Report card on sustainable natural resource use in the rangelands

Status and trend in the pastoral rangelands of Western Australia

Supporting your success

Section 1
The Western Australian rangelands
Section 1 The Western Australian rangelands
Western Australia’s pastoral rangelands at a glance

### Pastoral statistics
- Total station area is 857,833 km²:
  - 436 stations (491 leases)
  - 27 land conservation districts (LCDs)
- Management:
  - 163 individual or family (light blue)
  - 175 company (yellow), of which 7 are owned for conservation purposes (green)
  - 55 indigenous (purple)
  - 41 mining (orange)
  - 2 public sector (grey)

### Annual rainfall (mm)
- Annual rainfall ranges from 180 to 1200 mm:
  - Kimberley: 350–1200 mm
  - Pilbara: 220–400 mm
  - Southern Rangelands: 180–300 mm

### Percentage of winter rainfall
- The Kimberley has predominantly summer rainfall (300–1150 mm).
- Pilbara rainfall is variable, with summer rainfall ranging from 140 to 280 mm. Ashburton LCD and coastal areas of the Pilbara are bi-seasonal with 30–50% winter rainfall.
- The Southern Rangelands has predominantly winter rainfall near the coast (70–80%), reducing eastwards away from the coast. Southern Rangelands winter rainfall ranges from 75 to 250 mm.

### Potential pastoral production
- Northern Rangelands:
  - The Potential Carrying Capacity of tussock grasslands (30–200 DSE/km²) is more productive than hummock grasslands (2–30 DSE/km²).
- Southern Rangelands:
  - The Potential CC varies from 5–20 DSE/km² for chenopod shrublands to 3–7 DSE/km² for mulga woodland.

### Changes in livestock type
- The type of livestock run has changed over time. In 2014, cattle were run on 88% of stations.
- 1984:
  - 763,600 cattle (brown)
  - 1,901,600 sheep (yellow)
  - 293,900 goats (orange)
- 2014:
  - 1,402,900 cattle (brown)
  - 293,900 sheep (yellow or orange)
  - 12,800 goats (purple or green)
1.1 Scope of the report

This report card presents the best information on the condition (or risk to condition) and trend in condition of the natural resources that support pastoralism in the Western Australian (WA) rangelands. In particular, this report:

- explains how condition, risk and trend was determined
- assesses pastoral resource condition and trend
- highlights factors affecting the sustainable use of this resource
- discusses the management implications of these findings
- provides recommended actions where appropriate.

The report focuses on the sustainable natural resource use of the WA native rangeland for pastoralism (grazing by livestock). Pastoral rangeland activities in WA are on state-managed leasehold land administered by the Department of Lands, under the Land Administration Act 1997.

Pastoral rangelands provide a range of benefits in addition to pastoralism: tourism, ecological services, mining, and cultural and heritage values for Indigenous people. These benefits are not considered in this report.

This report provides information for government, land conservation district committees and the pastoral industry to use in developing strategies and actions to manage change and to ensure a more sustainable use of the pastoral resource.

Information in this report is presented at the land conservation district (LCD) or regional scale; it does not have information at the pastoral lease scale.

Drivers for change in the rangelands

The WA pastoral rangelands have highly variable landscapes, soils, vegetation, rainfall and seasonality. The three primary drivers of change across all WA rangelands are:

- seasonal quality
- grazing pressure
- fire.

Seasonal quality is the amount and distribution of rainfall and its interaction with vegetation to determine grazing values. Climatic variation within and between years is a major concern for management.

Grazing pressure is the demand–supply ratio between forage needs of herbivores and the forage supply in a pasture at a specific time. The aim of management is to match grazing pressure to production and recovery of rangeland vegetation.

Fire is a naturally occurring hazard, especially in the Northern Rangelands, with limited management options.

Natural resource themes

Rangeland status and changes are described in the themes:

- rangeland vegetation condition: from pastoral station assessments
- plant population change at the regional level: from the Western Australian Rangeland Monitoring System (WARMS) data
- vegetation cover: from remotely sensed data
- soil erosion: from pastoral station assessments
- soil organic carbon: from modelling.

The drivers of change interact and their effect manifests in the themes.
1.2 The rangeland regions

Rangeland, sometimes referred to as native pasture, is any extensive area of land that is occupied by native herbaceous or shrubby vegetation which is grazed by livestock, and native and introduced herbivores.

