Department of Primary Industries

NSW Seasonal Conditions Report - December 2013

Highlights

- Near normal rainfall is likely over the next 3 months, with lower rainfall probabilities for eastern NSW, especially the north east.
- Warmer daytime & overnight temperatures are likely in the northern, central & eastern areas of NSW.
- November was close to normal in daytime temperature, & rainfall was above average along the coast but below average across the west & central west.
- Over the last 3 months, rainfall has been below average over most of western & central NSW.
- Pasture growth during November was low across most of western, north western & central western NSW, but average in the east. Modelled topsoil moisture was low across western & central NSW, but improved on the coast. Subsoil moisture declined slightly.
- Stock condition & pasture production will depend upon follow up rainfall over the coming months. Considerable resources are available to assist in management at http://www.dpi.nsw.gov.au/agriculture/emergency/drought/managing

1. Summary

Over December to February near normal rainfall conditions are likely across most of western and central NSW, with a slightly reduced likelihood across the tablelands and south and central coast. Lower than normal rainfall is likely in the north east of NSW. December and January are likely to be drier than normal.

Warmer than normal daytime and overnight temperatures are likely over the December to February period, particularly across the northern and central areas of NSW. Near normal temperatures are likely in the south west. December is likely to be warmer than normal, except overnight in the south west. January is also likely to be warmer than normal.

The ENSO climatic indicators are currently neutral, and the ENSO outlooks suggest a high probability for neutral conditions to continue over summer.

Over November, 53% of NSW received below average rainfall, with western and central NSW receiving less than 60% of average. The east received 80-200% of average, with the highest falls along the coast. Daytime temperatures were near average, and overnight temperatures slightly cooler than average.

Most of the Western and Central West LLS districts received below to well below average November rainfall, relative to historical records. Rainfall across most of these districts was restricted to 10 mm or less. The majority of the coast and eastern fall areas received well above average to extremely high relative rainfall (19% of NSW), with falls of between 100-300 mm or more.

In relative terms, quarterly rainfall was below average across 71% of NSW, covering most of the western and central areas. It was extremely low across an area extending from Tibooburra to the south and south east towards Hay and Deniliquin. Quarterly relative rainfall was average or above over 29% of NSW.

Relative rainfall for the last six months was below average across the north west and far north west, but average over the remainder of NSW.

Modelled topsoil moisture was low over 89% of NSW, particularly across the western and central areas, but improved over the coastal LLS districts. Modelled subsoil moisture also declined slightly during the month, with an additional 8% of NSW in the low category. Higher than normal rainfall is needed to replenish depleted profiles.

Modelled pasture growth for November was limited across most of the Western and Central West LLS districts. Relative to historical records, it was well below average in these areas. Biomass levels were similar to October, were low in the north of the Western LLS district and across the North West and Central West LLS districts but improved along the coast. Relative to historical records, biomass was average across the coast and most of the west.

Quarterly relative pasture growth was low over much of the Western, North West, Northern Tablelands and Central Tablelands LLS districts.

The seasonal outlooks presented in this report are obtained from the Australian Bureau of Meteorology & other sources. These outlooks are general statements about the likelihood (chance) of (for example) exceeding the median rainfall or minimum or maximum temperatures. Such probability outlooks should not be used as categorical or definitive forecasts, but should be regarded as tools to assist in risk management & decision making. Changes in seasonal outlooks may have occurred since this report was released. Outlook information was up to date as at 6th December 2013.

2. Seasonal outlook

Seasonal outlook and ENSO information are sourced from the Australian Bureau of Meteorology (BoM) and international sources. The BoM's official outlooks are based on modelled output from the Predictive Climate Ocean Atmosphere Model for Australia (POAMA), which is a dynamical (physics-based) climate model developed by the BoM and CSIRO Marine and Atmospheric Research. Further information on POAMA outlooks can be obtained here and at http://poama.bom.gov.au/.

Outlooks should be treated with caution when skill is low and strong climate drivers are lacking. In these situations, secondary influences (such as sea surface temperatures around the continent) may have a higher impact.

Changes in seasonal outlooks may have occurred since this report was released, and can be determined by clicking on the links provided.

Seasonal outlook and ENSO information were collated from late November to early December and were up to date as at 6th December 2013.

2.1 Seasonal rainfall outlook

- For the three month period from December to February, near normal rainfall conditions are likely over the central and western areas of the State. There is a slightly reduced (40-45%) chance of exceeding median rainfall across the tablelands and south from the mid-north coast. Lower than normal rainfall is likely across the north east of the State, including the north coast as well as part of the mid north coast and northern tablelands. Here the probability of exceeding median rainfall is at 30-40% (Figure 1).
- This means that for every ten years with similar climate patterns to those at present, in north eastern NSW three to four December to Feburary periods would be expected to be wetter than average, and six to seven drier than average.
- The confidence (skill) for this outlook is moderate across the northern half of NSW and parts of southern and south eastern NSW, (ranging from 55-65%). The skill is low (50-55%) for the far north west, far south west and for the remainder of the southern half of the State (Figure 4).

2.2 Seasonal temperature outlook

- Over the three month period from December to February, warmer than normal daytime temperatures are likely across north western, north-central and eastern NSW, with the probability of exceeding the long term median maximum temperature being more than 60%. There is a 65-70% probability across north eastern NSW, but for the far west and southern areas of the State, the probability of warmer than normal daytime temperatures is 50-60% (Figure 2).
- The confidence (skill) for this outlook is high across north eastern NSW, low to moderate for central NSW and low for western NSW (Figure 4).
- This means that for every ten years with similar climate patterns to those at present, about six to seven December to February periods would be expected to have warmer than average daytime temperatures and three to four cooler than average temperatures.
- Warmer than normal overnight temperatures over December to February are also likely across northern, north-central and eastern NSW, with the probability of exceeding the long term median maximum temperature being more than 60% and increasing to the north and north east. For the far west and southern areas of the State, the probability of warmer than normal overnight temperatures is 50-60% (Figure 3).
- The confidence (skill) for the minimum temperature outlook is low to moderate across NSW (Figure 4).

2.3 Monthly rainfall and temperature outlook (experimental)

The monthly experimental climate outlooks from the POAMA model are provided with thanks to, and by special agreement with, the Bureau of Meteorology. However, they are experimental only, do not currently form part of the BoM's standard services and are not yet fully calibrated. They also may differ from the operational seasonal outlooks as they may be based on a different number of scenarios (ensembles). They should therefore be used with some caution. Feedback on the experimental outlooks can be provided to climate.helpdesk@bom.gov.au.

December

- The experimental rainfall outlook for December (Figure 5) suggests drier than normal conditions are likely across NSW, with a 30-40% probability of above median rainfall occurring over most of the State. For the north west, the probability is 20-30%. The outlook has a moderate confidence

(skill) over most of the State, except for the south west where it is low.

- The experimental maximum temperature outlook for December (Figure 5) suggests warmer than normal daytime conditions are likely, with a 70-80% probability of above median maximum temperatures occurring across northern, central, coastal and north eastern NSW, and a slightly lower probability to the south west. The confidence (skill) for this outlook is moderate.
- The experimental outlook for minimum temperature indicates warmer than normal conditions are likely during December, with a 60-70% probability of above median temperatures across the north, north east, coastal and central areas of NSW. Normal overnight temperatures are likely across the south west. The confidence (skill) for this outlook is moderate for most of NSW, but low for the coastal areas.

December multi-week

- Weekly experimental outlook information suggests that drier than normal conditions are likely across of the State during the second and third weeks of December, and for the central and south eastern areas in the fourth week. However, the skill for these outlooks is low.
- Warmer than normal daytime temperatures are likely across the State during the second and third weeks of December and for the coast and north during the fourth. Skill levels are moderate for the second week, but low for the third and fourth.
- Overnight temperatures for early-mid December are also likely to be warmer than normal across most of NSW, except for the far south west. Temperatures are likely to be higher in the north and north east during the fourth week. The skill levels are moderate for the minimum temperature outlook in the second week of December, and low for the third and fourth.

January

- The experimental outlook for January is for lower than normal rainfall across most of NSW, with an increased probability of below normal rainfall over the north east and coast (Figure 6). The skill for this outlook is low.
- The experimental January outlook indicates an increased probability (70-80%) of above normal daytime temperatures across most of the northern, central and eastern areas of NSW (Figure 6). The rest of NSW has a slightly lower probability of 60-70%. The skill for this outlook is moderate for the eastern and central areas of NSW, but low in the west.
- Overnight temperatures are also likely to be above normal across northern, north eastern, south eastern and central NSW, with a 60-70% of exceeding the median minimum temperature (Figure 6). However, the skill for this outlook is low, except for the north of NSW where it is moderate.

2.4 Other climatic models

- The Bureau of Meteorology's old statistical model indicates a likelihood of near neutral rainfall conditions across the western, southern and central areas of the State over the next three months, with an increased probability of above median rainfall in the north east, northern tablelands and central coast. It indicates that near normal overnight temperatures are likely, and an increased probability of above average daytime temperatures in the south and south west, a slightly lower probability in the north east, and near normal conditions for the rest of NSW. The statistical outlook is based on past trends in sea surface temperatures. In comparison, the output of the POAMA model takes account of more data and has better skill. Skill assessments for the statistical model are available via this link.
- The UK Meteorology Office's global long range probability modelled output indicates near normal rainfall is likely across NSW in the December to February period (with the exception of an area in the north east). The skill assessment for this outlook is low for most of NSW, and low-moderate for the north and north west. The model indicates above average temperatures for the period (particularly in the central west and far north west). The skill for the temperature outlook is high for north eastern NSW, moderate for south eastern NSW and low for the remainder of the State.
- For January to March, UK Meteorology Office's global long range probability modelled output indicates that near normal rainfall is likely, with a moderate to high skill for all but the south of NSW. For temperature, the outlook indicates that above normal conditions are likely, with a moderate to high skill for northern, north east and coastal NSW, and low skill for the west of the State. The output from this model is provided for the use of international meteorological

centres and not as general seasonal outlooks.

- The APEC Climate Centre's multi-model ensemble outlook of rainfall anomalies for December to February indicates a somewhat lower than normal rainfall is likely across the north east, higher than normal rainfall is likely across north west, and near normal rainfall likely across the west of the State. The temperature anomaly outlook indicates a likelihood of increased temperatures across the State, particularly in the central and south eastern areas. No skill assessment is available for these outlooks.
- During December, the APEC Climate Centre's rainfall anomaly outlook indicates an increased likelihood of rainfall in the north of the State, a near normal rainfall likelihood in the central areas and slightly lower rainfall likelihood in the south east. The temperature anomaly outlook indicates higher than normal temperatures are likely, particularly in the south. No skill assessment is available for these outlooks.

2.5 El Niño-Southern Oscillation (ENSO)

- The Pacific Ocean remains in a neutral ENSO state (neither El Niño nor La Niña). The seven international climate models surveyed by the Bureau of Meteorology indicate this state is likely to continue through to autumn.
- ENSO neutral conditions do not guarantee normal seasonal conditions, as more localised weather extremes can and do occur due to the influence of secondary or local factors, such as the warmer than normal sea surface temperatures occurring around parts of the Australian coastline.
- The CPC/IRI consensus ENSO forecast (as at 21st November) of the NINO3.4 index shows that of the 24 climate prediction models surveyed, most indicate ENSO neutral conditions will continue over the December to February and into the first quarter of 2014. (Table 1).
- However, during autumn and winter 2014 more of the models in the CPC/IRI consensus ENSO forecast are indicating a warming tendency, with 29% indicating El Niño conditions are probable between April-June next year, increasing to 36% over July-August (Table 1). It should be noted that the Bureau of Meteorology's POAMA model currently indicates ENSO neutral conditions during autumn.

Table 1: Current ENSO consensus forecast probabilities

Season	La Niña	Neutral	El Niño
Dec-Feb	9%	82%	9%
Jan-Mar	10%	78%	12%
Feb-Apr	10%	74%	16%
Mar-May	11%	67%	22%
Apr-June	11%	60%	29%
May-Jul	12%	55%	33%
Jun-Aug	12%	52%	36%

Source: Climate Prediction Centre/International Research Institute for Climate and Society.

