Seasonal outlook – spring 2019

Compiled by:

Matthew Lieschke, Senior Agriculture Advisor, South East Local Land Services

Phil Graham, Graham Advisory

September 2019

Table of Contents

Executive summary

In looking ahead, the projected pasture conditions for this spring can be categorised into three groups:

1) The '**eastern fall**' sites which include **Taralga**, **Bungonia**, **Lake Bathurst**, **Braidwood** and **Sutton Forest**. Soil conditions are extremely dry at these locations as they are on the eastern side of the range and recorded far less August rainfall. These sites are projected to have a very tough spring and are likely to require significant changes to normal management. For example, selling young stock early and doing a 'clean up' cull of breeding females. It's important to remember that summer storms are possible at these locations and should be considered in planned actions.

2) The '**central**' sites which include **Gunning**, **Bannister**, **Wheeo**, **Laggan** and **Bigga**. Some of these sites had reasonable winter rain and, in some cases, have had good winter pasture growth. These sites, while generally down on soil moisture compared to the normal late winter levels, are likely to experience a tough spring, but one that but can be managed by some fine tuning of management. Rain in the first half of September will be critical at Gunning and Bigga due to lower elevation and drier soil conditions. Sites at higher elevation (800m +) with better soil moisture will be able to withstand a dry start to spring.

3) The '**western**' sites which include **Rugby**, **Boorowa**, **Bowning**, **Bookham**, **Murrumbateman** and **Tidbinbilla**. Soil moisture, and hence the spring outlook varies quite considerably between these sites. For example, Rugby has had quite good winter rainfall (108mm) and is likely to experience a tough, but manageable spring. In contrast, Boorowa is much drier, has a high chance of a very poor spring and is likely to require significant changes to normal management. For example, selling young stock early and doing a 'clean up' cull of breeding females.

Unfortunately the Bureau of Meteorology is predicting **drier and warmer than average conditions for September and October.** This is largely due to a positive Indian Ocean Dipole (IOD) at present. A positive IOD is typically associated with below average rainfall for large parts of southern and central Australia in spring. Past forecasting accuracy for September and October is high.

If a drier than average spring does eventuate, the major concern will be the lack of carry-over feed and the ability to maintain **adequate ground cover** during the summer/autumn period. This was a big issue last summer and unfortunately there were cases where significant erosion occurred. Erosion results in the loss of valuable topsoil and nutrients and has a long-lasting impact on the property. This risk needs to be carefully assessed on an individual basis. Some producers have managed this risk through a significant reduction of stock numbers, while others have used sacrifice areas/drought lots to maintain a certain percentage of core breeders. Refer to Appendix 3 for further information on ground cover targets and how to assess ground cover.

Stock water is likely to be a major problem this summer; with some producers already concerned about dam water levels. If water is looming as an issue, it's important to assess how much water you have (in relation to stock and domestic requirements) and determine early if this is likely to cause destocking.

If major management changes (i.e. early weaning, destocking) are required, seek advice and look at the impacts over the medium term, not just the next 6 months. In any **destocking strategy** it's important to consider the impact on the herd/ flock structure, livestock production and cash-flow of the business over a 3 - 5 year period. Decision support tools such as StockPlan® can assist in looking at a range of scenarios before a decision is made.

Finally, in drought it's important to **have a plan**, to act early, review and plan for the next phase. Be realistic in your assessment of the situation and not underestimate the resources (capital, fodder and management) and personal and family cost to complete a particular course of action. StockPlan® can assist in thinking through these difficult issues.

Key points to consider when looking at the graphs

− It is the stocking rate run at each site which is important, not the enterprise selected. Most sites are set up on the basis that fertility is good and that the pasture mix is able to respond to moisture in any month of the year. So, a cattle producer can look at a site running sheep and the pasture production range will still apply with minor changes.

− The graphs are reporting green herbage in kg DM/ha for grazed pastures at the stocking rate listed. Any paddocks that you have had shut up or grazed at lower stocking rate will have greater values.

− The critical thing to look at is how the projected values (solid lines) move compared to the historical values (dotted lines). The longer the projected lines (solid) stay close together the less the site is relying on continuing rain to drive pasture production.

− Pasture benchmark tables for sheep and cattle have been provided as an Appendix to help you interpret the graphs. Refer to these benchmarks to see how stock will perform on the herbage mass indicated in the graphs for each location.

Steps to convert this data to your property

1. Look at the moisture probe website (www.soilmoistureprobes.com.au) and select a site with a similar soil type (detailed soil information is available at the bottom of the webpage). Selecting a site with a similar soil type is more important than selecting the site that is closest to your property.

2. Compare your rainfall to your selected site. If rainfall is similar then you can expect that the pasture projection would be similar to your property. The starting pasture values will probably be different but the pattern of the solid lines will be driven by moisture.

3. If your rainfall is well below then the spread of the lines will be greater so your pasture supply future is more variable, with rainfall in the next month being critical.

Background

During 2016 South East Local Land Services, in conjunction with Tablelands Farming Systems and Monaro Farming Systems established a network of soil moisture probes across the Southern Tablelands and Monaro. As part of this network 20 moisture probes have now been strategically positioned across the landscape to gather real-time information on what's happening to soil moisture under our pastures. Moisture probes have been installed at the following locations:

- Murrumbateman
- Yass
- Bookham
- Boorowa
- Bigga
- Laggan
- Wheeo

- Taralga
- Bannister
- Rugby
- Bungonia
- Gunning
- Lake Bathurst
- Sutton Forest

- Braidwood
- Cooma (x2)
- Delegate
- Bombala
- Berry

Soil moisture information is provided in real-time, with measurements taken at 10cm, 20cm, 40cm, 60cm, 80cm and 100cm. Soil temperature is also recorded at these depths. Each site also has an automatic rain gauge. For further information go to: www.soilmoistureprobes.com.au

One of the major benefits of collecting soil moisture data is it gives us an indication of how much moisture we have in the profile at any given time - i.e. is the 'bucket' full, half full or almost empty? Having some understanding of current soil moisture provides an extra piece of valuable information which can be used to increase your confidence with decision making at critical stages of the season.

To help guide decision making, the following report presents a three month pasture outlook for the various probe sites across the Southern Tablelands and Highlands. Information from each of these soil moisture probes has been used to help guide the GrassGro outputs contained below (refer to section: 'What might happen to pastures and livestock in the next three months?'). Information on the major drivers of spring rainfall has also been provided, including a summary of the most recent forecast from the Bureau of Meteorology (BOM).

Image: Soil moisture logger recording real-time information on an improved pasture at Bannister (M. Lieschke, South East Local Land Services).
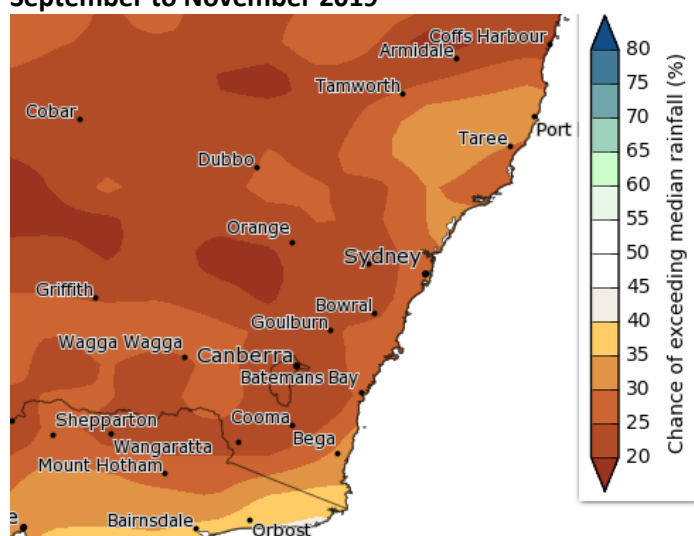
Climate outlook

Key messages from the recent Bureau of Meteorology Climate Outlook (issued 29 August 2019) are:

- A drier and warmer than average spring is likely for most of Australia, including NSW.
- A positive Indian Ocean Dipole (IOD) remains the main driver of Australia's climate. A positive IOD is typically associated with below average rainfall for large parts of southern and central Australia in spring.

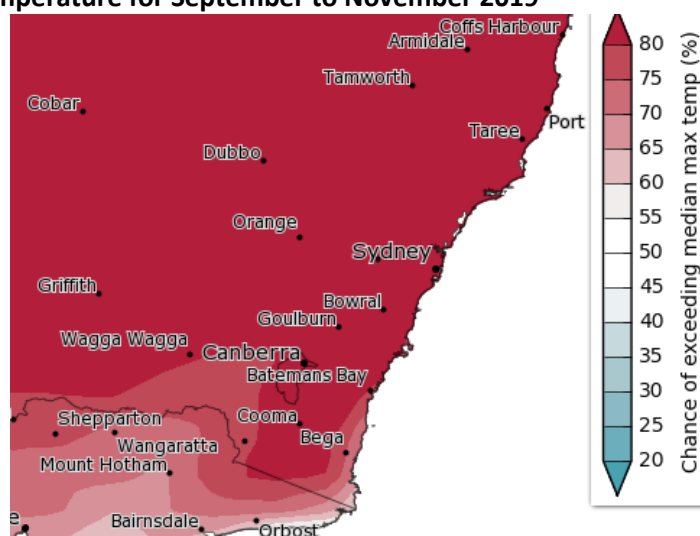For further information, including the latest outlook video from BOM go to:
http://www.bom.gov.au/climate/outlooks/#/overview/summary

Rainfall: the chance of above median for September to November 2019

Temperature: the chance of above median maximum temperature for September to November 2019

Source: BOM (2019)

What might happen to pastures and livestock in the next three months?

The outcome is a combination of current soil moisture, pasture mass and stock condition at the assessment date and expectations regarding weather over the future period. Unfortunately no one has a crystal ball, so what other method can be used?