The WA rangelands are highly varied and are contained wholly or partly within 20 IBRA (Interim Biogeographic Regionalisation for Australia) bioregions (environment.gov.au). These rangelands occur in climates ranging from tropical to arid temperate; with topography including coastal plains, rocky ranges and semi-arid desert; and rainfall amount and distribution ranging from summer-dominant with 1200mm annually to winter-dominant and less than 250mm. The combination of climate, topography and soils renders them unsuitable for broadacre farming and so agriculture is typically limited to pastoralism (Harrington et al. 1984).

The WA rangelands cover about 2.2 million square kilometres (87% of WA, which is all but the south-west agricultural region), and pastoral stations for grazing livestock cover 40% (857,833km$^2$) of that, based on active leases as at June 2016 (C Olsen [Landgate] 2016, pers. comm., 4 August). The rest of the rangelands consist of land vested for conservation, Indigenous purposes and unallocated Crown land (UCL).

DAFWA divides the WA pastoral rangelands into two areas: the Northern Rangelands, which contains the Kimberley (206,775km$^2$) and the Pilbara (147,940km$^2$) regions, and the Southern Rangelands, which is south of the Pilbara region and between the south-west agricultural region and the arid interior. It contains the Gascoyne (138,650km$^2$), Murchison (128,620km$^2$) and the Goldfields–Nullarbor (235,850km$^2$) regions (Figure 1.1).
The rangeland vegetation types range from grasslands to shrublands to woodlands (see Glossary) as well as patches of monsoonal forests in the north. The two distinct types of rangelands used for grazing livestock are:

- grasslands, which are predominantly perennial tussock (bunch) and hummock grasses, with or without some tree cover. They occur mainly in the Northern Rangelands
- shrublands, which are vegetation types characterised by shrubs with a variable mulga (Acacia aneura) or eucalypt overstorey. They occur mainly in the Southern Rangelands.

Grasslands and shrublands are both present in the southern Pilbara and Gascoyne.

Perennial vegetation in the Southern Rangelands is adapted to characteristically low and highly variable rainfall, and pasture productivity is low relative to that in the Northern Rangelands. Perennial vegetation in the Southern Rangelands is more susceptible to degradation through overutilisation than that in the Northern Rangelands.

The pastoral industries in the Kimberley and Pilbara are similar in that they consist of enterprises with a high proportion of tropically adapted breeding cattle. Pastoralists in the Kimberley sell most cattle for live export, and pastoralists in the Pilbara sell for live export and domestic markets. Kimberley stations have run only cattle for some time, while a few stations in the south-west of the Pilbara still run sheep.

The Gascoyne, Murchison, Goldfields and Nullarbor were major wool-producing areas as recently as the early 1990s. However, during the following 20 years, the number of sheep, especially Merino sheep, greatly declined. Merinos have been replaced to some extent by meat sheep on stations in the western Gascoyne and Murchison, but the most significant change has been from sheep to cattle across the Southern Rangelands. Rangeland sheep production now comprises less than 3% of the total value of the WA sheep production.

The Southern Rangelands goat population was estimated to be between 150,000 and 250,000, although goats are now rarely sighted in the Goldfields and eastern Murchison. There has been a de facto managed goat industry and an industry based on the sale of unmanaged (feral) goats. Opportunistic harvesting of goats has provided significant and timely income for many leaseholders, even to the extent of some leaseholders imposing a level of management on feral goat flocks rather than simply harvesting.

**Climate**

Climate, particularly the amount, intensity and seasonal distribution of rainfall, is a major determinant of rangeland productivity. Dealing with rainfall variability is a major component of rangeland management.

**Northern Rangelands**

The Kimberley has a tropical monsoon climate with two dominant seasons separated by short transitional periods:

- The wet summer season (November to April) is hot and humid, with seasonal rainfall up to 1200mm in the north (Figure 1.2). Typically, 90% of annual rainfall occurs during this period, when low pressure systems and unstable air dominate.
- The dry winter season (May to October) is influenced by high pressure systems and a predominantly south-easterly airflow from the interior. This rainfall pattern leads to tropical savanna vegetation in the north and arid desert grassland in southern parts.

