GOVERNMENT OF
WESTERN AUSTRALIA

Department of **Agriculture** and **Food**

Ms L Corker
Chair
Pastoral Lands Board of Western Australia
c/- Pastoral Lands Unit
Dept Regional Development & Lands
PO Box 1143
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Your Ref:
Our Ref:
Enquiries: A Watson
Date: 4 September 2012

Dear Leanne

ANNUAL REPORT TO THE PASTORAL LANDS BOARD

The attached report has been prepared to satisfy the obligation under section 137(2) of the *Land Administration Act 1997*. This requires the Commissioner of Soil and Land Conservation to furnish the Board with an annual report on the current condition of land under pastoral lease. The report also brings together seasonal quality, Western Australian Rangeland Monitoring System (WARMS) and data from the *Annual Return of Livestock and Improvements* for Land Conservation Districts (LCD) in accordance with the draft MOU.

Most of the State enjoyed average to well above average rainfall in 2011-12. The Kimberley continued its long run (18 years) of above average conditions, with increased frequency of perennial grasses recorded on WARMS sites since measurements commenced in 1993-94. However, it is important to note that the data indicate a continued decline in the palatable productive perennial species in response to increased grazing pressure.

Although there has been some reduction in reported stock numbers in the preceding 12 months in the Derby-West Kimberley, Halls Creek- East Kimberley and North Kimberley LCDs, 60%, 42 % and 31% of leases respectively reported stock numbers in excess of the Present Carrying Capacity.

In the Pilbara, monitoring data for three of the five LCDs show a continuing decline in productive palatable, perennial grass frequencies since 2003. While stock numbers fell in all LCDs in 2010 and again in 2011, they remain above desirable levels in all districts except Lyndon and on the majority of leases. In the Ashburton, reported stock numbers declined from 81800 in 2009 to 46500 in 2011.

The declining condition of the Pilbara grasslands was highlighted in recent years' reports. It is of concern that this trend is continuing. In 2011-12, 92% and 58% of leases in the De Grey and East Pilbara districts respectively reported stock numbers above Present Carrying Capacity and desirable perennial species were observed to have declined by 9.1% and 8.2% respectively since the last monitoring period.

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It is again strongly recommended that where stock numbers reported by lessees are high in relation to the Present Carrying Capacity, the Board acts to ensure that appropriate management of those leases is in place.

Seasonal conditions in the shrublands in 2011 were generally much better than 2010, with 93% of districts receiving average or above average rainfall. However, it should be noted that in the Yilgarn and Wiluna districts, more than 50% of WARMS sites were assessed to have had below average seasonal quality.

The previously reported decline in desirable perennial shrubs on most WARMS sites in the Southern Rangelands continued in the current assessment cycle, despite the average-above average seasonal conditions experienced on most sites. While an overall decline of 15% was observed, it was again most evident in the Wiluna LCDC, where sites receiving below average seasonal quality lost 42.8% of desirable shrubs, while those sites receiving average and above average seasonal quality lost 22.3% and 19.6% respectively.

At district level, reported stock numbers have generally declined since 2001 (13/17 LCDs) and are generally below the estimated Present Carrying Capacity. However, the Upper Gascoyne and Wiluna LCDs are notable exceptions. Across the Southern Rangelands, 56 leases reported stock numbers in excess of the Present Carrying Capacity, including 66% of Upper Gascoyne and 50% of Wiluna leases.

The continuing decline in desirable shrub density undermines the future viability of the grazing industry and indicates that managers are not achieving ecologically sustainable management of the land as required under the *Land Administration Act (1997)*. Therefore it is again recommended that the Board takes action where high stock numbers are reported.

Should you require further information, please contact me on 93683282.

Yours sincerely

Andrew Watson
COMMISSIONER FOR SOIL AND
LAND CONSERVATION

Att

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Department of Agriculture and Food

GOVERNMENT OF WESTERN AUSTRALIA

DEPARTMENT OF AGRICULTURE AND FOOD

and the

COMMISSIONER OF SOIL AND LAND CONSERVATION

REPORT TO

THE PASTORAL LANDS BOARD ON THE CONDITION OF THE WESTERN AUSTRALIAN PASTORAL RESOURCE BASE

AUGUST 2012

Executive Summary

This report documents changes in the Western Australian pastoral rangelands at Land Conservation District (LCD) scales, providing updated information on seasonal quality, stock numbers and changes in the density/frequency of perennial shrubs and grasses. It is based on data from the Bureau of Meteorology, the *Annual Return of Livestock and Improvements* (submitted annually by pastoral lessees) and the Western Australian Rangeland Monitoring System (WARMS). The sixth assessment of the Kimberley (grassland) sites (Epoch 6) was completed in 2011. The second full cycle (i.e. three assessments) was completed for shrubland sites in 2010. This report discusses changes recorded over 2010 and 2011 in relation to previous years.

Key points

- Rainfall was generally favourable throughout the pastoral rangelands during 2011/2012 (although there were some regional differences), and seasonal quality was "above average" to "average" across virtually all of the rangelands. Recent years have well illustrated the extreme climate variability that the rangelands experience, with some locations experiencing their wettest period on record.

- Although variable, stock densities have generally risen in the Kimberley over the past 16 years, with the exception of the Halls Creek East Kimberley LCD. However, stock densities vary significantly between leases, with some Kimberley leases virtually destocked.

- Reported cattle numbers in the Pilbara increased from 1993 to 2009, more than doubling in the East Pilbara and De Grey LCDs, although they fell in all LCDs in 2010 and in all bar Lyndon LCD in 2011. However, numbers generally remain well above estimated Present Carrying Capacity (Present CC), both for Pilbara LCDs as a whole and on the majority of leases.

- The frequency of all perennial grasses (both desirable and undesirable) generally increased in all Kimberley LCDs, although the increase was more variable in both the Broome and the North Kimberley LCDs. In the Pilbara, the reverse was recorded, although in the Lyndon LCD frequencies did increase.

- Frequency of pastorally desirable species declined in all Kimberley and Pilbara LCDs except the North Kimberley (6% increase) and Lyndon (8.2% increase). Desirable perennial grass frequency continues to decline in all Pilbara LCDs where reported stock numbers exceed the Present CC. The De Grey and East Pilbara LCDs are of most concern. In the De Grey LCD, reported stock numbers are over 150% the Present CC and the decline in desirable perennial grass frequency approaches 10%. The Ashburton, East Pilbara and Roebourne LCDs are also reporting stock numbers well above Present CC.

- Reported stock numbers varied across the Shrublands over the past ten years. Compared with 2001, numbers in 2011 were lower in 13 of the 17 LCDs. However, there was considerable variation, with declines and increases recorded in all LCDs. Reported stock numbers are generally below the Present CC in all LCDs with the exception of Wiluna and Upper Gascoyne LCDs.

- Shrub numbers declined at a high proportion of WARMS sites in the Southern Rangelands between Epoch 3 and Epoch 4, with declines even at sites which had recorded "above average" seasonal conditions. This suggests that season alone was not the factor, but that excessive grazing pressure also contributed to the decline.

- From the Pilbara south, serious issues are emerging and appear more pronounced in LCDs in which the average stock numbers exceed the Present CC.

1. Introduction

Western Australia's rangelands cover 87% of the state (all but the south west). Pastoral leases, used for grazing livestock on native vegetation, cover 35% (874,000 km^2) of the rangelands; the balance consists of Unallocated Crown Land (UCL) and land vested for conservation and Indigenous purposes. There are currently 453 registered pastoral stations (comprised of 508 pastoral leases) in Western Australia; 152 stations in the Northern Rangelands (Kimberley and Pilbara - 93 in the Kimberley and the remainder in the Pilbara), 292 stations in the Southern Rangelands, and nine stations in the South West Land Division. These latter are generally grouped with the Southern Rangelands. Ownership is variable, ranging from large corporate conglomerates, private companies, family operations, and indigenous organizations and, particularly in the Pilbara and Goldfields, mining companies

In the Pilbara, vegetation gradually changes from grasslands common to the Kimberley (hummock (mainly spinifex) or tussock grasses) to a shrub-dominated understorey (a mix of semi-arid mulga, spinifex and saltbush/bluebush vegetation communities) common in the south. Consequently, range condition assessment in the Kimberley and much of the Pilbara is based on the frequency of perennial grasses; in the Southern Rangelands (or Shrublands) it is determined by the density of perennial shrub species.

2. Data Sources and Information Provided

This report provides information on seasonal conditions, and information provided by the Western Australian Rangeland Monitoring System (WARMS), the Pastoral Lands Board's (PLB) Annual Returns database and the Bureau of Meteorology.

WARMS provides information on rangeland condition trend in the pastoral rangelands at a regional or district scale, not the lease scale. It does this through a representative network of point-based sites on which attributes of the soil surface and the vegetation are recorded. Site installation began in 1993, with the final sites installed in 1999. There are 1,622 sites, with 633 grassland sites and the remainder shrubland sites. Grassland sites are reassessed on a 3-year cycle; shrubland sites are reassessed on a 5-year cycle. The sixth assessment of the grassland sites (Epoch 6) was completed in 2011. The second full cycle (i.e. three assessments) was completed for shrubland sites in 2010.

In this report, data are provided at the Land Conservation District (LCD) level. Seasonal quality was estimated for each reassessment period (Epoch) or each year at each site. Seasonal quality describes the relative value of recent climate (principally rainfall) with respect to biological functioning. Biological functioning broadly means vegetation growth as a basic resource for both livestock (forage) and fauna (food and shelter) and for soil protection.

