not necessarily those of the Australian Government or of state or territory governments. The Commonwealth does not accept responsibility in respect of any information or advice given in relation to or as a consequence of anything contained herein.

ISBN 978 0 642 37146 1
ISBN 978 0 642 37147 8 (CD-ROM of the report)
ISBN 978 0 642 37148 5 (PDF)
Product number: PN21387

Suggested citation

Bastin G and the ACRIS Management Committee, Rangelands 2008 — Taking the Pulse, published on behalf of the ACRIS Management Committee by the National Land & Water Resources Audit, Canberra.

Acknowledgments

Rangelands 2008 — Taking the Pulse is the work of many people who have provided data and information that has been incorporated into this report. It has been possible due to significant in-kind contributions from the State and Territory governments and funding from the Australian Government through the Natural Heritage Trust. Particular thanks are due to staff of the Desert Knowledge Cooperative Research Centre, including Melissa Schliebs, Ange Vincent and Craig James.

Cover photograph

West MacDonnell Ranges (photo Department of the Environment, Water, Heritage and the Arts)

Principal author: Gary Bastin, CSIRO and Desert Knowledge CRC
Technical editor: Dr John Ludwig
Editors: Biotext Pty Ltd
Design: Design ONE
Printed in Australia by Lamb Print

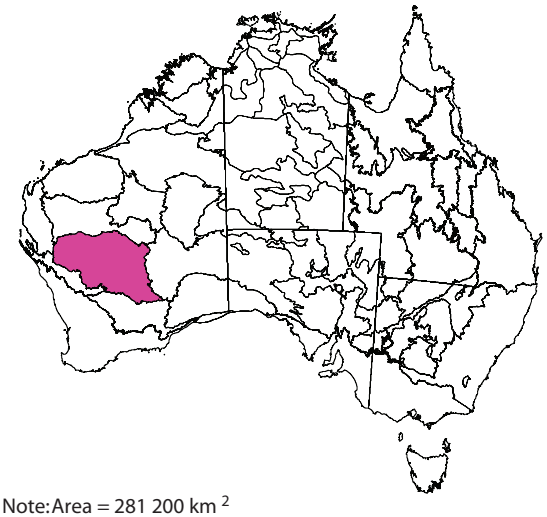
Printed with vegetable-based inks on stock that comprises 80% recycled fibre from postconsumer waste and 20% totally chlorine-free pulp, sourced from sustainable forests.

August 2008

Murchison bioregion (WA)

The Murchison bioregion encompasses much of the mulga country in the southern rangelands of WA (Figure 4.23) and is 281 200 km^2 in area. The climate is arid with predominantly winter rainfall. Landscapes comprise low hills and mesas separated by flat colluvium and alluvial plains. Mulga low-woodlands dominate. Other vegetation types include saltbush shrubland on calcareous soils, saline areas with samphire, and hummock grassland on red sandplain. The Murchison is one of the main pastoral (sheep and cattle) areas in WA, but mining (gold, iron and nickel) contributes more to the region's economy. Major population centres are Meekatharra, Leonora, Cue and Mount Magnet.

