Department of Primary Industries

NSW Seasonal Conditions Report - April 2014

Highlights

- Good rainfall in March improved conditions greatly with most of NSW receiving 50-200mm. However, some areas of the north west & far west received lighter falls.
- The chances of a drier or wetter April to June are nearly equal, with drier conditions likely in the north east. Warmer than normal temperatures are likely.
- Pasture growth was average or above over most of NSW, with improved species responding well to the conditions. Growth was limited in some areas of the north west & far south east. Over the last 6 months it was average or above over 50% of NSW, but low over north west, central & some eastern areas.
- Sowing of dual purpose crops continued, with grazing of early sown crops. The outlook for winter cereal crops has greatly improved, particularly in central & southern areas.
- Stock water supplies remain low in some areas due to insufficient run off.
- Resources to assist in management are available at http://www.dpi.nsw.gov.au/agriculture/emergency/drought/managing

1. Summary

Good rainfall occurred across much of NSW in March, with nearly 70% of NSW receiving above average rainfall. However, areas of the north west and far west received lighter, patchy falls.

Combined with mild-warm temperatures, the rainfall provided a much needed boost to pasture growth. Improved pastures responded well where sufficient rainfall was received. Sowings of dual purpose crops continued during the month. Early sown dual purpose crops responded well, with many now being grazed. Soil moisture levels over central and southern NSW are now sufficient for the sowing of winter cereal grain crops, but more rainfall will be needed, particularly in spring. More rainfall is still needed over much of the northern cropping area. Stock water supplies remain variable.

The outlook for April to June indicates the chances of a drier or wetter season are nearly equal across central NSW, with a slightly increased chance of drier conditions in the north. Drier than normal conditions are likely over the north east. April is likely to be wetter than normal, except in the north west. The chances of a drier or wetter May are near equal, except for drier conditions likely across a band running across the centre of NSW. Warmer daytime temperatures are likely over central and eastern NSW from April to June, and warmer than normal overnight temperatures across the State.

Overall, ENSO is still neutral, but there is an elevated risk of El Niño conditions developing. Sea surface temperatures are warming, and there is a more than 70% chance of them reaching El Niño levels in July. Other indicators are also showing increasing El Niño trends.

NSW received average or above average rainfall during March, with most of the State receiving rainfall of 50-200 mm. Daytime and overnight temperatures were above average.

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.

Stock water supplies remain low in many areas as limited run off occurred. Streamflow analysis over the last year indicates well below average or worse run off across most of the tablelands, Monaro, north coast and north west in particular.

Modelled pasture growth improved greatly across the tablelands, upper slopes, central west, central coast and areas of the north west. Relative to historical records, it was average or better over 74% of NSW and only below average in the far south east and areas of the north west. Biomass levels increased, particularly over the central tablelands and adjacent areas. Relative to historical records, biomass and quarterly growth were low over the north west and across the north and south coast but average or above average over more than 70% of NSW. Half yearly relative pasture growth was average or above over 50% of NSW, but low across the north west, central and much of eastern NSW.

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 31st March-9th April 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 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 late March and early April and were up to date as at 31st March - 9th April 2014.

2.1 Seasonal outlook summary

Table 1: Seasonal outlook summary

	Current Outlook	Previous Outlook
Rainfall (quarter)	Neutral (Drier – northern/north-eastern NSW)	Neutral (Possibly drier – northern NSW)
Max Temperature (quarter)	Warmer (Neutral – western NSW)	Neutral (Possibly warmer – coastal NSW)
Min Temperature (quarter)	Warmer	Warmer

Outlook Legend: Grey = Neutral, i.e. equal chance of drier/wetter or warmer/cooler.
Red = Drier or warmer.
Blue = Wetter or cooler.

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

2.2 Seasonal rainfall outlook (BoM)

- For the three month period from April to June, the chances of a wetter or drier than normal season are equal across the central areas of the State. There is a slightly reduced (40-45%) chance of exceeding median rainfall across north. However, in the north east corner of NSW drier than normal conditions are likely (with a probability of exceeding median rainfall of 35-40%). This includes areas of the North Coast, Northern Tablelands and North West LLS districts. Areas in the far west, far south west and between the central coast and upper south coast have a slightly higher probability of exceeding median rainfall of 55-60% (Figure 6).
- This means that for every ten years with similar climate patterns to those at present, across most of NSW five April to June periods would be expected to be wetter than normal and five drier than normal.
- In the north east, three to four April to June periods would be expected to be wetter than normal and six to seven drier than normal.

  The outlook accuracy (confidence or skill) is moderate to high across most of NSW, ranging from 55-75%, but low in the north and north west at less than 55% (Figure 9).

2.3 Seasonal temperature outlook

- Over the three month period from April to June, warmer than normal daytime temperatures are likely (60-75% probability) across most of the State. In the far west, the chances of exceeding the median maximum temperature are slightly above even at 50-55%. There is an increased probability (75% or more) of exceeding the long term median maximum temperature in the south east corner of NSW, and along the south, central and mid-north coastal strip (Figure 7).
- The outlook accuracy (confidence or skill) is moderate to high (55-75%) across most of NSW but low in a small area of the central west (Figure 9).
- This means that for every ten years with similar climate patterns to those at present, across most of NSW about six to seven April to June periods would be expected to have warmer than normal daytime temperatures, and three to four cooler than normal daytime temperatures.
- Warmer than normal overnight temperatures between April to June are likely across the whole of NSW. The probability of exceeding the long term median minimum temperature is more than 80% over most of NSW, decreasing slightly in the north to 70-80% (Figure 8).
- The outlook accuracy (confidence or skill) for the minimum temperature outlook is moderate (55-75%) across most of NSW, but is low to very low in the north eastern corner (Figure 9).

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.

April

- The experimental rainfall outlook for April (Figure 10) indicates that wetter than normal conditions are likely across most of NSW, except for the far north west, with a probability of above median rainfall of 60-70%. The south east, coastal areas and the tablelands have a higher probability of above median rainfall at 70-80%. The outlook has a moderate accuracy (skill) over most of the State, but low skill in the far west and south west.
- The experimental daytime temperature outlook for April (Figure 10) indicates cooler temperatures are likely across the northern, coastal and central areas of the State, particularly in the north east. There is a roughly equal probability for warmer or cooler than normal daytime temperatures across the west of NSW, with warmer conditions likely in the far north west. This outlook has a moderate accuracy (skill).
- The experimental overnight temperature outlook for April indicates that cooler than normal conditions are likely across the north eastern corner of NSW, and warmer than normal conditions in the western, central and southern areas of the State. There is a roughly equal probability for warmer or cooler than normal daytime temperatures across parts of the central tablelands, and the north west. However, this outlook has a low accuracy (skill).

April multi-week (as at 3rd April)

- Weekly experimental outlook information suggests that in the third and fourth week of April, wetter conditions are likely along the coast and tablelands, and in the south east and drier than normal conditions in the far west. There is a roughly equal probability for wetter or drier conditions in central NSW. The accuracy (skill) for this outlook is low.
- Daytime temperatures over the third and fourth week of April are likely to be cooler than normal over eastern and parts of central NSW, particularly in the north east and central-mid north coast. Conditions are likely to be warmer than normal in the far north west. For the rest of NSW, there is a roughly equal probability for warmer or cooler than normal conditions. This outlook has moderate accuracy (skill) over most of NSW, but accuracy is low along the coast.
- Overnight temperatures over the third and fourth week of April are likely to be warmer than normal over the western third of NSW, the south east and along the south to mid north coast. Conditions are likely to be cooler than normal in the north eastern corner of NSW. The central areas of NSW have a equal probability for warmer or cooler than normal overnight temperatures. The accuracy (skill) level for this outlook is low.

May

- The experimental outlook for May indicates a roughly equal probability for wetter or drier conditions across southern and north eastern NSW, with a 40-60% probability of above median rainfall. However, a there is a probability of drier than normal conditions (a 30-40% probability of exceeding median rainfall) in a band running across the centre of the State from east of west (Figure 11). The accuracy (skill) for this outlook is low.
- The experimental May outlook indicates that the chances of receiving warmer or cooler than normal daytime temperatures are roughly equal across most of the State (Figure 11). There is a possibility of cooler than normal conditions in the far south east. The skill for this outlook is moderate.
- There is a roughly equal probability for warmer or cooler overnight temperatures in May across NSW, although temperatures may be slightly warmer in the south east and along the coast (Figure 11). 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 and their relationship to rainfall and temperatures across Australia. These historical relationships and current observations are used to produce the outlook. The statistical model outlooks have been superseded by the outlooks

from the POAMA model, and the information is provided for comparative purposes only.

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 wetter than normal conditions are likely across most of NSW over the next three months (a 55-75% probability), with an increasing probability towards the north eastern corner of the State (70-75%). A nearly equal probability for wetter or drier rainfall conditions exists over the south west of NSW (50-60%).
- The statistical model indicates that overnight temperatures have an equal probability to be warmer or cooler over most of the State, but indicates that warmer than normal overnight temperatures are likely in the north east and cooler than normal in the south west.
- The statistical model indicates that a nearly equal probability for warmer or cooler than normal daytime temperatures across the State, with a slightly increased probability of cooler than normal daytime temperatures over the north, north east, Hunter valley and central 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 a roughly equal probability (40-60%) for wetter or drier conditions across most of NSW between April and June. Some areas in the north west and far west have a reduced probability of exceeding average rainfall (20-40%). The skill assessment for this outlook moderate for most of NSW, but low in the north west and far west. The model indicates above average temperatures are likely for the period across most of NSW. The skill for the temperature outlook is high for eastern and western NSW and moderate for the central areas.
- For May to July, the UK Meteorology Office's global long range probability modelled output indicates drier conditions are likely across central-north west and southern NSW. For the remainder of the State, there is an equal probability for wetter or drier conditions. The skill assessment for this outlook is low-moderate for most of the State. 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 a more than 80% probability across the coastal areas and parts of the northern tablelands. The temperature outlook has a moderate skill for most of the State, and a low skill in the west.

APEC Climate Centre

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

2.6 El Niño-Southern Oscillation (ENSO)

ENSO summary

- ENSO is currently neutral, but there is an increased risk of El Niño conditions developing in winter and spring.
- Indicators for the development of an El Niño event during the winter to spring period have continued to strengthen (see below). The SOI, sea sub surface temperatures, and trade wind and cloud conditions along the International Date Line are beginning to show El Niño-type trends.
- The Bureau of Meteorology's POAMA model's long range outlook indicates a 49% chance of sea surface temperatures in the NINO3.4 Pacific Ocean region reaching El Niño levels in June, increasing to 73% in July (Figure 1).
- All international climate models surveyed by the Bureau indicate that these levels will be exceeded by August.
- It should be noted, however, that ENSO forecasts at this time of year have low predictive skill. El Niño conditions do not

always develop even when the various indicators suggest they are possible.

Table 2: ENSO Summary

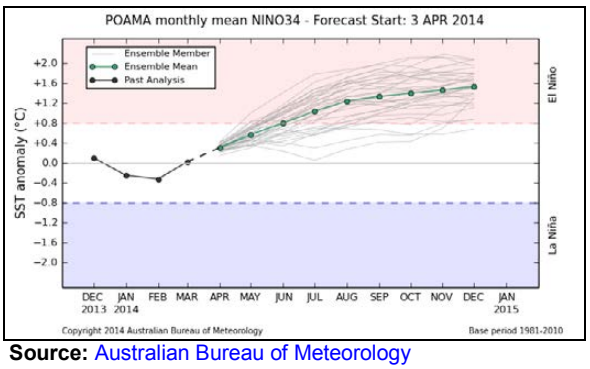
	Current Outlook (early April)	Previous Outlook (early March)
ENSO (overall)	Neutral – El Niño likely	Neutral
SOI	Neutral (negative trend)	Neutral
Pacific Ocean SST (NINO3.4)	Neutral (warming trend)	Neutral (warming trend - winter)
Indian Ocean (IOD)	Neutral	Neutral
Southern Annular Mode (SAM/AAO)	Weakly-moderately positive/neutral	Weakly positive/neutral

Summary Legend: Grey = Neutral, i.e. neither El Niño nor La Niña.
Red = El Niño range or trend.
Blue = La Niña range or trend.