All pastoral lessees in Western Australia submit an *Annual Return of Livestock and Improvements* to the PLB, providing, among other information, an estimate of the number of stock held on the lease, defined by specific categories. This information is made available to the Department of Agriculture & Food Western Australia (DAFWA) for analysis and interpretation.

This report should be read in conjunction with the report provided in July 2011 in order to provide context for much of the information presented.

3. Seasonal Conditions

Rainfall was generally favourable throughout the pastoral rangelands during 2011/2012 (Figures 1 and 2). This was particularly the case in the Kimberley, parts of the Pilbara and in the eastern areas of the Ashburton, Gascoyne and Murchison. However, much of the Kimberley, and the eastern Pilbara, Ashburton and Gascoyne received less rain in 2011/2012 than was received in 2010/2011 (Figure 3). The western areas of the Southern Rangelands generally experienced average rainfall (Figure 2).

Rainfall during winter 2011 was above to very much above average in a band extending from the southern Gascoyne, through the Goldfields and into the southern Interior and Eucla, mainly due to a middle level low in June and a number of cloud bands in July.

Middle level troughs were a significant weather feature in spring 2011, particularly in October and November, and were responsible for numerous periods of active thunderstorms and unseasonal rainfall events. These led to the second wettest spring on record for the state. Numerous sites in the Central West, Goldfields, Gascoyne, Pilbara, and Kimberley recorded their wettest spring on record,

Rainfall during summer 2011/12 was above to very much above average across most of WA, apart from small isolated areas where below average rainfall was recorded, most notably in the Eucla and southeast Goldfields, and north and east Kimberley. When averaged across the state as a whole, rainfall for summer 2011/12 was above average, mostly due to above average rainfall during December 2011,

The monsoon season was active over northern WA. There were three tropical cyclones during summer 2011/12, and these brought a very wet spell to parts of the Pilbara and Kimberley. Above to very much above average rainfall was recorded through most of the Kimberley and adjacent parts of the Pilbara and northern Interior, as well as small patches through central WA, primarily due to a monsoonal burst in mid-March and the passage of tropical cyclone *Lua* across the Pilbara coast and through central parts of the state.

In general, assessed seasonal quality has been above average in the Kimberley over the past 18 years, with the majority of WARMS sites classified as "above average", and again no sites assessed as "below average" (Table 1). Seasonal conditions in the Pilbara grasslands have been variable, with the most favourable conditions being recorded in the 1990s, and a greater prevalence of "average" or "below average" years being recorded since 2000. However, seasonal quality was assessed as "above average" or "average" in all Pilbara LCDs in 2011, with both De Grey and East Pilbara LCDs recording 100% "above average" (Table 1).

Summer rainfall is the key driver in the northern grasslands. Based on interpolated rainfall data of WARMS sites, all northern LCDs received well above their long term summer rainfall for 2010/11 (Table 1). All centres examined received rainfall totals above the mean and the median. Winter rainfall is important in the Southern Rangelands (Shrublands) and is also important for Pilbara grasslands. Seasonal conditions varied between 1999 and 2011. The Binnu LCD has only two WARMS sites, and therefore the seasonal condition rating at these sites does not necessarily reflect the entire LCD. Seasonal conditions in 2011 (Table 2) were commonly "above average" (68%) or "average" (25%), with Cue and Gascoyne Wooramel LCD WARMS sites being assessed at well above 90% "above average". Of the 17 LCDs, 13 LCDs had no sites assessed as "below average" seasonal quality. Yilgarn and Wiluna LCDs were drier, with over 50% of WARMS sites in each LCD assessed as recording "below average" seasonal quality (Table 2).

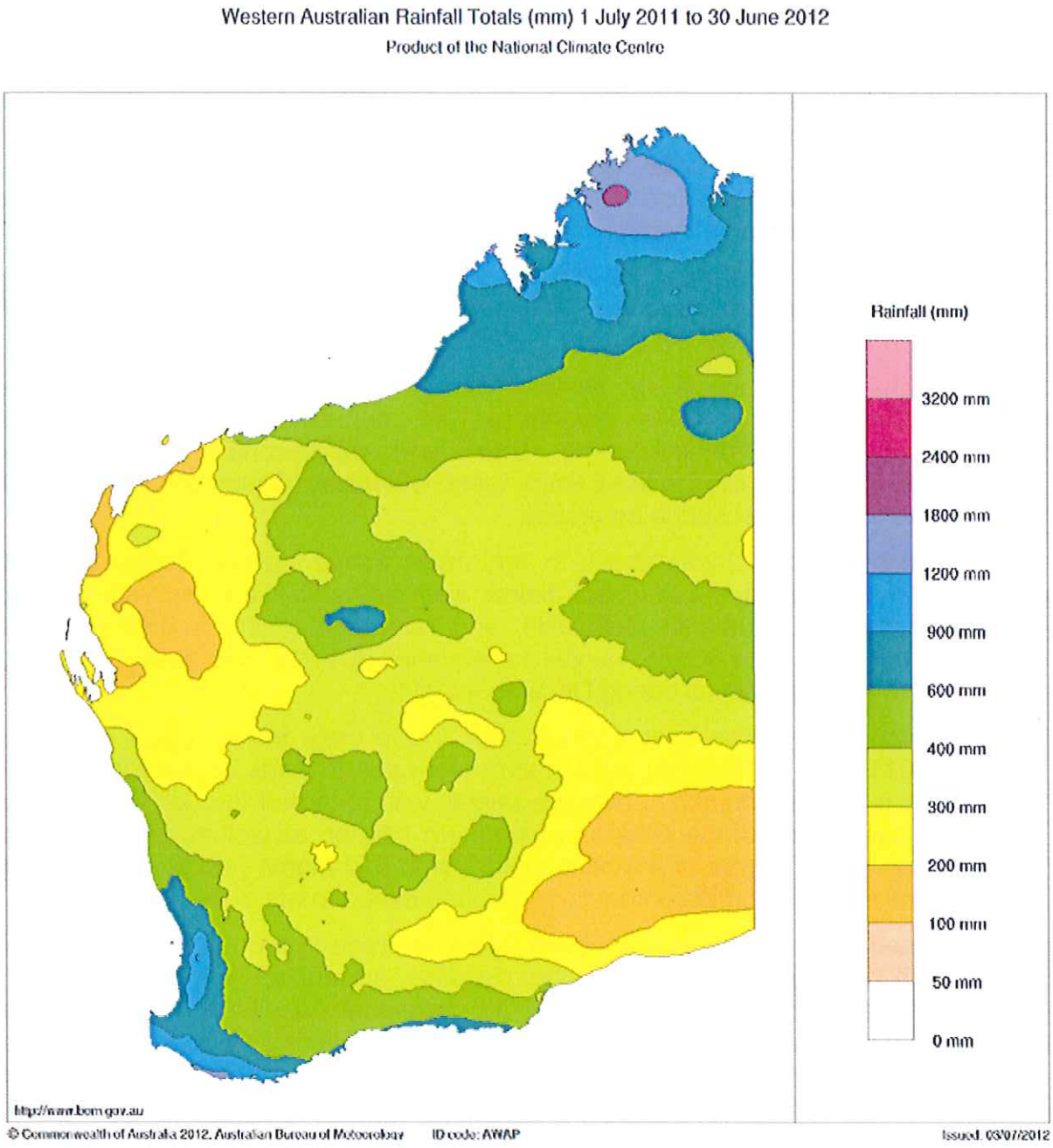


Figure 1. Western Australian rainfall totals July 2011 to June 2012 (mm) (source BoM).

