Department of Primary Industries

NSW Seasonal Conditions Report - March 2014

Highlights

- Good rainfall in mid-late February eased dry conditions across much of NSW. However, areas of the north west, north east, far west & far south east received below average rainfall. More rainfall is needed to sustain pastures & replenish soil moisture & water supplies.
- The outlook indicates the chances of a drier or wetter March to May period are nearly equal, as are the chances for warmer or cooler daytime temperatures. Overnight temperatures are likely to be warmer.
- February pasture growth was average across much of NSW, but low in the north west, north east & south east. Over the last 6 months it was low across much of NSW.
- Modelled topsoil moisture improved, but still remains low across 98% of NSW. Subsoil levels declined slightly.
- Stock water supplies remain low over areas of the west, north west, north east & tablelands.
- 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

Good rainfall occurred across most of NSW in mid-late February, although follow up rainfall is needed to sustain pasture growth and to replenish soil moisture reserves and stock water supplies. Areas of the north west, far north east, far south east and far west only received light falls and rainfall in these areas was below average or worse.

The outlook for March to May indicates the chances of a drier or wetter season are nearly equal across NSW, with a slightly reduced chance of exceeding median rainfall in the north west, north east and parts of the central west, and a slightly increased chance in the south east. March is likely to be drier than normal, and the chances for drier or wetter April are near equal. The chances of warmer or cooler than normal daytime temperatures are near equal across NSW over the March to May period, with slightly increased chances of warmer conditions across the east. Warmer than normal overnight temperatures are likely, particularly in the south east. March and April are likely to be warmer than normal.

The ENSO climatic indicators are currently neutral, although a warming trend is likely over autumn, approaching El Niño levels in winter.

Over February, 58% of NSW received average rainfall, with only 10% receiving below normal rainfall. The worst affected areas included the north coast, far south east and areas of the north west. The majority of NSW received falls of 25-100 mm. Daytime and overnight temperatures were above average.

Despite the rainfall, stock water supplies remained low across areas of the north east, north west, tablelands, Monaro, south west slopes, Riverina and western NSW. In these areas streamflow analysis shows well below average or worse run off over the last 1-2 years.

In relative terms, quarterly rainfall was below average across 46% of NSW, particularly across the north west, northern tablelands and coast, but near average over much of the western, southern and central areas. Half yearly relative rainfall was below average for the majority of NSW, except areas in the south and south east.

Modelled topsoil moisture remained low, but was improved by rainfall across the slopes, central west and south west, as well as areas of the north west, tablelands and central to mid-north coast. Modelled subsoil moisture levels declined slightly, being low over 59% of NSW. Continued rainfall is needed to replenish depleted profiles.

Modelled pasture growth improved during February across the tablelands, slopes and south west. Relative to historical records, it was average or better over 62% of NSW and below average in the north east, south east and parts of the north west. Biomass levels were stable. Relative to historical records, biomass was low across the north west, central NSW and the north and south coast. Quarterly relative pasture growth was low over 31% of NSW, particularly the north west and south east. Half yearly relative pasture growth was poor across 66% of NSW including the north west, north east, tablelands and slopes and areas of the far west.

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 - 10th March 2014.

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 in early March and were up to date as at 6th - 10th March 2014.

2.1 Seasonal outlook summary

Table 1: Seasonal outlook summary

	Current Outlook	Previous Outlook
Rainfall (quarter)	Neutral (Possibly drier – northern NSW)	Neutral-possibly drier
Max Temperature (quarter)	Neutral (Possibly warmer – coastal NSW)	Neutral-warmer
Min Temperature (quarter)	Warmer	Neutral-warmer

Source: Derived from information provided by the Australian Bureau of Meteorology

2.2 Seasonal rainfall outlook (BoM)

- For the three month period from March to May, the chances of a wetter or drier than normal season are roughly equal across the State. There is a slightly reduced (40-45%) chance of exceeding median rainfall across the far north west, the north east corner of NSW and parts of the central west. This includes areas of all LLS districts except South East. A small area in the south east corner of NSW has a 55-65% chance of exceeding median rainfall (Figure 3).
- This means that for every ten years with similar climate patterns to those at present, across most of NSW four to five March to May periods would be expected to be wetter than normal and five to six drier than normal.

  The outlook accuracy (confidence or skill) is moderate to high across most of NSW, ranging from 55-75% (Figure 6).

2.3 Seasonal temperature outlook

- Over the three month period from March to May, the chances of receiving warmer or cooler than normal daytime temperatures are roughly equal across the State. There is a slightly increased probability (55-60%) of exceeding the long term median maximum temperatures across the north east corner of NSW and along the coast, including areas of the Northern Tablelands, North Coast, Hunter, Greater Sydney and South East LLS districts. In the far south east corner of the State, the probability of receiving higher than normal daytime temperatures over the period is higher, at between 55-70% (Figure 4).
- The outlook accuracy (confidence or skill) is moderate to high (55-75%) across most of NSW but low over areas of western NSW and the far south east corner of the State (50-55%) (Figure 6).
- This means that for every ten years with similar climate patterns to those at present, across NSW about five March to May periods would be expected to have warmer than normal daytime temperatures, and five cooler than normal daytime temperatures.
- Warmer than normal overnight temperatures between March to May are likely across the NSW, particularly in the south east. The probability of exceeding the long term median minimum temperature is 60-65% for most of NSW, increasing to 65-70% in the east and to over 75% in the far south east (Figure 5).
- However, the outlook accuracy (confidence or skill) for the minimum temperature outlook is low (45-55%) to very low (<45%) across NSW (Figure 6).

2.4 Monthly rainfall and temperature outlook (BoM, 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.

March

- The experimental rainfall outlook for March (Figure 7) suggests that drier than normal conditions are likely across most of NSW, with a 30-40% probability of above median rainfall occurring over most of the State, decreasing to 20-30% in the south east. For some areas of the north west of the State, the probability of drier or wetter conditions over March is roughly equal. The outlook has a moderate accuracy (skill) over most of the State.
- The experimental maximum temperature outlook for March (Figure 7) suggests that warmer than normal daytime conditions are likely, with a 60-80% probability of above median maximum temperatures across most of NSW, increasing to above 80% in the south east. This outlook has a moderate accuracy (skill).
- The experimental outlook for the minimum temperature is similar, indicating warmer than normal conditions are likely during March, with a 60-80% probability of above median temperatures across most of NSW, increasing to over 80% in the south east. The accuracy (skill) for this outlook is low for northern, north eastern and eastern NSW, and moderate for the south and south west.

March multi-week

- Weekly experimental outlook information suggests that drier than normal conditions are likely across all but the north eastern and parts of coastal NSW in the third and fourth week of March, with a 30-40% probability of above median rainfall. However, the accuracy (skill) for this outlook is low.
- Warmer than normal daytime temperatures are likely across the State during the third and fourth weeks of March. The accuracy (skill) level for this outlook is moderate for north west and western NSW, and low for the remainder of the State.
- Overnight temperatures in mid-late March are likely to be warmer than normal across NSW, except for areas of the north coast. However, the accuracy (skill) level for this outlook is low.

April

- The experimental outlook for April indicates a roughly equal probability for wetter or drier conditions across most of NSW, with a 40-60% probability of above median rainfall. However, there is a slightly increased probability for drier conditions in north western NSW (Figure 8). The accuracy (skill) for this outlook is low for central and north eastern NSW and moderate for western and southern NSW.
- The experimental April outlook indicates an increased probability for warmer daytime temperatures across NSW, with a 60-80% probability of above median maximum temperatures, except for the far north east corner of NSW (Figure 8). The skill for this outlook is moderate for the north of NSW, but low in the south.
- There is also an increased probability for warmer overnight temperatures in April, with a probability of more than 70% for above median minimum temperatures across most of the State, with the probability increasing to the south and east (Figure 8). However, the accuracy (skill) for this outlook is low.

2.5 Other climatic models

Bureau of Meteorology statistical model (superseded)

The Bureau of Meteorology statistical outlook is based on past trends in sea surface temperatures. It has been superseded by the outlooks from the POAMA model. 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 Bureau of Meteorology's statistical model indicates a nearly equal probability for wetter or drier rainfall conditions over the eastern and central areas of NSW over the next three months (50-60%), with the probability for wetter conditions increasing slightly to the west. There is an increased probability (60-65%) of above median rainfall over the far west.
- The statistical model indicates that overnight temperatures have an equal probability to be warmer or cooler in the south and south west, but indicates that warmer than normal overnight temperatures are likely in the north and north east.
- The statistical model indicates that lower than normal daytime temperatures are likely with a 35-40% probability of exceeding the median maximum temperature in the north of the State, increasing slightly to a nearly equal (40-45%) probability for warmer or

cooler temperatures in the south and along the coast.

UK Meteorology Office

The output from this model is provided for the use of international meteorological centres, and not as general seasonal outlooks. It should therefore be used with caution.

- The UK Meteorology Office's global long range probability modelled output indicates drier than normal conditions are likely across NSW during March to May. The skill assessment for this outlook moderate for most of NSW, but low in the north east. The model indicates above average temperatures for the period across all but the north eastern corner of NSW. The skill for the temperature outlook is high for north western and central NSW, moderate for coastal NSW and low-moderate for the west of the State.
- For April to June, the UK Meteorology Office's global long range probability modelled output indicates drier conditions are likely across most of NSW except for the north, where there is an equal probability for wetter or drier conditions. The skill assessment for this outlook is low-moderate for most of the State, and low for the west. For temperature, the outlook indicates that above normal conditions are likely with a 60-80% probability of above average temperatures across most of the State, and more than 80% probability across the north and central coast and Hunter region. The temperature outlook has a high to very high skill for eastern NSW, and a moderate-high skill for most of the remainder of the State.

APEC Climate Centre

- The APEC Climate Centre's deterministic multi-model ensemble outlook of rainfall anomalies for March to May indicates that near normal rainfall is likely across most of the State, with a slightly less rainfall in the north east and slightly more in the south east. The temperature anomaly outlook indicates a likelihood of increased temperatures across the State during March to May. No skill assessment is available for these outlooks.
- During March, the APEC Climate Centre's rainfall anomaly outlook indicates a likelihood of higher than normal rainfall across the south of the State, lower than normal rainfall in the north east and near normal rainfall in the north. The temperature anomaly outlook indicates higher than normal temperatures are likely during March. No skill assessment is available for these outlooks.

2.6 El Niño-Southern Oscillation (ENSO)

ENSO summary

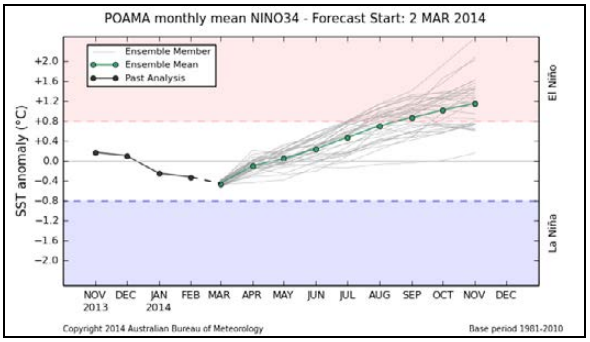
Table 2: ENSO Summary

	Current Outlook (early March)	Previous Outlook (early February)
ENSO (overall)	Neutral	Neutral
SOI	Neutral	Neutral
Pacific Ocean (NINO3.4)	Neutral-warming	Neutral-warming
Indian Ocean (IOD)	Neutral	Neutral
Southern Annular Mode (SAM/AAO)	Weakly positive/neutral	Weakly-moderately positive/neutral

Source: Derived from information provided by the Australian Bureau of Meteorology and the US National Oceanic and Atmospheric Administration.

- The Pacific Ocean remains in a neutral ENSO state (neither El Niño nor La Niña). The international climate models surveyed by the Bureau of Meteorology indicate that warming is likely in the tropical Pacific in the coming months, approaching El Niño thresholds in mid-winter.
- The CPC/IRI ENSO Alert System Status (as at 6th March) moved from 'inactive' to 'El Niño watch' this month, for the first time since 2012.
- The CPC/IRI consensus ENSO forecast of the NINO3.4 index (as at 6th March) indicates that of the 24 climate prediction models surveyed, 84% indicate ENSO neutral conditions will continue over March to May (Table 3).
- However, during late autumn and winter 2014 most of the models in the CPC/IRI consensus ENSO forecast are indicating a warming tendency, with 38% indicating El Niño conditions are probable between May-July, increasing to 50% over August-October (Table 3).
- The Bureau of Meteorology's POAMA model currently indicates ENSO neutral conditions through autumn although with increasing warming, and subsequently approaching to El Niño conditions in winter (Figure 1).