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

- The CPC/IRI ENSO Alert System Status has remains on 'El Niño watch'. This indicates conditions are favourable for the development of an El Niño event within the next six months.
- The CPC/IRI consensus ENSO forecast of the NINO3.4 index (as at 10th April) indicates ENSO neutral conditions continuing through autumn, although with above average sea surface temperatures over much of the eastern tropical Pacific. Of the 24 climate prediction models surveyed by IRI, 64% indicate ENSO neutral conditions will continue over April to June (Table 3).
- However, during late autumn and winter 2014 most of the models in the CPC/IRI consensus ENSO forecast indicate a warming tendency, with 52% indicating El Niño conditions are probable between June to August (Table 3). There is, however, considerable uncertainty as to when El Niño conditions may develop and how strong they may become.
- The Bureau of Meteorology's POAMA model currently indicates ENSO neutral conditions continuing through autumn although with increasing warming, and subsequently approaching El Niño conditions in June/July (Figure 1).
- The POAMA outlook indicates a 49% probability of reaching El Niño thresholds in sea surface temperature anomalies over the NINO3.4 Pacific Ocean region in June, increasing to 73% in July, 82% in August and 91% in September (Figure 1).

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



Source: Australian Bureau of Meteorology

- El Niño conditions are often associated with below normal rainfall and above normal daytime temperatures across much of NSW in the second half of the year. However, this is not always the case, particularly if the Indian Ocean Dipole is negative at the same time.
- Note that 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. This will result in differences in when various meteorological organisations report that El Niño or La Niña conditions are developing.
- ENSO neutral conditions also 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

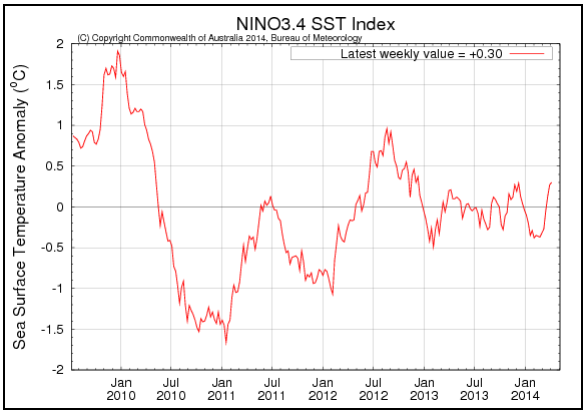
Season	La Niña	Neutral	El Niño
Mar-May	1%	79%	20%
Apr-June	1%	64%	35%
May-Jul	2%	53%	45%
Jun-Aug	2%	46%	52%
Jul-Sep	3%	41%	56%
Aug-Oct	3%	36%	61%
Sep-Nov	3%	34%	63%
Oct-Dec	4%	32%	64%
Nov-Jan	4%	30%	66%

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 warming has occurred across equatorial Pacific between February and March.
- Much of the equatorial Pacific is now average to warmer than average in temperature. Cooler anomalies in the eastern Pacific have weakened.
- The most recent monthly temperature index value in the NINO3.4 region is 0.0°C for March, an increase of 0.3°C since February.
- Weekly sea surface temperatures have increased, with above-average anomalies across most of the equatorial Pacific. The NINO3.4 region is now at +0.3°C (Figure 2), an increase of nearly 0.2°C since the week ending the 23rd March.
- Warm anomalies are present around most of the Australian coastline, but have declined in the north and north east, corresponding with the movement of warm water from this region to the east (Figure 1).

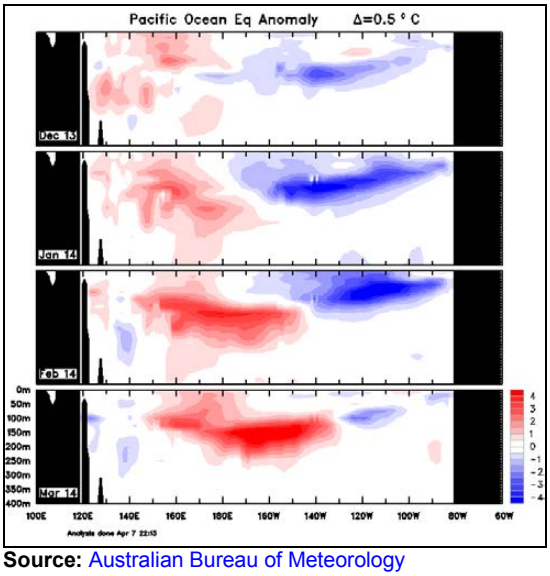
Figure 2: NINO3.4 Sea Surface Temperature Index



Source: Australian Bureau of Meteorology

- The sub surface sea temperatures in the Pacific show the development of a strong warm anomaly in the western Pacific over the last few months, strengthening and moving eastwards into the central Pacific. It has warmed and reduced the area and intensity of the cooler than average water in the eastern equatorial Pacific (Figure 3). A small area of weak cool anomalies still remains in the eastern Pacific.
- This warm anomaly is very strong, and its temperatures have reached up to 6°C above normal, above the scale in Figure 3.
- This event is known as an equatorial downwelling Kelvin wave, and is associated with weakening of the easterly trade winds and strengthening of westerly winds. If it results in the warming of the sea surface in the eastern Pacific, it can lead to a greater risk of El Niño conditions. IRI reports that it increased the oceanic heat content to the largest March value in the historical record (since 1979).

Figure 3: Monthly sea sub-surface temperatures



Source: Australian Bureau of Meteorology

Southern oscillation index (SOI)

- The Southern Oscillation Index fell during January to March, but has now stabilised somewhat.
- The SOI decreased from a peak of +14.5 in early February to a low of -13.7 in mid-late March, and the Bureau of Meteorology is reporting the current 30-day value to be -9.3 as at 7th April. (Table 4).

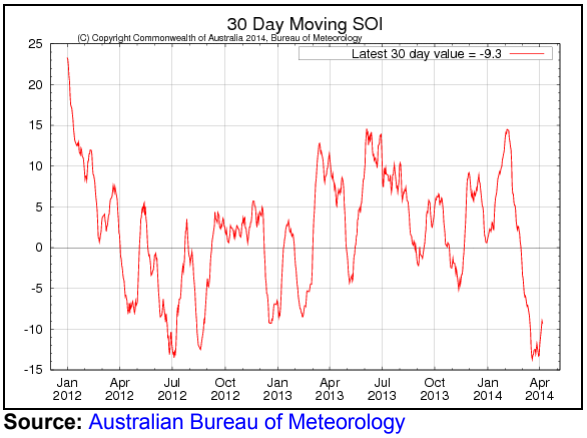
Table 4: Values of the Southern Oscillation Index

	Current monthly value (7-8th April)	Previous monthly value (4th March)
SOI (30 day)	-9.3	-3.8

Source: Australian Bureau of Meteorology.

- The late March SOI level was the lowest 30-day value since March 2010, during the last El Niño event.
- However, the SOI will need to remain below -7 to -8 for a few months to indicate that atmospheric pressure and sea temperatures are reinforcing each other.

Figure 4: 30 day moving SOI



Source: Australian Bureau of Meteorology

- The Southern Oscillation Index is one factor indicating the development and intensity of El Niño and La Niña events in the Pacific Ocean. It is calculated from variations in surface atmospheric pressure between Darwin and Tahiti. 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.

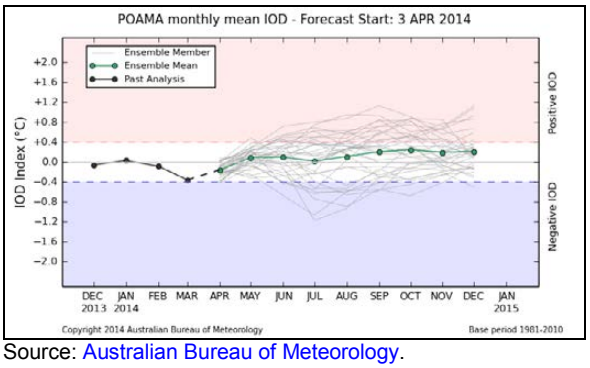
Sub-tropical ridge (STR)

- The sub-tropical ridge remained near the southern edge of the continent during the 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 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 to around 30°S, 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 6th April is -0.47°C, increasing slightly from the previous weekly value of -0.58°C (to the 30th March).
- Although the current value is below that for a negative IOD event, such events rarely develop until May, and the values would need to remain below -0.4°C for some time. So far, it has remained at this level for 3 weeks.
- 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, although the chances for a positive IOD event will increase if an El Niño event occurs (Figure 5). The IOD is consistent with El Niño or La Niña conditions in the Pacific about 70% of the time.

Figure 5: Current Bureau of Meteorology POAMA Indian Ocean Dipole Forecast



Source: Australian Bureau of Meteorology.

- The IOD has little effect on Australian climate until late autumn or winter. An IOD event usually starts between May and June, peaks in August to October and rapidly decays afterwards.
- A negative IOD period (a sustained IOD index value of -0.4°C or less) is caused by warmer than normal water in the tropical eastern Indian Ocean and cooler than normal water in the tropical western Indian Ocean. A negative IOD period 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 negative IOD can also contribute to below-average mean sea level pressure over Darwin, which may cause an increase in the SOI.
- A positive IOD period (a sustained IOD index value of +0.4°C or more) is the result of cooler than normal water in the tropical eastern Indian Ocean and warmer than normal water in the tropical western Indian Ocean. Positive IOD periods have been associated with a decrease in rainfall during winter and spring across southern, western and central NSW.

Trade winds and Pacific cloud conditions

- Trade winds are now near normal, after a series of strong westerly wind bursts during the last few months.
- Easterly trade winds strengthen across the tropical Pacific during La Niña events and weaken or reverse during El Niño events. Weakening of the trade winds allows warmer than normal water to move into the central and eastern tropical Pacific Ocean.

- Weakening of the trade winds over the last few months has allowed a strong warm anomaly in the sea sub surface of the western tropical Pacific to move eastwards into the central Pacific (an equatorial Kelvin wave - Figure 3). If it results in the warming of the sea surface in the eastern Pacific, it can lead to a greater risk of El Niño conditions.
- Cloud conditions at the equator near the International Date Line have been above average since late February, and recently decreased slightly.
- 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 is currently weakly positive.
- As at 6th April, the SAM index from POAMA was close to +1.0, and as at 8th April the AAO index from NOAA was just above +1.0.
- The outlook from POAMA indicates the SAM index is likely remain weakly positive through to mid-late April, decreasing to near neutral late in the month, with the NOAA forecast suggesting it will increase to be moderately positive in mid April then decrease to be weakly positive 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 March was above normal across most of the State, particularly along the central to the north coast and areas of the central west. High atmospheric pressure can be linked to drier than normal conditions.
- Cloud conditions over NSW were above normal over the last month, particularly over the tablelands, slopes and the south east.

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 1890 (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 5: Rainfall relative to historical records – percentage area of NSW in each class

Period	Missing data	Below Average (0-30%)	Average (31-70%)	Above Average (71-100%)
Month	5%	0%	26%	69%
Quarter	0%	11%	65%	24%
Half year	0%	41%	57%	2%
Year	0%	48%	51%	1%

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

March

- Relative to historical records, rainfall for March was average or above over 95% of NSW. Rainfall was above average across 69% of NSW (Figure 12, Table 5), covering most of central and south eastern NSW, and much of northern NSW.
- Some areas of the central and mid north coast received close to average relative rainfall (30-70% of normal), as did areas of north western, western and south western NSW.
- An area of extremely high relative rainfall extended from the southern and central

areas of the North West LLS, though the Hunter and Central Tablelands LLS districts and into the Central West LLS district (Figure 12). In these areas, rainfall was 50-100 mm above normal for the month (based on records from 1961-1990).

- Above average rainfall extended across 95-100% of the Central Tablelands, Central West and South East LLS districts, and more than 84% of the North West and Northern Tablelands LLS districts.

January to March (3 months)

- Over the period from January to March, relative rainfall was average or above over nearly 90% the State (Figure 13, Table 5).
- Below average rainfall occurred over areas of the North Coast, Northern Tablelands and Hunter LLS districts, as well as between Walgett, Lightning Ridge and Goodooga in North West and Western LLS districts. It alos occurred in the far south of the South East LLS district. In these areas, rainfall was less than 60% of normal (based on records from 1961-1990).
- Over areas of the Northern Tablelands and North Coast LLS districts between Glen Innes, Armidale and Grafton, relative rainfall over the period was in the lowest 10% of records.
- Above average or better relative rainfall over the period was confined primarily to the Central West LLS (except in the north and north east corner), and areas in the far south west and north of the Western LLS district (from Wentworth to Pooncarie, and from Cobar and Bourke to Wanaaring).