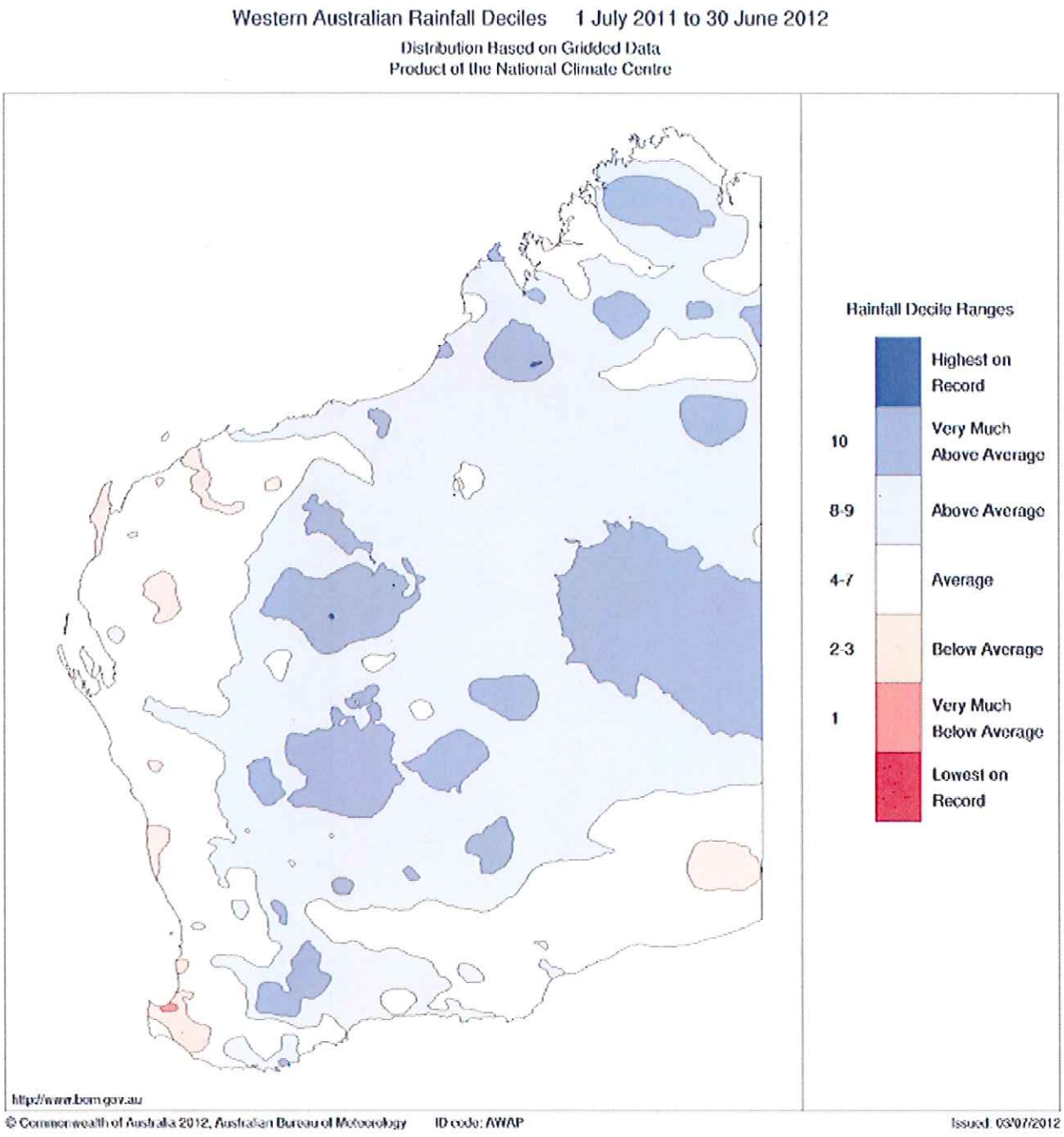


Figure 2. Rainfall deciles Western Australia, July 2011 to June 2012 (source BoM).

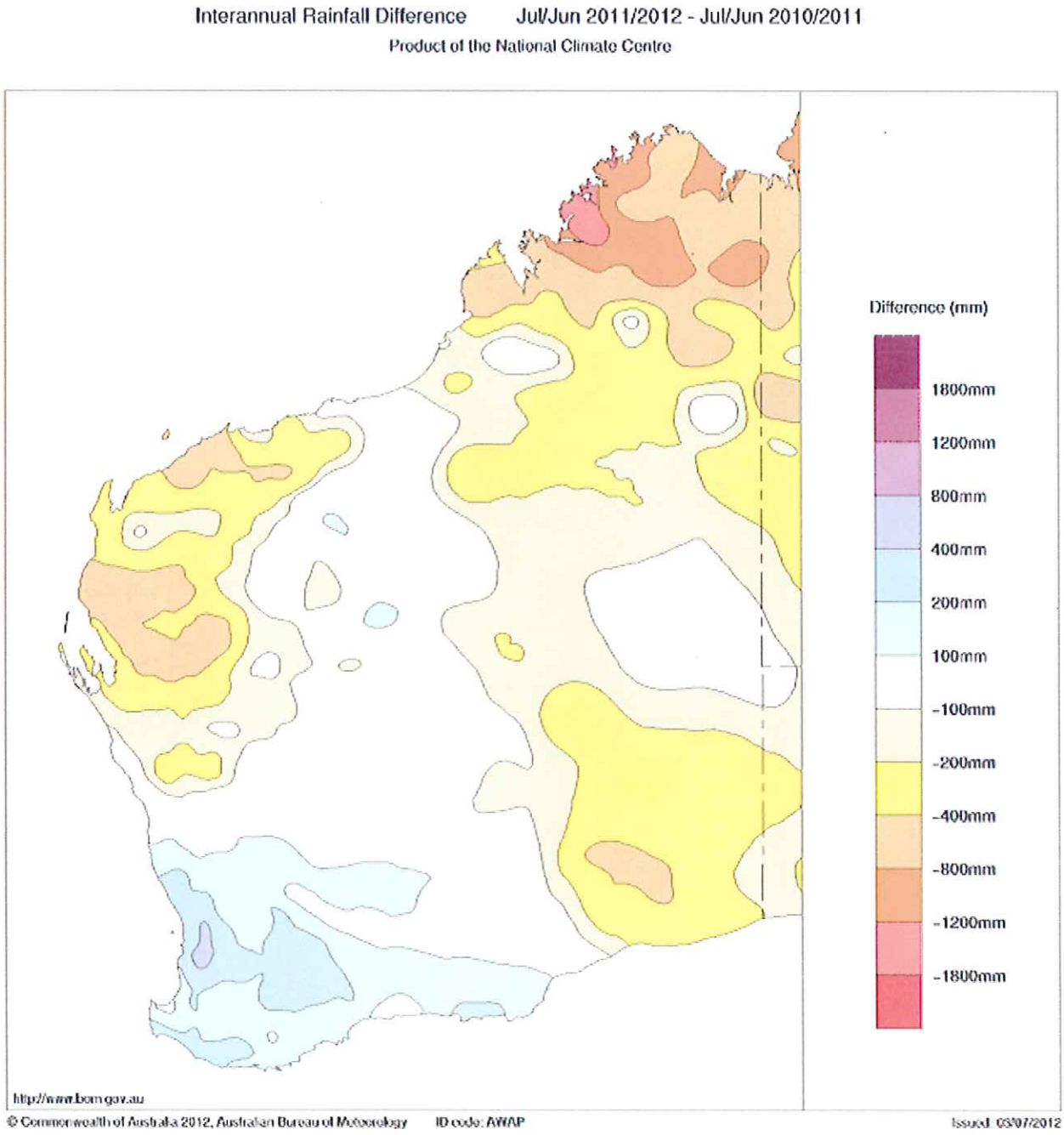


Figure 3. Inter annual rainfall variation 2011/2012 versus 2010/2011 (source BoM).

Blue and purple shades indicate areas which have been wetter this year. Yellow and red shades indicate areas which have been drier this year.

Table 1. Seasonal quality, Northern Rangelands LCDs, 2010/2011 (see text for explanation).

LCD	% above average	% average	% below average	% long term summer rainfall	Average long term summer rainfall (mm)
Broome	100%	0%	0%	160%	460
Derby W Kimberley	95%	5%	0%	145%	506
Halls Creek E Kimberley	61%	39%	0%	122%	534
N Kimberley	100%	0%	0%	135%	785
Kimberley	86%	14%	0%		
Ashburton	36%	64%	0%	111%	177
De Grey	100%	0%	0%	175%	247
E Pilbara	100%	0%	0%	195%	192
Lyndon	88%	12%	0%	143%	125
Roebourne	73%	27%	0%	140%	219
Pilbara	78%	22%	0%		

Table 2. Seasonal quality, Southern Rangelands LCDs, 2011.

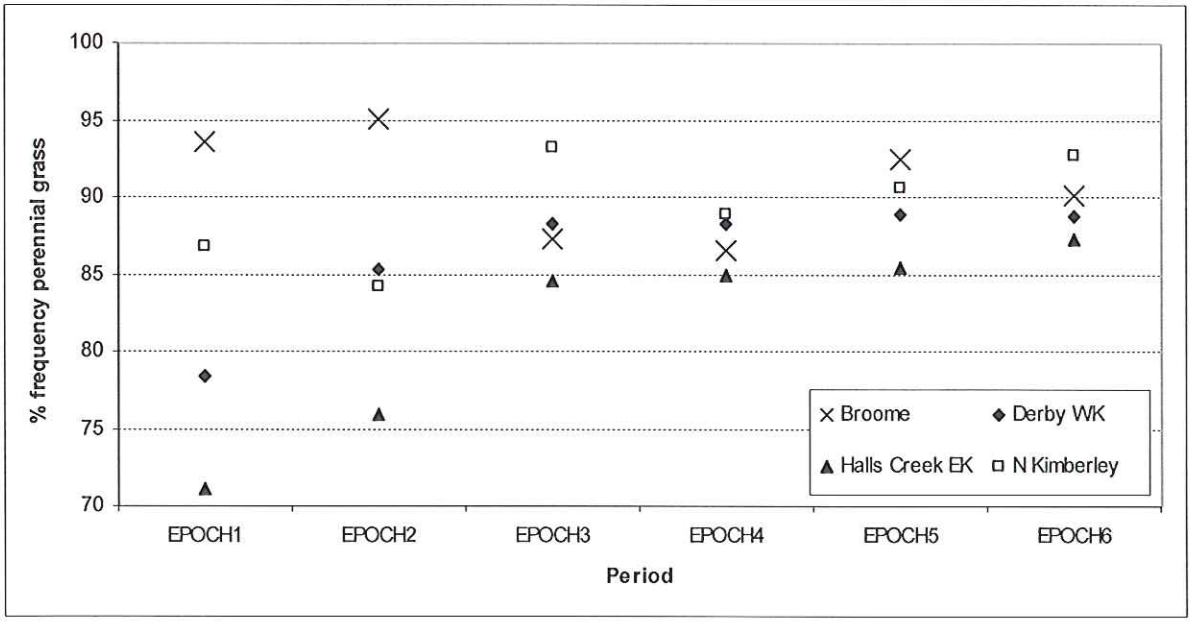
LCD	% above average	% average	% below average
Binnu	0%	100%	0%
Cue	94%	6%	0%
Gascoyne Ashburton Headwaters	57%	15%	28%
Gascoyne Wooramel	96%	4%	0%
Kalgoorlie	75%	25%	0%
Lyndon	36%	64%	0%
Meekatharra	47%	47%	6%
Mt Magnet	86%	14%	0%
Murchison	72%	28%	0%
NE Goldfields	72%	28%	0%
Nullarbor Eyre Highway	85%	15%	0%
Sandstone	87%	13%	0%
Shark Bay	52%	48%	0%
Upper Gascoyne	79%	21%	0%
Wiluna	23%	26%	51%
Yalgoo	77%	23%	0%
Yilgarn	17%	17%	66%
Shrublands overall	**68%**	**25%**	**7%**