- Monthly sea surface temperatures from the Bureau of Meteorology and the US National Oceanic and Atmospheric Administration (NOAA) indicate close to average conditions over most of the central and eastern tropical Pacific. Weak cool anomalies are present in the far eastern Pacific south of the equator along the South American coast. Weak warm anomalies are present in the west, and along areas of the south eastern and western coastline of Australia. Conditions are near average in the central Pacific. The most recent monthly temperature index value in the NINO3.4 region is +0.2°C, a +0.3°C change since October, and +0.19°C for the week ending 1st December. Most models suggest the NINO3.4 region will remain in the neutral range through to autumn 2014, as shown in Table 1 above.
- The sub surface sea temperatures in the Pacific (to the 2nd December) remain slightly cooler than average in the east and slightly warmer in the west. Areas of cool anomalies in the east have been present throughout the last few months. They have strengthened near the surface west of 120°W, but declined at depth to the east.
- The Southern Oscillation Index (SOI) is close to the neutral range, but rose steeply over late November due to monsoonal activity near Darwin. The latest 30-day value to 4th December is +8.2 and the average for the last 90 days to 4th December (supplied by QDSITIA) is +4.6. Values of between -8 and +8 indicate neutral conditions, sustained values above +8 may indicate a La Niña event, and sustained values below -8 may indicate an El Niño event.
- The Sub-Tropical Ridge (STR) moved south of the Great Australian Bight from a quite northerly position last month, as indicated on NOAA and Bureau of Meteorology mean sea

level pressure charts. The sub-tropical ridge is a zone of high pressure which between November to April is normally located south of Australia, and tends to suppress cold front activity. During winter, it generally moves northwards allowing cold fronts to extend further into southern Australia.

- The Indian Ocean Dipole (IOD) remains neutral. The latest IOD index value is +0.49°C for the week ending 1st December. Most climate models surveyed by the Bureau of Meteorology favour a neutral IOD over the coming months. This is because IOD patterns are generally inhibited by the development and position of the monsoonal trough. The IOD has little effect on Australian climate until autumn or winter. A negative IOD increases the chances of above normal rainfall during winter and spring across southern and much of western and central NSW, as shown in this link.
- Trade wind patterns over the tropical Pacific are near average, although somewhat stronger in the west and weaker in the east. Trade winds strengthen across the tropical Pacific during La Niña events and weaken during El Niño events.
- Cloud conditions at the equator near the International Date Line have been below average. This has generally been the case since April, apart from a near average period from mid-September through to late October. Cloudiness in this area decreases during La Niña and increases during El Niño events.

2.5 Other climatic indicators

- The experimental Southern Annular Mode (SAM) index was weakly positive throughout early to mid-November, weakly negative during most of late November, and is currently positive at about +1.5. Predictions from POAMA and the US National Oceanic and Atmospheric Administration (NOAA) indicate the SAM index is likely to remain positive over the one to two weeks, then decline to near neutral from mid-December.
- A negative SAM event indicates an expansion of the belt of strong westerly winds towards the equator, resulting in more or stronger low pressure systems across southern Australia and potentially increased rainfall.
- A positive SAM event indicates the contraction of the belt of strong westerly winds towards Antarctica and higher pressures over southern Australia. During autumn and winter, a positive SAM event can potentially mean a decrease in rainfall across southern Australia. However, a strongly positive SAM in spring and summer can mean southern Australia is influenced by the northern half of high pressure systems, leading to a slightly higher likelihood of increased rainfall over south eastern and central NSW.
- Atmospheric pressure during November was near normal across the central areas of the State. It was slightly above normal across the west of the State and slightly lower than normal across the central, upper south and mid north coast, Hunter valley and parts of the northern tablelands. High atmospheric pressure is linked to drier than normal conditions.

3. Rainfall

3.1 Relative rainfall

Relative rainfall information is sourced from the AussieGRASS project of the Queensland Department of Science, Information Technology, Innovation and the Arts and from the Bureau of Meteorology.

Relative rainfall is calculated by comparing and ranking the current rainfall against that for the same period over every year since 1900.

This means that if the current period has a rank of between 30 to 70 against all other years, it is regarded as being “average” and the conditions experienced will occur over about 4 out of every 10 years.

November

- Relative to historical records, rainfall for November was below average to well below average across most of the Western, Central West LLS districts and the east of the Murray and Riverina LLS districts, covering some 53% of the State (Figure 7)
- The majority of the Greater Sydney, Hunter and North Coast LLS districts received above average to well above average relative rainfall during November.
- Above average to extremely high relative rainfall also occurred across the east of the Northern Tablelands, the south east of the North West and the south and north east of the South East LLS districts. Above average rainfall occurred across 19% of the State.
- The remainder of the central areas of the State, including most of the Central

Tablelands LLS district, received average relative rainfall.

September to November (3 months)

- Over the period from September to November, relative rainfall was below average across 71% of the State (Figure 8). The areas of lowest relative rainfall extended from Tibooburra to Wentworth, White Cliffs and Ivanhoe and to Hay and Deniliquin. Other areas were around Coonamble, Bourke, Albury, Wagga and Blayney.
- Above average or better relative rainfall was confined to the far south east and parts of the North Coast and Hunter LLS districts, and amounted to only 6% of the State.
- Average relative rainfall was restricted to an area between Griffith, Condobolin and Temora, as well as covering most of coastal and the Northern Tablelands LLS districts, and the east of the North West LLS district.
- Over the period, 80-83% of Central Tablelands and Central West LLS districts had below average rainfall, as did 94-97% of Murray and Western LLS districts.
- Some 24-40% of Greater Sydney, North Coast, South East and Hunter LLS districts experienced above average relative rainfall over the period.

June to November (6 months)

- Over the six months to November, relative rainfall was below average or worse across most of north and north western NSW (Figure 9). This area extended from the north of the Western LLS district, through to the western half of the North West LLS district, and to the north of the Central West LLS district and covered 44% of the State.
- Other areas of below average relative rainfall occurred in the south of the Western, the south west of the Riverina, the western half of the Northern Tablelands and the central areas of the Central Tablelands LLS districts.
- Areas of above average to well above average relative rainfall were restricted to an area between Tullibigeal, Lake Cargelligo, Condobolin and Nymagee, as well as areas along the coast and particularly in South East LLS district.
- Some 63% of the Western and 75% of the North West LLS districts had below average relative rainfall for the period, as well as 45% of Northern Tablelands and 55% of Central Tablelands LLS districts.
- Approximately 44% of the South East LLS district had above average rainfall during the period.

March to November (9 months, BoM)

- Over the 9 month period from March to November, relative rainfall across the State was below average across areas of far western and north western NSW (Figure 10), as well as areas of the northern slopes, northern, central and southern tablelands and south west and central west slopes. Most of these areas received 60-80% of their normal rainfall.
- Areas of particular deficiency occurred in the far north west between Bourke, Walgett and Collarenebri (in Western and North West LLS districts) and in the far west north of Broken Hill, with these areas receiving between 40-60% of the long term average rainfall.
- Limited areas received above average rainfall over the period, including areas on the mid north coast, parts of the alpine areas and an area between Ivanhoe and Wilcannia. The remainder of the State was near average.

December to November (12 months)

- Relative rainfall for the last 12 months was generally below average to well below average across much of the north west, the central areas of the State and parts of the far west, south west, and central and northern tablelands (Figure 11).
- Areas of the Western, North West, Central West, Central Tablelands, Riverina and Murray LLS districts had below average relative rainfall, along with the western edges of the Northern Tablelands and the South East LLS districts.
- The eastern side of Northern Tablelands and Hunter LLS districts and the North Coast LLS district had above average to well above average relative rainfall for the period. The remainder of the State was generally within the average range.

3.2 Total rainfall

Total rainfall information is sourced from the AussieGRASS project of the Queensland Department of Science, Information Technology, Innovation and the Arts and from the Bureau of Meteorology.

November

- Rainfall during November was between 0-60% of average across much of western and

central NSW. Most of the west received less than 20% of average rainfall. The east of the State received between 80-200% of average, increasing towards the coast. Some areas of the central and north coast and Hunter valley received above 200% of their average rainfall for the month. Over the whole State, the average rainfall was 40.1 mm, somewhat below the long term average of 44.9 mm.

- The rainfall across the State in November was associated with a series of complex surface troughs and associated thunderstorms. Significant rainfall occurred along areas of the coast mid and late month, particularly over the Hunter valley on the 18th due to a localised low pressure system.
- The amount of rainfall across the State ranged from 0-300 mm, with the western areas receiving 0-25 mm, the central areas 25-100 mm and the eastern areas 50-200 mm, and higher falls of up to 300 mm in areas of the central and mid-north coast and Hunter valley (Figure 12).
- Rainfall across much of the far west and western Riverina was restricted to falls of less than 10 mm, with much of the area receiving less than 5 mm.
- The north west received some relief, although the majority of the rainfall occurred to the east of Pilliga, Mungindi and Coonabarabran.

September to November (3 months)

- Total rainfall over the three months to November ranged from 10-300 mm over most of the State, with some areas receiving as little as 2-10 mm and others over 300 mm.
- The far north west and much of the far west received 2-25 mm. The far north western corner of the State received 2-10 mm.
- Most of the central areas of the State received 50-200 mm, with the amount received increasing to the east.
- The coastal areas received 200-300 mm, with areas in the Hunter and Greater Sydney LLS districts receiving 300-400 mm, as did limited areas of the South East LLS district around Moruya and some alpine areas (Figure 13).

June to November (6 months)

- Rainfall across the State during the June to November period ranged from 10 mm to over 1200 mm (Figure 14).
- The lowest rainfall over the period (10-25 mm) fell in the far north west, at Tibooburra and to the north and west, increasing to 50 mm towards Broken Hill and Wilcannia.
- Most of the far west and north west of the State received 5-100 mm over the period, increasing to the south and east to 100-200 mm.
- The central areas of the State, including the slopes and much of the tablelands received 100-300 mm during the period, with areas of the Central Tablelands, South East, Hunter and Northern Tablelands receiving 300-400 mm. The eastern areas of Riverina and Murray LLS districts also received similar rainfall up to over 400 mm.
- The coastal LLS districts generally received 300-600 mm. Rainfall was higher in a small area between Wollongong and Jervis Bay, and in the alpine areas.

4. Temperature anomalies

Temperature information is sourced from the Bureau of Meteorology.

- Maximum temperatures across the State in November averaged 1.1°C above normal, associated with a near-average cloudiness.
- Maximum temperature anomalies ranged from -1-3°C across the State, with the highest temperatures in the north west, central and north east. In these areas, temperatures were generally 1-2°C above normal.
- In the far west, daytime temperatures were near normal, and slightly below normal for some areas of the far south west (Figure 16).
- Minimum temperatures during the month averaged 0.5°C below normal across the State, making it the coolest November (in minimum temperature) since 1999.
- Overnight temperatures were lowest in early to mid-November. During the month, overnight temperatures were lowest in the southern Riverina, the south west and the southern areas of the far west, where they ranged from -2 to -1°C below average, with some areas ranging from -3 to -2°C below average. Overnight temperatures were about 1°C below average across most of the remainder of the State (Figure 17).

5. Relative soil moisture

Soil moisture information is sourced from the joint CSIRO and Bureau of Meteorology Australian Water Availability Project (AWAP).

5.1 Topsoil

- Modelled topsoil moisture remained low over the west and central areas of NSW, due to low November rainfall (Figure 17). However, it improved along the coast and across the Hunter LLS district, as a result of the moderate to heavy November rainfall in these areas. Some improvements in topsoil moisture also occurred over the Northern Tablelands, south eastern areas of the North West and the north western areas of the South East LLS districts. Approximately 89% of the State had low modelled topsoil moisture over November, down from 99% in October. On a percentile rank basis, about two thirds of the State ranked as having below average to extremely low relative soil moisture.
- Levels remained particularly low across the Western and Central West LLS districts, and across the west of the North West and most of the Central Tablelands, Riverina and Murray LLS districts. Across most of these areas, modelled topsoil moisture averaged generally less than 10 mm for the month, except for the eastern areas and the Central Tablelands.
- Average soil moisture levels in those coastal areas that received heavy rainfall improved to between 40-80 mm, with isolated areas of higher soil moisture in the Hunter Valley LLS district.