Figure 4.23 Murchison bioregion, WA

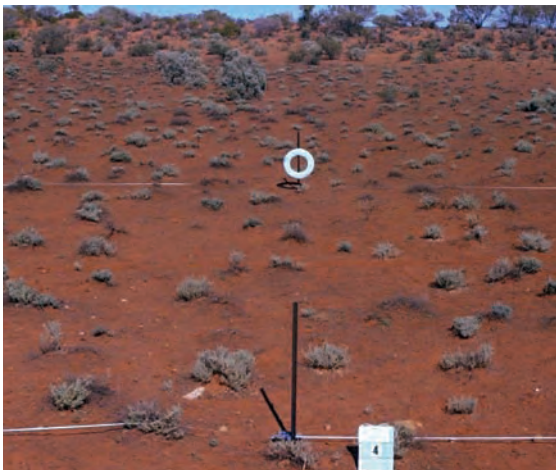


Note: Area = 281 200 km^2

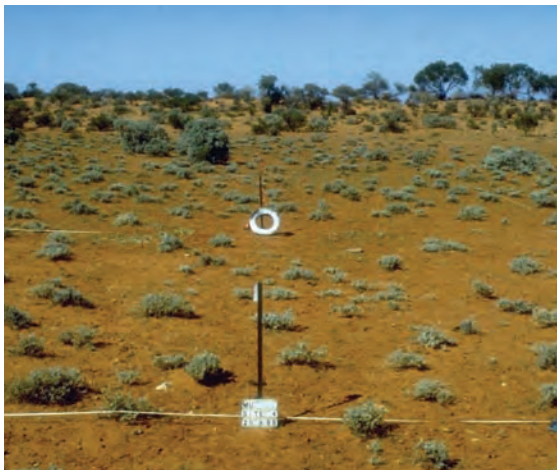
Regional issues

- Over approximately the past decade, the cover and density of shrubs and trees on Western Australian Rangeland Monitoring System (WARMS) sites increased. At other sites, cover and density remained stable (Figure 4.24).
- In general, grazing-sensitive species were not adversely affected on WARMS sites. However, on sites where overall decline was observed, the decline was greatest for grazing-sensitive species.
- Species richness of native shrubs (all species) on WARMS sites increased slightly.
- The apparent positive trends provided by WARMS data apply at a site level. Ecosystem Management Understanding (EMU) Project data, collected at the landscape to patch scale by Pringle et al (2006), generally contradict those findings and conclude that increased erosion, hydrological dysfunction and habitat homogenisation are increasing features of the bioregion.
- About 6% of the pastoral leases are under Indigenous ownership and 22% are under mining company ownership, and are either destocked or running low numbers of livestock.
- There has been a strong trend in enterprise type away from merino sheep to cattle, meat sheep (Figure 4.25) 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. The region has also seen a large increase in the number of self-mustering yards (Figure 4.26), which enable total grazing pressure (TGP) to be better managed as well as decreasing mustering and labour costs.
- An increasing percentage of pastoralists expect to earn significant off-station income, principally from supporting the mining industry. Many leases are unviable as pastoral enterprises on their own.
- Unmanaged goats contribute a large proportion of the TGP and landscape degradation, but their contribution to station income can be high. A large number of trap yards have been built in the

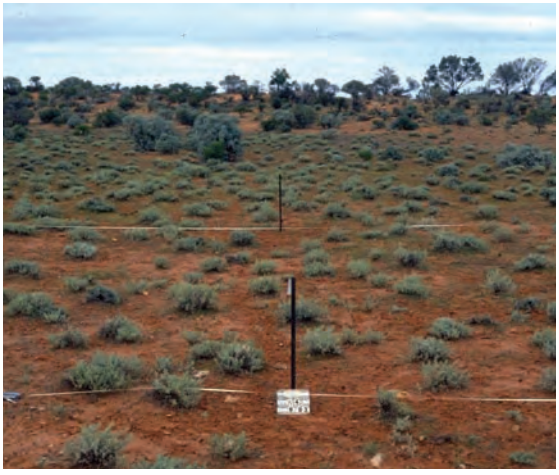
Figure 4.24 WARMS site in the Murchison bioregion, showing little change from 1982 to 2006



1982



1988



1993

2006

Most of the low vegetation is either bladder saltbush (*Atriplex vesicaria*) or low bluebush (*Maireana platycarpa*). Both species are decreasers and are preferentially grazed by livestock.

Photos: WA Department of Agriculture and Food

past 10 years as a way of lowering the cost of mustering and for better control of TGP (Figure 4.26).