Figure 1: Current Bureau of Meteorology POAMA NINO3.4 Forecast



Source: Australian Bureau of Meteorology

- It should be noted, however, that ENSO forecasts generally have a lower skill at this time of year, and should therefore be treated with caution.
- Also, the CPC/IRI classifies values of the NINO3.4 index between -0.5°C and +0.5°C as indicating neutral conditions, rather than the -0.8°C to +0.8°C range used by the Bureau of Meteorology.
- 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 warmer than normal sea surface temperatures occurring around parts of the Australian coastline.

Table 3: Current consensus ENSO forecast probabilities

Season	La Niña	Neutral	El Niño
Feb-Apr	3%	94%	4%
Mar-May	3%	84%	13%
Apr-June	4%	68%	28%
May-Jul	5%	57%	38%
Jun-Aug	6%	49%	45%
Jul-Sep	7%	44%	49%
Aug-Oct	7%	43%	50%
Sep-Nov	7%	42%	51%
Oct-Dec	7%	41%	52%

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

Sea temperatures

- 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. Weak warm anomalies are present in the west, and along areas of the southern and south 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 -0.3°C, a -0.4°C change since December, and -0.32°C for the week ending 2nd March. Most models suggest the NINO3.4 region will remain in the neutral range through autumn, although will continue to warm, as shown in Table 3 above.
- The sub surface sea temperatures in the Pacific (to 24th February) show recent warming in the western and central Pacific, with cooling to the east of the Date Line. This pattern has been similar for a number of months, but has strengthened significantly over the last few months.

Southern oscillation index (SOI)

- The Southern Oscillation Index has continued to fall over the last fortnight. The latest 30-day value to 23rd February is +2.6 and to the 4th March is -3.8. The average for the last 90 days to 4th March (supplied by QDSITIA) is +2.9.
- Values of the SOI 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.

Sub-tropical ridge (STR)

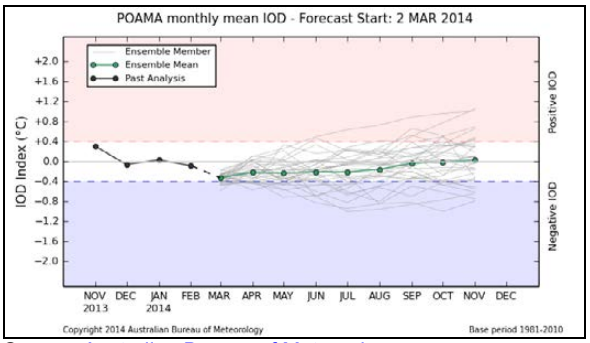
- The sub-tropical ridge remained just south of the continent during the month, as indicated on NOAA and Bureau of Meteorology mean sea level pressure charts. The forecast to mid-March is for it to remain at an approximately similar position or to move slightly northward. The presence of high pressure systems in the Tasman (associated with the sub-tropical ridge) during January to mid-February may have contributed to higher temperatures and reduced rainfall during this period.
- The sub-tropical ridge is a zone of high pressure which between November and April is normally located south of Australia at about 40°S, and tends to suppress cold front activity. During winter, it generally moves northwards allowing cold fronts to extend further into southern Australia.

Indian Ocean dipole (IOD)

- The Indian Ocean dipole remains neutral. The latest IOD index value for the week ending the 2nd March is -0.04°C.

- The Bureau of Meteorology's POAMA model and most climate models surveyed by the Bureau of Meteorology favour a neutral IOD over the coming months (Figure 2). This is because IOD patterns are generally inhibited by the development and position of the monsoonal trough.

Figure 2: Current Bureau of Meteorology POAMA Indian Ocean Dipole Forecast



Source: Australian Bureau of Meteorology.

- The IOD has little effect on Australian climate until autumn or winter. A negative IOD period (IOD index value of -0.4 or less) 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. A positive IOD period (IOD index value of +0.4 or more) has been associated with a decrease in rainfall during winter and spring across southern, western and central NSW. IOD events normally commence in May-June, peak in August-October and then rapidly decay.

Trade winds and Pacific cloud conditions

- Trade wind patterns over the tropical Pacific are near average across most of the equator. They strengthened in the western Pacific recently (23rd February), but have since returned to near normal (4th March). 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 are currently slightly below average, and have been so since early January. Cloudiness in this area decreases during La Niña events and increases during El Niño events.

2.7 Other climatic indicators

Southern annular mode (SAM)

- The experimental Southern Annular Mode or Antarctic Oscillation (AAO) index, which had been weakly negative since mid-late December, moved to be moderately positive in mid-February at about +1.25 to +1.5.
- As at 2nd March, the SAM index was neutral at close to zero from POAMA, and was slightly positive as at 5th March from NOAA.
- The forecasts from POAMA and the US National Oceanic and Atmospheric Administration (NOAA) indicate the SAM index is likely to increase to be weakly positive in early-mid March, with the NOAA index suggesting it will become moderately positive. The NOAA forecast suggests the index will remain positive, while POAMA indicates a return to near neutral later in the month.
- 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 and NSW cloud conditions

- Atmospheric pressure during February was below normal across most of the State, particularly in the far north west. Atmospheric pressure was near normal on the north coast. High atmospheric pressure is linked to drier than normal conditions.
- Cloud conditions over NSW were above normal over the last month, except in the far north east corner where they were near normal to below normal.

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 (percentile ranks).

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.

Summary

Table 4: Rainfall relative to historical records – percentage area of NSW in each class

Period	Below Average (0-30%)	Average (31-70%)	Above Average (71-100%)
Month	10%	58%	32%
Quarter	47%	48%	5%
Half year	73%	26%	1%
Year	61%	39%	0%

Source: Derived from information supplied by the Queensland Department of Science, Information Technology, Innovation and the Arts.

February

- Relative to historical records, rainfall for February was average across 58% of NSW (Figure 9, Table 4), covering most of central NSW, and along the central and mid north coast.
- The far north coast (to the north of Coffs Harbour) and far south coast (to the south of Bega) received well below average to extremely low relative rainfall. Most of these areas were in the lowest 10% of years for February rainfall. Areas of the northern tablelands, north west and Hunter valley also received below average rainfall.
- The far north east corner of NSW received less than 40% of normal February rainfall, with the area between Grafton and Lismore receiving less than 20% of normal.
- Below average rainfall extended across areas of the North Coast, Northern Tablelands, North West, Hunter and South East LLS districts and occurred across 10% of the State (Figure 9), compared to 49% in January.
- Above average rainfall extended across the far north west and south west of the Western LLS, as well as areas of the Central West, Central Tablelands, Hunter, South East, Riverina and Murray LLS districts and covered 32% of NSW. The far south west received more than 200% of normal February rainfall.

December to February (3 months)

- Over the period from December to February, relative rainfall was below average across 46% of the State (Figure 10, Table 4), covering most of the north west, northern tablelands and coast.
- Below average rainfall extended across all of the North West, Northern Tablelands, North Coast, and the majority of the Hunter, Greater Sydney, Central Tablelands and South East LLS districts. Areas of below average rainfall also occurred in the central areas of Western and Riverina LLS districts. Most of these areas received less than 80% of their normal quarterly rainfall, with the north west and coastal areas receiving less than 60% of normal rainfall.
- Over the North West, Northern Tablelands and North Coast LLS districts and much of Hunter LLS district, the December to February rainfall was in the lowest 10% of years. Most of these areas received less than 40% of their normal quarterly rainfall. The north and mid north coast had a rainfall deficit of 200-400 mm for the quarter, with the far north east corner having a deficit of over 400 mm.
- Above average or better relative rainfall was confined the far south west of the State.
- Average relative rainfall occurred over the central and southern areas of NSW and across most of Western LLS district.

September to February (6 months)

- Over the six months to February, relative rainfall was below average or worse across 73% of NSW (Figure 11, Table 4). Most of the State received less than 80% of normal rainfall for the period.
- A large proportion of this area received rainfall in the lowest 10% of years, including large areas of the North West, Northern Tablelands, North Coast and Western LLS districts. These areas received less than 60% of their normal half yearly rainfall, with areas of particular deficiency in the far west and north west receiving less than 40%.
- Areas of the Western, Hunter and South East LLS districts, and the south and some central areas of the State received average relative rainfall over the period, amounting to 26% of the State.

- An isolated area in the far south west of NSW near Wentworth received above average rainfall (100-125% of normal).

June to February (9 months, BoM)

- Over the 9 month period from June to February, relative rainfall across the State was below average across most of the north, far west, tablelands, south west slopes, and the central coast to the north coast (Figure 12). Most of these areas received between 40-80% of their normal rainfall.
- Areas of particular deficiency occurred in the far north west between Walgett, Goodooga and Collarenebri which received between 20-40% of their long term average rainfall over the 9 month period.
- Limited parts of NSW received above average rainfall, in the alpine areas and far south west. The remainder of the State was near average (mainly the south and south east), receiving 80-100% of normal rainfall.

March to February (12 months)

- Over the twelve months to February, below average relative rainfall extended across the north west and tablelands and the north coast, including the North West, Northern Tablelands, Central Tablelands and North Coast LLS district, and areas of the remaining LLS districts (Figure 13, Table 4), covering 61% of NSW.
- Areas of Western, North West, Northern Tablelands, North Coast, Central West, Hunter, South East and Central Tablelands received extremely low rainfall over the period, that is, rainfall in the lowest 10% of years.
- The remainder of the State (39%), including most of the south and central coast and central areas had average relative rainfall for the period. Only isolated areas received above average relative rainfall.

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.

February

- NSW received an average of 48 mm for the month, in comparison to the historical average of 51 mm.
- The first half of the month was mostly dry, with rainfall occurring later in the month, particularly as a series of troughs crossed the State between 15th-17th February, 19th-20th, and from the north west to the central coast on the 28th February.
- Rainfall during February was between 80-200% of average across most of NSW.
- A trough on the 28th February caused localised heavy falls on the central coast of between 200-300 mm.
- Total rainfall over the State ranged from 1-300 mm. However, the higher recordings were only received in limited areas, and the majority of the State received between 25-100 mm (Figure 14).
- Rainfall was above average in areas of the Western LLS district, particularly in the south and north east.
- Much of the drought-affected areas in the north received above average rainfall of 50-100 mm, however the area around White Cliffs received only 10 mm or less.
- The remainder of north western NSW received 25-50 mm, although an area between Walgett, Collarenebri and Pilliga received 10-25 mm, as did an area between Moree and Boggabilla. Rainfall coverage over some of these areas was patchy.
- Rainfall was limited to less than 25 mm over areas of the North Coast LLS district between Grafton and Lismore.
- The northern half of Northern Tablelands LLS district received below average relative rainfall, although falls in that area were generally between 25-50 mm.
- The southern areas of the South East LLS district (from Bega and Cooma south to the border) also received limited rainfall, with falls of 25 mm or less, particularly to the south of Bega.

December to February (3 months)

- Total rainfall over the three months to February ranged from 25-200 mm over most of the State, with some areas receiving as little as 25-50 mm or less and others over 200 mm (Figure 15).
- An area between Walgett, Collarenebri and Pilliga in north western NSW received 25-50 mm as did an area extending from around Nymagee and Ivanhoe to the west. Some areas within this zone (near Wilcannia) received less than 25 mm.
- Most of the central and western areas of the State received 50-100 mm, with the east of Central West LLS district, much of the

Northern Tablelands and South East receiving 100-200 mm. Over the period, the coastal LLS districts generally received 100-200 mm, as did areas near Wentworth, Balranald and Cobar.

September to February (6 months)

- Rainfall across the State during the September to February period ranged from 25-600 mm (Figure 16), with most areas receiving between 100-400 mm.
- Some of the lowest rainfall over the period (50-100 mm) fell in the north west between Walgett, Goodooga, Collarenebri and Pilliga, and in the far west extending from Nymagee and Ivanhoe to the west and north west. An area within this zone from about Wilcannia to the west only received 25-50 mm.
- The central areas of the State, including the slopes and much of the tablelands, received 100-300 mm during the period. The eastern areas of Riverina and Murray LLS districts also received similar rainfall with the far east of these districts receiving 300-400 mm.
- The coastal LLS districts generally received 300-400 mm. Areas of the coast received up to 600 mm, as did the alpine areas.

4. Temperature anomalies

Temperature information is sourced from the Bureau of Meteorology.

The data used to create the temperature anomaly maps was not available this month.