4. WARMS Site Data

4.1 Grassland sites

Frequency of all perennial grasses (both desirable and undesirable) as recorded at WARMS sites generally increased in all Kimberley LCDs from Epochs 1 to 5 and into Epoch 6, although the increase was more variable in both the Broome and the North Kimberley LCDs (Figure 4). Perennial grass frequencies at Pilbara grassland sites generally declined during Epochs 4, 5 and 6, although in both the Lyndon and Roebourne LCDs, data suggested that frequencies increased from Epoch 4 to Epoch 5, with the Lyndon LCD sites continuing to increase further in Epoch 6 (Figure 5). While these figures do not discriminate between desirable and undesirable grasses, they provide an indication of ecosystem function, and suggest that ground cover levels are high and, in some cases increasing in Kimberley, whereas the situation is more variable in the Pilbara.

Figure 4. Mean perennial grass frequencies, (all grasses) Kimberley LCDs, Epoch 1 to Epoch 6.



Changes in desirable perennial grass frequency (Table 3), as opposed to the frequencies of all grasses (Figures 4 and 5), show considerable variation. Frequency of those species desirable for pastoralism (the productive, palatable, perennial (3P) grasses) have declined in all Kimberley and Pilbara LCDs from Epoch 5 to Epoch 6 except the North Kimberley (6% increase) and Lyndon (8.2% increase) LCDs despite generally very favourable seasonal conditions.

Figure 5. Mean perennial grass frequencies (all grasses) Pilbara LCDs, Epoch 1 to Epoch 6.

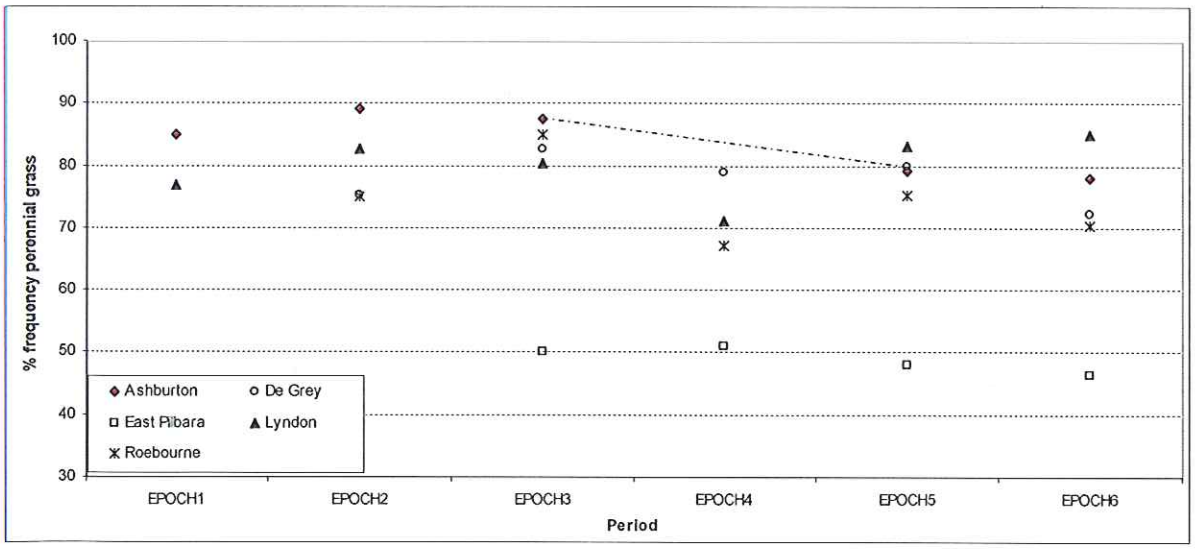


Table 3. Change in frequency of desirable perennial grasses by cycles - Northern Rangelands.

LCD	Cycle 1 (E1 to E2)	Cycle 2 (E2 to E3)	Cycle 3 (E3 to E4)	Cycle 4 (E4 to E5)	Cycle 5 (E5 to E6)
Kimberley					
Broome	3.2%	-11.9%	-3.6%	4.3%	-0.3%
Derby West Kimberley	8.8%	7.1%	-0.6%	2.6%	-0.4%
Halls Creek East Kimberley	0.8%	11.0%	-2.4%	2.9%	-3.5%
North Kimberley	1.5%	2.9%	-2.7%	2.8%	6.0%
Pilbara					
Ashburton	6.4%	-6.2%			-3.5%
De Grey		7.3%	-2.7%	-2.8%	-9.1%
East Pilbara			0.3%	-3.2%	-8.2%
Lyndon		16.9%	-4.4%	-6.2%	8.2%
Roebourne		4.3%	-27.1%	12.9%	-4.4%

In interpreting this response, the antecedent status of grass frequency should be considered. For example, while desirable grass frequency in Roebourne LCD improved substantially (12.9%) in Cycle 4 (despite a slightly above capacity stock level across the district and 34% of WARMS sites in the district having a seasonal quality rated as "below average" and only 18% "above average"), data indicate that this increase is on the back of the previous three year period in which the frequency of desirable perennial grasses in the Roebourne LCD declined by over 27%. Therefore, the increase in Cycle 4 was from a low base, with the recovery significantly less than the decline in Cycle 3. The decline of 4.4% in Cycle 5 (the last 3 years) is therefore worrying as it suggests that any further recovery may have stalled. De Grey LCD is particularly worrying, as the most recent data (collected in 2010) suggest a continued decline in desirable grass frequency, particularly given the favourable 2010/2011 rainfall (see 2011 Report to the Commissioner), when 75% of sites were assessed as receiving "above average" seasonal quality, and no sites were assessed as being "below average" seasonal quality.

4.2 Shrubland sites

The preponderance of WARMS sites in the Southern Rangelands LCDs assessed to date in the current assessment cycle exhibit lower shrub numbers than in the previous assessment. The density of desirable perennial shrubs in the Southern Rangelands is generally declining (Table 4 and Figure 6).

That this is happening at WARMS sites where the seasonal quality is assessed as being "above average" is particularly worrying, while the decline at sites assessed as having had "below average" seasonal quality suggests that management response to these conditions is completely inappropriate. In the Wiluna LCD, approximately half of the desirable shrubs recorded in the previous assessment have died from those WARMS sites assessed as having received "below average" seasonal quality, with approximately one-fifth of the desirable shrubs disappearing from other sites in that LCD.

Table 4. Change in number of desirable shrubs across seasonal conditions (Epoch 3 to Epoch 4).

	Seasonal Conditions		
LCD	**Above average**	**Average**	**Below average**
Cue	5.0%	2.3%	na
Kalgoorlie	-13.1%	-7.7%	-25.9%
Lyndon	na	-19.9%	-28.3%
NE Goldfields	na	-8.6%	-22.6%
Upper Gascoyne	-21.4%^	-14.4%	-12.6%
Wiluna	-19.6%	-22.3%	-42.8%

^ Small population (~140 desirable plants) in "above average" seasonal quality sites.

Figure 6 is based on 351 sites reassessed to June 2012 - Epoch 3 (2005, 2006 or 2007) compared to Epoch 4 (2010, 2011 or 2012). Only on 68 sites (19.3% - located above the diagonal line through the graph) has an increase in shrub numbers been recorded. Of the 68 sites where plant numbers increased, 22% were rated as receiving "above average" seasonal quality, 44% "average" and 34% "below average" seasonal quality. The overall situation is dire (Table 5), with an overall decline of over 15% in perennial shrub numbers across all sites and assessments of seasonal quality. Despite these figures representing only a limited number of WARMS sites from the latest reassessment cycle, overall shrub numbers are substantial and represent a reasonable sample of the situation in the Southern Rangelands.