October to March (6 months)

- Over the six months to March, relative rainfall was below average or worse across 41% of NSW (Figure 14, Table 5). Much of the north, north east and the west of the State received less than 80% of normal rainfall (based on records from 1961-1990).
- A large proportion of this area received rainfall in the lowest 20% of years. An area extending from Coonabarabran to Walgett, Collarenebri, Lightning Ridge and Goodooga received relative rainfall for the six months in the lowest 10% of years. The same was the case for an area to the south east of Moree, between Armidale, Glen Innes, Grafton and Coffs Harbour, and an area between Byron Bay and Tweed Heads.
- Some 57% of the State had average (31-70%) relative rainfall for the period.
- Isolated areas in the far south west of NSW near Wentworth and in the central west around Parkes received above average rainfall.

July to March (9 months, BoM)

- Over the 9 month period from July to March, relative rainfall across the State was below average across the North West, Northern Tablelands and North Coast LLS districts, and across the majority of the Central Tablelands, Hunter Greater Sydney and Western LLS districts (Figure 15). Most of these areas received between 40-80% of their normal rainfall, with some areas receiving less.
- Areas near Fowler's Gap, Packsaddle and Lightning Ridge had the lowest rainfall on record for the period.
- Areas of very much below average relative rainfall occurred in the far north west between Coonabarabran, Pilliga, Walgett, Collarenebri and Goodooga. Other areas were in the far west to the north and north east of Broken Hill, around Oberon, and near Gloucester and Taree. Most of the Northern Tablelands LLS district and the southern and central areas of the North Coast LLS district also had very much below average rainfall for the period, in the lowest 10% of years.
- Much of the central and southern areas of the State had average rainfall for the period.

April to March (12 months)

- Over the twelve months to March, below average relative rainfall extended across most of the North West, Northern Tablelands Central West, Central Tablelands and North Coast LLS districts, as well as areas of Western LLS district (Figure 16, Table 5), and covering 61% of NSW.
- Areas of Western, North West, Northern Tablelands, North Coast, Central West and Hunter LLS districts received extremely low rainfall over the period, that is, rainfall in the lowest 10% of years.
- Some 51% of the State, including most of the south east, southern, central and western 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.

March

- Overall, NSW received an average of 78 mm for the month, in comparison to the historical average of 49 mm.
- Most of the rainfall was due to a number of surface troughs and thunderstorms, particularly early and late in the month.
- Rainfall during March was generally between 40-400% of average (based on records between 1961-1990) across NSW. Some 69% of the State had above average rainfall (Table 5).
- Total rainfall over the State ranged from about 5-400 mm, with isolated areas in the Illawarra and far north coast receiving between 400-600 mm. The majority of the State received between 50-200 mm (Figure 17). The far west, western Riverina and some areas of the north west (to the north and north west of Walgett) received less than 25 mm and between 20-60% of their normal March rainfall.
- Rainfall was above average across most of the central and eastern areas of the State, and in a band across the north east of the Western LLS district. Many areas received heavy, localised storms.
- Much of the drought-affected area in the north west received above average rainfall of 50-200 mm or more. However, the area from Walgett to the north and north west towards Lightning Ridge and Goodooga received only 10-25 mm or less. Rainfall over some of these areas was patchy.
- The far west and south of the Western LLS district (west of White Cliffs, Ivanhoe and Balranald) received falls of 5-25 mm. The lightest falls were in the Pooncarie and Packsaddle areas, where rainfall was less than 40% of average (calculated between 1961-1990).
- Most of the coast received 100-200 mm, with areas of the south, mid north and far north coast receiving more. Isolated areas such as between Murwillumbah, Tyalgum, Kyogle, Nimbin, and Mullumbimby and also between Jervis Bay, Nowra, Kiama, Robertson, Albion Park and Kangaroo Valley received over 300 mm, with some receiving rainfall of over 400 mm.

January to March (3 months)

- Total rainfall over the three months to March ranged from 50-300 mm over most of the State, with some areas receiving as little as 25-50 mm or less, and others 300-400 mm or more (Figure 18).
- The area between Walgett, Lightning Ridge and Goodooga in north western NSW received 50-100 mm over the period. Some areas to the north and east of Broken Hill received less than 50 mm.
- Most of the central and western areas of the State received 50-200 mm. The east of Central West LLS district, much of the Central Tablelands, Northern Tablelands, North Coast, Hunter and Greater Sydney and the east of South East LLS districts, and eastern areas of the North West LLS district received 200-300 mm.

October to March (6 months)

- Rainfall across the State during the October to March period ranged from 25-800 mm (Figure 19), 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 and Lightning Ridge, and in the far west extending from Ivanhoe and Broken Hill to the west and north west. An area within this zone to the west of Packsaddle received only 25-50 mm.
- The plains received 100-300 mm and central areas of the State, including the slopes and much of the tablelands, received 200-400 mm during the period.
- The coastal LLS districts generally received 300-600 mm. Some areas of the coast received up to 800 mm.

4. Temperature anomalies

Temperature information is sourced from the Bureau of Meteorology.

The data used to create the temperature anomaly maps in Figure 21 and Figure 22 are slightly different from that used to create the anomaly maps on the Bureau of Meteorology website. The comments below reflect the website maps, which are more accurate, rather than those included in this report. The maps in Figure 21 and Figure 22 are provided for a general assessment only.

- Maximum temperatures across the State in March averaged 0.2°C above normal, with most of the State having maximum temperatures within 1°C of normal.

- Daytime temperatures were affected by the surface troughs and extensive rainfall, particularly early and late in the month.
- An area spanning much of the tablelands and the central west had maximum temperature anomalies of down to -1°C above below normal. In areas of the far west, maximum temperatures averaged 1-2°C above normal.
- Most of the coastal areas had near normal maximum temperatures.
- Minimum temperatures during the month averaged 1°C above normal across the State, making it the warmest March (in minimum temperatures) since 2007.
- Generally, the western and central areas of the State had minimum temperatures of between 0-1°C above normal and the south east of the State from 0-2°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).

- Unfortunately, AWAP soil moisture data were not available at the time of production of this report.

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 March, modelled pasture growth continued to improve as a result of the widespread rainfall and warm temperatures.
- Across much of the tablelands, upper slopes, and parts of the north west and central coast, growth improved to between 100-500 kg/ha dry matter (DM) from levels of 50-100 kg/ha over February.
- Areas of Western LLS between Cobar, Ivanhoe, Nymagee and Euabalong improved from less than 50 kg/ha DM in March to generally between 50-500 kg/ha DM.
- However, large parts of the far western area, centred on Broken Hill, had growth of less than 10-50 kg/ha DM.
- Other areas to show this level of growth included the Lightning Ridge to Goodooga area in North West and Western LLS districts, and the western areas of the Riverina and Murray LLS districts (Figure 27).
- While growth improved across the South East and Hunter LLS districts, areas of the coastal strip still showed poor growth. Growth improved over the North Coast LLS district, but patches of low-moderate pasture growth still remain.
- The central areas of the North West LLS district also had low growth of 10-50 kg/ha DM, even though it improved over last month.
- The greatest improvements in modelled growth occurred in the Central Tablelands LLS district and adjacent areas, where growth was estimated at 500 kg/ha to more than 1,000 kg/ha DM.
- Anecdotal information suggests that the best responses occurred in improved pastures, with native pastures not responding as dramatically.

6.2 Modelled biomass

- Modelled total standing dry matter (biomass) levels improved over March, particularly across the Central Tablelands LLS district and adjacent areas in the upper Hunter, the north east of Riverina and the east of Central West LLS districts (Figure 28). Improvements also occurred in the east and north east of the Western LLS district.
- Modelled biomass levels declined since February across the coastal areas of the South East LLS district, and remained relatively stable or slightly decreased in the coastal areas of the Hunter LLS district and across the North Coast LLS district (Figure 28). Declines also occurred in the Riverina and Central Tablelands LLS districts.
- Elsewhere, modelled biomass levels remained relatively stable.

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 and biomass 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
Growth					
Month	22%	3%	22%	52%	1%
Quarter	1%	17%	49%	32%	1%
Half Year	1%	49%	43%	6%	1%
Year	0%	31%	57%	11%	1%
Biomass					
Month	0%	29%	48%	22%	1%

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

March

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 to historical records, pasture growth improved during March, with many areas that were average in February moving to above average or better. Many areas that were below average in February also improved to an average level in March (Figure 29).
- Relative growth remained poor in the area between Lightning Ridge and Goodooga in the North West and Western LLS districts, and between Moree and Boggabilla in the North West LLS district. Other areas of poor relative pasture growth occurred across the south/far south coast and parts of the Monaro in the South East LLS district.
- Improvements in growth from average to above average or better occurred over much of the eastern third of the State, extending through the Northern Tablelands, Central Tablelands, Greater Sydney and Hunter LLS districts. Other areas extended across the southern tablelands region of the South East LLS district, the southern areas of North Coast, the east of Riverina, Murray and the North West LLS districts and across almost all of the Central West LLS district.
- The February and March rainfall also contributed to a major improvement in growth in Western LLS district, extending from Wanaaring and Enngonia to the south east to Bourke, Brewarrina, Cobar and Euabalong.
- Anecdotal information suggests that the best responses occurred in improved pastures, with native pastures not responding as dramatically.
- Only 3% of the State was below average in relative growth for the month, with 22% being average and 52% above average (Table 6).
- Areas of missing data accounted for 22% of the area of NSW, primarily across the west of the State. Missing data covered 44% of the Western LLS district, 26% of Murray and 9% of Riverina, Hunter and North Coast LLS districts.

January to March (3 months)

- Over the three months to March, relative pasture growth was average or better across 82% of NSW (Table 6).
- However, 17% ranked as having below average growth, and areas of the South East and North Coast LLS district decreased in relative growth from the previous three month period (Figure 30).
- Although conditions generally improved since the last period, approximately 44% of the North West LLS district had below average relative growth for the period (down from 69%), along with 46% of North Coast and 40% of South East LLS districts.
- Above average relative growth for the period was particularly high across the southern and central tablelands, and some adjacent area of the slopes.
- Above average relative growth occurred across the far south west, the far north and east of Western LLS district, and extended across areas of the Central West, and Central Tablelands LLS districts.
- Additional areas also occurred in the upper reaches of the Hunter LLS district, and the south and central areas of the Northern Tablelands LLS district, the south of the North Coast and the north west of the South East LLS district.

October to March (6 months)

- Over the six month period from October to March, relative pasture growth was average or above over 50% of the State (Table 6), an

improvement from 33% over the previous half yearly period.

- However, large areas of below relative average growth still occurred across most of the North West LLS district (87%), with a significant proportion being in the extremely low category.
- Below average relative growth also occurred across the central and southern areas and the far west of the State, as well as across the north east (Figure 30). This was particularly the case in the Northern Tablelands, South East and Riverina LLS districts, with below average growth across 67-68% of the districts. Murray, Central West, Central Tablelands and North Coast LLS districts ranged from 42-60% of their area in the below average category, followed by Western LLS district with 32%.
- Areas of extremely low relative growth occurred across in the North West LLS, as well as the central area of Western, the eastern area of Riverina and Northern Tablelands and the north of South East LLS districts.
- Above average relative growth was limited over the period. The largest area extended along the coast from Sydney to Kempsey, and into the Hunter valley.

March to February (12 months)

- Relative pasture growth over the last 12 months was average or above across 68% of the State (Figure 32).
- The best relative growth extended across the central and southern tablelands, and the central-eastern areas of Western LLS district, and made up 11% of the State.
- Below average relative growth extended across the north west and the north eastern corner of NSW, covering the majority of the North West, Northern Tablelands and North Coast LLS districts. Areas of Hunter and Greater Sydney LLS districts also showed below average growth.
- Relative growth across most of the central, southern and south eastern areas of NSW was generally average (57% of the State), with pockets of above and below average growth.