5.2 Subsoil

- Modelled subsoil moisture levels continued to decline in November. The areas of lowest subsoil moisture were in the north west of the State. Some 52% of NSW had low subsoil moisture over November, up from 44% in October. Most of the decline was in the western, central and northern areas of the State, including the Central Tablelands, Riverina, Murray, North West and Western LLS districts.
- Modelled subsoil moisture levels declined across most of the cropping districts from October (Figure 18).
- Average modelled subsoil moisture for the month was less than 200 mm across most of the State, with areas having less than 100 mm increasing since October, particularly in the Central West LLS district.
- Only 2% of the State remained in the high subsoil moisture category during November.
- The greatest declines in modelled subsoil moisture occurred in the Central Tablelands Central West, Riverina and Greater Sydney LLS districts. The declines ranged from 12-14% of the area of the LLS districts.
- Smaller declines in modelled subsoil moisture occurred across most other LLS districts.
- The North West LLS district had the lowest overall relative subsoil moisture during the month, with 84% of its area in the low category. This was followed by 73% of the Central West, 64% of Murray, 60% of the Riverina and 53% of the Western LLS districts.
- Subsoil moisture levels remained moderate along a narrow coastal strip from Bega to Tweed Heads.

6. Pasture growth and biomass

Pasture growth and biomass information is sourced from the AussieGRASS project of the Queensland Department of Science, Information Technology, Innovation and the Arts.

6.1 Modelled pasture growth

- During November, modelled pasture growth remained very low across the Western LLS district, most of the Central West and the western edge of the Riverina and Murray LLS districts (Figure 20).
- In these areas, modelled pasture growth remained at less than 10 kg/ha dry matter (DM).
- Modelled growth improved across most of the coastal areas and upper Hunter valley, and across the tablelands and parts of the slopes, to generally above 100 kg/ha DM across the slopes and central tablelands, and above 200-500 kg/ha DM along the coast.

6.2 Modelled biomass

- Modelled total standing dry matter (biomass) levels during November remained similar to those of October across most of Western and North West LLS district, although declines occurred in the Central West LLS district.
- Modelled biomass levels improved across the coastal LLS districts in November (Figure

21). Across the Hunter and North Coast LLS districts and areas of the South East LLS district, modelled biomass improved during the month from 250-500 kg/ha dry matter (DM) to 500-1,500 kg/ha DM. Across Greater Sydney LLS district and the east of the Northern Tablelands LLS district, modelled biomass improved by at least 500 kg/ha DM.

- During November, modelled biomass levels declined across the west of the Central West LLS district, by about 500 kg/ha DM.
- Levels remained moderate to high across much the Riverina and Murray LLS districts (with the exception of areas around Griffith and Deniliquin) and the south eastern areas of the Western LLS district. In these areas, modelled biomass ranged from generally 500-2,000 kg/ha DM, with some areas on the south-west slopes exceeding 3,000 kg/ha DM.

6.3 Relative pasture growth

Relative pasture growth and biomass area calculated by comparing and ranking the current modelled growth and biomass against that for the same period over every year since 1957. This means that if the current period has a rank of between 30 to 70 against all other years, it is regarded as being “average” and the conditions experienced will occur over about 4 out of every 10 years.

November

Relative monthly pasture growth should be compared to modelled pasture growth for interpretation. “Average” levels of relative growth may correlate with modelled levels (in kg/ha) that are quite low or high at certain times of year.

- Relative pasture growth during November was poor across most of the western and central areas of the State (Figure 22).
- Some 40% of the State was below average in relative growth for the month, 22% average and 11% above average. Areas of missing data accounted for the remaining 27%, primarily across the west of the State.
- The worst areas of relative pasture growth extended across the Western and Central West LLS districts, the western half of the North West LLS district, the central areas of Central Tablelands and the east of Riverina and Murray LLS districts.
- Relative growth across the coastal districts, Monaro and eastern fall areas was generally average or above. The majority of the Hunter and Greater Sydney LLS districts had above average to extremely high relative growth during the period.
- Missing data covered large areas of the Murray and Western LLS districts (45% and 54% of their areas, respectively).

September to November (3 months)

- Over the three months to November, relative pasture growth was below average or worse across much of the Western, North West, Northern Tablelands and Central Tablelands LLS districts (Figure 23). Some 58% of the State had below average relative growth for the period.
- Over the Western LLS district, some 61% of the district had below average relative growth for the period. This area extended north and west from Wentworth and Booligal, north to Ivanhoe and Wilcannia, then north east to Bourke, Brewarrina and Goodooga.
- The majority of the North West (83%), Northern Tablelands (80%) and Central Tablelands (79%) also had below average relative growth for the period.
- The eastern areas of the Western LLS district, the west of Central West and much of the Murray, Greater Sydney, Hunter, North Coast and South East LLS districts had average or better relative growth over the three months to November. Little of the State (4%) had above average relative growth.

June to November (6 months)

- In the period from June to November, relative pasture growth was average or better over most of the State (74%), with the exception of areas in the North West, Northern Tablelands, Hunter and Central Tablelands LLS districts and the south of the North Coast district (Figure 23).
- The northern areas of the Western LLS district also had below average relative growth, although the central and eastern areas of the district had above average or better relative growth for the period.
- Patches of above average or better relative growth also occurred in the west of the Central West LLS district, and in areas of the south and east across parts of the Riverina, Murray and South East LLS districts.
- Approximately half the State had average relative growth over the six monthly period, including parts of the far west and the central, southern and coastal areas.

December to November (12 months)

- Relative pasture growth across the State over the last 12 months was below average to extremely low across the north west and areas of the far west (Figure 25).
- The Western LLS district had generally average relative growth, with the exception of the far north east and areas of the far north west and south west.
- An area of below average to extremely low relative growth in the north west extended from Wanaaring, Louth, Cobar, Enngonia, Goodooga, Bourke and Brewarrina in Western LLS district to Walgett, Pilliga, Narrabri, Bellata, Moree, Warialda and Boggabilla in North West LLS district, and south to Coonamble in the Central West LLS district. This area included approximately 23% of the State.
- Relative growth across most of the tablelands, the remainder of central, coastal and southern NSW was generally average (60% of the State), with pockets of above and below average growth. Relative growth across the eastern edge of the Northern Tablelands LLS district and the coastal LLS districts was generally average or above.

6.4 Relative biomass

Relative monthly biomass should be compared to modelled biomass for interpretation. “Average” levels of relative biomass may correlate with modelled levels (in kg/ha) that are quite low or high at certain times of year.

- Modelled relative total standing dry matter (biomass) levels remained more or less stable across NSW between October and November. For the time of year, modelled relative biomass levels were average or better across much of coastal, central, southern and far western NSW (Figure 26).
- Better areas of relative biomass (above average or higher) occurred in areas of the Western LLS district, in areas of the Riverina and Murray LLS districts (primarily in the east), some areas of the coastal LLS districts.
- Areas of below average or worse relative biomass occurred between Wanaaring, Louth, Byrock, Bourke, Brewarrina, and Goodooga in the Western LLS district. These areas also extended across most of the North West and Central Tablelands LLS districts, as well as into the east of the Northern Tablelands and the north of the Hunter LLS districts.

6.5 Pasture curing

- The curing index indicated a high degree of pasture curing across most of Western and Central West LLS districts and the western half of the North West LLS district (Figure 27).
- Other areas of high curing were in the south of the Murray, the western and central areas of the Riverina and the north of the Central Tablelands LLS districts.
- Curing was variable across the Murray and the western and central areas of the Riverina LLS district.
- Curing was relatively low to average over most of the Northern Tablelands and the coastal LLS districts, and the east of the North West LLS district.

7. Crop production

Crop production information is sourced from the NSW DPI grains report. An updated grains report was not available at the time of publication.

8. Water storage and irrigation allocations

8.1 Storage levels

Storage levels are given as at 27th November 2013.

- Levels in water storages remain generally moderate, with the average effective capacity being 76%, a 1% increase from last month.
- Changes in storage levels were generally small, with the exception of the Hume (-8%) and Split Rock (-13%) Dams and Lake Wetherell (-13%).
- Minor decreases occurred across most of the other storages, with the exception of Brogo, Glennies and Lostock Dams, which increased by 1%, 3% and 14% respectively.

Table 2: Capacity of storages

Storage	Current Volume (GL)	Effective Capacity (%)	Monthly Change (%)
Toonumbar	11	96	-
Glenbawn	725	97	0
Glennies	272	96	3
Lostock	20	101	14
Brogo	9	101	1
Cochrane	1	-	-
Dartmouth	3786	98	-1
Hume	2415	80	-8
Blowering	1444	88	-1
Burrinjuck	671	65	0
Brewster	-	-	-
Carcoar	22	59	-3
Cargelligo	33	89	-
Wyangala	779	64	-3
Glenlyon	222	-	-
Pindari	190	61	-2
Copeton	892	65	-
Chaffey	43	69	-2
Keepit	-	-	-
Split Rock	294	74	-12
Burrendong	459	37	-3
Oberon	36	79	-2
Windamere	199	54	-1
Lake Cawndilla	289	37	-5
Lake Menindee	153	16	-7
Lake Pamamaroo	336	122	-4
Wetherell	174	91	-13
Total	**1739**		
Average		**76**	

8.2 Irrigation allocations

Allocations are given as at 27th November 2013.

- High security and general security allocations remained the same as last month, with the exception of the general security licences for the Murrumbidgee river valley, which increased from 43-47%, and the Bega-Brogo, which increased from 40-48%.
- Irrigators in the Murrumbidgee river valley will be able to access an additional 5% of their entitlement after February 2014.

Table 3: Irrigation allocations

River valley	Allocation	Licence category
NSW Border Rivers*	100%	General security A Class
	1.7%	General security B Class
	100%	High security
Richmond	90%	General security
	100%	High security
Gwydir*	0%	General security
	100%	High security
Hunter	100%	General security
	100%	High security
Paterson	100%	General security
	100%	High security
Lachlan*	0%	General security
	100%	High security
Belubula*	0%	General security
	100%	High security
Lower Darling*	100%	General security
	100%	High security
Macquarie and Cudgegong*	6%	General security
	100%	High security
Murray*	100%	General security
	100%	High security
Murrumbidgee*	47%	General security
	95%	High security
Lower Namoi*	6%	General security
	100%	High security
Upper Namoi*	100%	General security
	100%	High security
Peel	45%	General security
	100%	High security
Bega Brogo	48%	General security
	100%	High security

* Carry over water may be available

Appendix

Maps and data used in the production of this report.