- Wild dog numbers and their impacts have increased markedly in recent years.
- There has been an expansion of mining interest to banded ironstone ranges in recent years. This is significant for conservation, as those systems are highly restricted in area and frequently support endemic biota or assemblages.
- Sandalwood harvesting persists as an industry but will be unsustainable in the longer term if lack of recruitment cannot be addressed.
- About 6.7% of the region is within the conservation estate, but that proportion is inadequate under the principles of CAR (comprehensiveness, adequacy and representativeness).
- More than 40% of the original mammal fauna is now regionally extinct, including almost all medium weight-range species.

Figure 4.25 Dorper and damara meat sheep

Dorpers

Damaras

Photos: Mark Alchin, WA Department of Agriculture and Food

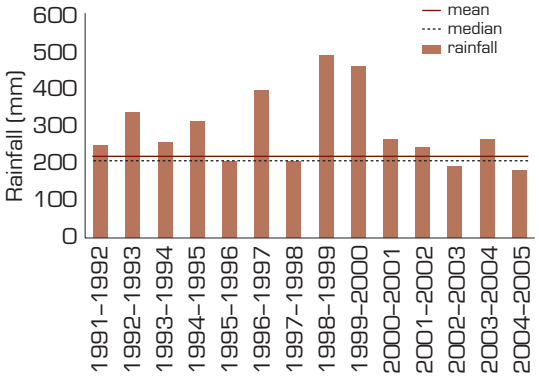
Figure 4.26 Feral goats mustered in a trap yard to help control total grazing pressure

Photo: Mark Alchin, WA Department of Agriculture and Food

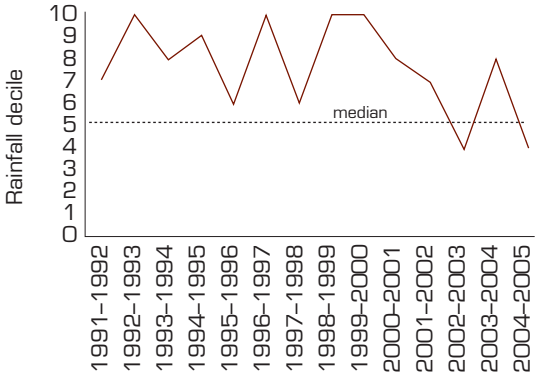
- Three mammals, three birds and one reptile are listed as vulnerable, and one reptile is listed as endangered. Three species of plant are listed as declared rare flora and many more have priority status, although most of them have not been studied well enough to determine their current condition and trend.
- As long as goats remain unmanaged, they will continue to be one of the more significant threats to biodiversity conservation through broadscale impacts on vegetation associations, cascading influences on landscape function, and grazing of environmentally sensitive sites.
- Although there are no formally listed threatened ecosystems, more than 52 vegetation associations and community types are considered to be at risk from grazing, changed fire regimes and other factors.
- The average 'lease and improvement' value of pastoral land in the Carnarvon–Gascoyne–Murchison region increased by 230% over the period from 1992 to 2005.
- The mid-to-late 1990s was an exceptional sequence of above-average years, particularly in summer rainfall. For part of the bioregion, the period since mid-2001 has been dry.
- The western and southern parts of the region were declared for Exceptional Circumstances drought relief in 2003. Some areas had this declaration extended in 2006.

Further information relevant to recent change in the Gascoyne–Murchison region (which includes the Murchison bioregion) is available in Watson et al (2005b).