CSIRO released a program called GrassGro in the 1990s. This program uses daily weather data, local soil types, relevant pasture species and suitable livestock parameters to model livestock production systems across southern Australia. It has been used extensively in the South East region of NSW over a long period of time and is accepted by producers as providing robust data to assist farm decision making related to the risk from seasonal variation.

Seasonal reports, what do they tell us?

The logic behind a seasonal report is too see what the next "2-3 months" could look like by using current conditions (pasture mass, soil moisture, body weights etc.) and then projecting forward using historical weather for the same 2-3 month period.

The historical weather used to create the pasture projections was daily data from 1960 to 2018. So, GrassGro essentially creates 58 different potential pasture curves all starting from the conditions on 29 August 2019. From this data we can get an estimate/risk of pasture supply for the period examined (i.e. in this case it was from 30 August to 30 November 2019). The tactical runs (projected) are reported against the long term historical data for the same period to give you a feel of how pasture conditions are currently positioned (compared to history) and the potential risk for the future.

It is important to note that the pasture curves are not forecasts as they are based on historical weather data for each location.

The pasture curves are reported via percentile graphs. The three percentiles used are 10%, 25%, 50%. The 25% line means that in 75% of years (i.e. 42 years) the green pasture supply was better than this line. The 50% line means half the years were above the line and half below. This logic applies to both the historical and projected lines.

The seasonal forecast from BOM can be used to assist with deciding which percentile data is the most relevant for the current year. If the BOM forecast for the next month was a 70 per cent chance of below median rainfall then you might only look at the projection lines below 50%.

There is no process that can provide a precise forecast. We need to use all available information to improve our confidence in making farm management decisions.

Tidbinbilla

Self replacing merino flock, 10.0 DSE, microlaena, sub clover and annual grass pasture

Projected pasture supply for the 30 Aug to 30 Nov period
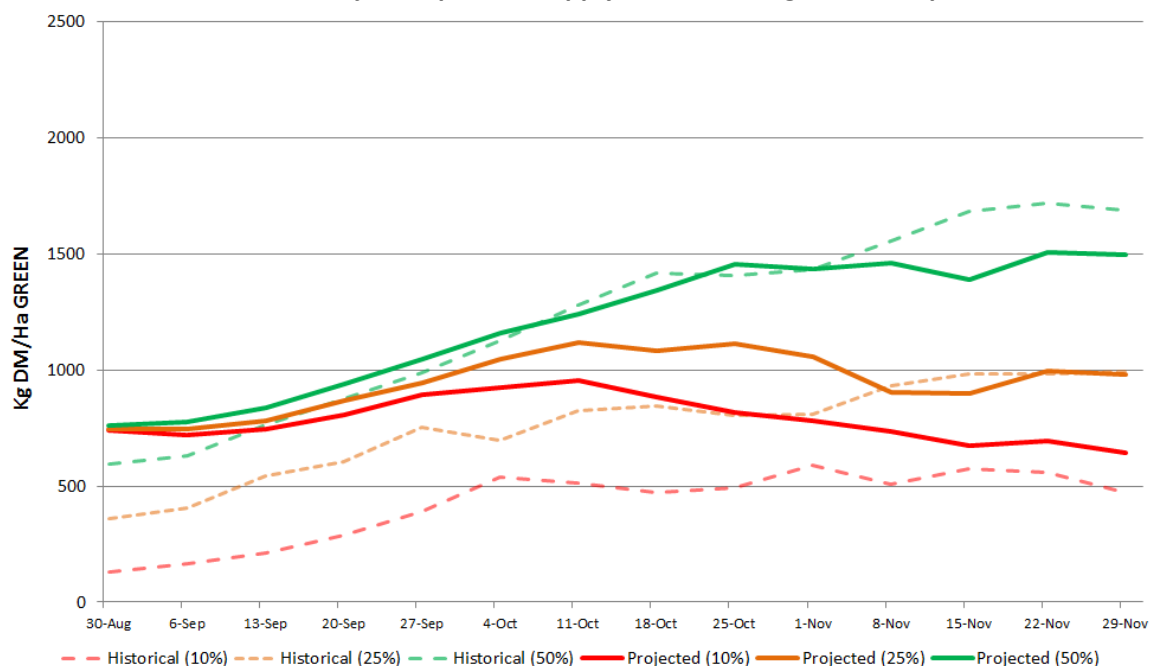
Pasture conditions are above average for the start of spring and good August rainfall (55mm) means that this site has reasonable moisture to depth. The 'fuel gauge' is also showing slightly better soil moisture at this site compared to 12 months ago (see right).

Looking at the pasture outlook graph above, rain by late-September will be important to keep pastures going – this is where the solid lines start to separate.

The 50% projection line (solid green line) would be a good outcome and result in an 'average' spring. However, given the dry forecast this is unlikely.

The 25% projection line (solid brown line) represents a drier than average spring. This would result in a tough spring, but one that can be managed with relatively small changes to your normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

If a drier than average spring does eventuate, the major concern will be maintaining adequate ground cover during the summer/autumn period. These risks need to be managed.

Soil moisture
(as of 4 September 2019)

|	
10cm:	64%
20cm:	72%
40cm:	65%
60cm:	74%
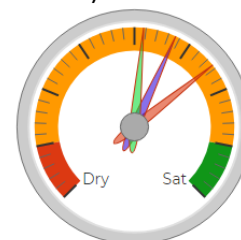
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Note: the projected pasture outlook for this site has been strongly influenced by 55 mm of rain in August. As such, it does not provide a guide to the majority of the ACT which did not receive this much rain. The Murrumbateman outlook (following page) is more representative of the general ACT conditions, but it also received more rain in August.

Murrumbateman

Self replacing merino flock, 10.0 DSE, microlaena, sub clover and annual grass pasture

Projected pasture supply for the 30 Aug to 30 Nov period
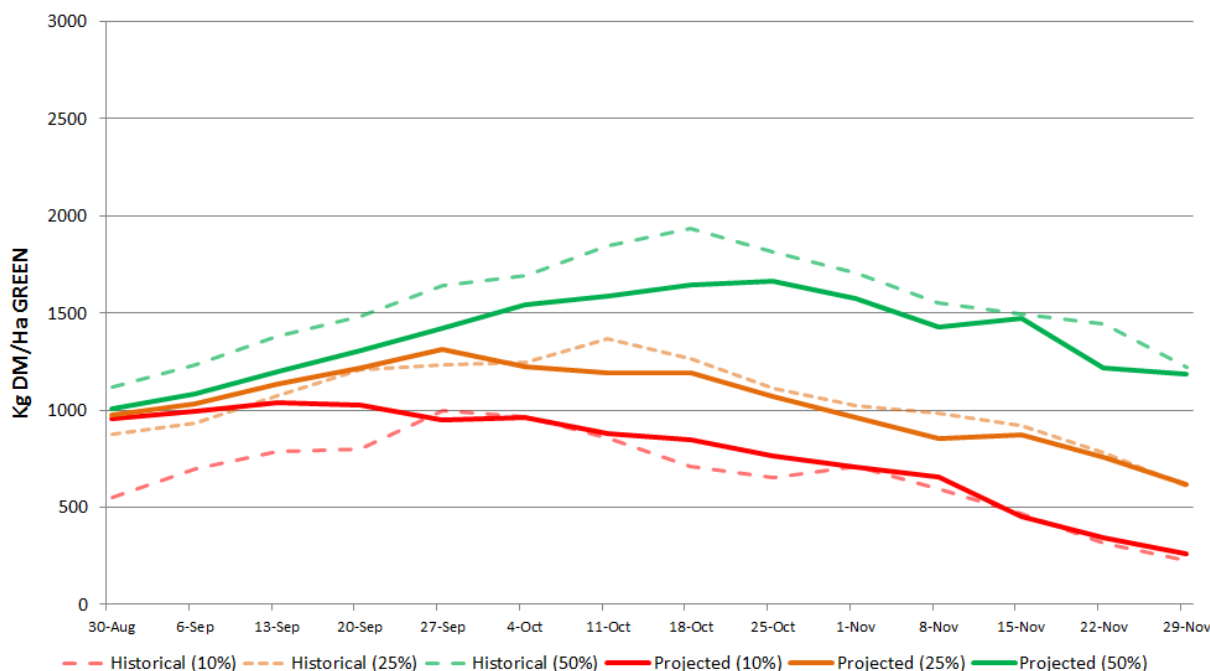
The soil moisture probe is indicating very dry conditions below 20cm and slightly less moisture in the top 60cm compared to this time last year (see right).

Rain by mid-September will be important to keep pastures going – this is where the solid lines start to separate.
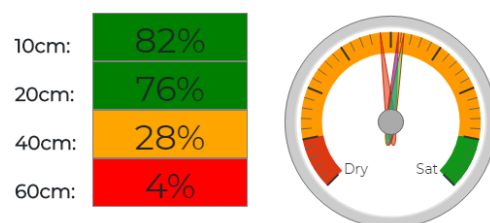
The 50% projection line (solid green line) would be a good outcome and result in just a 'spring'. However, given the dry forecast this is unlikely.

The 25% projection line (solid brown line) represents a drier than average spring. This would result in a tough spring, but one that can be managed with relatively small changes to your normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

If a drier than average spring does eventuate, the major concern will be maintaining adequate ground cover during the summer/autumn period. These risks need to be managed.

