PASTORAL LAND BOARD

NORTHERN TERRITORY

ANNUAL REPORT

2014-15

EXECUTIVE SUMMARY

Good land condition is not only essential for a profitable and sustainable pastoral industry but is also essential to underpin future growth and development of agribusiness.

The Pastoral Land Board is chartered with monitoring the condition and use of pastoral land to facilitate its sustainable use and economic viability. The Board is committed to the maintenance, and where possible, the improvement of the condition of the Northern Territory's pastoral land.

The Board is a statutory authority made up of five members, including a Chairman, appointed by the Minister for Land Resource Management and is tasked with reporting to the Mnister on the general condition of pastoral land under the *Pastoral Land Act*. This report provides the Minister with a comprehensive analysis of current land condition across the NT Pastoral Estate. Encompassing an area of approximately 596 091 km^2 the NT Pastoral Estate comprises 45% of the Northern Territory's land mass held under 223 pastoral leases.

The Board's annual reporting period spans from 1 October to 30 September to align with the growing season. Using a comprehensive integrated monitoring system, Rangeland Monitoring Officers from the Department of Land Resource Management combine measured field data collected on-ground with remote sensing satellite monitoring products and the knowledge and experience of the land managers to enable reporting of land condition at property, landscape and regional scales.

The report includes specific land condition issues faced by pastoralists including erosion, feral animals, weeds and bushfires and the impact of seasonal conditions. Supplementary information includes the operations of the Board and the state of the NT cattle industry as supplied by the Department of Primary Industry and Fisheries.

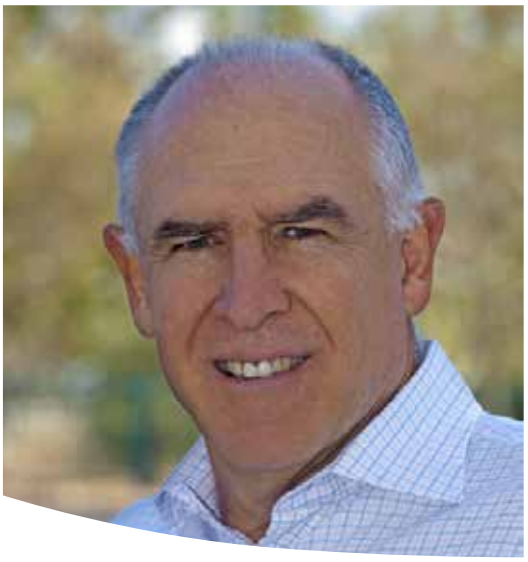
During this 2014-15 reporting season, monitoring was undertaken at 256 sites on 45 properties across nine of the 11 pastoral districts. Of the 256 sites assessed, 141 were assessed in 'Good' condition, 63 were assessed in 'Fair' condition and 52 were assessed in 'Poor' condition. Seasonal quality varied across the Darwin, Katherine, VRD, Sturt Plateau, Barkly and Southern Alice Springs pastoral districts. Northern Alice Springs, Plenty and Tennant Creek pastoral districts experienced above average seasonal quality and the Gulf and Roper pastoral districts experienced average to below average seasonal quality.

The Board held three meetings during this reporting period, including one in Darwin and one in Tennant Creek, and visited Neutral Junction Station in the Northern Alice Springs Pastoral District and Helen Springs Station and Newcastle Waters Station in the Barkly Pastoral District. The Board approved a land clearing permit and non-pastoral use permit (horticulture) for Undoolya Station, and a non-pastoral use permit for Flying Fox Station.

"It's our vision to support a viable pastoral industry in the NT"

CONTENTS

CHAIRMAN'S FOREWORD



I am pleased to present the 2014-15 Pastoral Land Board Annual Report highlighting the condition of the NT pastoral estate, the operations of the Board, the issues facing pastoralists through bushfires, weeds and feral animals, and some supplementary information on the pastoral industry.

The Annual Report helps to fulfil one of the most important functions of the Pastoral Land Board; reporting on the general condition of pastoral land across the Northern Territory.

This report would not be possible without the hard work and dedication of the Department of Land Resource Management (DLRM), particularly the Rangeland Monitoring Branch, who spend much of their time out in the field traversing thousands of kilometres to visit numerous properties across the 11 pastoral districts. Property visits have again increased significantly from previous years; from 29 properties across six pastoral districts in 2012-13, 36 properties across seven pastoral districts in 2013-14 up to an incredible 45 properties across 11 pastoral districts in the 2014-15 reporting period.

Significant improvements have been made to the Annual Report, largely thanks to the efforts of Dr Gary Bastin, DLRM Rangeland Monitoring Manager. The integrated monitoring program is now in full implementation mode and you will see some of the results of remote sensing to support the on-ground monitoring throughout this report.

As one door closes another opens as they say. During this period the Board has farewelled two of its former members, Tom Stockwell and Dr Campbell 'Joe' Miller. We sincerely thank them for their contribution to the Board and wish them all the very best in future endeavours. We welcome the addition of David James from the Sturt Plateau Pastoral District and rangeland scientist Dr Leigh Hunt to the Board. Their collective experience will serve the Board well.

The Board has relished the opportunity to get out and meet pastoralists as we travelled through the Alice Springs, Tennant Creek and Barkly pastoral districts in 2015. In particular it was great to see the non-pastoral use diversification opportunities being established.

On a final note, I express my sincerest thanks to all the Board members, past and present, for dedicating their valuable time to be part of the Board. The members' hard work and dedication to supporting the pastoral industry and fulfilling important legislative functions undertaken by the Board is greatly appreciated.

Richard Galton

MEMBERSHIP OF THE BOARD

Name	Position	Commenced	Current Term	Term Expiry Date
Richard Galton	Chairman	2013	3 years	25 June 2016
Colleen Costello	Member	2005	3 years	30 April 2016
Steven Craig	Member	2002	3 years	30 April 2016
David James	Member	2015	3 years	27 Sept 2018
Dr Leigh Hunt	Member	2015	3 years	27 Sept 2018

Former member Thomas Stockwell tendered his resignation 9 March 2015.

Former member Dr Campbell (Joe) Miller's term expired 25 June 2015.

Executive Officer

Mrs Karlie Weinert

FUNCTIONS OF THE BOARD

Section 29 of the *Pastoral Land Act* outlines the function of the Board:

a. to report regularly to, and as directed by, the Minister, but in any case not less than once a year, on the general condition of pastoral land and the operations of the Board;

b. to consider applications for the subdivision or consolidation of pastoral land and make recommendations to the Minister in relation to them;

c. to plan, establish, operate and maintain systems for monitoring the condition and use of pastoral land on a District or other basis;

d. to assess the suitability of proposed new pastoral leases over vacant Crown land;

e. to direct the preparation, and monitor the implementation of, remedial plans;

f. to monitor, supervise or cause to be carried out work in relation to the rectification of degradation or other damage to pastoral land;

g. to monitor the numbers and effect of stock and feral and other animals on pastoral land;

h. to monitor and administer the conditions to which pastoral leases are subject;

ha. to consider and determine applications for permission to use pastoral land for a non-pastoral purpose in accordance with Part 7;

j. to make recommendations to the Minister on any matter relating to the administration of the Act;

k. to hear and determine all questions, and consider and make recommendations on all matters, referred to it by the Minister; and

m. such other functions as are imposed on it by or under the *Pastoral Land Act* or any other Act or as directed by the Minister.

Other functions outlined in the Act include:

1. to determine applications for clearing pastoral land [section38(1)(h)]
2. to consider breaches of conditions referred by the Minister [section 41]
3. to consider and make recommendations to the Minister on application for conversion of term pastoral leases to perpetual tenure [section 62]
4. to administer the access provision of the Act, including nomination of access routes under Part 6
5. to determine applications for non-pastoral use of pastoral land under Part 7.
6. to consider and make recommendations to the Minister on application for subdivision [section 61]; and
7. to consider and make recommendations to the Minister on application for consent to transfer a pastoral lease or sub-lease should the advice of the Board be sought [section 68(2)].

LAND CONDITION

Land condition should be an assessment of vegetation and soil health as indicated by ground species composition, tree and shrub density, abundance of invading plants (native and exotic), soil surface condition and soil erosion. These indicators are relatively unaffected by season or seasonal conditions compared with indicators like ground cover and pasture yield. The former, more stable attributes are assessed relative to land in near-pristine condition.

The main influences on land condition are grazing by domestic, native and feral grazers, fire and combinations of the two. Grazing is managed by manipulating stocking rate, stock water distribution, feral grazing control and fire. Fire on its own can change land condition by being too frequent or too infrequent over a long period of time, but its main effect on land condition is through changing the distribution of grazing as grazers prefer younger grass.

Implementation of Management Plans to address Land Condition Issues

In cases where land condition issues are identified on a pastoral property, the Board may request the lessee to prepare a management plan detailing the action to be taken to address the land management issues which have been identified. It is a basic tenet of the *Pastoral Land Act* that pastoral lessees acknowledge their duty to adopt sound management practices and their responsibility to address any land condition issues that may arise. In line with this philosophy, the Board seeks voluntary collaboration with pastoral lessees to address land condition issues and implementation of rehabilitation programs.

While voluntary management plans are preferred in the first instance, if the Board is of the opinion that pastoral land has been degraded or otherwise damaged it may require a remedial plan detailing the proposed management of the pastoral land over a specified period of time. Remedial plans need to be endorsed by the Board and are registered on the title.

The Board has a voluntary management plan currently in place on a pastoral lease in the Katherine Pastoral District addressing land degradation caused by heavy grazing, poorly located linear infrastructure and weed infestations. There are currently no remedial plans in place.

Erosion on Roads, Fences and other Infrastructure

Erosion on roads, tracks and fence lines continues to be a significant soil management issue on pastoral leases throughout the NT. Officers of the Department of Land Resource Management's Rangelands Division adopt a co-operative approach to assist station managers with appropriate soil conservation earthwork design and construction. Voluntary management plans have been prepared by pastoral lessees and successfully implemented on a number of properties to address issues arising from the poor siting of infrastructure, and/or inappropriate maintenance techniques.

PASTORAL LAND MONITORING PROGRAM

The Northern Territory Government's Department of Land Resource Management (DLRM) is chartered with the assessment, monitoring and reporting of land condition on behalf of the Pastoral Land Board.

Integrated Monitoring Program

The integrated monitoring program was introduced in 2013 to provide objective, whole of landscape reporting of changes in land cover across the pastoral estate. It comprises a network of ground based sites, incorporating the existing Tier 1 sites where suitable, with newly established ground sites to validate and inform satellite data and products.

New sites are established at or near relocated Tier 1 sites to maintain consistency in the photographic and data records. In some cases, it is not appropriate to locate a site nearby due to factors such as proximity to infrastructure, land system boundaries and changes in vegetation structure and type. Where Tier 1 sites are not appropriate for inclusion in the integrated monitoring program, sites continue to be photographed to expand the Tier 1 photo archive.

The integrated monitoring program, like the previous Tier 1 system, is heavily reliant upon the knowledge and experience of land managers and lessees. Both the ground data collected and information products produced from satellite data require on-ground local knowledge and understanding to explain changes and gain a further understanding of landscape dynamics. Measured field data is used to better calibrate Landsat-derived products to NT conditions and then validate their accuracy for specific locations. The two sources of information (ground based and remote sensing) are then interpreted with regard to the knowledge and experience of practical land managers to enable reporting of land condition at property, landscape and regional scales.

As the number of revisits increase at a site, the expanding monitoring record will allow changes in the vegetation and soils, and their probable causes, to be documented – in a similar way to that which is now possible for vegetation cover using remote sensing.

Remote sensing of the dynamics of vegetation cover

The remote sensing or satellite based data component of the integrated monitoring program has been developed through a collaborative research program between DLRM and the Queensland Department of Science, Information Technology and Innovation (DSITI). Through this collaboration, DLRM officers are contributing to an internationally recognised method for systematically monitoring change in vegetation cover and its converse, bare soil, at a range of spatial and temporal scales. The 900 m^2 pixel size of Landsat satellite imagery allows change

in vegetation cover to be analysed at site level (1 ha) through to pastoral districts (~10,000 km^2 to >130,000 km^2) and the entire NT (~1,346,500 km^2). Reporting intervals can be as short as three months over a 28 year period (1988 to current).

Fractional cover

Analysis of the dynamics of vegetation cover (conversely, bare soil) within this report is based on fractional cover. This is a model of the three components of land cover that can be discriminated from the spectral data collected by the Thematic Mapper instrument carried on the Landsat satellite (i.e. Landsat TM). The three components are bare soil (comprising soil, rocks and gravels), actively growing (photosynthetic) vegetation and senescent (non-photosynthetic) vegetation (including litter).

The level of vegetation cover or bare soil present and their change over time are reported in three ways:

1. As the actual amount present during a specified period of time. For this report, this is September - November 2015, the latter part of the dry season for central and northern pastoral districts and the time when early summer storms may promote pasture growth in the southern NT. It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense, early wet season storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

2. As a decile rank of vegetation cover present in late 2015 compared with that present at similar times back to 1988, a 27-year period.

3. The percentage area of each pastoral district having various categories of bare soil between September and November 2015. Categories of bare soil are:

    - minor, ≤20% of Landsat pixel is bare soil;

    - moderate, 21% - 40% bare soil in pixel;

    - high, 41% - 60% bare soil in pixel; and

    - very high, >60% of pixel is bare soil.

The number of pixels in each category are counted, multiplied by pixel area (0.09 ha) and converted to the percentage of pastoral district area.

Rainfall

The amount, timing and effectiveness of rainfall are major drivers of the quantity, composition and quality of pastures across the NT pastoral estate. Monitoring data collected using ground and remote sensing-based methods must account for the effects of variable rainfall (seasonal quality) in understanding the impacts of stocking rates and grazing management on the vegetation resource.

Due to the large variation in annual rainfall across the NT, a comparison of location-specific rainfall against its longer term history is a useful way of illustrating recent seasonal conditions.

An NT map of decile-ranked rainfall for the current reporting cycle (October 2014 to September 2015) is shown on page 11. Rainfall is ranked on a baseline of approximately 100 years.

Fire

Fire and its effect on vegetation cover across the NT cannot be understated. This can be seasonal in the savannah landscapes of the central and northern parts of the NT or relatively infrequent and episodic in the southern arid region. Mapped fire scars and associated statistics accessible from the North Australian Fire Information (NAFI) website (www.firenorth.org.au/nafi3) are used to report spatial and temporal information on burnt area.

Woody cover

The density of trees and shrubs changes over time in many rangeland environments, but generally at a slower rate than changes in the pasture layer. A particular issue facing long-term sustainability of the pastoral industry in some landscapes is woody thickening which can suppress pasture growth and reduce opportunities to use fire for broadscale control of problem tree or shrub species. Two remote sensing products are being adapted to NT conditions to improve monitoring of vegetation cover dynamics. The first is a foliage projective cover product that discriminates woody cover from ground cover. The second is a probability-based model that allows ground cover under trees to be estimated. Both will allow improved monitoring of cover dynamics in woodland / savannah environments when suitably refined and validated.

CRITERIA USED TO ASSESS PASTURE CONDITION

Three classes are used to assess pasture condition: good, fair and poor.

These classes are based on indicators of pasture condition such as the abundance of perennial plants known to increase or decrease following grazing, and ground surface indicators such as the exposure of bare soil to wind and water and its subsequent erosion. These indicators of pasture condition and associated assessment criteria have largely been determined from historical information, local knowledge, cross fence comparisons and stock grazing gradients out from water. The further from water the less intense the stock grazing pressure and the higher the condition class rating tends to be. The condition classes can be described as follows:

Good

There is close to maximum diversity and cover of annual and perennial plant species possible for that pasture type with perennial species of various ages. There is no active erosion other than natural features and processes. Plant and litter cover protects the soil from wind and water in all seasons except following fire. Pastures in good condition are stable and are at, or close to, their productive potential. Pastoral managers should be aiming for good pasture condition, which necessitates careful management practices that maintain or improve pasture condition.

Fair

Reduced cover and regeneration of palatable perennial species and there has been some establishment of less preferred unpalatable plants. Productivity remains high in good seasons but is markedly reduced in dry seasons. Lower plant cover increases the susceptibility of soil to erosion in most seasons and there is evidence of moderate erosion on susceptible land types. Pastures in fair condition are productive, but below their productive potential. They are sometimes actively eroding and can rapidly deteriorate to poor condition. Maintaining pastures in fair condition is not a satisfactory status quo, as long term damage to their productive capacity will result. They should be managed with the aim of improving condition and ultimately achieving good condition status.

Poor

The palatable component of the pasture is depleted and the pasture is dominated by annual, ephemeral and unpalatable perennial species. There is no, or markedly reduced, regeneration of desirable perennial plants, productivity is impaired and the seasonal response is poor. Soils are unstable and susceptible to erosion in all seasons and past erosion leaves the site susceptible to further soil movement if grazed. Pastures in poor condition have severely reduced productivity, which is most noticeable during dry periods. They require a very long period of spelling to improve condition or mechanical intervention such as erosion control earthworks or reseeding.

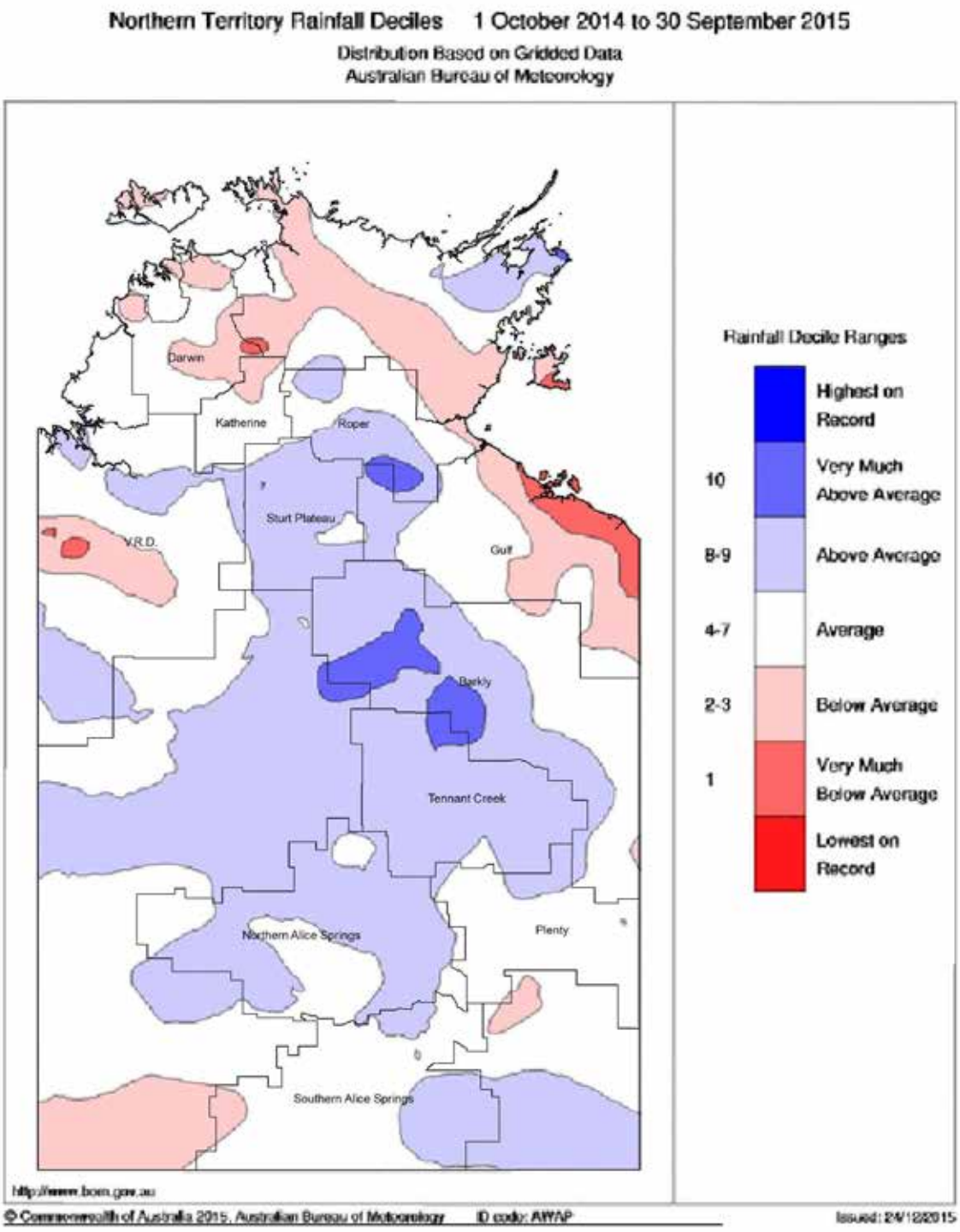
2014-15 MONITORING SEASON

During the 2014-15 monitoring season, the DLRM Rangeland Monitoring Branch undertook rangeland monitoring assessments in nine of the 11 Pastoral Districts; Darwin, Katherine, VRD, Sturt Plateau, Gulf, Barkly, Tennant Creek, Northern Alice Springs and Southern Alice Springs. A total of 45 properties were inspected and 256 sites monitored.

Seasonal Conditions

Seasonal conditions for 2014-15, based on rainfall amount compared with the long-term record, were:

- Above average for most of the Sturt Plateau and Tennant Creek districts, the western Barkly and much of the Northern Alice Springs districts (Map 1). Above average rainfall extended into the south western part of the Roper district. The eastern Barkly and remainder of the Roper and Northern Alice Springs pastoral districts experienced average rainfall.
- Average across most of the Plenty, Southern Alice Springs and Katherine districts. Rainfall was above average in the eastern part of the Southern Alice Springs district and below average in the far west. The northern part of the Katherine district had below average rainfall.
- Average to below average in the Darwin and Gulf pastoral districts. Parts of the Gulf coast had very much below average rainfall compared with the long-term record.
- Mixed seasonal conditions occurred across the VRD: much of the pastoral district had average rainfall with a band of below average rainfall in the central west and strips of above average rainfall in the south and north east.



Map 1: Decile-ranked rainfall for the October 2014 to September 2015 period. Map obtained from the Bureau of Meteorology website (http://www.bom.gov.au/jsp/awap/rain/index.jsp).

Black polygons show the Pastoral Districts as gazetted under the Pastoral Land Act *namely Darwin, Katherine, Roper, VRD, Sturt Plateau, Gulf, Barkly, Tennant Creek, Plenty, Northern Alice Springs and Southern Alice Springs.*

Land Condition

Land condition was assessed using a combination of remotely sensed (satellite) and field (site) data, and lease inspection. Landsat data are processed to indicate the proportions of vegetation cover (photosynthetic and non-photosynthetic) and bare soil in each pixel, an area of 900 m^2 or 0.09 ha. Change in each component can be examined since 1988, providing important information on cover dynamics over the last 27 years.

Map 2 provides an example of comparing the present with the past. This image highlights:

- Increased amounts of bare soil (less vegetation cover) in the southern NT compared with savannah landscapes in the north. This pattern is shown by the predominantly red colouring. Parts of the southern NT also had relatively more bare soil in late 2015 compared with the same time of year back to 1988 (yellow coloured areas). Much of this recent relative increase in bare soil results from vegetation still recovering from extensive wildfires in 2011 and 2012, exacerbated in some areas by lack of rainfall (Map 1). High grazing pressure may also be implicated in increased levels of bare soil within parts of pastoral districts in the southern NT but this visual display does not allow such areas to be definitively identified.

- Higher vegetation cover (less bare soil) in the woodland-dominant savannah landscapes of the central and northern NT. Most of this area also has a substantial component of perennial grasses in the pasture meaning that there is considerable vegetation cover in the late dry season (illustrated by the brown colouring in Map 2), where not recently burnt. Fires remove most of the pasture layer and may cause leaf fall from trees where scorching occurs. Areas burnt in 2015 show as brighter shades of green in Map 2, because they had less vegetation cover compared to most previous years since 1988. Areas recovering from earlier fires (prior to 2015) show as shades of orange through to yellow.

In summary, Map 2 shows the contrast in levels of vegetation cover (conversely, bare soil) across the NT, the extent and significance of fire on the dynamics of vegetation cover and, within individual pastoral districts, the influence of rainfall on the amount of cover present.

The following sections provide a detailed account of components of land condition in each pastoral district. Information is compiled on:

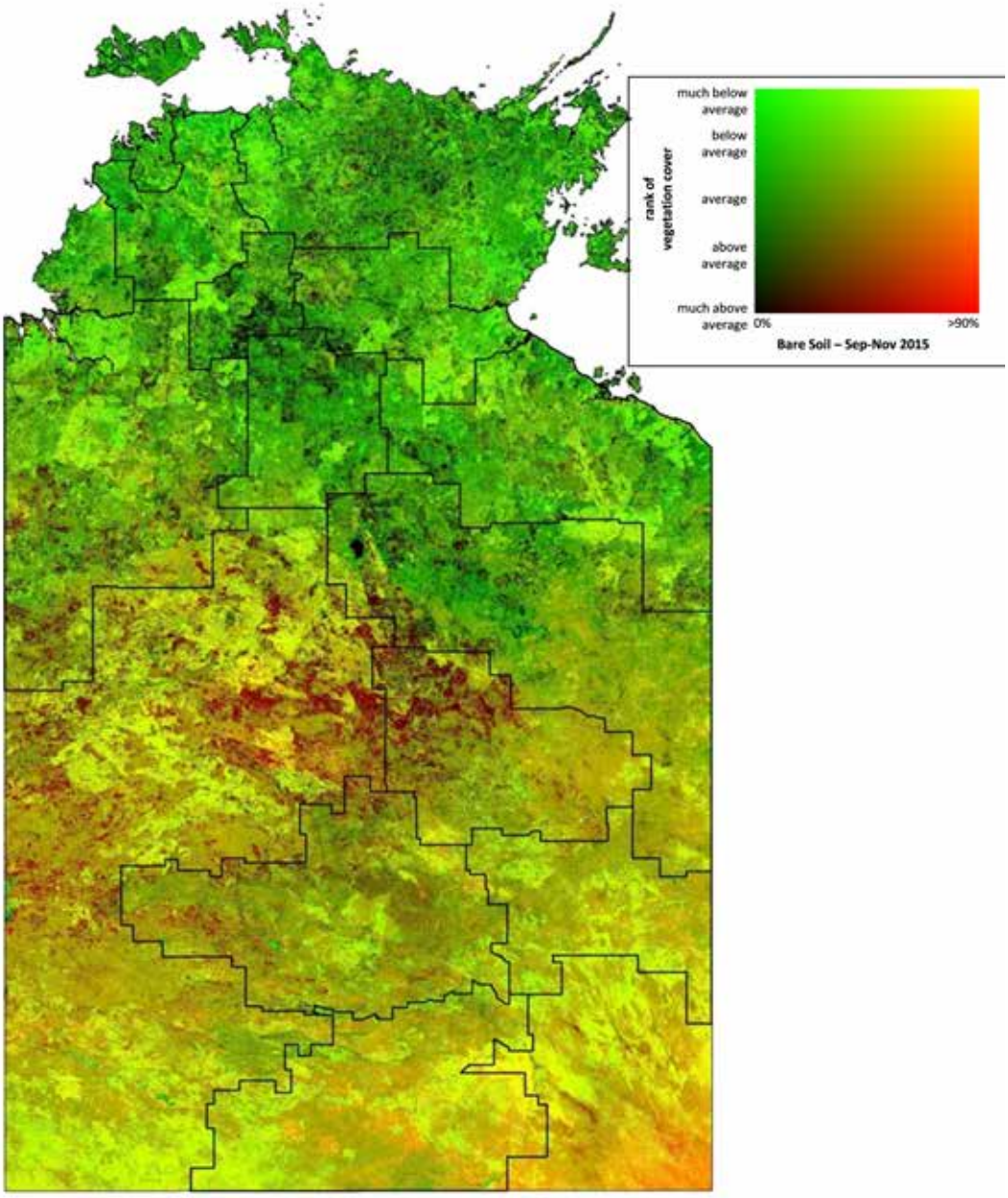
- Seasonal quality – the amount and effectiveness of rainfall in growing forage for livestock,

- Extent and timing of wildfire,

- Further information on bare-soil dynamics including mapped areas exceeding specified thresholds of bare soil, and

- Data collected at monitoring sites and observations made during lease inspections relevant to pasture condition, presence of weed species, tree-grass balance (e.g. woody thickening) and soil erosion.

Information from the pastoral district reports is summarised on pages 14-17.



Map 2: The percentage of bare soil present in 900 m² Landsat pixels in the latter part of 2015 compared with the pixel-level rank of vegetation cover over time. The latter compares vegetation cover in late 2015 against that present at the same time of year since 1988.

The amount of bare soil is shown in shades of red (see legend; high bare soil = bright red, little bare soil = dark red).

The rank of vegetation cover is depicted in green; relatively less cover in late 2015 = bright green, relatively more cover = dark green.

Mixing of green and red indicate other possible responses (see legend): dark brown represents less bare soil in the Landsat pixel and more vegetation cover in 2015 compared with the last 27 years; yellow means high levels of bare soil and less vegetation cover relative to the recent history (since 1988).

Black polygons show gazetted pastoral districts (refer Map 1 for their names).

Pastoral District	AG[1] Growth Percentile	% PD[2] Burnt	% Pastoral District with category of Bare Soil[3]				Site Data			Summary of Pastoral District
			minor	moderate	high	very high	#[4] stations	condition class	#[5] sites	
Darwin	55	122	60	35	5	0	8	Good	19	Spatially variable seasonal quality. Extensive and frequent fire. Vegetation cover suppressed by recent fire. Minor amounts of bare soil. Majority of ground sites in good condition. Based on visual inspection, majority of area on most stations in good or fair condition. Sections of tracks and creeks eroded, mainly by gullying. Weeds, where present, include mimosa, rubber bush and hyptis.
								Fair	9	
								Poor	1	
Katherine	39	57	70	26	4	0	4	Good	8	Based on modelled pasture growth, seasonal quality below average in the east and north, and average or better elsewhere. Extensive fire which suppresses vegetation cover in the short-term. Minor bare ground. Monitoring sites mostly in good condition. Visual inspection of broader areas indicates that majority of one lease in good condition, two further leases in generally fair condition and a fourth property in fair to poor condition. All properties have weed-infested areas including bellyache bush, grader grass, hyptis or parkinsonia.
								Fair	2	
								Poor	2	
VRD	46	26	20	53	25	2	12	Good	50	Variable seasonal quality based on expected pasture growth through the wet season: below average in much of the north west of the district, above average in the south and closer to the long-term average elsewhere. Moderately extensive fire in late 2014 (probable wildfire) and early dry season of 2015 (controlled burning). Moderate amounts of bare soil, mainly in the central and southern parts of the district. Bare soil related to extensive wildfire in 2011 and 2012. Most sites in good condition. Similarly, much of the pastorally more productive country on most leases judged to be in good condition with lesser areas in fair condition. Parkinsonia, prickly acacia or rubber bush present around some yards and waterpoints. Sections of tracks eroded through gullying.
								Fair	12	
								Poor	1	

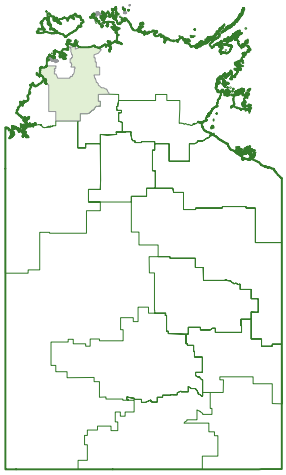
Pastoral District	AG[1] Growth Percentile	% PD[2] Burnt	% Pastoral District with category of Bare Soil[3]				Site Data			Summary of Pastoral District
			minor	moderate	high	very high	#[4] stations	condition class	#[5] sites	
Sturt Plateau	52	10	68	29	3	0	3	Good	12	Above average seasonal quality in much of the north of the district and below average in the south west, based on modelled pasture growth. Approximately 1800km2 burnt in November 2014. Minor occurrence of elevated amounts of bare soil and its presence influenced by recent fire and poor seasonal quality. Monitoring sites and majority of area on three stations in mostly good condition. Limited erosion and few weeds detected.
								Fair	3	
								Poor	0	
Roper	32	74	51	40	8	1	0	N/A		The eastern half experienced poor seasonal quality based on expected wet season pasture growth. Seasonal conditions were close to average in the west and south west. Extensive fire in late 2014 and mid-2015. Minor to moderate amounts of bare soil with enlarged areas related to recent fire. No on-ground monitoring.
Gulf	28	14	44	44	11	1	2	Good	0	Poor seasonal quality, based on modelled pasture growth, adjacent to the Gulf coast and extending up to 150 km inland. Seasonal conditions closer to the long-term average in the south west of the pastoral district. Vegetation cover temporarily decreased by recent fire with main fire activity in late 2014 and April-May 2015. Minor to moderate amounts of bare soil, partly related to recent fire history. Rugged terrain and heavily timbered country common to both leases. More accessible country in mostly poor or fair condition as indicated by information collected at monitoring sites.
								Fair	2	
								Poor	9	

Pastoral District	AG[1] Growth Percentile	% PD[2] Burnt	% Pastoral District with category of Bare Soil[3]				Site Data			Summary of Pastoral District
			minor	moderate	high	very high	#[4] stations	condition class	#[5] sites	
Barkly	62	3	26	38	32	4	4	Good	18	Simulated pasture growth, as an indicator of seasonal quality, was above average in the north west and centre of the region. Areas of poor seasonal quality in the south east and north east. Minor to moderate amounts of bare soil. Bare soil more common in the south east, coincident with poorer seasonal quality. On-ground monitoring conducted in the western part of the district where most sites and the majority of the pastorally most productive country judged to be in good condition. Areas of rubber bush on three leases which are actively being controlled.
								Fair	4	
								Poor	0	
Tennant Creek	63	3	1	32	61	6	4	Good	12	Higher rainfall and much above average modelled pasture growth in the north west. Average to above average seasonal quality on most other pastoral leases. Extensive wildfire in 2011 and 2012 which continues to have a legacy effect on increased levels of remotely sensed bare soil. Moderate amounts of bare soil, particularly in spinifex country in the east of the region. Majority of productive country on most leases considered in fair condition with smaller areas (particularly on one station) in good condition. Areas of parkinsonia and rubber bush. Work continuing to reclaim historically eroded alluvial country on one station.
								Fair	8	
								Poor	5	
Plenty	57	0	0	9	66	25	0	N/A		Mainly average to above average seasonal quality based on modelled pasture growth. High to very high levels of bare soil, particularly in the east and south east. Bare soil related to extensive wildfire in 2011 and 2012 and recent very dry years. No on-ground monitoring.