The Pilbara has a similar summer and winter seasonal pattern to the Kimberley, with generally lower annual rainfall (300–500mm) and more-frequent poor wet seasons. The southern Pilbara occurs roughly on the boundary between the summer-dominant and winter-dominant/seasonally uniform rainfall zones.
Figure 1.2 Rainfall isohyets for the Northern Rangelands and average monthly rainfall for selected locations.
Figure 1.3 Rainfall isohyets for the Southern Rangelands and average monthly rainfall for selected locations
Southern Rangelands

The Southern Rangelands have predominantly winter rainfall, with an average annual rainfall generally below 300mm (Figure 1.3). Rainfall is highly variable within and between years, and variation is high compared to similar areas elsewhere in Australia. This arid climate, with frequent dry years interspersed with occasional high rainfall events, makes it difficult to match forage demand (stocking rate) with supply (available forage). Summer rainfall probabilities are low throughout the region, although the proportion of annual rainfall occurring in the summer months has increased over recent decades. Substantial variation in rainfall also occurs in cycles that vary from 2.5 to 30 years or more.

Climate change and the WA rangelands

High seasonal variability in the rangelands masks climate change to some extent.

Climate records indicate a drying trend for much of WA, except for the Kimberley, and modelling suggests a continued warming trend over the coming decades (Indian Ocean Climate Initiative [IOCI] 2012). Rainfall in northern Australia, including the Kimberley, are likely to be heavier, with more rain falling per rain day. As a result, flash floods may become more common. There are likely to be more dry days (time between rains), which may cause water supply problems. In north-western Australia, the wet season is becoming wetter and, since the 1950s, annual rainfall has increased by more than 30mm per decade and exceeding 50mm per decade over parts of the north-west coast (Figure 1.4). This increase in annual rainfall has generally been associated with...
an increase in summer rainfall (Figure 1.5) and a decrease in winter rainfall (Figure 1.6).

In the decade 2005–14, all LCDs in the Southern Rangelands had more years with above-average summer rainfall (6 to 9 years out of 10) than the long-term above-average rainfall in a 10-year period (3 to 4 years out of 10). In this period, the largest increases above the long-term monthly average rainfall were in December (9mm or 76%), January (18mm or 82%) and March (13mm or 50%). In the same period, the average rainfall declined in May (–10mm or –32%) and June (–12mm or –36%).

Legislation, land tenure and pastoral leases

Land tenure in the rangelands is predominantly pastoral leasehold, with leases issued under the Land Administration Act 1997. The statutory authority for managing the pastoral estate rests with the Department of Lands and the Pastoral Lands Board of Western Australia (PLB). DAFWA provides technical assistance to the PLB to support their activities.

The Land Administration Act states that the function of the PLB is to ensure that pastoral leases are managed on an ecologically sustainable basis. Leases are developed and assigned to enable them to be worked as an economically viable and ecologically sustainable pastoral business unit.

In addition, under the Soil and Land Conservation Act 1945, the Commissioner of Soil and Land Conservation (the Commissioner) has the duty and powers to prevent activities that could lead to land degradation and, if warranted, the power to instruct lessees to ameliorate or repair degraded land.

A pastoral lease is a title issued by the Minister for Lands for the lease of an area of Crown land for the limited purpose of grazing of livestock (cattle, sheep, goats and horses) and ancillary activities. Under the Land Administration Act and the Soil and Land Conservation Act, pastoral lessees are obliged to manage the vegetation and soil resources on their lease to avoid soil and land degradation and, under the Biosecurity and Agricultural Management Act 2007, to control declared plant and animal pests.

A permit from the PLB is required for any non-pastoral use carried out on a pastoral lease. A permit may be granted if the property as a whole continues to be managed for pastoral purposes. Mining leases may be issued concurrent to pastoral leases and mining operations can occur on pastoral land.

In 2016, there were 491 registered pastoral leases in WA, held in 436 pastoral stations: 152 stations in the Northern Rangelands (92 in the Kimberley and 60 in the Pilbara); and 284 stations in the Southern Rangelands. Lease ownership includes large corporations, private companies, family operations, Indigenous organisations, and, particularly in the Pilbara and Goldfields, mining companies (Figures 1.7 and 1.8).