Soil moisture
(as of 4 September 2019)

10cm:	82%
20cm:	76%
40cm:	28%
60cm:	4%

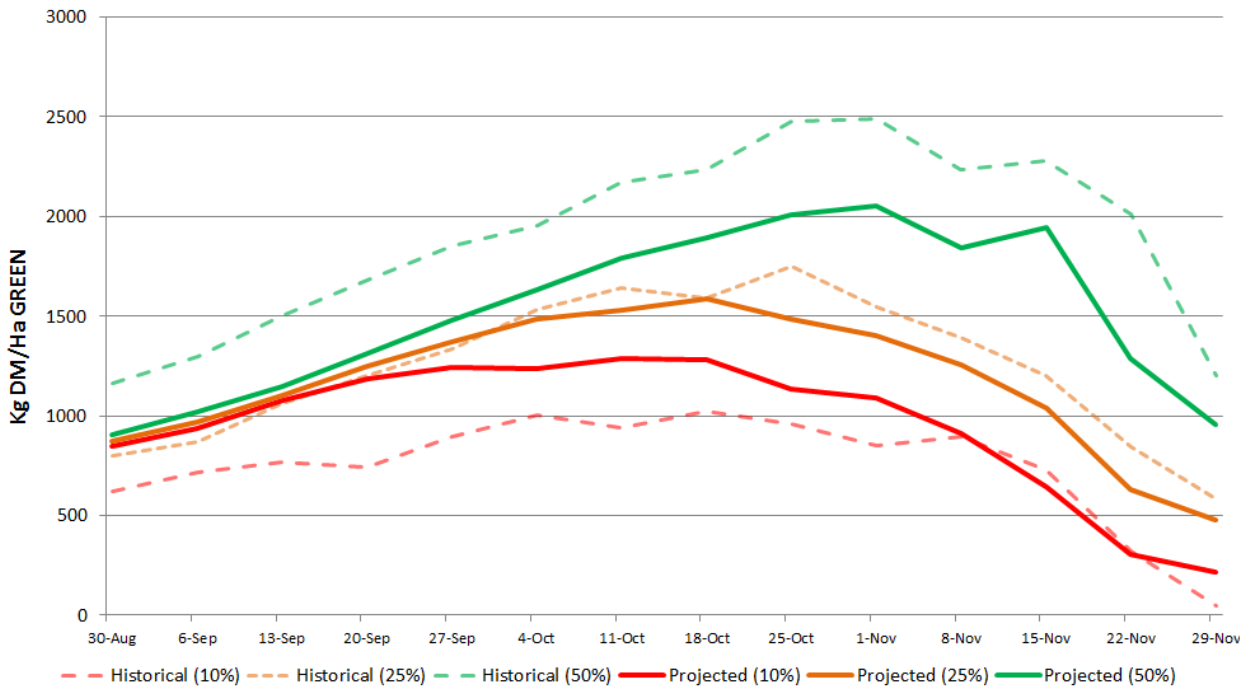**Red needle:** current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Bookham

Self replacing merino flock, 10.7 DSE, microlaena, sub clover and annual grass pasture

Projected pasture supply for the 30 Aug to 30 Nov period

Legend: − − Historical (10%) − − Historical (25%) − − Historical (50%) — Projected (10%) — Projected (25%) — Projected (50%)

The soil moisture probe at the Bookham site is indicating reasonable moisture heading into spring, with slightly better soil moisture compared to this time last year (see right).

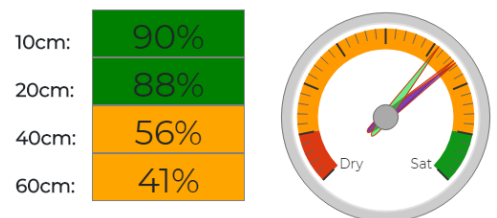Rain by late-September will be important to keep pastures going – this is where the solid lines start to separate.

The 50% projection line (solid green line) would be a good outcome and achieve a 'spring'. However, given the dry forecast this is unlikely.

The 25% projection line (solid brown line) represents a drier than average spring. This would result in a tough spring, but one that can be managed with relatively small changes to your normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

If a drier than average spring does eventuate, the major concern will be maintaining adequate ground cover during the summer/autumn period. These risks need to be managed.
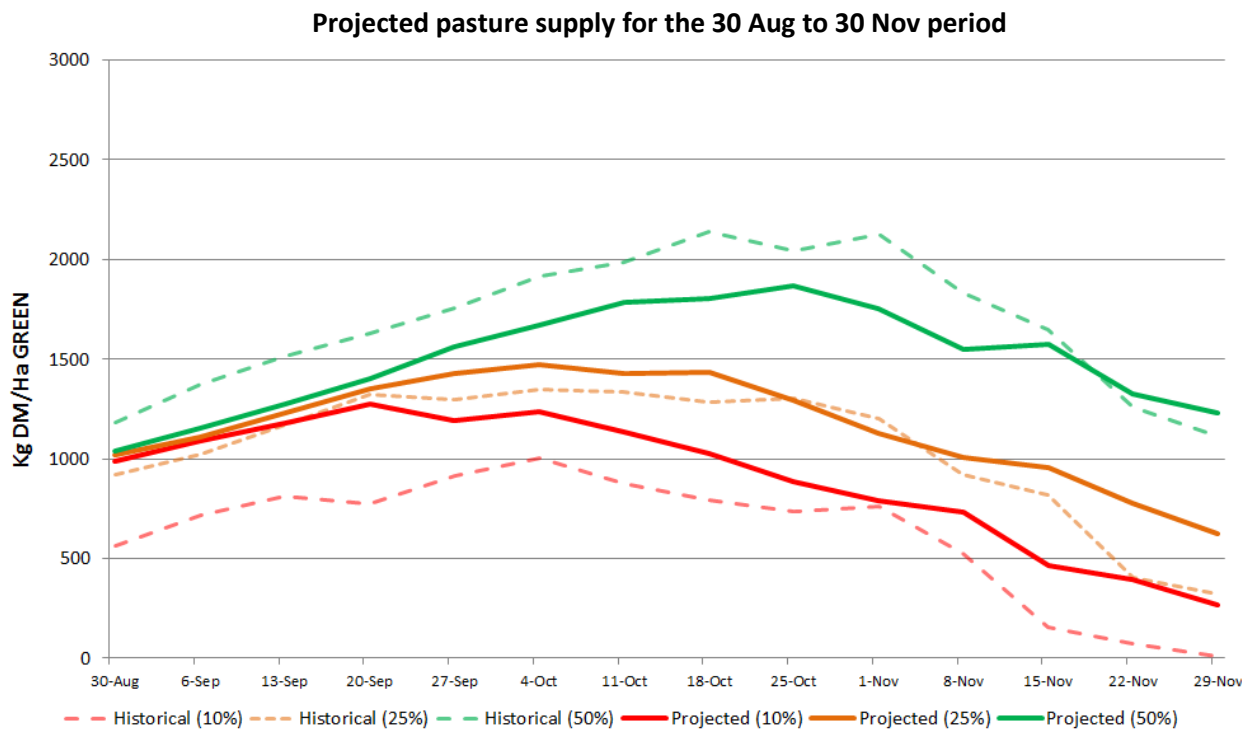
Soil moisture
(as of 4 September 2019)

10cm:	90%
20cm:	88%
40cm:	56%
60cm:	41%

Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Bowning

Self replacing merino flock, 10.7 DSE, microlaena, sub clover and annual grass pasture

Projected pasture supply for the 30 Aug to 30 Nov period

The soil moisture probe at the Bowning site is indicating a fairly dry profile heading into spring, with less soil moisture available compared to this time last year (see right).

Rain by late-September will be important to keep pastures going – this is where the solid lines start to separate.
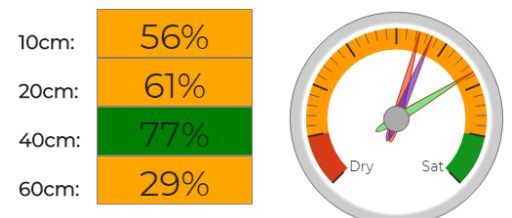
The 50% projection line (solid green line) would be a good outcome and result in a 'spring'. However, given the dry forecast this is unlikely.

The 25% projection line (solid brown line) represents a drier than average spring. This would result in a tough spring, but one that can be managed with relatively small changes to your normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

If a drier than average spring does eventuate, the major concern will be maintaining adequate ground cover during the summer/autumn period. These risks need to be managed.

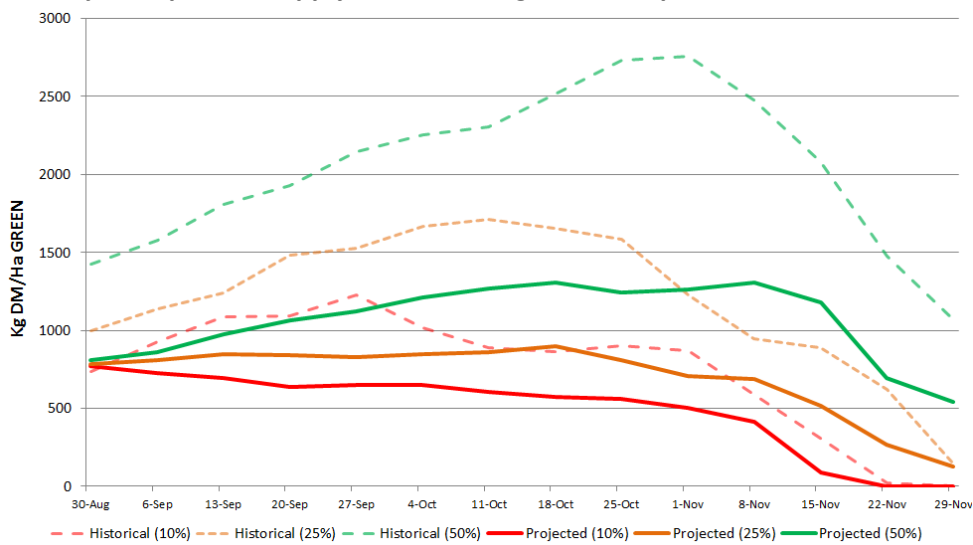**Soil moisture**
(as of 4 September 2019)

10cm:	56%
20cm:	61%
40cm:	77%
60cm:	29%

Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Boorowa

Self replacing merino flock, 10.0 DSE, phalaris, sub clover and annual grass pasture

**Projected pasture supply for the 30 Aug to 30 Nov period**

Boorowa is one of the driest sites heading into spring due to lack of winter rainfall (71mm in total – less than half the long term average). The moisture probe is showing a very dry soil – much drier than this time last year.

The low pasture starting position combined with a very dry soil means that this site has a high chance of a very poor spring. As such, maintaining adequate ground cover during the summer/autumn period is a key risk going forward.