Pastoral District	AG[1] Growth Percentile	% PD[2] Burnt	% Pastoral District with category of Bare Soil[3]				Site Data			Summary of Pastoral District
			minor	moderate	high	very high	#[4] stations	condition class	#[5] sites	
Northern Alice Springs	65	1	0	34	61	5	5	Good	18	Above average seasonal quality across much of the pastoral district based on modelled pasture growth. Moderate to high levels of bare soil with increased bare soil partly corresponding with extensive wildfire in 2011 and 2012. Areas of country in good or fair condition on all leases. Smaller areas in poor condition, often due to historic erosion and pasture degradation.
								Fair	15	
								Poor	20	
Southern Alice Springs	49	0	0	5	53	42	3	Good	4	Areas close to Alice Springs and near the South Australian border experienced better seasonal conditions. Poor seasonal quality in the far south west. High to very high levels of bare soil, particularly fringing the Simpson Desert and on areas of open calcareous and alluvial country. Increased amounts of bare soil partly related to legacy effects of extensive wildfire in 2011 and 2012. Majority of monitoring sites assessed in poor condition. Broader areas of productive country on three stations judged in mainly fair condition. Smaller areas in either poor or good condition. Thickening of woody species a feature of some calcareous and sandy country although partly checked by heavy browsing in some areas.
								Fair	8	
								Poor	14	

1. AussieGRASS-modelled pasture growth for the period November 2014 to April 2015 as a percentile of the modelled growth for all previous summers. Percentile values available for Australia on a 5 km2 grid. Value is the spatial average of all grid-cell values in the pastoral district.
2. Percentage area of pastoral district burnt between October 2014 and September 2015. Fire scars sourced from the North Australian Fire Information website (www.firenorth.org.au/nafi3). Repeat fires in the Darwin Pastoral District means that cumulative burnt area is greater than the area of the pastoral district.
3. The area of bare soil present between September and November 2015, as a percentage of the area of the pastoral district. Bare soil is derived from Landsat satellite imagery where the fractions of photosynthetic (green) vegetation, non-photosynthetic vegetation (dry vegetation and litter) and bare soil are estimated in each 30 m2 square pixel (900 m^2 or 0.09 ha). Categories of bare soil are: minor, ≤20% of pixel is bare soil; moderate, 21% - 40% bare soil in pixel; high, 41% - 60% bare soil in pixel; and very high, >60% of pixel is bare soil. The number of pixels in each category are counted, multiplied by pixel area (0.09 ha) and converted to the percentage of pastoral district area.
4. Number of stations visited in the pastoral district.
5. Number of sites in each condition class monitored in the pastoral district.

DARWIN PASTORAL DISTRICT



Map 3: Location of Darwin Pastoral District

Seasonal quality was spatially variable across the district – being better in the north, north west and far south, and poor in the centre, based on AussieGRASS-modelled pasture growth.

The region experienced extensive and frequent fire and the Landsat record shows where vegetation cover is suppressed by recent fire. Minor amounts of bare soil detected based on remote sensing. The majority of ground sites visited across the eight properties inspected were in good condition. Based on visual inspection, the majority of country on most properties was judged to be in good or fair condition. Sections of some tracks and creeks were eroded, mainly by gullying. Weeds, where present, included mimosa (*Mimosa pigra*), rubber bush (*Calotropis procera*) and hyptis (*Hyptis sauveolens*).

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 1) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

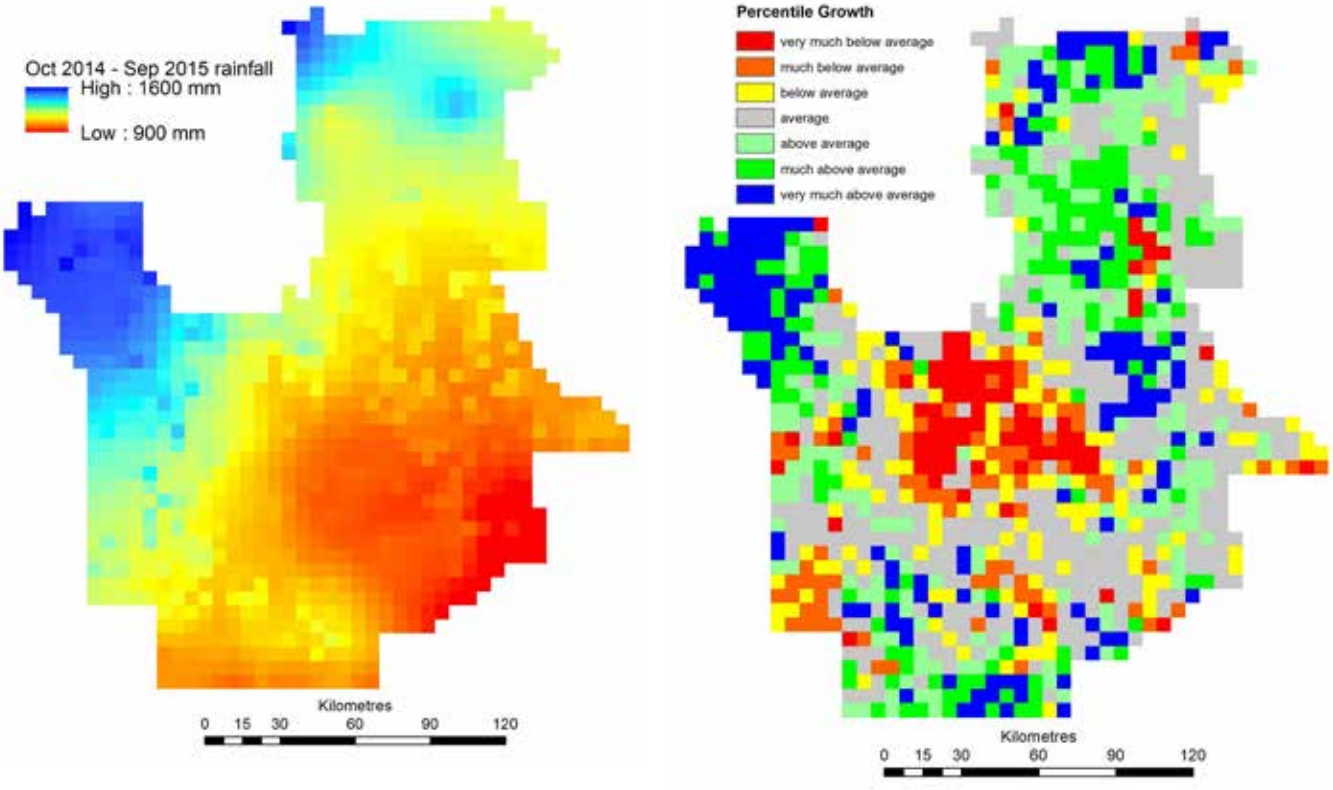
Rainfall (mm)		AussieGRASS	
2014 - 2015	1163	Growth (kg/ha)	1923
Long term medium	1262	Percentile	55

Table 1: Indicators of seasonal quality. Data spatially averaged for the Darwin Pastoral District.

DARWIN PASTORAL DISTRICT

Spatially averaged rainfall for the Darwin Pastoral District was 100 mm below the long-term median (Table 1). Rainfall decreased from the coast inland in a south easterly direction (Figure 1, left-hand panel), in line with the usual wet season pattern for this far northern part of the NT.

Modelled pasture growth over the last summer was close to average based on the spatial mean (Table 1). Tipperary, Mount Bundey and Douglas stations had much below average modelled growth (Figure 1, right-hand panel). Seasonal conditions, based on simulated pasture growth, were better in the north and north west, and in the far south of the pastoral district.



Spatially interpolated rainfall
October 2014 - September 2015

Simulated summer pasture growth
as a percentage of the long term record

Figure 1: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 45,187 km^2 burnt between October 2014 and September 2015. This was an area larger than the actual pastoral district and resulted from some areas burning in late 2014 being burnt again by September 2015. Wildfire was most extensive in October 2014 (Figure 2) with the next peak of fire activity in May-June 2015.

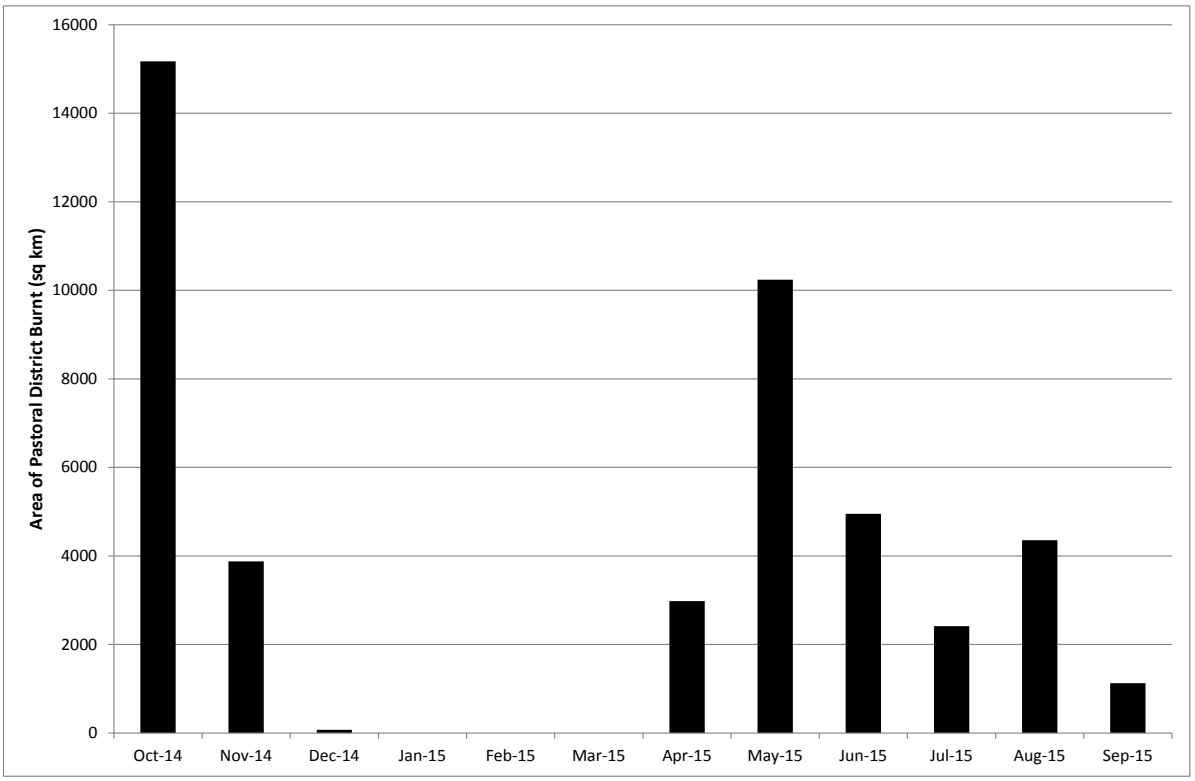


Figure 2: Monthly area burnt (km^2) in the Darwin Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 square Landsat pixel (or 0.09 ha) was used to report the amount of bare soil across all pixels in the Darwin Pastoral District.

Areas of reduced vegetation cover, compared with the last 27 years, across much of the Darwin Pastoral District were associated with recent fire (Figure 3, burnt areas shown with diagonal hatching). However, fire did not always suppress vegetation cover, relative to past levels, probably because fire is a recurrent (almost annual) event in the Darwin region or the most recent fire was less damaging to vegetation cover than past fires. Ignoring fire effects on the dynamics of vegetation cover, much of the eastern part of the pastoral district had relatively less cover in late 2015 compared with the same period back to 1988. Parts of the south western area had relatively more vegetation cover when compared with its recent history.

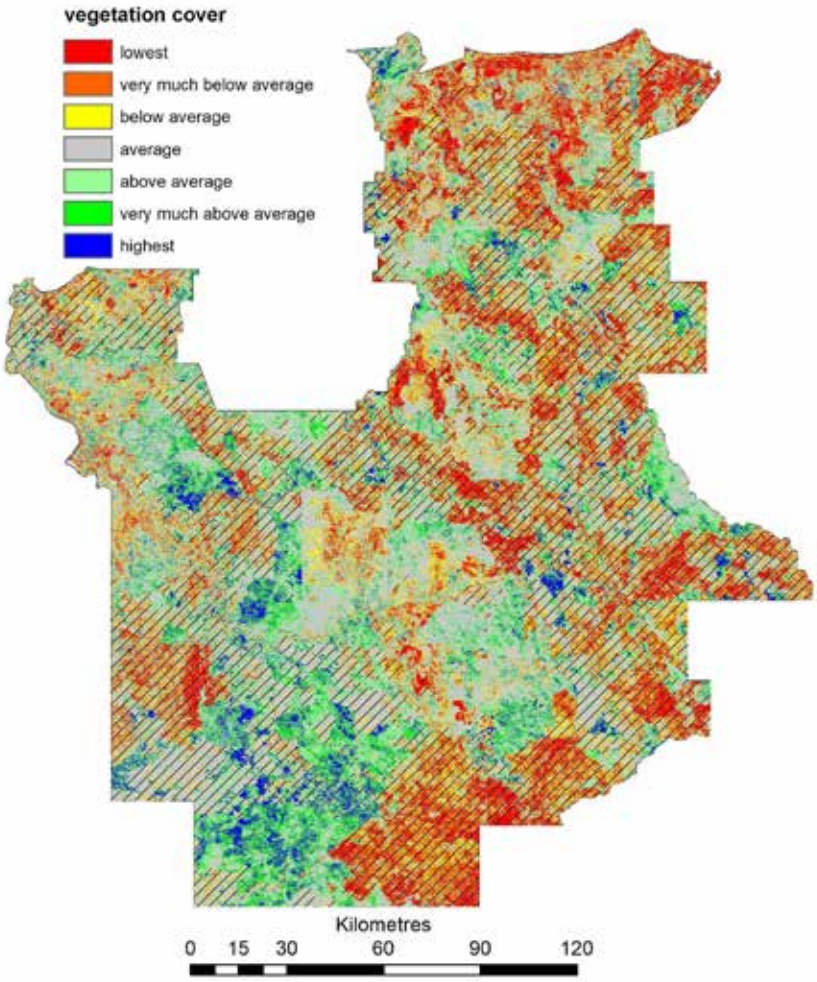
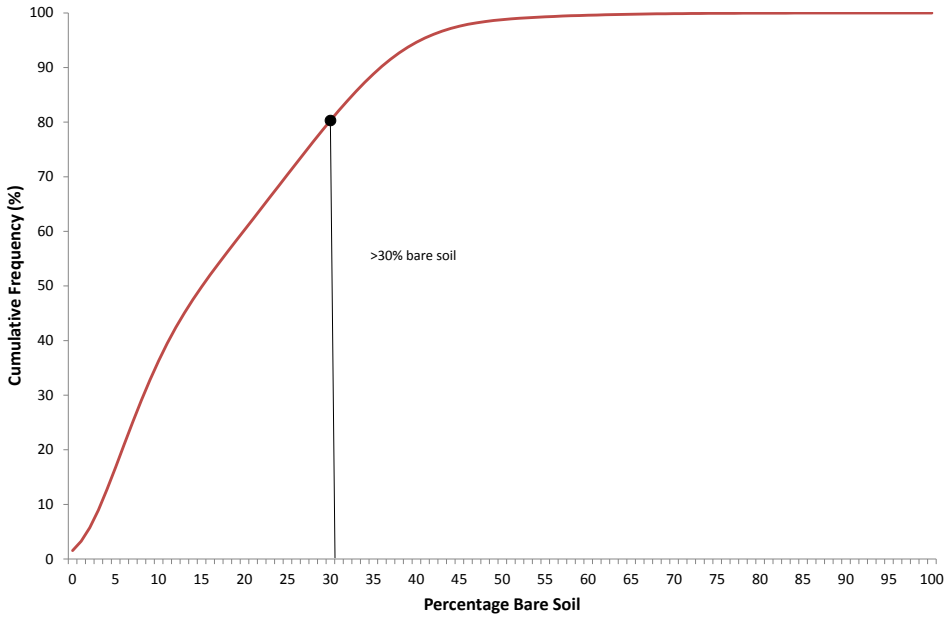


Figure 3: Rank of the amount of remotely-sensed vegetation cover present from September - November 2015 against that for previous years back to 1988.

Diagonal lines show those areas burnt January - November 2015.

A little more than one third of the pastoral district had minor amounts of bare soil (<10% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 4). Seventy percent of the region had <25% bare soil per pixel. One fifth of the pastoral district had >30% bare soil in each Landsat pixel with this latter area mapped in Figure 6. It includes areas burnt earlier in 2015.

Figure 4: Percentage cumulative frequency of varying levels of bare soil in 900 m^2 Landsat pixels in the Darwin Pastoral District September - November 2015. Areas with greater than 30% bare soil are mapped in Figure 5.



DARWIN PASTORAL DISTRICT

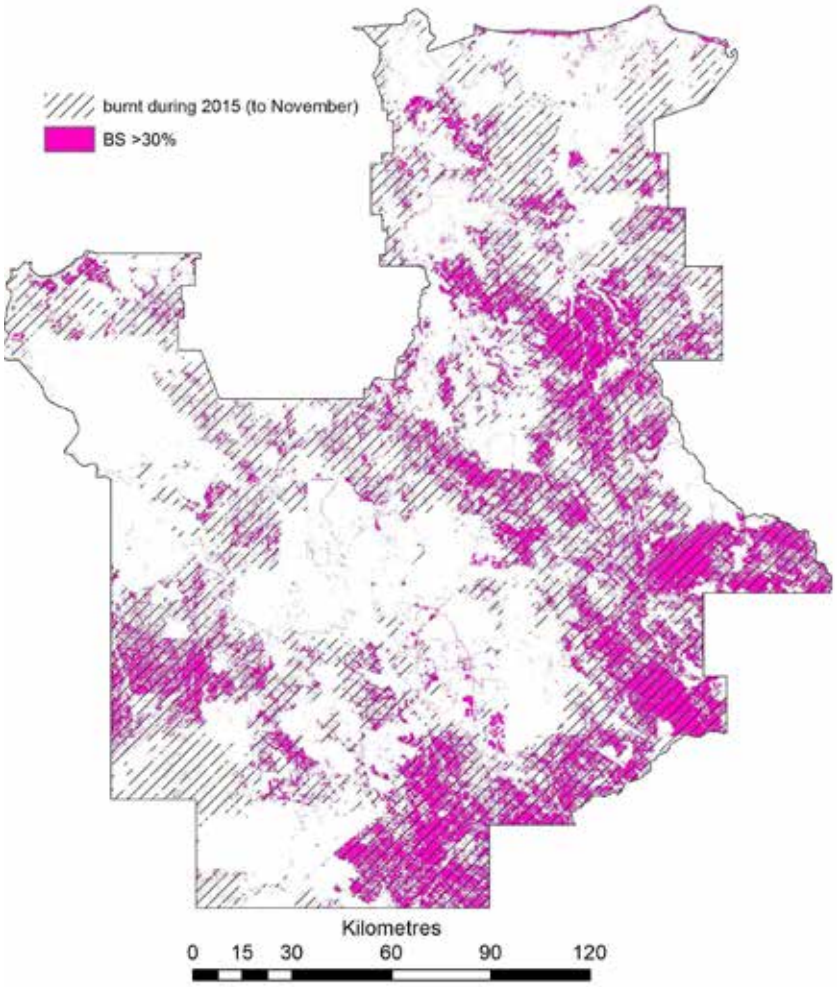


Figure 5: Parts of the Darwin Pastoral District having more than 30% bare soil (BS) per Landsat pixel in late 2015. Areas burnt January - November 2015 are shown with diagonal lines.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

Site-based monitoring

Eight pastoral leases in the Darwin Pastoral District, comprising 39% of the pastoral district area, were visited during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 30 sites across the eight leases. Sites, on average, had a good cover of perennial grasses, a moderate amount of litter and very small amounts of annual grass (Figure 6). The cover of forbs was quite variable being barely present on most sites but as high as 22% and 48% at two sites on one station. Three sites had increased amounts of bare soil as they were burnt prior to being monitored.

DARWIN PASTORAL DISTRICT

Perennial grasses are important because they protect the soil surface against wind and water erosion and, where palatable, provide persistent forage to carry livestock through dry times. Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

The majority of sites (60%) had moderate or heavy levels of grazing (Table 2), although this assessment was partly mitigated by most stations being visited later in the dry season when increased pasture utilisation is expected. There was minimal evidence of erosion at monitoring sites (Table 2).

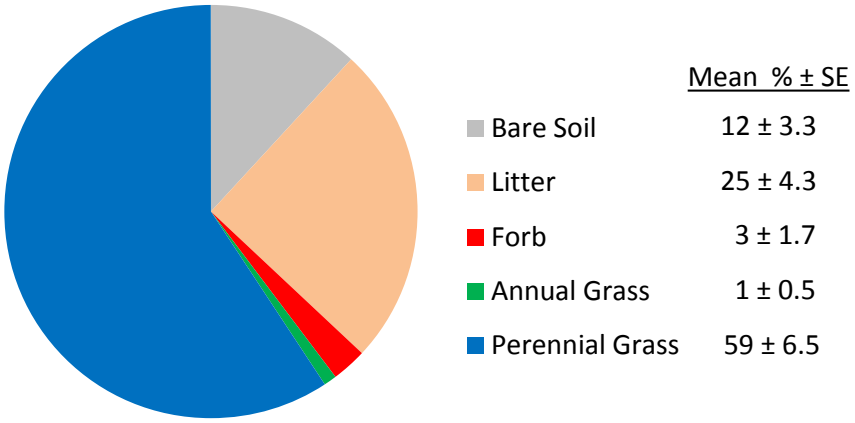


Figure 6: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 30 sites on eight pastoral leases in the Darwin Pastoral District.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
Not recorded		Wind	
Minimal	40	Scalding	3
Moderate	13	Water sheeting	
Moderate to heavy	17	Gullying	3
Heavy	30		

Table 2: Levels of pasture utilisation and evidence of erosion assessed at 30 sites on eight pastoral leases in the Darwin Pastoral District.

Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 3.

To the extent possible, these assessments are independent of the variable seasonal quality across the Darwin Pastoral District during 2014-15 (described above).

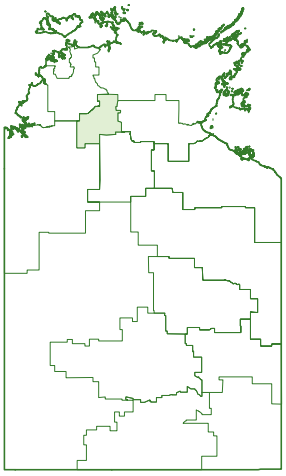
DARWIN PASTORAL DISTRICT

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 5 sites	General station area judged to be in good condition, consistent with the rating applied to all sites. Pastures dominated by perennial grasses of intermediate grazing value in accord with mapped land systems. No serious weed or erosion issues detected.
2	Good: 2 sites Fair: 2 sites Further site burnt, condition indeterminate	Corresponding with site assessments, the majority of the property was considered to be in good to fair condition. Small areas in poor condition. Most pastures were dominated by perennial grasses of moderate to high grazing-value. Erosion noted on some old tracks and along fence lines. Work continuing to control mimosa (*Mimosa pigra*).
3	Fair: 3 sites	Station considered in mostly fair condition. Good ground cover but comprising weed species rubber bush (*Calotropis procera*), mimosa (*Mimosa pigra*) and hyptis (*Hyptis sauveolens*) in many areas. Gully erosion evident along tracks and creeks in some areas.
4	Good: 4 sites	Lease in mostly good condition with areas in fair condition. Pastures dominated by grasses of moderate to high grazing value. Significant infestations of mimosa (*Mimosa pigra*). Some previously cleared areas have dense regrowth of pandanus palms. Erosion present on sections of old tracks and some fence lines.
5	Fair: 1 site	Not possible to access parts of the lease. Those areas visited assessed to be fair to poor condition. Managed part of the station heavily grazed with unpalatable northern wanderrie grass (*Eriachne obtusa*) dominant in the sparse pasture. Palatable perennial grasses present in pastures on less used areas, being grazed mainly by a variety of feral animals. Sections of track overgrown and eroded into deep gullies.
6	Good: 1 site Fair: 2 sites Poor: 1 site	Station in generally fair condition with good ground cover, except where recently burnt, and grasses of moderate to low grazing value present in the pasture. Erosion present on some old tracks and sections of fence lines.
7	Good: 2 sites Fair: 1 site	Property in good to fair condition. Pastures dominated by grasses of moderate to high grazing value. Infestations of mimosa (Mimosa pigra) present on the margins of water sources (lagoons, billabongs and floodplains). Dense regrowth of pandanus palms on some previously cleared areas. Sections of old tracks and some fence lines eroded.
8	Good: 5 sites	Most sites located on seasonally inundated, open floodplains. Lease in good condition with pastures dominated by perennial grasses of moderate to high grazing value. Restricted areas of weeds and erosion.

Table 3: Assessed land condition at monitoring sites and traversed parts of eight pastoral leases in the Darwin Pastoral District.

KATHERINE PASTORAL DISTRICT

Seasonal quality was below average in the east and north of the district, and average or better elsewhere, as indicated by AussieGRASS-modelled pasture growth.



Map 4: Location of Katherine Pastoral District

The region experienced extensive fire with 57% of the pastoral district burnt between October 2014 and September 2015. Most (70%) of the region had minor occurrence of bare ground late in the 2015 dry season. Two thirds of measured sites over the four properties inspected were assessed to be in good condition. Beyond monitoring sites, visual inspection of broader areas indicated that the majority of one lease was in good condition, two other leases were in generally fair condition and a fourth property was in fair to poor condition. All properties had weed-infested areas including bellyache bush (*Jatropha gossypiifolia*), grader grass (*Themeda quadrivalvis*), hyptis (*Hyptis suaveolens*) or parkinsonia (*Parkinsonia aculeata*).

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 4) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

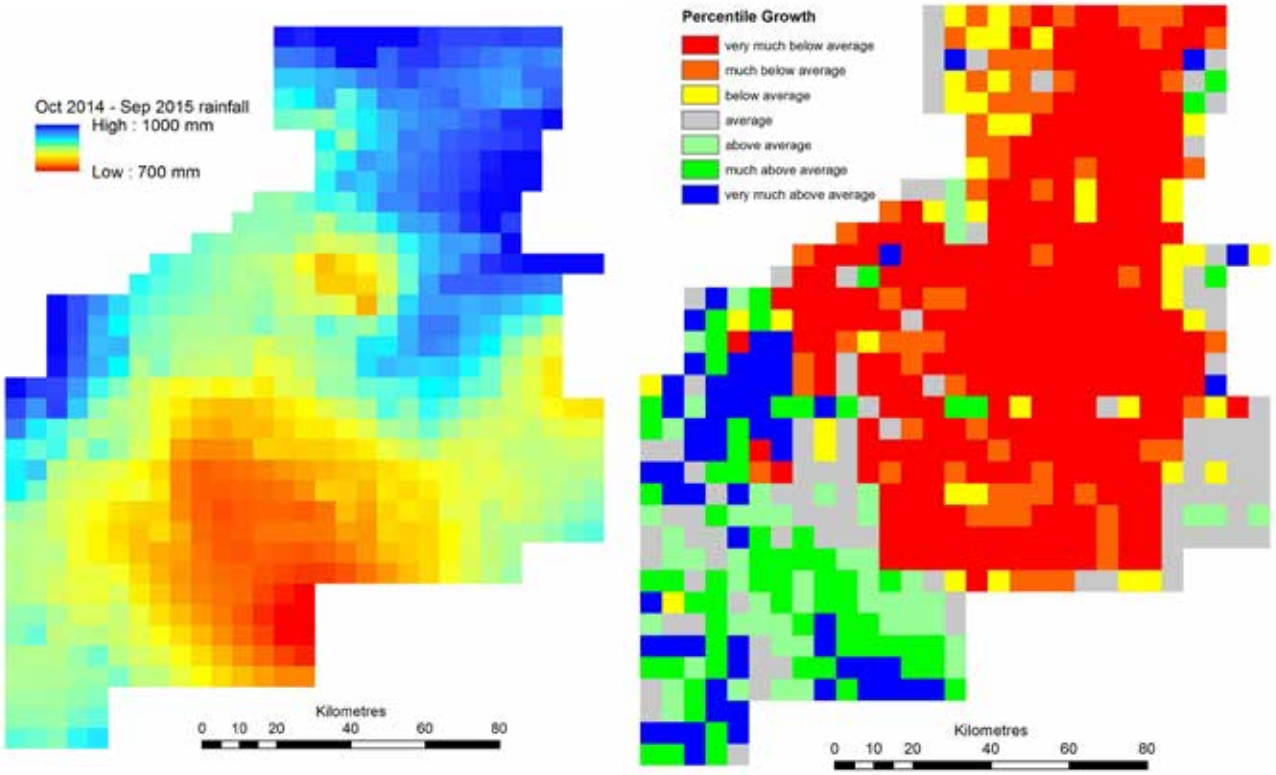
Rainfall (mm)		AussieGRASS	
2014 - 2015	853	Growth (kg/ha)	1964
Long term medium	900	Percentile	39

Table 4: Indicators of seasonal quality. Data spatially averaged for the Katherine Pastoral District.

KATHERINE PASTORAL DISTRICT

Spatially averaged rainfall for the Katherine Pastoral District was close to the long term median (Table 4). Rainfall increased from south to north across the region (Figure 7, left-hand panel). Dry River Station (in the north west of the Sturt Plateau Pastoral District neighbouring the Katherine district) had ~660 mm in the 12 month period and Edith Falls Ridge (north of Katherine) had 958 mm for the same period.

Modelled pasture growth over the last summer was below average based on the spatial mean (Table 4). Most of the eastern part of the district had much below average modelled growth (Figure 7, right-hand panel). Seasonal conditions were better in the south west based on simulated pasture growth.



Spatially interpolated rainfall
October 2014 - September 2015

Simulated summer pasture growth
as a percentage of the long term record

Figure 7: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 11,043 km^2 (57% of the district) burnt between October 2014 and September 2015. Fire was most extensive in October and November 2014 (Figure 8) suggesting wildfire was the main reason (as this is typically when wildfires started by lightning occur) with the next peak in fire activity between March and May 2015 probably being due to managed, early dry season burning.

KATHERINE PASTORAL DISTRICT

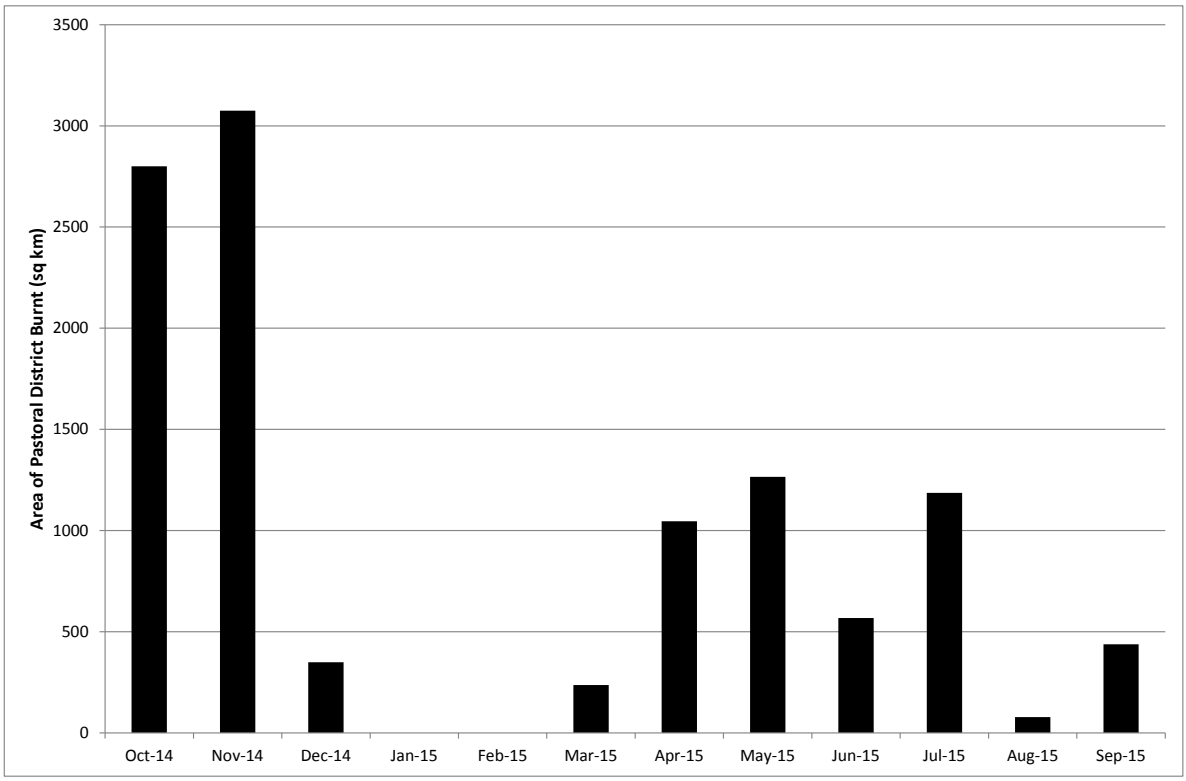


Figure 8: Monthly area burnt (km^2) in the Katherine Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense wet-season storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Katherine Pastoral District.

Recent fire contributed to reduced vegetation cover, compared with the last 27 years, across much of the Katherine Pastoral District (Figure 9, burnt areas shown with diagonal hatching). The pixel-level amount of vegetation cover present, relative to its recent history, was not exclusively depressed by fire, however, as some burnt areas had above-average cover compared to the past. Parts of the central southern area were characterised by their highest vegetation cover since 1988. Much of this response class had not burnt earlier in 2015.

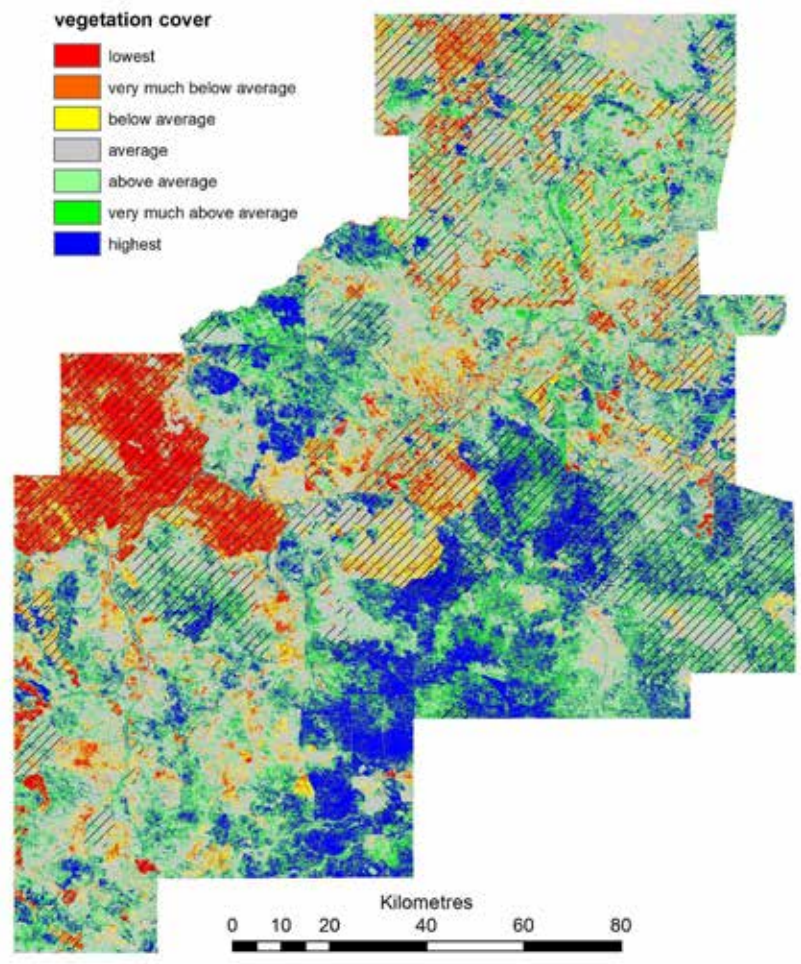


Figure 9: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988.