Land conservation districts

Information in this report is presented at the LCD scale. Pastoral LCDs, as with all LCDs, are appointed under legislation, constituted under section 22(1) of the Soil and Land Conservation Act 1945 and comprise pastoral leasehold land, defined conservation areas (which may have formed part of the pastoral estate prior to their declaration as conservation areas) and UCL. Land conservation district committees (LCDCs) are community-based groups focused on sustainable resource management and their role is to promote on-ground involvement in voluntary land management and conservation activities. Many LCDCs also manage externally-funded projects aimed at preventing land degradation and promoting soil and land conservation and reclamation. In WA, the Commissioner resides within DAFWA and provides administrative services for the LCDCs, including a state officer (a nominee of the Commissioner), insurance, information and administrative funds.
Figure 1.7 Land tenure in the Northern Rangelands, as at June 2016
Figure 1.8 Land tenure in the Southern Rangelands, as at June 2016
There are 27 LCDs in the WA rangelands (Figures 1.9 and 1.10). This report relates to the proportion of each LCD that was pastoral land or conservation areas which formed part of the pastoral estate prior to declaration as conservation areas; it does not relate to UCL.

**Legend**
- Pastoral station
- Non-pastoral area
- Land Conservation District boundary
- Area excluded from LCDs (includes UCL and reserves)

**Figure 1.9** LCDs in the Northern Rangelands
Figure 1.10 LCDs in the Southern Rangelands
In the Northern Rangelands, the Kimberley LCDs are Broome, Derby – West Kimberley, Halls Creek – East Kimberley and North Kimberley; the Pilbara LCDs are Ashburton, De Grey, East Pilbara and Roebourne – Port Hedland (Table 1.1). Pilbara LCDs generally have a reasonably uniform number of stations, but in the Kimberley, the two major catchments of the Ord and the Fitzroy rivers contain most of the pastoral stations.

The Southern Rangelands has 19 LCDs, which have been subdivided based on rainfall distribution. The Gascoyne – Ashburton Headwaters, Upper Gascoyne and Wiluna LCDs are classed as ‘Southern Rangelands (SR) summer’ because they receive a substantial proportion of their annual rainfall in summer. The rest of the LCDs are classed as ‘SR winter’ (Table 1.2).

Table 1.1 LCD statistics in the Northern Rangelands

<table>
<thead>
<tr>
<th>Region</th>
<th>LCD</th>
<th>LCD area (ha)</th>
<th>Number of pastoral stations</th>
<th>Total station area (ha)</th>
<th>Average station area (ha)</th>
<th>Proportion of LCD as pastoral lease (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kimberley</td>
<td>1</td>
<td>North Kimberley*†</td>
<td>11 276 364</td>
<td>14</td>
<td>3 772 831</td>
<td>269 488</td>
</tr>
<tr>
<td>Kimberley</td>
<td>2</td>
<td>Halls Creek – East Kimberley*†</td>
<td>8 753 170</td>
<td>35</td>
<td>8 071 616</td>
<td>230 618</td>
</tr>
<tr>
<td>Kimberley</td>
<td>3</td>
<td>Derby – West Kimberley*†</td>
<td>7 518 115</td>
<td>32</td>
<td>7 367 869</td>
<td>230 246</td>
</tr>
<tr>
<td>Kimberley</td>
<td>4</td>
<td>Broome*†</td>
<td>2 582 365</td>
<td>9</td>
<td>1 465 265</td>
<td>162 807</td>
</tr>
<tr>
<td>Pilbara</td>
<td>5</td>
<td>De Grey*†</td>
<td>5 082 429</td>
<td>15</td>
<td>3 798 009</td>
<td>253 201</td>
</tr>
<tr>
<td>Pilbara</td>
<td>6</td>
<td>Roebourne – Port Hedland*†</td>
<td>5 177 240</td>
<td>18</td>
<td>2 993 965</td>
<td>166 331</td>
</tr>
<tr>
<td>Pilbara</td>
<td>7</td>
<td>East Pilbara*†</td>
<td>4 831 201</td>
<td>13</td>
<td>3 168 985</td>
<td>243 768</td>
</tr>
<tr>
<td>Pilbara</td>
<td>8</td>
<td>Ashburton*†</td>
<td>6 152 959</td>
<td>16</td>
<td>3 733 040</td>
<td>233 315</td>
</tr>
</tbody>
</table>

