

**REPORT TO THE COMMISSIONER OF SOIL CONSERVATION ON THE
CONDITION OF THE WESTERN AUSTRALIAN PASTORAL
RESOURCE BASE**

JULY 2011

**Dr PE Novelly DAFWA South Perth
Mr PWE Thomas DAFWA South Perth**

1. Introduction

Western Australia's rangelands cover 87% of the state and include all but the south west. Pastoral leases, used for grazing livestock on native vegetation, cover 35% (874,000 km²) of the rangelands, with the balance consisting of Unallocated Crown Land (UCL) and land vested for conservation and Indigenous purposes. There are currently 459 registered pastoral stations (comprised of 510 pastoral leases) in Western Australia; 159 stations are in the Northern Rangelands (Kimberley and Pilbara - 92 in the Kimberley and the remainder in the Pilbara), 291 stations in the Southern Rangelands, and nine stations in the South West Land Division. These latter are generally grouped with the Southern Rangelands. In the Pilbara, there is a gradual change from hummock (mainly spinifex) or tussock grasses in the north to shrub-dominated understoreys (a mix of semi-arid mulga, spinifex and saltbush/bluebush vegetation communities) in southern parts. Consequently, assessment of range condition in the Pilbara and Kimberley is based on the frequency of perennial grasses, while that of the Southern Rangelands (or Shrublands) is determined by the density of shrub species. Ownership is variable, ranging from large corporate conglomerates, private companies, family operations, and indigenous organizations and, particularly in the Pilbara, mining companies

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 the 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 Kimberley (grassland) sites (Epoch 6) will be completed in 2011. The second full cycle (i.e. three assessments) has been completed for the shrubland sites. In this report, data are provided at the Land Conservation District (LCD) level.

Seasonal quality is 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 to the PLB, providing, among other information, the numbers 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 2010 in order to provide context for much of the information presented.

3. Seasonal Conditions

In general, seasonal quality has been above average in the Kimberley over the past 17 years, with the majority of WARMS sites classified as “above average”, and no sites assessed as “below average”. 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. The East Pilbara LCD has received good seasons over the last 6 years, while Ashburton, Lyndon and Roebourne LCDs received a preponderance of below average conditions.

In the grasslands of the northern rangelands, summer rainfall is the key driver. 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 in excess of the mean and the median. Seasonal rainfall for November 2010 to April 2011 was in the top decile (i.e. wettest 10% of records) across the Kimberley and Pilbara. Translated into anomalies, (how many mm above or below average), most of the Kimberley region has had at least 400 mm of rain above average.

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%	178%	458
Derby W Kimberley	100%	0%	0%	169%	504
Halls Creek E Kimberley	100%	0%	0%	168%	533
N Kimberley	100%	0%	0%	175%	783
Kimberley	100%	0%	0%		
Ashburton	100%	0%	0%	209%	177
De Grey	75%	25%	0%	145%	246
E Pilbara	100%	0%	0%	157%	191
Lyndon	100%	0%	0%	323%	125
Roebourne	100%	0%	0%	227%	219
Pilbara	94%	6%	0%		

Generally there was an early start to the 2010/2011 wet season in the Kimberley, although November and December were generally at, or very slightly below average (except Broome where these months were well above average). Significant, well above average, rainfall was recorded during January to April in the East Kimberley, while in the West Kimberley, rainfall was well above average in January and

February, and close to average in March and April. The wet season did not extend beyond the end of April.

Rainfall was more variable in the Pilbara, with all assessed centres receiving either one or two months of well above average rainfall, although March was generally at or below average levels. Little significant rain was recorded beyond the end of February.

Seasonal conditions also varied across the Shrublands between 1999 and 2010. Winter rainfall is far more important in this region. Some LCDs (such as Murchison LCD) experienced equal proportions of “above average”, “average” and “below average” seasons, while others (such as Shark Bay LCD) recorded predominantly “below average” seasons. The Binu 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 2010 (Table 2) were commonly below average, except in the south-eastern districts (NE Goldfields, Nullarbor and Kalgoorlie) and in Wiluna LCDs.

Table 2. Seasonal quality, Southern Rangelands LCDs, 2010.

LCD	% above average	% average	% below average
Binu	0%	0%	100%
Cue	0%	0%	100%
Gascoyne Ashburton Headwaters	0%	61%	39%
Gascoyne Wooramel	0%	0%	100%
Kalgoorlie	24%	70%	6%
Lyndon	0%	53%	47%
Meekatharra	0%	22%	78%
Mt Magnet	0%	83%	17%
Murchison	0%	7%	93%
NE Goldfields	38%	62%	0%
Nullarbor Eyre Highway	36%	64%	0%
Sandstone	0%	58%	42%
Shark Bay	0%	0%	100%
Upper Gascoyne	0%	0%	100%
Wiluna	59%	30%	11%
Yalgoo	0%	12%	88%
Yilgarn	0%	0%	100%
Shrublands overall	15%	41%	44%

The impact of seasonal rainfall over the last few years is illustrated in Figures 1 and 2. This suggests that the northern pastoral areas of Western Australia had a “reasonable season” in 2010, while the Southern Rangelands (shrublands) areas had more variable seasonal responses.