Diagonal lines show those areas burnt January - November 2015.

Forty percent of the pastoral district had minor amounts of bare soil (<10% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 10) and a further 30% of the region had <20% bare soil per pixel. Slightly more than 20% of the pastoral district had >25% bare soil in each Landsat pixel. This latter area is mapped in Figure 6 and includes areas burnt earlier in 2015.

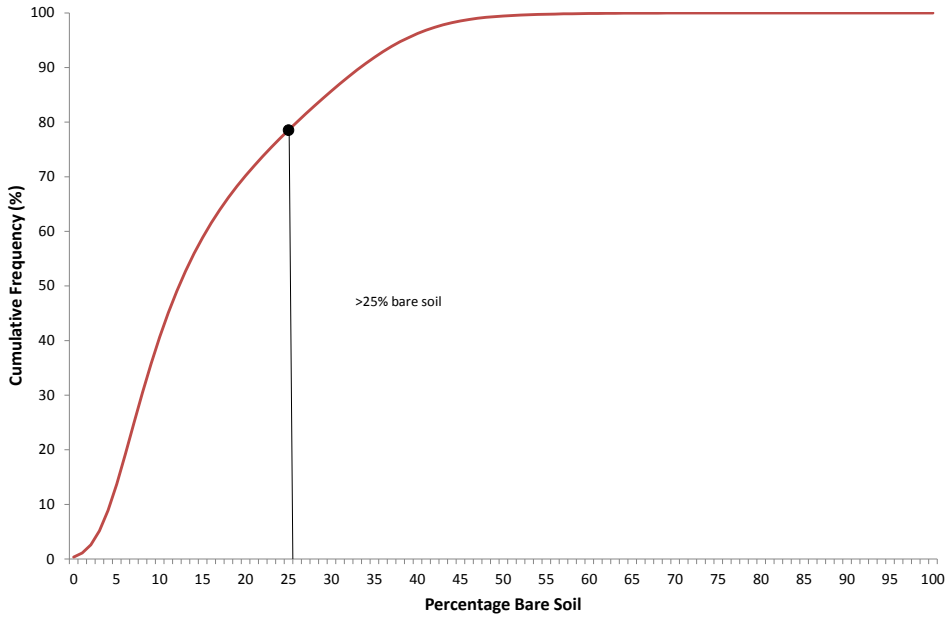


Figure 10: Percentage cumulative frequency of varying levels of bare soil in 900 m^2 Landsat pixels in the Katherine Pastoral District September - November 2015. Areas with greater than 25% bare soil are mapped in Figure 11.

KATHERINE PASTORAL DISTRICT

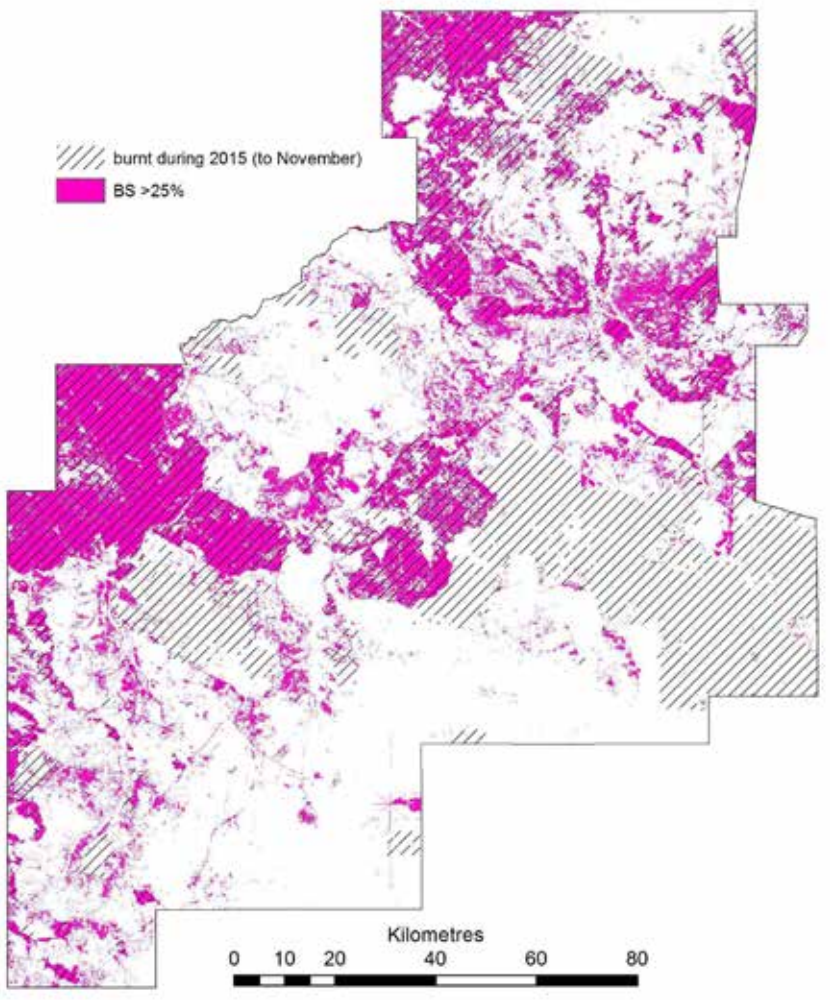


Figure 11: Parts of the Katherine Pastoral District having more than 25% bare soil (BS) per Landsat pixel in late 2015. Areas burnt January - November 2015 are shown with diagonal lines.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

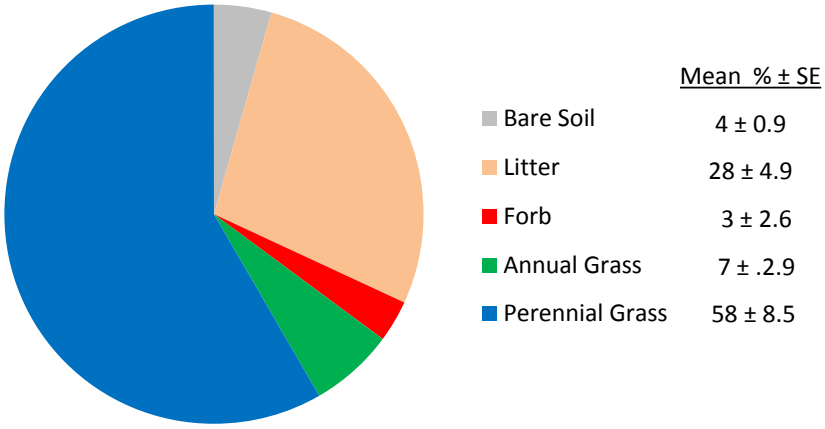
Site-based monitoring

Four pastoral leases in the Katherine Pastoral District, comprising 44% of the pastoral district area, were visited during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 12 sites across the four leases. Sites, on average, had a good cover of perennial grasses, a moderate amount of litter and small amounts of bare soil, annual grasses and forbs (Figure 12). Perennial grasses are important because they protect the soil surface against wind and water erosion and, where palatable, provide persistent forage to carry livestock through dry times. Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

KATHERINE PASTORAL DISTRICT

Figure 12: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 12 sites on four pastoral leases in the Katherine Pastoral District.



Seven of the 12 sites (58%) were rated as being minimally grazed (Table 5). One site showed evidence of gully erosion.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
Not recorded	8	Wind	
Minimal	58	Scalding	
Moderate	25	Water sheeting	8
Moderate to heavy	8	Gullying	
Heavy			

Table 5: Levels of pasture utilisation and evidence of erosion assessed at 12 sites on four pastoral leases in the Katherine Pastoral District.

Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 6.

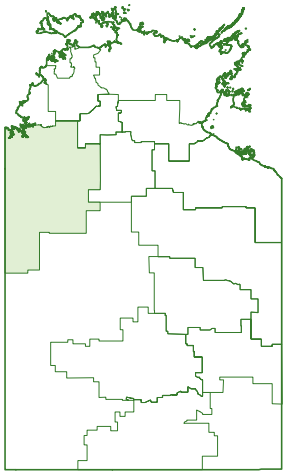
To the extent possible, these assessments are independent of the variable seasonal quality across the Katherine Pastoral District during 2014-15 (described above).

KATHERINE PASTORAL DISTRICT

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 3 sites	Much of the property is in good condition. High levels of pasture biomass and a predominance of desirable and intermediate grazing-value pasture species is present in most areas. Restricted areas of erosion and weeds, including bellyache bush (*Jatropha gossypiifolia*) and grader grass (*Themeda quadrivalvis*).
2	Poor: 1 site	General lease area in mostly fair condition. Palatable grasses lacking and range of weed species, including hyptis (*Hyptis suaveolens*), present. Continuous heavy stocking has generated bare areas on some parts of the station. Gully erosion evident along tracks and in some creek sections.
3	Good: 5 sites	The northern part of the property is in generally fair condition and most of the southern portion in good condition, apart from parts of smaller paddocks that are weed-infested. Weeds, particularly bellyache bush (*Jatropha gossypiifolia*), and erosion are contribute to areas of poor condition in the northern portion.
4	Fair: 2 sites Poor: 1 site	General station area considered to be in fair to poor condition. The presence of dense patches of black spear grass (*Heterpogon contortus*) or grader grass (*Themeda quadrivalvis*) in some areas indicates recent disturbance such as that associated with extended heavy stocking. In addition to grader grass, other weeds on parts of the property include bellyache bush (*Jatropha gossypifolia*) and parkinsonia (*Parkinsonia aculeata*).

Table 6: Assessed land condition at monitoring sites and traversed parts of four pastoral leases in the Katherine Pastoral District.

VRD PASTORAL DISTRICT



Map 5: Location of VRD Pastoral District

The VRD Pastoral District experienced variable seasonal quality based on expected pasture growth through the 2014-15 wet season.

Seasonal quality was below average in much of the north west of the district, above average in the south and closer to the long-term average elsewhere. Fires burnt moderately extensive areas in late 2014 and the early dry season of 2015. Based on remote sensing, moderate amounts of bare soil were present in the September-November period of 2015, mainly in the central and southern parts of the district. The occurrence of bare soil was related to extensive wildfire in 2011 and 2012. Sixty three monitoring sites were measured on 12 leases with most sites (79%) assessed to be in good condition. Similarly, much of the pastorally more productive country on most leases was judged to be in good condition with lesser areas in fair condition. Parkinsonia (*Parkinsonia aculeate*), prickly acacia (*Acacia nilotica*) or rubber bush (*Calotropis procera*) was recorded around some yards and waterpoints. Sections of some tracks were eroded through gullying.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 7) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

Rainfall (mm)	VRD North	VRD South
2014 - 2015	746	467
Long term medium	757	463

Table 7: Indicators of seasonal quality. Data spatially averaged for the VRD Pastoral District.

VRD PASTORAL DISTRICT

Spatially averaged rainfall for the northern and southern sections of the VRD Pastoral District was close to the long term median (Table 7). In the northern part of the region, there was a considerable north-to-south decrease in the spatial distribution of rainfall (Figure 13). Rainfall in the southern part of the pastoral district was more uniformly distributed, as indicated by the colour shading in Figure 13.

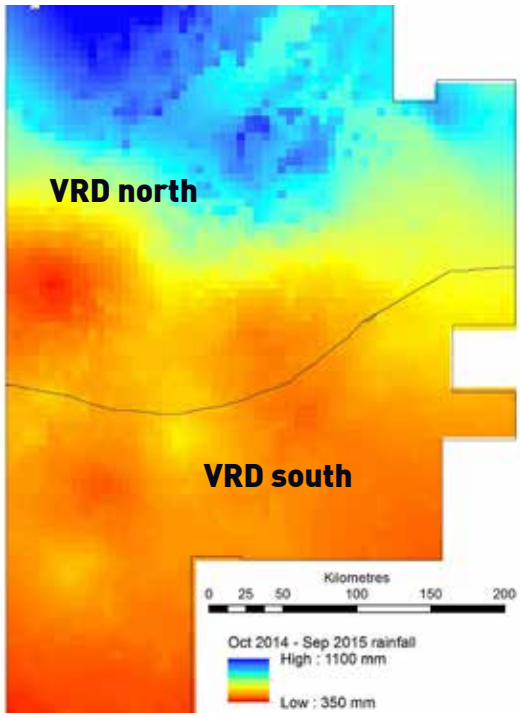


Figure 13: Spatially interpolated, gridded rainfall for the Victoria River Pastoral District. Reporting period is October 2014 to September 2015.

AussieGRASS-modelled pasture growth, as a second indicator of seasonal quality for the entire VRD Pastoral District, is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers back to 1957. In this case, spatially-averaged growth through the 2014-15 wet season was ~1640 kg/ha which was close to the long term median (Table 8).

Index of seasonal quality	VRD Pastoral District
Growth (kg/ha)	1639
Percentile	46

Table 8: Recent seasonal quality averaged across the entire VRD Pastoral District, as indicated by modelled pasture growth.

VRD PASTORAL DISTRICT

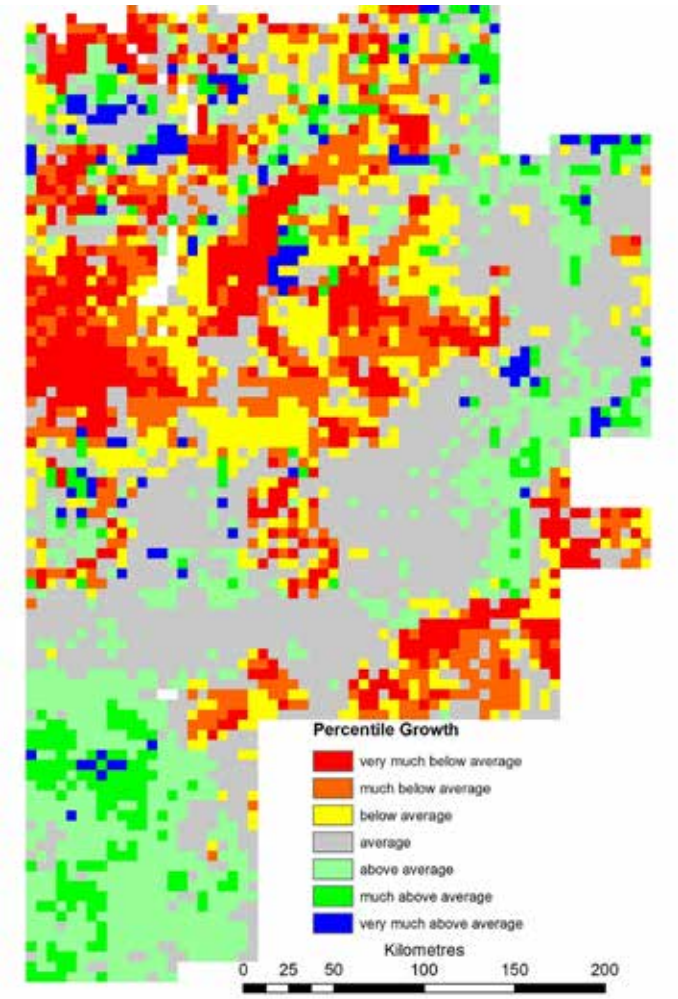


Figure 14: Simulated pasture growth for the 2014-15 wet season as a percentage of the long-term record.

Modelled pasture growth over the last summer, as a percentage of the long-term record, was above average in the far south of the pastoral district and predominantly below average in the northwest (Figure 14). An area adjacent to the Western Australian border had modelled growth much below the long-term average. Elsewhere, there was mixed seasonal quality: the central and north eastern region had predominantly average seasonal growth and the south east had either below average or above average modelled growth.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 35,268 km^2 (26.3% of the VRD Pastoral District) burnt between October 2014 and September 2015. Fire was most extensive in November 2014 (Figure 15; 11,177 km^2 burnt) suggesting wildfire was the main reason (as this is typically when wildfires started by lightning occur). The next greatest fire activity was in April and May 2015 and probably mainly due to controlled burning.

VRD PASTORAL DISTRICT

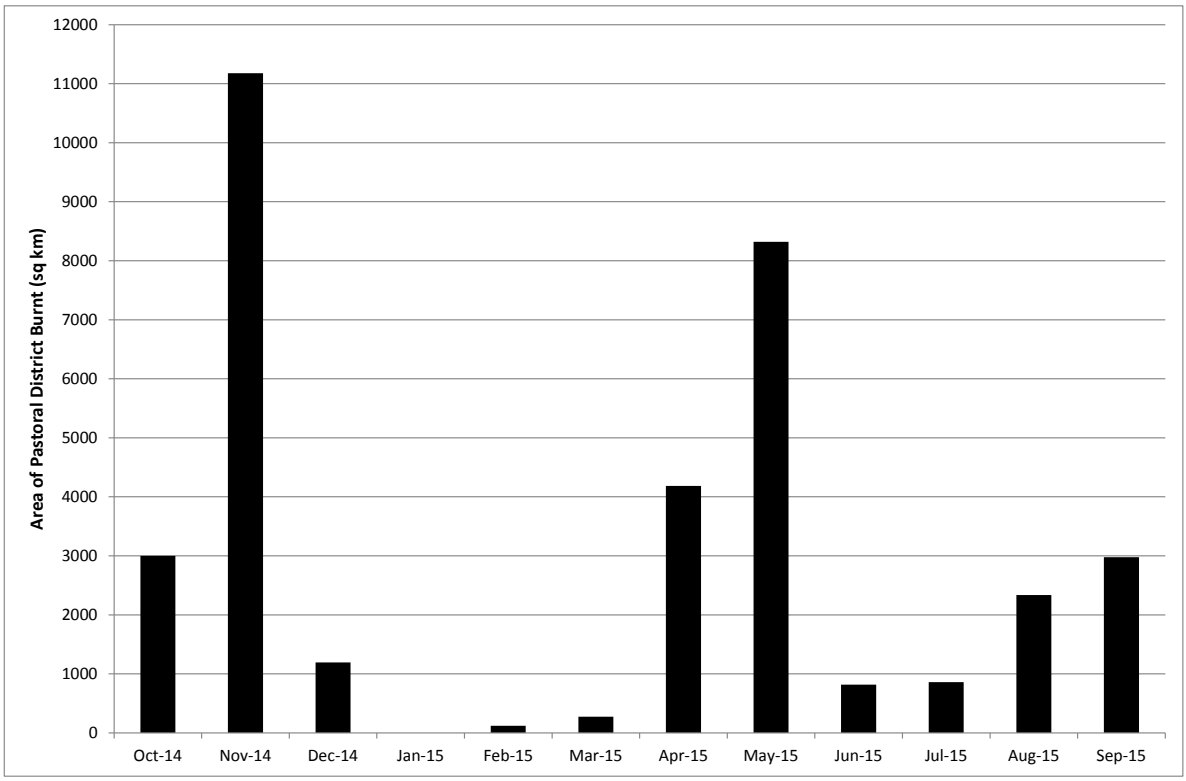


Figure 15: Monthly area burnt (km^2) in the Victoria River Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. Remote sensing was used to assess the amount of bare soil. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the VRD Pastoral District.

Recent fire contributed to reduced vegetation cover, compared with the last 27 years, across much of the northern section of the pastoral district and small parts of the southern VRD region (Figure 16). Elsewhere, there was broad spatial correspondence between historically ranked vegetation cover derived from remote sensing (Figure 16) and modelled wet season pasture growth (Figure 14).

Twenty percent of the pastoral district had minor bare soil (<20% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 17). Approximately 45% of the region had <30% bare soil with a little more than one quarter of the district having >40% bare soil. This latter area is mapped in Figure 18 and includes some of the country burnt in 2015 (until November).

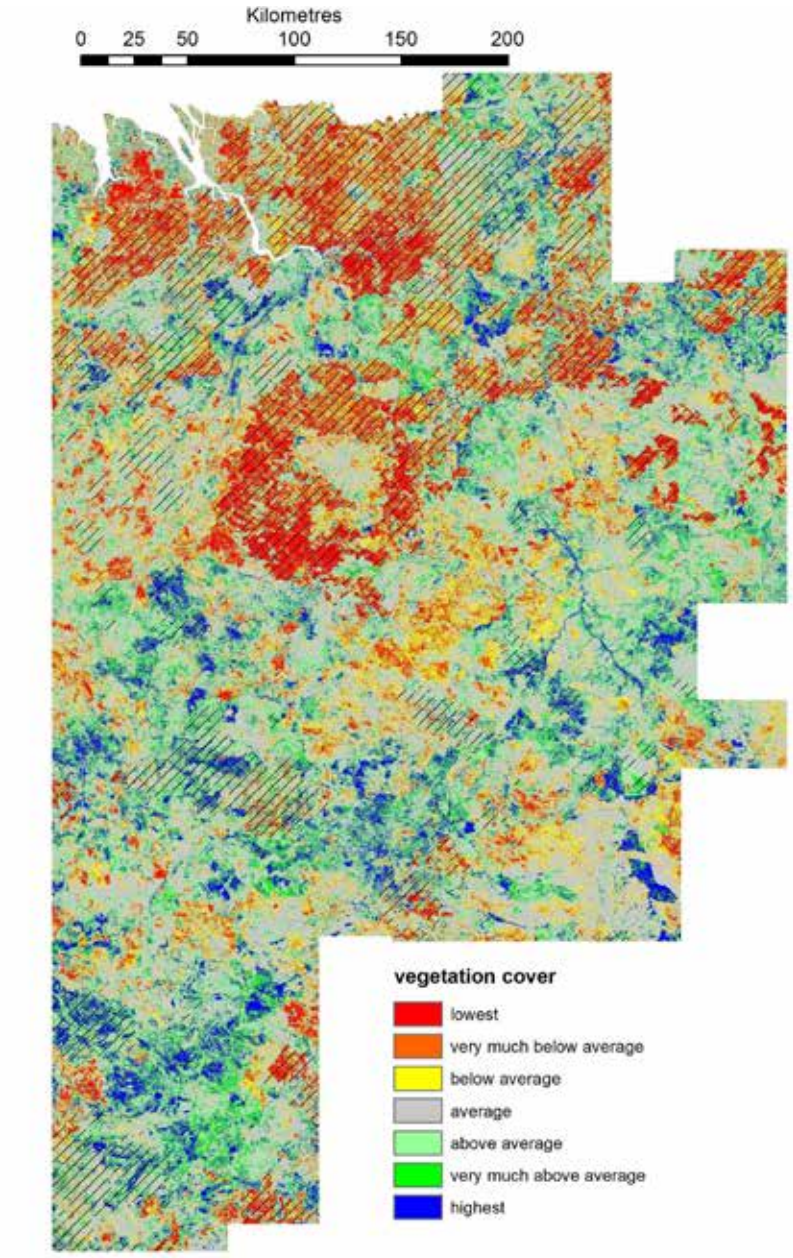


Figure 16: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

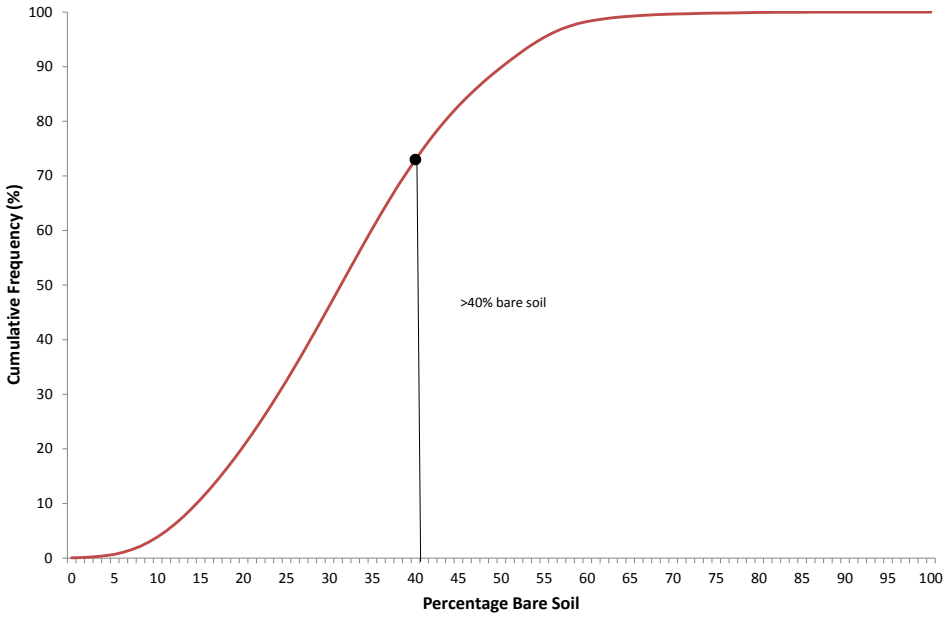


Figure 17: Percentage cumulative frequency of varying levels of bare soil in 900 m² Landsat pixels in the VRD Pastoral District between September and November 2015. Areas with greater than 40% bare soil are mapped in Figure 18.

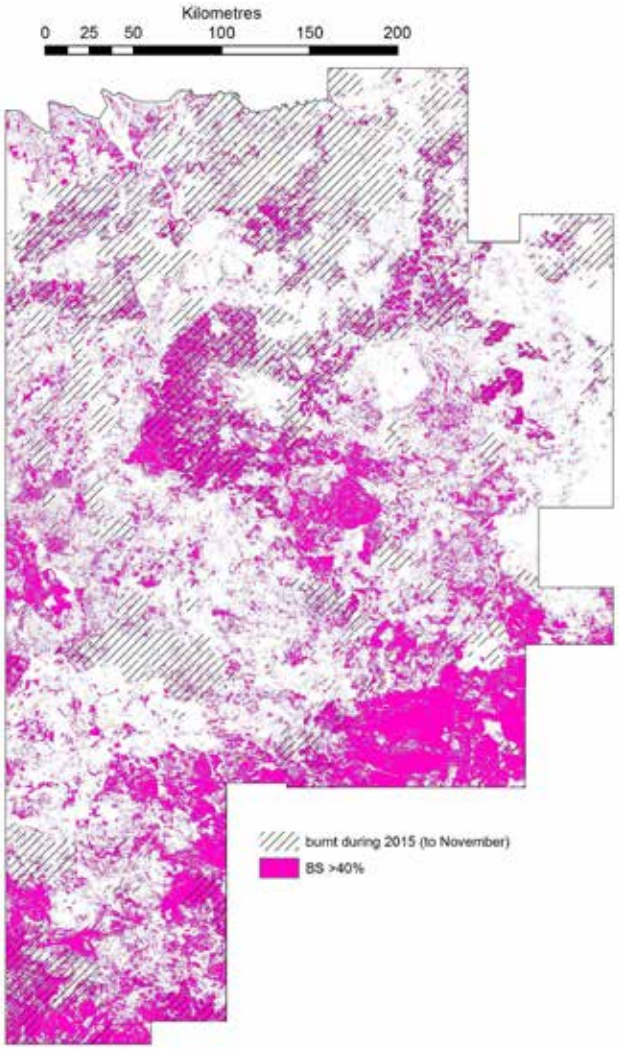


Figure 18: Parts of the VRD Pastoral District having more than 40% bare soil (BS) per Landsat pixel in late 2015. Areas burnt between January and November 2015 are shown with diagonal lines. Concentrated areas exceeding the 40% bare soil threshold in the south-east comprise desert country of low pastoral value. Extensive wildfires in 2011 and 2012, and lesser amounts of fire since, have reduced vegetation cover in this area.

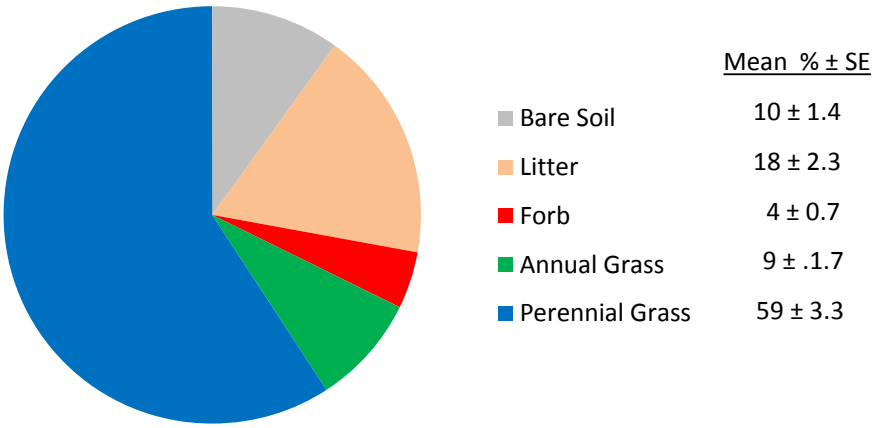
Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

Site-based monitoring

Twelve pastoral leases in the VRD Pastoral District, comprising 53% of the pastoral district area, were visited by DLRM Rangeland Monitoring Officers in the latter part of 2014 and during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 63 sites across the twelve leases. Sites, on average, had a good cover of perennial grasses, a small contribution of annual grasses, minor forbs and reasonable litter cover (Figure 19). Bare soil comprised about 10% of the 1 ha site area, on average. Perennial grasses are important because they protect the soil surface against wind and water erosion and, where palatable, provide persistent forage to carry livestock through dry times. Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

Figure 19: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 63 sites on 12 pastoral leases in the VRD Pastoral District.



Most sites were minimally grazed at the time of assessment (Table 9). Leases assessed later in the dry season were likely to have had a higher level of pasture utilisation due to the time elapsed since the end of the previous wet season growth event. Evidence of wind erosion was documented at two sites.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
Not recorded	11	Wind	2
No grazing	5	Scalding	
Minimal	41	Water sheeting	
Moderate	32	Gullying	
Moderate to heavy	22		
Heavy			

Table 9: Levels of pasture utilisation and evidence of erosion assessed at 63 sites on 12 pastoral leases in the VRD Pastoral District.

Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 10.

To the extent possible, these assessments are independent of the variable seasonal quality experienced across the region in the current reporting cycle (described above). Two pastoral leases were visited in late 2014 when rainfall for the 2013-14 wet season rainfall was above average.

VRD PASTORAL DISTRICT

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 2 sites Fair: 1 site	Much of the lease comprised of rugged country that is not commercially grazed. Utilised country had some desirable forage species as well as less palatable grasses. Mimosa bush (*Vachelia farnesiana*) was widely distributed but had not formed dense infestations. Other widespread weeds included hyptis (*Hyptis sauveolens*) and spiny-head sida (*Sida acuta*). Some tracks and sections of creeks were eroded into gullies.
2	Good: 8 sites	Majority of those parts of the station inspected were in good condition. A good biomass and cover of desirable perennial grasses in the pasture. Some areas where grasses of low grazing value present, mainly black speargrass (*Heteropogon contortus*) and feathertop wire grass (*Aristida inaequiglumis*).
3	Good: 2 sites Fair: 2 sites	Station mostly in good condition based upon monitoring sites and limited inspection elsewhere. Pastures had responded reasonably well to limited wet season rainfall in some areas, but ground cover was patchy across much of the property, allowing for the different land types present. Parkinsonia (*Parkinsonia aculeata*), rubber bush (*Calotropis procera*) and prickly acacia (*Acacia nilotica*) present at some yards and waterpoints. Some tracks and creek sections gully-eroded.
4	Good: 2 sites Fair: 2 sites	Those parts of the lease traversed were assessed to be in mainly fair condition, with a diversity of palatable perennial and annual grasses present on the more productive parts of the station. Large areas of prickly acacia, parkinsonia and mimosa bush growing around some bores, yards and along tracks. Few signs of active erosion. Vehicle access to parts of the station restricted due to tracks and fence lines not being recently maintained.
5	Good: 7 sites	Most of those parts of the station visited were assessed to be in good condition. Good pasture response to wet season rainfall. Generally high percentage of desirable perennial grasses with some areas having less desirable grasses present (black speargrass, *Heteropogon contortus* and wire grasses, *Aristida species*). Minimal evidence of weeds or active erosion.
6	Good: 6 sites	Station generally in good condition based on sites and inspection. Pastures on pastorally more productive country dominated by perennial grasses. Gully erosion noted in one part of the lease.
7	Good: 3 sites Fair: 1 site Poor: 1 site	Property generally in good condition. Pastures varied between areas with a good mix of palatable perennial grasses to areas dominated by cane grass (*Ophiuros exaltatu*), a species of low grazing value.

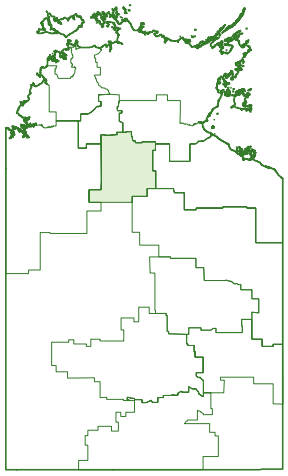
VRD PASTORAL DISTRICT

Station	Condition Rating	Comments with regard to pastoral lease
8	Good: 1 site Fair: 2 sites	Based on inspection and site data, the property was assessed to be in generally fair condition. Parkinsonia (Parkinsonia aculeata), rubber bush (*Calotropis procera*) and prickly acacia (*Acacia nilotica*) present across the property, mainly around yards and waterpoints. Gully erosion evident along some tracks and creeks.
9	Good: 4 sites	Lease in mostly fair condition. Good ground cover in most areas but lack of vegetation elsewhere, partly due past wildfire and limited summer rainfall. Parkinsonia (*Parkinsonia aculeata*), rubber bush (*Calotropis procera*) and prickly acacia (*Acacia nilotica*) present, mainly around yards and waterpoints. Some tracks and creek sections gully eroded.
10	Good: 6 sites	Vehicular access to much of the property restricted due to tracks not being maintained at the time of the monitoring visit. Those parts visited judged in good condition with a good response by pastures to preceding average wet season rainfall. Pastorally more productive country had a mix of perennial and annual grasses, including palatable species.
11	Good: 2 sites Fair: 1 site	Visual inspection of parts of the lease and site data confirms that most of the station is in good condition. Evidence of a satisfactory density of perennial, palatable and productive (3P) grasses (including golden beard grass, *Chrysopogon fallax*) despite moderate grazing when lease inspected late in the dry season. Parkinsonia (*Parkinsonia aculeate*) and rubber bush (*Calotropis procera*) present on the property.
12	Good: 7 sites Fair: 3 sites	Majority of lease traversed considered to be in good condition. A diversity of palatable perennial and annual grasses present with limited evidence of active erosion. Prickly acacia (*Acacia nilotica*) and mimosa bush (*Vachelia farnesiana*) present around some yards and bores. These weeds are actively being controlled.

Table 10: Assessed land condition at monitoring sites and traversed parts of 12 pastoral leases in the VRD Pastoral District.

STURT PLATEAU PASTORAL DISTRICT

Based on modelled pasture growth, the Sturt Plateau Pastoral District experienced above average seasonal quality in much of the north of the district and below average seasonal conditions in the south west.