Figure 6. ***Shrub number on Shrubland WARMS sites of varying seasonal quality as recorded in Epoch 3 (2005, 2006 and 2007) and Epoch 4 (2010, 2011 and 2012 - data as at June 2012).***

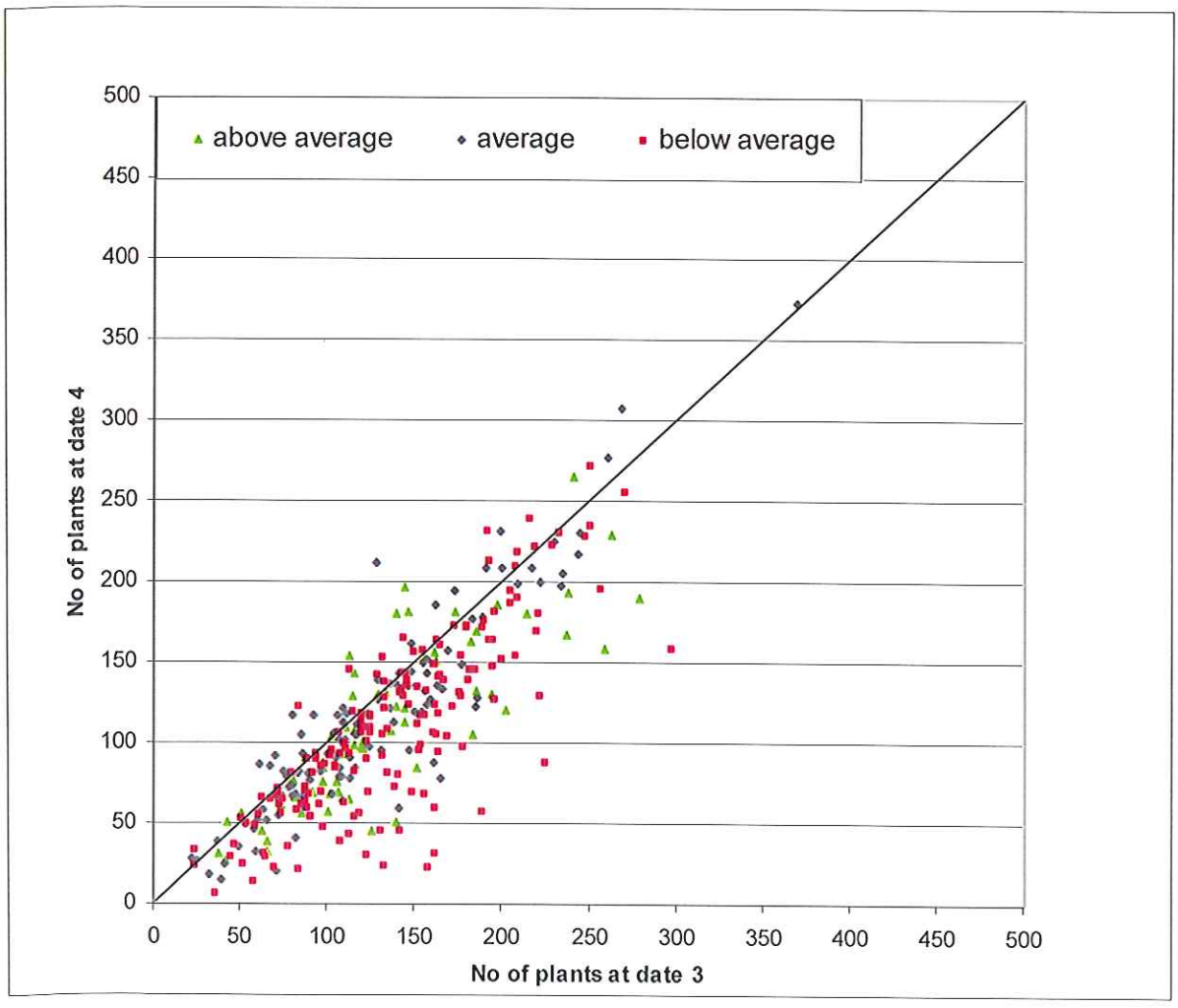


Table 5. Change in perennial shrub numbers by seasonal quality

Seasonal quality	Change	Plant population at Epoch 4
Overall	-15.3%	39,455
Above average	-14.1%	7,902
Average	-8.6%	12,801
Below average	-19.8%	18,752

5. Stock Densities

5.1 Northern Rangelands (Kimberley and Pilbara)

Relative stock densities between LCDs reflect both the different potentials (in terms of Carrying Capacity) of the LCDs and the degree of development of the individual leases. Grazing capacity is defined as a Present Carrying Capacity (the Present CC), that is, the Potential Carrying Capacity, the inherent capacity of the rangeland to run stock when the rangeland is in good condition all areas are accessible to domestic stock and seasonal conditions are average, discounted for the current range condition. Neither the Potential nor Present CC values are maxima; lessees can run stock numbers in excess of these figures and would be expected to do so during favourable seasons. Conversely, during unfavourable seasons stock numbers would be expected to be substantially below these values.

Kimberley

Reported stock numbers (from the *Annual Return of Livestock and Improvements* provided by each pastoral lease) show that, although variable, stock densities (cattle units/sq km) have generally risen in the Kimberley over the past 16 years, with the exception of the Halls Creek East Kimberley LCD (Figure 7), where, although variable over time, stock density is below the 1993 figure. Reported 2011 figures indicate a slight decline from 2010 figures for Halls Creek East Kimberley and Broome LCDs, and a stable or increased situation in other LCDs. As a point of contrast to current stocking levels (Figure 7), estimated Present Carrying Capacities (in cu/sq km) for the region are Broome LCD 4.1, Derby West Kimberley LCD 3.1, Halls Creek East Kimberley LCD 2.5 and North Kimberley LCD 2.2, indicating that Derby West Kimberley LCD is running stock numbers in excess of the Present CC, and that this is currently being sustained by the long run of favourable seasons.

Stock densities vary significantly between leases, with some Kimberley leases virtually destocked. Lease carrying capacities per unit area also vary widely. Reported 2011 stock numbers were above the Present CC in 33% of Broome LCD leases, 60% of Derby West Kimberley LCD leases, 42% of Halls Creek East Kimberley LCD leases and 31% of North Kimberley LCD leases. Finally, with the cessation of rangeland traversing by DAFWA, data on current range condition are no more recent than 2008 at best. Therefore, comparisons between an estimated carrying capacity and reported stock numbers should be treated with caution.

Pilbara

Reported cattle numbers in the Pilbara increased from 1993 to 2009 (Figure 8), more than doubling in the East Pilbara and De Grey LCDs, although they fell in all LCDs in 2010, and in all bar Lyndon LCD in 2011. However, reported stock numbers generally remain well above estimated Present CC, both for Pilbara LCDs as a whole and on the majority of leases. The estimated Present Carrying Capacities (in cu/sq km) for the region are Ashburton LCD 1.5, De Grey LCD 1.6, East Pilbara LCD 1.0, Roebourne LCD 1.7 and Lyndon LCD 1.5. The stock density in the De Grey LCD is above current Carrying Capacity in 92% of leases (12 of 13 leases), with densities in the Ashburton, East Pilbara and Roebourne LCDs also above current Carrying Capacity at 36% (5 of 14 leases), 58% (7 of 12 leases) and 37% (6 of 16 leases) respectively. Densities in the Lyndon LCDs are below Present CC, but again the absence of contemporary range condition data should be noted. Some Pilbara leases are carrying two to three times the estimated Present CC. The sustainability of this situation is debateable. Of interest, is the decline in reported stock numbers in the Ashburton LCD. In 2009, reported numbers were 81800 cu and in 2011 reported numbers were down to 46500 cu (a decline of approximately 45%).

Figure 7. Mean reported stock densities (cu/sq km) Kimberley LCDs, 1993 to 2011.