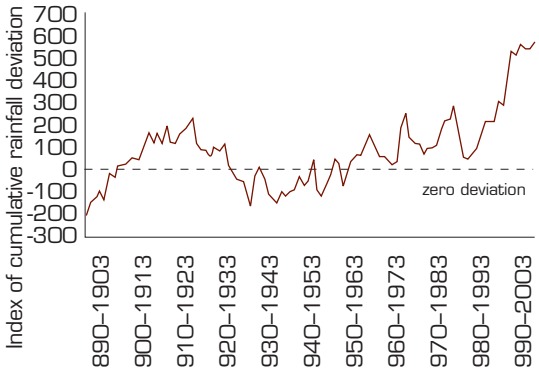
Figure 4.27 Indicators of *seasonal quality*, Murchison bioregion



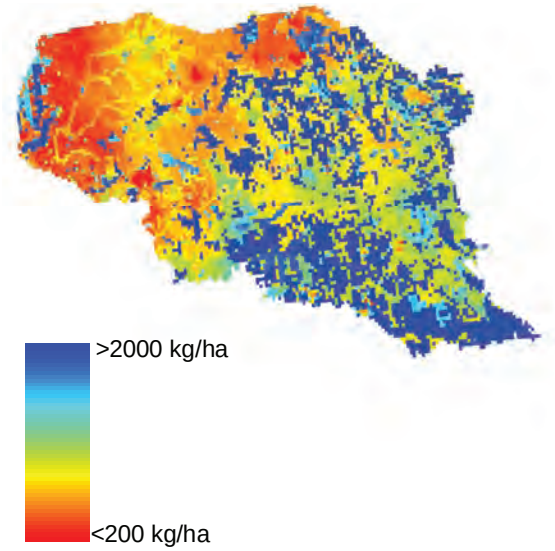
Annual rainfall. Long-term (1890–2005) mean and median rainfalls are also shown



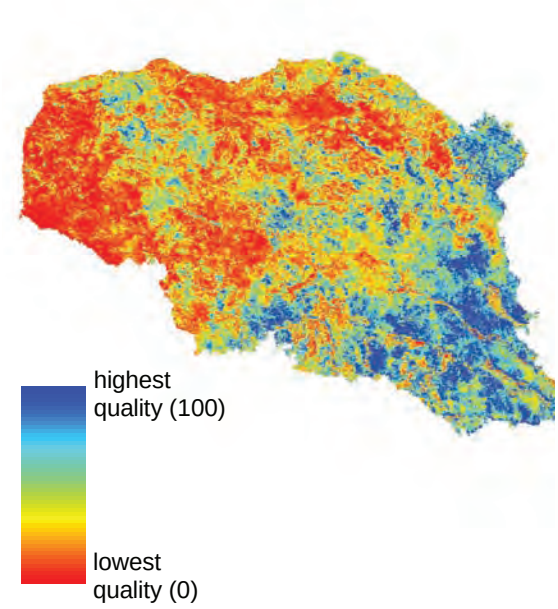
Annual rainfall as deciles of the long-term (1890–2005) rainfall



Cumulative percentage deviations of annual (April–March) rainfall from the long-term (1890–2005) median for all 14-year periods between 1890–1903 and 1992–2005



Aussie-GRASS simulated total standing dry matter — 2001



NDVI-based image of 'season quality' for 2001. Each pixel has a relative value according to the greeness of vegetation (ie photosynthetic activity)

Left: Rainfall

Right: Simulated pasture biomass and vegetation greenness (NDVI)

Note: Indicators are based on spatially averaged annual rainfall (April–March) between 1991–92 and 2004–05. For cumulative percentage deviations, periods below the dashed zero line indicate 14-year sequences with generally less rainfall (poorer *seasonal quality*) and periods above the line indicate sequences of increased rainfall (better *seasonal quality*).

Seasonal quality — 1992–2005

Rainfall was above average for most years, and the 1992–2005 period as a whole was generally wetter than all other 14-year periods since 1890 (Figure 4.27, left panel). Notwithstanding this, the spatial pattern of simulated pasture biomass produced by AussieGRASS and 'season quality' derived from the NDVI show that there was considerable regional variation in some years (Figure 4.27, right panel); that is, some parts of the region were much drier than others (and not all parts can be considered to have had such a good run of seasons).