Seasonal outlook

Figure 1: Quarterly rainfall outlook

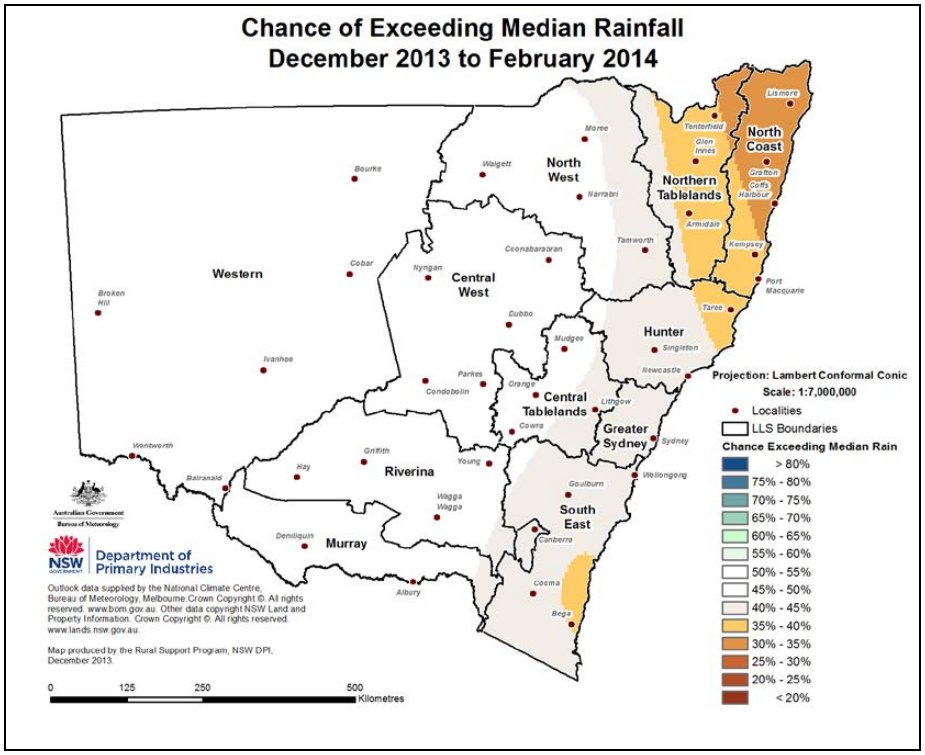


Figure 2: Quarterly maximum temperature outlook

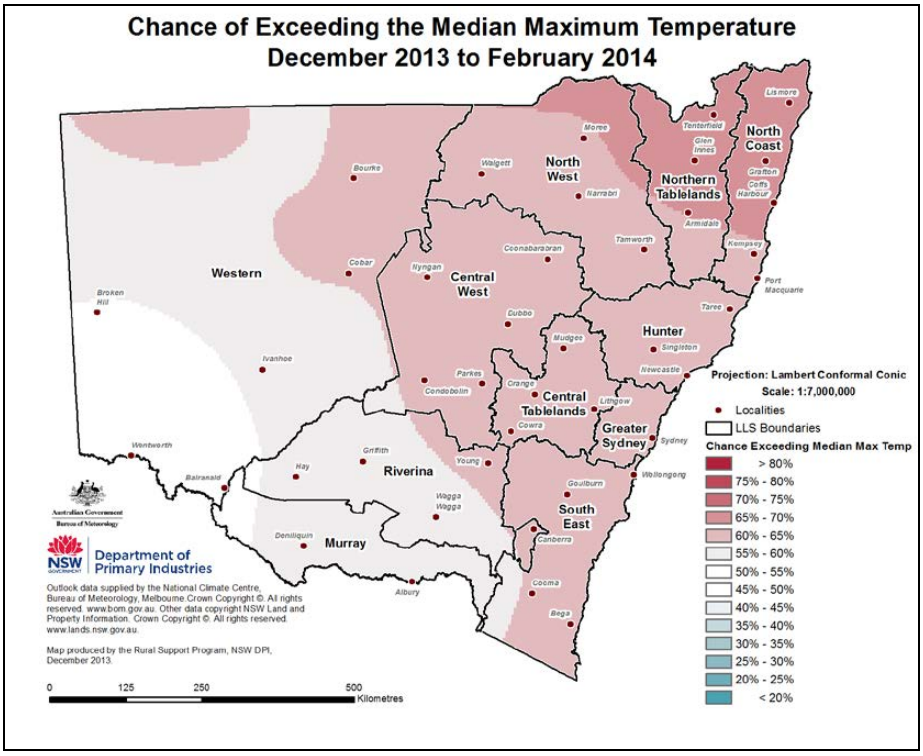


Figure 3: Quarterly minimum temperature outlook

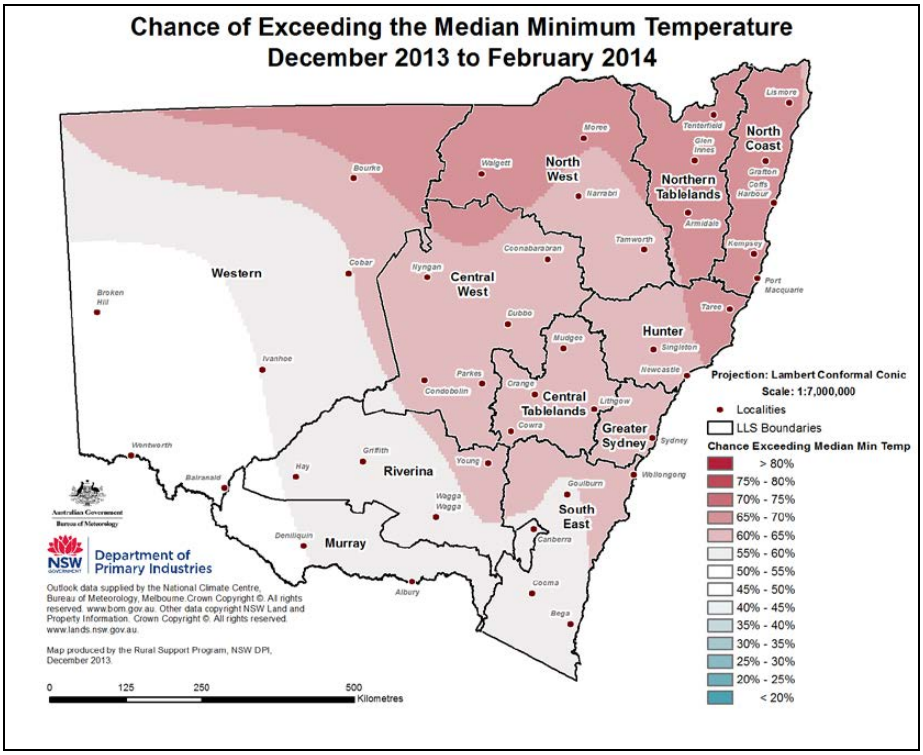
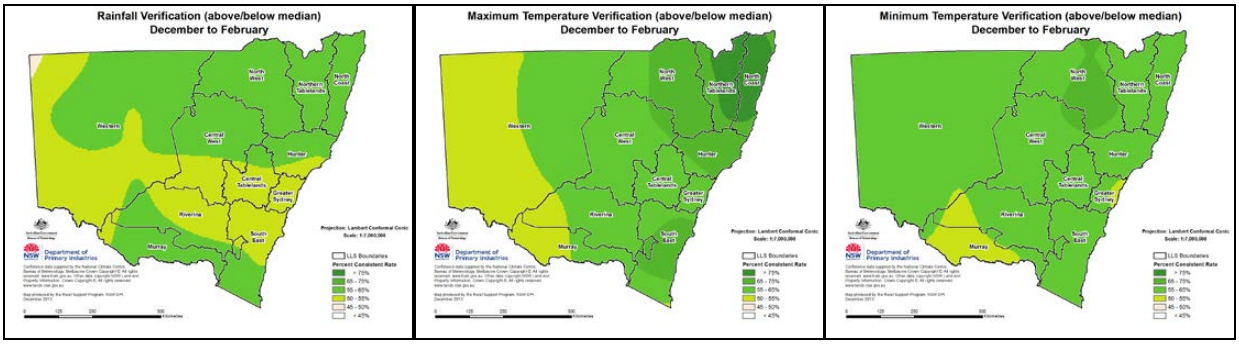


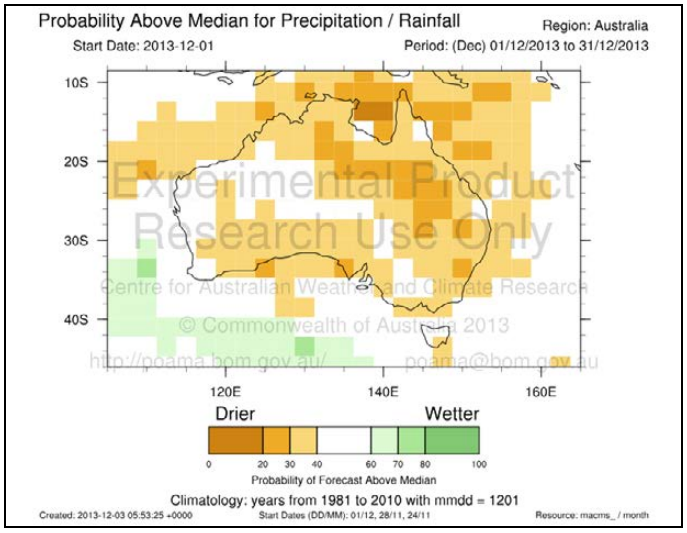
Figure 4: Outlook skill maps

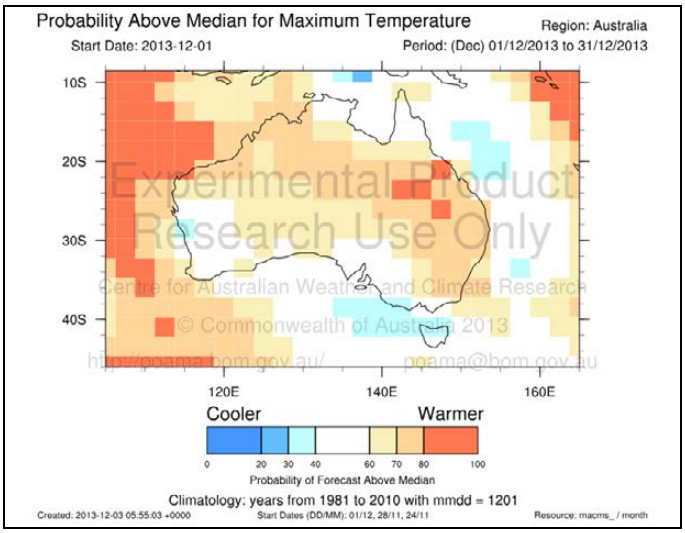


Monthly rainfall & temperature outlook

(Bureau of Meteorology, POAMA - experimental)

Figure 5: Experimental December rainfall and temperature outlooks





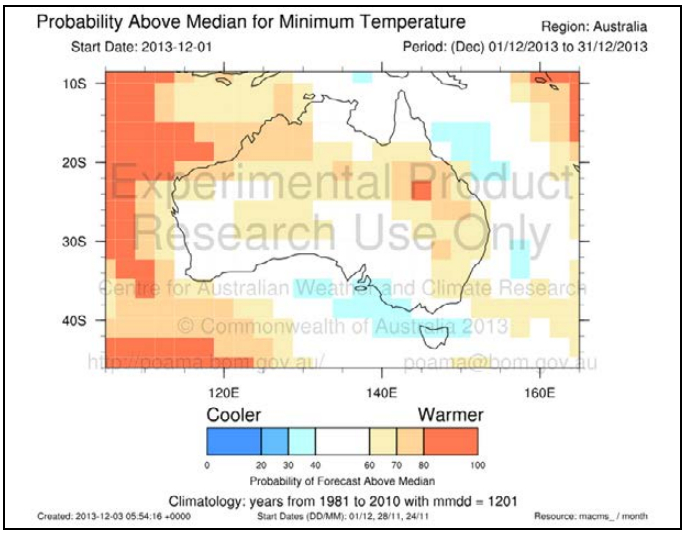
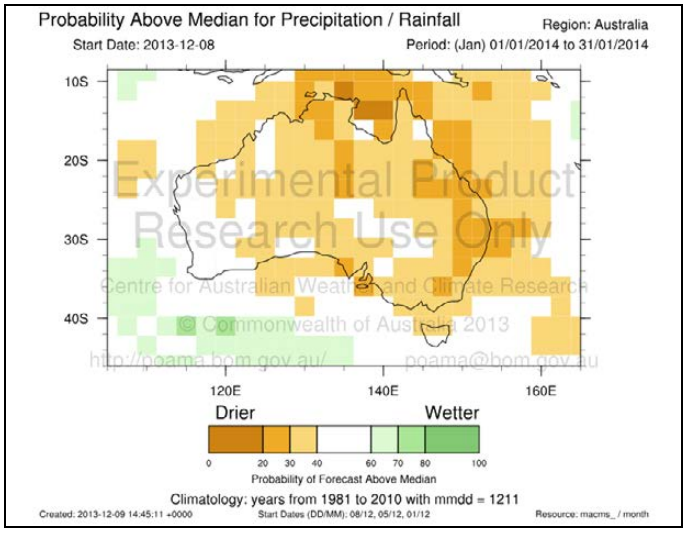
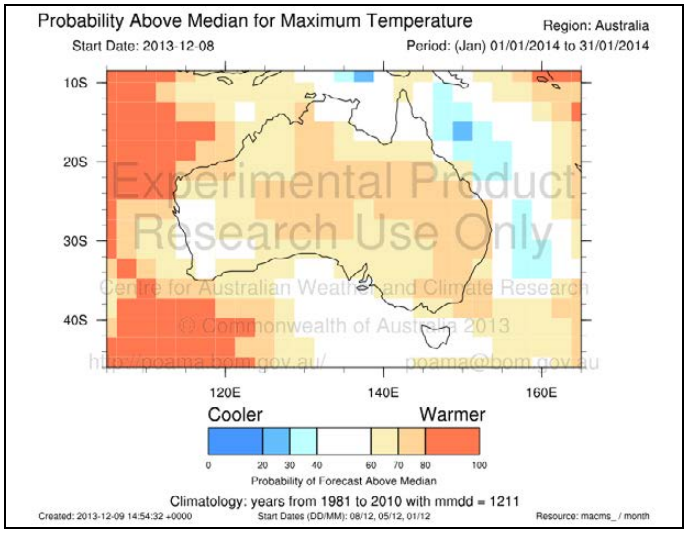
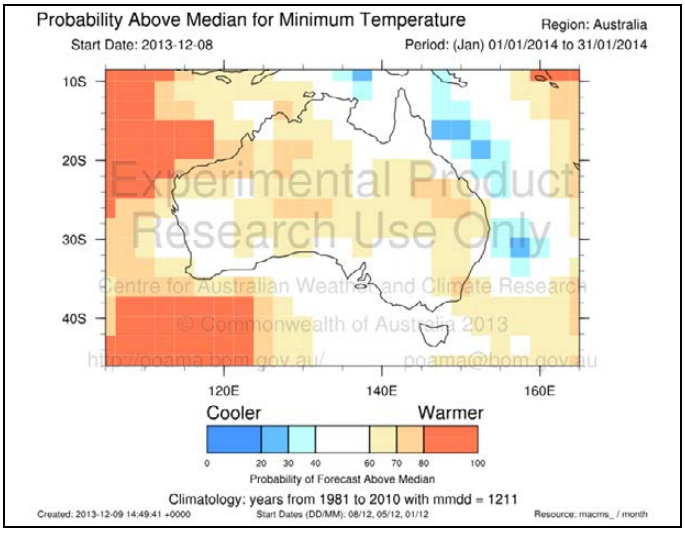