The lack of moisture means that rainfall will be required in early September to keep pastures going. This is indicated by the speed at which the solid lines start to separate.

The second graph shows the likely outcome if 2006 or 2018 spring conditions were repeated. 2006 is regarded as one of the worst springs on record – a bit of rain at the start of September and then extremely dry. 2018 saw a dry start to spring, but good rainfall from mid-October onwards. As shown in the graph, this site is not in a position to handle another dry start to spring. Spring

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period
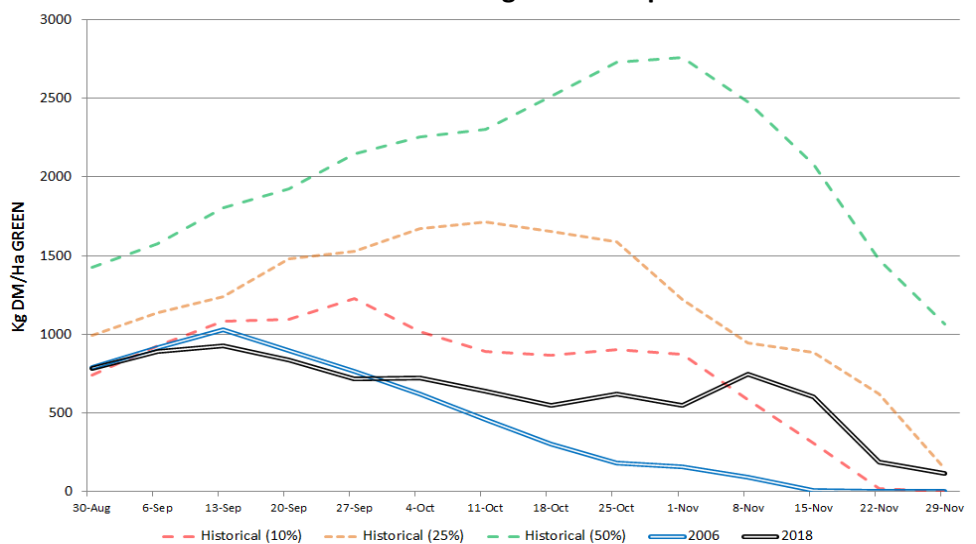

rainfall of 2018 was too late at this site to be of any significant benefit.

The amount of carry-over feed and managing ground cover is of major concern at this site. Reducing stocking pressure at the earliest opportunity will be an important strategy in managing the period ahead - i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

Soil moisture
(as of 4 September 2019)

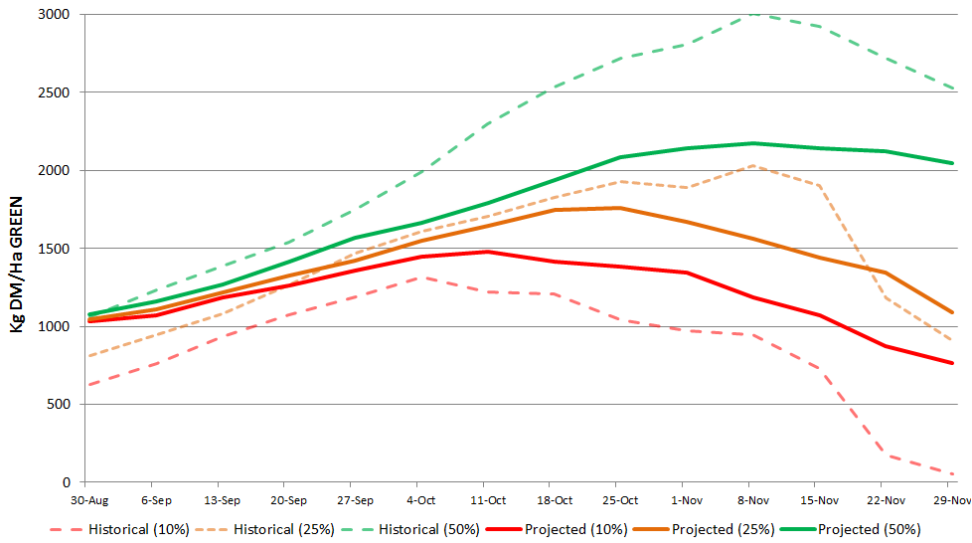|	
10cm:	33%
20cm:	32%
40cm:	14%
60cm:	5%
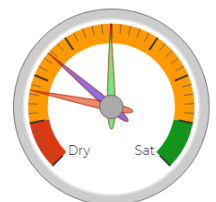
Red needle: current moisture (0 – 60cm)
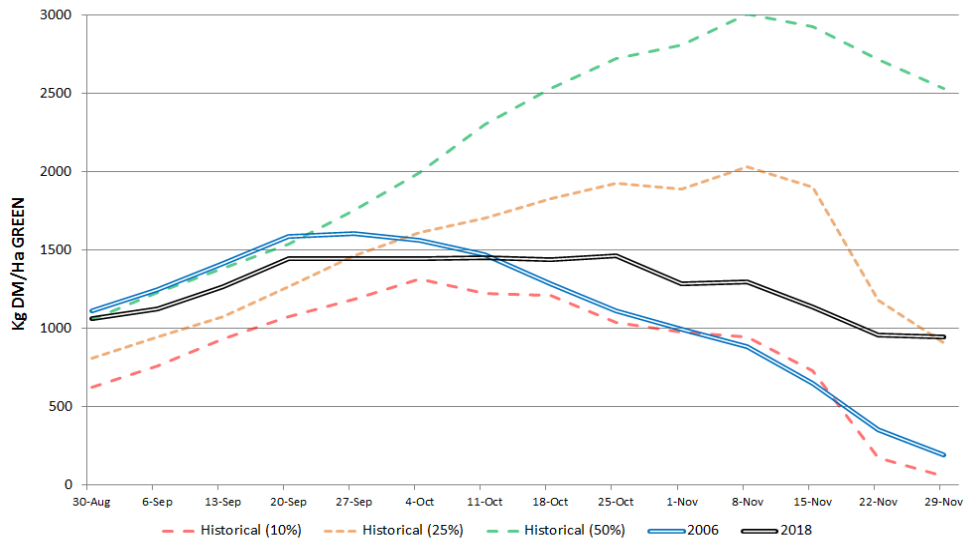**Purple needle:** 1 month ago
Green needle: 1 year ago

Rugby

Prime lamb enterprise, 11.4 DSE, phalaris, sub clover and annual grasses

Projected pasture supply for the 30 Aug to 30 Nov period

The moisture probe is showing reasonable moisture to depth and slightly better soil moisture compared to 12 months ago (see bottom right).

The 25% projection line (solid brown line) represents a drier than average spring. This would result in a tough spring, but one that can be managed with relatively small changes to normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc. Maintaining adequate ground cover during the summer/autumn period would also be a key risk going forward.

The second graph shows the likely outcome if 2006 or 2018 spring conditions were repeated. 2006 is regarded as one of the worst springs on record – a bit of rain at the start of September and then extremely dry. 2018 saw a dry start to spring, but good rainfall from mid-October onwards. If 2018

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period

occurred again, the black line ends up in a similar position to the 25% historical line (dotted brown line).

If a drier than average spring does eventuate, stock will perform well during spring due to pastures maintaining digestibility for longer. However, the major concern will be the lack of carry-over feed and managing ground cover during the summer/autumn period. These risks need to be managed.
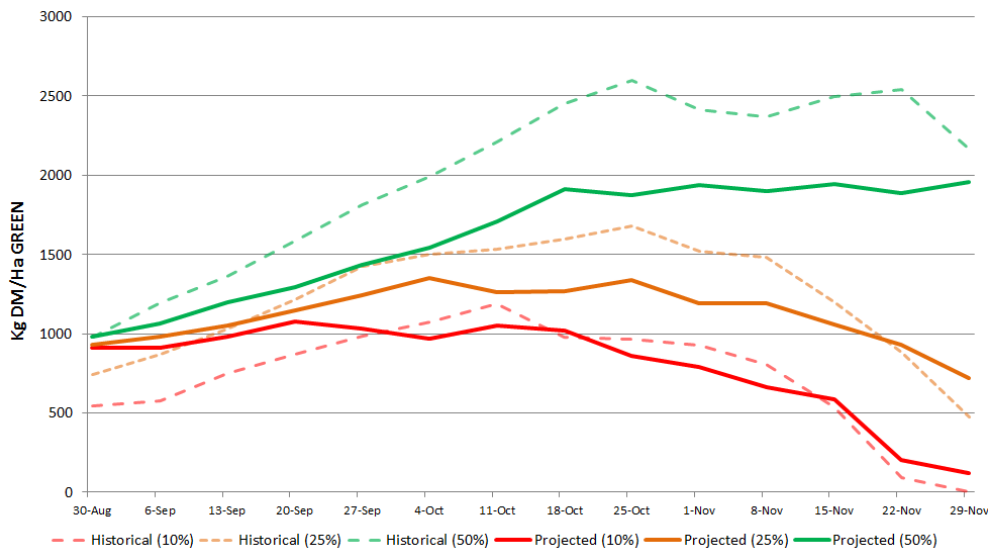
Soil moisture
(as of 4 September 2019)

10cm:	39%
20cm:	57%
40cm:	65%
60cm:	93%
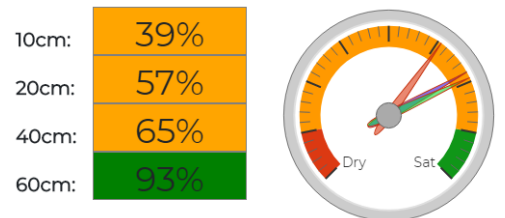
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Bigga

Self replacing merino flock, 11.5 DSE, perennial grass, annual grass, sub clover

**Projected pasture supply for the 30 Aug to 30 Nov period**

The soil moisture probe at the Bigga site is indicating dry conditions, with much less soil moisture available compared to this time last year (see right).