* LCD includes areas of non-pastoral land (UCL and reserves).
† LCD includes Department of Parks and Wildlife reserves.
‡ LCD includes UCL.
<table>
<thead>
<tr>
<th>Rainfall area</th>
<th>LCD</th>
<th>LCD area (ha)</th>
<th>Number of pastoral stations</th>
<th>Total station area (ha)</th>
<th>Average station area (ha)</th>
<th>Proportion of LCD as pastoral lease (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR summer</td>
<td>9</td>
<td>Gascoyne – Ashburton Headwaters†‡</td>
<td>6,906,425</td>
<td>16</td>
<td>4,982,019</td>
<td>311,376</td>
</tr>
<tr>
<td>SR summer</td>
<td>10</td>
<td>Upper Gascoyne†</td>
<td>4,181,585</td>
<td>18</td>
<td>3,273,876</td>
<td>181,882</td>
</tr>
<tr>
<td>SR summer</td>
<td>11</td>
<td>Wiluna†</td>
<td>33,705,599</td>
<td>18</td>
<td>4,394,778</td>
<td>244,154</td>
</tr>
<tr>
<td>SR winter</td>
<td>12</td>
<td>Lyndon†‡</td>
<td>3,715,081</td>
<td>21</td>
<td>3,302,125</td>
<td>157,244</td>
</tr>
<tr>
<td>SR winter</td>
<td>13</td>
<td>Gascoyne–Wooramel†</td>
<td>1,653,843</td>
<td>16</td>
<td>1,915,542</td>
<td>119,721</td>
</tr>
<tr>
<td>SR winter</td>
<td>14</td>
<td>Shark Bay†‡</td>
<td>2,667,947</td>
<td>13</td>
<td>1,491,284</td>
<td>114,714</td>
</tr>
<tr>
<td>SR winter</td>
<td>15</td>
<td>Murchison†</td>
<td>4,475,451</td>
<td>24</td>
<td>4,022,350</td>
<td>167,598</td>
</tr>
<tr>
<td>SR winter</td>
<td>16</td>
<td>Meekatharra†‡</td>
<td>3,211,619</td>
<td>20</td>
<td>3,648,574</td>
<td>182,429</td>
</tr>
<tr>
<td>SR winter</td>
<td>17</td>
<td>Cue†‡</td>
<td>1,257,263</td>
<td>8</td>
<td>889,716</td>
<td>111,214</td>
</tr>
<tr>
<td>SR winter</td>
<td>18</td>
<td>Mount Magnet</td>
<td>1,223,568</td>
<td>17</td>
<td>1,651,313</td>
<td>97,136</td>
</tr>
<tr>
<td>SR winter</td>
<td>19</td>
<td>Sandstone†‡</td>
<td>3,330,243</td>
<td>12</td>
<td>2,409,539</td>
<td>200,795</td>
</tr>
<tr>
<td>SR winter</td>
<td>20</td>
<td>Yalgoo†‡</td>
<td>3,020,649</td>
<td>19</td>
<td>2,451,420</td>
<td>129,022</td>
</tr>
<tr>
<td>SR winter</td>
<td>21</td>
<td>Perenjori†§</td>
<td>1,017,906</td>
<td>2</td>
<td>176,296</td>
<td>88,148</td>
</tr>
<tr>
<td>SR winter</td>
<td>22</td>
<td>Binnu†§</td>
<td>1,216,520</td>
<td>3</td>
<td>198,550</td>
<td>66,183</td>
</tr>
<tr>
<td>SR winter</td>
<td>23</td>
<td>Mount Marshall†§</td>
<td>782,248</td>
<td>2</td>
<td>274,727</td>
<td>137,364</td>
</tr>
<tr>
<td>SR winter</td>
<td>24</td>
<td>North-eastern Goldfields†</td>
<td>3,936,601</td>
<td>29</td>
<td>6,211,091</td>
<td>214,176</td>
</tr>
<tr>
<td>SR winter</td>
<td>25</td>
<td>Kalgoorlie†</td>
<td>6,092,703</td>
<td>22</td>
<td>3,849,399</td>
<td>174,973</td>
</tr>
<tr>
<td>SR winter</td>
<td>26</td>
<td>Yilgarn†§</td>
<td>3,057,623</td>
<td>4</td>
<td>190,954</td>
<td>47,739</td>
</tr>
<tr>
<td>SR winter</td>
<td>27</td>
<td>Nullarbor – Eyre Highway‡</td>
<td>6,247,761</td>
<td>20</td>
<td>6,078,174</td>
<td>303,909</td>
</tr>
</tbody>
</table>

* LCD includes UCL and Indigenous land.
† LCD includes Department of Parks and Wildlife reserves.
‡ LCD includes UCL.
§ LCD includes small stations abutting the agricultural zone and UCL.
# For reporting purposes, some stations are aligned with the LCD even though they are not formally incorporated into the LCD and hence the station area exceeds the registered LCD area.
1.3 Rangeland resources and change

The goal of sustainable pastoralism is the continued use of rangeland natural resources for livestock production without causing a loss of land capability. To monitor achievement of this goal, we need to know the starting condition (baseline), changes over time of the natural resources used in pastoralism, and the sustainable carrying capacity for livestock.