Figure 1:

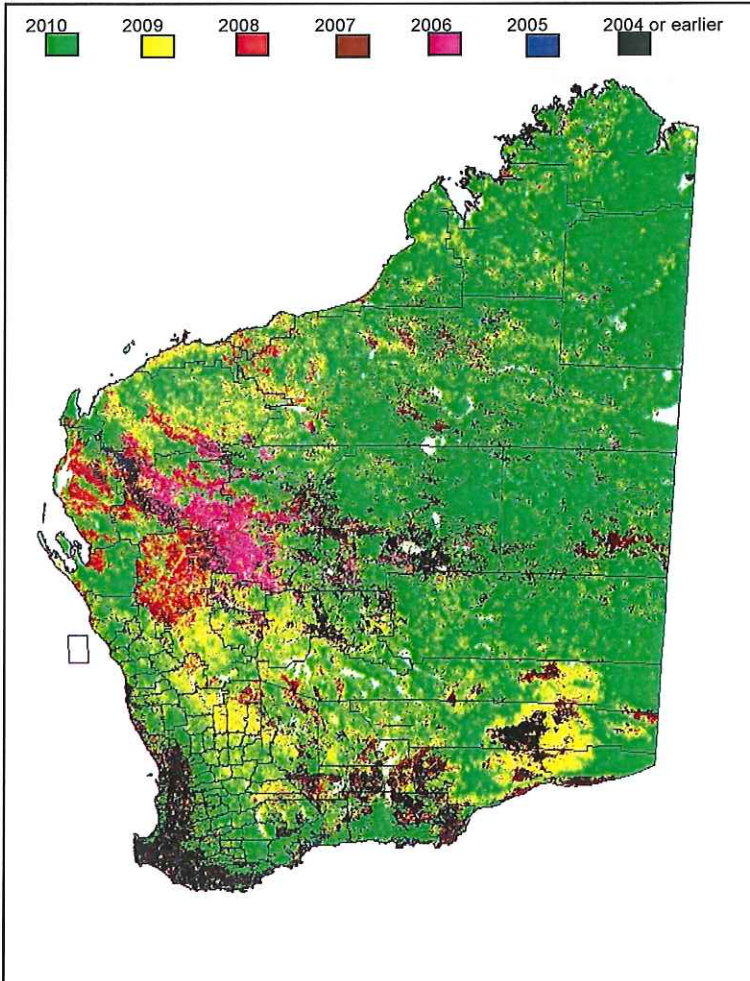


Figure 2:

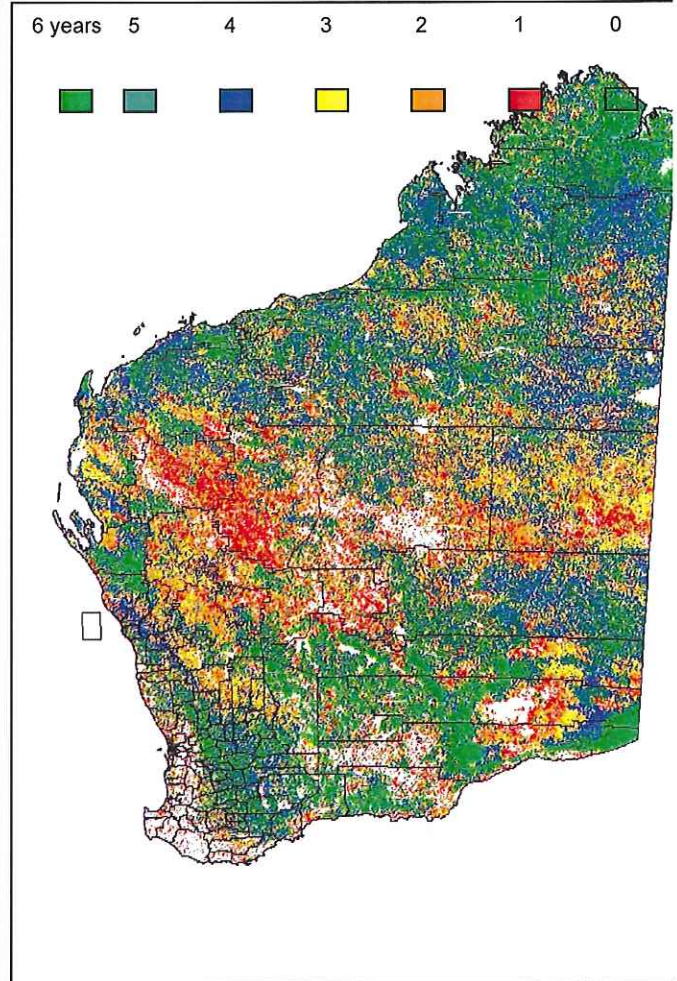


Figure 1: Year of last reasonable season (as determined by NOAA NDVI)

Figure 2: Number of reasonable seasons over the last 6 years (as determined by NOAA NDVI)