Rain in early September will be important to keep pastures going – this is indicated by the speed of which the solid lines start to separate.

The 10 and 25% projection lines (solid red and brown lines) represents much drier than average conditions. This type of scenario would require major changes to normal management, especially if conditions trend towards the red line. For example, selling young stock early, doing a 'clean up' cull of breeding females etc. Maintaining adequate ground cover during the summer/autumn period would also be a key risk going forward.

The second graph shows the likely outcome if 2006 or 2018 spring conditions were repeated. 2006 is regarded as one of the worst springs on

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period
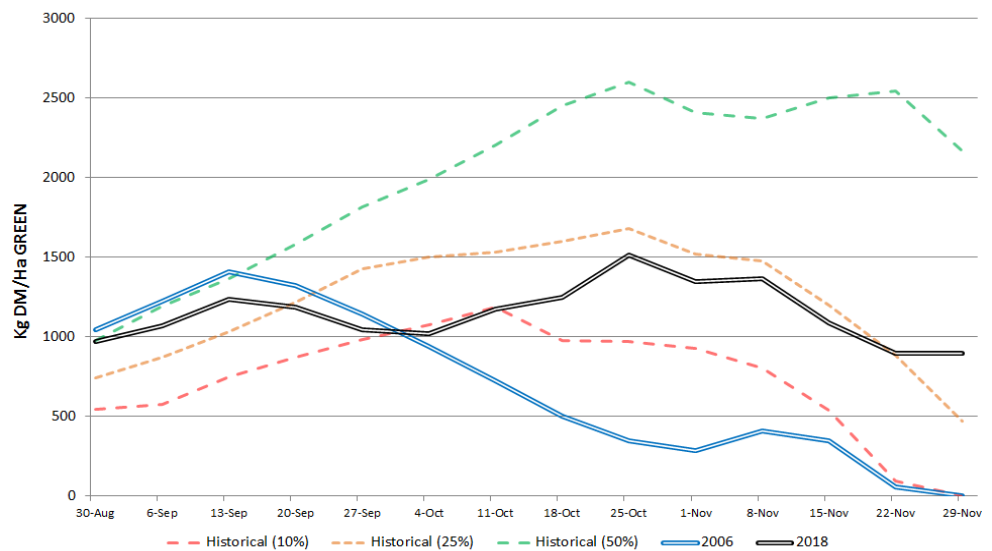

record – a bit of rain at the start of Sept and then extremely dry. The blue line shows that green feed quickly disappears out of the system if this was to occur.

2018 saw a dry start to spring, but good rainfall from mid-Oct onwards. If 2018 conditions occurred again, pastures would respond and the black line ends up in a similar position to the 25% line.

Soil moisture
(as of 4 September 2019)

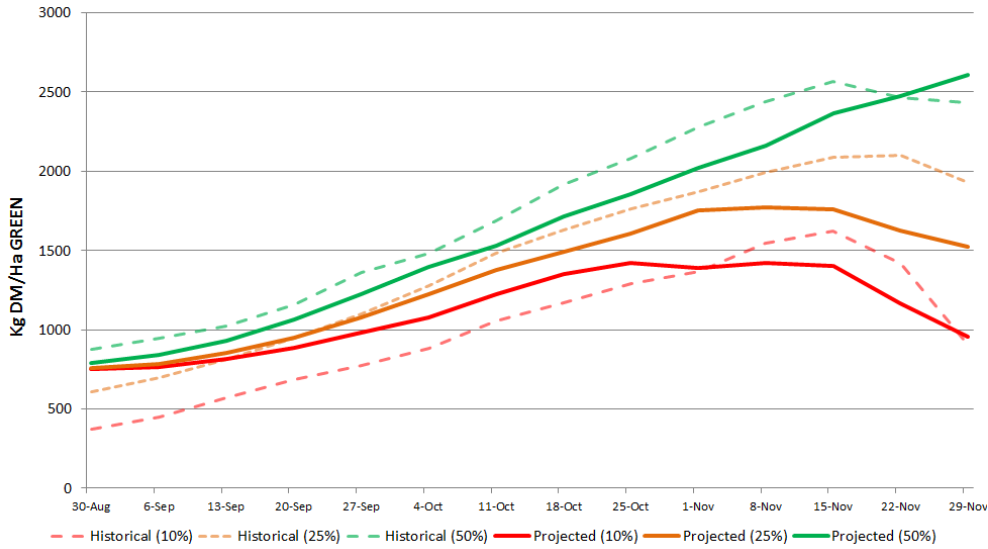|	
10cm:	46%
20cm:	48%
40cm:	23%
60cm:	38%
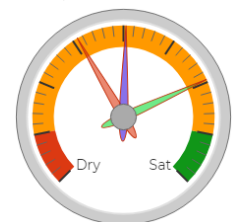
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Laggan

Self replacing merino flock, 7.3 DSE, microlaena, sub clover and annual grasses

**Projected pasture supply for the 30 Aug to 30 Nov period**

The moisture probe is showing reasonable moisture to depth and slightly better soil moisture compared to 12 months ago (see bottom right). As such, all projected lines are showing increasing pasture supply until mid-October.

The 25% projection line (solid brown line) represents a drier than average spring, but the solid brown line still reaches 1800kg DM/ha (green). This result could be managed with relatively small changes to normal management.

The solid red line (10%) represents a very dry scenario and would require major changes to normal management. For example, selling young stock early, doing a 'clean up' cull of breeding females etc.

The soil moisture and elevation is currently providing a time buffer heading into spring – this site is able to withstand a dry start to spring. This is evident

**Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period**
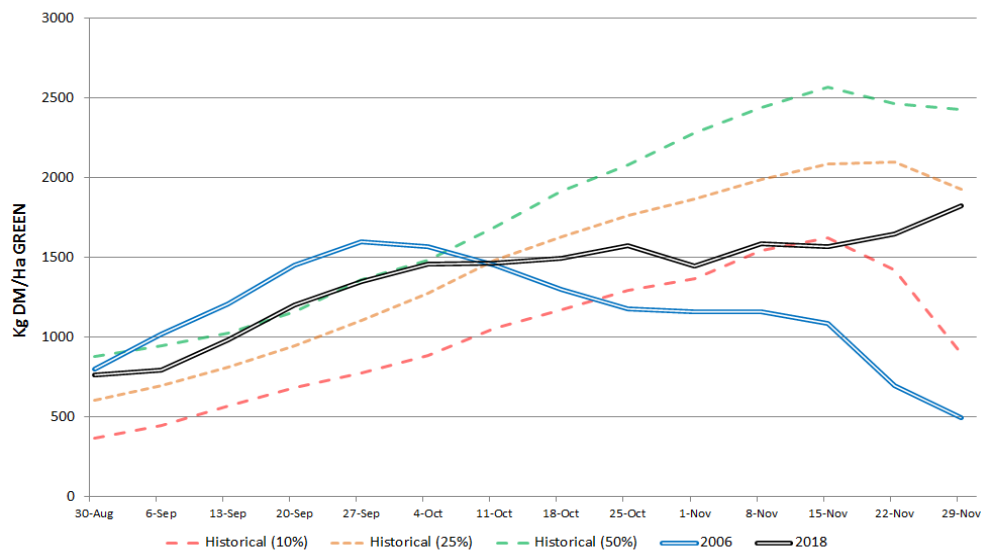
in the second graph by looking at the 2006 and 2018 weather scenarios.

2018 saw a dry start to spring, but good rainfall from mid-Oct onwards. If 2018 conditions occurred again, pastures in the Laggan region would be able to respond well, whereas at lower elevations the Oct/Nov rainfall was too late.

Soil moisture
(as of 4 September 2019)

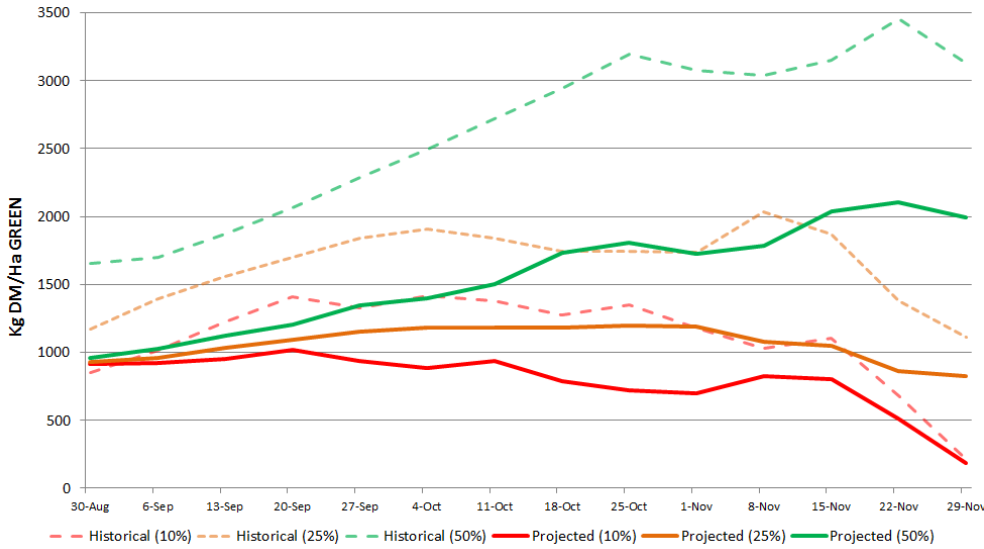|	
10cm:	69%
20cm:	70%
40cm:	50%
60cm:	63%
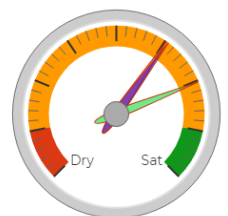
Red needle: current moisture (0 – 60cm)
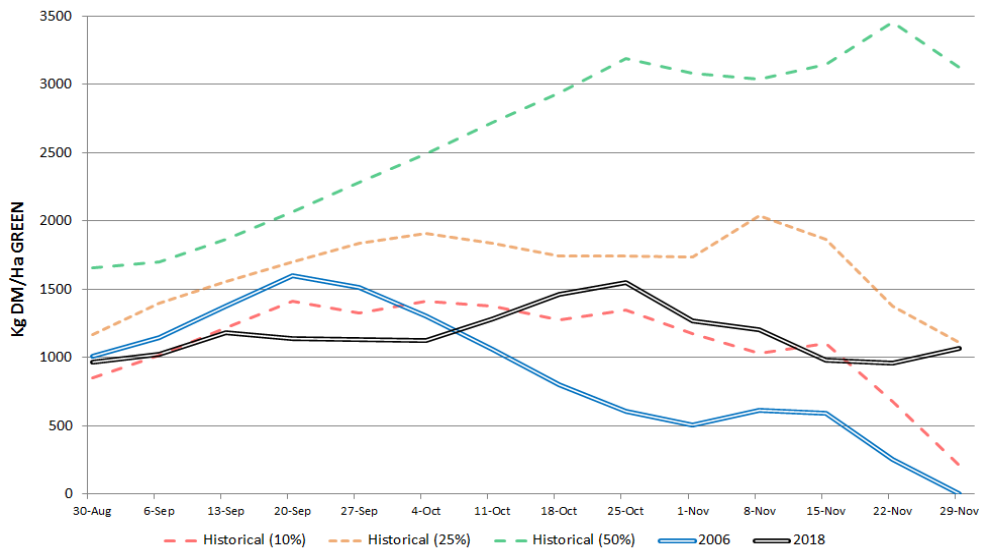**Purple needle:** 1 month ago
Green needle: 1 year ago