Rangeland surveys

Rangeland surveys provide the baseline data for pastoral resource condition and estimates of pastoral value. This baseline data is used to determine rangeland vegetation in ‘good condition’ for different land systems. Rangeland surveys provide information about the amount of vegetation available for grazing on these good condition land systems, and this is used to estimate the Potential Carrying Capacity (Potential CC) for the land systems, LCDs and rangeland regions. See the glossary for explanations of these terms.

Fourteen condition and inventory surveys have been completed and surveys now cover about 87% of the state’s pastoral rangeland. Beard’s vegetation mapping (Beard 1975) is used to provide information for those areas not surveyed (the southern Goldfields and areas east of Wiluna).

Survey reports are available at agric.wa.gov.au/land-use/rangelands-surveys.

Carrying capacity as a measure of sustainable pastoral productivity

Pastoral business viability relies on being able to turn-off a sufficient number of livestock. To determine the number of livestock that could potentially be sustainably carried on a pastoral lease, DAFWA estimates carrying capacity from rangeland vegetation condition (good, fair, poor for each pasture type within a land system) and pastoral values (livestock units per unit area) of the land systems that make up the lease.

Note: The LCD Present Carrying Capacity (Present CC) is calculated from the sum of pastoral station assessments of land systems and their condition. The last on-station assessments were in 2009 or earlier. Based on analysis of WARMS data, seasonal quality and remote sensing data (Normalized Difference Vegetation Index and cover), DAFWA has moderate to high confidence in using these Present CC estimates.

The change from Potential CC to Present CC gives an indication of trend in resource capability for pastoralism.

The Potential CC and the Present CC of all stations in an LCD are summed to provide an estimate of LCD-scale carrying capacity (Tables 1.3 and 1.4). In general, LCDs in the Northern Rangelands are composed of land systems with higher carrying capacities than those in the Southern Rangelands.

Carrying capacities in Tables 1.3 and 1.4 are in cattle units (CU) and dry sheep equivalents (DSE); 1 CU equals 7 DSE.
### Table 1.3  LCD-scale Potential CC and the most recently assessed Present CC in the Northern Rangelands

<table>
<thead>
<tr>
<th>LCD</th>
<th>Potential CC (CU / DSE)</th>
<th>Present CC (CU / DSE)</th>
<th>Period Present CC was determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 North Kimberley</td>
<td>105 235/ 736 645</td>
<td>82 057/ 574 399</td>
<td>2002–07</td>
</tr>
<tr>
<td>2 Halls Creek – East Kimberley</td>
<td>288 360/ 2 018 520</td>
<td>199 244/ 1 394 708</td>
<td>2003–09</td>
</tr>
<tr>
<td>3 Derby – West Kimberley</td>
<td>350 219/ 2 451 533</td>
<td>237 186/ 1 660 302</td>
<td>2003–09</td>
</tr>
<tr>
<td>4 Broome</td>
<td>81 578/ 571 046</td>
<td>65 672/ 459 704</td>
<td>2005–09</td>
</tr>
<tr>
<td>5 De Grey</td>
<td>68 466/ 479 260</td>
<td>60 920/ 426 440</td>
<td>2002–08</td>
</tr>
<tr>
<td>6 Roebourne – Port Hedland</td>
<td>65 566/ 458 965</td>
<td>51 378/ 359 646</td>
<td>2002–09</td>
</tr>
<tr>
<td>7 East Pilbara</td>
<td>45 449/ 318 146</td>
<td>34 155/ 239 085</td>
<td>2002–08</td>
</tr>
<tr>
<td>8 Ashburton</td>
<td>72 696/ 508 870</td>
<td>54 605/ 382 236</td>
<td>2001–08</td>
</tr>
</tbody>
</table>