Change in landscape function

Change in landscape function at the site scale can be reported in a number of ways using WARMS data. Here, we report on the basis of the Resource Capture Index (RCI) and shrub density (Figure 4.28, the latter for consistency with reporting by other jurisdictions).

WARMS data have high reliability for each site: there are many well-distributed sites in selected parts of the landscape; quantitative data are collected; the focus is on longer-lived plant species, which helps to filter short-term seasonal variability; and both indices (RCI and shrub density) usefully indicate landscape function. WARMS sites report change for the local areas they represent and should not be considered as representing the entire landscape (Pringle et al 2006).

Shrub density

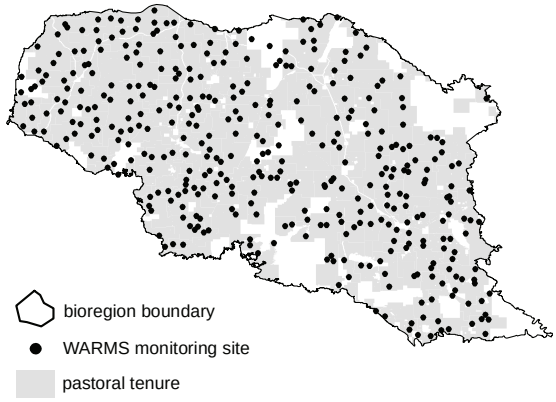
Based on the density of long-lived perennial plants recorded at WARMS monitoring sites, landscape function at those sites generally improved

Table 4.9 Seasonally interpreted change in landscape function at WARMS sites in the Murchison bioregion, based on change in density of longer-lived perennial vegetation

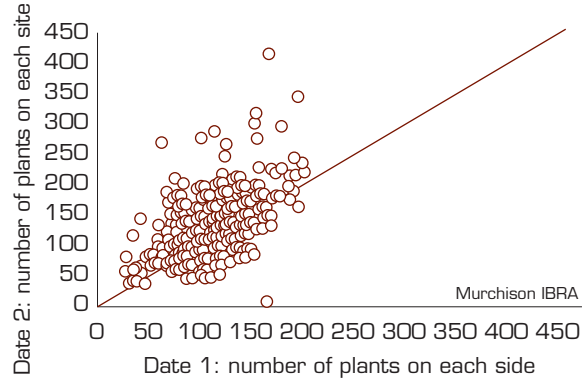
Seasonal quality	Number of sites	Decline. Density <95%	No change. Density between 95% and 105%	Increase. Density >105%
Above average	157	14%	15%	71%
Average	167	30%	23%	47%
Below average	62	60%	19%	21%

Note: The light grey cell indicates a likely adverse effect related to grazing management, in that no change or an increase in the landscape function indicator would be expected following above-average *seasonal quality*. The grey cell represents an encouraging result, as a decrease in landscape function would be expected following poor seasonal conditions.

Figure 4.28 Changes in landscape function, Murchison bioregion



WARMS sites used to report changes in landscape function



Changes in density of long-lived perennial plants

Table 4.10 Seasonally interpreted change in landscape function at WARMS sites in the Murchison bioregion, based on change in the Resource Capture Index (RCI)

Seasonal quality	Number of sites	Decline. RCI < 0.90	No change. 0.90 ≥ RCI <1.10	Increase. RCI ≥ 1.10
Above average	94	60%	9%	32%
Average	141	55%	15%	30%
Below average	62	68%	11%	21%

Note: See Table 4.9 for an explanation of cell colours.

Table 4.11 Seasonally interpreted change in critical stock forage at WARMS sites in the Murchison bioregion

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	153	17%	11%	73%
	Intermediate	151	16%	19%	65%
	Increaser	74	7%	36%	57%
Average	Decreaser	165	33%	20%	47%
	Intermediate	166	25%	31%	44%
	Increaser	108	12%	34%	54%
Below average	Decreaser	61	67%	10%	23%
	Intermediate	58	45%	34%	21%
	Increaser	43	28%	33%	40%

Notes: Critical stock forage is based on the frequency of decreaser species. See Table 4.9 for an explanation of cell colours.