Figure 6: Experimental January rainfall and temperature outlooks







Rainfall

Figure 7: Relative rainfall – monthly

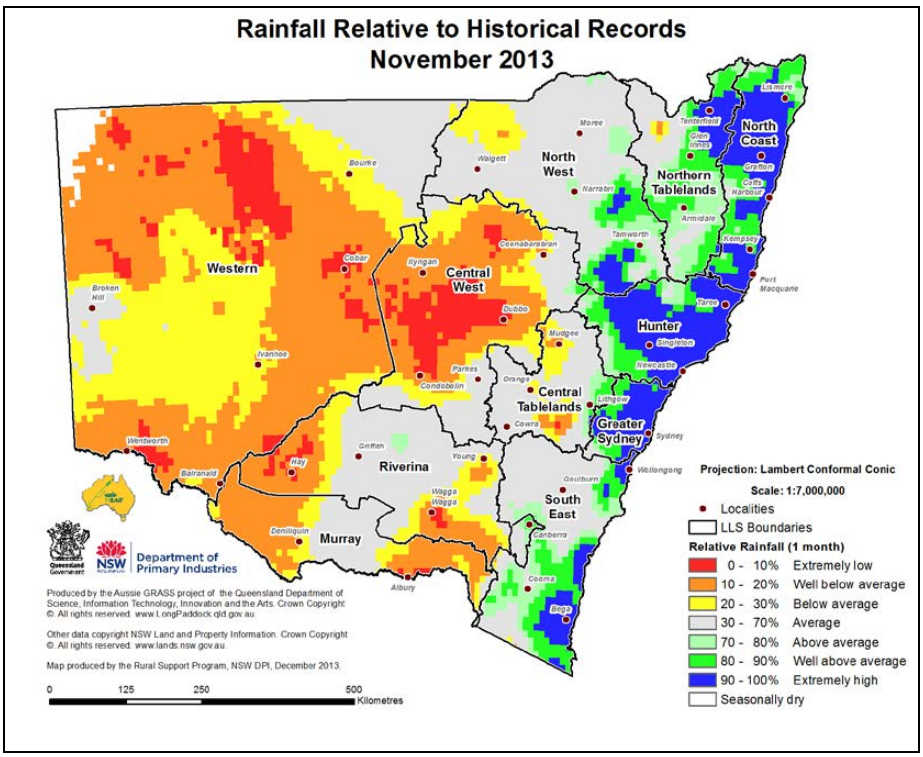


Figure 8: Relative rainfall – quarterly

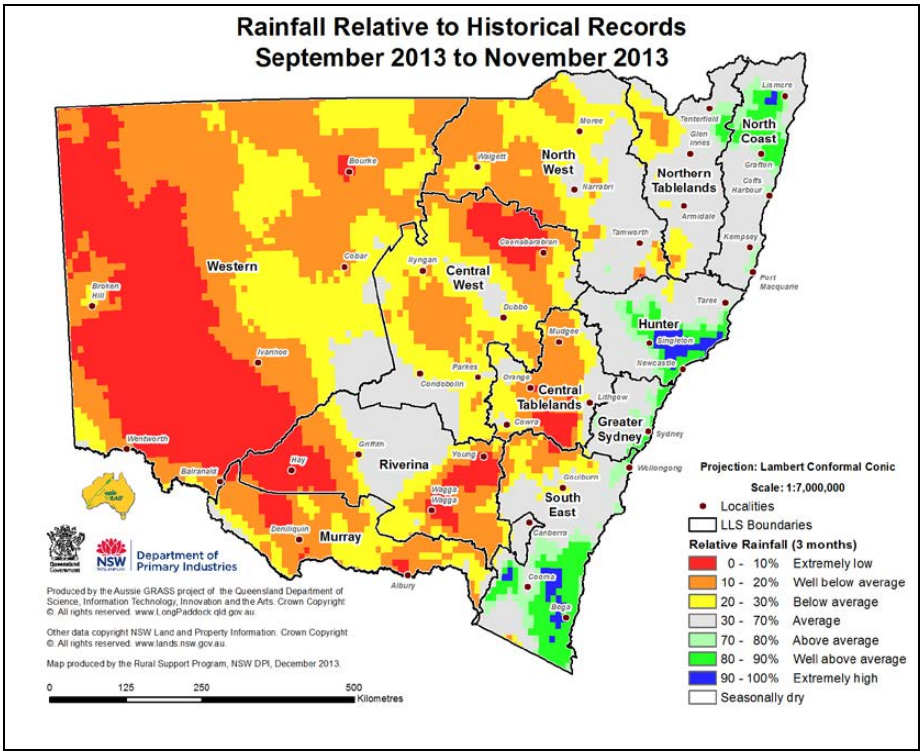


Figure 9: Relative rainfall – half yearly

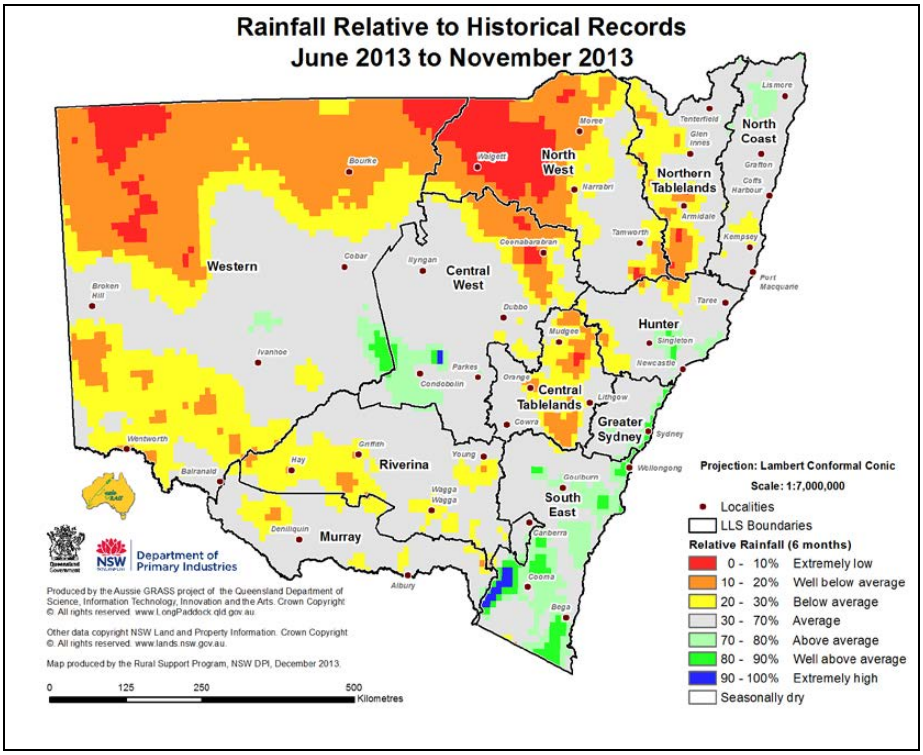


Figure 10: Relative rainfall – nine monthly

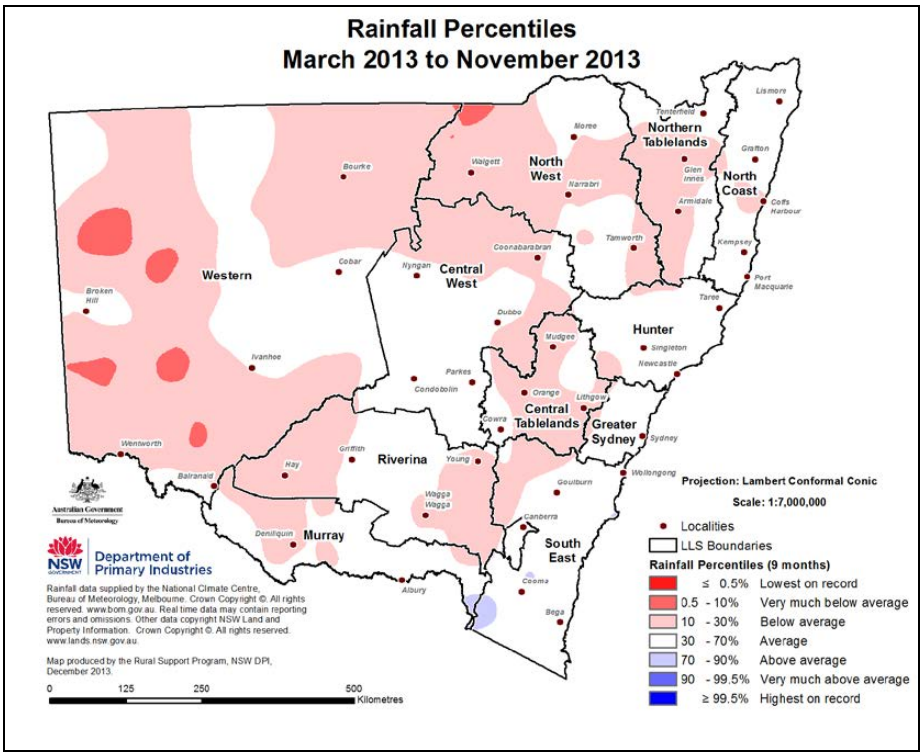


Figure 11: Relative rainfall – yearly

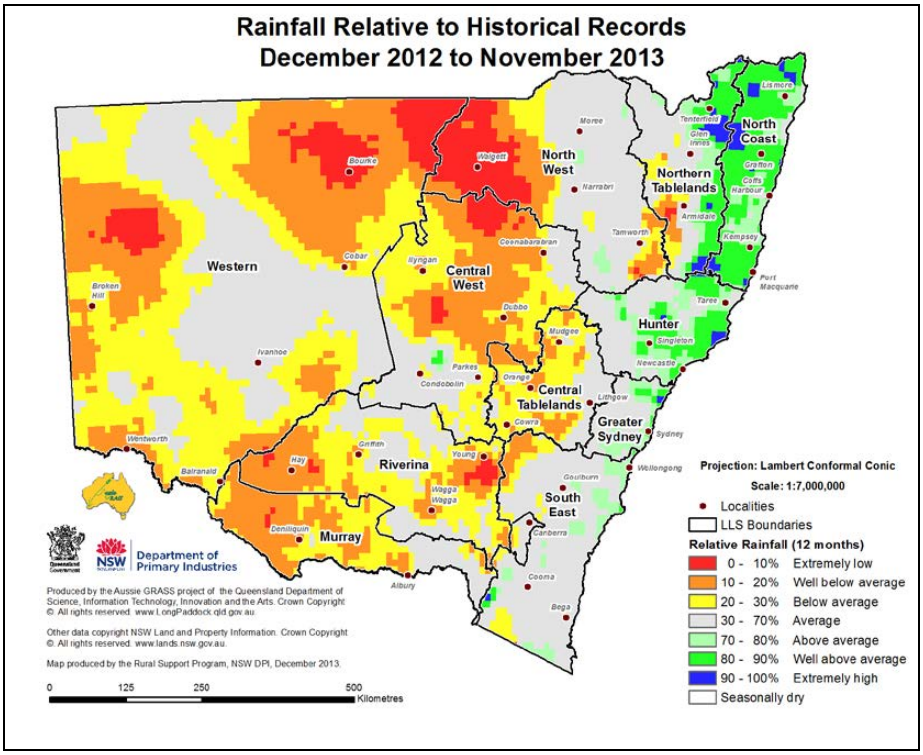