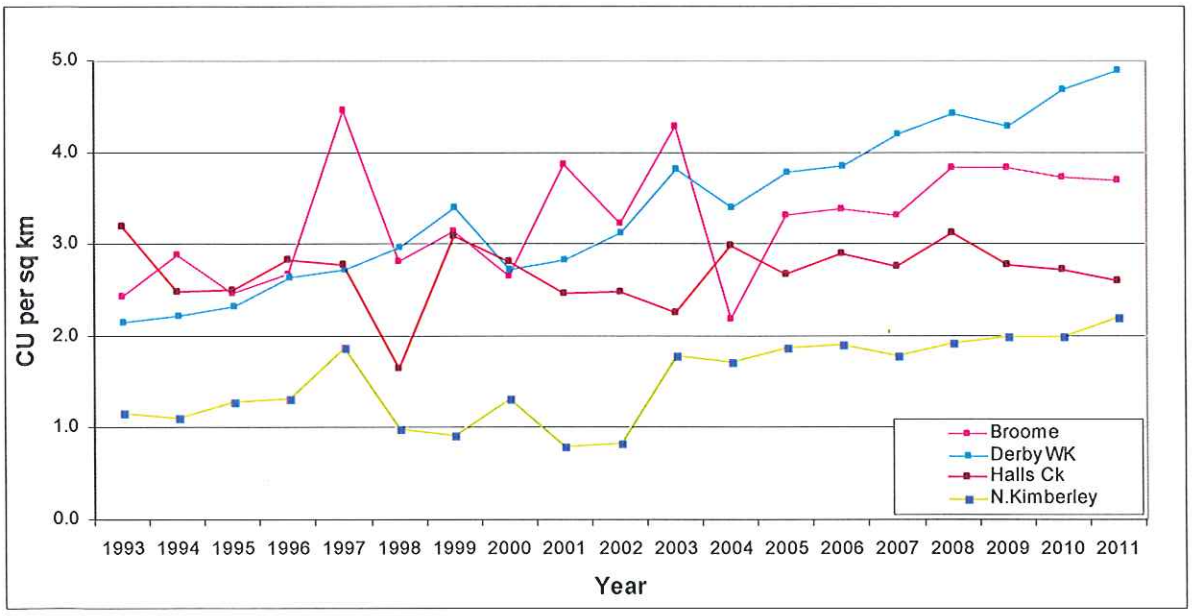
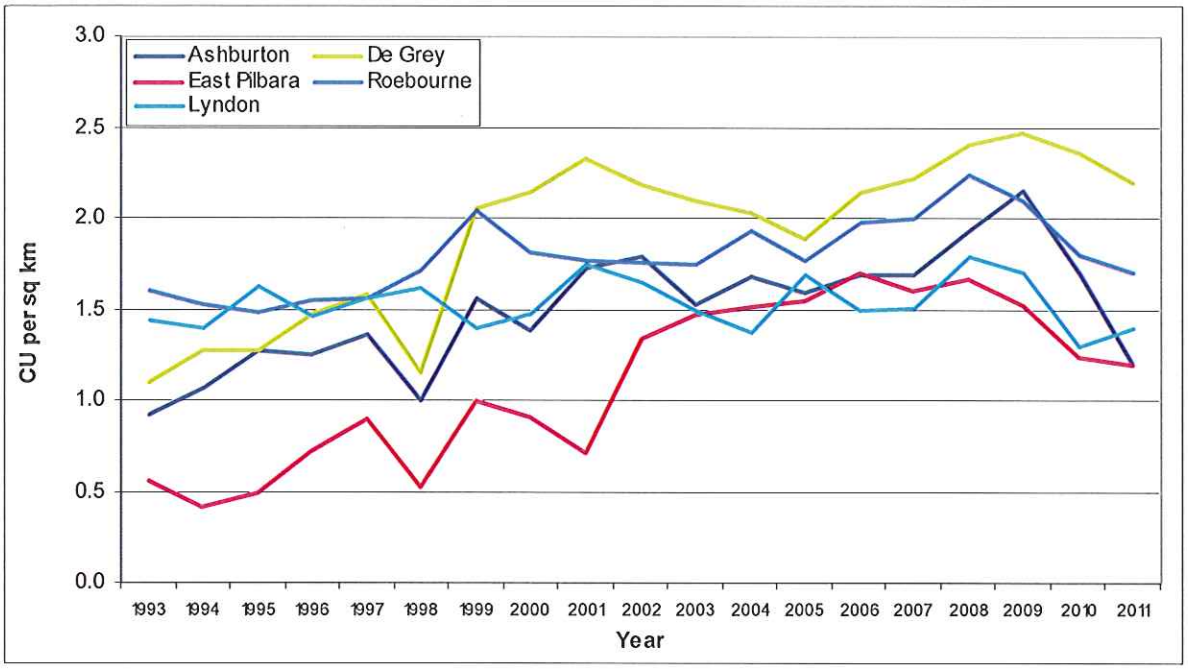


Figure 8. Mean reported stock densities (cu/sq km) Pilbara LCDs, 1993 to 2011.



5.2 Southern Rangelands (Shrublands)

Reported stock numbers (ha/dse – stocking rate declines as value increases) varied across the Shrublands region over the past ten years (Table 6). Of the 17 LCDs, stock numbers in 2011 compared with 2001 had declined in thirteen LCDs and increased in four (although in several cases only marginally). However, over the period there was considerable variation, both declines and increases recorded in all LCDs. Reported stock numbers are generally below the Present CC in all LCDs with the exception of Wiluna and Upper Gascoyne LCDs. Of the 266 leases for which both a Present CC and a reported 2011 stock figure is available, 56 (21%) reported an actual stock number in excess of the Present CC, with the maximum being 345% above the Present CC. The proportions of leases reporting stock number above the Present CC was highest in the Upper Gascoyne (66%) and Wiluna (50%) LCDs.

Table 6. Reported stock densities (ha/dse) by LCD, Shrublands region, 2001 to 2011.

LCD	Ave. Present CC	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
Binnu	25.2	34.1	53.9	40.6	44.7	54.2	45.1	15.1	60.7	52.7	55.8	51.4
Cue	18.7	23.6	28.0	29.9	46.0	41.6	33.6	26.5	31.9	35.8	67.7	64.9
Gascoyne - Wooramel	11.4	10.6	13.6	16.8	14.3	11.6	11.3	11.0	10.1	9.0	11.7	14.6
Gascoyne Ashburton Headwaters	20.8*	20.9	20.1	19.1	20.7	23.9	24.1	19.6	17.9	16.1	27.1	28.9
Kalgoorlie	20.3	37.9	27.0	34.0	37.5	37.2	45.2	53.4	46.5	52.6	61.4	53.1
Lyndon	9.5	10.0	8.9	10.8	10.7	8.7	9.9	9.7	8.1	8.4	11.1	10.4
Meekatharra	22.2	32.7	32.6	30.8	29.1	29.0	26.8	26.8	25.0	24.7	31.8	31.2
Mount Magnet	17.1	16.8	18.8	24.1	25.0	22.1	18.3	22.0	22.9	24.6	29.6	41.8
Murchison	18.1	21.3	23.5	32.2	40.6	33.4	26.4	29.0	22.2	24.7	34.3	37.8
North Eastern Goldfields	23.1	46.8	47.7	46.2	48.6	46.2	55.0	42.2	36.8	44.4	43.8	44.3
Nullarbor - Eyre Highway	24.2	28.5	24.5	23.5	22.7	25.0	32.9	27.8	32.0	32.9	33.4	26.1
Sandstone	19.2	51.6	84.7	77.5	64.0	99.2	85.0	74.1	64.2	59.5	64.6	51.3
Shark Bay	12.8	17.3	17.3	18.2	20.2	17.0	18.4	21.7	18.5	16.3	21.7	21.0
Upper Gascoyne	19.2	18.4	17.5	23.0	19.4	16.5	15.3	12.9	12.5	10.9	13.9	15.7
Wiluna	23.6*	27.2	31.0	17.5	19.2	22.4	21.7	20.0	17.5	18.4	21.3	20.6
Yalgoo	18.1	21.0	23.4	33.0	39.1	37.4	30.9	25.6	28.8	28.4	44.9	46.4
Yilgarn	16.8	46.8	44.1	46.9	51.6	111.9	118.7	104.0	52.5	109.7	101.6	54.8

* Not all stations in LCD have Present CC determined.

6. Interaction of stock numbers and desirable plant counts

6.1 Northern Rangelands

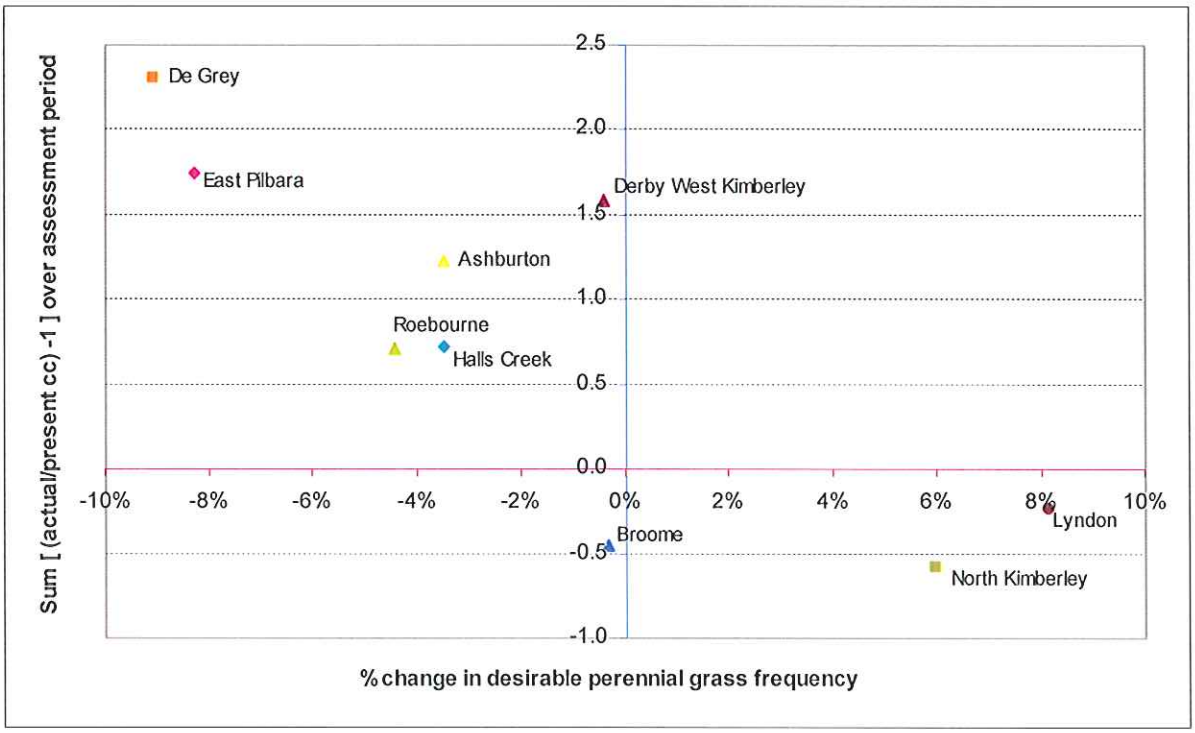
The consequence of stock numbers on the rangelands resource over the 3 years 2009 to 2011 in the Northern Rangelands and the relative stocking levels are illustrated in Figure 9. Changes in recorded frequencies of desirable grasses from WARMS sites are represented horizontally, either increasing (to the right of the figure) or decreasing (to the left) compared with the previous WARMS sampling cycle (Epoch 5 versus Epoch 6). Ideally, the place to be is on the right hand side of Figure 9.