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 improved dramatically over those for January and February. This was particularly across the central areas of the State, the tablelands and the Hunter valley, and across part of the north east of the Western LLS district.
- Biomass levels increased dramatically across the Central Tablelands, Northern Tablelands and much of the Central West LLS districts, areas of Western LLS district and the tablelands areas of the South East LLS district (Figure 33), reflecting the good rainfall across these areas.
- Below average relative biomass made up 29% of NSW in March (Table 6), extending primarily across the central and western areas of the North West LLS district, the north east of the Western LLS district, areas of the North Coast LLS district and the coastal and Monaro areas of the South East LLS district.
- Patches of below average biomass also occurred in the Riverina and Murray LLS districts, covering approximately 35-40% of these districts.
- Better areas of relative biomass (above average or higher) made up 22% of the area of the State, an increase of 16%.

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 2nd April 2014.

- Levels in water storages are low-moderate, with the average capacity being 47%.
- Changes in storage levels were generally small, with the exception of the Brogo (+24%) and Hume (-9%) Dams.
- Minor changes occurred across most other storages.

Table 7: Capacity of storages

Storage	Current Volume (GL)	Effective Capacity (%)	Monthly Change (%)
Toonumbar	-	-	-
Glenbawn	688	92	0
Glennies	252	89	0
Lostock	-	-	-
Brogo	9	101	24
Cochrane	-	-	-
Dartmouth	3444	89	-1
Hume	1105	36	-9
Blowering	805	48	-6
Burrinjuck	471	46	2
Brewster	-	-	-
Carcoar	10	27	-3
Cargelligo	36	100	0
Wyangala	533	44	0
Glenlyon	-	-	-
Pindari	53	17	1
Copeton	469	34	0
Chaffey	27	42	-3
Keepit	80	18	1
Split Rock	84	21	1
Burrendong	216	16	1
Oberon	30	67	-1
Windamere	184	50	0
Lake Cawndilla	146	11	-4
Lake Menindee	24	0	0
Lake Pamamaroo	157	54	-7
Wetherell	60	29	-2
Total	**8883**		
Average		**47**	

8.2 Irrigation allocations

Allocations are given as at 2nd April 2014.

- High security and general security allocations remained the same as last month.

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 6: Quarterly rainfall outlook

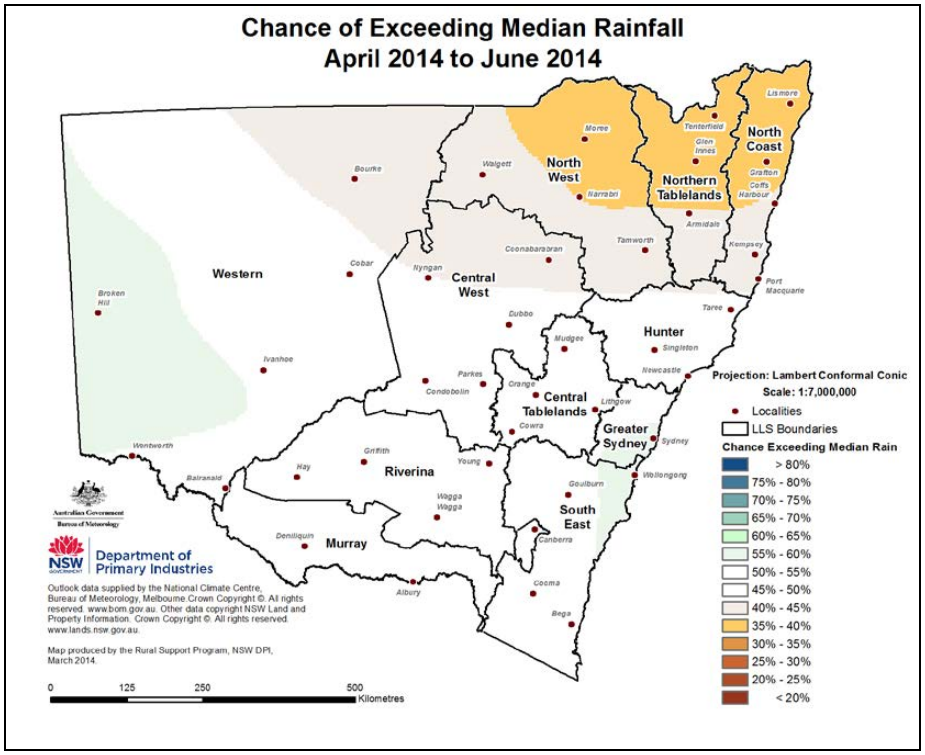


Figure 7: Quarterly maximum temperature outlook

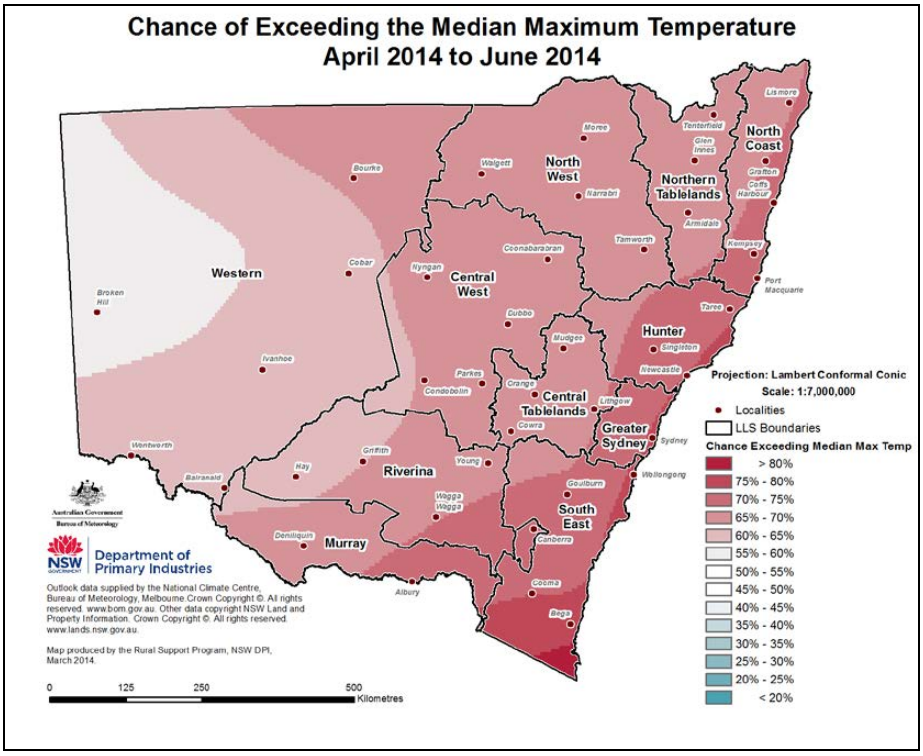


Figure 8: Quarterly minimum temperature outlook

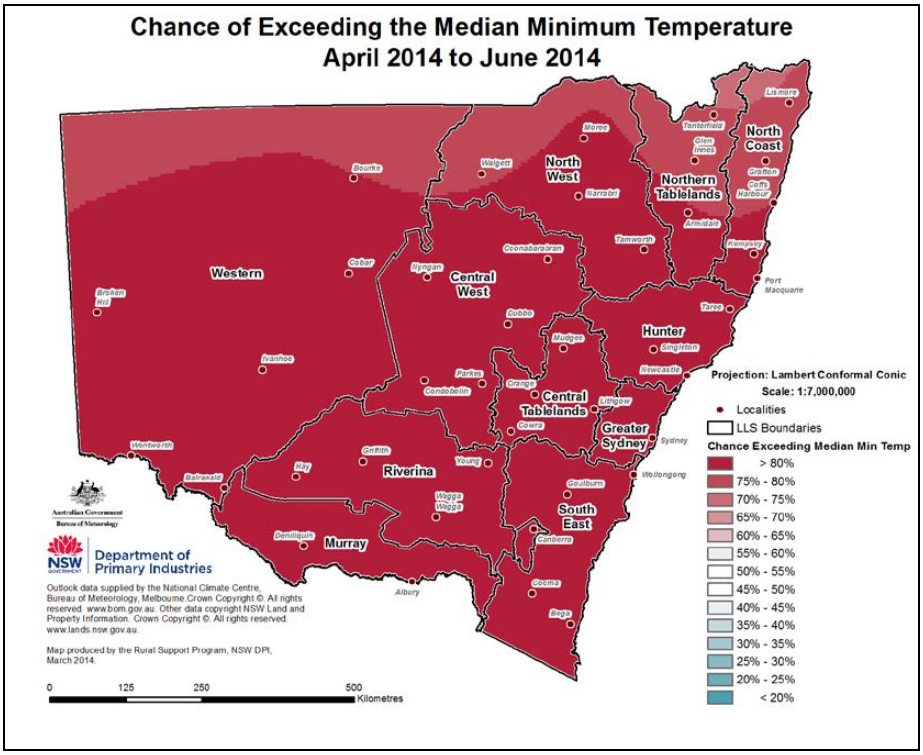
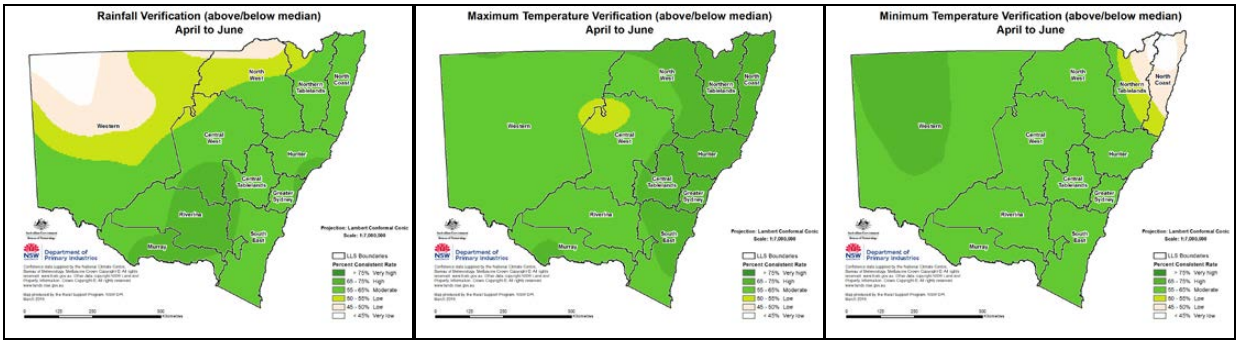


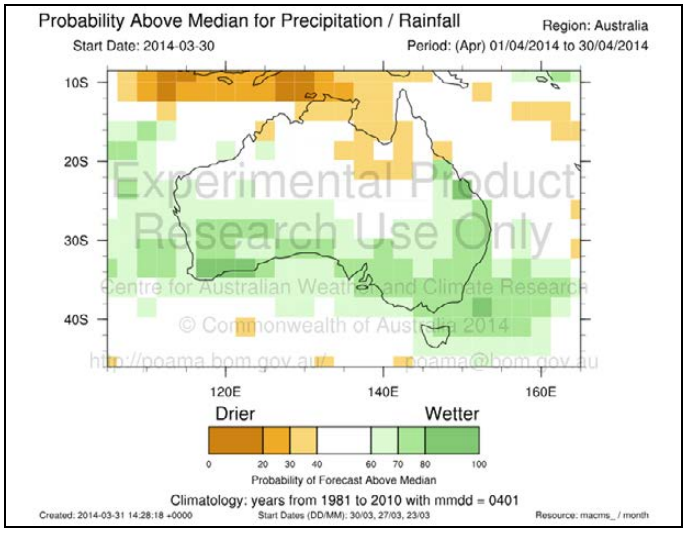
Figure 9: Outlook skill maps

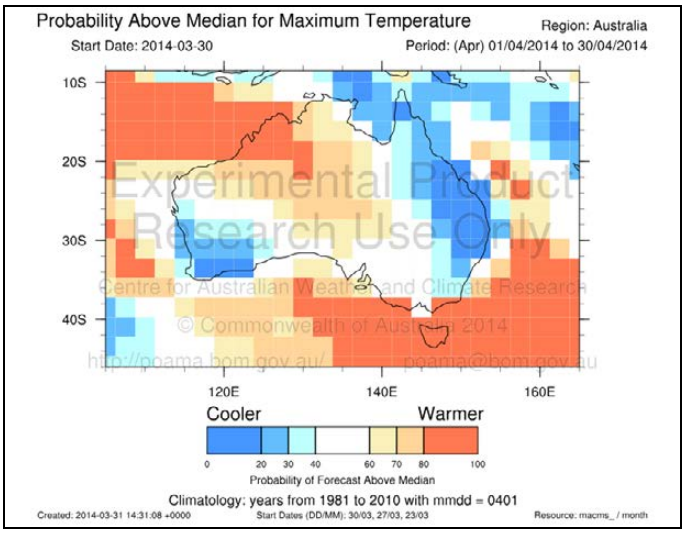


Monthly rainfall & temperature outlook

(Bureau of Meteorology, POAMA - experimental)