(Figure 4.28), in that there was a higher population at the second assessment (1999–2005) at most sites compared with the initial assessment (1993–2001).

Fourteen per cent of sites showed a decline in the density of longer-lived perennial vegetation when *seasonal quality* was above average, and 21% of sites showed improvement when *seasonal quality* was below average (Table 4.9). Interpretation of these seasonally adjusted changes would be enhanced with knowledge of the grazing pressure exerted at each site, but stocking density data at that resolution are not available. Regional livestock numbers decreased between 1998 and 2004, particularly in the west, in response to poorer *seasonal quality* (see Figure 4.29). However, data are lacking on TGP, particularly for feral goats and kangaroos. It is not possible to convert regional livestock trends to an estimate of stocking density at WARMS sites.

Resource Capture Index

Sixty per cent of sites showed a decline in the RCI when *seasonal quality* was above average, and 21% of sites showed an improvement when *seasonal quality* was below average (Table 4.10).

Sustainable management

Change in critical stock forage

The density of long-lived decreaser shrubs declined at 17% of sites following above average *seasonal quality* (Table 4.11). The density of decreaser shrubs increased at 23% of sites following below-average *seasonal quality*.

Native shrub species richness

The richness of native shrub species recorded at WARMS sites provides insight into one aspect of sustainable management: a greater diversity of species provides increased grazing choice for sheep

Table 4.12 Seasonally interpreted change in native-shrub species richness at WARMS sites in the Murchison bioregion

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	157	3%	67%	31%
Average	167	3%	83%	14%
Below average	62	5%	81%	15%

Note: See Table 4.9 for an explanation of cell colours.

Table 4.13 Percentages of pastoral lease area of each sub-IBRA within 3 km and beyond 8 km of permanent or semipermanent sources of stock water, Murchison bioregion

Sub IBRA	% sub IBRA area included	% area ≤3 km from stock water	% area >8 km from stock water
Eastern Murchison (MUR1)	78.3	38.3	11.1
Western Murchison (MUR2)	90.9	48.6	0.3

or cattle and improved ecosystem health. Based on 386 sites, the average ratio of species richness at first assessment (December 1993 to April 2001) to richness at second assessment (September 1999 to November 2005) was 1.08 ± 0.01 (SE). Three per cent of sites had decreased species richness following above average *seasonal quality*, whereas 15% had increased species richness following below-average *seasonal quality* (Table 4.12).

Change in woody cover

Based on WARMS data, cover of woody species increased on average by 28% and remained the same or increased on most sites (68%). On only 3% of sites did cover drop below 50% of the initially recorded value. These results were similar whether large overstorey species were considered or not. Much of the increase in canopy area was driven by *seasonal quality*. Canopy area decreased markedly for those sites that experienced below-average seasonal conditions.

Distance from water

Based on the locations of stock water sources (derived from WA mapping of lease infrastructure), Table 4.13 lists the percentages of pastoral lease areas within each sub-IBRA that are less than 3 km and more than 8 km from waterpoints (water-remote).

The Western Murchison sub-IBRA had almost no areas remote from water.

These analyses do not include the locations of ephemeral natural waters, which can provide additional sources of water for stock, particularly in the early dry season.

It is not possible to report change in watered area for the 1992–2005 period.