Taralga

Prime lamb enterprise, 17.2 DSE, phalaris, sub clover and annual grasses

Projected pasture supply for the 30 Aug to 30 Nov period

The low pasture starting position combined with a very dry soil means that this site has a high chance of a very poor spring. The lack of moisture means that rainfall will be required in early September to keep pastures going.

The 50% projection line (solid green line) would result in a 'spring'. However, given the dry forecast this is unlikely.

The 10% and 25% projection lines (solid brown and red lines) represents a drier than average spring. This type of scenario would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc. Maintaining adequate ground cover during the summer/autumn period is a key risk going forward.

The second graph shows the likely outcome if 2006 or 2018 spring conditions were repeated. 2018 saw a dry start to spring, but good rainfall from mid- October onwards. Due to its elevation, this site would benefit from late

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period

spring rainfall – the black line shows the pasture responding and ending up near the 25% line. Still a very tight scenario, but late spring rain would ease some pressure on the system.

It's important to remember that summer storms are possible at Taralga (eastern side of the range). These storms are driven by east coast lows – events that can quickly change the situation from a pasture perspective.

Soil moisture
(as of 4 September 2019)

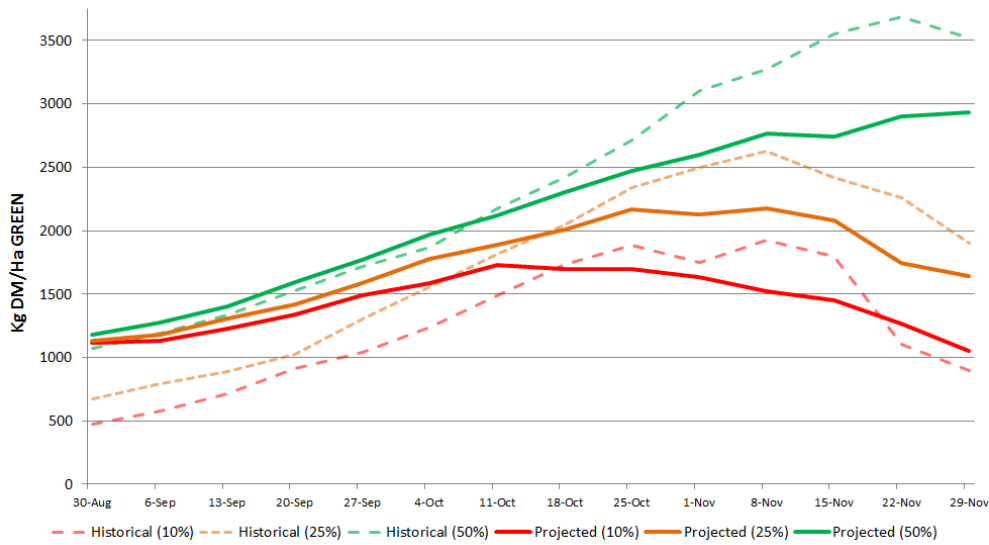| 10cm: | 20% |
| 30cm: | 43% |
| 50cm: | 18% |
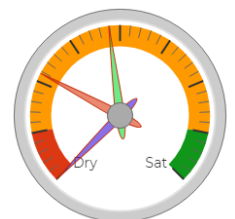
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
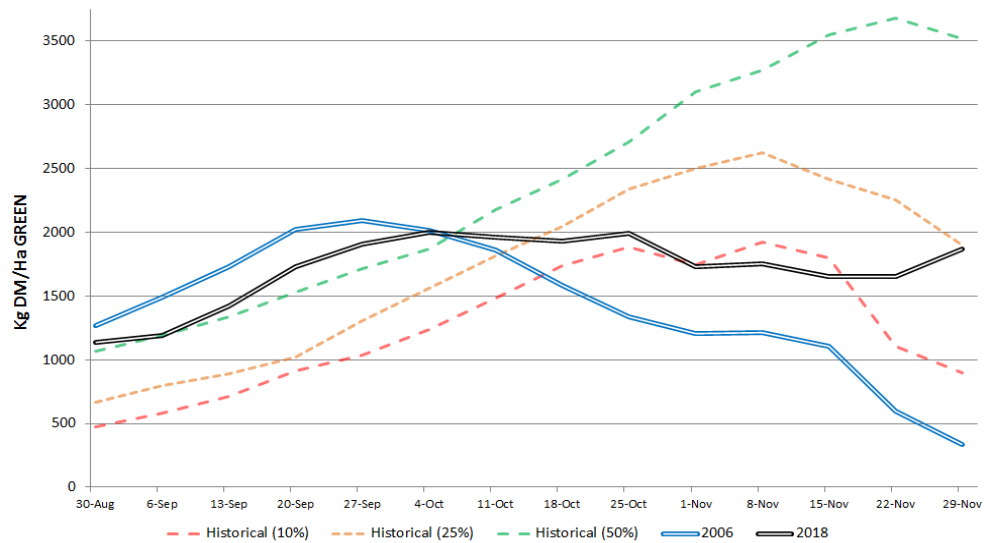**Green needle:** 1 year ago

Wheeo

Self replacing merino enterprise, 13 DSE, perennial grass, sub clover and annual grasses

Projected pasture supply for the 30 Aug to 30 Nov period

Historical (10%) — — — Historical (25%) — — — Historical (50%) — — — Projected (10%) ——— Projected (25%) ——— Projected (50%)

The solid lines don't start separating until early October – indicating that this site can handle a dry start to spring.

The 50% projection line (solid green line) would be a good outcome and result in a 'spring'. However, given the dry forecast this is unlikely.

The 25% projection line (solid brown line) represents a drier than average spring, but still reaches 2500kg DM/ha (green). This scenario would require relatively small changes to normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

The second graph shows the likely outcome if 2006 or 2018 spring conditions were repeated. 2018 saw a dry start to spring, but good rainfall from mid- October onwards.

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period

Historical (10%) — — — Historical (25%) — — — Historical (50%) — — — 2006 ——— 2018 ———

If 2018 spring conditions were experienced again scenario the black line ends up in a similar position to the 25% line, hovering around 2000kg DM/ha (green). This would result in a tight, but manageable spring.

2006 is regarded as one of the worst springs on record. The blue line shows green feed on a steady decline from late September onwards.

Soil moisture
(as of 4 September 2019)

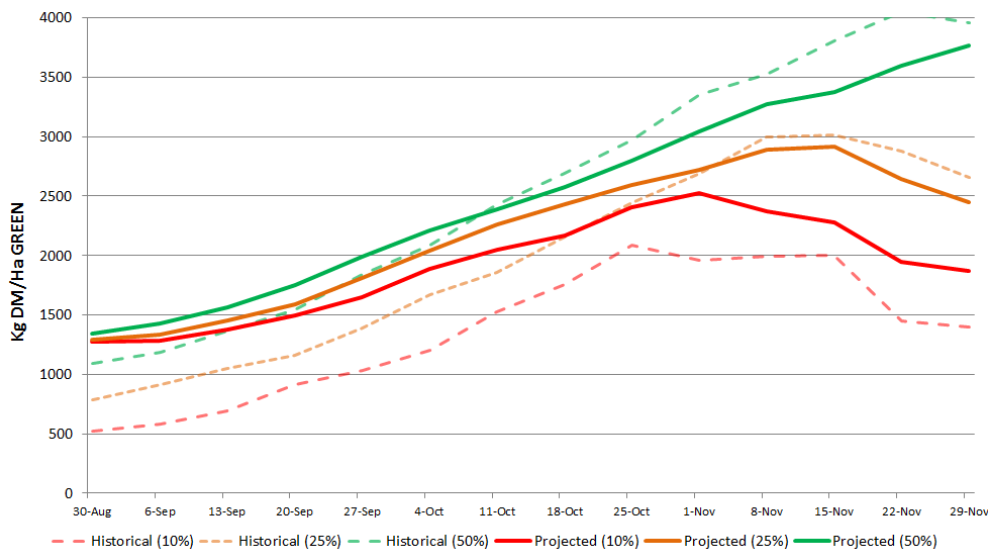|	
10cm:	50%
20cm:	100%
40cm:	82%
60cm:	22%
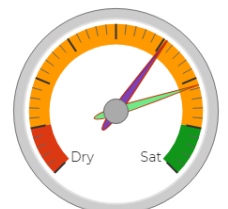
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
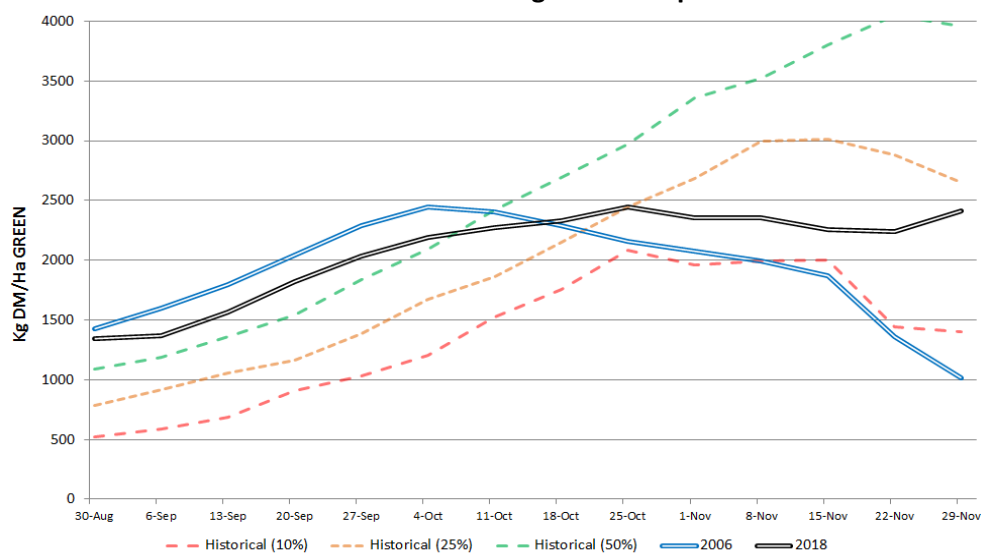**Green needle:** 1 year ago