Figure 10: Experimental April rainfall and temperature outlooks





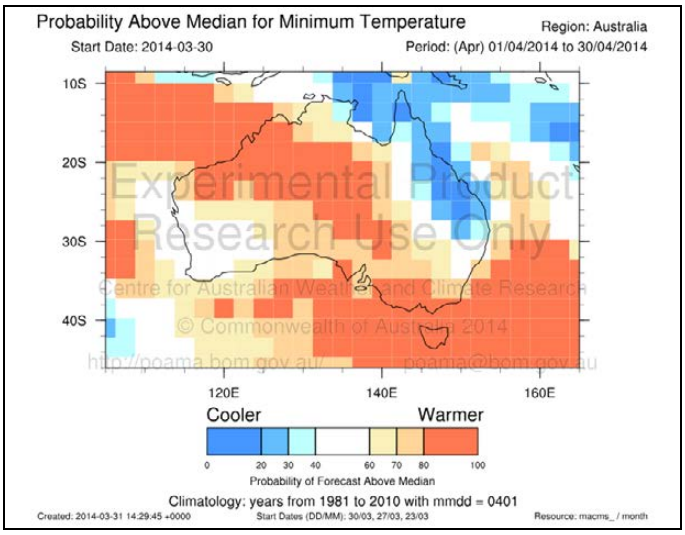
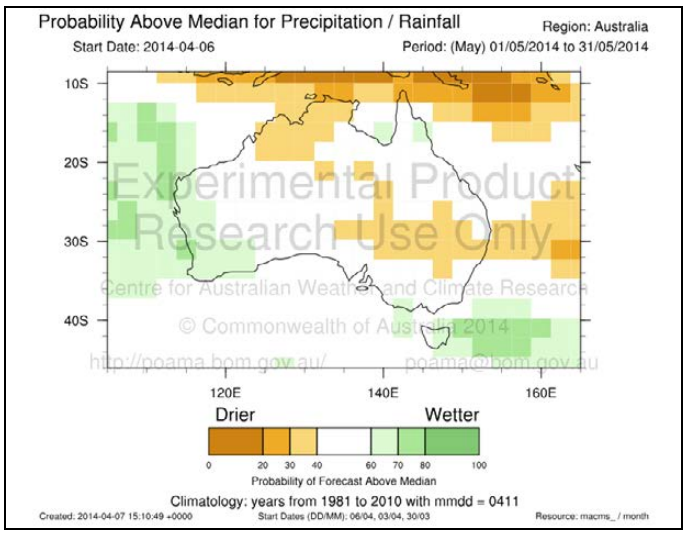
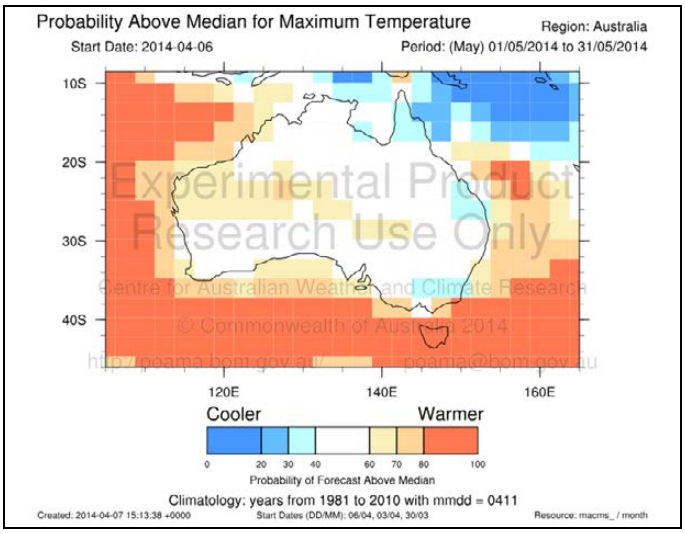
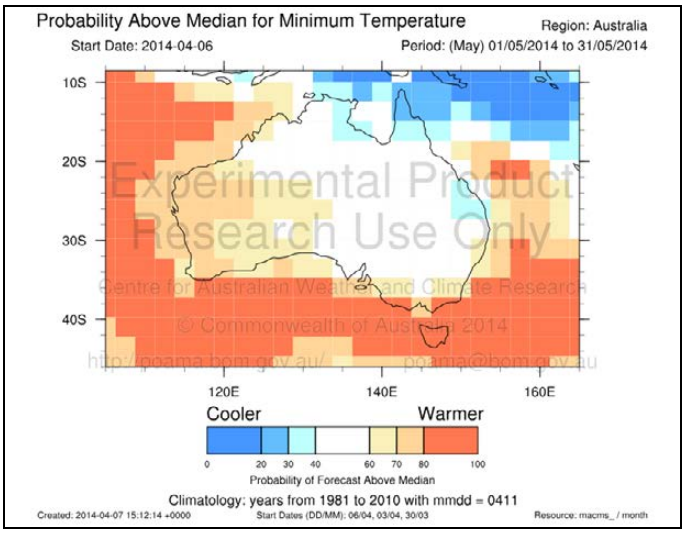