- Maximum temperatures across the State in February averaged 1.6°C above normal, and it was the warmest February since 2007.
- Daytime temperatures were well above average over the first half of the month, but closer to normal during the second half. Daytime temperatures dropped significantly due to the cold conditions associated with the rain events on the 20th-21st and 28th February.
- Maximum temperature anomalies ranged from 1-2°C above normal across most of the State, with the highest temperatures occurring in a belt through the west, south and north west. In these areas, temperatures were generally 2-3°C above normal.
- Most of the coastal areas and adjacent tablelands experienced near normal temperatures, with the most of the south and central coast experiencing temperatures slightly below normal.
- Minimum temperatures during the month averaged 1.4°C above normal across the State, making it the warmest February since 2007.
- Generally, the western and central areas of the State had minimum temperatures of 1-2°C above normal and the east between 0-1°C above normal.

5. Relative soil moisture

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

The soil moisture maps show the average monthly (or weekly) soil moisture content for the topsoil and subsoil, as a proportion of its saturated capacity. They do not show monthly soil moisture relative to historical records (percentile ranking).

5.1 Summary

Table 5: Average monthly relative soil moisture – percentage area of NSW in each class

Layer	Low (0-0.3)	Moderate (0.3-0.7)	High (0.7-1.0)
Topsoil	98%	2%	0%
Subsoil	59%	40%	1%

Source: Derived from information supplied by CSIRO and the Australian Bureau of Meteorology.

5.2 Topsoil

Monthly topsoil moisture

- Modelled topsoil moisture remained low across over 98% of NSW in February (Figure 20, Table 5), improving just 1% over January.
- Improvements in the average topsoil moisture did occur, shifting the soil moisture up two levels in the far south west and over much of the central west and central tablelands. However, the improvements were not quite enough in most areas to shift them from the 'low' (0-0.3) to the 'moderate' (0.3-0.7) level.
- On a percentile rank basis, about half the State ranked as having average relative soil moisture over the month. Most of the Western LLS district shifted to being average to above average. Much of the North West, Central West, South East and Central Tablelands LLS districts and the east of the Riverina LLS district shifted from well below average or extremely low to average. While the coastal and Northern Tablelands LLS

districts improved, they still remained below average or worse. The northern half of the North Coast and Northern Tablelands LLS districts remained extremely low. Areas of North West LLS around Walgett and Pilliga remained below average.

- Across the western and central areas of the State, modelled topsoil moisture for February averaged 10-20 mm or less. Similar levels occurred in the south and the far south east corner.
- Average February topsoil moisture levels of 20-40 mm occurred across most of the eastern third of the State and in the far south west corner.
- The reason that a greater improvement was not obvious in the February relative soil moisture (as a result of the mid-late February rainfall) was the extremely dry conditions to mid-February. The relative soil moisture is averaged across the whole month, and so took account of the dry conditions in early February and the wetter conditions later in the month. A greater change is likely to be more obvious in next month's data.

Weekly topsoil moisture

- More detail of the overall change in soil moisture was obvious on the weekly data. The weekly modelled topsoil moisture to the 23rd February (Figure 23) shows a marked improvement in comparison to the previous week (Figure 22), as a result of the mid-late monthly rainfall.
- Most of the State was in the lowest three ranges (the 'low' category) in the week to 16th February, but generally improved two to four levels across the Central West and Central Tablelands LLS districts.
- Similar improvements occurred over the east of the North West LLS districts, the south of the Northern Tablelands and North Coast and much of the South East and Hunter LLS districts.
- Major improvements also occurred in the north east and south of the Western LLS district, and in the far west and far east of Murray and Riverina LLS districts.

5.3 Subsoil

- Modelled subsoil moisture levels declined slightly between January and February, with the area of the State in the 'low' category increasing from 55% to 59%. The areas of lowest subsoil moisture continued to be the north west and south west of the State (Figure 21, Table 5).
- On a percentile rank basis, the majority of the North West, Northern Tablelands and Central Tablelands LLS districts had below average to extremely low subsoil moisture, as did the north and south of North Coast, the north of Central West, the north and north west of South East and the eastern and central areas of Riverina LLS districts. Greater Sydney LLS district also had generally below average relative soil moisture.
- The Northern Tablelands and Central Tablelands LLS districts showed the greatest decline in subsoil moisture level between January and February.
- Subsoil moisture levels remained moderate along a narrow coastal strip from Bega to Tweed Heads, although levels have declined somewhat since January.
- Only 1% of the State remained in the high subsoil moisture category during February.
- The North West LLS district had the lowest overall relative subsoil moisture during the month, with 91% of its area in the low category. This was followed by 82% of Central West, 72% of Central Tablelands, 68% of Murray, and 61-62% of Riverina and Northern Tablelands LLS districts.
- Total modelled subsoil moisture for the month was less than 200-300 mm across most of the State, and less than 50 mm near Walgett in the North West LLS district.

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 February, modelled pasture growth improved markedly across much of the State as a result of the late February rainfall.
- Across much of the tablelands, upper slopes, far south west and parts of the north west and central coast, growth improved to between 50-200 kg/ha dry matter (DM) from levels of less than 20 kg/ha dry matter.
- However, large parts of the central area of the Western LLS district, and the central areas of the State (including areas of the North West, Central West, and Riverina LLS districts) showed low growth of less than 10-20 kg/ha dry matter.

- Other areas to show this level of growth included much of the North Coast LLS district (particularly north of Coffs Harbour), the central areas of Hunter, the south west of Murray and the eastern and southern areas of South East LLS districts (Figure 24).
- Growth declined in the north eastern corner of the State, over areas of the North Coast and Northern Tablelands LLS district.

6.2 Modelled biomass

- Modelled total standing dry matter (biomass) levels were stable across much of the State during the month, although at relatively low levels (Figure 25).
- Modelled biomass levels declined across the coastal LLS districts, with the area in the less than 250-1,000 kg/ha dry matter range increasing markedly (Figure 25). Declines also occurred in the Riverina and Central Tablelands LLS districts.
- The areas of reasonable biomass also declined in the Riverina and Murray LLS districts, and the across the west of the Central Tablelands LLS district.

6.3 Relative pasture growth

Relative pasture growth and biomass are calculated by comparing and ranking the current modelled growth and biomass against that for the same period over every year since 1957 (percentile ranks).

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.

Summary

Table 6: Pasture growth relative to historical records – percentage area of NSW in each class

Period	No Data	Below Average (0-30%)	Average (31-70%)	Above Average (71-100%)	Other
Month	23%	14%	43%	19%	1%
Quarter	1%	31%	58%	9%	1%
Half Year	0%	66%	31%	1%	1%
Year	0%	33%	56%	11%	1%

Source: Derived from information supplied by the Queensland Department of Science, Information Technology, Innovation and the Arts.

February

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 improved during February. Many areas that were below average in January improved to average or above average growth in February (Figure 26).
- Relative growth remained poor between Lightning Ridge, Walgett, Pilliga and Narrabri and to the north of Moree in the North West LLS district. Other areas of poor relative pasture growth were in the Coonabarabran and Inverell areas, across the northern half of the North Coast LLS district, and across the coastal and Monaro areas of the South East LLS district.
- Improvements in growth from below average to average or better occurred across most of the tablelands, slopes and over the Hunter valley.
- Some 14% of the State was below average in relative growth for the month, a major improvement from 42% in January. Some 43% was average and 19% above average.
- Areas of missing data accounted for 23% of the area of NSW, primarily across the west of the State. Missing data covered large areas of the Western LLS district and parts of Murray, Riverina and Central West.

December to February (3 months)

- Over the three months to February, relative pasture growth remained below average or worse across much of the North West LLS district, the north west of the Northern Tablelands, the north of the Central West and the east of the Riverina LLS districts.
- Another area of below average relative growth remained in the Western LLS district between Broken Hill, Menindee, Wilcannia and Tibooburra. In addition, the relative growth across the Monaro declined to extremely low levels (Figure 27).
- Some 31% of the State had below average relative growth for the period, an improvement from 60% over the three months to January.
- Approximately 69% of the North West LLS district had below average relative growth for the period, along with 48% of South East and 38% of Northern Tablelands and Riverina LLS districts.

- The majority of the State (58%) had average or better relative growth for the period, covering most of the western and central areas of the State.
- An area in the far south west corner of the State showed above average relative growth.

September to February (6 months)

- Over the six month period from September to February, relative pasture growth was below average over 66% of the State, similar to the previous half yearly period.
- Only the far south east and the south of the State, as well as the south easterly and easterly areas of Western LLS district had average relative growth over the six months to February, amounting to 31% of the State (Figure 27).
- Areas of well below average to extremely low relative growth in the six months to February occurred in west of the Western LLS district as well as the North West, Central West, Central Tablelands and Northern Tablelands LLS districts.
- Other areas of well below average to extremely low relative growth over the period occurred across the North Coast LLS district, the northern and southern areas of the Hunter LLS district, the north of South East and the east of Riverina LLS districts.

March to February (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 northern tablelands, central tablelands and the mid-north to north coast (Figure 29).
- These areas extended from the far north eastern corner of the Western LLS district through the North West, Northern Tablelands, and North Coast LLS districts, and also covered areas of the Central West, Hunter, Greater Sydney and Central Tablelands LLS districts.
- The area of below average yearly growth made up 33% of NSW, and increase from 26% in the period from February 2013 to January 2014.
- The Western LLS district had generally average relative growth over the period, with the exception of the far north east and areas of the far north west.
- Relative growth across most of the central, southern and south eastern areas of NSW was generally average (56% of the State), with pockets of above and below average growth.
- Relative growth across the alpine and coastal areas of the South East LLS district was generally above average.

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 were similar to January, with some declines in the North Coast, Greater Sydney and South East LLS districts. Some improvements occurred in the Central Tablelands, and to a lesser extent in the Northern Tablelands and Central West LLS districts (Figure 30). Below average relative biomass made up 53% of NSW in February.
- Better areas of relative biomass (above average or higher) occurred in the coastal areas of the Hunter LLS district. These only made up 6% of the area of the State.
- The central and eastern areas of the Western and the Murray LLS districts and the west of the Central West LLS district, as well as areas of the Hunter and Greater Sydney LLS districts had average relative biomass.

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 6th March 2014.

- Levels in water storages are low-moderate, with the average capacity being 50%.
- Changes in storage levels were generally small, with the exception of the Blowering (-12%), Hume (-11%) and Brogo (-11%) Dams and Lake Pamamaroo (-10%). Minor decreases occurred across most other storages, with the exception of Lake Cargelligo.

Table 7: Capacity of storages

Storage	Current Volume (GL)	Effective Capacity (%)	Monthly Change (%)
Toonumbar	10	90	-3
Glenbawn	690	92	-1
Glennies	253	89	-2
Lostock	17	82	-1
Brogo	7	77	-11
Cochrane	-	-	-
Dartmouth	3488	90	-2
Hume	1350	45	-11
Blowering	890	54	-12
Burrinjuck	458	44	-2
Brewster	-	-	-
Carcoar	11	30	-7
Cargelligo	37	100	7
Wyangala	537	44	-4
Glenlyon	99	-	-
Pindari	51	16	-4
Copeton	470	34	-4
Chaffey	29	45	-
Keepit	79	17	-8
Split Rock	83	20	-2
Burrendong	203	15	-5
Oberon	31	68	-2
Windamere	184	50	0
Lake Cawndilla	169	15	-5
Lake Menindee	34	0	0
Lake Pamamaroo	174	61	-10
Wetherell	64	31	-4
Total	**9418**		
Average		**50**	

8.2 Irrigation allocations

Allocations are given as at 6th March 2014.

- High security and general security allocations remained the same as last month.
- Irrigators in the Murrumbidgee river valley will be able to access an additional 5% of their entitlement after February 2014.