### Table 1.4  LCD-scale Potential CC and most recently assessed Present CC in the Southern Rangelands

<table>
<thead>
<tr>
<th>LCD</th>
<th>Potential CC (CU / DSE)</th>
<th>Present CC (CU / DSE)</th>
<th>Period Present CC was determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Gascoyne – Ashburton Headwaters</td>
<td>47 346/ 331 423</td>
<td>24 880/ 174 160</td>
<td>2002–09</td>
</tr>
<tr>
<td>10 Upper Gascoyne</td>
<td>32 086/ 224 605</td>
<td>23 803/ 166 622</td>
<td>2002–09</td>
</tr>
<tr>
<td>11 Wiluna</td>
<td>35 110/ 245 769</td>
<td>20 582/ 144 072</td>
<td>2001–08</td>
</tr>
<tr>
<td>12 Lyndon</td>
<td>62 357/ 436 497</td>
<td>50 069/ 350 480</td>
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</tr>
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<td>13 Gascoyne–Wooramel</td>
<td>36 917/ 258 422</td>
<td>24 286/ 170 000</td>
<td>2003–09</td>
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<td>14 Shark Bay</td>
<td>22 255/ 155 782</td>
<td>16 801/ 117 605</td>
<td>2003–08</td>
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<td>33 165/ 232 155</td>
<td>2003–09</td>
</tr>
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<td>33 628/ 235 393</td>
<td>23 580/ 165 058</td>
<td>2002–09</td>
</tr>
<tr>
<td>17 Cue</td>
<td>9 320/ 65 240</td>
<td>6 943/ 48 600</td>
<td>2003–08</td>
</tr>
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<td>18 Mount Magnet</td>
<td>16 420/ 114 943</td>
<td>13 061/ 91 424</td>
<td>2002–08</td>
</tr>
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<td>17 405/ 121 835</td>
<td>2001–08</td>
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<tr>
<td>20 Yalgoo</td>
<td>24 704/ 172 926</td>
<td>19 274/ 134 916</td>
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Table 1.4 continued

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<th>Present CC (CU / DSE)</th>
<th>Period Present CC was determined</th>
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<td>476/3 330 2002–04</td>
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<td>Binnu</td>
<td>1 493/10 453</td>
<td>1 278/8 950 2003</td>
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<td>Mount Marshall</td>
<td>2 594/18 160</td>
<td>1 846/12 920 2005–06</td>
</tr>
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<td>North-eastern Goldfields</td>
<td>52 063/364 442</td>
<td>36 805/257 632 2001–09</td>
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<td>25</td>
<td>Kalgoorlie</td>
<td>35 348/247 435</td>
<td>25 000/175 000 2002–09</td>
</tr>
<tr>
<td>26</td>
<td>Yilgarn</td>
<td>3 632/25 424</td>
<td>2 533/17 730 2003–07</td>
</tr>
</tbody>
</table>

Interpreting change

The status and trend of themes in this report are based on the continued use of rangeland natural resources for livestock production without causing a loss of land capability.

For example, an increase in unpalatable perennial grasses may be interpreted as a decline in rangeland condition from a pastoral production perspective, whereas the greater soil cover and protection from erosion provided by the additional perennial grasses might be viewed as improving landscape function (see Glossary).

DAFWA uses WARMS to assess plant population change at the regional scale (Watson et al. 2007, Novelly et al. 2008). WARMS comprises a set of fixed sites on representative areas of pastoral land and provides an indication of change at a regional or vegetation type scale, not at the pastoral station scale. WARMS uses permanent ground-based sites on which perennial vegetation (shrubs and grasses of most value to pastoralism) and soil surface characteristics are assessed.

There are 633 grassland sites throughout the Northern Rangelands and on some areas south of the Pilbara, and 989 shrubland sites, mostly in the Southern Rangelands (Figures 1.11 and 1.12). Grassland sites are assessed every three years and shrubland sites are assessed every five years.

Information from these sites is aggregated to indicate changes in plant populations, which is generally expressed as increased, stable or decreased populations of desirable perennial plants.

Assessing change

The interaction of drivers of change

The most important interaction for pastoral managers is between seasonal quality and grazing pressure. This complex interaction may take many seasons to express changes in some of the themes in this report card.

Fire causes rapid changes to several of the themes and requires specific management for recovery.
Figure 1.11 Location of WARMS sites in the Northern Rangelands
Figure 1.12 Location of WARMS sites in the Southern Rangelands
Sources of information

Beard, JS 1975, *Vegetation survey of Western Australia*, University of Western Australia Press, Perth.


Payne, AL, Curry, PJ & Spencer, GF 1987, ‘An inventory and condition survey of rangelands in the Carnarvon Basin, Western Australia’, *Technical bulletin 73*, Department of Agriculture and Food, Western Australia, Perth.


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