Bannister

Beef breeding operation, 11.9 DSE, perennial grass, sub clover and annual grasses

Projected pasture supply for the 30 Aug to 30 Nov period

**Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 30 Nov period**

This site has received the most rainfall which is reflected in the good soil moisture levels at present (see bottom right). This site is also on basalt soil, so it has enormous capacity to store and hold moisture.

Pasture conditions at the start of the period are also good, sitting around the long term average of 1100kg DM/ha.

The three projected lines remain parallel as we move into spring, with soil moisture only becoming a major factor in late October.

Given that even the very dry scenario (solid red line) hits 2500kg DM/ha (green), it is likely that this site will yield a reasonably productive spring and no major changes will be required.
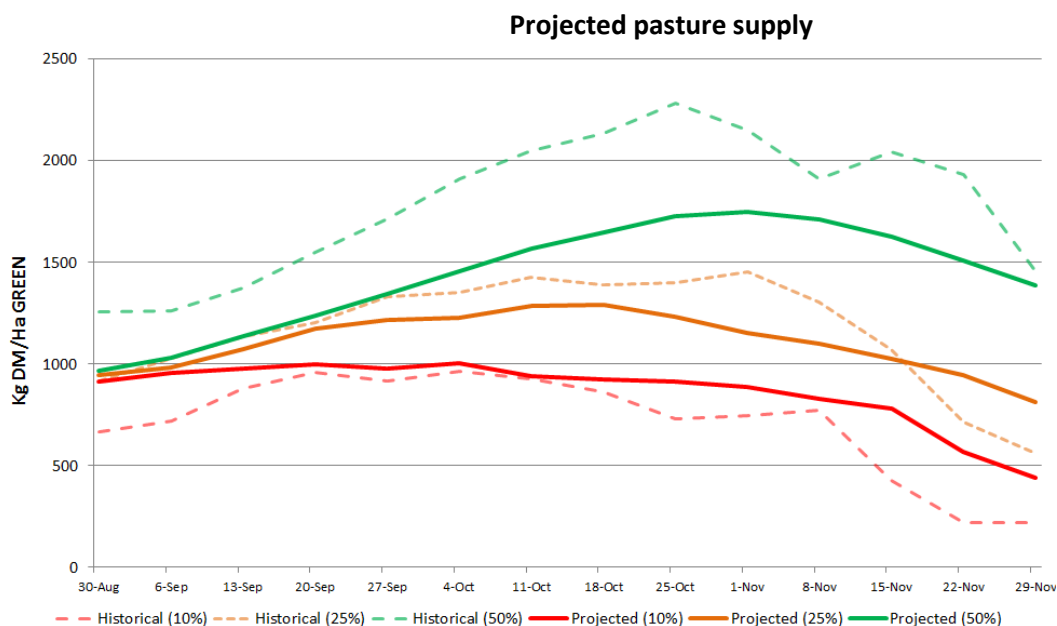
Soil moisture
(as of 4 September 2019)

10cm:	82%
20cm:	82%
40cm:	72%
60cm:	94%
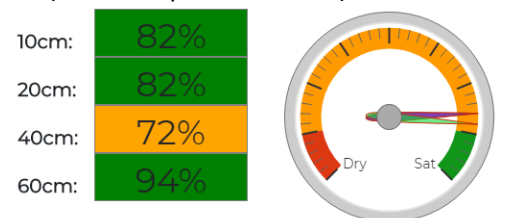
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Gunning

Self replacing merino flock, 12 DSE, microlaena, sub clover and annual grasses

Projected pasture supply

Rain by mid-September will be important to keep pastures going – this is where the solid lines start to separate.

The 50% projection line (solid green line) would be a good outcome and result in a 'spring'. However, unfortunately the dry forecast means that this is unlikely.

The 25% projection line (solid brown line) represents a drier than average spring. This would result in a tough spring, but one that can be managed with relatively small changes to your normal management.

The 10% projection line (very dry scenario) would require major changes to normal management i.e. selling young stock early, doing a 'clean up' cull of breeding females etc.

If a drier than average spring does eventuate, the major concern will be maintaining adequate ground cover during the summer/autumn period. These risks need to be managed.
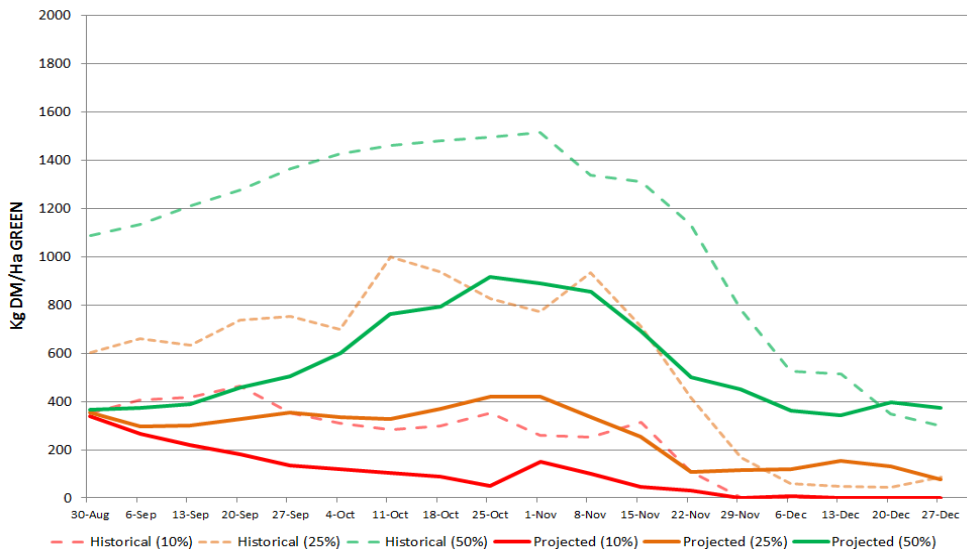
Soil moisture
(as of 4 September 2019)

Note: The Gunning moisture probe was relocated in August, and as a result is showing abnormally high moisture readings at present. This probe will take 2-3 months to settle in.
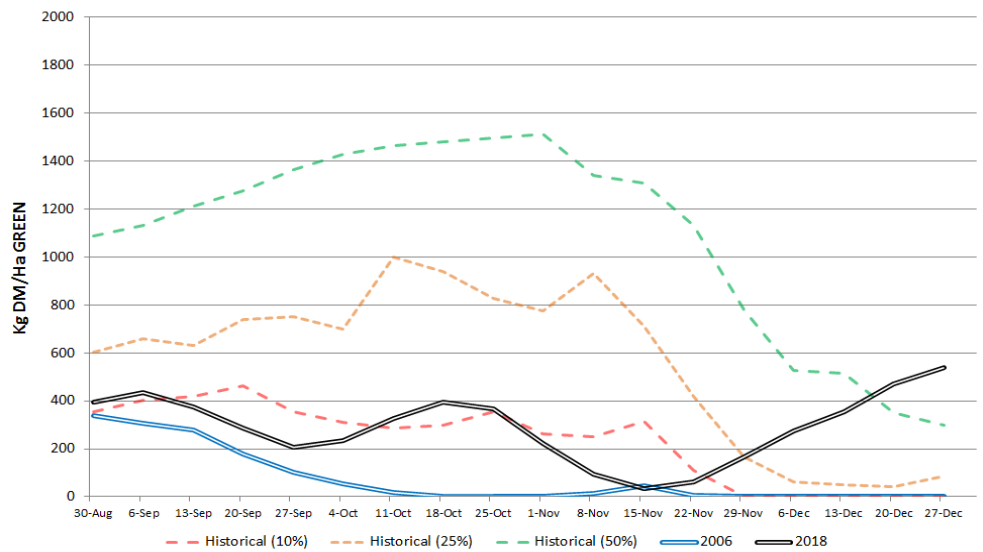
Bungonia

Self replacing merino flock, 7.0 DSE, phalaris, microlaena, sub clover and annual grasses

Projected pasture supply for the 30 Aug to 31 Dec period

The low pasture starting position combined with a very dry soil means that this site has a high chance of a very poor spring.

Early September rainfall will be critical to get pastures going again. However, even the 50% projection line (solid green line) would result in a tough spring and likely to require significant changes to normal management. For example selling young stock early, doing a 'clean up' cull of breeding females etc.