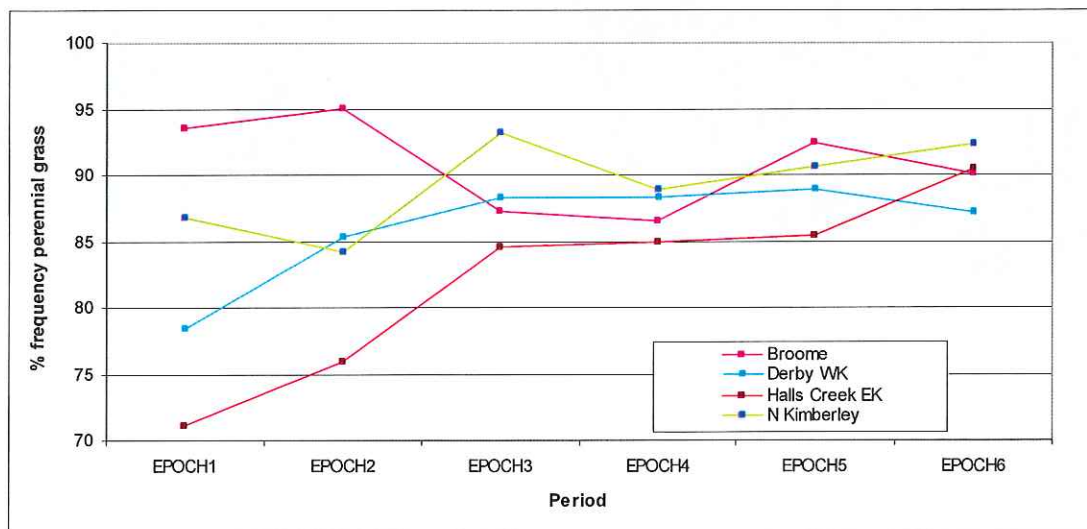
4. WARMS Site Data

4.1 Grassland sites

Frequency of all perennial grasses (both desirable and undesirable) 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 3). Perennial grass frequencies at Pilbara WARMS 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 (Figure 4). 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 far less sanguine for the Pilbara.

In the Kimberley and Pilbara regions, limited WARMS data are available as yet for Epoch 6 (2009 to 2011). In the Kimberley, Derby West Kimberley LCD has only 48% of sites assessed and Halls Creek East Kimberley LCD only 74% of sites assessed at present. Epoch 6 will be completed in 2011 however, allowing a full assessment in the next report. In the Pilbara, Epoch 6 sampling will be completed in 2011 with the completion of site assessment in the East Pilbara and Lyndon LCDs.

Figure 3. Mean perennial grass frequencies, (all grasses) Kimberley LCDs, Epoch 1 to Epoch 6.



Changes in the frequency of desirable perennial grasses (Table 3), as opposed to the frequencies of all grasses (Figures 3 and 4), show considerable variation. No data have been collected in the current cycle in the East Pilbara and Lyndon LCDs. These data suggest that the frequency of those species desirable for pastoralism (the productive, palatable, perennial (3P) grasses) have declined in all Kimberley and Pilbara LCDs except the North Kimberley, although the data for Derby West Kimberley LCD, despite being incomplete, indicate only a very slight decline.

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

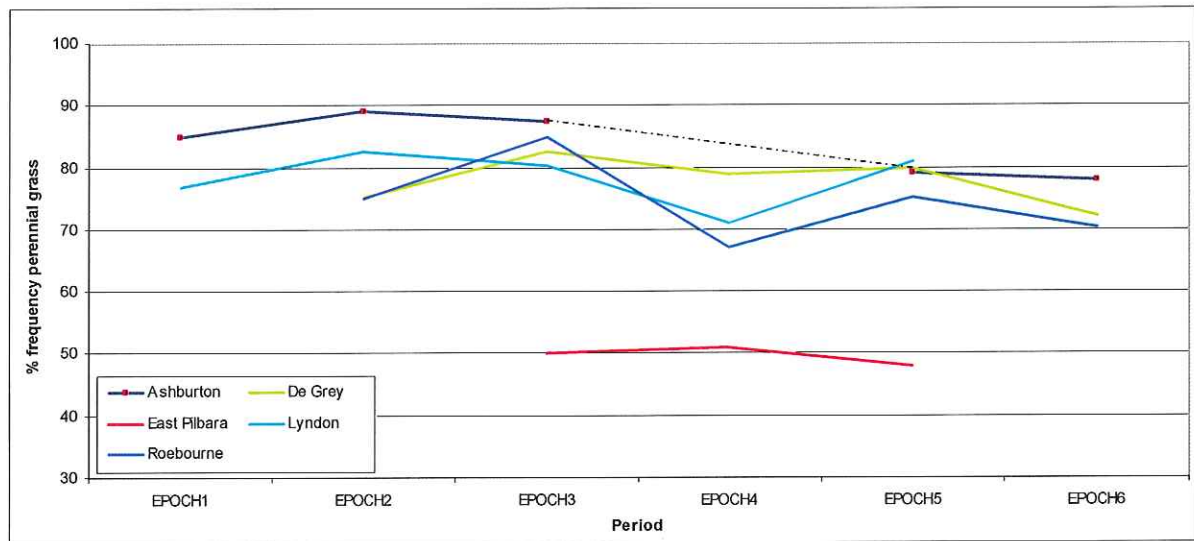


Table 3. Change in frequency of desirable perennial grasses by cycles - Northern Rangelands.

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%	-1.4%
Derby West Kimberley	8.8%	7.1%	-0.6%	2.6%	-0.1%*
Halls Creek East Kimberley	0.8%	11.0%	-2.4%	2.9%	-2.7%*
North Kimberley	1.5%	2.9%	-2.7%	2.8%	5.8%
Pilbara					
Ashburton	6.4%	-6.2%		0.9%	-3.5%
DeGrey		7.3%	-2.7%	-2.8%	-9.1%
East Pilbara			0.3%	-3.2%	
Lyndon		16.9%	-4.4%	-6.2%	
Roebourne		4.3%	-27.1%	12.9%	-4.4%

* In Derby West Kimberley LCD, change is based on sites assessed to 2010 (48% of the LCD's WARMS sites), while in Halls Creek East Kimberley LCD, change is based on sites assessed in 2010 (74%).