Map 6: Location of Sturt Plateau Pastoral District

Approximately 1,800 km^2 burnt in November 2014 with a total of 4,326 km^2 (10% of the district) burnt between October 2014 and September 2015. There was minor occurrence of elevated amounts of bare soil with the locations of higher levels of bare soil influenced by recent fire and poor seasonal quality. Three stations in the Sturt Plateau Pastoral District were visited during this reporting season. Most monitoring sites and the majority of the area inspected were assessed to be in good condition. There was limited evidence of erosion and few weeds were detected.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 11) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

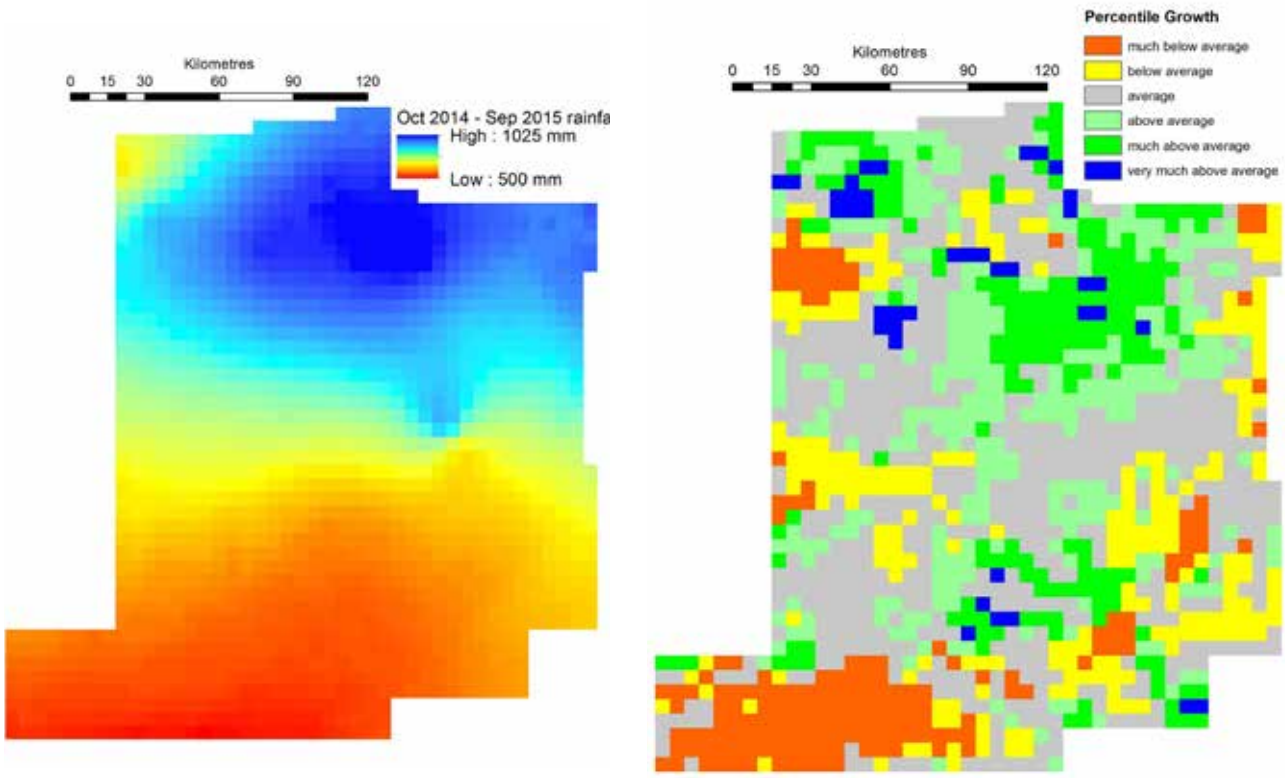
Rainfall (mm)		AussieGRASS	
2014 - 2015	736	Growth (kg/ha)	1852
Long term medium	634	Percentile	52

Table 11: Indicators of seasonal quality. Data spatially averaged for the Sturt Plateau Pastoral District.

STURT PLATEAU PASTORAL DISTRICT

Spatially averaged rainfall for the Sturt Plateau Pastoral District was greater than the long term median (Table 11). Rainfall increased from south to north across the region (Figure 20, left-hand panel) and was considerably greater than the spatial average in the north east. For example, Larrimah received 1047 mm in the 12 month period.

Modelled pasture growth over the last summer was average based on the spatial mean (Table 11). Growth reflected rainfall distribution, being mostly above average in the north and much below average in the south west (Figure 20, right hand panel). A small area in the north west of the region also experienced below average growth.



Spatially interpolated rainfall
October 2014 - September 2015

Simulated summer pasture growth
as a percentage of the long term record

Figure 20: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 4,326 km^2 (10% of the district) was burnt between October 2014 and September 2015. Fire was most extensive in November 2014 (Figure 21) suggesting wildfire as this is typically when wildfires started by lightning occur. The limited fire activity between March and May 2015 was probably due to managed, early dry season burning.

STURT PLATEAU PASTORAL DISTRICT

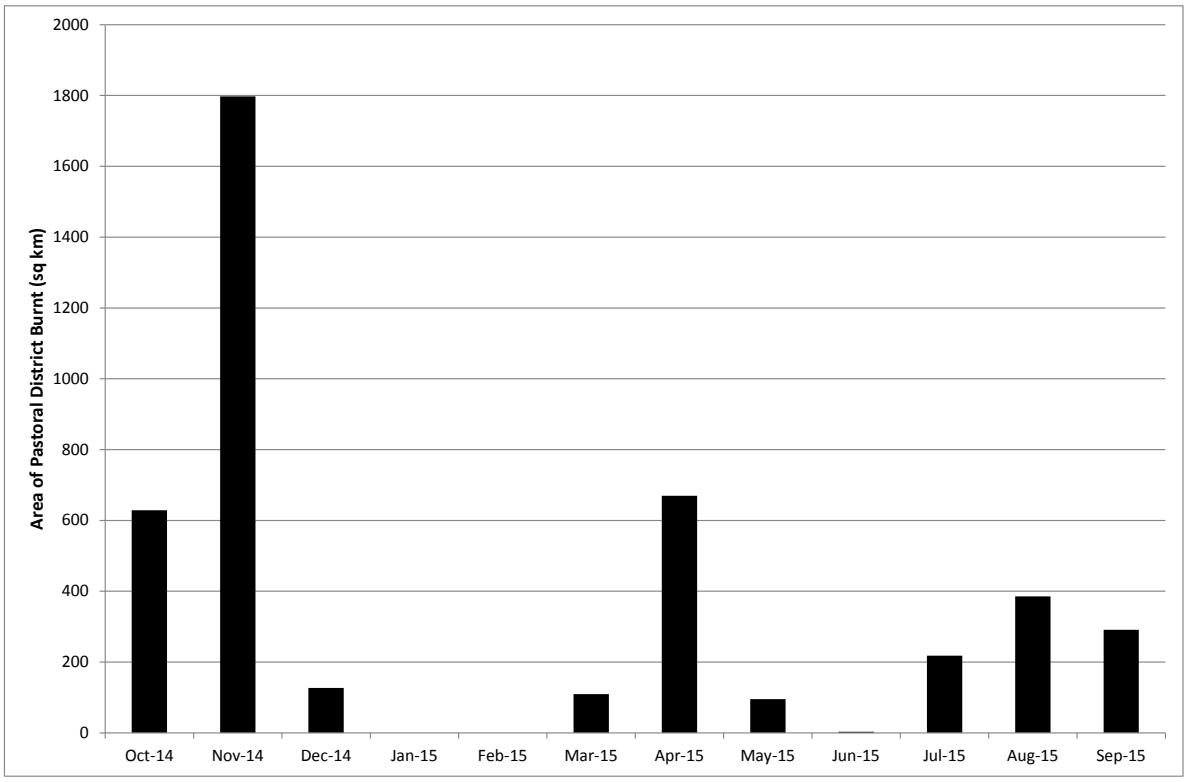


Figure 21: Monthly area burnt (km²) in the Sturt Plateau Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense wet season storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Sturt Plateau Pastoral District.

There were quite distinct boundaries between different categories of decile-ranked vegetation cover (Figure 22). This image depicts the amount of vegetation present in the late 2014 dry season relative to that present at the same time each year since 1988. Some areas of recent relatively lower vegetation cover, compared with the previous 27 years, correspond with fire prior to image acquisition (i.e. areas shown with diagonal lines). Other north-south and east-west boundaries align with pastoral tenure and are seemingly related to management influences on fires and grazing management as they affect vegetation cover.

STURT PLATEAU PASTORAL DISTRICT

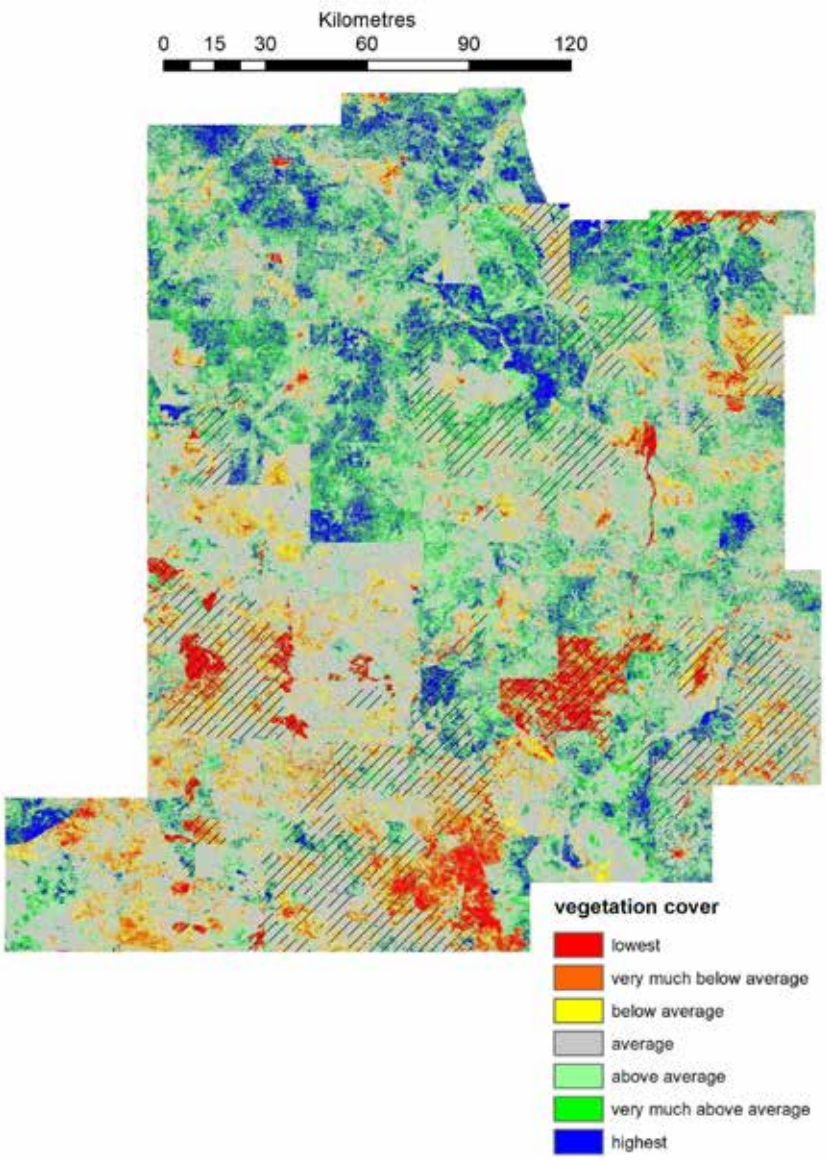
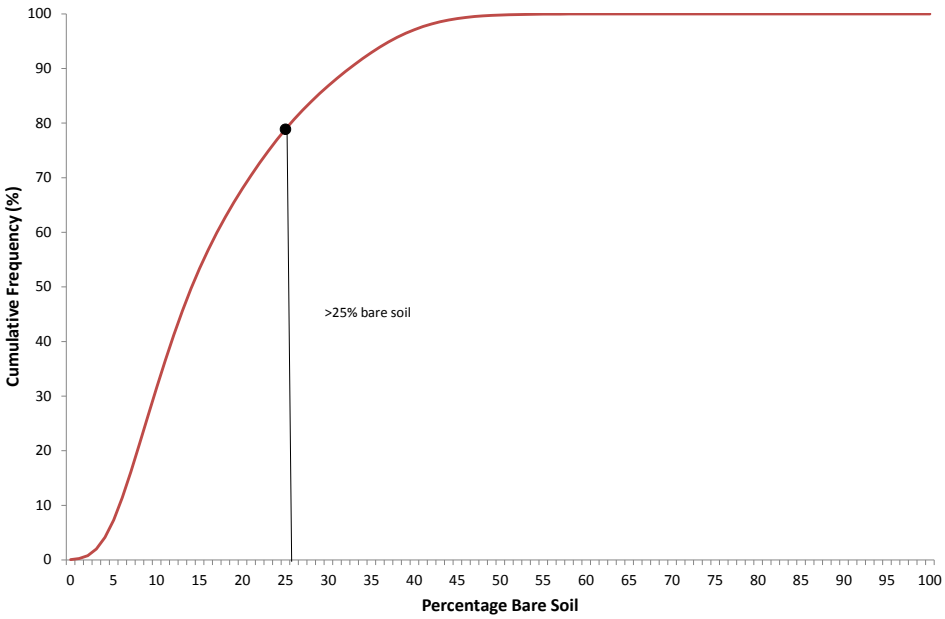


Figure 26: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

Approximately 30% of the pastoral district had negligible amounts of bare soil (<10% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 23). Almost 70% of the region had <20% (i.e. minor) bare soil. Slightly more than 20% of the pastoral district had >25% bare soil in each Landsat pixel. This latter area is mapped in Figure 24 and includes areas burnt earlier in 2015. Parts of pastoral leases not recently burnt in the south-west of the pastoral district had concentrated areas of >25% bare soil per Landsat pixel. This area aligns with the indicators of poor seasonal quality shown in Figure 20.

STURT PLATEAU PASTORAL DISTRICT

Figure 23: Percentage cumulative frequency of varying levels of bare soil in 900 m² Landsat pixels in the Sturt Plateau Pastoral District between September and November 2015. Areas with greater than 25% bare soil are mapped in Figure 24.



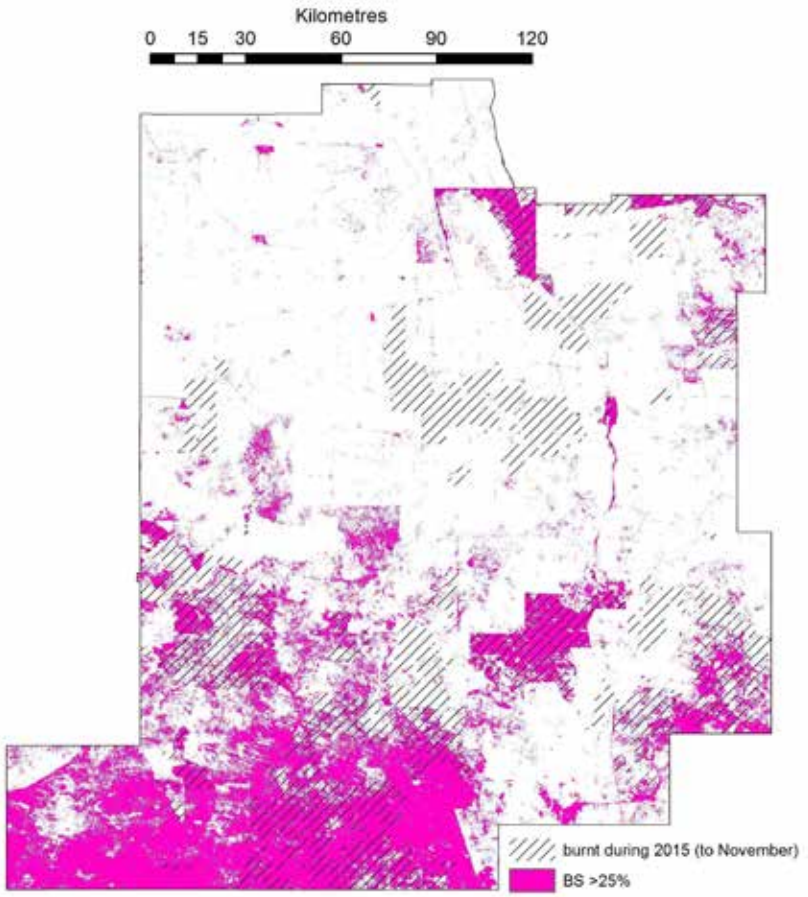


Figure 24: Parts of the Sturt Plateau Pastoral District having more than 25% bare soil (BS) per Landsat pixel in late 2015. Diagonal lines show areas burnt between January and November 2015.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

STURT PLATEAU PASTORAL DISTRICT

Site-based monitoring

Three pastoral leases in the Sturt Plateau Pastoral District, comprising 12% of the pastoral district area, were visited during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 15 sites across the three leases. Sites, on average, had a good cover of perennial grasses, small amounts of bare soil and litter and equal, but minor, contributions by annual grasses and forbs (Figure 25). Perennial grasses are important because they protect the soil surface against wind and water erosion and, where palatable, provide persistent forage to carry livestock through dry times. Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

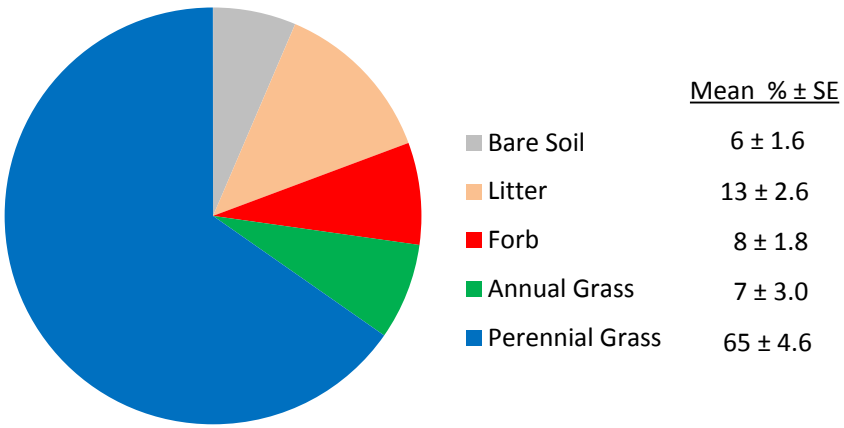


Figure 25: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 15 sites on three pastoral leases in the Sturt Plateau Pastoral District.

Ten of the 15 sites (67%) were rated as being minimally grazed (Table 12). Evidence of erosion was not recorded at any site.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
No grazing	27	Wind	
Minimal	67	Scalding	
Moderate	7	Water sheeting	
Moderate to heavy		Gullying	
Heavy			

Table 12: Levels of pasture utilisation and evidence of erosion assessed at 15 sites on three pastoral leases in the Sturt Plateau Pastoral District.

STURT PLATEAU PASTORAL DISTRICT

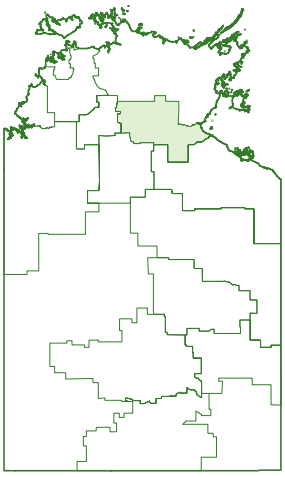
Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 13.

To the extent possible, these assessments are independent of the above average seasonal quality in the north of the pastoral district and poorer seasonal conditions in the south.

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 4 sites	Those parts of the lease inspected were assessed to be in generally good condition. Most pastures dominated by moderate to high grazing-value perennial grasses. Pastures recovered well from extensive fire in 2012. Restricted areas of gully erosion on some fence lines.
2	Good: 6 sites Fair: 3 sites	Property in good condition based on monitoring data and visual inspection of parts of the lease. A diversity of annual and perennial grasses present and few signs of active erosion. Individual plants of parkinsonia (*Parkinsonia aculeate*) are spread across the station.
3	Good: 2 sites	Station in generally good condition from site information and visual inspection. Many areas appear to have been minimally grazed in recent years with a high cover of robust and diverse grasses present. Some weeds present in previously cleared areas.

Table 13: Assessed land condition at monitoring sites and traversed parts of three pastoral leases in the Sturt Plateau Pastoral District.

ROPER PASTORAL DISTRICT



Map 7: Location of Roper Pastoral District

The eastern half of the district experienced poor seasonal quality based on expected wet season pasture growth (from AussieGRASS simulation). Seasonal conditions were close to average in the west and south west of the district. Extensive fires occurred in late 2014 and mid 2015.

Analysis of Landsat imagery indicates that minor to moderate amounts of bare soil were present in the late 2015 dry season. Enlarged areas of bare soil were related to recent fire. No on-ground monitoring was conducted in the Roper Pastoral District during this reporting season.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 14) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

Rainfall (mm)		AussieGRASS	
2014 - 2015	853	Growth (kg/ha)	1895
Long term medium	789	Percentile	32

Table 14: Indicators of seasonal quality. Data spatially averaged for the Roper Pastoral District.

ROPER PASTORAL DISTRICT

Spatially averaged rainfall for the Roper Pastoral District was a little above the long-term median (Table 14). Rainfall progressively decreased from the north west, then west to the east of the region (Figure 26, left-hand panel).

Modelled pasture growth over the last wet season was below average based on the spatial mean (Table 14). Most of the eastern part of the district had much below average modelled growth (Figure 26, bottom right-hand panel). Seasonal conditions, based on simulated pasture growth, improved in the south west to be on par with the long term record.

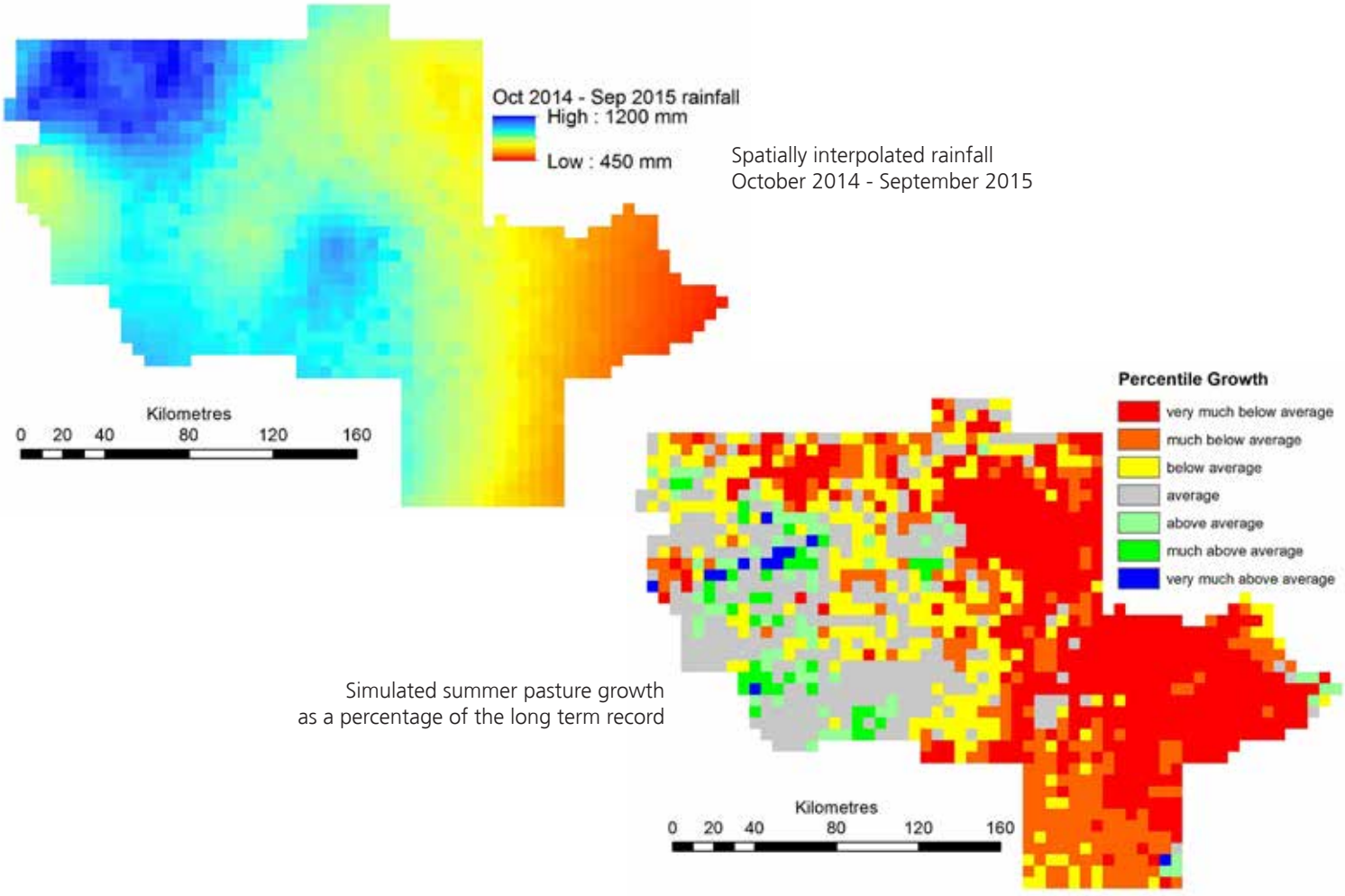


Figure 26: Maps of seasonal quality. Top left, gridded rainfall, October 2014 to September 2015; bottom right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 31,191 km^2 (74% of the district) burnt between October 2014 and September 2015. Fire was most extensive in October and November 2014 (Figure 27) suggesting wildfire (as this is typically when wildfires started by lightning occur) with May 2015 providing the next peak in fire activity. Some of this fire was probably due to managed, early dry season burning.

ROPER PASTORAL DISTRICT

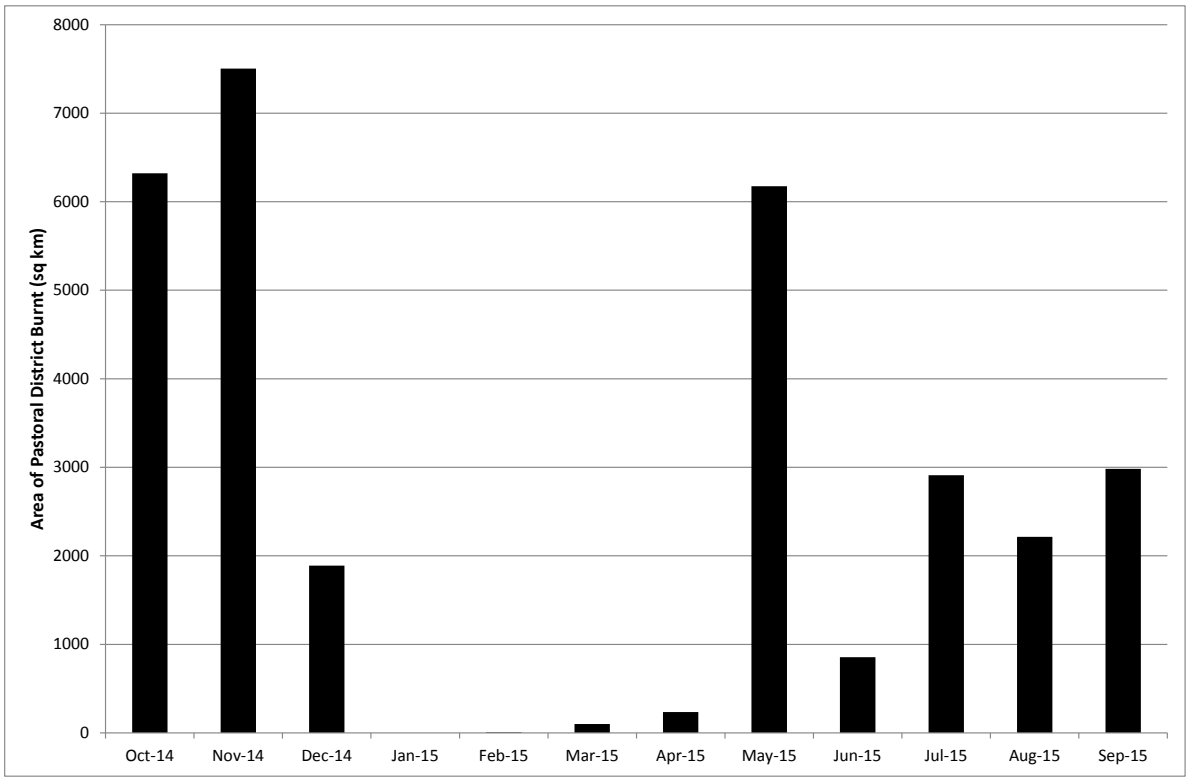


Figure 27: Monthly area burnt (km²) in the Roper Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense wet season storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m² Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Roper Pastoral District.

Recent fire contributed to substantially less vegetation cover, compared with the average cover over the last 27 years, across much of the Roper Pastoral District (Figure 28, burnt areas shown with diagonal hatching). Much below-average levels of vegetation cover were most pronounced in the south-east of the region where the effects of recent fire on cover coincided with poor seasonal quality.

ROPER PASTORAL DISTRICT

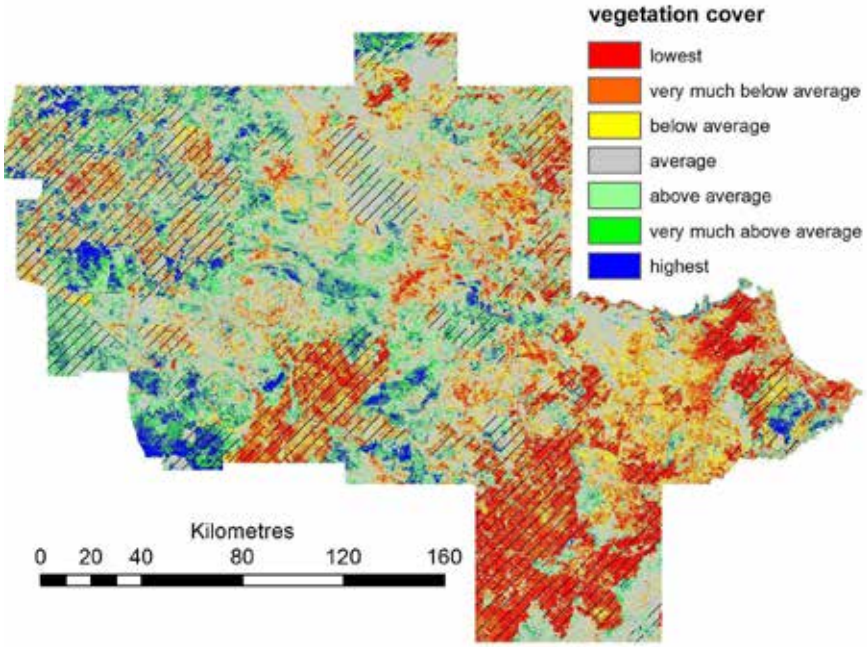
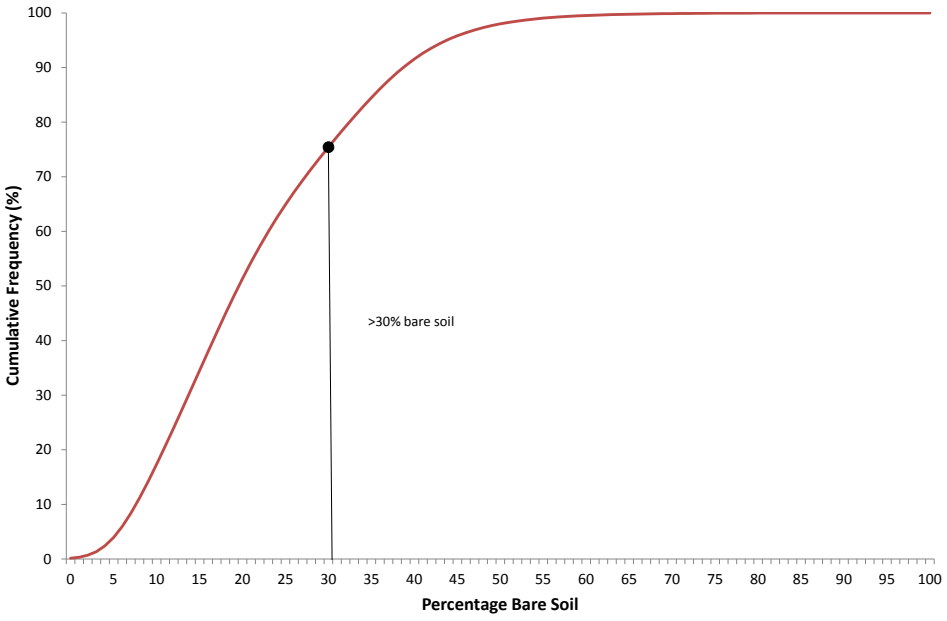


Figure 28: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

Seventeen percent of the pastoral district had minor amounts of bare soil (<10% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 29) and half of the region had <20% bare soil per pixel. One quarter of the Roper district had >30% bare soil in each Landsat pixel. This latter area is mapped in Figure 30 and includes areas burnt earlier in 2015.

Figure 29: Percentage cumulative frequency of varying levels of bare soil in 900 m^2 Landsat pixels in the RoperPastoral District between September and November 2015. Areas with greater than 30% bare soil are mapped in Figure 30.



ROPER PASTORAL DISTRICT

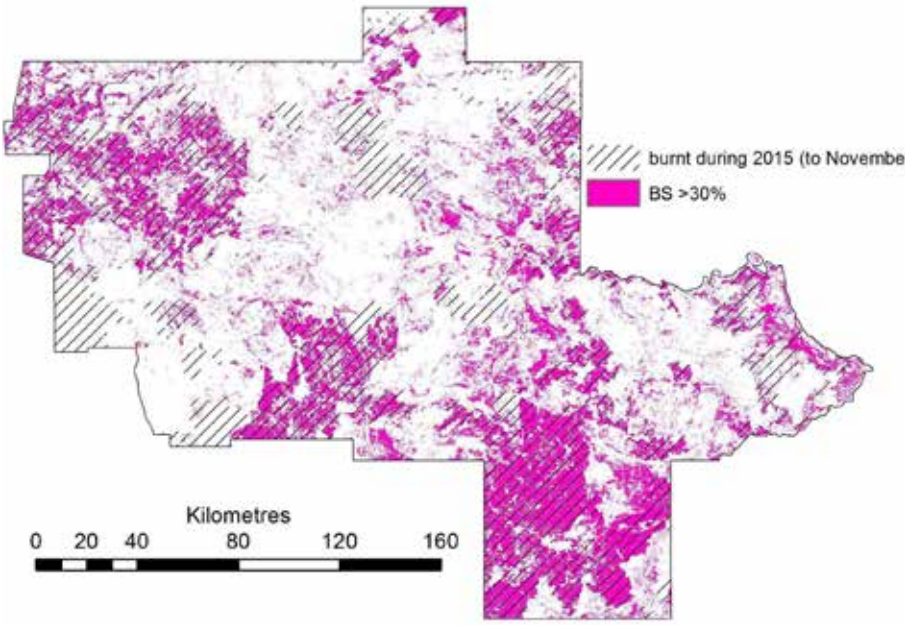


Figure 30: Parts of the Roper Pastoral District having more than 30% bare soil (BS) per Landsat pixel in late 2015. Areas burnt between January and November 2015 are shown with diagonal lines.

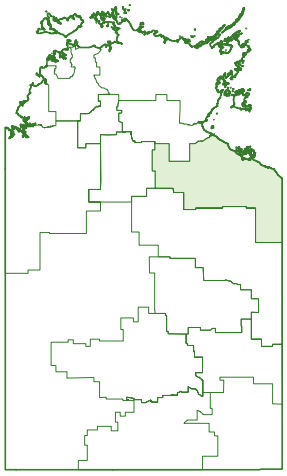
Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

Site-based monitoring

No pastoral leases were monitored in the Roper Pastoral District in the 2014-15 reporting year.