Figure 11: Experimental May rainfall and temperature outlooks







Rainfall

Figure 12: Relative rainfall – monthly

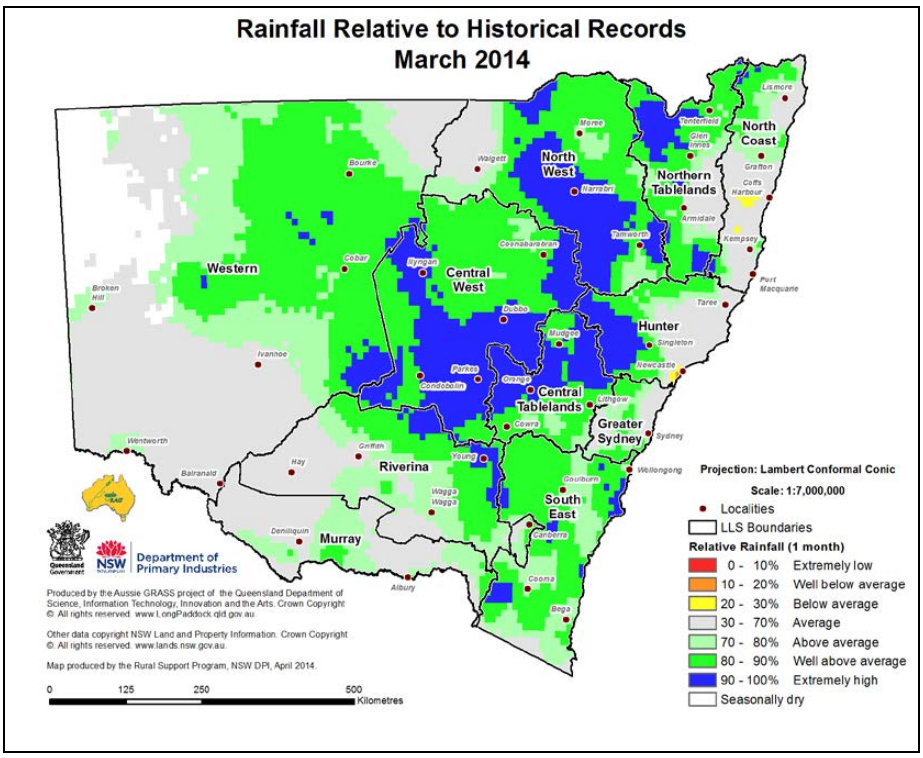


Figure 13: Relative rainfall – quarterly

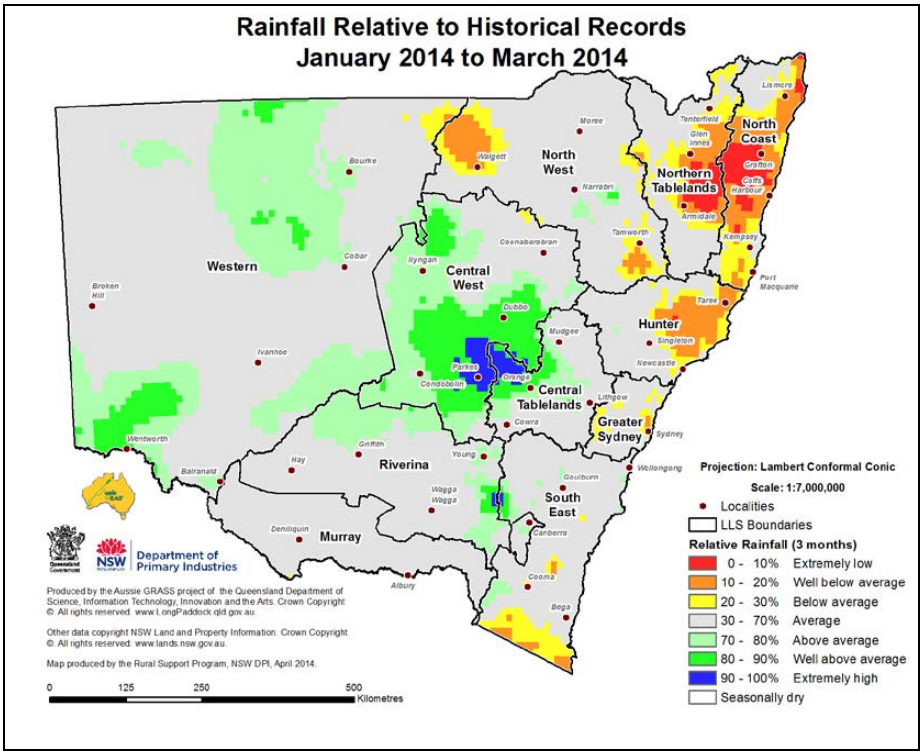


Figure 14: Relative rainfall – half yearly

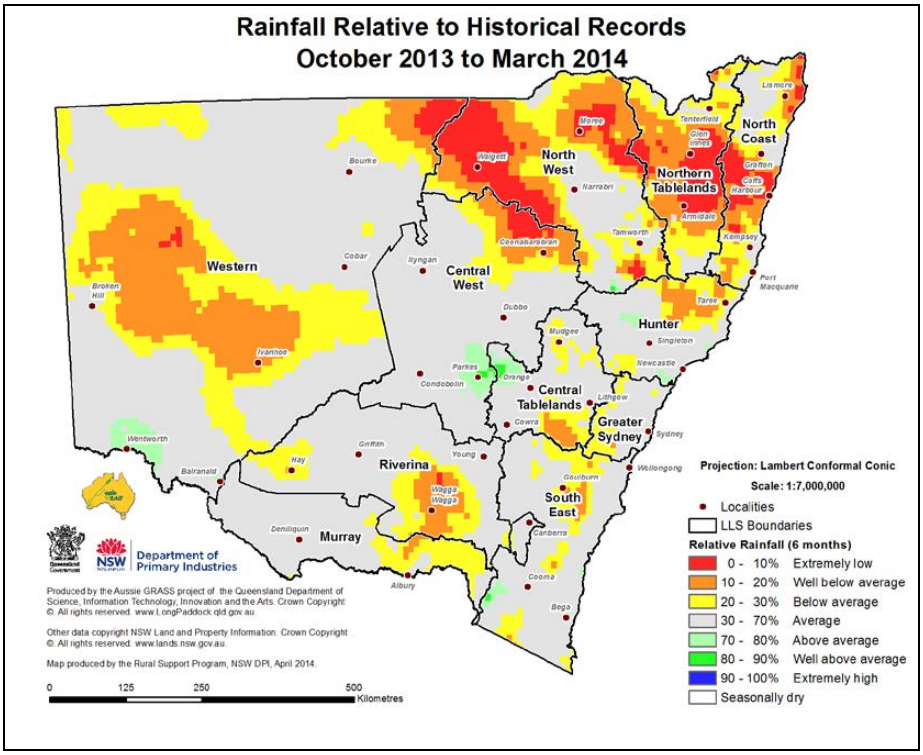


Figure 15: Relative rainfall – nine monthly

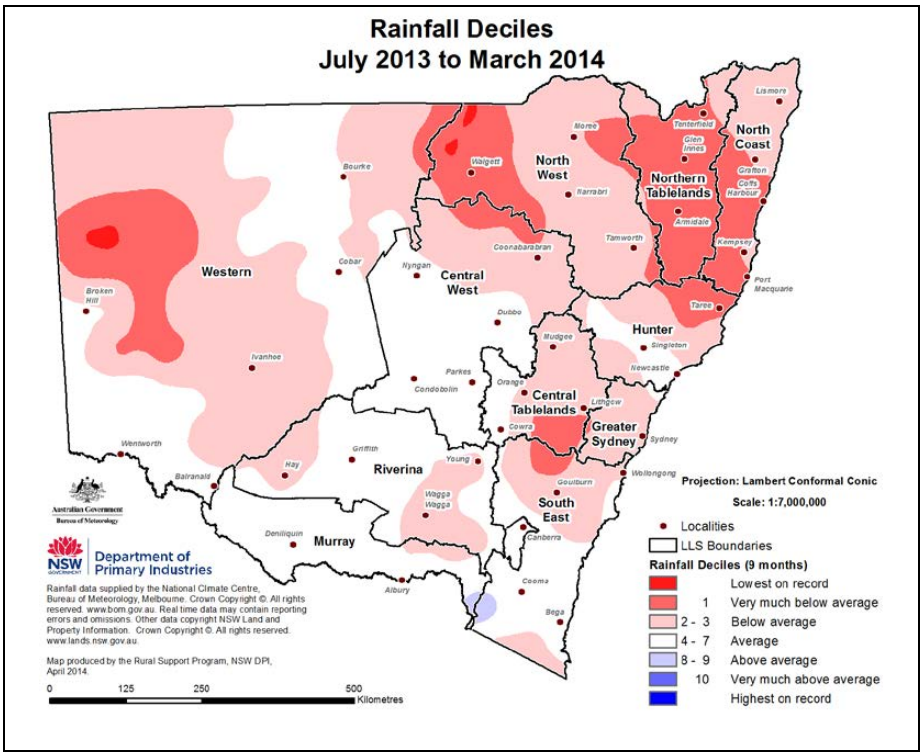


Figure 16: Relative rainfall – yearly

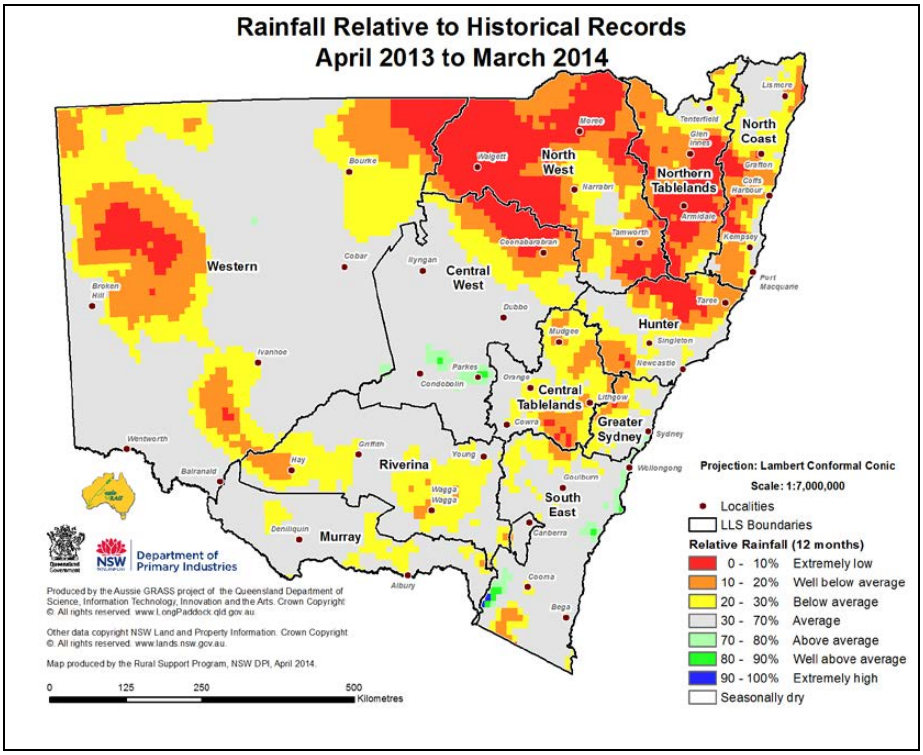


Figure 17: Total rainfall – monthly

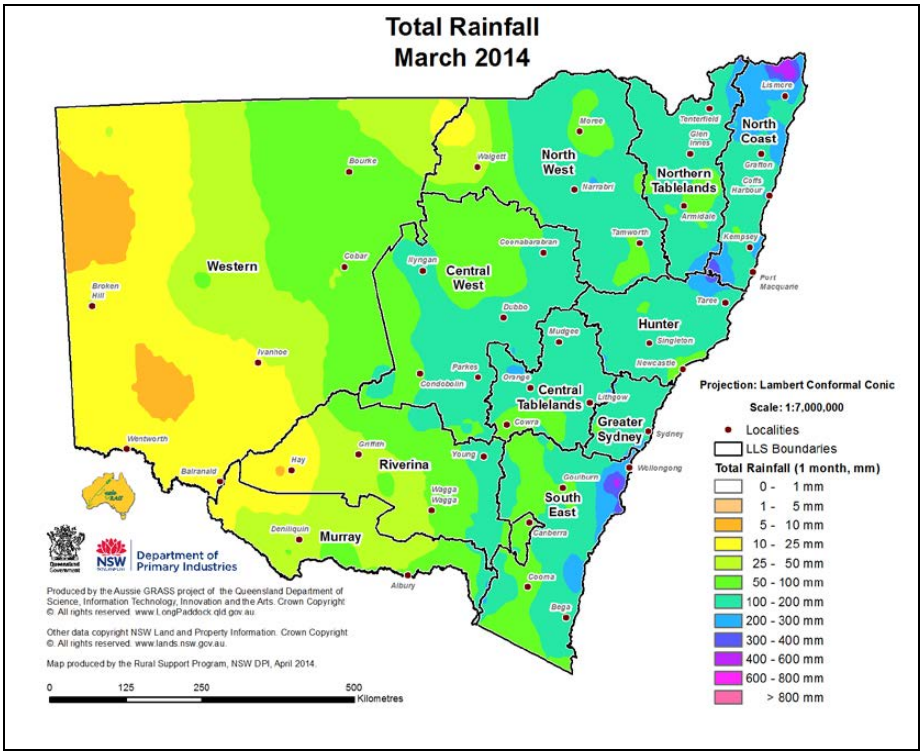


Figure 18: Total rainfall – quarterly

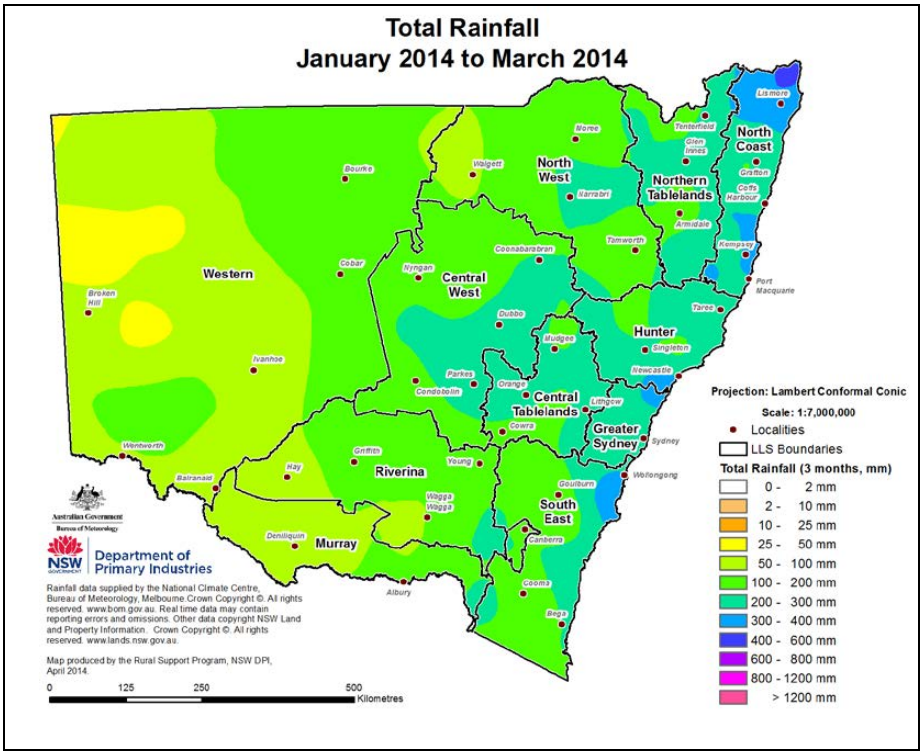


Figure 19: Total rainfall – half yearly

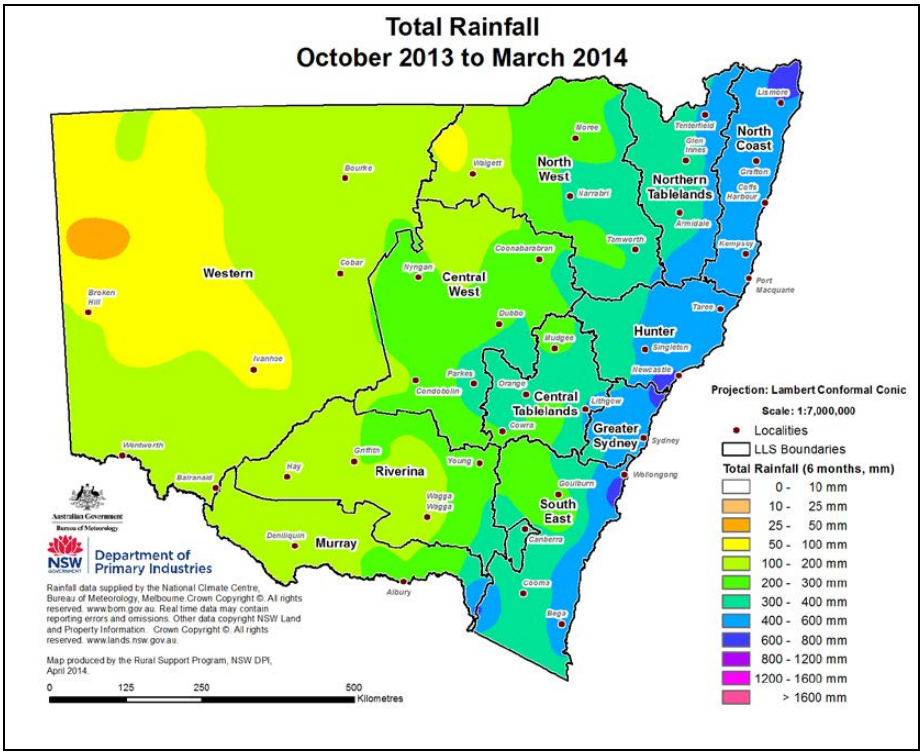
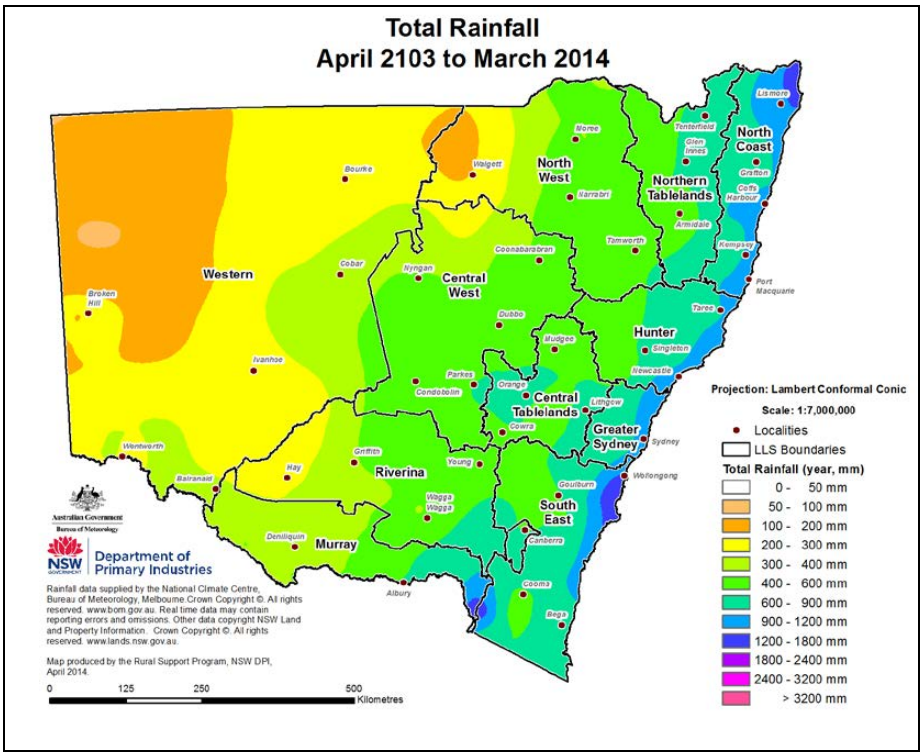