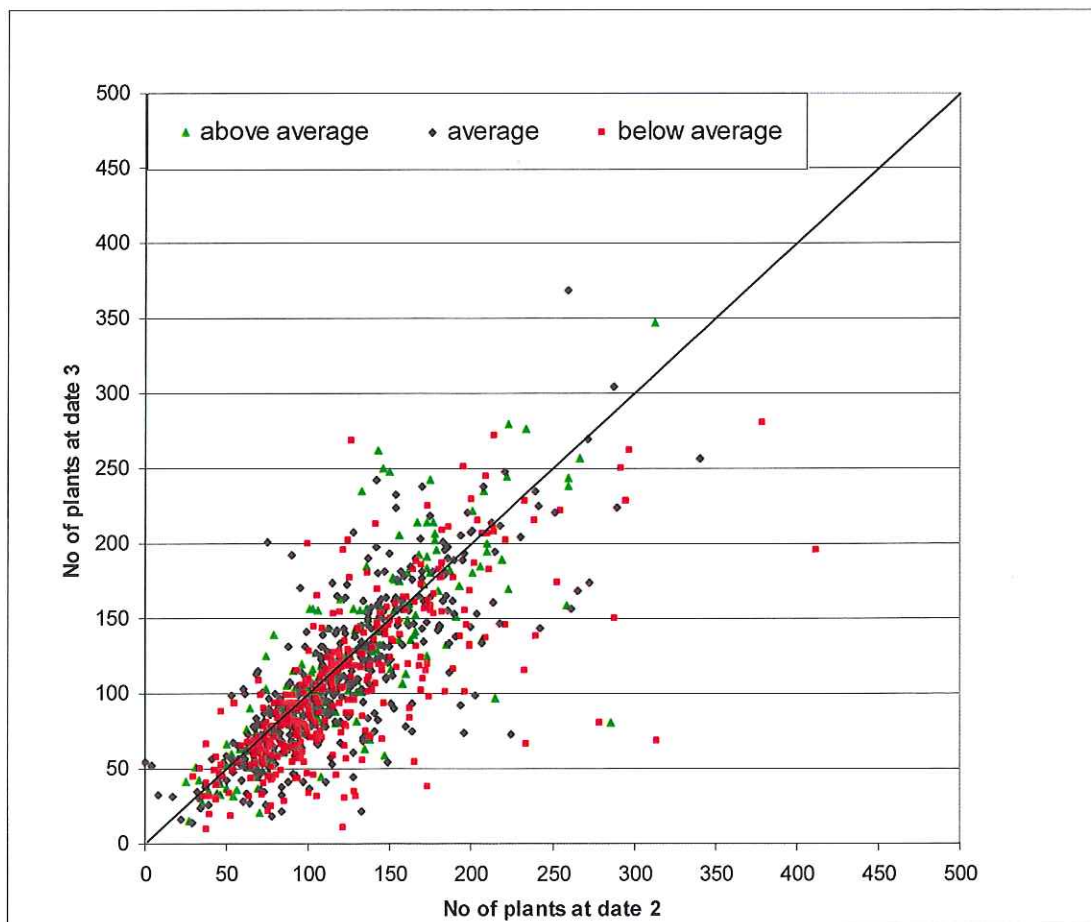
In considering the information provided in Figure 4 and Table 3, the antecedent status of grass frequency should be considered. For example, while desirable grass frequency in the Roebourne LCD improved substantially in Cycle 4 (despite a slightly above capacity stock level across the district and 34% 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 in Cycle 4 significantly less than the decline in Cycle 3.

4.2 Shrubland sites

Because of the five year cycle for WARMS in the Shrublands (compared with the three year cycle in grasslands) there are insufficient "new" data available such that an updated assessment of range trend at the LCD level can be made with confidence. Current data reflect Epoch 2 (1999 to June 2006) and Epoch 3 (May 2005 to 2010). Data reported previously suggested change in shrub density on WARMS sites in the Shrublands was quite spatially variable. In general, shrub densities declined in the Gascoyne Ashburton Headwaters, Murchison, Lyndon, Meekatharra, Shark Bay and Upper Gascoyne LCDs, and were stable or increased slightly in the other LCDs. The proportional decrease in shrub densities was greater than the proportional increase, suggesting that overall conditions declined in the Shrublands (Figure 5).

Figure 5. Shrub number on Shrubland WARMS sites as recorded in Epoch 2 and Epoch 3 (data as at June 2011).



That this trend is continuing in the most recent data (NE Goldfields and Wiluna LCDs) is evident (Table 4) and is occurring despite favourable seasons being recorded. For these two LCDs with Epoch 3 / Epoch 4 data, for the period Epoch 3 (2006) to Epoch 4 (2010/2011) in the Wiluna LCD there was a 26% loss of shrubs and in North Eastern Goldfields LCD a 14% loss of shrubs. Markedly, in Wiluna LCD, while there was a 42% loss of desirable shrubs for stations that experienced below average seasonal conditions, there were also declines in numbers of desirables across all seasonal conditions.

Table 4. Change in number of desirable shrubs across seasonal conditions.

LCD	Seasonal Conditions		
	Above average	Average	Below average
NE Goldfields	na	-8%	-21.6%
Wiluna	-20%	-14.5%	-42.4%

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 their degree of development. Reported stock numbers (from the Annual Return provided for each pastoral lease) show that, although variable, stock densities (cattle units/sq km) have generally risen in the Kimberley over the past 15 years, with the exception of the Halls Creek East Kimberley LCD (Figure 6), where, although variable over time, stock density is below the 1993 figures. Reported 2010 figures indicate a slight decline from 2009 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, 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 both Derby West Kimberley and Halls Creek East Kimberley LCDs are running stock numbers in excess of the present carrying capacity, and that this is currently being sustained by the long run of favourable seasons. It should be noted that stock densities vary significantly between leases, with some leases virtually destocked. Lease carrying capacities per unit area also vary widely. Reported 2010 stock numbers were above the present carrying capacity in 33% of Broome LCD leases, 73% of Derby West Kimberley LCD leases, 54% of Halls Creek East Kimberley LCD leases and 43% 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 estimated carrying capacity and reported stock numbers should be treated with caution.