GULF PASTORAL DISTRICT

The Gulf coast and hinterland, extending up to 150 km inland, experienced poor seasonal quality based on AussieGRASS-modelled pasture growth.



Map 8: Location of Gulf Pastoral District

Seasonal conditions were closer to the long-term average in the south west of the pastoral district. Fire is a feature of this savannah region with the main fire activity occurring in late 2014 and April-May 2015. Vegetation cover, as monitored with remote sensing, was temporarily decreased by recent fire. There were minor to moderate levels of bare soil present late in the 2015 dry season with the amount present partly related to recent fire history. Two pastoral leases were visited with both characterised by areas of rugged terrain and heavily timbered country. The more accessible country was assessed in poor to fair condition with this judgement supported by information collected at monitoring sites.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 15) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

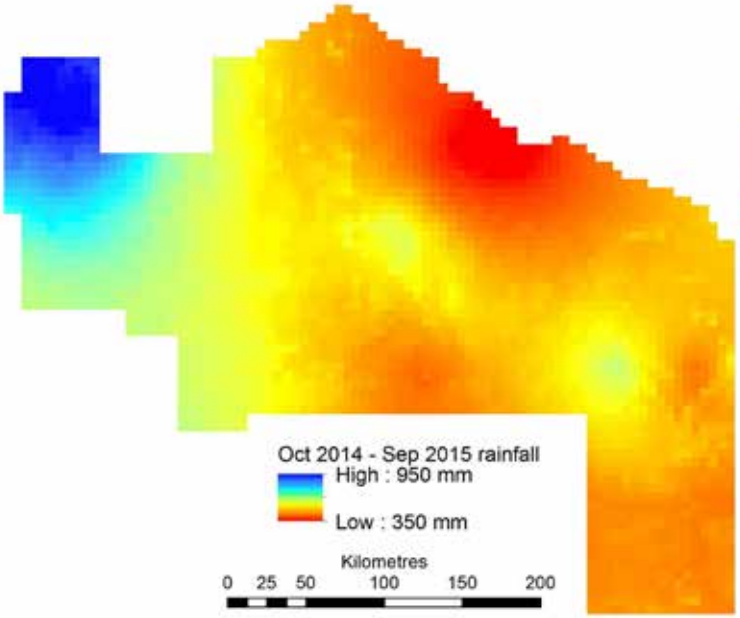
Rainfall (mm)		AussieGRASS	
2014 - 2015	532	Growth (kg/ha)	1580
Long term medium	658	Percentile	28

Table 15: Indicators of seasonal quality. Data spatially averaged for the Gulf Pastoral District.

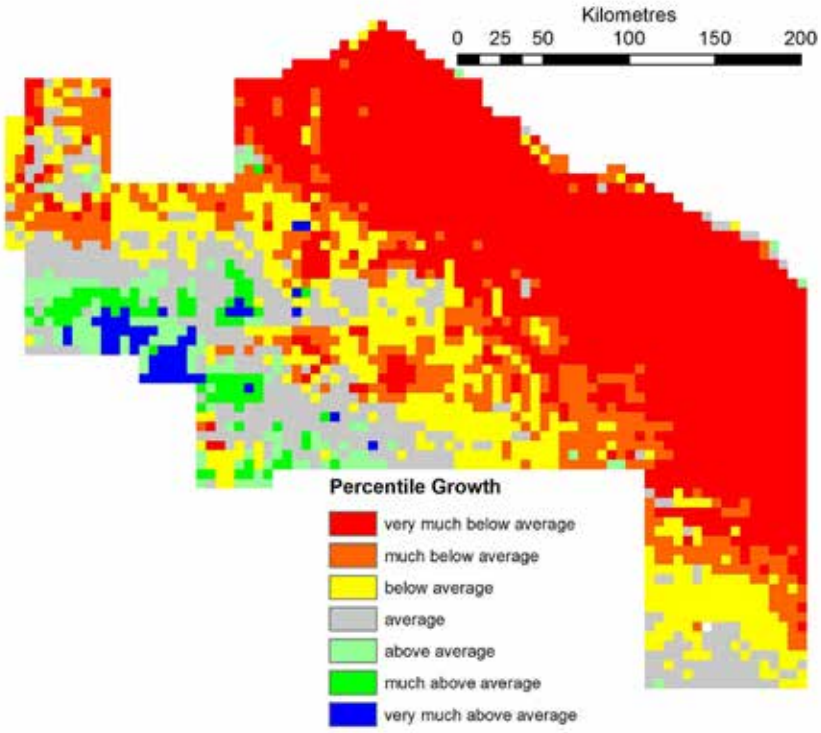
GULF PASTORAL DISTRICT

Spatially averaged rainfall for the Gulf Pastoral District was somewhat below the long term median (Table 15). As in other pastoral districts, there was considerable variation in interpolated rainfall across the region (Figure 31, left-hand panel) with the north western part of the district receiving more rainfall than the central and eastern areas. Rainfall was particularly reduced along the Gulf coast.

Modelled pasture growth over the last wet season, as a percentage of the long term record, was very much below the long term average inland from the Gulf coast (Figure 31, right hand panel). Further inland, wet season growth ranked as average to below average, except adjacent to the Barkly district in the south west where relatively higher rainfall resulted in modelled growth being much above average.



Spatially interpolated rainfall
October 2014 - September 2015



Simulated summer pasture growth
as a percentage of the long term record

Figure 31: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

GULF PASTORAL DISTRICT

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 12,536 km^2 (13.5% of the district) burnt between October 2014 and September 2015. There was considerable fire activity between March and May 2015 (Figure 32) suggesting that managed, early dry season burning was in place. The >1000 km^2 burnt in October and November 2014 was probably due to wild fire as this is typically when wildfires started by lightning occur.

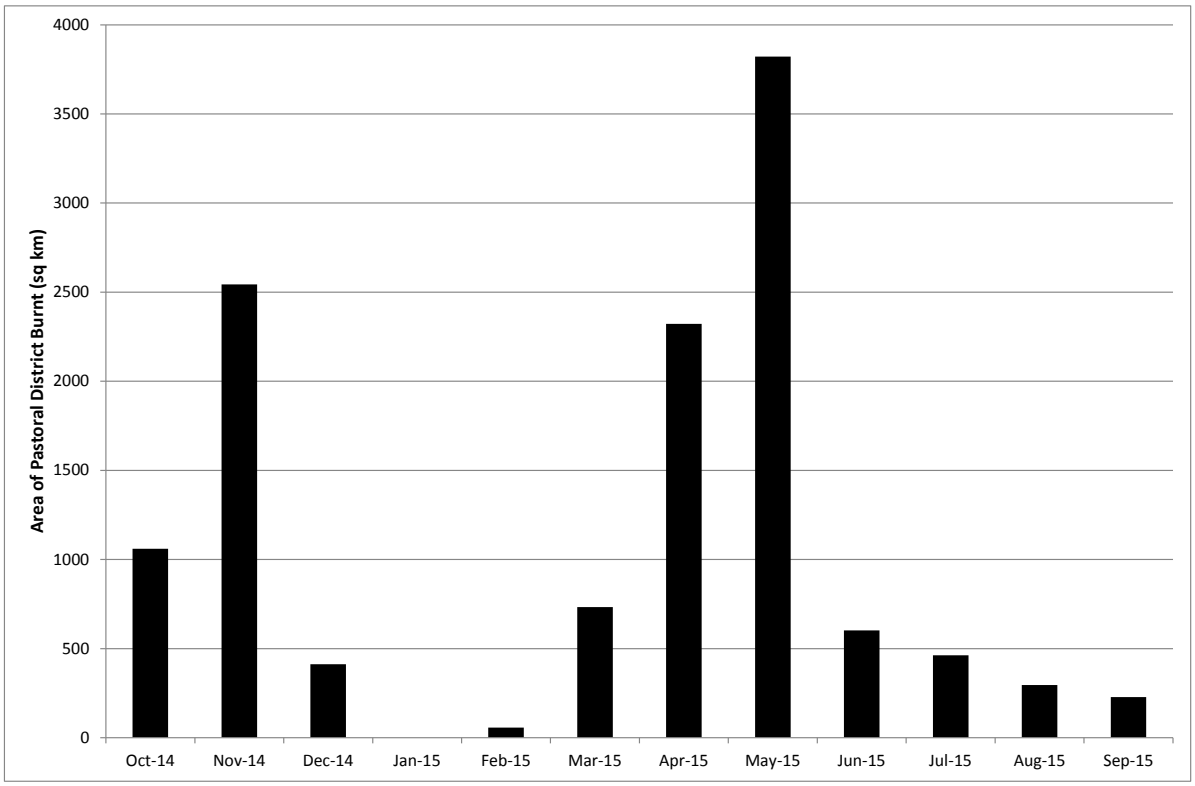


Figure 32: Monthly area burnt (km^2) in the Gulf Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense wet-season storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 square Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Gulf Pastoral District.

The decile-rank of vegetation cover in the late 2014 dry season against that present at the same time back to 1988 (Figure 33) was not as much affected by rainfall deficiency as modelled pasture growth (right-hand panel, Figure 31). This was probably due, in part, to two reasons: relatively constant tree and shrub cover and recent fire in the predominantly savannah landscape, the latter delineated with diagonal hatching in Figure 33.

GULF PASTORAL DISTRICT

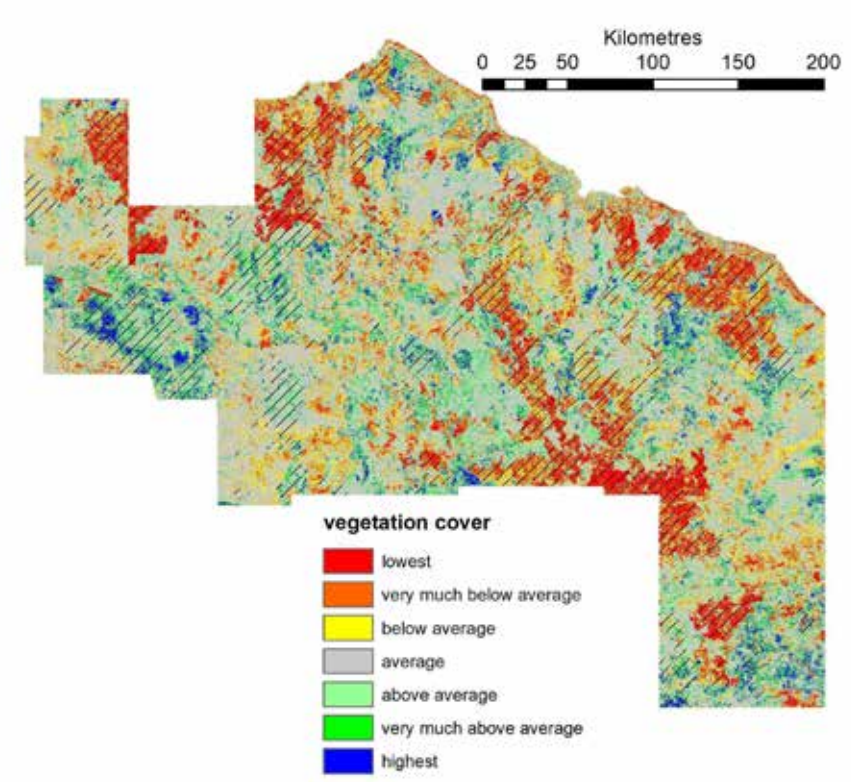
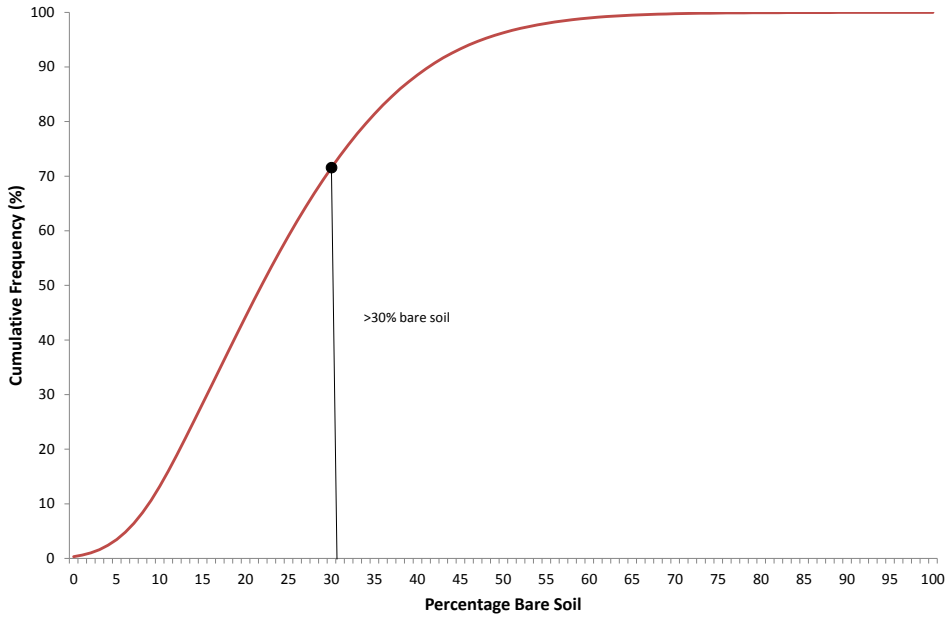


Figure 33: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

Approximately 13% of the pastoral district had minor amounts of bare soil (<10% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 34). Almost 60% of the region had <25% bare soil. Thirty percent of the pastoral district had >30% bare soil in each Landsat pixel. This latter area is mapped in Figure 35 and includes areas burnt earlier in 2015.

Figure 34: Percentage cumulative frequency of varying levels of bare soil in 900 m^2 Landsat pixels in the Gulf Pastoral District between September and November 2015. Areas with greater than 30% bare soil are mapped in Figure 35.



GULF PASTORAL DISTRICT

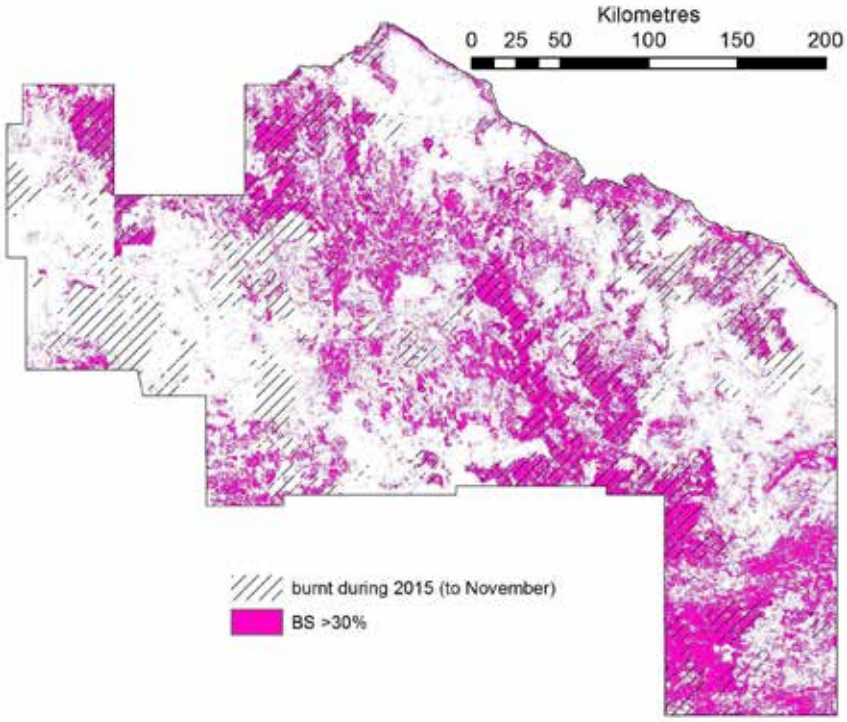


Figure : Parts of the Gulf Pastoral District having more than 30% bare soil (BS) per Landsat pixel in late 2015. Areas burnt between January and November 2015 are shown with diagonal lines.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

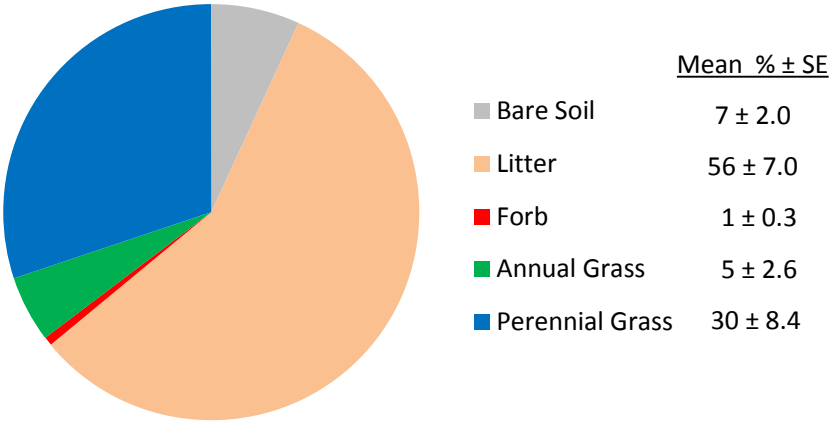
Site-based monitoring

Two neighbouring pastoral leases in the eastern part of the Gulf Pastoral District, comprising 19% of the pastoral district area, were visited near the end of 2014.

Vegetation cover of the ground layer was measured using the point intercept method at 11 sites across the two leases. Sites, on average, had a small amount of bare soil, good litter cover, a moderate cover of perennial grasses and small amounts of annual grasses and forbs (Figure 36). Perennial grasses are important because they protect the soil surface against wind and water erosion and, where palatable, provide persistent forage to carry livestock through dry times. Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

GULF PASTORAL DISTRICT

Figure 36: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 11 sites on two pastoral leases in the eastern part of the Gulf Pastoral District.



Four of the 11 sites (36%) were rated as being minimally grazed with a further five sites (45%) heavily grazed (Table 16). A mitigating factor was that sites were visited late in the dry season when grazing effects are likely to be greater.

Five sites (45%) showed evidence of erosion by water sheeting.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
No grazing		Wind	
Minimal	36	Scalding	
Moderate	9	Water sheeting	45
Moderate to heavy	9	Gullying	
Heavy	45		

Table 16: Levels of pasture utilisation and evidence of erosion assessed at 11 sites on four pastoral leases in the Gulf Pastoral District.

Both pastoral leases were visited in late 2014 so seasonal conditions associated with the 2013-14 wet season apply to assessment of land condition and its interpretation. Wet season rainfall was above average in 2013-14 and both stations experienced better seasonal quality than was the case for 2014-15 (described above).

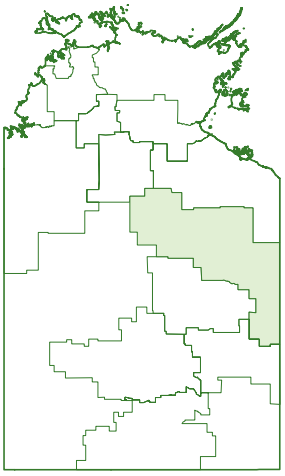
Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of both pastoral leases traversed are summarised in Table 17.

GULF PASTORAL DISTRICT

Station	Condition Rating	Comments with regard to pastoral lease
1	Poor: 7 sites	Lease considered in poor condition based on evidence from monitoring sites and limited ground traverse. Station contains rocky and heavily timbered country that is difficult to access. Low biomass of desirable perennial grasses and marginally palatable grasses such as black spear grass (*Heteropogon contortus*) and northern kerosene grass (*Aristida hygrometrica*) dominant. No significant areas of erosion or weeds detected.
2	Fair: 2 sites Poor: 2 sites	Station has areas of rugged or heavily wooded country of marginal grazing value and it was difficult to access these areas. Pastorally more useful country was judged to be in fair to poor condition dominated by species of low grazing value (e.g. black spear grass, *Heteropogon contortus*) or limited amounts of desirable grasses such as curly bluegrass (*Dichanthium fecundum*).

Table 17: Assessed land condition at monitoring sites and traversed parts of two pastoral leases in the Gulf Pastoral District.

BARKLY PASTORAL DISTRICT



Map 9: Location of Barkly Pastoral District

Seasonal quality, based on expected pasture growth, was above average in the north west and centre of the region. The south eastern and north eastern parts experienced poor seasonal quality.

Landsat imagery indicates that minor to moderate amounts of bare soil were present in the latter part of 2015 with bare soil more common in the south east, coincident with poorer seasonal quality. On-ground monitoring was conducted on four properties in the western part of the district where most sites and the majority of the pastorally productive country was judged to be in good condition. Areas of rubber bush (*Calotropis procera*) occurred on three leases and this problem weed is actively being controlled.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 18) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

Rainfall (mm)	Barkly North	Barkly South
2014 - 2015	530	418
Long term medium	422	300

Table 18: Indicators of seasonal quality. Data spatially averaged for the Barkly Pastoral District.

BARKLY PASTORAL DISTRICT

Spatially averaged rainfall for the northern and southern sections of the Barkly Pastoral District was considerably above the long term median (Table 18). Within each part of the region, there was considerable west to east variation in interpolated rainfall (Figure 37). In particular, the north western part of the Barkly South district received appreciably more rainfall than the far south east. In the northern section, the eastern Barkly was drier than the western part.

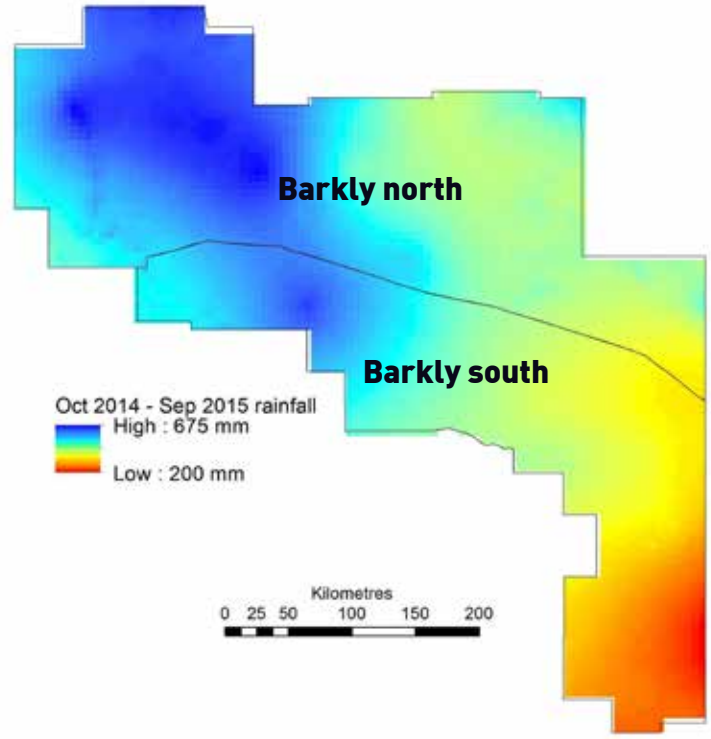


Figure 37: Spatially interpolated, gridded rainfall for the Barkly Pastoral District. Reporting period is October 2014 to September 2015.

AussieGRASS-modelled pasture growth, as a second indicator of seasonal quality for the entire Barkly region, is for the period November 2014 to April 2015 (Table 19). This growth is ranked as a percentile of the growth for all previous summers. In this case, spatially-averaged growth through the 2014-15 wet season was ~920 kg/ha which was slightly above the long term median (Table 19).

Index of seasonal quality	Barkly Pastoral District
Growth (kg/ha)	922
Percentile	62

Table 19: Recent seasonal quality averaged across the entire Barkly Pastoral District, as indicated by modelled pasture growth

Modelled pasture growth over the 2014-15 wet season, as a percentage of the long term record, was well above average in the north west of the pastoral district, above average in the centre and below average in the north east and parts of the south east (Figure 38).

BARKLY PASTORAL DISTRICT

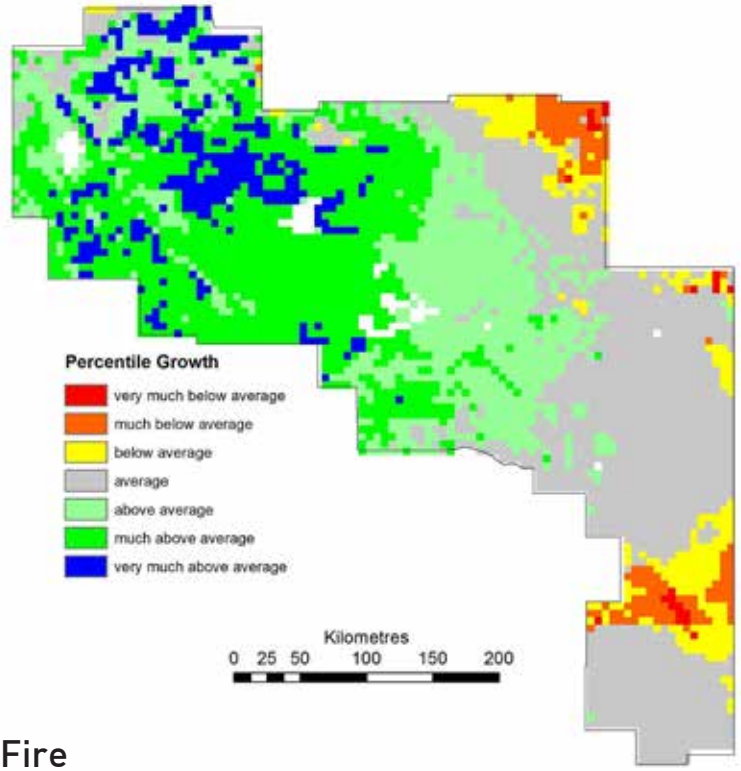


Figure 38: Simulated pasture growth for the 2014-15 wet season as a percentage of the long-term record.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 3,557 km^2 (2.7% of the Barkly Pastoral District) burnt between October 2014 and September 2015. Fire was most extensive in November 2014 (1,352 km^2 burnt) with greater than 400 km^2 burnt in December 2014 and May 2015.

Wildfire was much more extensive in the Barkly Pastoral District in 2011 and 2012 with 17% and 20% of the region burning in each year, respectively.

Bare Soil Dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Barkly Pastoral District.

Corresponding with indicators of seasonal quality mapped in Figures 37 and 38, parts of the north western Barkly Pastoral District had above average to highest levels of vegetation cover recorded since 1988 (Figure 39). Much of the central and eastern parts had average vegetation cover based on the 27 year record. Relative to the recent historical record, there was reduced vegetation cover (increased bare soil) in the far north east and south eastern parts of the district. Suppressed vegetation cover in the north east was likely associated with recent fire.

BARKLY PASTORAL DISTRICT

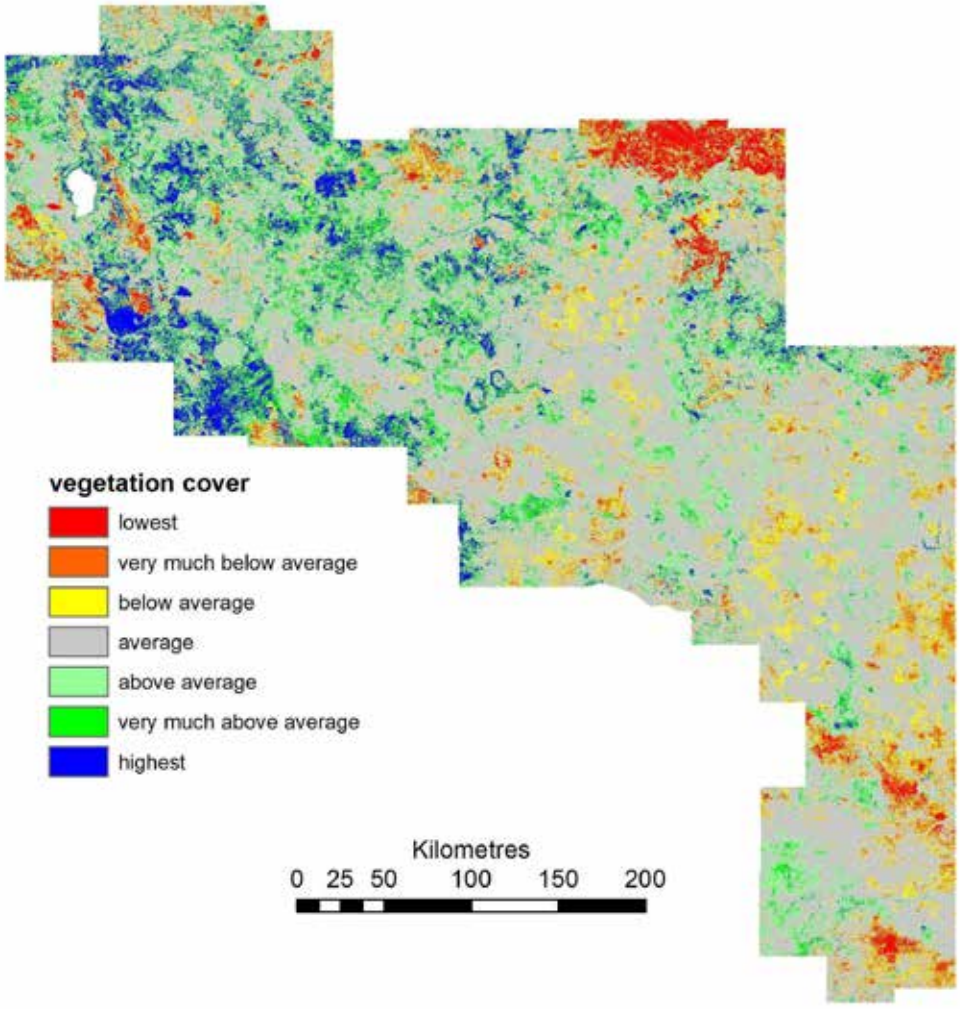
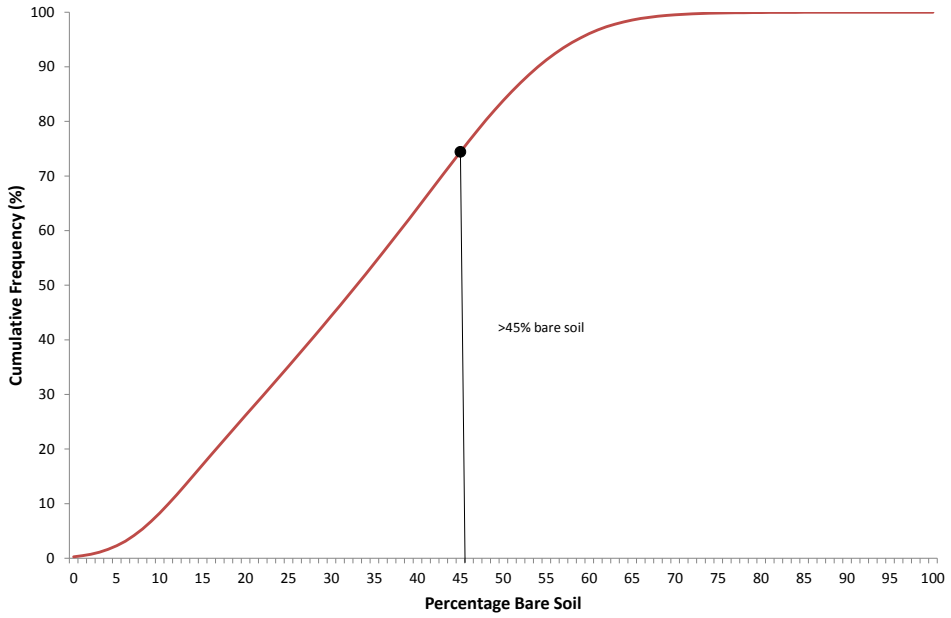


Figure 39: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

Approximately one quarter of the pastoral district had minor amounts of bare soil (<20% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 40). Forty five percent of the region had <30% bare soil with one quarter of the district having >45% bare soil. This latter area is mapped in Figure 41 and includes some of the country burnt in 2011 or 2012.

Figure 40: Percentage cumulative frequency of varying levels of bare soil in 900 m² square Landsat pixels in the Barkly Pastoral District between September and November 2015. Areas with greater than 45% bare soil are mapped in Figure 41.



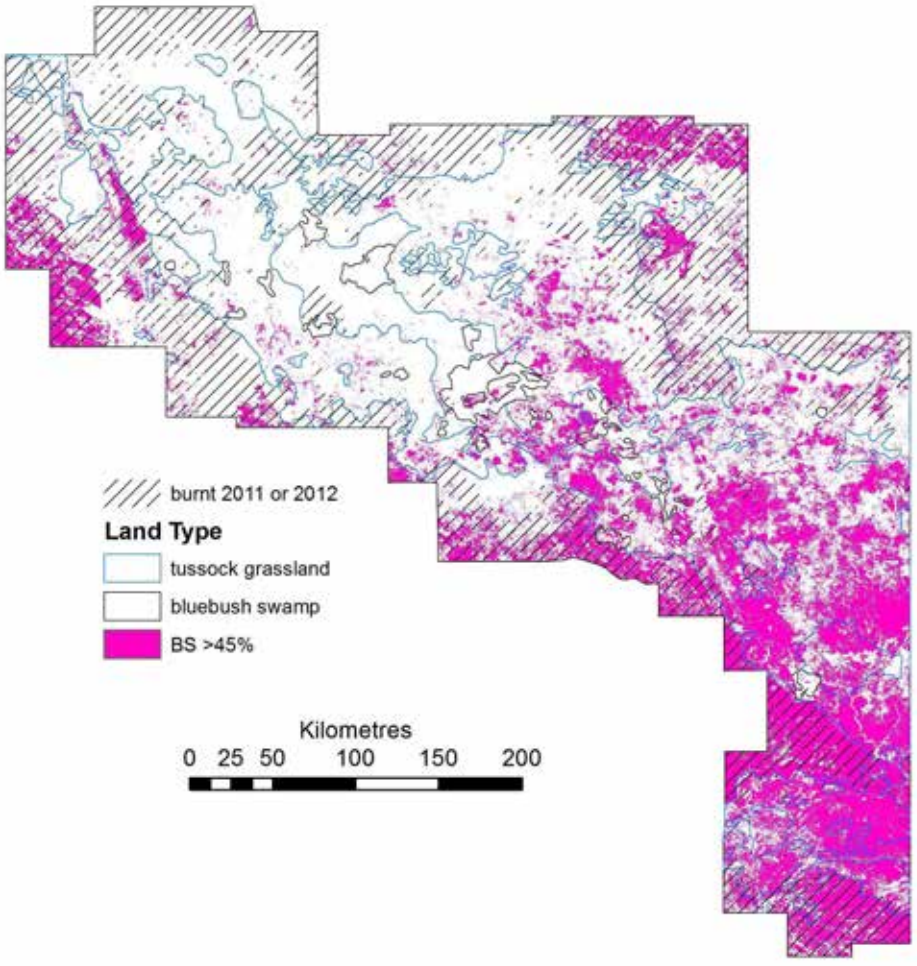


Figure 41: Parts of the Barkly Pastoral District having more than 45% bare soil (BS) per Landsat pixel in late 2015. Areas with higher pastoral value are shown with black and blue polygons. Diagonal striping shows country burnt in 2011 or 2012.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

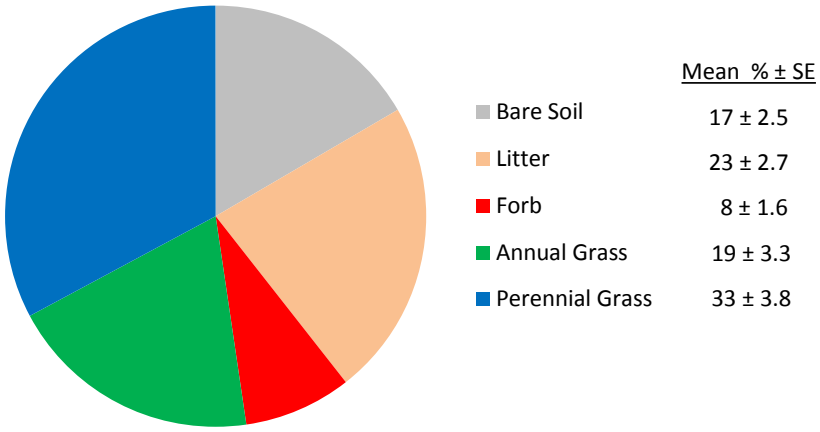
BARKLY PASTORAL DISTRICT

Site-based monitoring

Four pastoral leases in the western part of the Barkly Pastoral District, comprising 9% of the pastoral district area, were visited in the latter part of 2014 and during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 22 sites across the four leases. Sites, on average, had a good cover of perennial grasses, a lesser contribution of annual grasses, minor forbs and reasonable litter cover (Figure 42). Bare soil comprised about one-sixth of the 1 ha site area, on average. Perennial grasses are particularly important on the Mitchell grass downs as the mainstay of the grazing industry. They also protect the soil surface against wind and water erosion and, where sufficiently dense, provide competition against invasive woody species such as parkinsonia (*Parkinsonia aculeata*) and rubber bush (*Calotropis procera*). Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

Figure 42: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 22 sites on four pastoral leases in the Barkly Pastoral District.