Table 8: 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*	59%	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	52%	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 3: Quarterly rainfall outlook

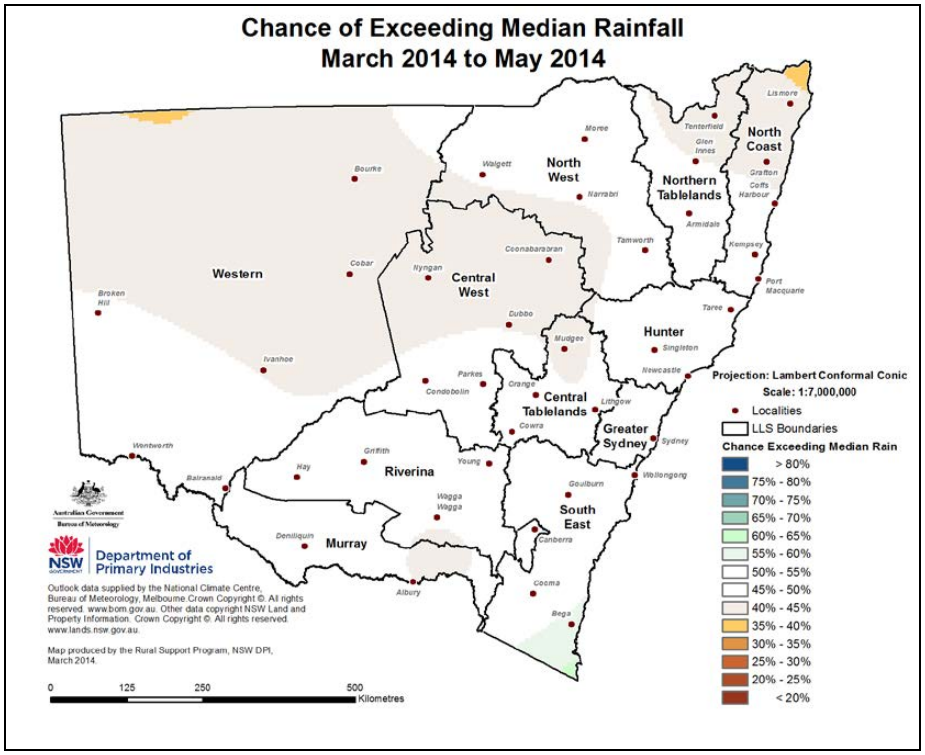


Figure 4: Quarterly maximum temperature outlook

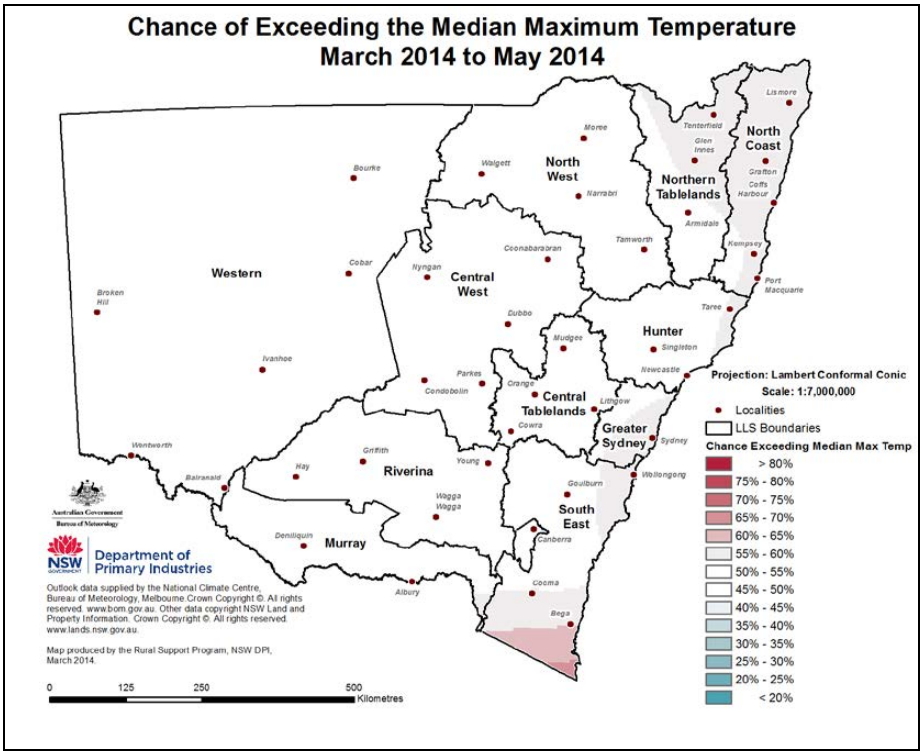


Figure 5: Quarterly minimum temperature outlook

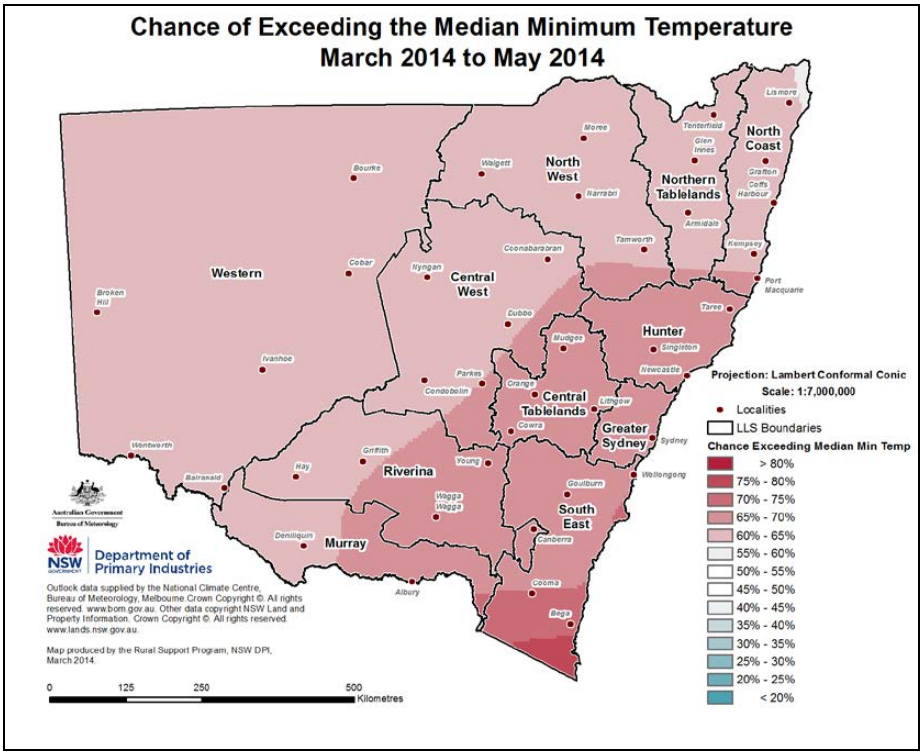
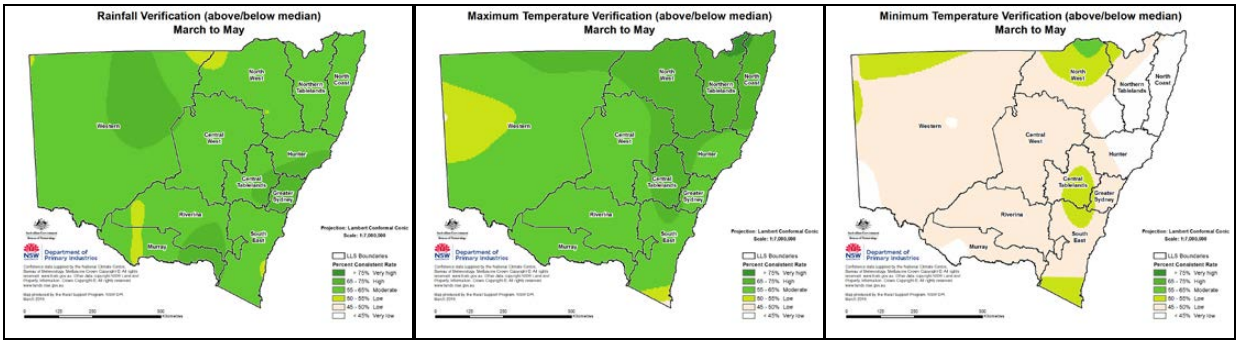


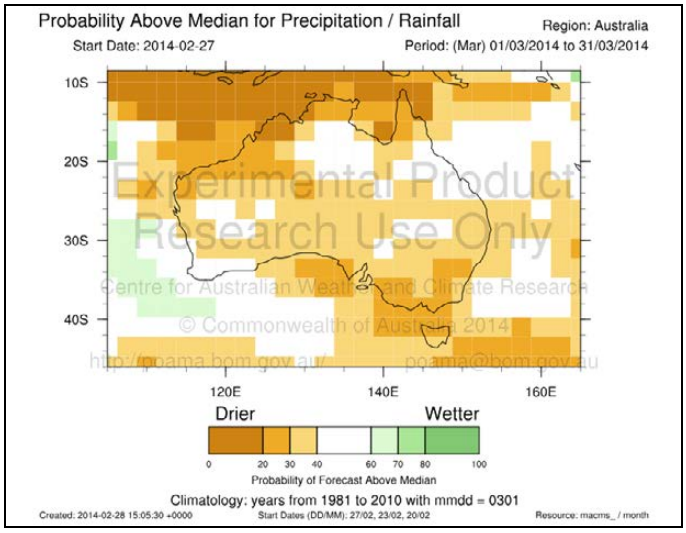
Figure 6: Outlook skill maps

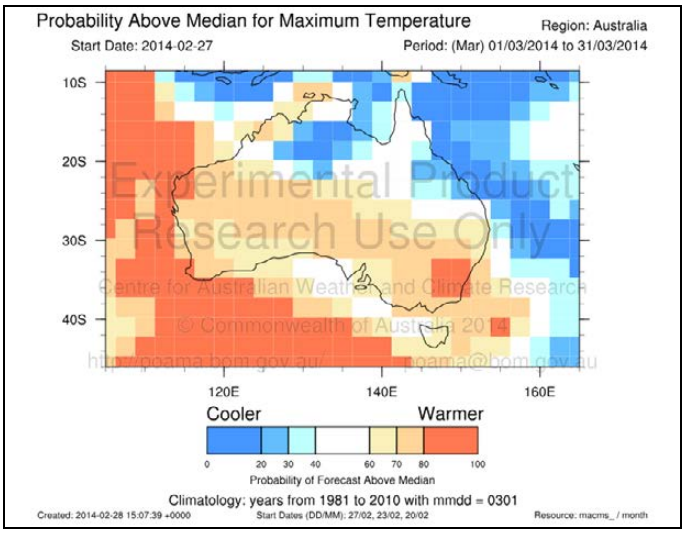


Monthly rainfall & temperature outlook

(Bureau of Meteorology, POAMA - experimental)

Figure 7: Experimental March rainfall and temperature outlooks





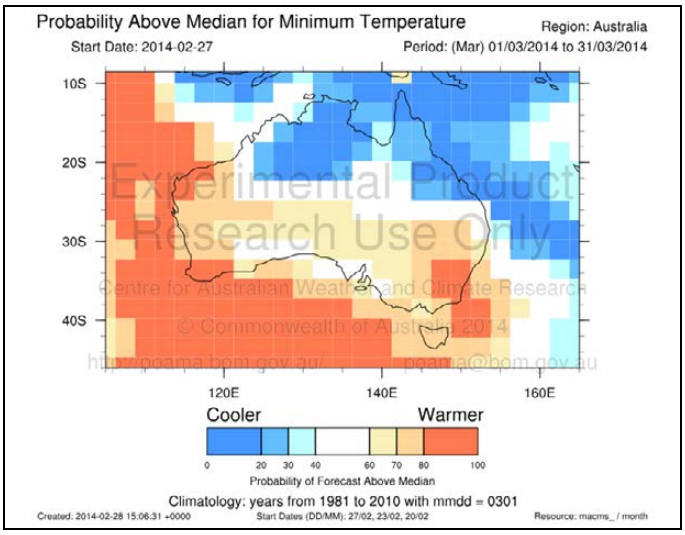
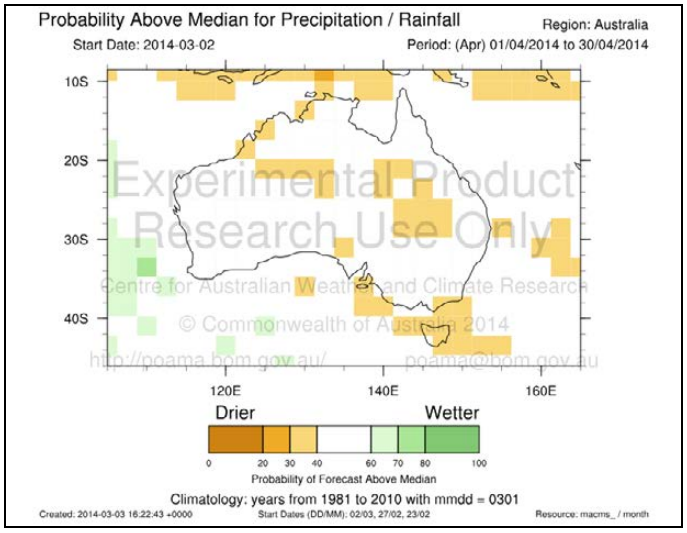
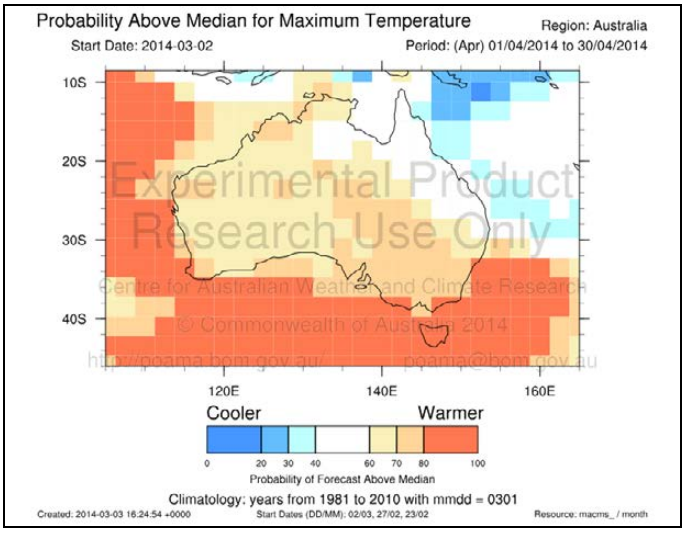
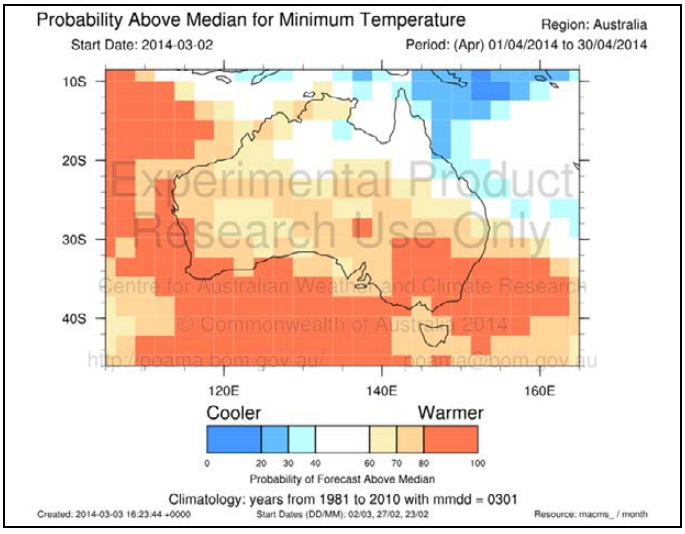