Figure 12: Total rainfall – monthly

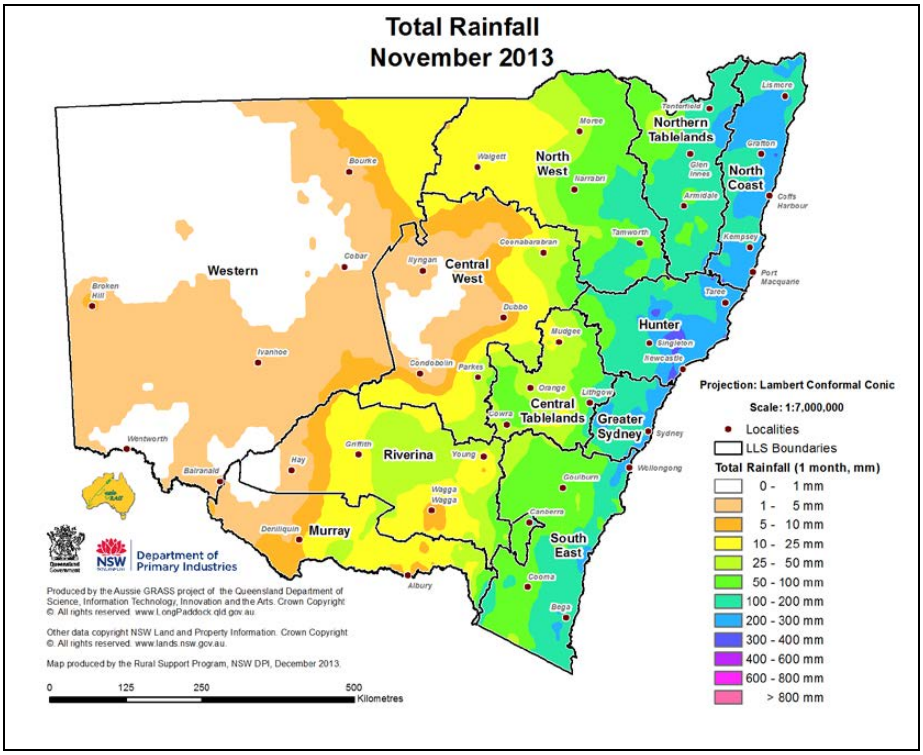


Figure 13: Total rainfall – quarterly

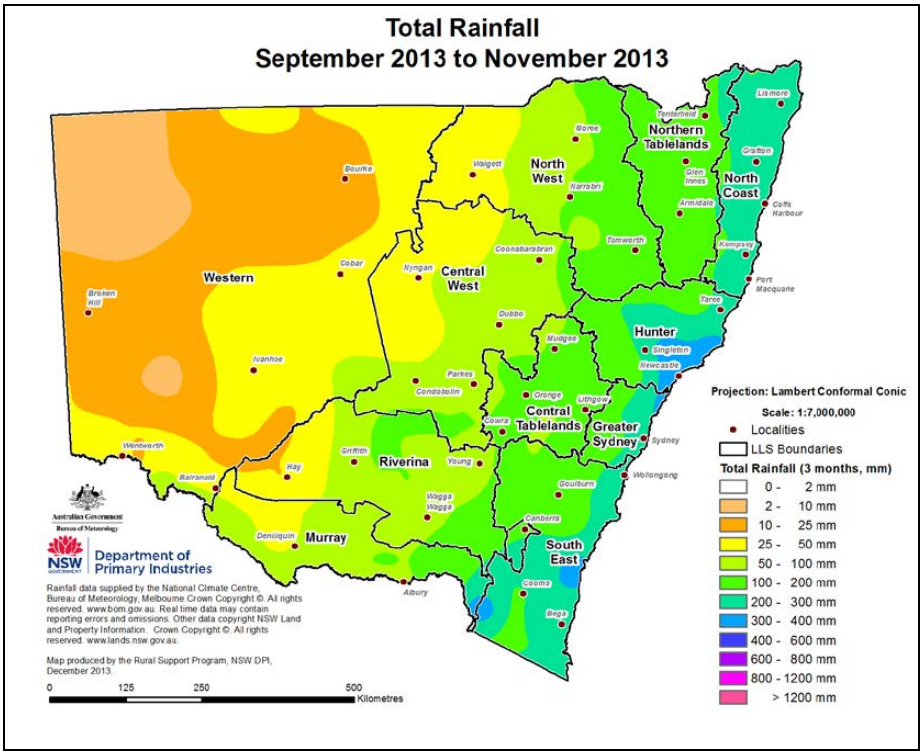


Figure 14: Total rainfall – half yearly

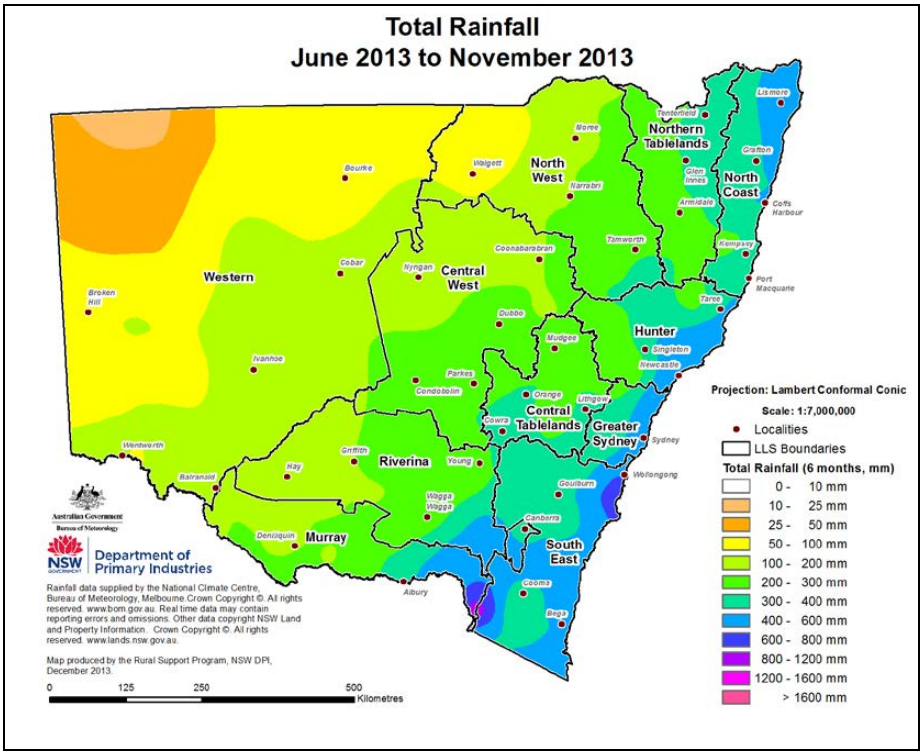
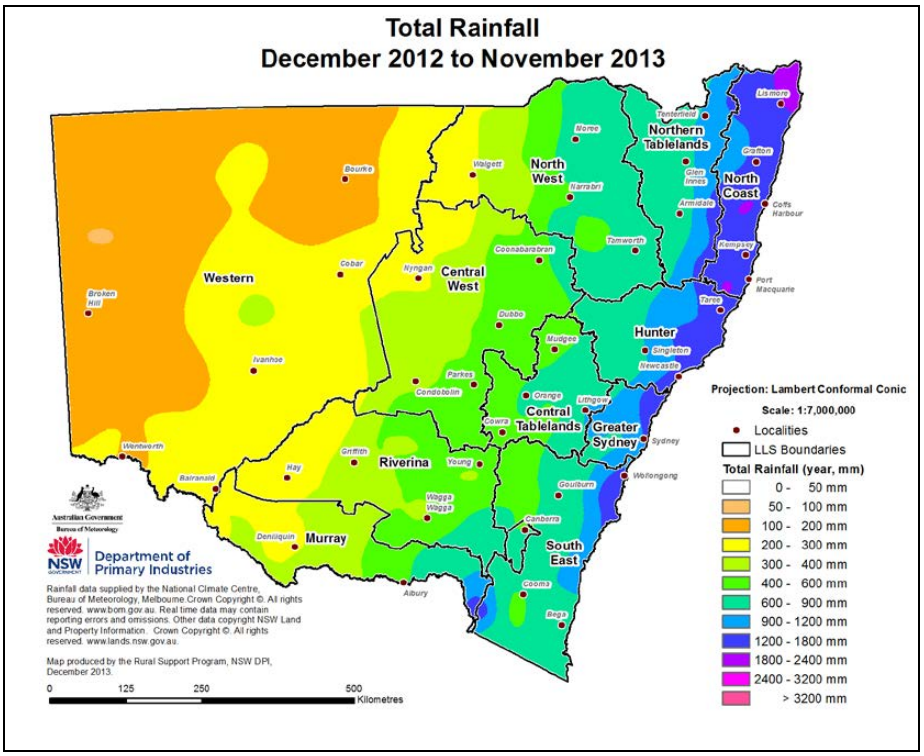


Figure 15: Total rainfall – yearly



Temperature

Figure 16: Maximum monthly temperature anomaly

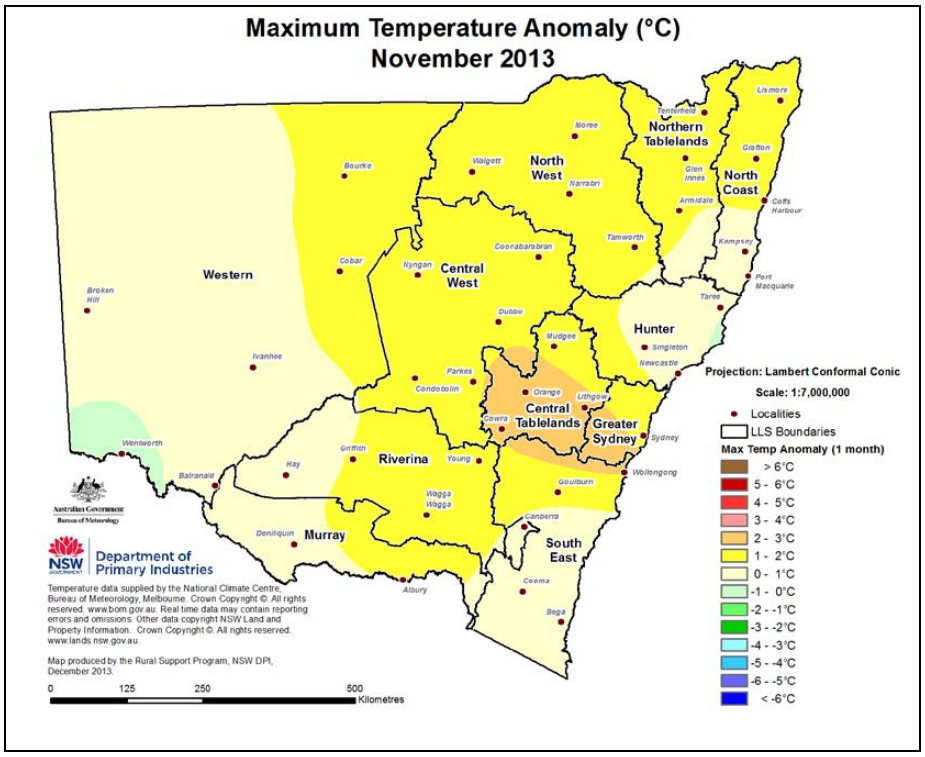
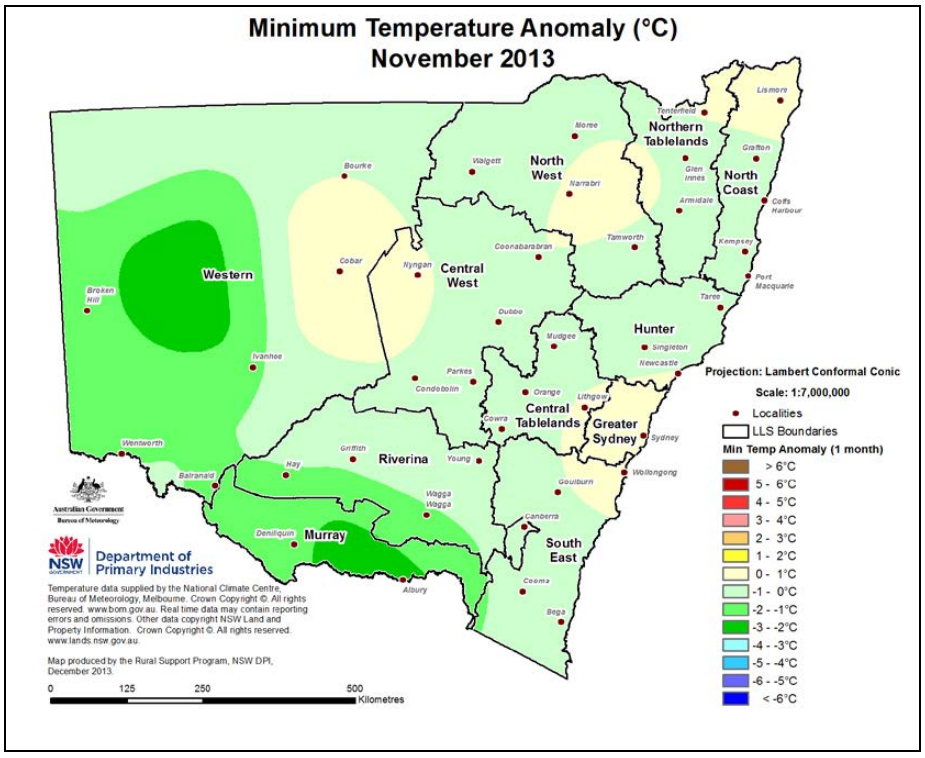