Most sites were minimally to moderately grazed (Table 20). Two sites had experienced more severe grazing. There was evidence of water sheeting at eight of the 22 sites (36%).

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
No grazing		Wind	
Minimal	77	Scalding	
Moderate	14	Water sheeting	36
Moderate to heavy	5	Gullying	
Heavy	5		

Table 20: Levels of pasture utilisation and evidence of erosion assessed at 22 sites on four pastoral leases in the western part of the Barkly Pastoral District.

BARKLY PASTORAL DISTRICT

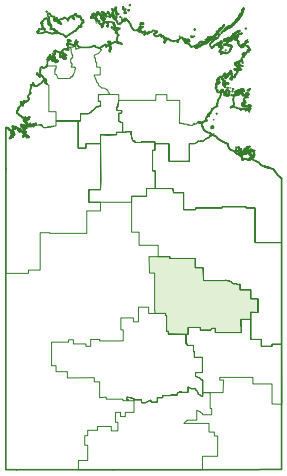
Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 21. The four stations experienced above average seasonal quality, based on rainfall and modelled pasture growth. Three leases were visited in late 2014 where land condition was assessed with regard to vegetation characteristics influenced by the 2013-14 wet season.

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 5 sites	Lease in generally good condition. Desirable and intermediate grazing-value grasses plentiful on the productive downs (black soil) country. No serious pest animal or erosion issues. Rubber bush (*Calotropis procera*) present, which is being controlled.
2	Good: 1 site Fair: 1 site	Small areas of pastorally productive black-soil country in fair to good condition. Some areas with Mitchell grass present at a low density but tussocks robust and had seeded. Other black-soil areas dominated by undesirable *Aristida* grasses with some recruitment of palatable, perennial (desirable) grasses. Extensive areas of spinifex country in good condition.
3	Good: 8 sites Fair: 1 site	Lease in generally good condition. Downs (black soil) pastures dominated by desirable and intermediate grazing-value species. No serious pest animal or erosion issues were observed. Areas of rubber bush (*Calotropis procera*) which is being controlled.
4	Good: 4 sites Fair: 2 sites	Pastorally productive black-soil (downs) country in mostly good condition. Some paddocks well grazed when assessed late in the dry season but retained satisfactory ground cover with a variety of perennial and annual grasses present. Substantial patches of rubber bush (*Calotropis procera*) adjacent to some yards and bores with dead and dying plants indicating that treatment was underway.

Table 21: Assessed land condition at monitoring sites and traversed parts of four pastoral leases in the Barkly Pastoral District.

TENNANT CREEK PASTORAL DISTRICT

Seasonal quality much above average in the north west of the district based on rainfall and modelled pasture growth. Average to above average seasonal quality on most other pastoral leases across the pastoral district.



Map 10: Location of Tennant Creek Pastoral District

Extensive wildfire occurred in 2011 and 2012 and this continues to have a legacy effect on increased levels of remotely sensed bare soil. Moderate amounts of bare soil, particularly in previously burnt spinifex country in the east of the region. The majority of the pastorally productive country on most leases considered to be in fair condition with smaller areas (particularly on one station) in good condition. Areas of parkinsonia (*Parkinsonia aculeate*) and rubber bush (*Calotropis procera*) noted. Work is continuing on one station to reclaim historically eroded alluvial country. Four properties were visited in the Tennant Creek Pastoral District this reporting season.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 22) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

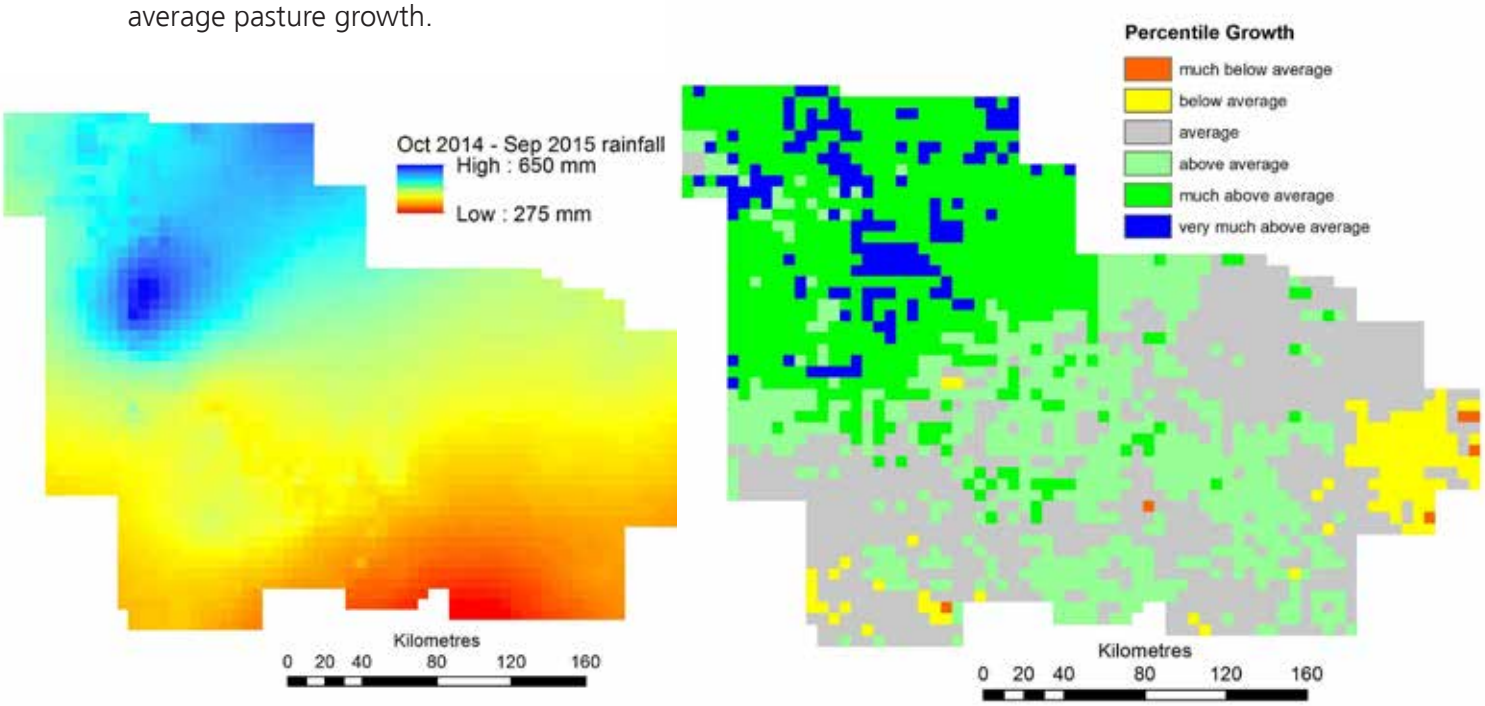
Rainfall (mm)		AussieGRASS	
2014 - 2015	432	Growth (kg/ha)	569
Long term medium	282	Percentile	63

Table 22: Indicators of seasonal quality. Data spatially averaged for the Tennant Creek Pastoral District.

TENNANT CREEK PASTORAL DISTRICT

Spatially averaged rainfall for the Tennant Creek Pastoral District was considerably above the long-term median (Table 22). However there was considerable variation in interpolated rainfall across the region (Figure 44, left-hand panel) with the south eastern part of the district receiving less rainfall and the north west, centred on Tennant Creek, having localised higher rainfall.

Modelled pasture growth over the last summer, as a percentage of the long-term record, was much above average to exceptional in the north west of the pastoral district (Figure 44, right hand panel), aligning with its higher rainfall. The central and southern areas had average to above average growth. Crown land in the far south east of the pastoral district had below average pasture growth.



Spatially interpolated rainfall
October 2014 - September 2015

Simulated summer pasture growth
as a percentage of the long term record

Figure 44: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) reports that 1,865 km^2 (2.7% of the district) burnt between October 2014 and September 2015. Greater than 100 km^2 burnt in October and December 2014, March-May 2015 and August-September 2015.

Wildfire was much more extensive in the Tennant Creek Pastoral District in 2011 and 2012 with 66% and 13% of the region burning in each year, respectively. Legacy effects of these wildfires remain in terms of reduced vegetation cover and increased bare soil, particularly in spinifex country.

TENNANT CREEK PASTORAL DISTRICT

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Tennant Creek Pastoral District.

Corresponding with indicators of seasonal quality mapped in Figure 44, much of the north-western part of the Tennant Creek Pastoral District had above average to highest levels of vegetation cover recorded since 1988 (Figure 45). Relatively higher levels of vegetation cover extended to the south and south east, with much of the eastern section having vegetation cover close to the average for the September-November period over the last 27 years. Below average vegetation cover, corresponding with relatively more bare ground, was present in the centre and on the north eastern, eastern and southern peripheries of the pastoral district. These areas of increased bare soil also correspond with past fires in spinifex sand-plain country (Figure 47).

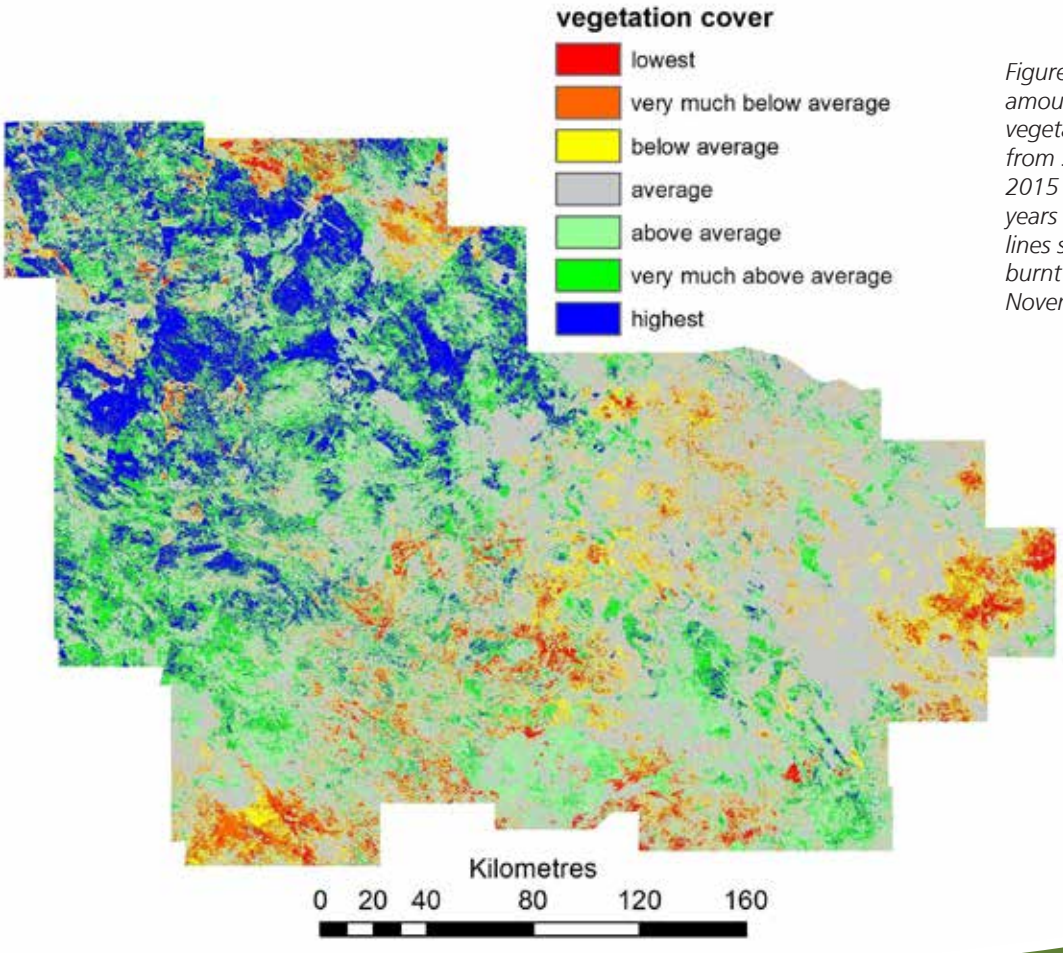


Figure 45: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

TENNANT CREEK PASTORAL DISTRICT

Approximately 1% of the pastoral district had negligible bare soil (<20% of the 900 m^2 Landsat pixel) towards the end of 2015 (Figure 46). One third of the region had <40% bare soil and a further third had >50% bare soil. This latter area is mapped in Figure 47 and includes areas burnt in extensive wildfires in 2011 or 2012.

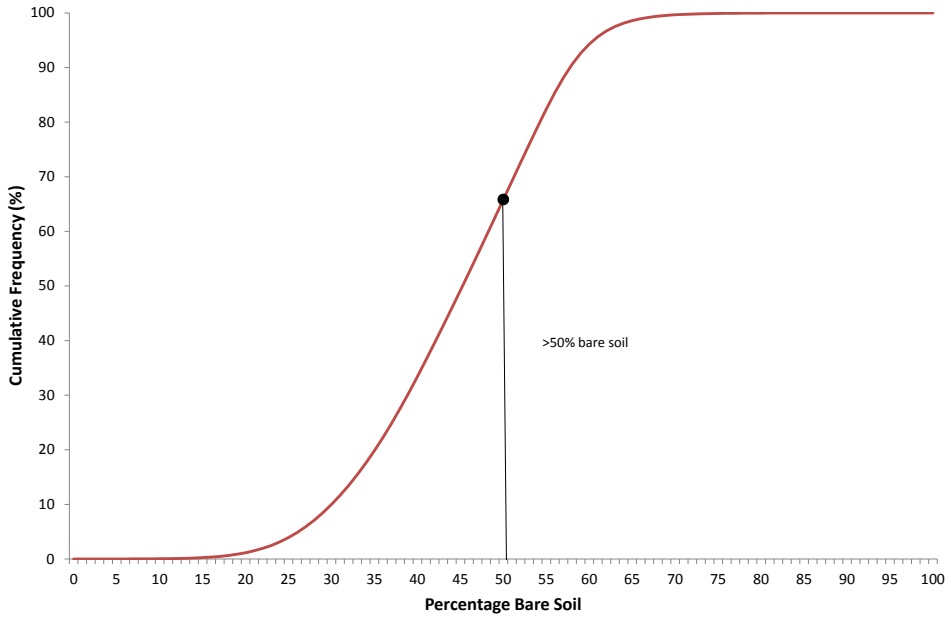


Figure 46: Percentage cumulative frequency of varying levels of bare soil in 900 m^2 Landsat pixels in the Tennant Creek Pastoral District between September and November 2015. Areas with greater than 50% bare soil are mapped in Figure 47.

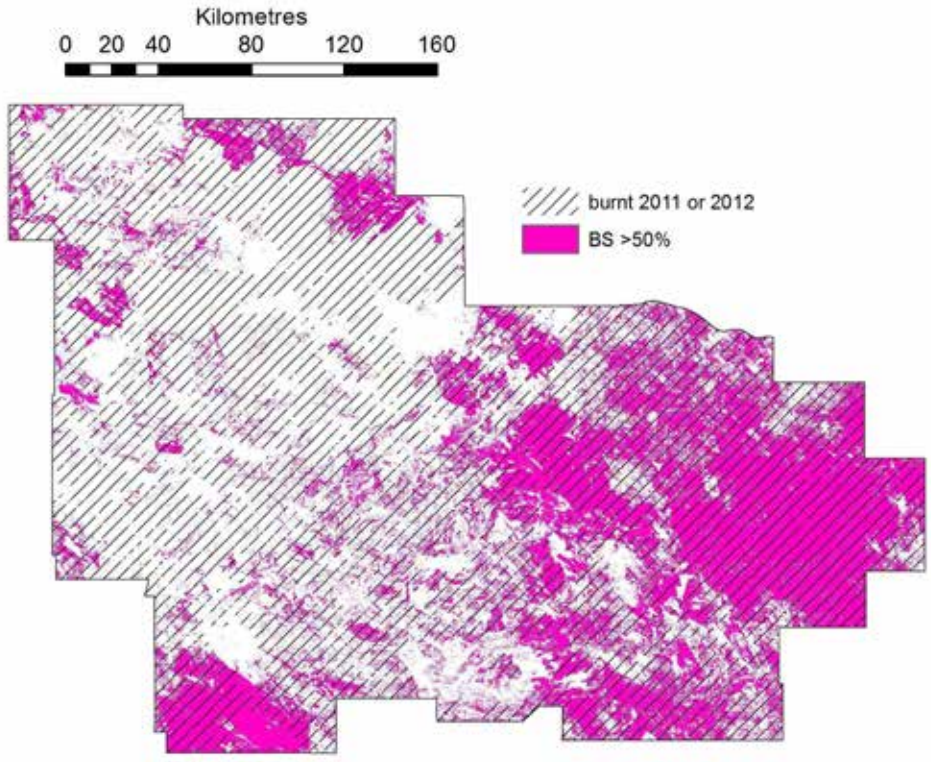


Figure 47: Parts of the Tennant Creek Pastoral District having more than 50% bare soil (BS) per Landsat pixel in late 2015. Areas burnt in 2011 or 2012 are shown with diagonal lines.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

TENNANT CREEK PASTORAL DISTRICT

Site-based monitoring

Four pastoral leases in the western and central parts of the Tennant Creek Pastoral District, comprising 49% of the pastoral district area, were visited during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 25 sites across the four leases. Sites, on average, had a moderate level of bare soil, reasonable levels of litter cover and perennial grass, and small contributions of annual grasses and forbs (Figure 48. Perennial grasses are important because they protect the soil surface against wind and water erosion and, where palatable, provide persistent forage to carry livestock through dry times. Litter cover also protects the soil surface, assists infiltration of rain water and helps retain plant seeds in situ.

Ten of the 25 sites (40%) were rated as being minimally grazed with a further 13 sites (52%) grazed to a moderate or more severe level (Table 23). Five sites (20%) showed evidence of erosion by water sheeting with four sites (16%) affected by scalding.

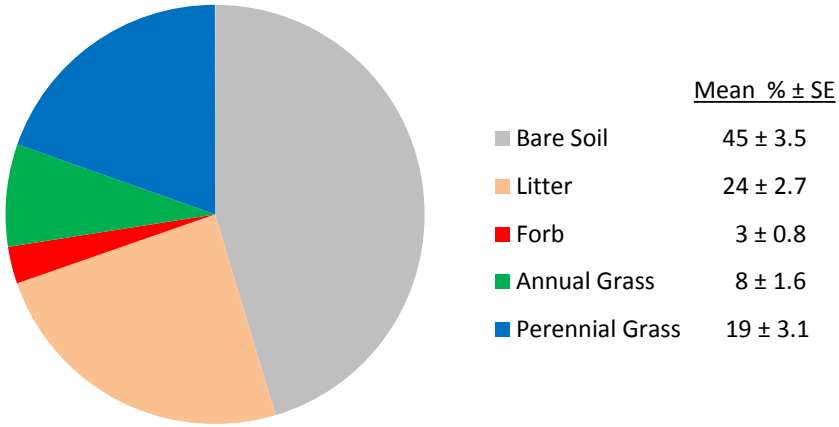


Figure 48: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 25 sites on four pastoral leases in the Tennant Creek Pastoral District.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
No grazing	4	Wind	
Minimal	40	Scalding	16
Moderate	16	Water sheeting	20
Moderate to heavy	20	Gullying	
Heavy	16		

Table 23: Levels of pasture utilisation and evidence of erosion assessed at 25 sites on four pastoral leases in the Tennant Creek Pastoral District.

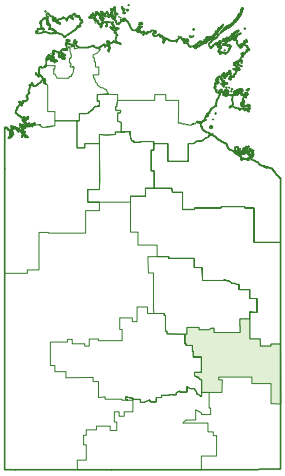
TENNANT CREEK PASTORAL DISTRICT

Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 24. Most stations experienced above average seasonal quality, based on rainfall and modelled pasture growth. To the extent possible, condition assessments are independent of year-to-year variability in rainfall.

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 4 sites Poor: 5 sites	Much of the lease in fair condition with moderately extensive, historically eroded alluvial country in poor condition. Considerable reclamation activity in recent years to treat eroded areas and this country is gradually improving.
2	Good: 2 sites Fair: 3 sites	Fair to good condition with a reasonable diversity of perennial grasses and palatable annual species. Rubber bush and parkinsonia (Class B weeds) established along major creeks and some flood-out country.
3	Good: 4 sites Fair: 1 site	Most of station in fair condition with a diversity of perennial and annual grasses in most areas. Some paddocks heavily grazed but retaining satisfactory ground cover. Weeds established near some yards.
4	Good: 2 sites Fair: 4 sites	Majority of lease area in fair condition. Good response by pastures to rainfall. A diversity of grasses, including palatable species, present. Few signs of active erosion.

Table 24: Assessed land condition at monitoring sites and traversed parts of four pastoral leases in the Tennant Creek Pastoral District.

PLENTY PASTORAL DISTRICT



Map 11: Location of Plenty Pastoral District

The district experienced mainly average to above average seasonal quality based on AussieGRASS-modelled pasture growth.

Landsat imagery indicates that high to very high levels of bare soil were present in the latter months of 2015, particularly in the east and south east. Despite reasonable rainfall across most of the area in early 2015, bare soil has persisted as a result of extensive wildfire in 2011 and 2012 and following very dry years. No on-ground monitoring was conducted in the Plenty Pastoral District during this reporting season.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 25) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

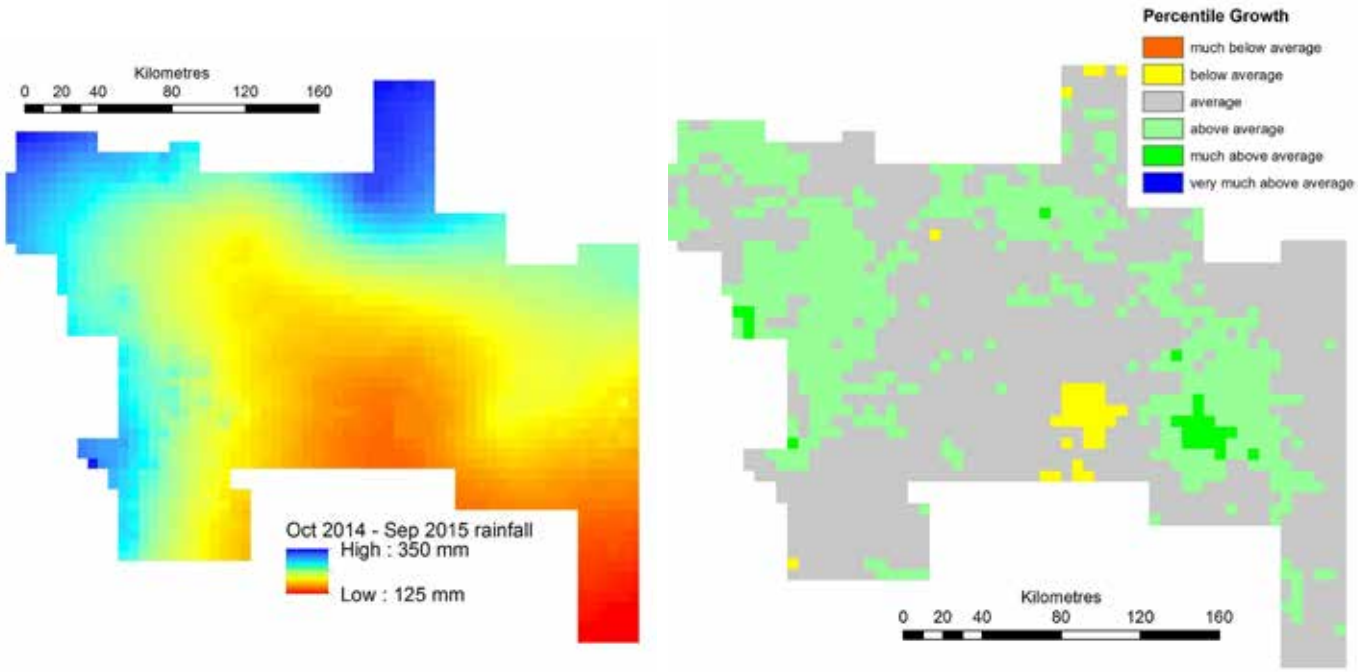
Rainfall (mm)		AussieGRASS	
2014 - 2015	222	Growth (kg/ha)	224
Long term medium	204	Percentile	57

Table 25: Indicators of seasonal quality. Data spatially averaged for the Plenty Pastoral District.

Spatially averaged rainfall for the Plenty Pastoral District was close to the long-term median (Table 25). However there was considerable variation in interpolated rainfall across the region (Figure 49, left-hand panel) with the south eastern part of the district being drier and the northern extremities wetter than indicated by the spatially averaged mean rainfall of 222 mm.

PLENTY PASTORAL DISTRICT

Much of the pastoral district experienced average to above average pasture growth over the last summer based on AussieGRASS simulation (Figure 49, right hand panel). An area centred on the central south had predicted pasture growth below the long-term median.



Spatially interpolated rainfall
October 2014 - September 2015

Simulated summer pasture growth
as a percentage of the long term record

Figure 49: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

The North Australian Fire Information website (www.firenorth.org.au/nafi3) does not report any fire activity in the Plenty Pastoral District between October 2014 and September 2015.

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. The highly variable nature of rainfall in the southern NT also means that it is necessary to carry dry feed, and associated ground cover, into the hotter months in case summer rains fail.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Plenty Pastoral District.

PLENTY PASTORAL DISTRICT

There was considerable variation in the spatial distribution of vegetation cover relative to its recent history (Figure 50) which broadly corresponded with rainfall (Figure 49), albeit at a finer scale. Parts of the north and west of the Plenty District had above average too much above average vegetation cover compared with the record since 1988. This improved cover corresponds with decreased amounts of bare soil. Areas of reduced vegetation cover (more bare soil) were interspersed with this relatively higher cover in the north-west, probably as a result of wild fire in 2011 and 2012. Much of the southern and south eastern parts of the district had historically less vegetation cover (more bare soil), in line with lower rainfall.

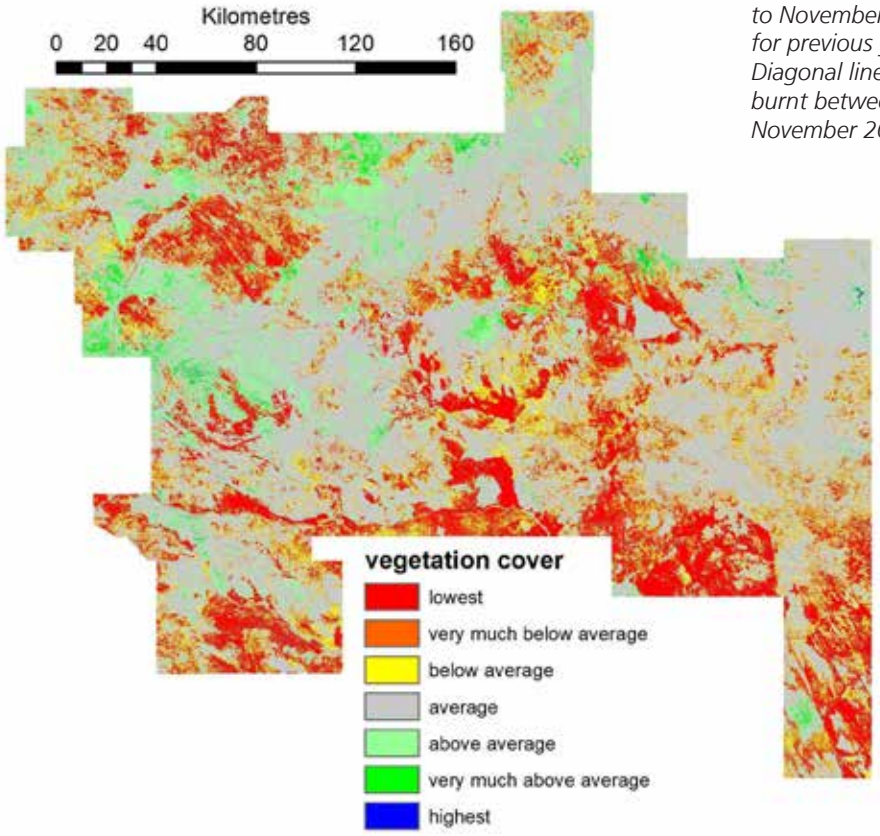


Figure 50: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

Less than 1% of the pastoral district had minor to moderate levels of bare soil (<25% of the 900 m^2 Landsat pixel) towards the end of 2015. A little more than one third of the region had <50% bare soil and one quarter had >60% bare soil. This latter area is mapped in Figure 52 and includes areas burnt in extensive wildfires in 2011 or 2012.

PLENTY PASTORAL DISTRICT

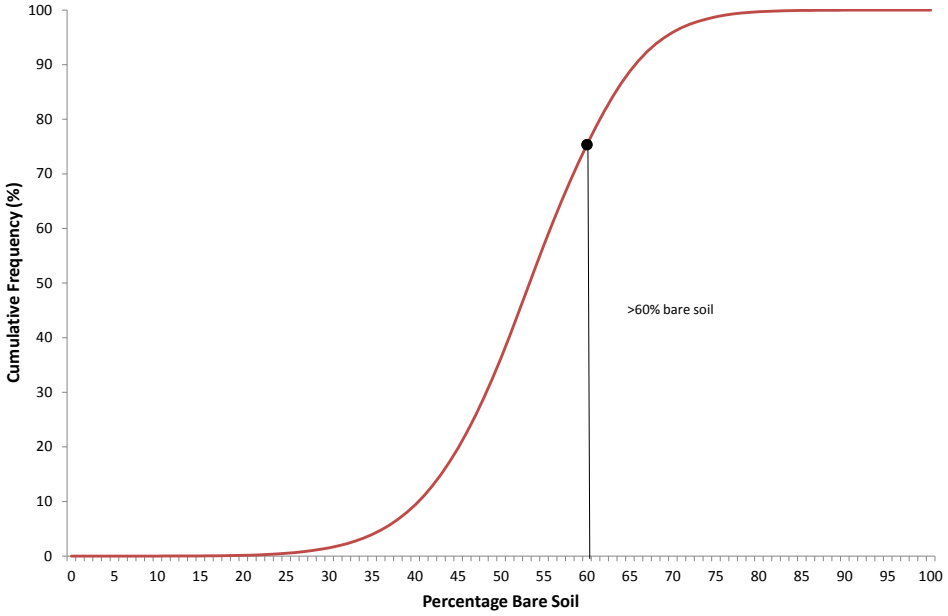


Figure 51: Percentage cumulative frequency of varying levels of bare soil in 900 m² Landsat pixels in the Plenty Pastoral District between September and November 2015. Areas with greater than 60% bare soil are mapped in Figure 52.

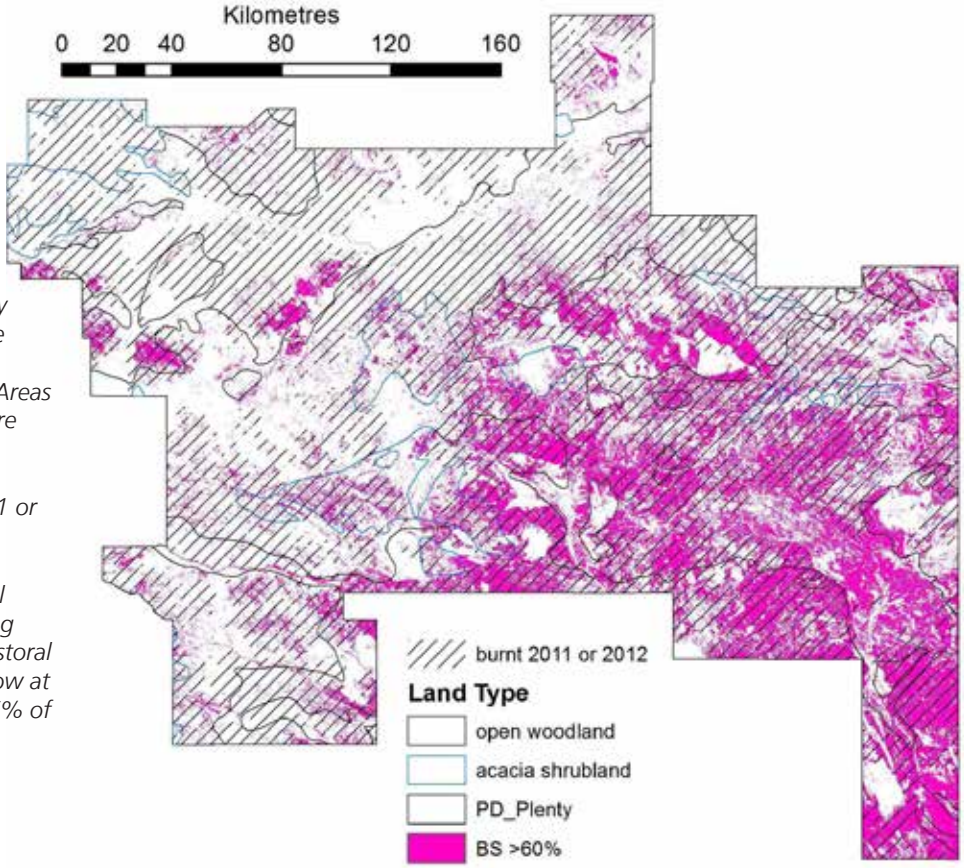


Figure 52: Parts of the Plenty Pastoral District having more than 60% bare soil (BS) per Landsat pixel in late 2015. Areas with higher pastoral value are shown with black and blue polygons. Diagonal striping shows country burnt in 2011 or 2012.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

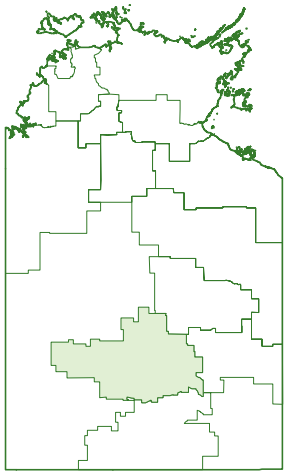
Site-based monitoring

No pastoral leases were monitored in the Plenty Pastoral District in the 2014-15 reporting year.