Figure 8: Experimental April rainfall and temperature outlooks







Rainfall

Figure 9: Relative rainfall – monthly

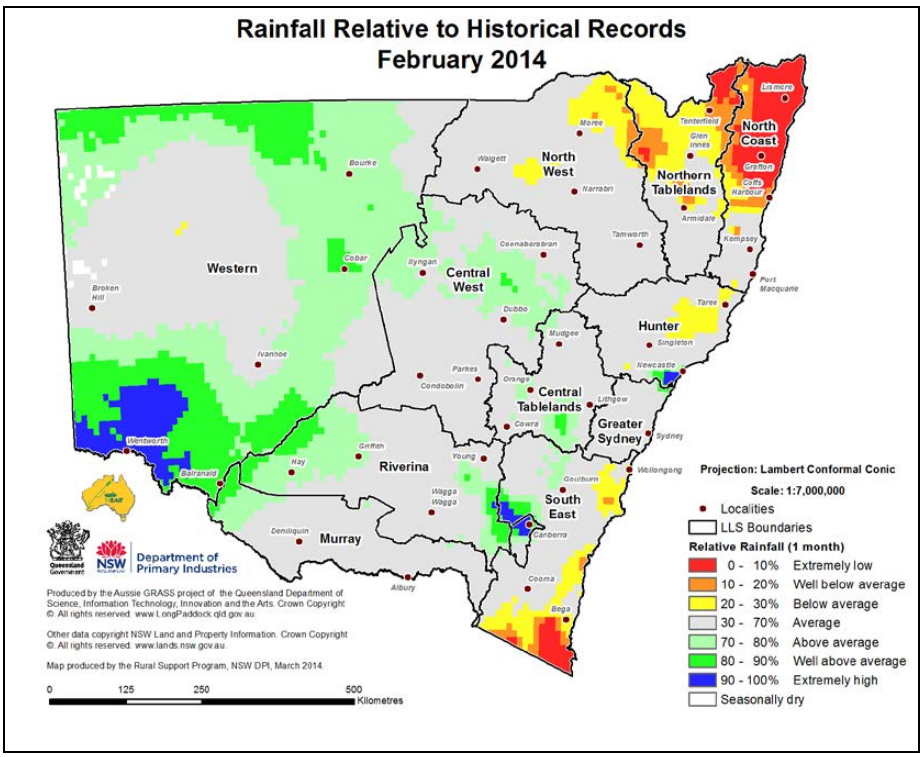


Figure 10: Relative rainfall – quarterly

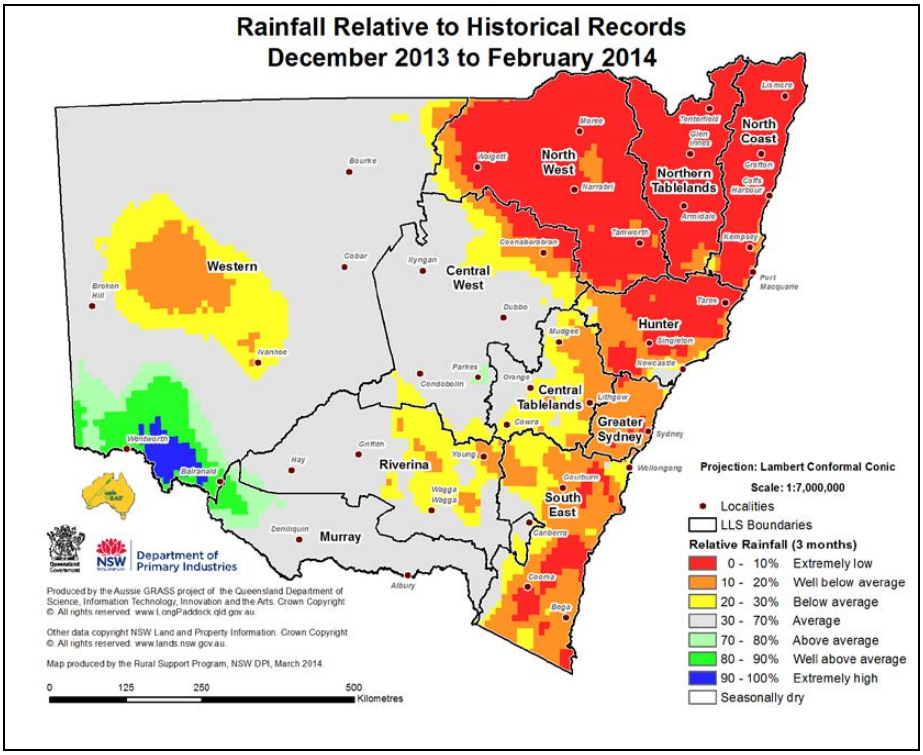


Figure 11: Relative rainfall – half yearly

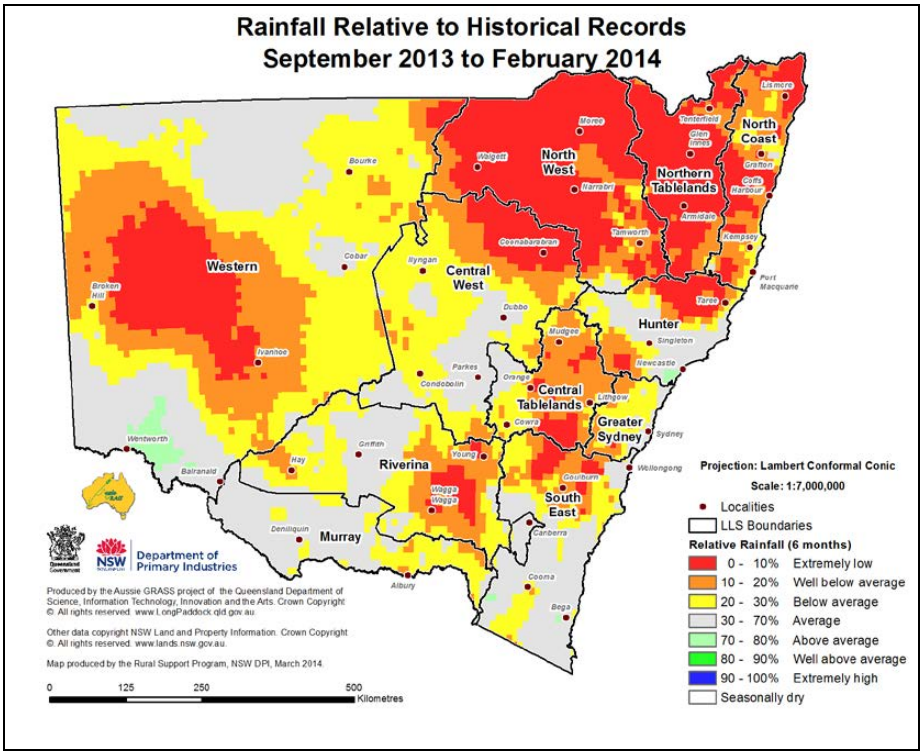


Figure 12: Relative rainfall – nine monthly