Reported cattle numbers in the Pilbara increased from 1993 to 2009 (Figure 7), more than doubling in the East Pilbara and De Grey LCDs, although they fell in all LCDs in 2010. However, reported stock numbers generally remain well above

Figure 6. Mean reported stock densities (cu/sq km), Kimberley LCDs, 1993 to 2010.

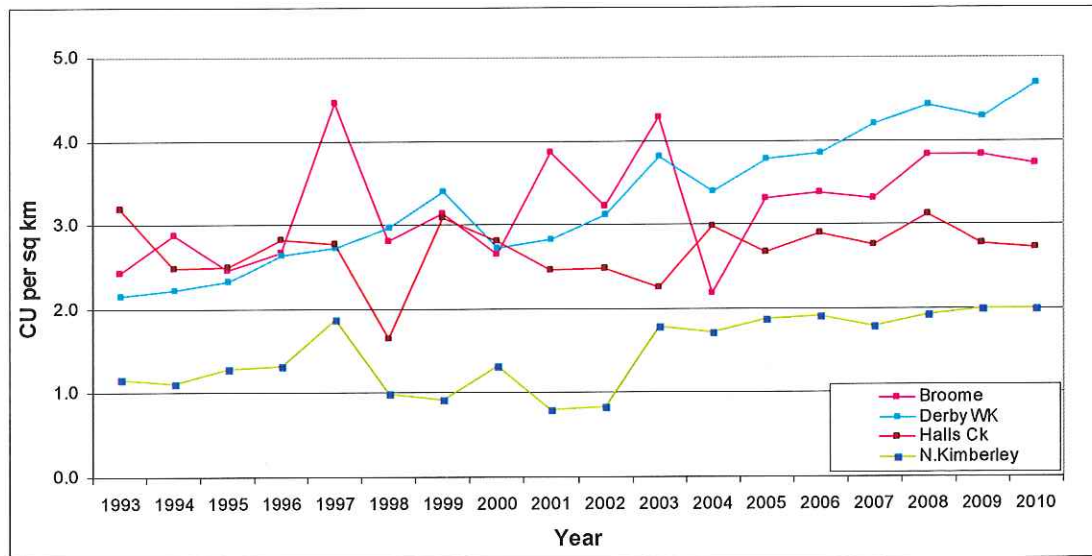
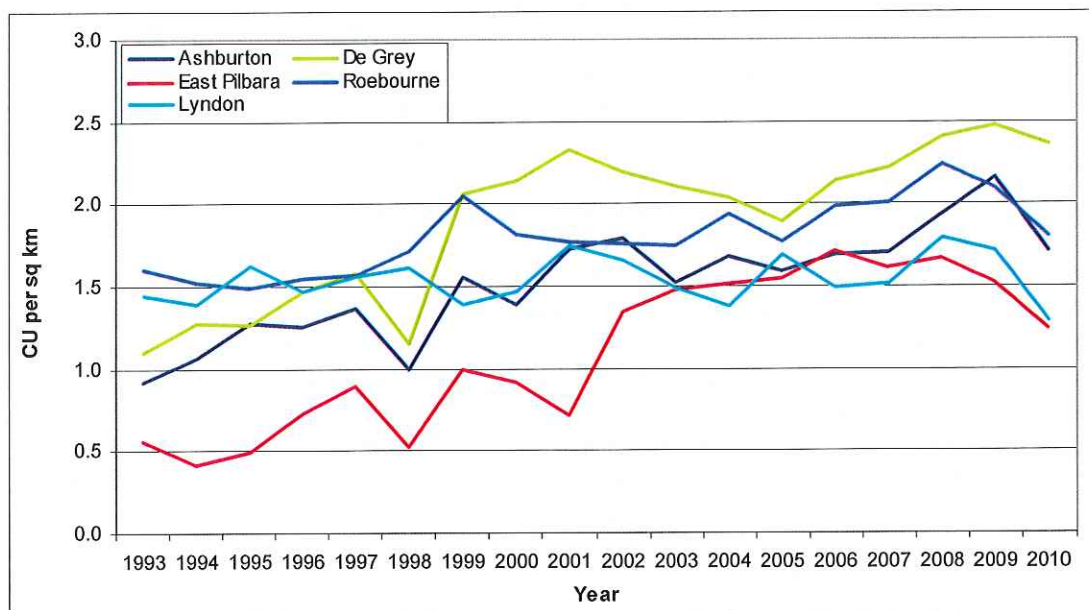
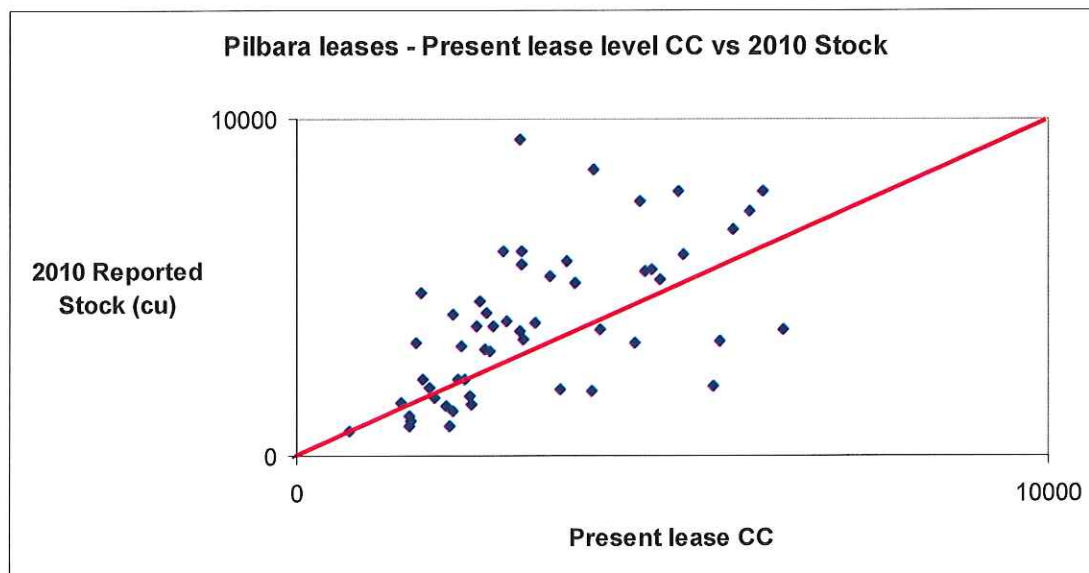