NORTHERN ALICE SPRINGS PASTORAL DISTRICT

Much of the pastoral district experienced above average seasonal quality based on expected pasture growth (modelled using AussieGRASS).

Landsat imagery indicates that moderate to high levels of bare soil were present in the latter part of 2015 with increased bare soil partly corresponding with extensive wildfires in 2011 and 2012. Based on data collected at monitoring sites and visual inspection of five leases, most of the pastorally more productive country was assessed to be in good or fair condition with smaller areas in poor condition.



Map 12: Location of Northern Alice Springs Pastoral District

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 26) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

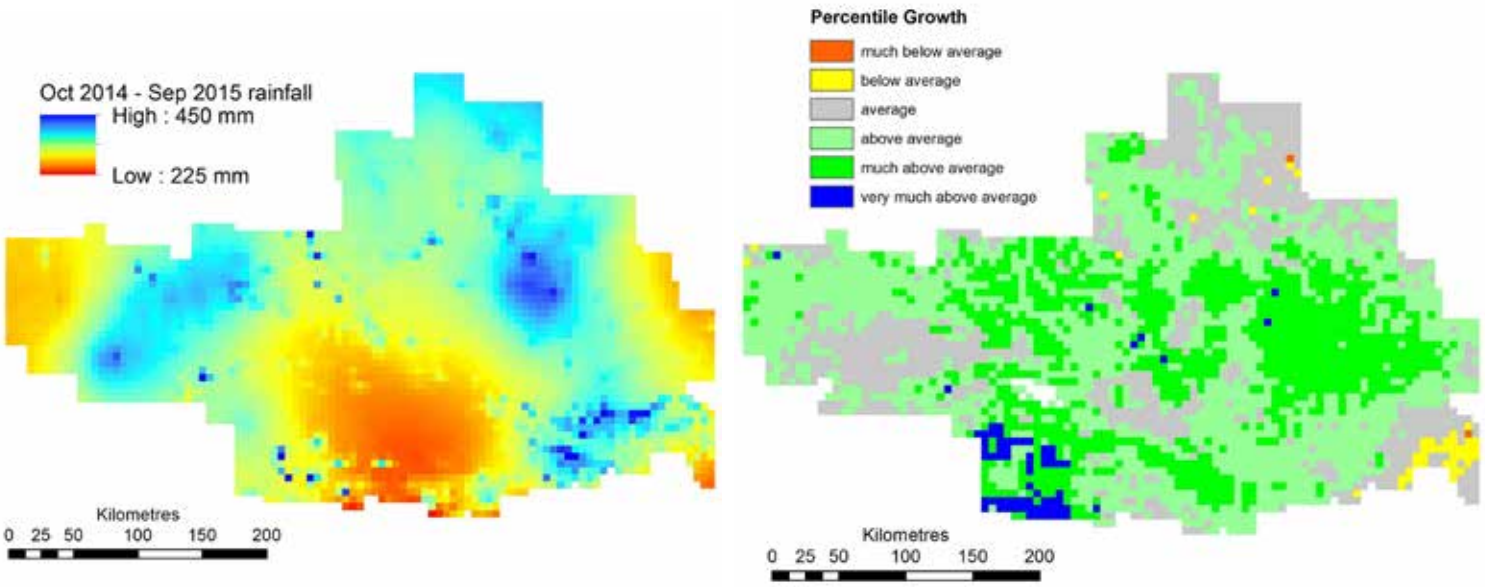
Rainfall (mm)		AussieGRASS	
2014 - 2015	334	Growth (kg/ha)	700
Long term medium	257	Percentile	65

Table 26: Indicators of seasonal quality. Data spatially averaged for the Northern Alice Springs Pastoral District.

Spatially averaged rainfall for the Northern Alice Springs Pastoral District was considerably above the long-term median of 257 mm (Table 26). There was some variation in rainfall across the region (Figure 53, left-hand panel) with the southern part of the district receiving less rainfall and localised higher rainfall occurring in the west, east and north east.

NORTHERN ALICE SPRINGS PASTORAL DISTRICT

Modelled pasture growth over the last summer, as a percentage of the long-term record, was average to above average across most of the pastoral district (Figure 53, right hand panel) with the far south west of the district having exceptional pasture growth.



Spatially interpolated rainfall
October 2014 - September 2015

Simulated summer pasture growth
as a percentage of the long term record

Figure 53: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

Fire

Data available from the North Australian Fire Information website (www.firenorth.org.au/nafi3) shows that 722 km^2 (0.7% of the district) burnt between October 2014 and September 2015 (the monthly distribution of burnt area is not graphed). Fire was most active in October and December 2014, and July-August 2015 (>100 km^2 burnt in each month).

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. It is also important to carry dry feed, and associated ground cover, into the latter months of each calendar year in case there is a late start to the usual wet season and/or monsoonal rains fail more generally.

NORTHERN ALICE SPRINGS PASTORAL DISTRICT

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Northern Alice Springs Pastoral District.

Much of the district had more vegetation cover (relatively less bare soil) in the latter period of 2015 compared with previous years since 1988 (Figure 54). This was particularly the case in the northern, central-eastern and parts of the western sections of the pastoral district. The centre of the region and parts of the eastern side had less vegetation cover (more bare soil) relative to the last 27 years. This was probably attributable to legacy effects of extensive wildfire in 2011 and 2012.

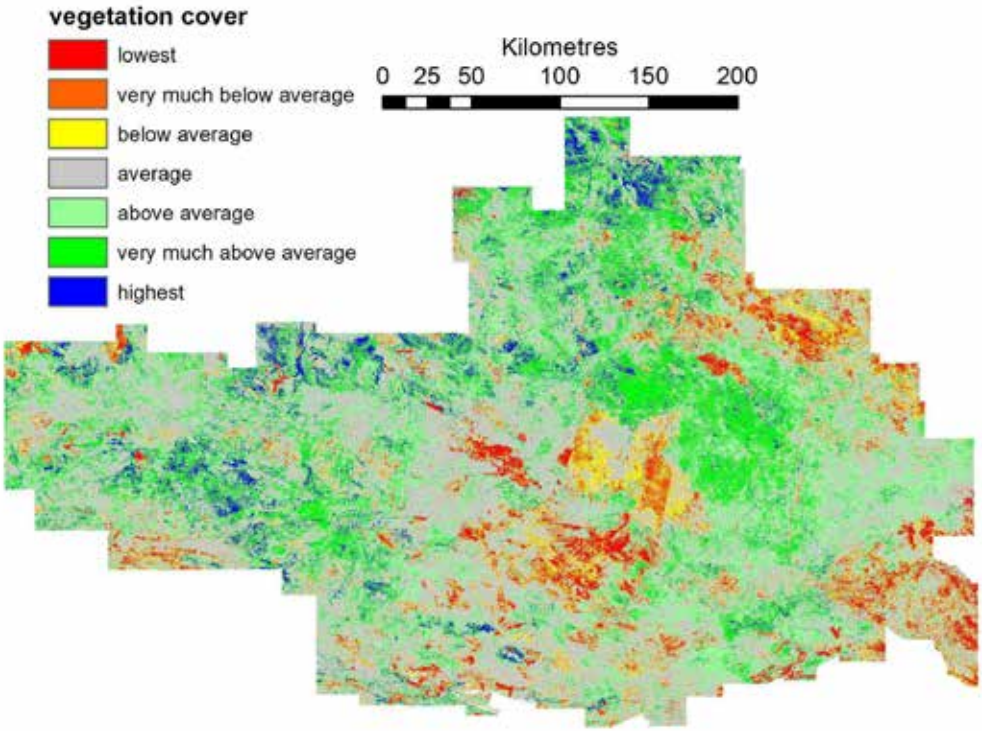


Figure 54: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

NORTHERN ALICE SPRINGS PASTORAL DISTRICT

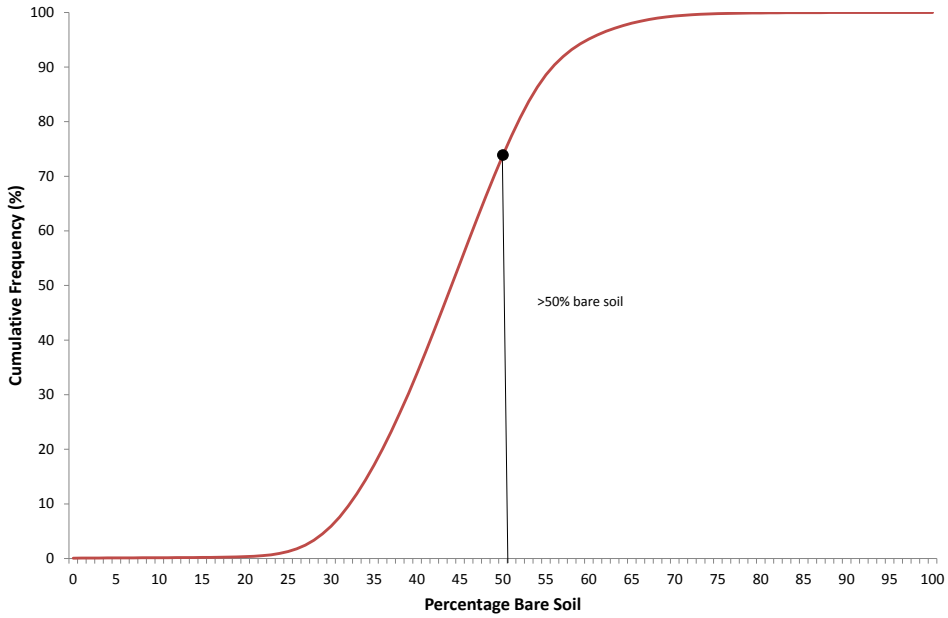
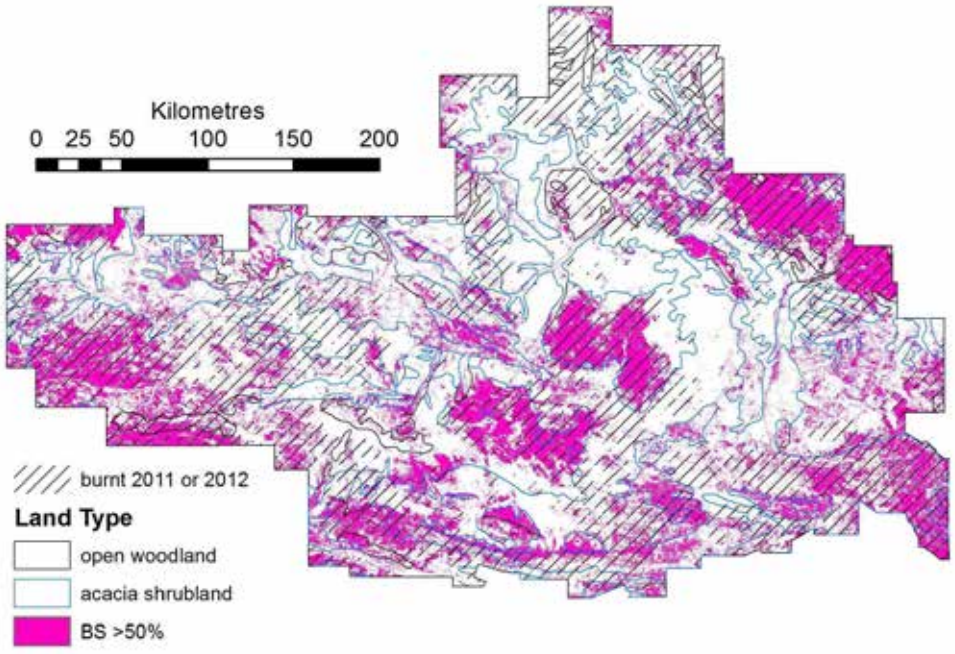


Figure 55: Percentage cumulative frequency of varying levels of bare soil in 900 m² square Landsat pixels in the Northern Alice Springs Pastoral District between September and November 2015. Areas with greater than 50% bare soil are mapped in Figure 56.

Figure 65: Parts of the Northern Alice Springs Pastoral District having more than 50% bare soil (BS) per Landsat pixel in late 2015. Areas with higher pastoral value are shown with black and blue polygons. Diagonal striping shows country burnt in 2011 or 2012.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.



NORTHERN ALICE SPRINGS PASTORAL DISTRICT

Site-based monitoring

Five pastoral leases in the southern central and south east of the Northern Alice Springs Pastoral District, comprising 19% of the pastoral district area, were visited during 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 53 sites across the five leases. Sites, on average, had a moderate level of bare soil, reasonable litter cover and small contributions of perennial and annual grasses, and forbs (Figure 57). Litter cover is important because it assists infiltration of rain water, helps retain seed on site and reduces erosion risk.

One third of the 53 sites were rated as being minimally grazed with a further 60% of sites grazed to a moderate or more severe level (Table 27). A third of sites showed evidence of erosion by water sheeting with a fifth of sites affected by scalding.

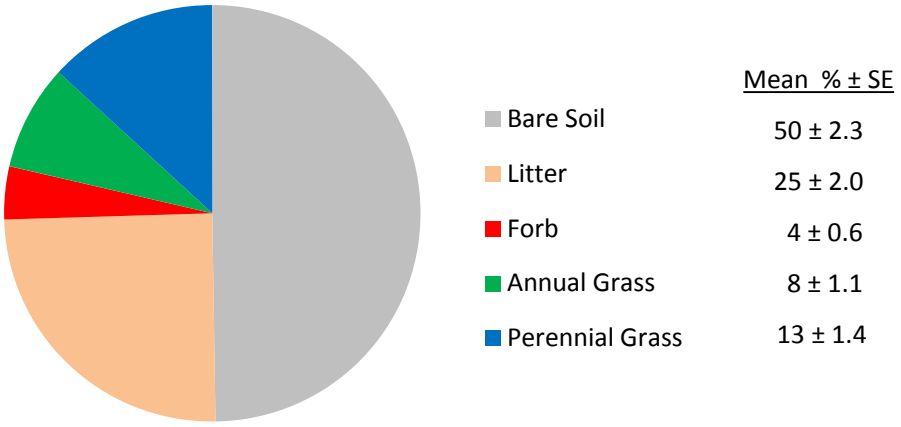


Figure 57: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 25 sites on four pastoral leases in the Tennant Creek Pastoral District.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
Not recorded	6	Wind	8
No grazing	2	Scalding	21
Minimal	34	Water sheeting	34
Moderate	13	Gullying	9
Moderate to heavy	23		
Heavy	15		
Very Heavy	8		

Table 27: Levels of pasture utilisation and evidence of erosion assessed at 53 sites on five pastoral leases in the Northern Alice Springs Pastoral District.

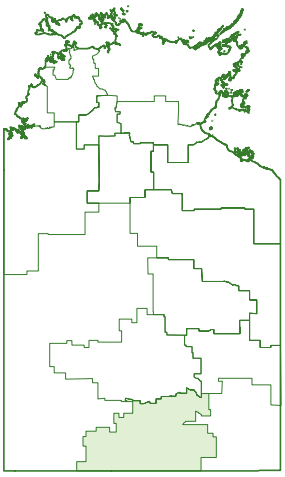
NORTHERN ALICE SPRINGS PASTORAL DISTRICT

Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 28. Most sites and pastorally more productive country in general, had responded favourably to improved seasonal conditions since 2013-14. To the extent possible, condition assessments are independent of year-to-year variability in rainfall.

Station	Condition Rating	Comments with regard to pastoral lease
1	Good: 3 sites Fair: 2 sites Poor: 5 sites	Parts of pastorally more productive land types eroded in the past, lacking expected pasture species and had made limited growth for the summer rainfall received. Less valuable pastoral country in good condition with satisfactory ground cover and expected pasture species composition.
2	Good: 2 sites Fair: 7 sites Poor: 2 sites	Most of the property in good condition. Areas burnt in extensive wildfire in 2011 recovering well.
3	Good: 6 sites Fair: 3 sites Poor: 2 sites	Grassland country in the south of the station in good condition. Areas of mulga woodland in fair condition. Small areas suffering erosion in poor condition.
4	Good: 2 sites Fair: 1 site Poor: 7 sites	Property generally in fair condition. Areas of formerly productive country which are now scalded or sheet-eroded assessed to be in poor condition. Small areas treated with ponding banks and showing some recovery.
5	Good: 5 sites Fair: 2 sites Poor: 4 sites	Most of lease in good condition. Some grassland pastures in poor condition. Areas of historic erosion which are mostly stabilised but continuing gully erosion in sections of some creeks.

Table 28: Assessed land condition at monitoring sites and traversed parts of five pastoral leases in the Northern Alice Springs Pastoral District.

SOUTHERN ALICE SPRINGS PASTORAL DISTRICT



Map 13: Location of Southern Alice Springs Pastoral District

Areas close to Alice Springs and near the South Australian border experienced better seasonal conditions based on expected pasture growth (modelled using AussieGRASS). Seasonal quality in the far south west was poor.

Analysis of Landsat imagery acquired in the latter months of 2015 indicated high to very high levels of bare soil across the pastoral district, particularly fringing the Simpson Desert and on areas of open calcareous and alluvial country. Increased amounts of bare soil were partly due to delayed recovery of vegetation from extensive wildfires in 2011 and 2012. The majority of monitoring sites visited on three stations in the Southern Alice Springs Pastoral District were assessed to be in poor condition. Beyond monitoring sites, broader areas of pastorally productive country were judged to be in mainly fair condition. Smaller areas were in either poor or good condition. The photo record shows that thickening of woody species was a feature on some calcareous and sandy country although this was partly checked by heavy browsing in some areas.

Seasonal quality

"Seasonal quality" describes the relative value of recent rainfall in producing forage for livestock. It is judged with reference to the historical record. Two indicators are used: rainfall amount compared with the long-term median and expected pasture growth based on rainfall received, simulated using AussieGRASS (www.longpaddock.qld.gov.au).

Descriptors of seasonal quality provide useful context for interpreting various measures of land condition at particular times. However, to the extent possible, land condition is assessed independently of seasonal conditions.

Rainfall statistics (Table 29) are based on gridded rainfall produced by the Bureau of Meteorology (www.bom.gov.au/jsp/awap/rain/index.jsp). Pixel (grid cell) values are calculated from rainfall amounts at recognised recording stations. Rainfall is from October 2014 to September 2015 thus incorporating one entire growing season. Modelled pasture growth is for the period November 2014 to April 2015. This growth is ranked as a percentile of the growth for all previous summers.

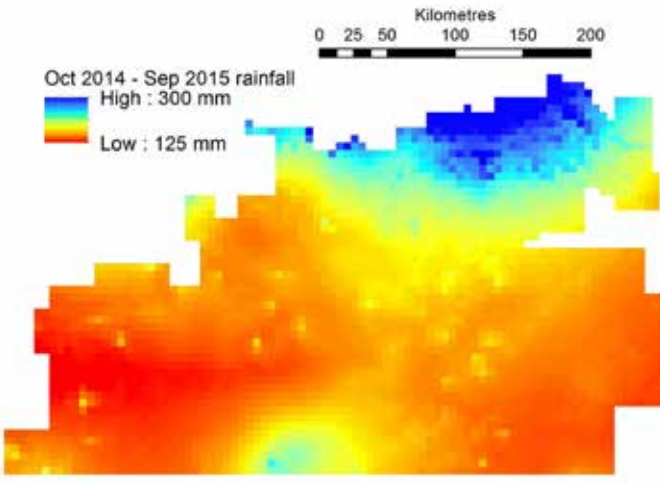
SOUTHERN ALICE SPRINGS PASTORAL DISTRICT

Rainfall (mm)		AussieGRASS	
2014 - 2015	170	Growth (kg/ha)	139
Long term medium	173	Percentile	49

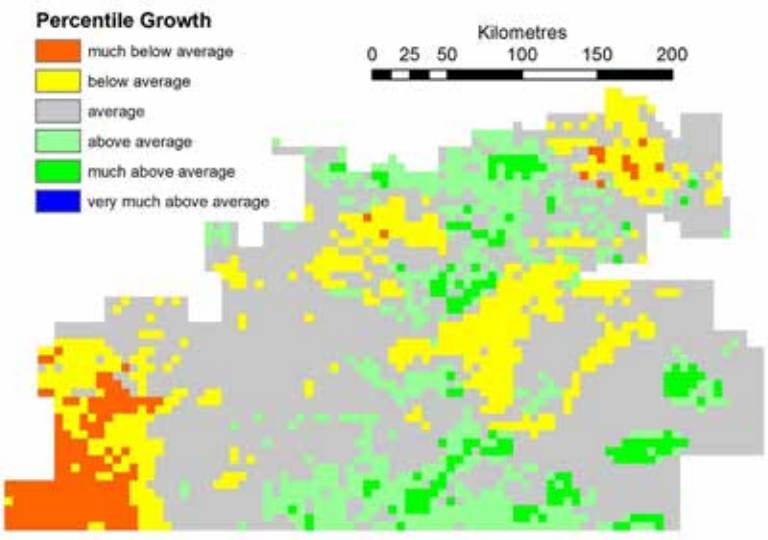
Table 29: Indicators of seasonal quality. Data spatially averaged for the Southern Alice Springs Pastoral District.

Although spatially averaged rainfall for the Southern Alice Springs Pastoral District was close to the long-term median (Table 29), there was considerable variation across the region. The north east had much higher rainfall (Figure 58, left-hand panel) with 195 mm recorded at the Alice Springs Airport in January 2015. Kulgera, near the South Australian border, also had more than 200 mm rainfall for the 12 months, October 2014 to September 2015. Elsewhere, the rainfall interpolated between sparse recording stations indicates a dry year with most of the pastoral district receiving less than 175 mm.

Modelled pasture growth over the last summer, as a percentage of the long-term record, was average to below average across much of the pastoral district (Figure 58, right hand panel). Based on modelling, the far south west of the district grew considerably less pasture than expected while parts of the central region had above average growth.



Spatially interpolated rainfall
October 2014 - September 2015



Simulated summer pasture growth
as a percentage of the long term record

Figure 58: Maps of seasonal quality. Left, gridded rainfall, October 2014 to September 2015; right, AussieGRASS-modelled pasture growth for the 2014-15 summer period as a percentage of previous summers.

SOUTHERN ALICE SPRINGS PASTORAL DISTRICT

Fire

Recent wildfire has been quite rare in the region. Data available from the North Australian Fire Information website (www.firenorth.org.au/nafi3) shows that fires in November 2014, March 2015 and September 2015 burnt 1,263 km^2 in the south west of the Southern Alice Springs Pastoral District

Bare soil dynamics

It is important to maintain adequate ground cover in the latter months of each year to minimise soil loss from wind erosion and intense summer storms. The highly variable nature of rainfall in the southern NT also means that it is necessary to carry dry feed, and associated ground cover, into the hotter months in case summer rains fail.

The amount of bare soil present at any location changes from year to year depending on rainfall and its effectiveness, fire history and amount of grazing. The percentage of bare soil in each 900 m^2 Landsat pixel (0.09 ha) was used to report the amount of bare soil across all pixels in the Southern Alice Springs Pastoral District.

Parts of the northern section of the Southern Alice Springs Pastoral District had above average vegetation cover (i.e. less bare soil) in the latter period of 2015 compared with previous years since 1988 (Figure 59). Country to the south through the central part of the region had an average level of bare soil compared with that present over the last 27 years. The south western and central eastern parts of the district had less vegetation cover (more bare soil) relative to that present since 1988. Legacy effects of extensive wildfire in 2011 and 2012 may have accounted for relatively more bare soil in these areas, and particularly those on the desert-margins of pastoral country.

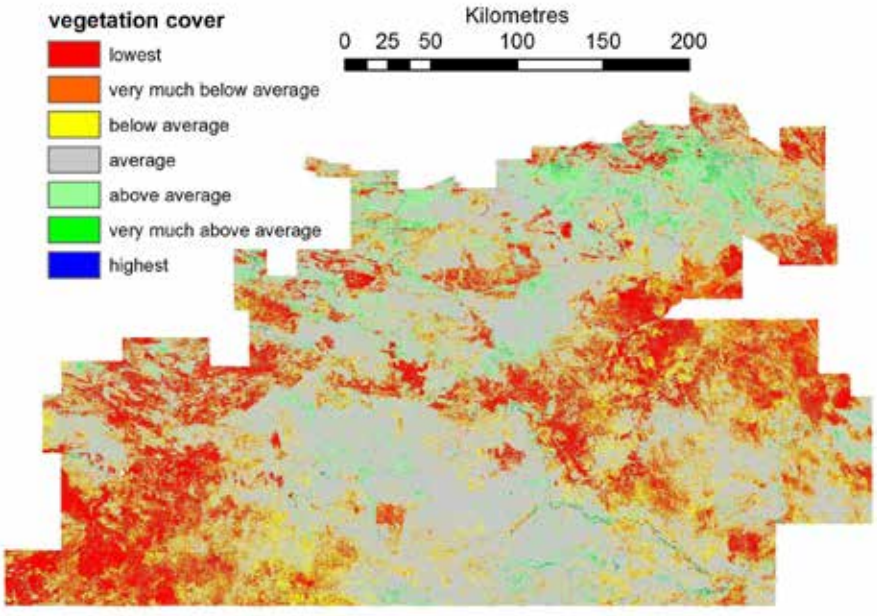


Figure 59: Rank of the amount of remotely-sensed vegetation cover present from September to November 2015 against that for previous years back to 1988. Diagonal lines show those areas burnt between January and November 2015.

SOUTHERN ALICE SPRINGS PASTORAL DISTRICT

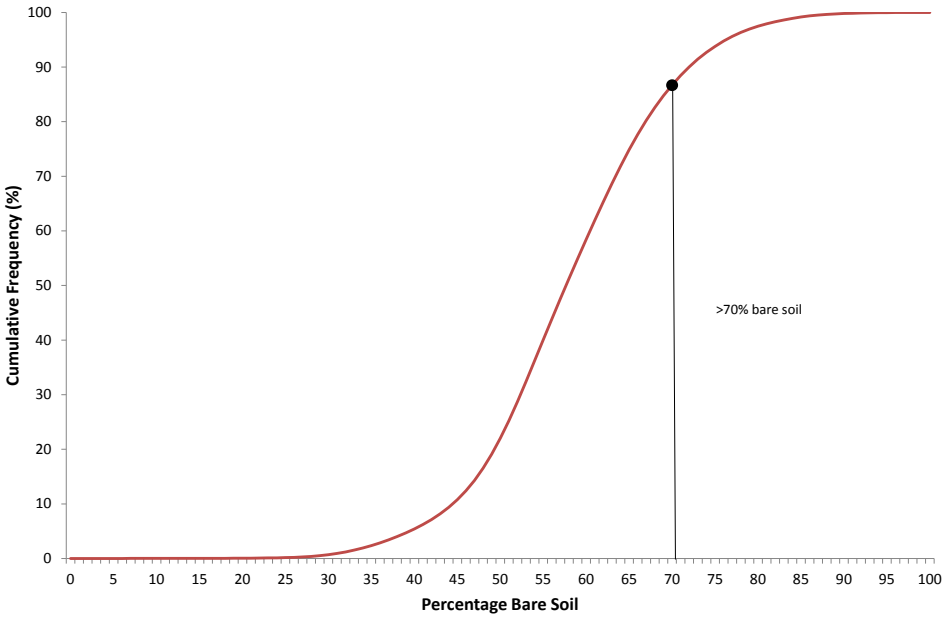


Figure 60: Percentage cumulative frequency of varying levels of bare soil in 900 m² square Landsat pixels in the Northern Alice Springs Pastoral District between September and November 2015. Areas with greater than 50% bare soil are mapped in Figure 61.

Less than 1% of the pastoral district had minor to moderate amounts of bare soil (<25% of the 900 m² Landsat pixel) towards the end of 2015 (Figure 60). Almost 80% of the region had >50% bare soil and approximately 15% had >70% bare soil. This latter area is mapped in Figure 61 and includes some areas burnt in extensive wildfires in 2011 or 2012.

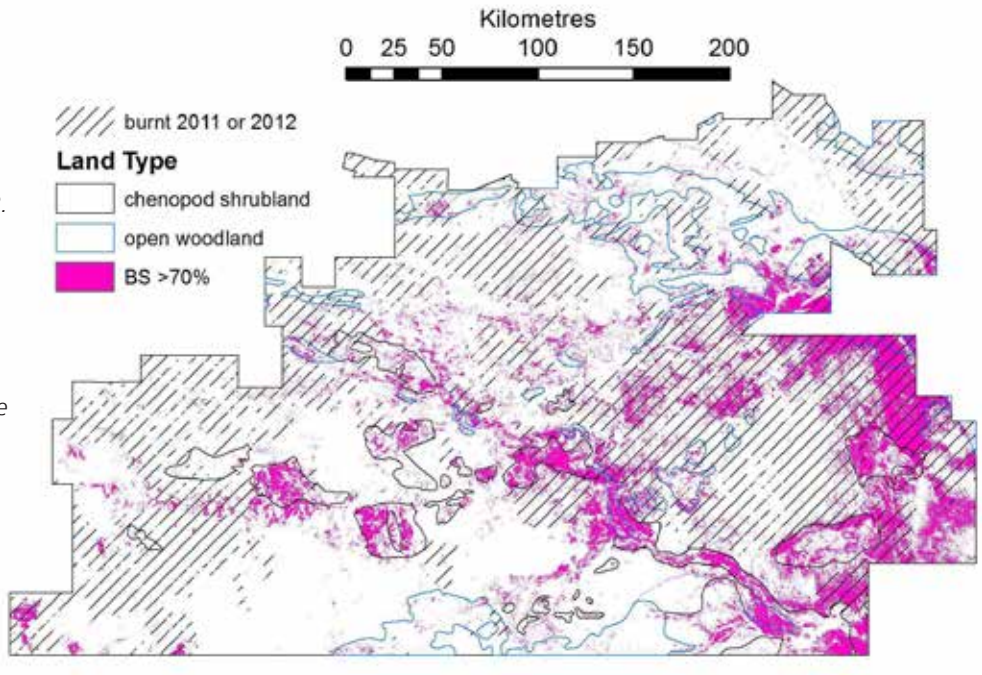


Figure 61: Parts of the Southern Alice Springs Pastoral District having more than 60% bare soil (BS) per Landsat pixel in late 2015. Areas with higher pastoral value are shown with black and blue polygons. Diagonal striping shows country burnt in 2011 or 2012.

Note that the threshold level of bare soil used for mapping purposes varies between pastoral districts. It is selected to show at what level approximately 25% of the district is affected.

SOUTHERN ALICE SPRINGS PASTORAL DISTRICT

Site-based monitoring

Three pastoral leases to the south and east of Alice Springs, comprising 8% of the pastoral district area in the Southern Alice Springs Pastoral District, were visited between August and October 2015.

Vegetation cover of the ground layer was measured using the point intercept method at 26 sites across the three leases. Sites, on average, had a high level of bare soil, moderate litter cover and minor contributions of grasses and forbs (Figure 62). Litter cover is important because it assists infiltration of rain water, helps retain seed on site and reduces erosion risk.

The majority of the 26 sites were assessed as having moderate to very heavy levels of pasture utilisation (Table 30). There was also considerable evidence of past and/or continuing erosion.

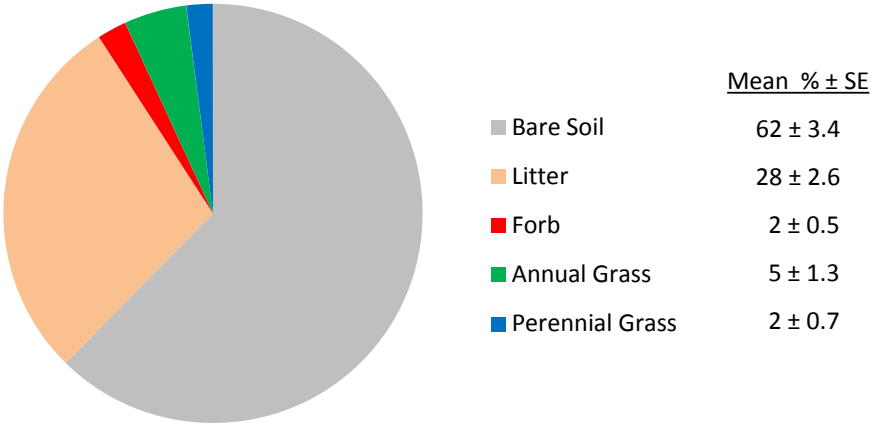


Figure 62: Mean percentage and standard error of measured components of vegetation cover in the ground layer from 26 sites on three pastoral leases in the Southern Alice Springs Pastoral District.

Pasture Utilisation		Evidence of Erosion	
Rank	% of sites	Type	% of sites
Minimal	4	Wind	73
Moderate	12	Scalding	12
Moderate to heavy	31	Water sheeting	50
Heavy	31	Gullying	4
Very Heavy	23		

Table 30: Levels of pasture utilisation and evidence of erosion assessed at 26 sites on three pastoral leases in the Southern Alice Springs Pastoral District.

SOUTHERN ALICE SPRINGS PASTORAL DISTRICT

Land condition ratings assigned at monitoring sites and the more generalised assessment of land condition across those parts of pastoral leases traversed are summarised in Table 31. To the extent possible, these assessments account for the recent generally unfavourable seasonal conditions experienced. However, it is difficult to objectively separate grazing effects from lack of rainfall in arid central Australia and a more confident judgement can only be made following seasonal conditions that promote reasonable pasture growth.

Station	Condition Rating	Comments with regard to pastoral lease
1	Fair: 2 sites Poor: 6 sites	Broader areas of calcareous country assessed to be in fair condition. Little feed remaining at time of visit but evidence of reasonable pasture growth by productive, palatable grasses in previous seasons. The majority of remaining productive country traversed considered in poor condition.
2	Good: 4 sites Fair: 2 sites Poor: 2 sites	Lease assessed in mostly fair condition. Some areas had made a reasonable response to previous, below average rainfall. Sections of some tracks and roads eroded. Thickening of woody species in some areas appears to be reducing pasture growth and grazing value.
3	Fair: 4 sites Poor: 6 sites	Station considered in poor to fair condition based on generally low vegetation cover and dominance of annual forbs and short-lived grasses in the pasture. Areas of woody thickening that may further reduce pastoral productivity. Evidence of erosion at some sites and elsewhere on those parts of the property visited.

Table 31: Assessed land condition at monitoring sites and traversed parts of three pastoral leases in the Southern Alice Springs Pastoral District.

BUSHFIRE ACTIVITY

Information supplied by the Department of Land Resource Management Bushfires NT Division

SAVANNA REGION

Higher than average rainfall in the 2013-14 wet season led to higher than average pasture/fuel loads across much of the region and a very active fire season in 2014. The late arrival of the 2014-15 wet season also saw significant fire activity continue well into December.