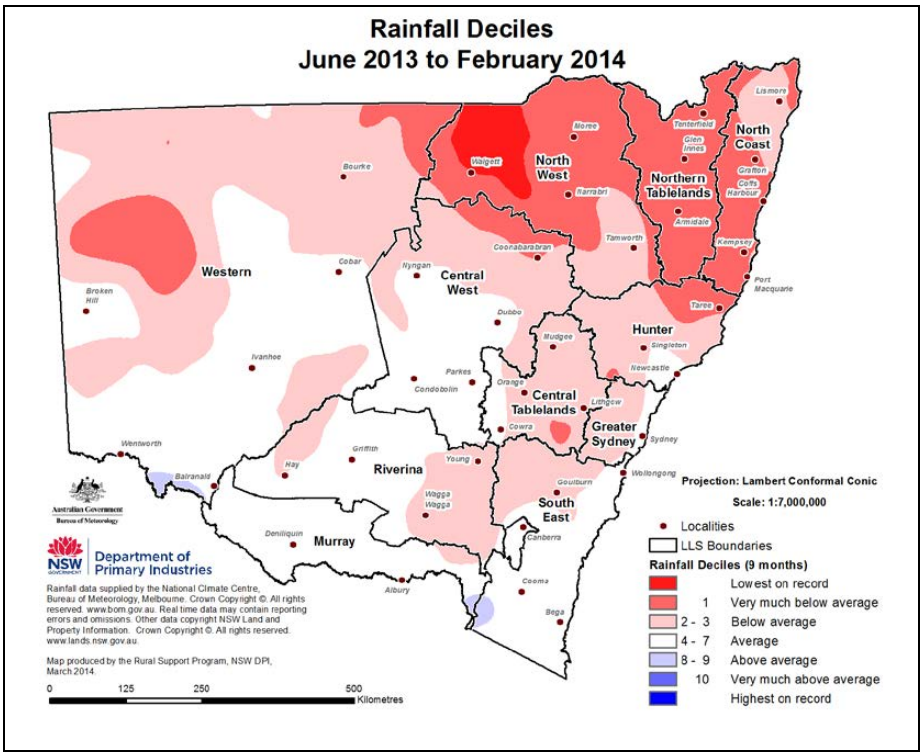


Figure 13: Relative rainfall – yearly

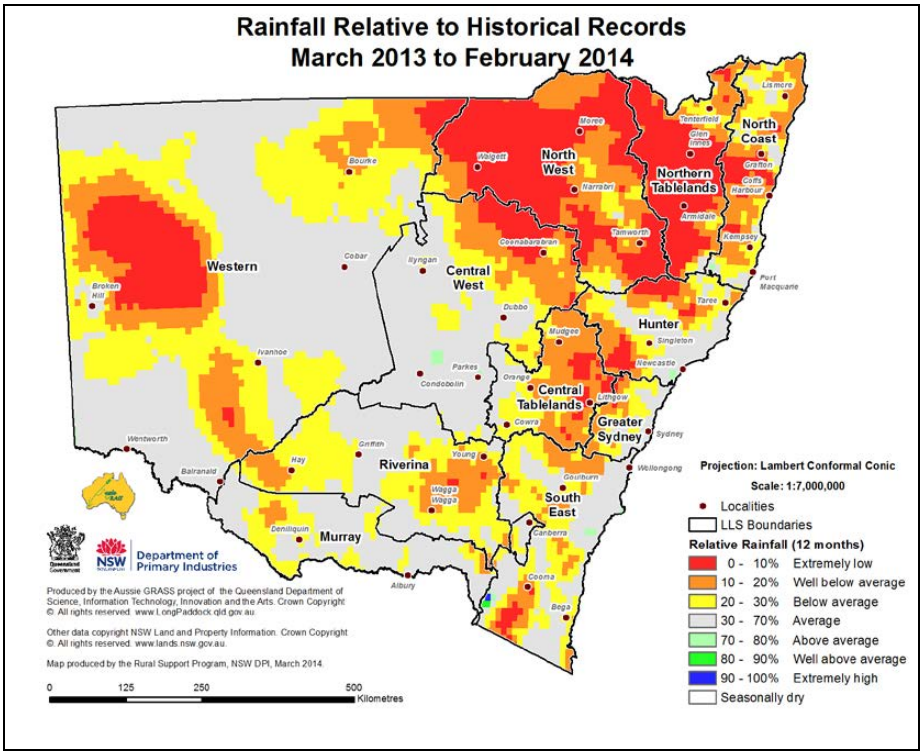


Figure 14: Total rainfall – monthly

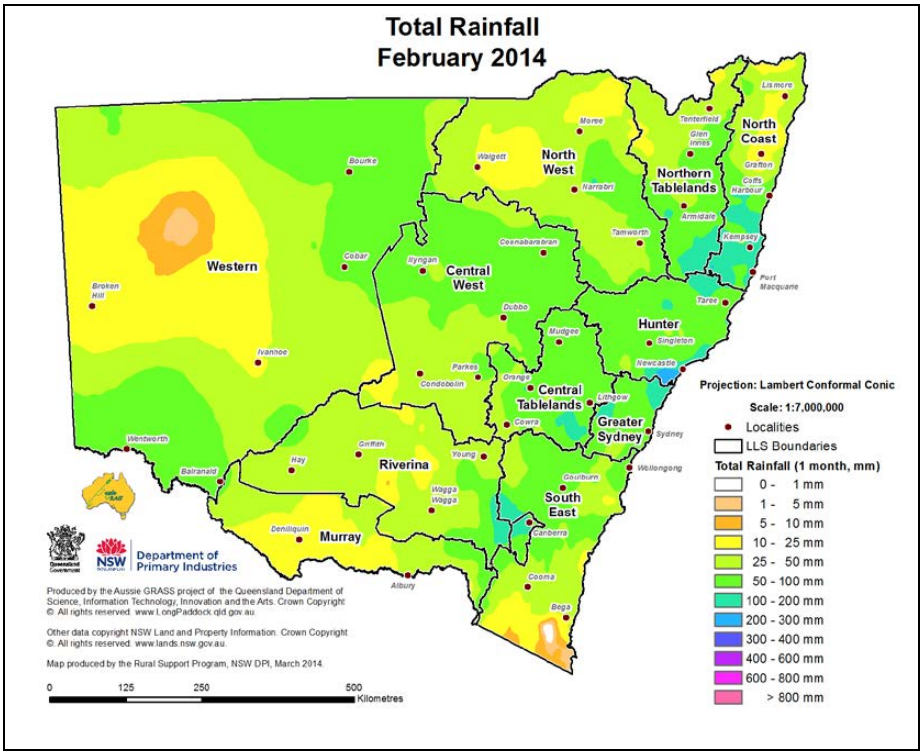


Figure 15: Total rainfall – quarterly

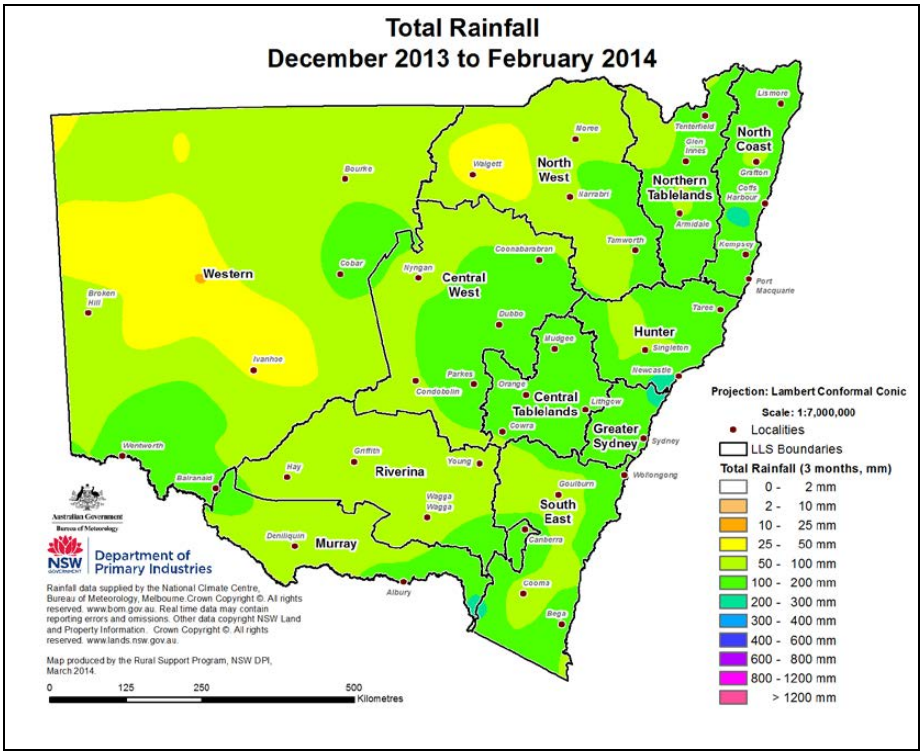


Figure 16: Total rainfall – half yearly

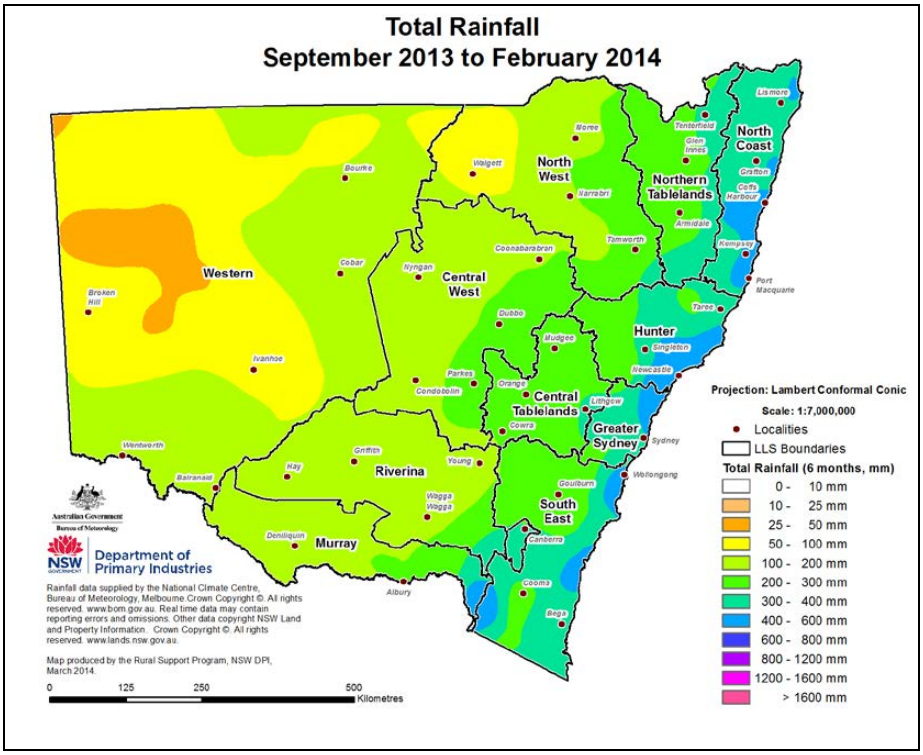
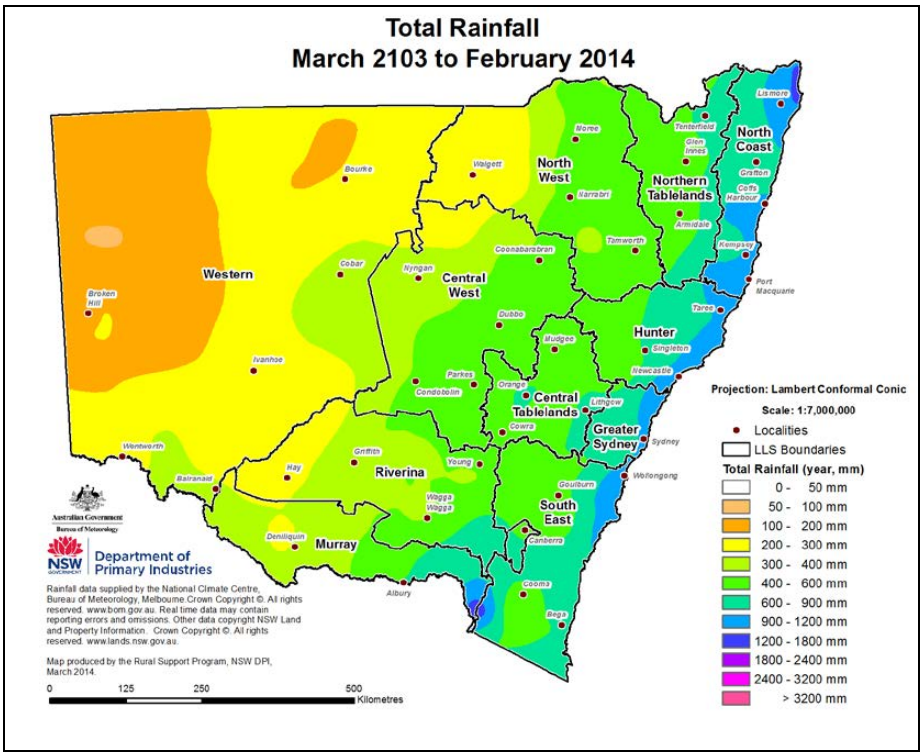