Figure 17: Minimum monthly temperature anomaly



Soil moisture

Figure 18: Relative topsoil moisture

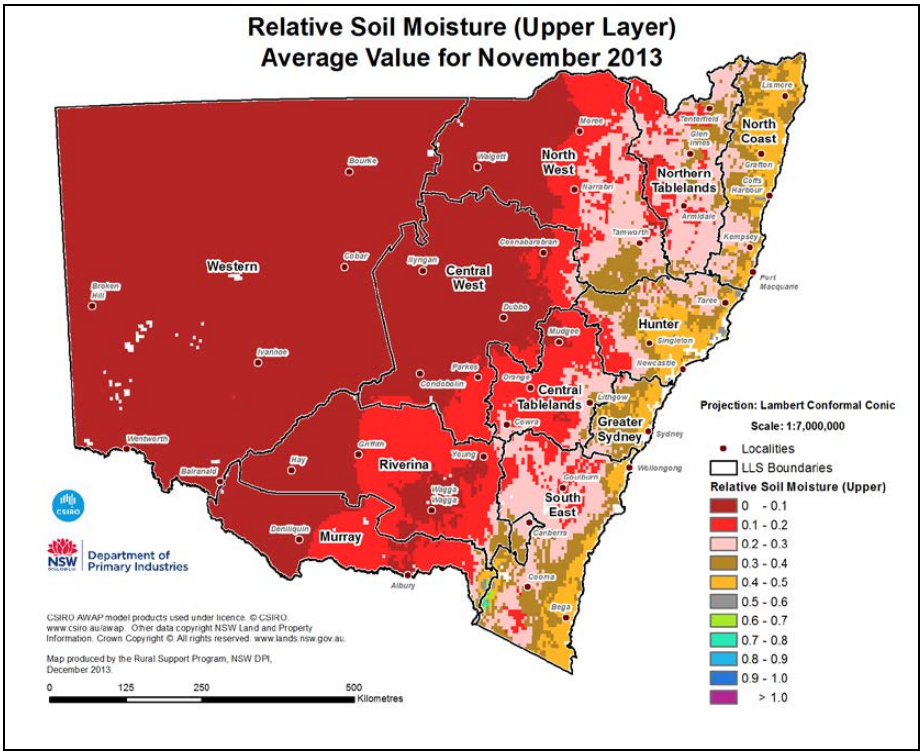
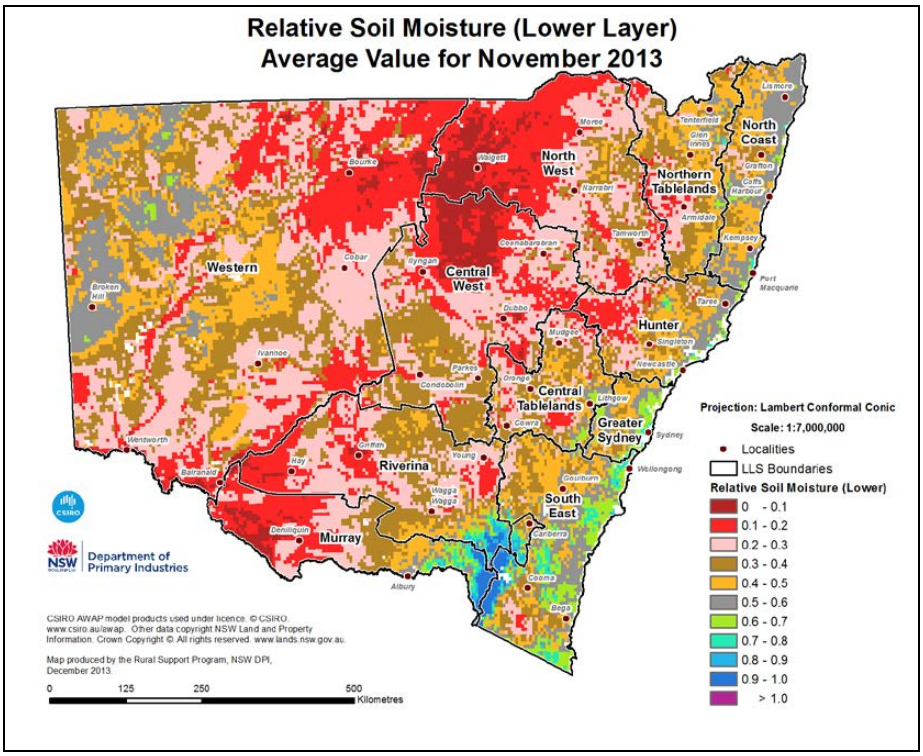