Figure 20: Total rainfall – yearly



Temperature

Figure 21: Maximum monthly temperature anomaly

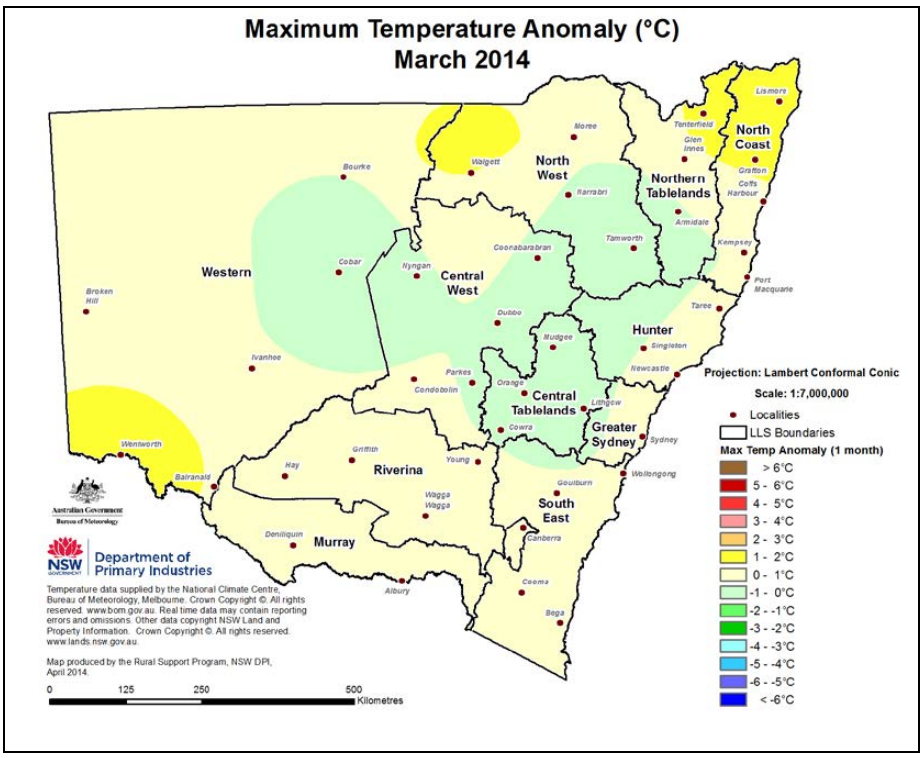
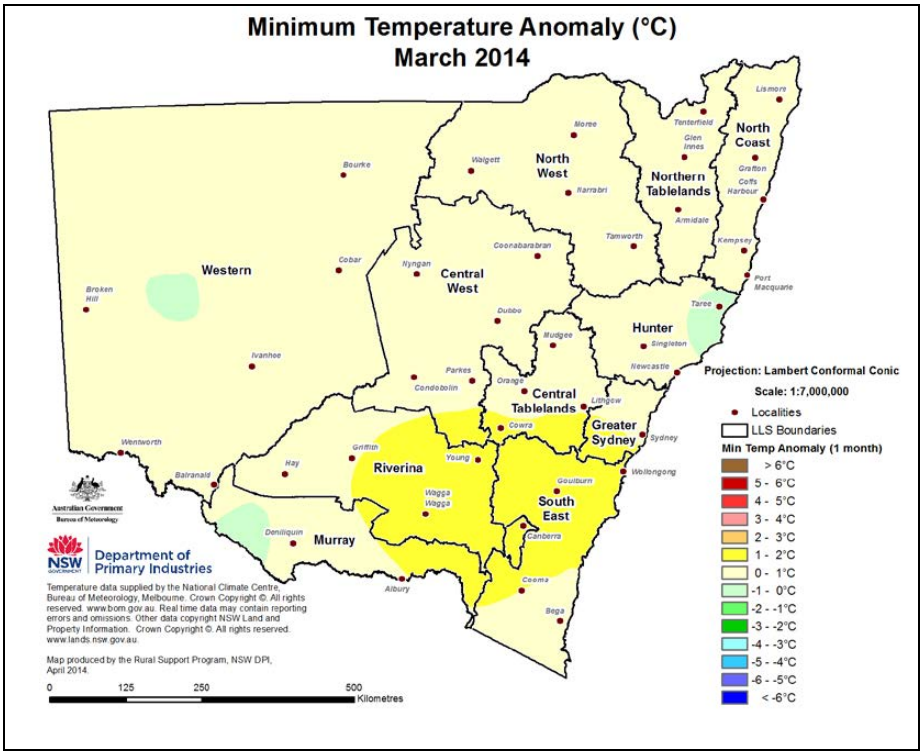