A significant fire that originated from Murranji Station in September 2014 continued to affect properties to its west including Wave Hill, Cattle Creek, Camfield and Dungowan Stations. This fire continued for 65 days and affected approximately 50,000 km^2 of pastoral and Aboriginal land.

Fuel loads following the 2014-15 wet season were less than the previous year, and weather conditions were conducive to successful mitigation burning early in the 2015 dry season. Many properties worked with Bushfires NT to conduct early season aerial incendiary burning with good results. Extensive on-ground strategic burning operations were also conducted with good results on Aroona, Willeroo, Manbulloo, Big River, Lonesome Dove, Murranji, Killarney, Birrimba and Delamere Stations. Many properties in the Gulf chose not to undertake burning due to the poor wet season and reduced pasture growth.

The less active wet season and successful mitigation activity combined to produce a less active fire season in 2015. Properties affected by wildfires to the end of the 2014-15 reporting period included: Tanumbirini-Nutwood, Kalala, Hayfield and Buchanan Downs Stations; properties surrounding Wubalawun, Gorrie, West Elsey and Cow Creek; Elsey and Vermelha; Scott Creek, Aroona and Dorisvale; Mooloolloo; Legune and Spirit Hills; Benmarra, Kiana, Cresswell- Walhallow and Calvert Hills Stations.

BARKLY REGION

Fire activity was a little higher than average across the Barkly region following slightly above average rainfall and pasture/fuel growth. Significant fires occurred on Beetaloo, Brunchilly, Mallapunyah, Kiana, Walhallow, Mount Drummond, Anthony Lagoon, Tennant Creek, Phillip Creek, Rockhampton Downs and Dalmore Downs Stations. An aerial prescribed burning program carried out by the Northern and Central Land Councils on Aboriginal Land Trusts lands lessened the impact of wildfires in some parts of the Barkly and Alice Springs regions.

ALICE SPRINGS REGION

Average rainfall led to a small number of fires affecting pastoral land during the 2014-15 reporting period. Fires affected Mount Doreen, Stirling, Tanami Downs, Anningie, Mount Denison and Deepwell Stations.

WEED ACTIVITY

Information supplied by the Department of Land Resource Management Weed Management Branch

Weeds are a significant land management issue on pastoral land in the Northern Territory through direct costs associated with control.

There are also a range of indirect costs including decreased pasture production from weed competition, and thick infestations reducing access to watering points or causing mustering difficulties. Measures to prevent weed spread within and between properties also has implications for livestock and pastoral lease management.

The Weed Management Branch (WMB), Department of Land Resource Management (DLRM), has weed officers based in the Darwin, Katherine, Tennant Creek and Alice Springs regions, and assists landholders to manage weeds by providing technical advice, assisting with weed management plans, carrying out surveys and controlling emergency incursions.

For more information phone 8999 4567 (Darwin), 8973 8100 (Katherine), 8951 9210 (Alice Springs) or email the Weed Management Branch at weedinfo@nt.gov.au.

DARWIN REGION

Mimosa (*Mimosa pigra*) remains the major weed impacting the pastoral industry in the Top End. Major infestations on pastoral land are located in the Mary, Adelaide, Finniss, Reynolds and Daly River catchments and result in subsequent negative effects on production and land condition. An aerial survey for mimosa in the Adelaide-Mary River catchments was conducted in the 2015 dry season in collaboration with Charles Darwin University. Results were distributed to the three individual pastoral leases within this project area, as well as a number of adjoining tenures, and demonstrated overall that these landowners are making concerted efforts for long term management of mimosa on their leases.

The Finniss Reynolds Rivers Management Project is a five-year Australian Government Biodiversity Fund project initiated in August 2012. The project is managed by TNRM with contribution from the WMB. Significant weed management, particularly for mimosa and gamba grass (*Andropogon gayanus*) continued across the range of tenures within this region, including four pastoral leases, and pastoral enterprises on adjoining tenures.

Bellyache bush (*Jatropha gossypiifolia*) infestations continued to be located on properties within the Daly catchment, and also a new infestation on a property within the Mary River catchment. Further establishment of this weed would have major implications on pastoral productivity, so identifying the extent of infestations of this weed continue to be a high priority for the Top End. One Daly River catchment property is involved in the Biodiversity Fund Bellyache Bush project, with significant on-ground actions conducted to manage this weed.

Parkinsonia (*Parkinsonia aculeata*). There are also increasing reports of the incidence of this weed, especially in the lower Daly River catchment, and efforts need to be made to increase awareness and requirements for control of this species in the Darwin region.

Prickly Acacia (*Vachellia nilotica*) The Darwin region has only a single pastoral lease with a known infestation of prickly acacia. This isolated population in the Adelaide River catchment was treated in the 2015 dry season, with this weed a target for eradication across the NT.

Weedy rats tail grasses (*Sporobolus* spp not declared) are increasing in prevalence. Increased reporting of this weed has occurred in conjunction with a Caring for Country project which aimed to increase awareness of the impacts of this weed with pastoralists. This species dramatically lowers production value of pasture and reportedly reduces the grazing life of cattle through increased wearing of teeth. WMB are currently conducting trials to evaluate herbicide options to contribute to better management of this, and other grassy weeds.

The suite of weeds including Hyptis (*Hyptis suaveolens*), *Sida* spp., gamba grass, perennial mission grass (*Cenchrus polystachios*), grader grass (*Themeda quadrivalvis*) and various *Senna* spp continue to be abundant in areas where disturbance has been caused by intense fires, feral animal damage, over-grazing or in old cropping areas.

KATHERINE REGION

The Katherine Region weed management area covers an area of approximately 386,000km^2, encompassing 95 pastoral leases. The region includes the Victoria River, Katherine, Roper, Sturt Plateau and Gulf pastoral districts. Through consideration of weed risk assessment outcomes and current distribution, the Katherine Regional Weed Reference Group has determined a list of priority and alert weeds for the region, which are identified in the Katherine Regional Weed Management Plan. Of these weeds, the following were the key focus on pastoral land in the region for the 2014-15 reporting year:

Mesquite (*Prosopis* spp.) has been known to occur on four different pastoral leases in the Victoria River District. Of these sites, one is thought to have been eradicated, and the remainder are under continual surveillance by WMB who conduct visits to the properties each year.

Prickly acacia (*Vachellia nilotica*) in the region is of increasing concern. Distribution records are available for 12 pastoral leases, the majority of which still have prickly acacia present to some degree. As survey efforts are intensified on impacted properties, infestations are continually found to be more widespread. Adult plants are often located in areas that are difficult to access. Pastoralists in the region are generally quite concerned about the presence of this weed, and in many cases are finding property owners to be proactive in regards to management effort. Further management and survey is still required, and the WMB is implementing a concerted and co-ordinated effort to engage landholders in the management of this weed on their properties.

Parkinsonia (*Parkinsonia aculeata*) is generally widespread predominately throughout the Victoria River and Gulf Districts. In many cases this weed is still considered to be eradicable at a property scale, and active management is encouraged. Few infestations are deemed to be of suitable size and density to warrant an attempt to establish the biological control agent "Uu" (Eueupithecia cisplatensis), however this agent has been released on seven properties in the region to date. Monitoring indicates that this agent is establishing on Nongra Lake, where potentially the largest parkinsonia infestation in the region exists.

Mimosa (*Mimosa pigra*) is known to occur on four pastoral properties in the region. All of these are isolated infestations and considered to have a high feasibility of control. Throughout the year the Weed Management Branch engages with the landholders to ensure adequate control programs are implemented.

Bellyache bush (*Jatropha gossypiifolia*) is known to occur on 12 pastoral leases throughout the region and continues to spread. It is anticipated that this weed will potentially spread to all properties along the Roper River, as infestations at the top of the catchment have proven to be unmanageable despite a concerted effort and input of funding. The large infestation in the upper Daly Catchment is the target of a jointly funded Federal and NT Government project which is seeing reductions in bellyache bush in strategic locations.

Grader grass (*Themeda quadrivalvis*) is well established on many pastoral properties in the Katherine and Roper Districts. This weed presents a range of challenges for landholders due to its competitiveness, short time frame to maturity and inaccessibility during optimal control periods. Trials are currently being undertaken on Delamere and Willeroo Stations to determine if alternative herbicides may afford improved management options.

TENNANT CREEK REGION

The WMB Tennant Creek region comprises the Barkly and Tennant Creek Pastoral Districts. The Barkly Regional Weed Working Group, in conjunction with the WMB, has finalised the Barkly Regional Weed Management Plan (BRWMP) which will guide regional stakeholders to target their weed control efforts. The plan identifies the declared weeds; prickly acacia, mesquite, parkinsonia, bellyache bush, rubber bush and athel pine as "priority species" that require management in this region.

Prickly acacia (*Vachellia nilotica*) was the major focus for this region, with the goal to have all known infestations treated and under an eradication programme. A concerted effort was made by the majority of Barkly pastoral leases to treat the current low level of infestations of this weed in recognition of the relative feasibility of control compared to the extensive populations found in Queensland.

Rubber bush (*Calotropis procera*) continues to pose a significant risk to productivity of grazing land. The Meat and Livestock Australia (MLA) funded Rubber Bush Project officially ended in June 2015 with a final report submitted to MLA outlining the recommendations from the trials conducted in Queensland and the Northern Territory. Monitoring of trial sites is still continuing on Rockhampton Downs Station and Helen Springs Station. Results from the trials in the Barkly will assist land managers in gaining a more thorough understanding of the control options available to them.

Two aerial trials of tebuthiuron on rubber bush were conducted by Australian Agricultural Company on Brunette Downs Station and S. Kidman & Co on Brunchilly Station, to compare kill rates of 98% recorded from Queensland. Initial trial results are very promising but further evaluation is required after the 2015-16 wet season.

Parkinsonia (*Parkinsonia aculeata*) was a target within the Lake Tarrabool, Lake Sylvester and Lake Woods catchments where the majority of properties have now completed surveys, developed management plans and commenced control. The biological control agent, "Uu" was released at six sites to evaluate whether this agent could establish viable populations. To date, it has established at Newcastle Waters, and further evaluation will be conducted to determine the effect on parkinsonia infestations.

ALICE SPRINGS REGION

Athel Pine (*Tamarix aphylla*). Long term amenity plantings of athel pine which persisted on two pastoral properties were controlled, demonstrating recognition of the eradication target for this weed. Five pastoral properties (Lilla Creek, Horseshoe Bend, Henbury, Maryvale and Idracowra) collaborated with WMB in athel pine management along 400 kms of the Finke River where there has been ongoing management for many years. Vigilant management will need to continue to ensure populations do not re-establish in this stretch of river.

Cactus (*Opuntioids*). Four pastoral properties (Orange Creek, Pine Hill, Henbury and Undoolya) collaborated with WMB in controlling the emerging threat of Cacti on their properties; this included common prickly pear (*Opuntia stricta*) and Rope cactus (*Cylindropuntia imbricata*). There are currently mainly isolated infestations of cacti on pastoral leases; consequently, these weed species should be a target for management leading to eradication.

NT WIDE

Alert weeds

Rubbervine (*Cryptostegia grandiflora*) presents a major threat to pastoralism across the NT. Annual surveys reveal a gradual encroachment from Queensland towards the NT border, with the closest known infestations recently found within three kilometres of the Northern Territory. WMB operates in partnership with Queensland Biosecurity, the Carpentaria Land Council and Southern Gulf Catchments to undertake planning and management through burning and herbicide application.

Rubbervine is also present on Argyle Lake in Western Australia, approximately 20 kms from the Northern Territory border. The Department of Agriculture and Food, WA is working with the owners of the affected area to actively manage the infestation.

Parthenium (*Parthenium hysterophorus*) is also a major threat to the Northern Territory, as it is likely to spread with machinery and cattle. Two new infestations were reported to the Weed Management Branch during the 2014-15 year. On both occasions these reports were followed up with emergency response visits to the pastoral properties. While parthenium was not located at either of these properties, regular inspections will occur during and after upcoming wet seasons.

A livestock holding facility at Tennant Creek remains under strict quarantine after prior detection. An education and awareness campaign for both rural and urban residents continues within the region.

Training

The WMB continued its involvement in conducting Weed Management courses within the Rangeland Management Workshops in collaboration with Department of Primary Industries and Fisheries and Pastoral companies including Heytseberry and AACo.

Weed Spread Prevention

A Weed Spread Prevention Project Officer was employed in 2014-15 to develop a cross-industry and cross-tenure strategy. The pastoral industry plays a key role in the prevention of weed spread, both within property, and between properties and regions. Annually, young prickly acacia plants are found to be growing on the roadside following the wet season. Adequate quarantining of cattle from Queensland is strongly encouraged by the Branch, however officers recognise this can present a logistical and costly challenge for station management. Selecting paddocks that can be more easily accessed and prioritised for subsequent surveillance may be a more feasible option.

FERAL ANIMALS

Information supplied by the Department of Land Resource Management Flora and Fauna Division

Camels

Feral camel management undertaken as part of the Australian Feral Camel Management Project (AFCMP) has continued in the Northern Territory as part of the Red Centre Biodiversity Project under funding from the Caring for Our Country Program. Two culling operations were undertaken in 2015 and a total of 769 camels were removed. At the conclusion of the AFCMP camel densities in the Northern Territory had been reduced by more than 80% of pre-removal densities. Current reports from land managers indicate that camels are not causing any major issues in the Northern Territory at present.

Feral cats

Exclusion fences are used to protect small populations of the endangered mala (rufous hare wallaby) from foxes and cats on Watarrka National and Uluru Kata Tjuta National Parks.

A multifaceted research effort is underway in the Top End to investigate the role of feral cats in mammal declines, funded by the National Environmental Research Program. Two 64 ha experimental cat exclusion plots have been constructed in Kakadu National Park to investigate the natural population responses of in situ small mammal and reptile populations in comparison to unfenced paired areas. Field work was completed in 2015 and the data is being analysed.

A large camera trapping trial has been undertaken, comparing lure types, camera position and camera number, in order to improve detection rates and optimise survey and monitoring methods for cats. Surveys have been completed across a range of land tenures to evaluate spatial relationships amongst small mammal diversity, cats, dogs and other relevant environmental parameters. The outcomes have been published and used to develop an award-winning booklet on camera trapping survey methods in northern Australia.

Rabbits

Rabbit numbers in central Australia appear to have increased in recent years but are not at levels recorded prior to the arrival of Rabbit Haemorrhagic Disease (RHD). RHD and myxomatosis are periodically active throughout the region and help keep rabbit numbers in check. Very little additional rabbit management is undertaken anywhere in central Australia.

Horses and donkeys

A total of 1554 horses have been removed from Aboriginal land and the National Park estate during culling operation undertaken in the southern Northern Territory during 2015.

There is a large-scale horse and donkey management program in the Victoria River district (mostly through the Victoria River District Conservation Association), where horses and donkeys have been declared as a pest and landholders are required to manage horse and donkey populations on their property under the *Territory Parks and Wildlife Conservation Act*. This program achieved substantive reductions in the horse and donkey populations between 1999 and 2006 and current activity is directed at maintaining those reductions.

Water buffalo

Current estimates put the feral water buffalo population across Arnhem Land at a minimum of 100,000 at an overall density of approximately 1 buffalo per km^2. Localised densities in excess of 10 buffalo per km2 have been recorded in some areas. Local indigenous land managers have reported severe land degradation from the impact of feral water buffalo, and buffalo densities and impact are a major concern for Traditional owners across Arnhem Land.

During 2015 local indigenous land managers undertook removal operations in Blyth/Cadell River floodplain and Arafura Swamp floodplain regions of Arnhem Land.

Wild dogs

Wild dogs are managed on the pastoral estate using a range of methods including 1080 baits under permit. The establishment of authorised Regional Wild Dog Management Groups, a one-stop-shop (single lead agency) for baiting authorisations, and increased industry involvement has seen a shift to trained and authorised members of the Regional Wild Dog Management Groups undertaking 1080 injection of wet meat baits.

The Minister for Land Resource Management and Primary Industry and Fisheries appointed a committee of industry and agency representatives to review wild dog management and report back in late 2015.

Feral pigs

Feral pig management is undertaken on some pastoral properties in the Top End using an integrated program of 1080 baiting, trapping, aerial and ground shooting. There is increasing interest from pastoral properties to undertake pig management using 1080 baiting.

Parks and Wildlife are currently undertaking a pig and banteng management program on the Cobourg Peninsula, which is having considerable success in the management of these species. Some pig management is being undertaken in Arnhem Land, particularly in the Blue Mud Bay area, to manage the impacts of pigs on the environment.

Parks and Wildlife staff provides free assistance to landholders who wish to conduct 1080 management for pigs.

MEETINGS OF THE BOARD

Three meetings of the Pastoral Land Board were held between 1 October 2014 and 30 September 2015 as follows:

101st Meeting: teleconference held 4 February 2015

The Board endorsed the 2013-14 Pastoral Land Board Annual Report to be sent to the Minister for Land Resource Management and tabled in the Legislative Assembly.

102nd Meeting: held 24 March 2015 in Darwin

The Board noted the out-of-session approval of a land clearing permit and non-pastoral use permit for horticultural activities on Undoolya Station in the Southern Alice Springs Pastoral District. The Board approved a non-pastoral use permit for accommodation activities on Flying Fox Station in the Roper Pastoral District. The Board considered the status of a voluntary management plan in the Katherine Pastoral District and the quarterly newsletter to be distributed to pastoralists. The Board received a presentation on the proposed Project Sea Dragon on Legune Station in the VRD Pastoral District. The Board considered the 2014-15 Rangeland Monitoring Field Schedule.

103rd Meeting: held 22 June 2015 in Tennant Creek

The Board considered the status of a voluntary management plan in the Katherine Pastoral District and the course of remedial action outlined in section 39 and 40 of the *Pastoral Land Act*. The Board endorsed the quarterly newsletter to be distributed to pastoralists. The Board noted the update of the Rangeland Monitoring Field Schedule, the process for applications for stock route and stock reserve incorporations and the submission of a subdivision application in the Katherine Pastoral District.

APPLICATIONS CONSIDERED BY THE BOARD IN 2014-15

Land Clearing Applications

Station	Pastoral District	Purpose	Total Area (approx.)	Decision
Undoolya	Southern Alice Springs	Horticulture	325 hectares	Approved

Non-Pastoral Use Applications

Station	Pastoral District	Purpose	Term	Decision
Undoolya	Southern Alice Springs	Horticulture	30 years	Approved
Flying Fox	Roper	Accommodation	30 years	Approved

Subdivision Applications

Under section 61 of the *Pastoral Land Act,* the Minister refers applications for subdivision of pastoral leases to the Board for consideration and recommendation. During 2014-15 the Board did not consider any applications for subdivision.

Perpetual Pastoral Lease Applications

Under section 62 of the *Pastoral Land Act,* the Minister refers applications for conversion of term pastoral leases to perpetual tenure to the Board for consideration and recommendation. During 2014-15 the Board did not consider any applications for lease conversions.

APPENDICES

APPENDIX 1

NT Cattle Industry

Source: Department of Primary Industry and Fisheries Livestock Industries Development Group

The NT cattle population has historically accounted for an estimated 2 million head, or over 7.0% of the Australian total. NT cattle herd by pastoral district; Alice Springs has 20%, Barkly Tablelands and Tennant Creek 30%, Victoria River District and Katherine 32%, and Darwin, Elsey and Gulf 18% of the total NT herd.[1]

In 2013-14, an estimated 511,846 head of cattle were turned off from Territory pastoral properties, a decrease of 17.0% on 2012-13.

Of the total Territory cattle turned off in 2013-14, 40.8% were destined for interstate trade, and 59.2% were exported live overseas reflecting the improved conditions in live export markets. 6,036 cattle were slaughtered in small private abattoirs. AAco has completed construction of a large-scale, state of the art meat processing facility at Livingstone (outside Darwin) and is preparing to ramp-up operations in 2015.

More recent figures for NT live cattle exports through the Port of Darwin show that in 2013-14, 302,768 head of NT cattle were exported, a increase of 22.4% compared to 2012-13. Facing of escalating domestic prices for beef, the Indonesian Government has subsequently eased import quotas on beef imports.

Interstate movements' fell to 203,042 a 44.7% decrease on 2012-13 as Indonesian buyers were importing more cattle.

Gross Value of Production

The estimated gross value of production for the cattle industry was $281.7 million in 2013-14, a 12.8% decrease compared to the previous year. This was mainly due to a decrease in the value of cattle movements' interstate. In 2014-15, cattle production value is projected to increase by 13.5% to $319.8 million.

Cattle contributed 57.6% of the total value of Territory rural industries and fisheries production in 2013-14.

(a) Direct Contribution to Gross State Product (GSP)

NT cattle industry's value adding direct contribution (output) to NT GSP in 2013-14 is estimated to be $143.7 million, or approximately 0.68% of total NT GSP.

(b) Flow-on Value (Direct and Indirect Contribution)

The flow-on effects of additional output (direct contribution) of $143.7 million and additional income (indirect contribution) of $35.6 million by the pastoral industry on the rest of the NT economy is estimated to be $179.3 million.

NT Farm Performance

Many farm businesses in the upper Northern Territory derive a large share of their total cash receipts from selling cattle for live export, particularly to Indonesia. Numbers of cattle sold for live export declined between 2009–10 and 2012–13, before rebounding strongly in 2013–14. They are expected to remain high in 2014–15. As a result of the expansion of the live export trade in 2013–14 and 2014–15, cattle for this market are now also being sourced from a much expanded area of northern Australia.

In 2013–14 farm cash income increased to average $382,100 a farm. While turn-off of cattle increased slightly, average prices received were lower than in 2012–13. Total cash receipts declined slightly as a result, but total farm cash costs declined by much more—mainly as a result of reduced purchases of cattle and transfer of cattle on to Northern Territory properties by farm businesses with properties interstate.[2]

Rural Land

During 2013-14, rural property sales recorded increased activity (three overseas buyers) in the market for beef cattle stations in NT.[3] This activity ended the sales drought with overseas buyers taking more interest, with 2014 finishing with other negotiations well underway. Current listings are light on properties with scale.

1. NT Herd figure based on Northern Territory Cattlemen's Association 2011 Year Book p11
2. ABARES Australian farm survey results 2012–13 to 2014–15 March 2015 p28
3. Herron Todd White National Rural Market Update Brisbane 27 February 2015 Tim Lane http://www.htw.com.au/Industry_Presentations/2015_Rural_Property_Update.pdf

APPENDIX 2

NT Cattle Outlook (to 2019-20)

Source: Department of Primary Industry and Fisheries Livestock Industries Development Group

The weighted average saleyard price of beef cattle is forecast to increase by 19% in 2014–15 to 349 cents a kilogram (dressed weight). Despite unfavourable seasonal conditions resulting in high cattle slaughter in the first half of the financial year, strong export demand for Australian beef and a depreciation of the Australian dollar supported cattle prices.

Between July and November 2014, the weighted average saleyard price of beef cattle averaged 9% higher year-on-year, even though Australian cattle slaughter was also 9% higher year-on-year. Cattle prices rose further in December 2014 and January 2015.

This followed widespread rainfall across major cattle producing regions that resulted in farmers increasing demand for restocker cattle (primarily young cattle). However, higher prices are expected to result in relatively high cattle slaughter continuing through the remainder of 2014–15.

Through 2015-16 the weighted average saleyard price of beef cattle is forecast to increase by 16% in 2015–16 to 405 cents a kilogram (dressed weight). This will place further upward pressure on cattle prices, particularly for trade steers and medium cows. Additionally, strong export demand for Australian beef is expected to continue, supported by an assumed lower Australian dollar and tariff reductions in some major markets as a result of recently negotiated bilateral trade agreements.

Cattle prices are projected to increase again in 2016–17 as herd rebuilding activities continue and cattle slaughter falls further. Increasing international demand for Australian beef and veal is projected to keep cattle prices high in real terms in 2017–18 and 2018–19. In 2019–20, with an expanded cattle herd, cattle prices are projected to fall in real terms as slaughter increases.

4. ABARES Agricultural commodities – vol. 5 no. 1 • March quarter 2015 p102-103

Prospects for Movement

A In 2014–15 Australian beef and veal exports are forecast to increase by 3% to more than 1.2 million tonnes. International demand for Australian beef and veal is forecast to be strong, supported by a fall in the Australian dollar and tariff reductions on imports into Japan and the Republic of Korea. The United States is forecast to be the largest market for Australian beef and veal in 2014–15, accounting for 34% of total exports, compared with 22% in 2013–14. Higher exports to Japan are also forecast.

Reflecting lower domestic supply, Australian beef and veal exports are forecast to fall by 5% in 2015–16 to below 1.2 million tonnes, followed by a projected 3% fall in 2016–17. However, international demand for Australian beef is expected to continue rising, leading to higher export unit values.

From 2017–18 to 2019–20, Australian beef and veal exports are projected to increase in both volume and value terms. Over the projection period, Australian exports are expected to be more concentrated on the four major markets (Japan, United States, Republic of Korea and China) than in previous years.

Demand for imported beef in Japan is forecast to be largely unchanged in the short term, but increased competition from US beef in the Japanese market is expected. Japan's demand for imported beef in 2014–15 is forecast to remain largely unchanged at around 520,000 tonnes (shipped weight), consistent with the past five years. However, the proportion of imports from Australia is forecast to fall, while the proportion from the United States is forecast to rise.

In 2014–15 Australia's market share is expected to increase as Australian beef gains a competitive advantage over US beef because of lower tariffs under the Japan–Australia Economic Partnership Agreement (JAEPA).

Australian beef and veal exports to Japan are forecast to rise by 7% in 2015–16 to 320,000 tonnes, followed by a projected 5% rise in 2016–17 to 335,000 tonnes. These increases largely reflect the effect of lower prices of Australian beef over US beef in the Japanese market.

From 2017–18 to 2019–20, relatively sluggish economic growth is assumed for Japan and total beef imports are projected to increase only marginally. However, increasing competition is expected from US exports because of an expected rise in US domestic beef supply following herd rebuilding. This is projected to lead to a small fall in Australian exports to Japan, particularly in higher value cuts, to around 330,000 tonnes in 2019–20.

Australian beef and veal exports to the United States are forecast to increase by 11% in 2013–14 to 230,000 tonnes (shipped weight) and a further 4% in 2014–15 to 240,000 tonnes. This reflects lower supply of manufacturing beef in the United States and a subsequent increase in demand for imports. In 2014–15 Australian beef and veal exports to the United States are forecast to rise by 58% to 420,000 tonnes. Between July 2014 and January 2015, beef and veal exports to the United States were 114% higher year-on-year.

In 2015–16 Australian beef and veal exports to the United States are forecast to decline by 10% to around 380,000 tonnes. Assuming average seasonal conditions, the United States is expected to continue herd rebuilding, retaining a higher proportion of female cattle. Australian beef and veal exports to the United States are projected to fall a further 8% in 2016–17 as Australian supply contracts further. Over the remainder of the projection period, Australian beef and veal exports to the United States are projected to rise.

Australian beef and veal exports to the Republic of Korea are forecast to remain largely unchanged in 2014–15 at around 155,000 tonnes. In the first seven months of 2014–15 exports to the Republic of Korea were 8% lower year-on-year. In 2015–16 Australian beef and veal exports to the Republic of Korea are forecast to increase by 2% to 158,000 tonnes. Beef production in Korea is expected to continue declining as producers take advantage of government assistance to exit the industry because of low profitability. Over the medium term, Australian beef and veal exports to Korea are forecast to increase to 175,000 tonnes in 2019–20.

Australian beef and veal exports to China are forecast to fall by 25% in 2014–15 to 120,000 tonnes, followed by a further 2% fall in 2015–16 to 118,000 tonnes. These falls largely reflect higher prices of Australian beef and greater competition from countries in South America. Over the medium term, relatively strong economic growth in China will support beef consumption and it is expected to increasingly exceed domestic production, leading to higher imports. Australia is expected to be an important supplier of beef to China, with exports projected to increase from 2016–17.[5]

Prospects for Live Cattle Trade

In 2015–16 feeder and slaughter cattle exports are forecast to fall by 10% to 900,000 head. This reflects lower available supply of exportable cattle following two years of high Australian cattle slaughter and live exports. Export unit values are forecast to rise because demand for Australian live cattle is expected to be high in 2015–16.

Over the medium term, feeder and slaughter cattle exports are projected to recover to around one million head, with Indonesia expected to remain the primary market. Growth in Indonesian beef consumption is expected to exceed growth in domestic production over the medium term. As a result, imports will be required to assist in stabilising domestic prices.

Demand is also expected to increase from Vietnam and Malaysia, as assumed relatively strong economic growth supports higher beef consumption. These are important markets for Australian live cattle exports because they do not impose weight or volume restrictions. Additional demand may come from new markets, including China, Thailand and Lebanon, if supply chains are developed in these countries and approved under the Exporter Supply Chain Assurance System.[6]

5. ABARES Agricultural commodities – vol. 5 no. 1 • March quarter 2015 p106-108
6. ABARES Agricultural commodities – vol. 4 no. 1 • March quarter 2014 p110

APPENDIX 3

Pastoral Production Activities

Source: Department of Primary Industry and Fisheries Livestock Industries Development Group

The DPIF Livestock Industries Development group provides research, development and extension services to facilitate the sustainable development of the Northern Territory pastoral industry. Areas of expertise include rangeland management, animal production, genetics, improved pastures and market development. The DPIF also plays a role in Indigenous economic development through its partnership in the Indigenous Pastoral Program.

The DPIF Rangeland Program's research and extension activities aim to optimise the sustainable and productive use of native pastures. Recent research efforts have focussed on investigating the benefits and costs of a range of grazing systems and land management practices. Over the past 14 years, DPIF has developed a nationally-significant catalogue of pasture growth models for the important pastoral land types of the NT. These models are used to estimate sustainable livestock carrying capacity and to test management scenarios with potential to increase the resilience of pastoral businesses to seasonal variability and climate change. The following sections summarise the outcomes of some of the main activities undertaken by the Rangeland Program in the past year.

Pastoral Feed Outlook Bulletin

Since late 2011 DPIF has produced a quarterly bulletin that summarises the seasonal outlook, recent forage growth and current standing pasture biomass in each of the 11 pastoral districts of the NT. The bulletin can alert the industry and its advisers to issues such as low pasture levels, increasing drought risk and high fire risk. The bulletin is available on the DPIF website at: www.nt.gov.au/d/Primary_Industry

When a new Pastoral Feed Outlook is released, an alert is emailed to DPIF staff, the NTCA, NT Drought Committee, selected DLRM staff and the Minister for Primary Industry and Fisheries. The availability of the Outlook is also advertised in the DPIF newsletters. Increasingly, producers are asking to be added to the distribution list. Anyone wishing to be added to the distribution list can contact dionne.walsh@nt.gov.au.

Carrying Capacity Research and Application

The DPIF continues to provide carrying capacity assessments to property owners on request. The agency also provides advice to the PLB on subdivision applications. In 2015 we also provided technical advice to the consultants undertaking the valuations for the Valuer General.

The DPIF has calibrated pasture growth models for more than 20 pasture types across the NT. Median pasture growth estimates from these models are routinely used for property carrying capacity assessments, Grazing Land Management workshops and for testing the performance of management options/practices in research projects.

It continues to be difficult for the DPIF to undertake objective assessments of carrying capacity in some areas of the NT due to inadequate land type mapping. This is particularly the case for parts of the Roper, Gulf and southern Sturt Plateau Districts. The DPIF values the assistance of DLRM staff in supplying customised land type mapping from remotely sensed data interpretation (via an informal arrangement) in these regions. Recent investments by DLRM to produce improved mapping for the northern Barkly have improved the spatial data available, but the need for high quality land type mapping in other areas of the NT remains.

Grazing Systems

Beyond Continuous Set Stocked Grazing

Current DPIF grazing systems trials and demonstrations are being conducted at Old Man Plains Research Station near Alice Springs, Mungabroom station (Barkly) and Douglas Daly Research Farm. Updates on these projects can be found in the DPIF Annual Research Achievement report at www.nt.gov.au/d/Content/File/p/Tech_Bull/TB354.pdf

The "Quality Graze" trial at Old Man Plains is testing and demonstrating recommendations that have been identified from recent research projects and promoted through the Grazing Land Management (GLM) workshops. The strategies being investigated include using the GLM methodology to set sustainable stocking rates, annual stocking rate adjustment based on seasonal variability, and pasture spelling achieved via rotational grazing. Pasture productivity, land condition and animal performance are regularly measured. Key findings to date include:

- Our current carrying capacity methodology appears to be sustainably matching stocking rate to land capability and maintaining land condition regardless of spelling or annual stocking strategy, and provides a buffering strategy for cattle production over a dry period of at least 12 months.

- Consistent production of steers for premium beef markets is possible in terms of growth rate and fat development across a range of seasons when stocking rates are matched to forage supply.

- Meat Standards Australia (MSA) compliance is possible under conditions similar to those experienced over the past 5 years however more research is required to determine how to achieve more consistent levels of compliance.

- Spelling has had no detectable effect on pasture dynamics over the trial period. Although it would be expected that spelling may be important in land condition recovery, no clear evidence has been found to date because all paddocks were spelled to some extent prior to the trial starting.

More information about this trial can be obtained by contacting chris.materne@nt.gov.au.

Sustainable Grazing Practices

In 2015, DPIF concluded a three-year project (Climate Clever Beef Phase 2) to assess the viability and practicality of integrating "carbon farming" into northern beef enterprises. The project worked with producers in the Barkly, VRD and Douglas Daly to determine what carbon farming options are relevant, how much carbon might be sequestered, how much methane could be abated and how various carbon farming options perform in terms of their potential impact on land condition, animal productivity and economic performance. The case study results show that some enterprises will have potential for carbon income; however, the implementation of practices that improve herd productivity in cost-effective ways is still the key way to improve profitability. Case studies from this project can be found at www.futurebeef.com.au/resources/projects/climate-clever-beef/. A summary of the major conclusions was recently published in the Katherine Rural Review newsletter www.nt.gov.au/d/Content/File/p/NL/KRR/KRR%20325.pdf. A Special Issue of the Rangeland Journal presenting the detailed results of this project will be published in 2016. More information about this project can be obtained by contacting dionne.walsh@nt.gov.au.

The "Shruburn" experiment at Kidman Springs has been investigating the impact of fire management on woody vegetation cover and pasture condition for 22 years. The trial plots are replicated on red and black soil sites, with grazed experimental plots burnt early or later in the dry season, every two, four and six years, and these are compared to unburnt control plots. The major findings were recently published in the Rangeland Journal (Cowley et al. 2014, Rangeland Journal 36(4): 323-345). More information about this experiment can be found at www.futurebeef.com.au/resources/projects/kidman-springs-fire-experiment-shruburn/ or by contacting robyn.cowley@nt.gov.au.

Future Developments

The latter part of 2014 and into 2015 has seen a greatly improved market situation for NT cattle and a significant boost in industry confidence. Many stations have been sold and property prices appear to be increasing. The Pastoral Land Act changes that facilitate diversification appear to be taking effect. A number of new and existing owners have expressed an intention to greatly increase herd numbers. The DPIF is therefore anticipating an increase in development advice, related to pastoral intensification, improved pastures and crops.

DPIF has started a project to estimate the potential for a sustainable increase in cattle numbers in the Northern Territory and the developments that would be needed to achieve this increase in the different production zones. This project is expected to have preliminary results available by the end of 2016.

www.lrm.nt.gov.au/pastoral-land-board