Reported animal numbers relative to the assessed Present CC (Present CC is the Potential CC discounted for current range condition) of leases within each LCD are represented vertically on a relative scale, with the reported stock numbers and the Present CC equal at the zero point. Present CC has been averaged for stations within each LCD. Note that not all stations have a calculated Present CC.

LCDs with average reported stock numbers above the average Present CC are in the upper half of the figure, and those with average stock numbers below the average Present CC are in the lower half of the figure.

Although stock density in the Halls Creek East Kimberley LCD is currently below 1993 levels, it remains above the Present CC, as does the stock density in the Derby West Kimberley LCD. The remaining LCDs in the Kimberley are close to or below the Present CC.

Figure 9. Changes in recorded frequency of desirable perennial grasses (2009/2011) in relation to grazing pressure, Northern Rangelands LCDs.

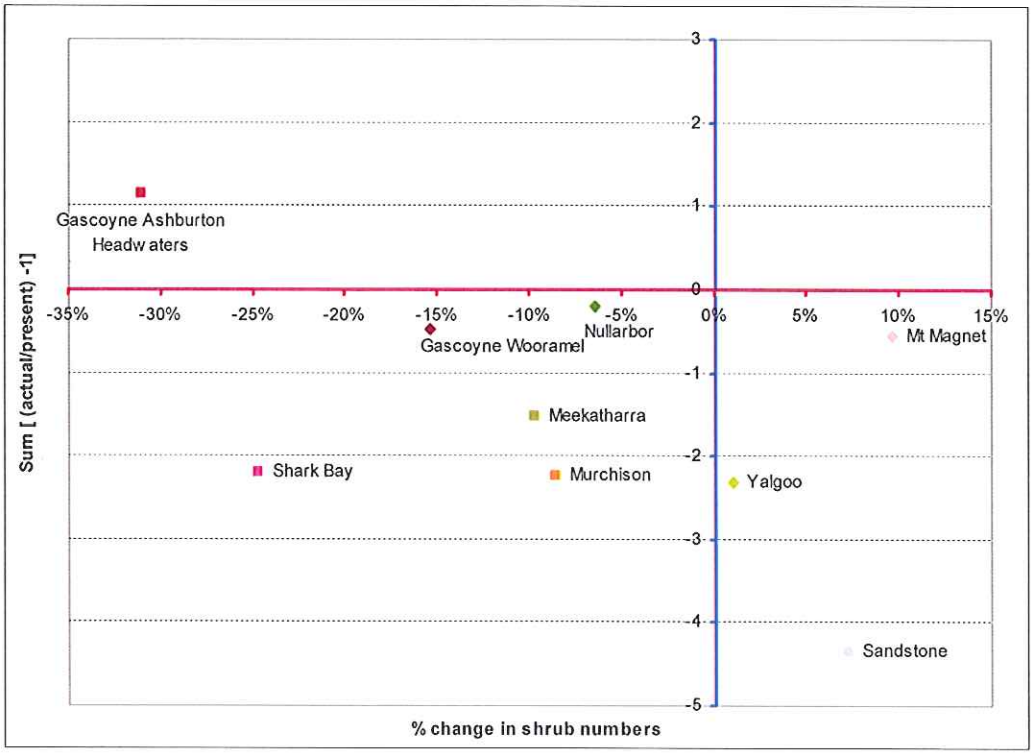


Desirable perennial grass frequency continues to decline in all Pilbara LCDs where reported stock numbers exceed the Present CC (Figure 9). The De Grey and East Pilbara LCDs are of most concern. In the De Grey LCD, reported stock numbers are over 150% the Present CC and the decline in desirable perennial grass frequency approaches 10%. The Ashburton, East Pilbara and Roebourne LCDs are also reporting stock numbers well above Present CC. Data for Figure 9 are based on a sum of stock for the assessment period, so the reported decline in stock numbers for 2011 in the Ashburton LCD will not be seen until next assessment in July 2012.

6.2 Southern Rangelands

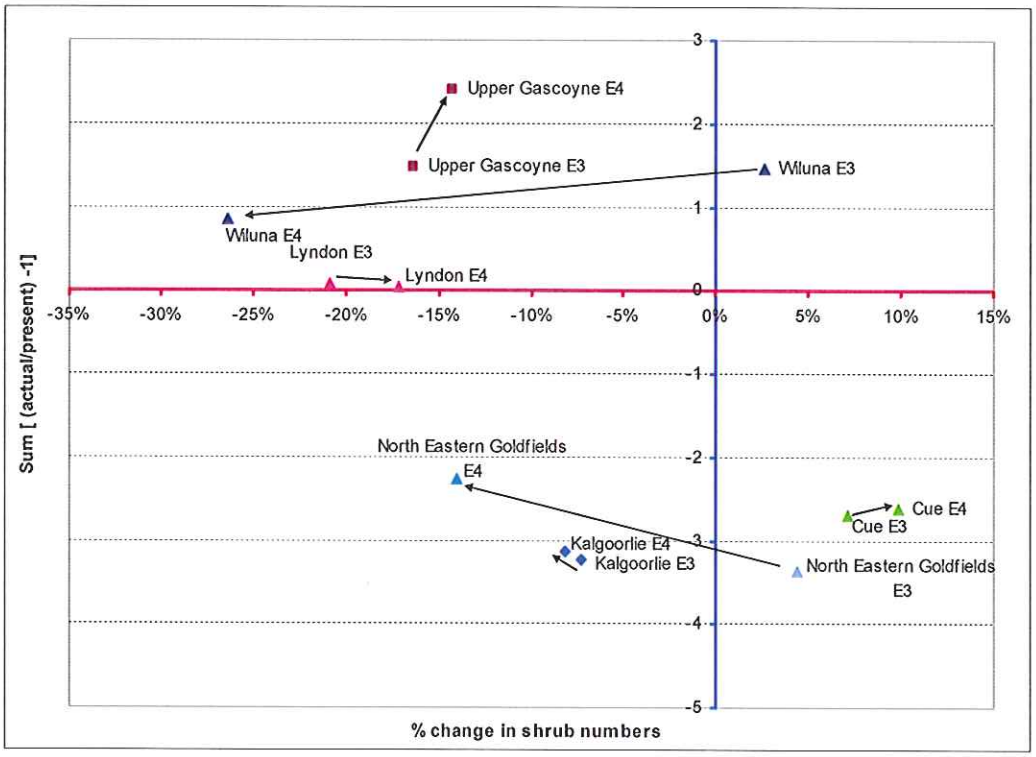
The percentage change in shrub numbers within each LCD in the Southern Rangelands and the relative stocking levels over the previous 5 years are illustrated in Figure 10 changes between Epoch 2 and Epoch 3) and Figure 11 (Epoch 2 to Epoch 3 and Epoch 3 to Epoch 4). Changes in recorded shrub numbers from WARMS sites are represented horizontally, either increasing (to the right of the figure) or decreasing (to the left) over the assessment period. Again, the ideal place to be is on the right hand side (Mt Magnet, Sandstone, Cue and Yalgoo, (Figure 10) and Cue LCD (Figure 11)). Reported animal numbers relative to the assessed Present CC of leases within each LCD are represented vertically on a relative scale, with the reported stock numbers and the Present CC equal at the zero point. LCDs with average stock numbers above the average Present CC are in the upper half of the figure, and those with average stock numbers below the average Present CC in the lower half.

Figure 10. . Changes in recorded shrub populations between Epoch 2 to Epoch 3 in relation to grazing pressure, Southern Rangelands LCDs



Desirable perennial shrub numbers in most of the Southern Rangelands increased substantially in the mid to late 1990s, when rainfall was well above average. Shrub species density was stable or increased on the majority of sites during the period when 88% of sites experienced average or above average seasonal conditions. The results were generally favourable and suggested that the negative impact of grazing was less than the positive impact of rainfall over the period of measurement, summarised across the region. From mid 2001, rainfall was lower, particularly in the south-west, western and north-western parts of the region. This drier period was characterised by a lack of winter rainfall.

Figure 11. Changes in recorded shrub populations for Epoch 2 to Epoch 3 and Epoch 3 to Epoch 4 in relation to grazing pressure, Cue, Kalgoorlie, Lyndon, North Eastern Goldfields, Upper Gascoyne and Wiluna LCDs Southern Rangelands LCDs



Data for shrub number change between Epoch 3 and Epoch 4 (Figure 11) are only available for the Cue, Kalgoorlie, Lyndon, North Eastern Goldfields, Upper Gascoyne and Wiluna LCDs to date. Values in Figure 10 for the remaining LCDs are the changes recorded between Epoch 2 and Epoch 3.

Between Epoch 3 and Epoch 4 only Cue LCD has had a continued increase in plant numbers, although Mt Magnet, Yalgoo and Sandstone had recorded increases between Epochs 2 and 3 (Figures 10 and 11). Perennial shrub numbers in the Cue LCD had increased around 7% in the previous sampling period, and have increased a further 10% (3% increase for desirable shrubs) in the latest sampling.

Conversely, the Upper Gascoyne and Lyndon LCDs which had recorded considerable falls in perennial shrub numbers in the previous assessment (16% and 21% respectively) showed further decline (14% (15% decline in desirable shrubs) and 17% (25% decline in desirable shrubs) respectively) in perennial shrub density (Figure 11). A similar result was recorded in the Kalgoorlie LCD. Upper Gascoyne and Lyndon LCDs have recorded a loss of around one-third of their desirable perennial shrubs at WARMS sites during the last decade following the exceptional seasons of the mid-1990s.