Figure 7. Mean reported stock densities (cu/sq km) Pilbara LCDs, 1993 to 2010.



estimated present carrying capacity (Figure 8), 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 71% (10 of 14 leases), 58% (7 of 12 leases) and 63% (10 of 16 leases) respectively. Densities in the Lyndon LCDs are below current carrying capacity, but again the absence of contemporary range condition data should be noted. Some Pilbara leases are carrying two to three times the estimated present carrying capacity. The sustainability of this situation is doubtful.

Figure 8. Reported stock (cu) 2010 in relation to estimated Present Carrying Capacity (cu), Pilbara leases.



5.2 Southern Rangelands (Shrublands)

Reported stock numbers (ha/dse) varied across the Shrublands region over the past ten years (Table 5). Of the 17 LCDs, stock numbers in 2010 compared with 2000 had declined in thirteen LCDs and increased in four. However, over the period there was considerable variation, both declines and increases being recorded in all LCDs. However, reported stock numbers are generally below the present carrying capacity in most cases. Of the 272 leases for which both a present carrying capacity and a reported 2010 stock figure is available, only 39 leases (14%) reported stock numbers above the present carrying capacity in 2010. 18 leases (7%) reported stock numbers greater than 150% of the present carrying capacity, while 8 leases (3%) reported stock numbers 200% above the present carrying capacity. Of interest is the fact that 34 leases (13%) reported a nil stock number in 2010.

Table 5. Reported stock densities (ha/dse) by LCD, Shrublands region, 2000 to 2010.

LCD	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10
Binnu	36.2	34.1	53.9	40.6	44.7	54.2	45.1	15.1	60.7	52.7	55.8
Cue	30.1	23.6	28.0	29.9	46.0	41.6	33.6	26.5	31.9	35.8	67.7
Gascoyne - Wooramel	9.4	10.6	13.6	16.8	14.3	11.6	11.3	11.0	10.1	9.0	11.7
Gascoyne Ashburton Headwaters	21.5	20.9	20.1	19.1	20.7	23.9	24.1	19.6	17.9	16.1	27.1
Kalgoorlie	36.9	37.9	27.0	34.0	37.5	37.2	45.2	53.4	46.5	52.6	61.4
Lyndon	9.9	10.0	8.9	10.8	10.7	8.7	9.9	9.7	8.1	8.4	11.1
Meekatharra	28.1	32.7	32.6	30.8	29.1	29.0	26.8	26.8	25.0	24.7	31.8
Mount Magnet	18.9	16.8	18.8	24.1	25.0	22.1	18.3	22.0	22.9	24.6	29.6
Murchison	16.4	21.3	23.5	32.2	40.6	33.4	26.4	29.0	22.2	24.7	34.3
North Eastern Goldfields	48.2	46.8	47.7	46.2	48.6	46.2	55.0	42.2	36.8	44.4	43.8
Nullarbor - Eyre Highway	25.5	28.5	24.5	23.5	22.7	25.0	32.9	27.8	32.0	32.9	33.4
Sandstone	52.8	51.6	84.7	77.5	64.0	99.2	85.0	74.1	64.2	59.5	64.6
Shark Bay	16.8	17.3	17.3	18.2	20.2	17.0	18.4	21.7	18.5	16.3	21.7
Upper Gascoyne	15.4	18.4	17.5	23.0	19.4	16.5	15.3	12.9	12.5	10.9	13.9
Wiluna	30.5	27.2	31.0	17.5	19.2	22.4	21.7	20.0	17.5	18.4	21.3
Yalgoo	18.9	21.0	23.4	33.0	39.1	37.4	30.9	25.6	28.8	28.4	44.9
Yilgarn	154.8	46.8	44.1	46.9	51.6	111.9	118.7	104.0	52.5	109.7	101.6