Figure 19: Relative subsoil moisture



Pasture growth and biomass

Figure 20: Modelled pasture growth

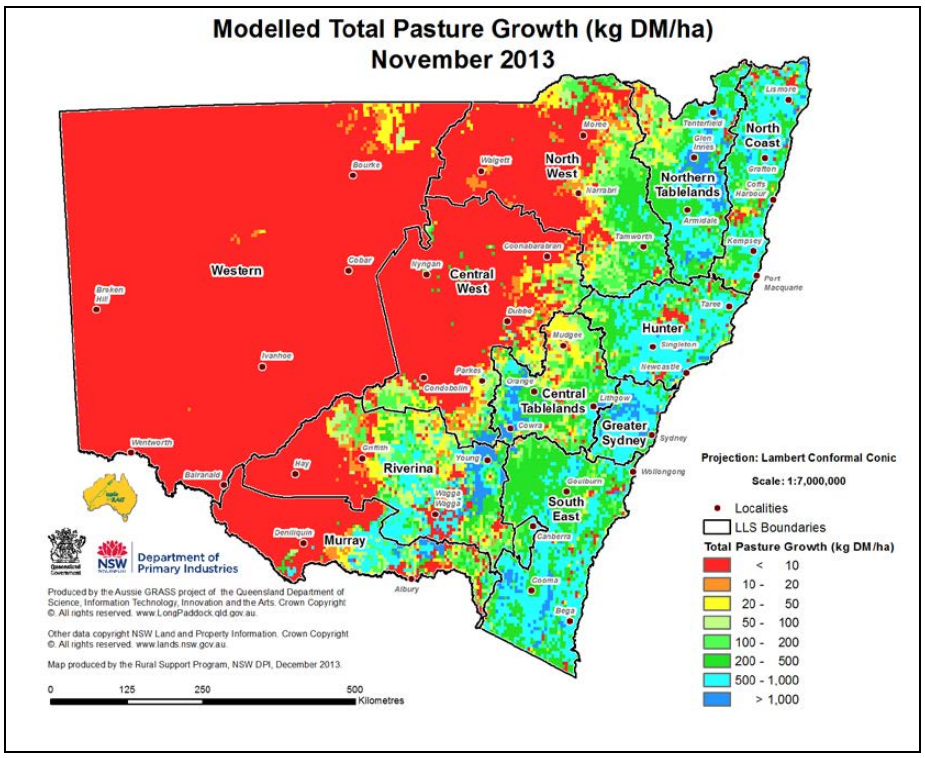


Figure 21: Modelled biomass

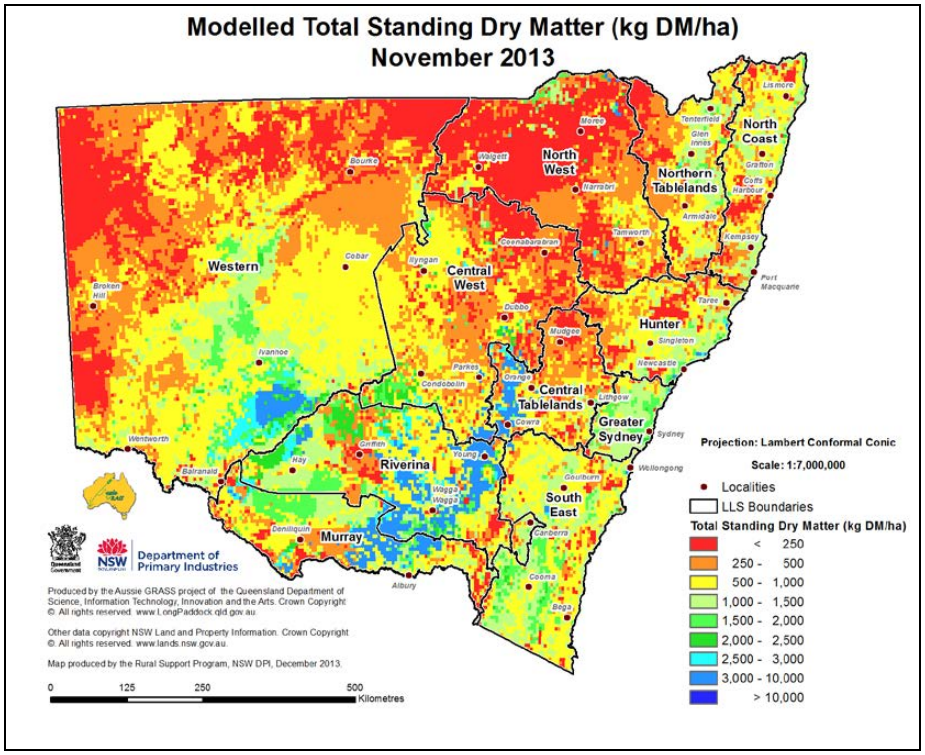


Figure 22: Relative pasture growth – monthly

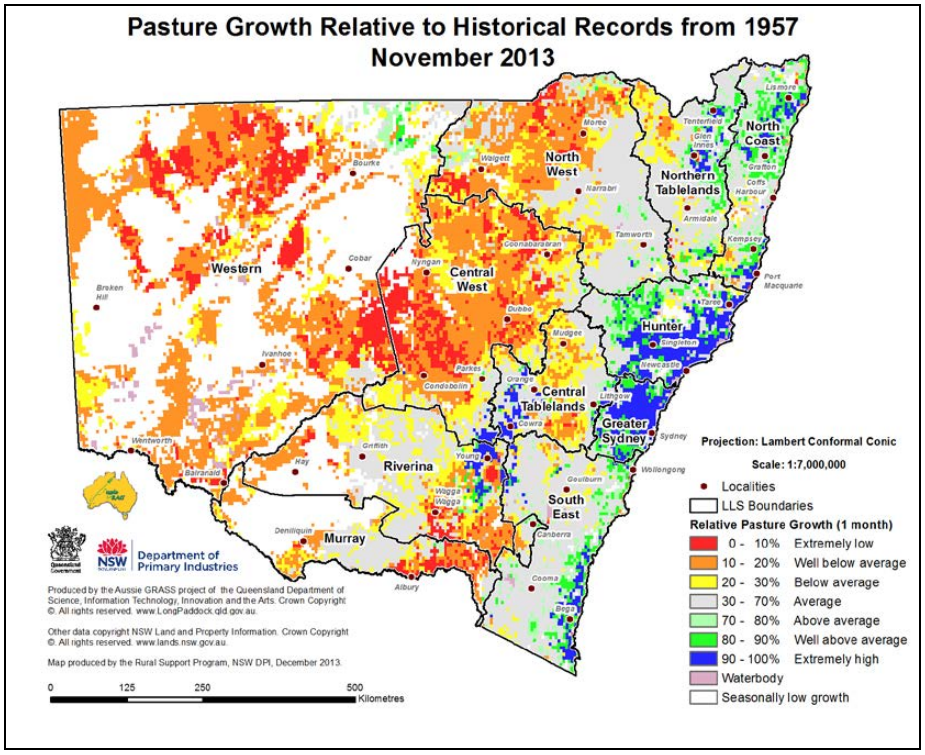


Figure 23: Relative pasture growth – quarterly

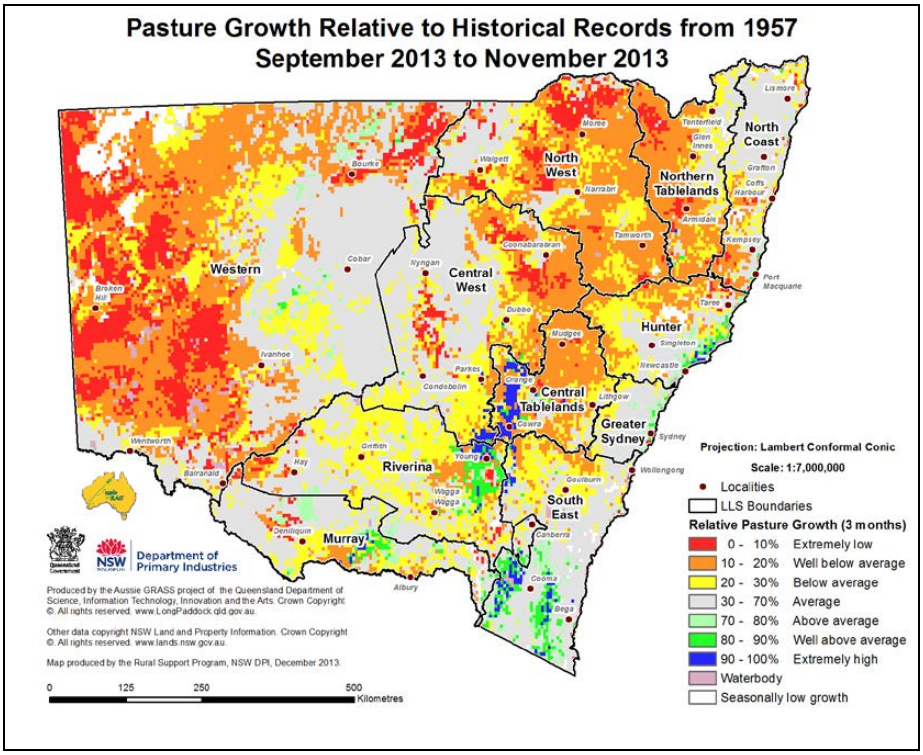


Figure 24: Relative pasture growth – half yearly

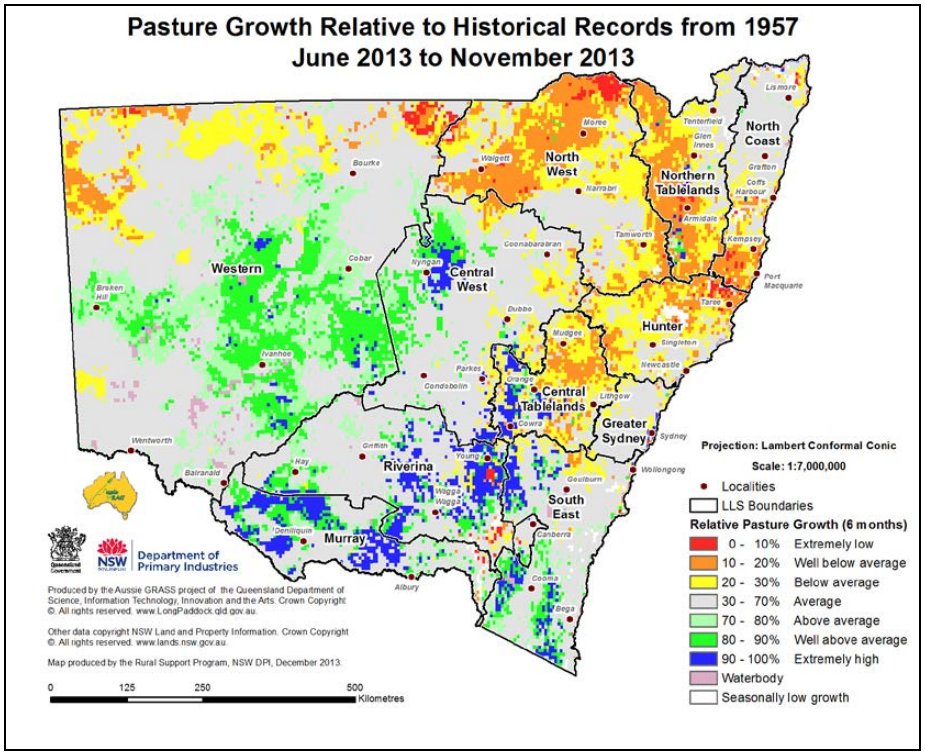


Figure 25: Relative pasture growth – yearly

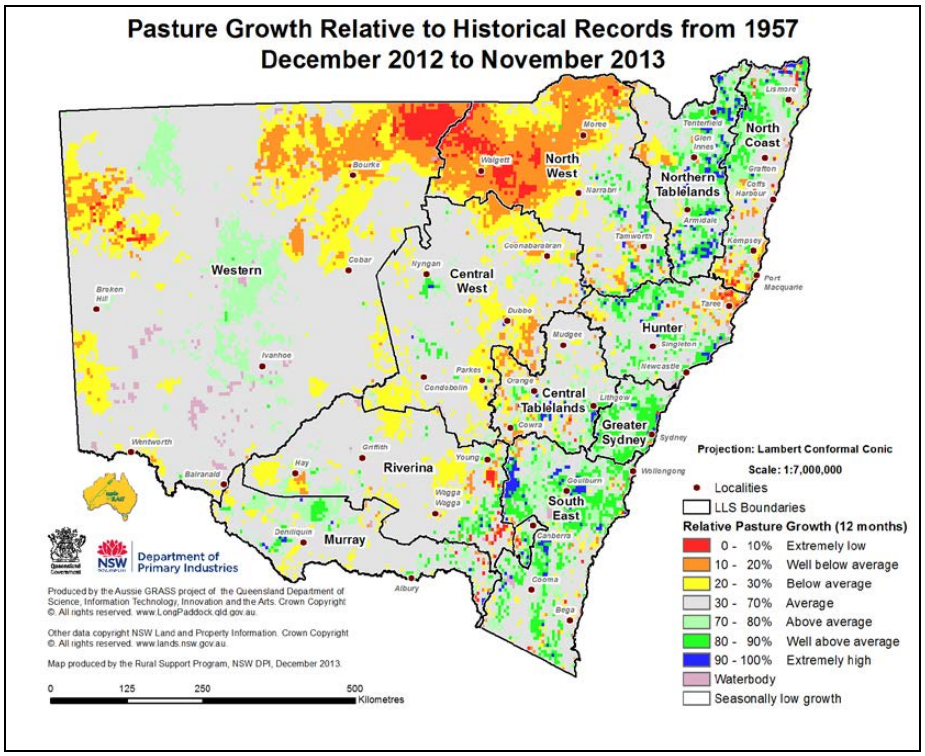


Figure 26: Relative biomass – monthly

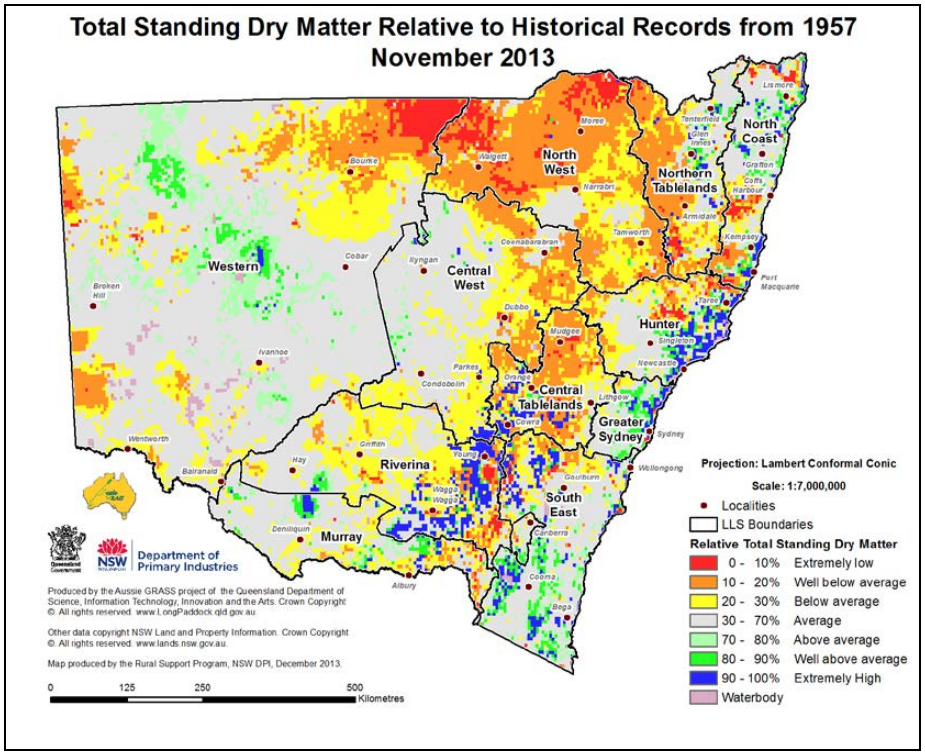
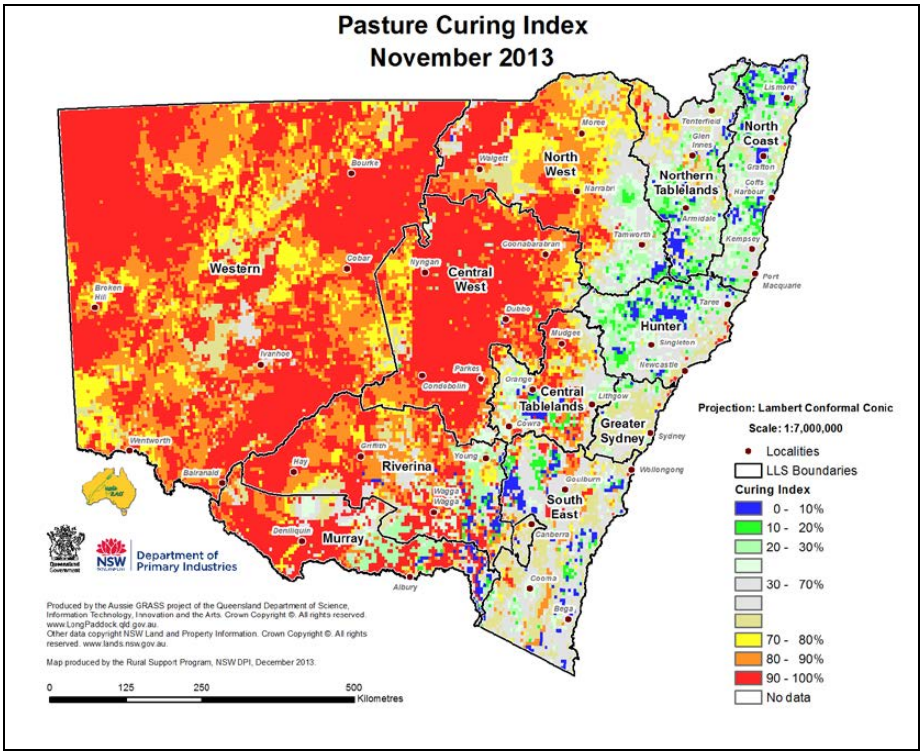


Figure 27: Pasture curing index



More information

For more information, contact the NSW Department of Primary Industries on 02 6391 3100.

Acknowledgments

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Warning

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