Figure 11 also illustrates the recent decline in shrub populations in the Wiluna and North Eastern Goldfields LCDs. In Wiluna, reported stock numbers have increased steadily since 2003, associated with an extended period of above average seasonal conditions from 1999 to 2008, when 73% of WARMS sites in the Wiluna LCD recorded "above average" seasonal quality, with no sites recording "below average" values. However, in 2009, 57% of WARMS sites in the Wiluna LCD recorded a "below average' seasonal quality, with no evident substantial reductions in stock numbers to address this. The result is a quite significant decline in perennial shrub densities. In the North Eastern Goldfields LCD, only 4% of WARMS sites recorded "below average" seasonal quality from 1999 to 2008, but 100% of WARMS sites recorded a "below average" seasonal quality in 2009, with, again, decline in perennial shrub numbers, despite reported stock numbers on an LCD basis being already below the Present CC. However, of the 30 leases in that LCD, 13 are owned by mining companies (generally running stock numbers well below the Carrying Capacity) and two are managed by indigenous communities (again with low stock numbers). This distorts the LCD average. Stock numbers are evidently too high to maintain rangeland condition on many leases, as grazing pressure has not been reduced sufficiently to respond to the unfavourable seasons.

Overall, recorded shrub numbers declined at a high proportion of WARMS sites in the Southern Rangelands between Epoch 3 and Epoch 4) (Figure 6), with declines even at sites which had recorded "above average" seasonal conditions. This suggests that season alone was not the factor, but that excessive grazing pressure also contributed to the decline.

7. Discussion

Given the favourable seasonal conditions and the generally stable stock numbers, the trend in the frequency of perennial grasses and the relatively stable range condition trend in the Kimberley region are not unexpected, despite the reported stock numbers. However, there is some variability in the desirable grass frequency. Favourable seasonal conditions have obviously encouraged an increase in the perennial grass frequency at a time of increases in reported stock densities, with cattle numbers above the Present CC in the Derby West Kimberley and Halls Creek East Kimberley LCDs, particularly the former. However, the Present CC assumes average seasonal conditions, while actual seasonal conditions have been favourable for many years. Consequently, although current stock numbers do not appear to be a major problem, the decline in the frequency of desirable perennial grasses is noteworthy and warrants consideration. At current stock numbers, there would be a significant risk of degrading the rangeland resource if seasonal conditions were to return to the long term average.

The data presented in this report are aggregated data at the LCD level, and numerous Kimberley leases, in particular most of the 30% of leases currently managed by indigenous communities, are carrying relatively low stock numbers.

Therefore, the relationship between the Present CC and the reported stock numbers on many of those leases that are being run commercially is likely to be associated with reported stock numbers well in excess of the Present CC. The decline in the recorded frequency of desirable perennial grasses reflects this, with the potential impact of stock numbers mitigated by the remarkable run of favourable conditions since monitoring began in the 1990s. What is of concern is that this decline is being recorded when desirable grasses should be increasing and consolidating in response to favourable seasons, in preparation for the inevitable return to more "average" season conditions or worse.

Therefore, this result must be considered in the context that WARMS reports on a regional or pasture type basis, not the basis of individual leases. Data from other sources (particularly the Pastoral Lease Assessment activities) do indicate that some individual leases have a declining range condition trend. Moreover, with the cessation of rangeland condition inventory assessment by DAFWA in 2008, contemporary data are now lacking as to range condition change over the previous three years as a minimum, with some leases last surveyed in 2004. This affects capacity to determine an up-to-date Present CC.

In the Pilbara, the frequency of desirable perennial grasses declined in all LCDs except Lyndon LCD, although no site was recorded as receiving "below average" seasonal conditions and 100% of sites in the De Grey and East Pilbara LCDs having been assessed as receiving "above average" seasonal conditions. The increase in reported stock density has not always been accompanied by good seasonal conditions. From Epoch 4 to Epoch 5, 62% of the sites in the Ashburton LCD were assessed as receiving a "below average" season, as were 34% of WARMS sites in the Roebourne LCD, where 63% of sites had recorded "below average" seasonal quality from Epoch 3 to Epoch 4. Lyndon LCD recorded 100% of WARMS sites with "below average" seasonal quality from Epoch 3 to Epoch 4, and 35% "below average" from Epoch 4 to Epoch 5. Declines in desirable grass frequency in the De Grey LCD have been recorded during the last three cycles, with declines in Cycle 4 also recorded in East Pilbara and Lyndon LCDs. However, stock densities rose in all Pilbara LCDs during this period, and the frequency of all perennial grasses and desirable perennial grasses declined. These current WARMS and seasonal quality data suggest that excessive grazing pressure may be reducing the capacity of the Pilbara rangeland to respond to the more favourable seasons recorded over the last few years.

Both these factors suggest that the current stock numbers in the Pilbara are unlikely to be sustainable, while in the East Pilbara LCD, a return to average seasons or perhaps below average seasons could cause significant problems if stock numbers are not rapidly reduced. Data suggest that many Pilbara leases, and the region as a whole, are being stocked above capacity. As in the Kimberley, most areas in the Pilbara recorded average or above-average rainfall and associated pasture growth for many of the 12 years to 2005 and especially from 1993 to 2001. This may have inflated expectations of property carrying capacities. Indeed, the current Pilbara cattle numbers are a reflection of the sharp increase in regional numbers that occurred from 1997 and plateaued from about 2002. The condition of the pastoral resource in the Pilbara is therefore at considerable risk, and close attention should be paid to this region over the coming 12 months.

As expected, as seasonal conditions declined in the Shrublands there was a pronounced decline in recorded shrub densities, suggesting an inadequate response from lessees to seasonal conditions. Most LCDs lost desirable plants between Epoch 2 and Epoch 3, with the trend continuing in the most recent (Epoch 4) data.

The extent of the decline in desirable shrub numbers would be associated, in part, with the decline from the peak initiated by the exceptional seasons in the late 1990s, with, for some sites, the latest assessment being the first since the end of the good seasons. However, although stock numbers in seven of the LCDs are below the Present CC, the current grazing pressure remains too high for the seasonal conditions (Present CC assumes average seasonal conditions), with detrimental results. As an example, the Upper Gascoyne LCD recorded 100% "below average" seasonal quality in both 2009 and 2010. Yet reported stock numbers in the Upper Gascoyne LCD remain well above the Present CC, with 10 of the 19 leases reporting stock numbers above Present CC in 2010, four of which are carrying more than twice the Present CC. Changes in stock numbers should not await a decline in desirable shrub numbers.

WARMS data do not provide an assessment of range condition trend on individual leases. However, by comparing the extent of change on sites on individual leases, the degree of variation in trend across an LCD can be determined and leases ranked in terms of their trend. While fairly coarse, this assessment does suggest some significant variation in the extent and direction of trend, and does suggest that, particularly in the Shrublands, the decline in desirable shrub density across an LCD is not entirely due to a decline in response to a move away from the very favourable seasonal conditions from the mid 1990s to the early 2000s. The significant range across an LCD suggests that seasonal conditions are not alone in determining changes in shrub density, and that there were obvious differences (even on adjoining leases) suggesting management was also important..

Of particular concern is that some of the changes currently being recorded on WARMS sites are, in fact, transitions to another less productive pasture condition and that reversal of these changes will be neither straightforward or short term. Recent analysis using a monitoring dataset containing 306 grassland sites and 919 shrubland sites was used to identify transitions that have occurred in the pastoral rangelands of Western Australia between 1993 and 2010, during which the grassland sites were assessed on five occasions and the shrubland sites on three occasions. A total of 11% of the grassland sites and 1% of the shrubland sites were determined to have undergone a transition, although in a few cases the transition was deemed to have been positive from a pastoral perspective. Responses to changes in seasonal conditions must be rapid to prevent the initiation of a degradation sequence which, once started, is difficult to stop, leads to a transition and often becomes virtually irreversible within a realistic management timeframe. That such transitions are currently being recorded is particularly worrying and indicative of totally inappropriate management.

8. Conclusions

Data suggest that from the Pilbara south, serious issues continue to emerge from the WARMS data, and that these issues appear more pronounced in LCDs in which the average stock numbers across an LCD are in excess of the Present CC. The data in Figures 9, 10 and 11 clearly demonstrate this situation. The frequency (grasses) or density (shrubs) of desirable, perennial species is declining, and while this may be, in the case of the shrubs, in part a response to changes in seasonal conditions in the Southern Rangelands, it appears that stocking rates are commonly excessive, and rangeland condition deteriorating as a result.

That this situation is occurring during a period of generally favourable seasons is particularly disturbing, and suggests that the rangelands are not getting the opportunity to develop some resilience in favourable seasons to assist in survival during less favourable seasons. The implications of this will be that when unfavourable seasons are recorded then quite dramatic declines in desirable species will be more likely.

Data show that most Shrubland LCDs lost desirable plants between Epoch 2 and Epoch 3, with the trend continuing in the most recent data. In other words, this is an on-going situation and one that will clearly not be sustainable, with the consequence being excessive grazing pressure and range condition decline. A similar situation is being recorded in much of the Pilbara, with the latest data simply replicating the conclusions from previous reports.

This report indicates that on-going rangeland degradation continues under current management on many leases, and that such management is therefore not in accordance with S. 95 of the *Land Administration Act (1997).* Action to address this situation will not be simple, but is necessary and should be immediate.