Weeds

Weeds known to occur in the bioregion include African boxthorn (*Lycium ferocissimum*), Patersons curse (*Echium plantagineum*), Bathurst burr (*Xanthium spinosum*), mesquite (*Prosopis* spp.) and Mexican poppy (*Argemone ochroleuca*).[48]

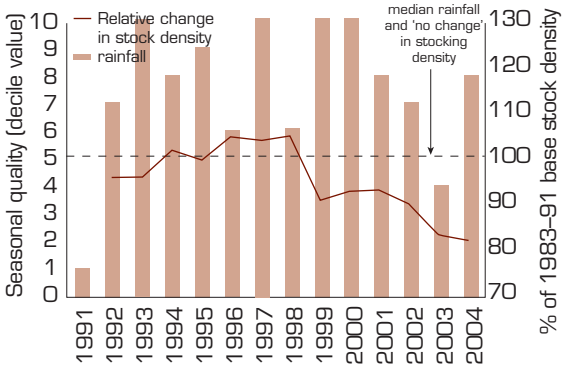
Components of total grazing pressure

Domestic stocking density

Eighty-eight per cent of the Murchison bioregion was pastoral land in the period from 1992 to 2001, reducing to approximately 83% of the bioregion in 2005. Based on ABS-sourced data and taking account of the reduction in grazed area, domestic stocking

[48] See http://www.anra.gov.au

Figure 4.29 Changes in domestic stocking density (sheep and beef cattle), Murchison bioregion, 1991 to 2004



Note: *Seasonal quality* as deciles of rainfall is also shown.

density was slightly above the 1983–91 average between 1996 and 1998 but decreased sharply in 1999 and then decreased further by 2003 and 2004 (Figure 4.29). The decrease reflects destocking of leases in the western part of the bioregion from 1999–2000 onwards as drought set in. All but the eastern parts of the region were drought declared in 2003. For some areas, this declaration was extended in 2006. Spatial averaging of stocking density across the large extent of this bioregion conceals variation in actual stocking density in parts of the region.

Feral goats contribute significantly to TGP in some parts. There are insufficient reliable data to report goat numbers or their change in density through the 1992–2005 reporting period.

Kangaroos

No suitable data are available to report change in kangaroo density.

Invasive animals

Invasive animal species known to occur in the bioregion include goat (*Capra hircus*), fox (*Vulpes vulpes*), rabbit (*Oryctolagus cuniculus*), wild dog (*Canis lupus familiaris*), feral cat (*Felis catus*), camel (*Camelus dromedarius*), donkey (*Equus asinus*), horse (*Equus caballus*) and feral sheep (*Ovis* spp.).[49]

[49] See http://www.anra.gov.au

Fire and dust

Fire

Fire was insignificant, with a maximum of 1.9% of the bioregion area burned in both 2000 and 2001. Based on the month of burn, fires between 1997 and 2005 were of both hot and cool types; both types occurred each year to varying extents. The frequency of fire between 1997 and 2005 was insignificant; the mean frequency (log_{10} transformed) was 0.03.

Absence of fire under present-day pastoral management may also be significant, as there may be many plant associations that would have burned under non-pastoral regimes but now rarely burn.

Dust

Atmospheric dust levels based on the DSI were relatively low (mean DSI_3 of 1.43 for the 1992–2005 period, in which the maximum value for all bioregions was 8.44). The spatial distribution map (Chapter 3) shows that the most dust occurs in the eastern area of the bioregion and is probably associated with mining activity in and around Kalgoorlie, which is just south of the bioregion boundary in the Coolgardie bioregion. Dust reporting for the Murchison bioregion has moderate reliability.

Change in biodiversity

The area set aside for conservation purposes increased from about 0.5% of the bioregion in 1998 to 6.7% in 2004, due to the purchase of pastoral leases by the WA Government.

Two plant species are listed as threatened in the Murchison bioregion. There are also 7 mammal species, 2 bird species and 3 species of reptile listed as threatened (Biodiversity Working Group indicator: Threatened species).

Change in land use and land values

Approximately 14 800 km^2 of pastoral land (5.3% of the bioregion) has been acquired for conservation purposes from 1998 onwards.

It is not possible to describe change in land values for the Murchison region alone, but land values for the Carnarvon–Gascoyne–Murchison region have increased by approximately 230% since 1992.