Figure 17: Total rainfall – yearly



Temperature

Figure 18: Maximum monthly temperature anomaly

Temperature data were not available at the time of publication

Figure 19: Minimum monthly temperature anomaly

Temperature data were not available at the time of publication

Soil moisture

Figure 20: Relative monthly topsoil moisture

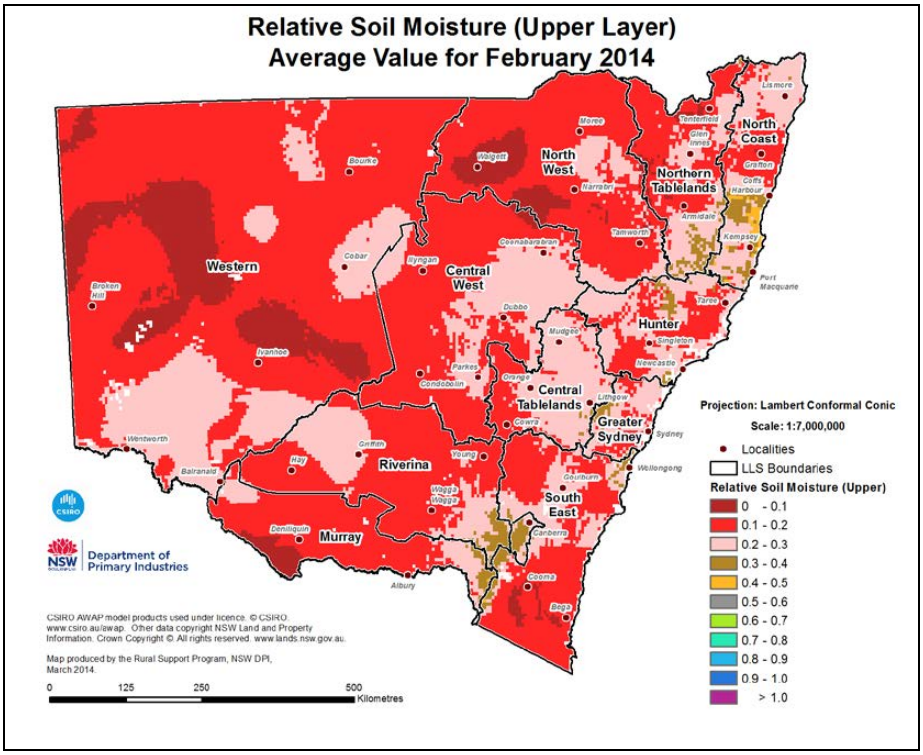


Figure 21: Relative monthly subsoil moisture

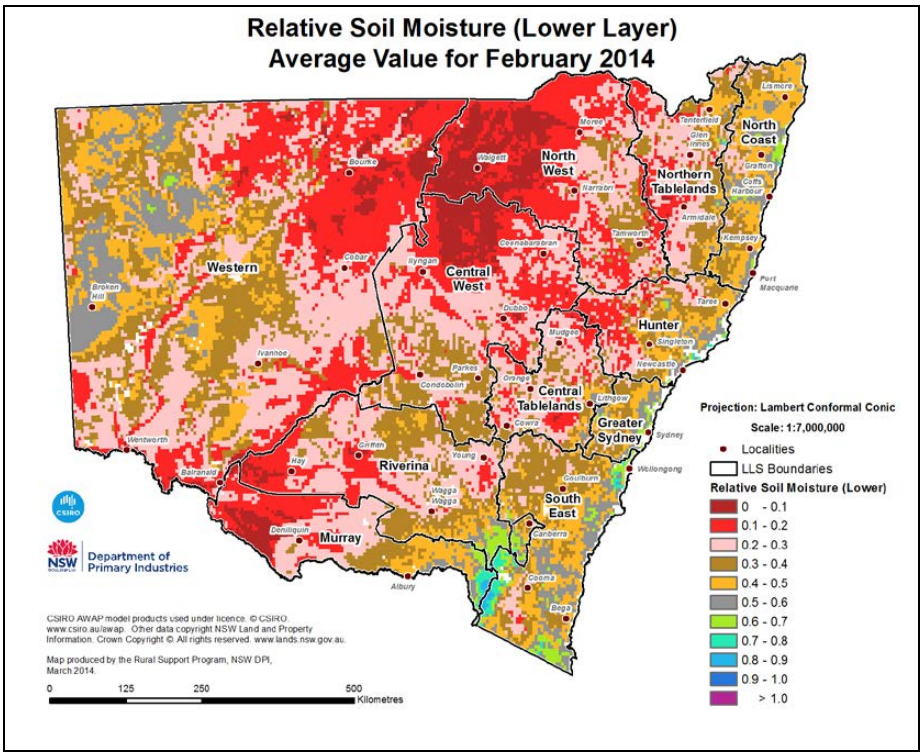


Figure 22: Relative weekly topsoil moisture to 16th February

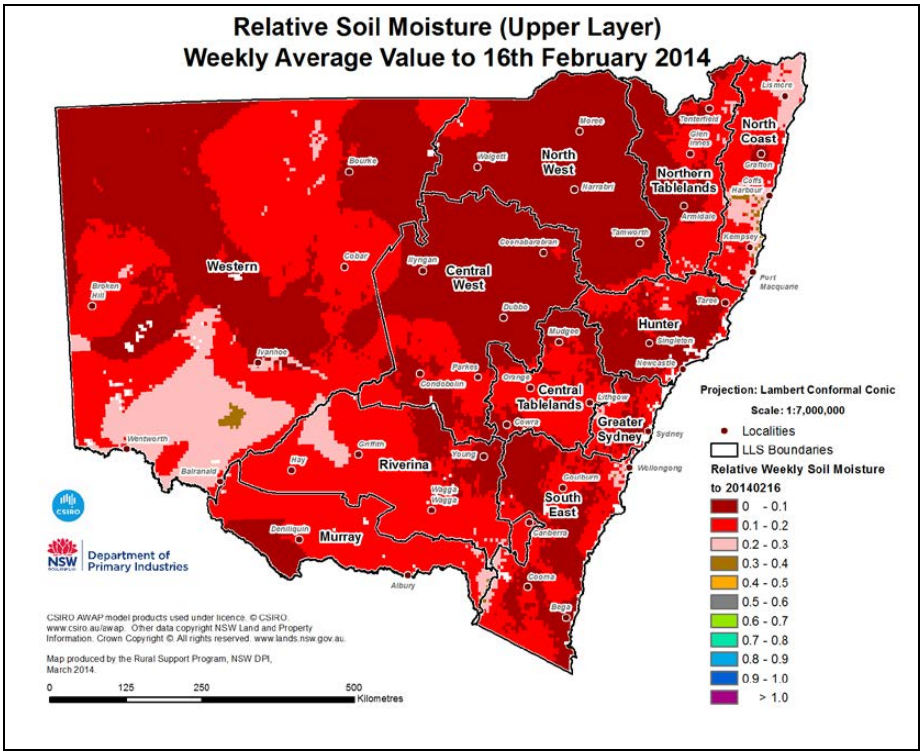
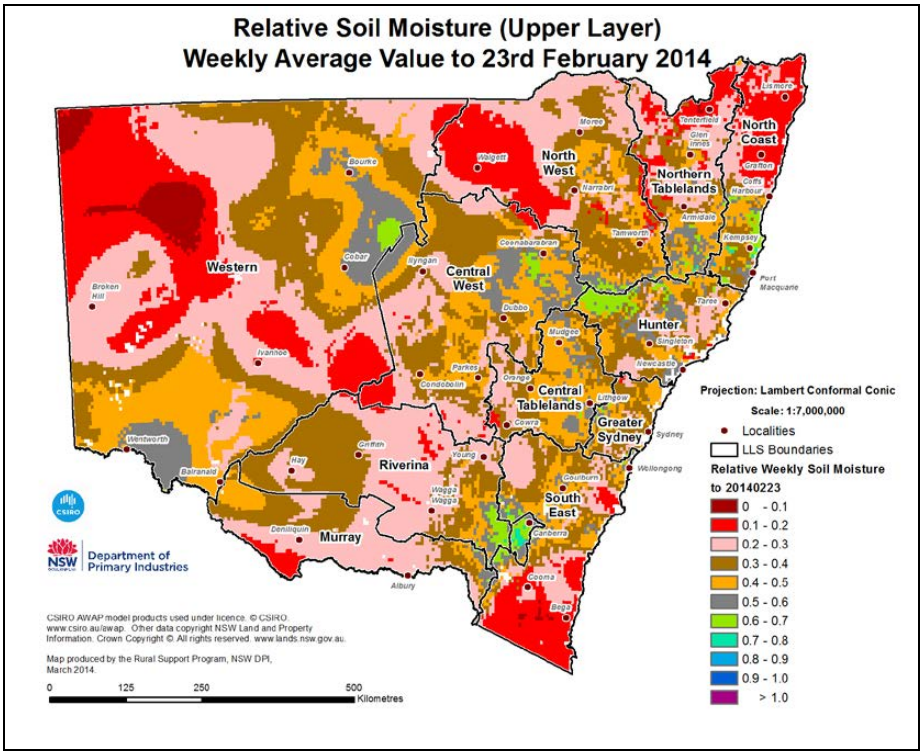