6. Interaction of stock numbers and desirable plant counts

6.1 Northern Rangelands

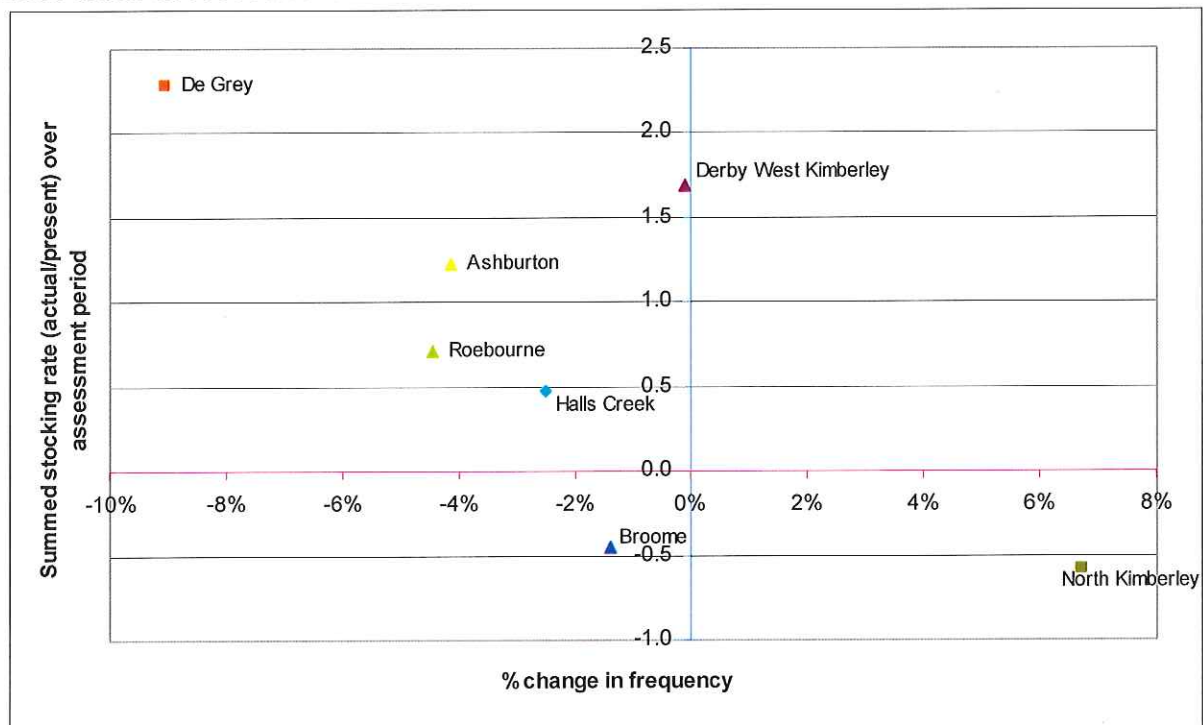
The consequence of stock numbers on the rangelands resource over the 3 years 2009 to 2011 in the Northern Rangelands and the relative stocking levels are illustrated in Figure 9. Changes in recorded frequencies of desirable grasses from WARMS sites are represented horizontally, either increasing (to the right of the figure) or decreasing (to the left) compared with the previous WARMS sampling cycle (Epoch 5 versus Epoch 6). Reported animal numbers relative to the assessed present carrying capacity (Present CC - (Present CC is the Potential CC discounted for current range condition)) of leases within each LCD are represented vertically. Present carrying capacity has been averaged for stations within each LCD. Note not all stations have a calculated present carrying capacity.

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. Ideally, the place to be is on the right hand side of Figure 9.

Pilbara LCD data demonstrate that stock numbers remain above desirable levels in all LCDs in Figure 6, based on present carrying capacity, and that the frequency of perennial grasses is declining. In the De Grey LCD, reported stock numbers are twice the present carrying capacity; with Ashburton and Roebourne LCDs also well above present carrying capacity. The consequences for sustainable pastoralism are clearly illustrated in Figure 6.

Figure 9. Changes in recorded frequency of desirable perennial grasses (2010/2011) in relation to grazing pressure, Northern Rangelands LCDs. Graph includes changes to De Grey and Roebourne LCDs, where sites burnt noted to be burnt in 2009 when assessed in 2010.