Figure 22: Minimum monthly temperature anomaly



Soil moisture

Figure 23: Relative monthly topsoil moisture

Soil moisture data and maps were not available at the time of publication

Figure 24: Relative monthly subsoil moisture

Soil moisture data and maps were not available at the time of publication

Figure 25: Relative weekly topsoil moisture to March

Soil moisture data and maps were not available at the time of publication

Figure 26: Relative weekly topsoil moisture to March

Soil moisture data and maps were not available at the time of publication

Pasture growth and biomass

Figure 27: Modelled pasture growth

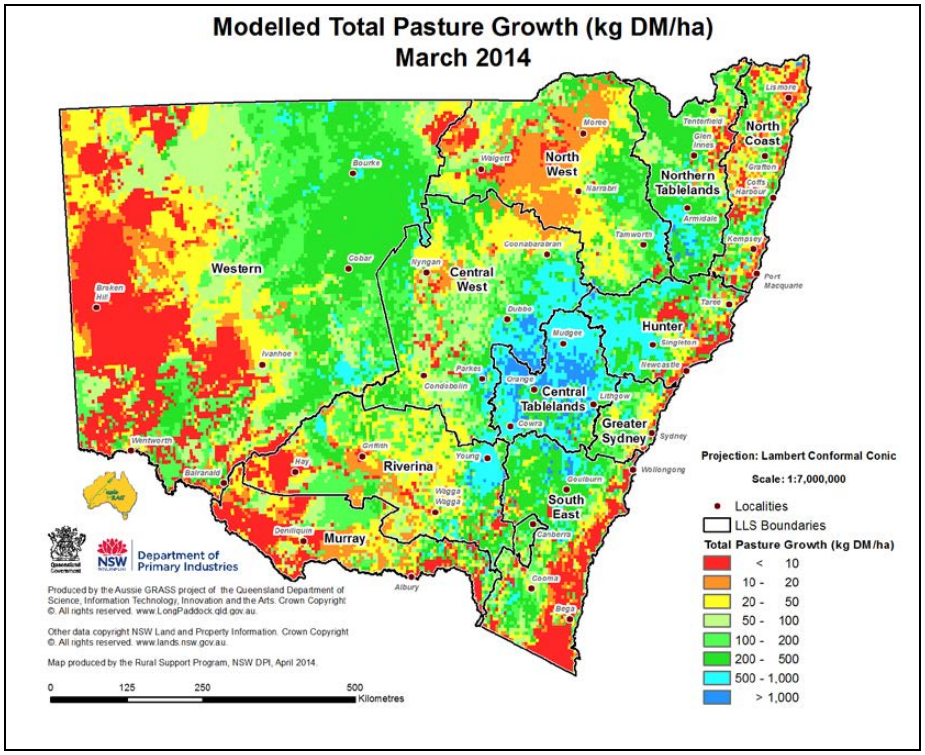


Figure 28: Modelled biomass

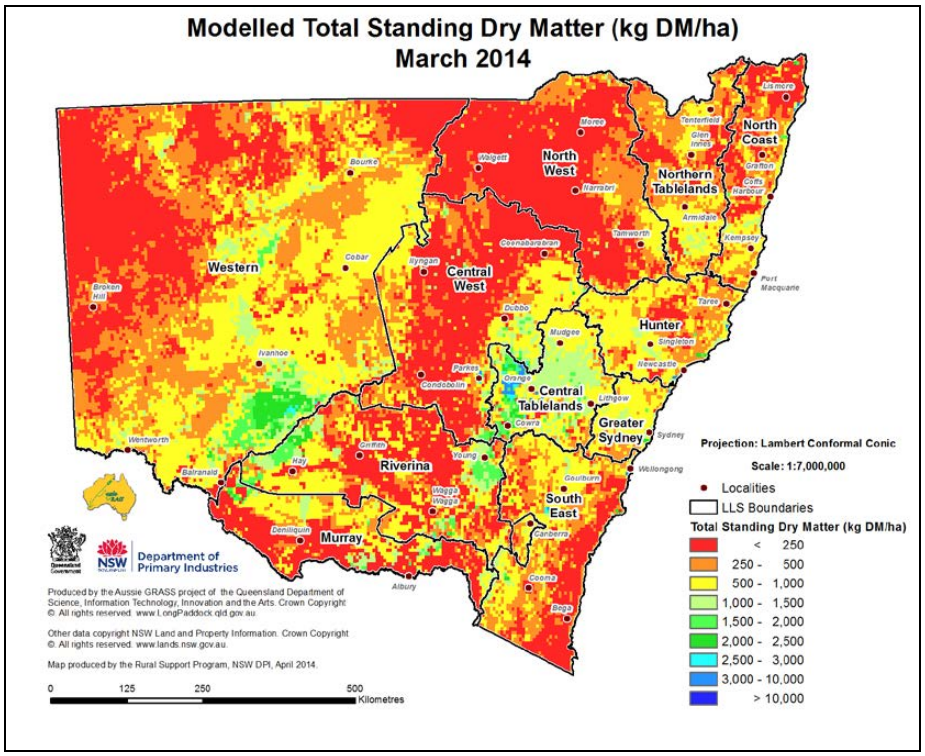


Figure 29: Relative pasture growth – monthly

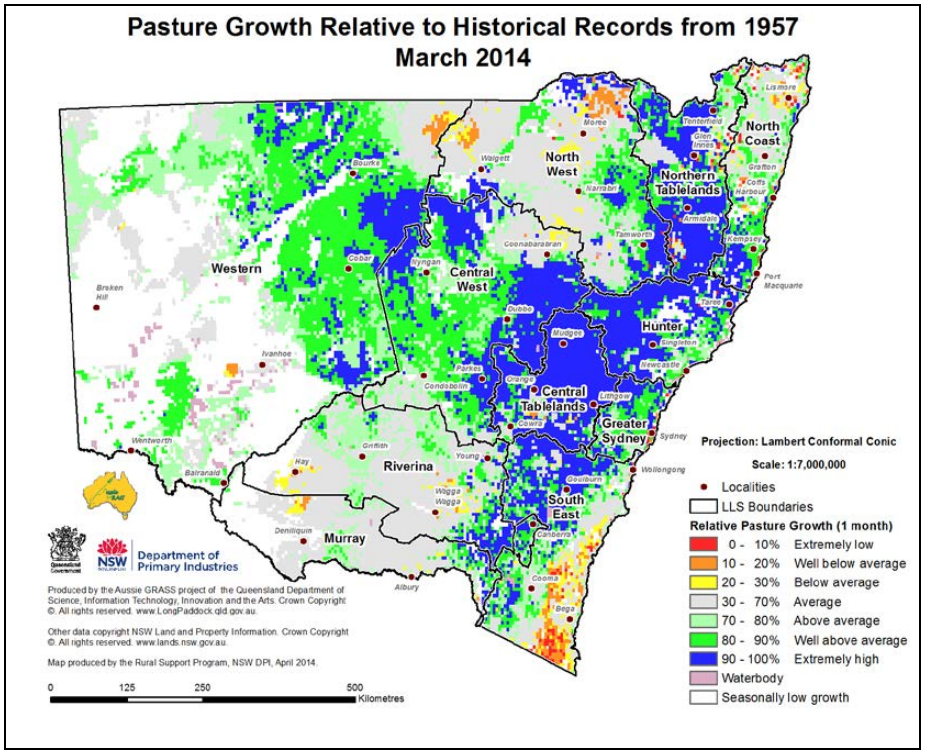


Figure 30: Relative pasture growth – quarterly

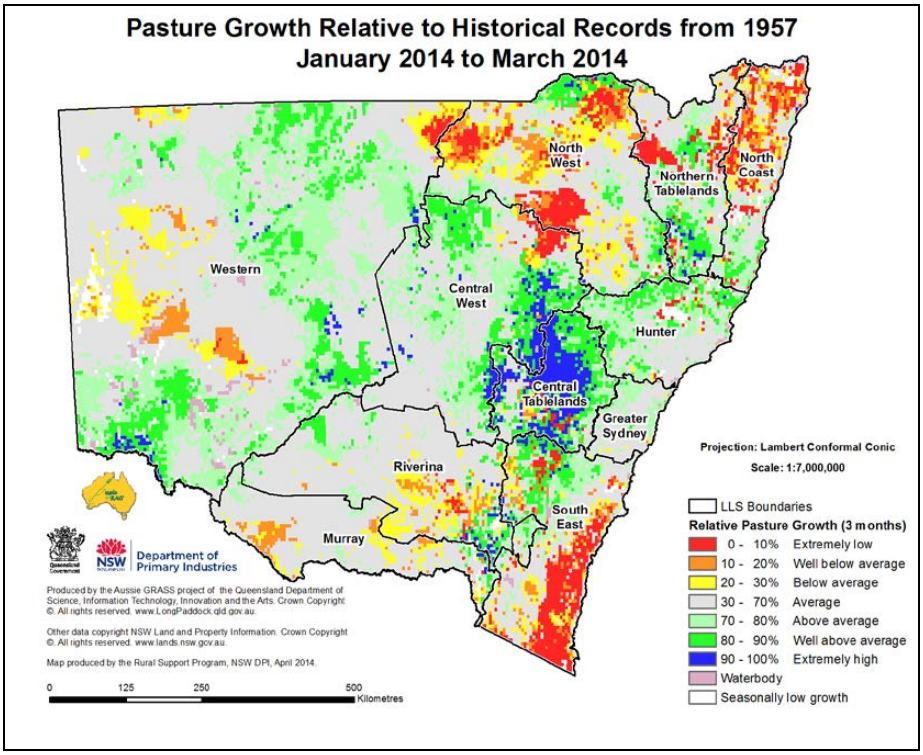


Figure 31: Relative pasture growth – half yearly

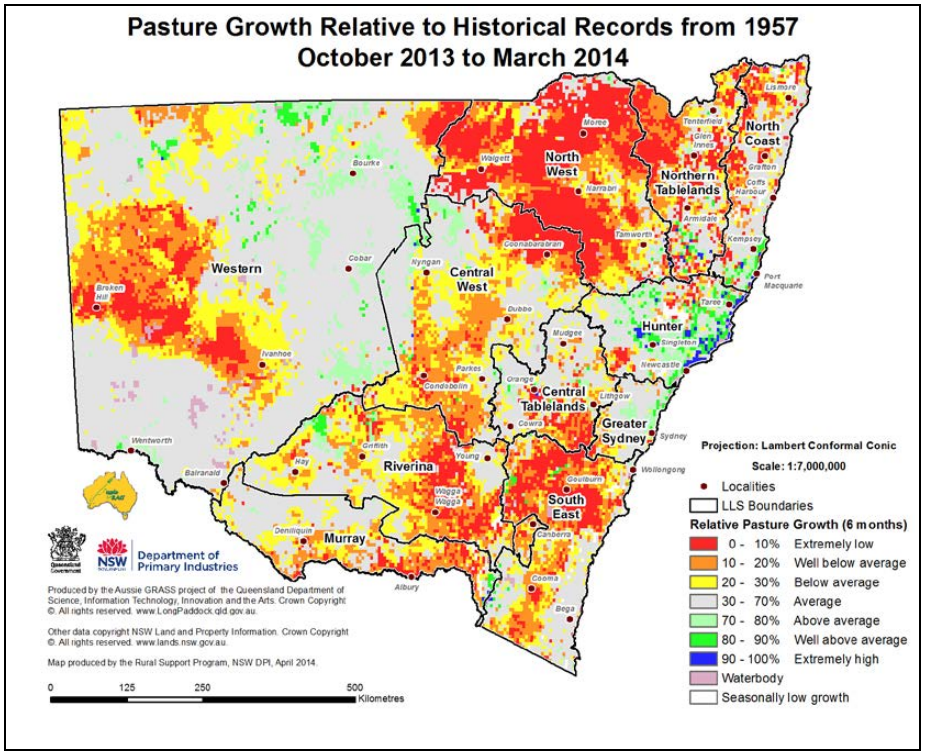


Figure 32: Relative pasture growth – yearly

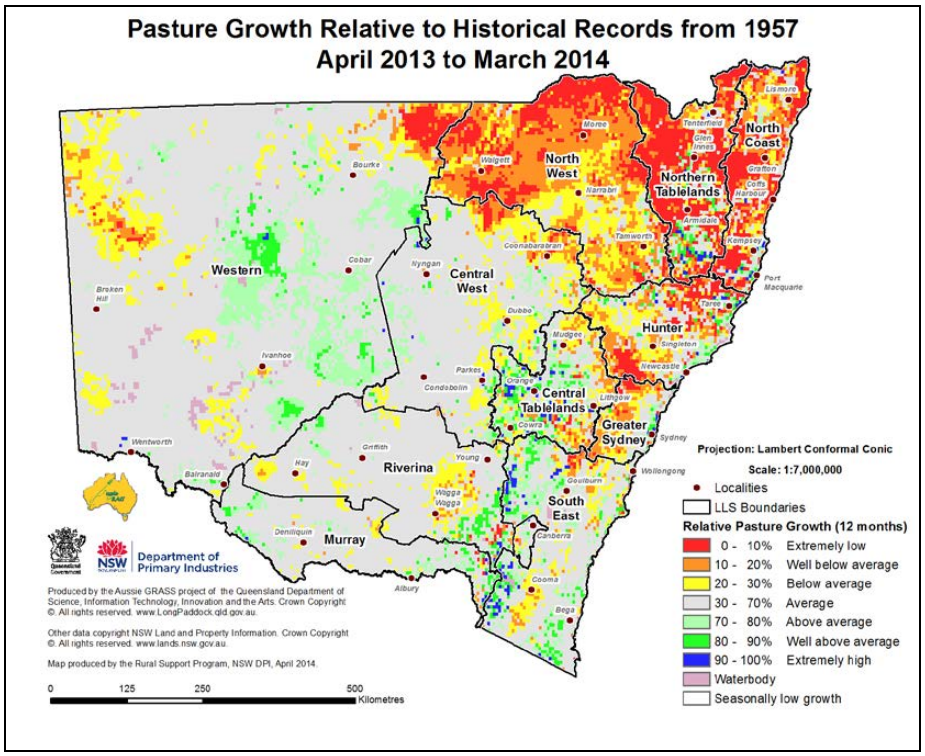


Figure 33: Relative biomass – monthly

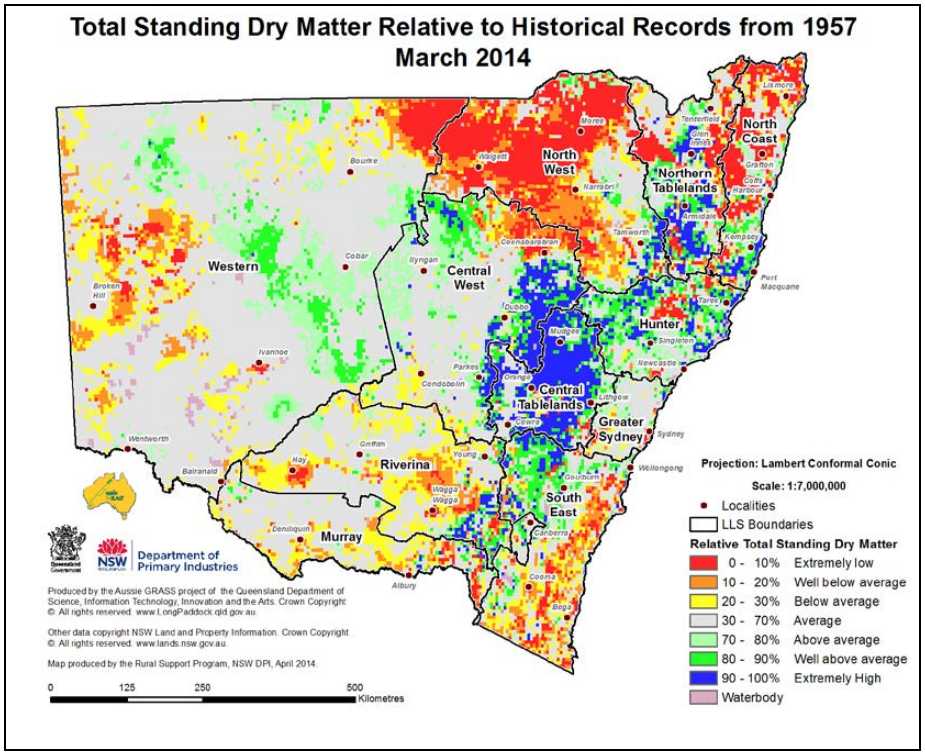
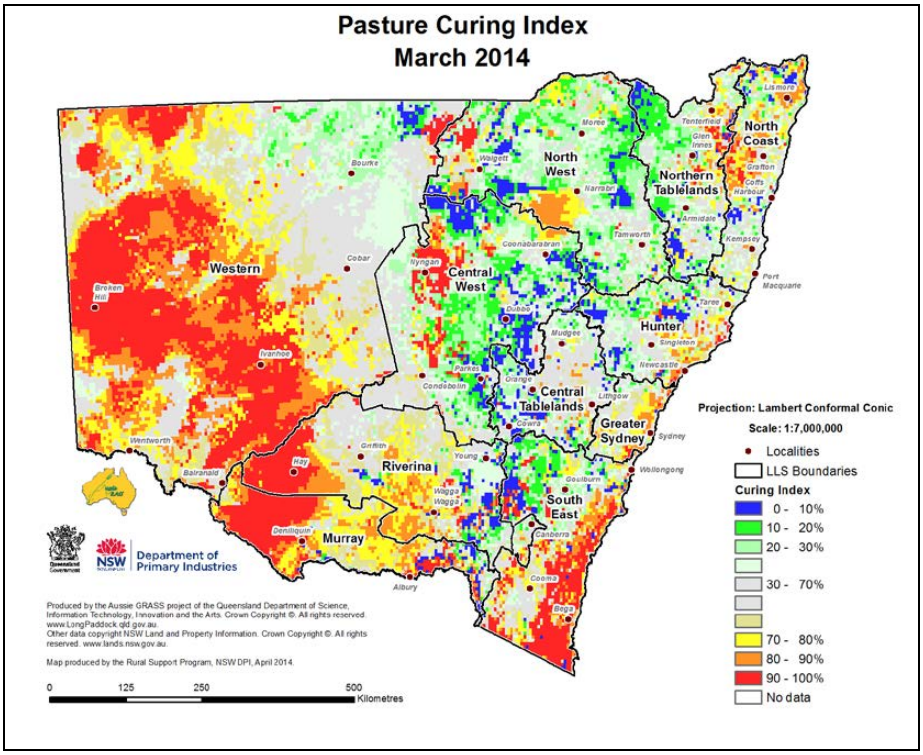


Figure 34: Pasture curing index



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.

Acknowledgments

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Warning

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