Figure 23: Relative weekly topsoil moisture to 23rd February



Pasture growth and biomass

Figure 24: Modelled pasture growth

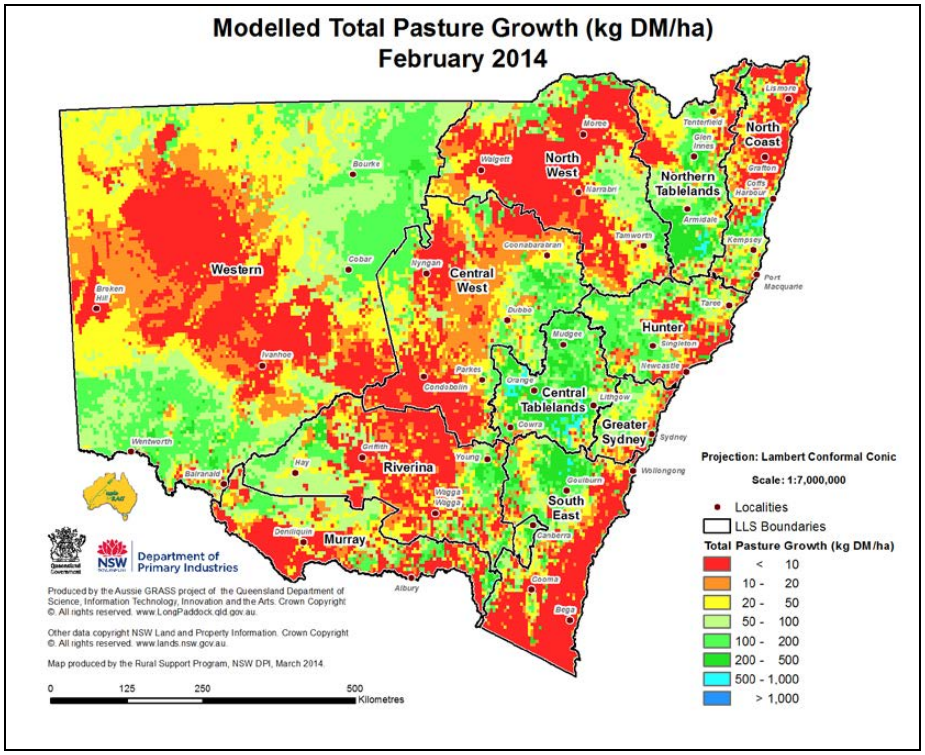


Figure 25: Modelled biomass

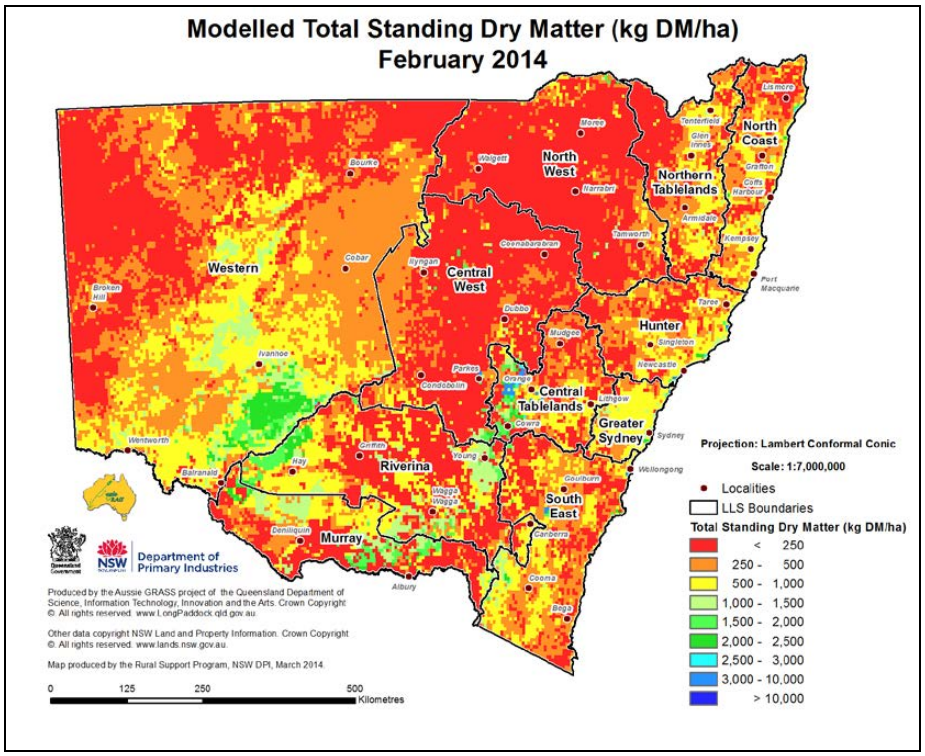


Figure 26: Relative pasture growth – monthly

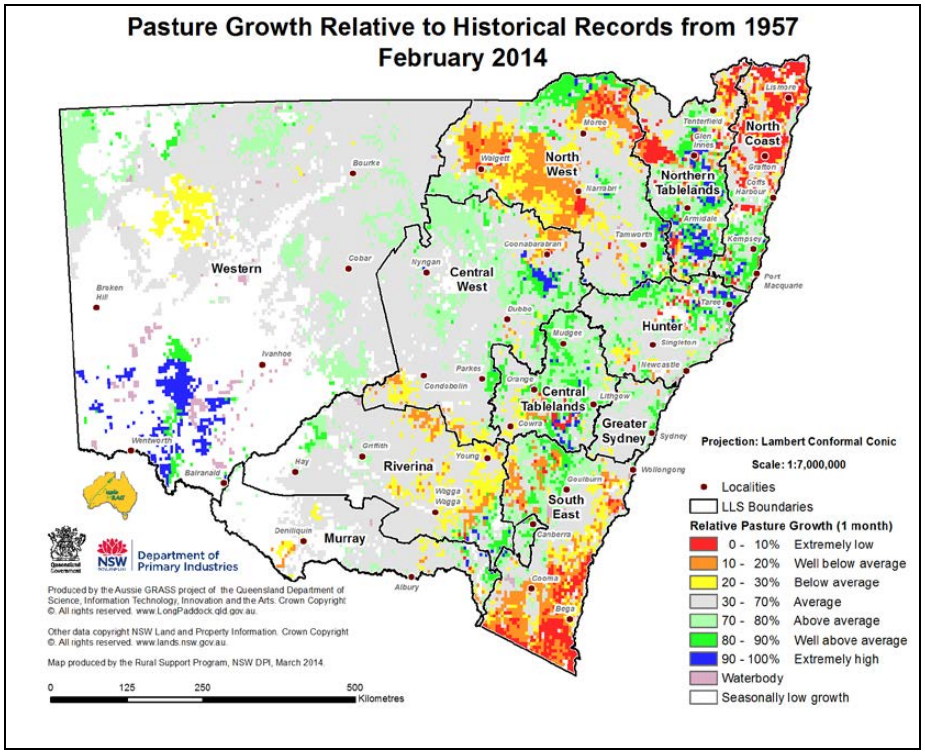


Figure 27: Relative pasture growth – quarterly

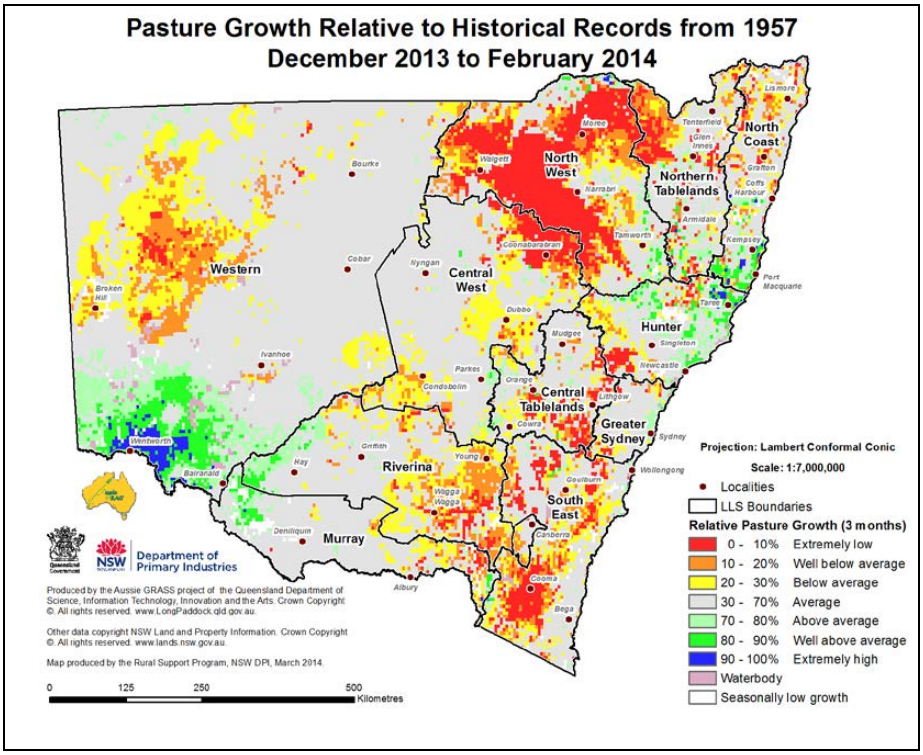


Figure 28: Relative pasture growth – half yearly

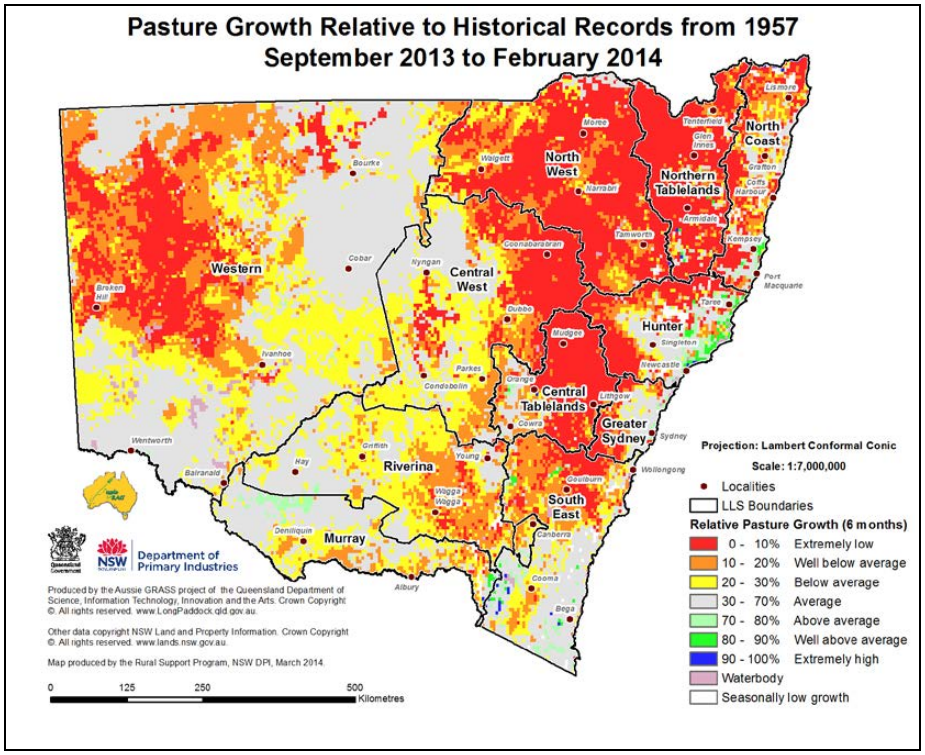


Figure 29: Relative pasture growth – yearly

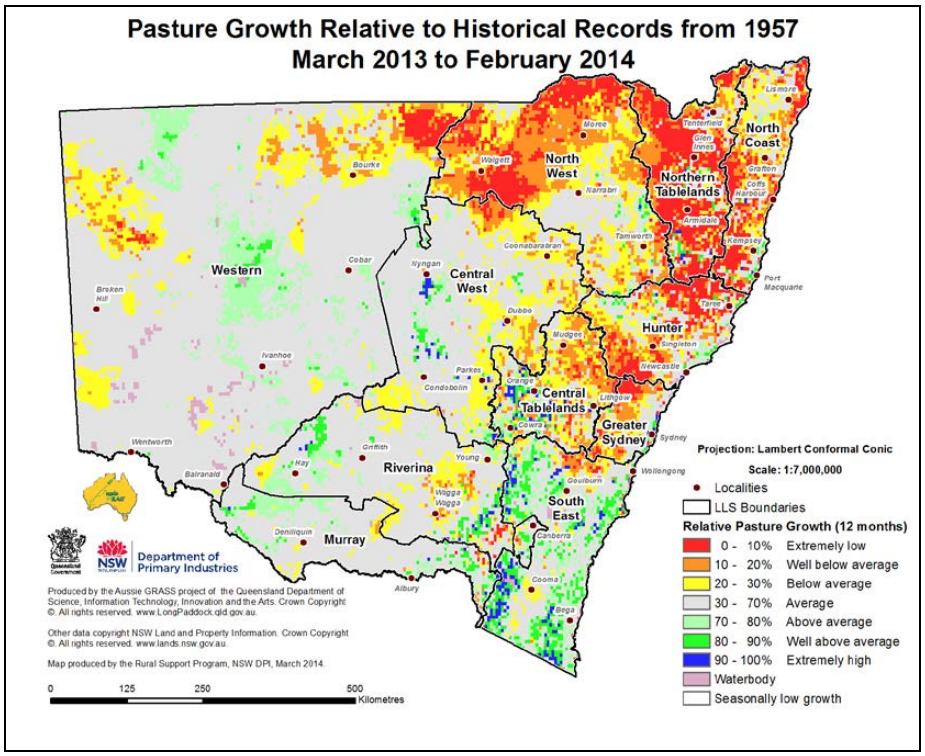


Figure 30: Relative biomass – monthly

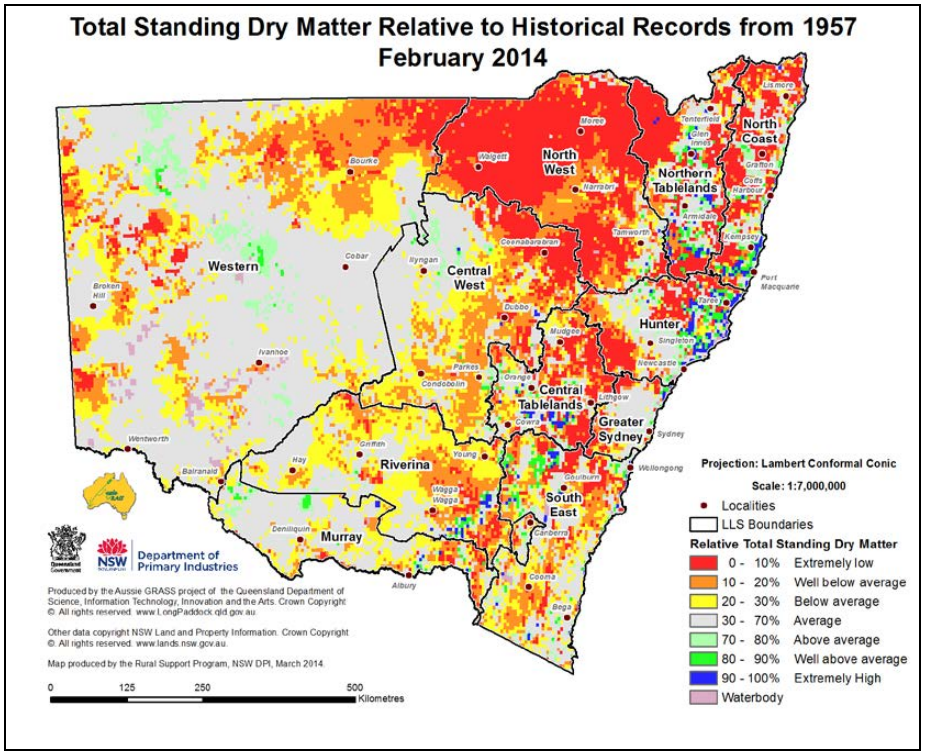
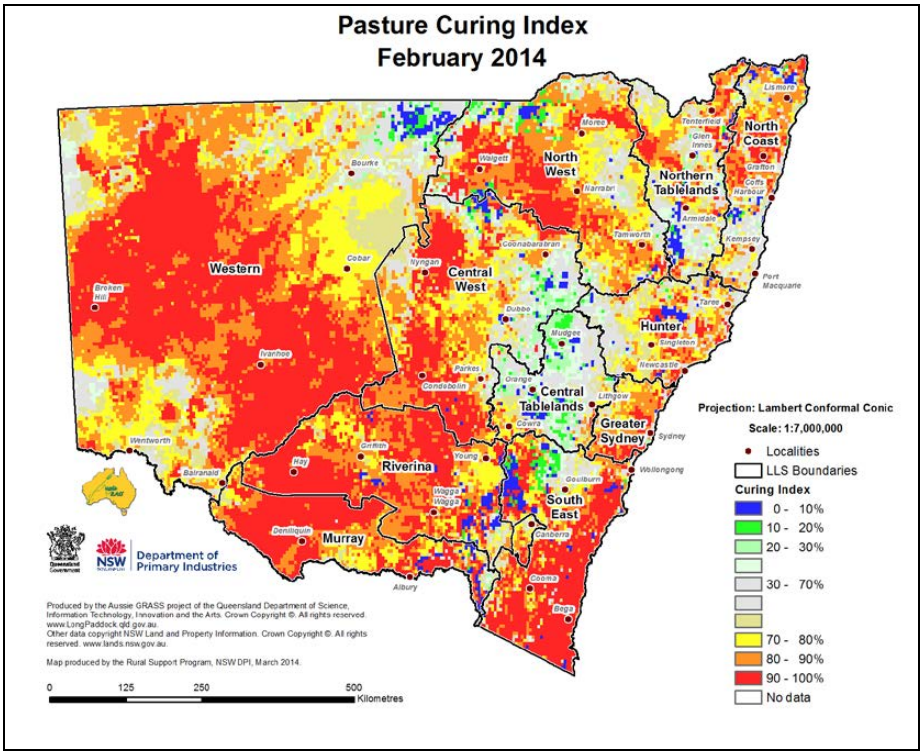


Figure 31: Pasture curing index



More information

For more information, contact the NSW Department of Primary Industries on 02 6391 3100 or Local Land Services on 1300 795 299.

A four-page simplified summary of the seasonal outlook and the current conditions is provided in the NSW Climate Summary, available at http://www.dpi.nsw.gov.au/agriculture/emergency/seasonal-conditions/summary.

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