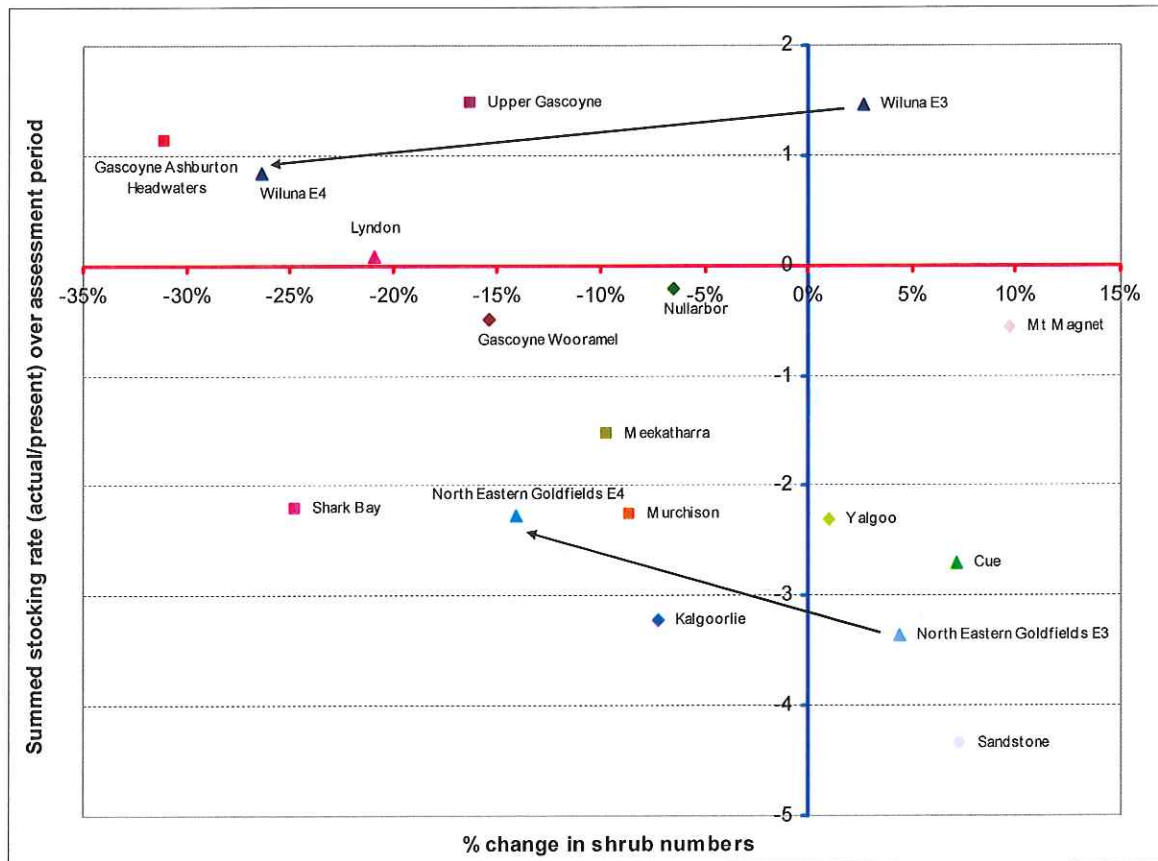
* Note that data have not been collected in the East Pilbara LCD in 2010.

6.2 Southern Rangelands

The percentage change in shrub numbers within each LCD and the relative stocking levels over the previous 5 years are illustrated in Figure 10. 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. Reported animal numbers relative to the assessed Present Carrying Capacity of leases within each LCD are represented vertically. 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. Again, the ideal place to be is on the right hand side (Mt Magnet, Sandstone, Cue and Yalgoo). Results show that

for some LCDs, the grazing pressure in times of “below average” seasons and in some cases “average” seasons is not sustainable

Figure 10. Changes in recorded shrub populations in relation to grazing pressure, Southern Rangelands LCDs, Epoch 2 to Epoch 3, and the recorded situation between Epoch 3 and Epoch 4, North Eastern Goldfields and Wiluna LCDs.



Overall, recorded shrub numbers declined at WARMS sites, 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.

Figure 10 illustrates the on-going decline in shrub populations in the Wiluna and North Eastern Goldfields LCDs as recorded in 2010. In Wiluna, reported stock numbers have increased steadily since 2003, associated with an extended period of above average seasonal conditions. 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, 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 carrying capacity. 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). Therefore, on those leases that are stocked, grazing pressure is evidently too high for sustainable use, and has not responded to the unfavourable seasons.

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 were not unexpected. The range trend in Kimberley grasslands continues to be generally stable, although 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. Data do suggest that cattle numbers are above the present carrying capacity in the Derby West Kimberley and Halls Creek East Kimberley LCDs, particularly the former. However, the present carrying capacity assumes average seasonal conditions, while actual seasonal conditions have been most favourable for many years. Consequently, current stock numbers do not appear to be a major problem, although the decline in the frequency of desirable perennial grasses is noteworthy. However, if seasonal conditions were to decline (essentially return to normal), current stock numbers would require an immediate and substantial response from lessees, as the variability in desirable grass frequency indicates a fine margin between sustainable and unsustainable grazing pressure.

This result, while positive, 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 gone against this 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 carrying capacity.

In the Pilbara, the increase in reported stock density has not always been accompanied by good seasonal conditions. In the period 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 (see previous report). However, stock densities continued to rise during this period, and the frequency of all perennial grasses and desirable perennial grasses declined. This suggests excessive grazing pressure is reducing the capacity of the rangeland to respond to the more favourable seasons.

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. The presence of palatable, perennial species defines range condition. In other words, they are a proxy for range condition, with range condition synonymous with the density of desirable species relative to the potential of the particular vegetation type in question. These data suggest that the Pilbara, as a whole, is being stocked above its 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 impact through 2011 and into 2012 of the suspension of live cattle exports to Indonesia has the potential to exacerbate this situation, indicating that the condition of the pastoral resource in the Pilbara is 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, the decline in recorded shrub densities was pronounced, suggesting an inadequate response from lessees to the seasonal conditions. Data show that most LCDs lost desirable plants between Epoch 2 and Epoch 3, with the trend continuing in the most recent data. While stock numbers in seven of the LCDs are below the present carrying capacity, the current grazing pressure remains too high for the seasonal conditions (present carrying capacity 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 carrying capacity of the rangelands, with 10 of the 19 leases reporting stock numbers above present carrying capacity in 2010, 4 of which are carrying more than twice the present carrying capacity. The consequence is excessive grazing pressure and range condition decline.

Matching of stocking rate to seasonal quality is the key factor influencing changes to plant populations (excluding natural events like floods or fire). LCDs such as Mt Magnet and Cue (100% of seasons assessed as "below average" seasonal quality) have increased shrub numbers, even under "average" and "below average" seasonal conditions because of their seasonally appropriate stocking rates. However, the results indicate that for many LCDs the current grazing pressure in times of below average seasons and in some cases average seasons is too high, and that range condition decline is current and continuing.