Below average spring rainfall will amplify the degree of action required (i.e. a heavier destocking strategy)

One of the major concerns at this site is the lack of carry-over feed and managing ground cover during the summer/autumn period. These risks need to be managed.

It's important to remember that summer storms are possible at

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 31 Dec period

Bungonia (eastern side of the range). These storms are driven by east coast lows – events that are totally random and can quickly change the situation from a pasture perspective.

This can be seen in the 2nd graph which shows the pasture response if a repeat of 2018 were to occur - note the 'kick' in pasture growth in late November as a result of rain.

Soil moisture
(as of 4 September 2019)

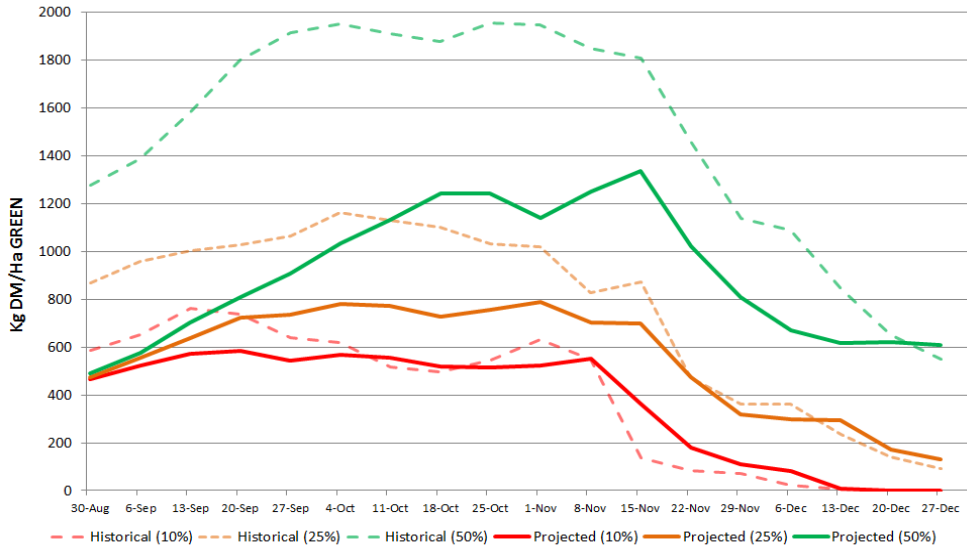|	
10cm:	3%
20cm:	9%
40cm:	27%
60cm:	13%
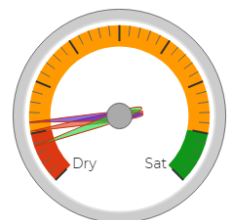
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
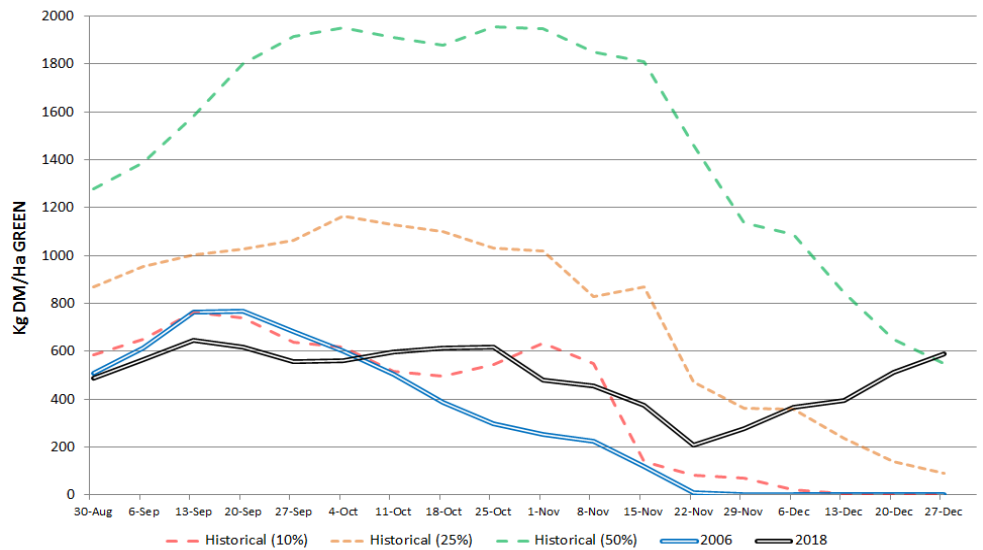**Green needle:** 1 year ago

Lake Bathurst

Merino x Terminal flock, 12.1 DSE, perennial grass, sub clover and annual grasses

Projected pasture supply for the 30 Aug to 31 Dec period

The low pasture starting position combined with a very dry soil means that this site has a high chance of a very poor spring.

Early September rainfall will be critical to get pastures going again. However, even the 50% projection line (solid green line) would result in a tough spring and likely to require significant changes to normal management. For example selling young stock early, doing a 'clean up' cull of breeding females etc.

Below average spring rainfall will amplify the degree of action required (i.e. a heavier destocking strategy)

One of the major concerns at this site is the lack of carry-over feed and managing ground cover during the summer/autumn period. These risks need to be managed.

It's important to remember that summer storms are possible at this location (eastern side of the range). These storms are driven by east coast lows – events that are totally random and can quickly change the situation from a pasture perspective.

This can be seen in the 2nd graph which shows the pasture response if a repeat of 2018 were to occur - note the 'kick' in pasture growth in late November as a result of rain.

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 31 Dec period

Soil moisture
(as of 4 September 2019)

10cm:	26%
20cm:	37%
40cm:	44%
60cm:	4%

Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Braidwood

Self-replacing beef enterprise, 10.4 DSE, phalaris, cocksfoot and sub clover pasture

Projected pasture supply for the 30 Aug to 31 Dec period
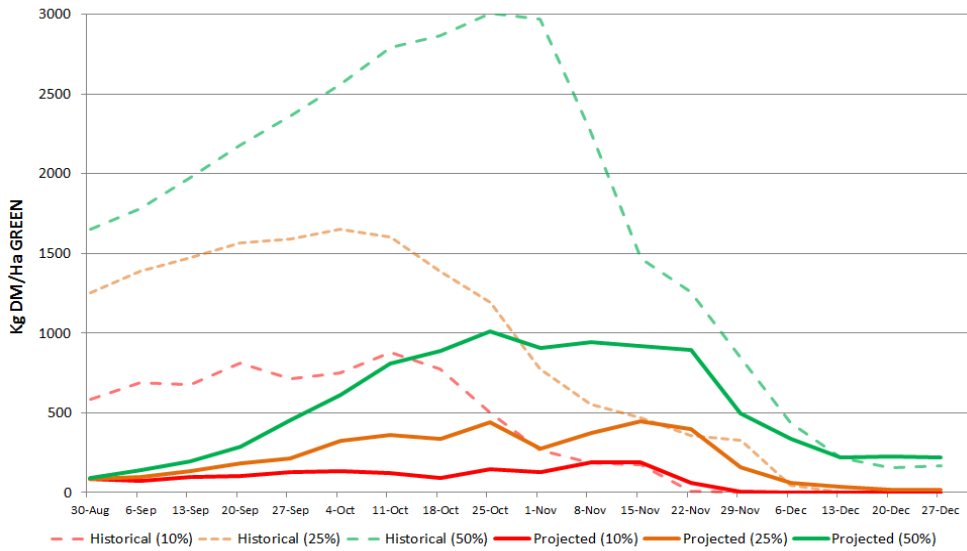
This site received the least amount of winter rainfall, recording only 50mm in total.

The low pasture starting position combined with a very dry soil means that this site has a high chance of a very poor spring.

Early September rainfall will be critical to get pastures going again. However, even the 50% projection line (solid green line) would result in a tough spring and likely to require significant changes to normal management. For example selling young stock early, doing a 'clean up' cull of breeding females etc.

Below average spring rainfall will amplify the degree of action required (i.e. a heavier destocking strategy)

One of the major concerns at this site is the lack of carry-over feed and managing ground cover during the summer/autumn period. These risks need to be managed.

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 31 Dec period
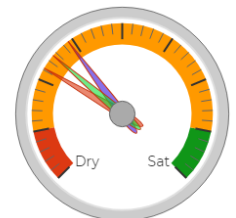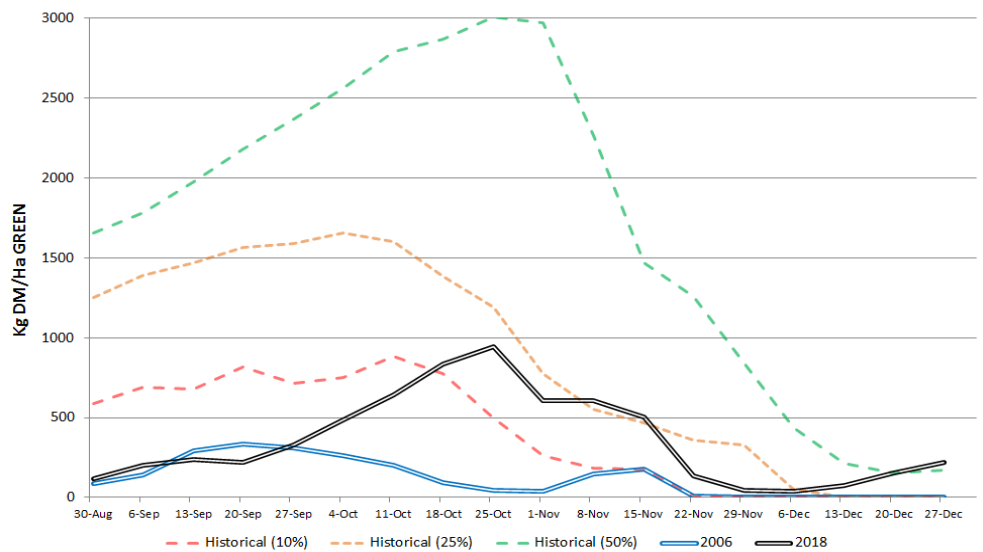

It's important to remember that summer storms are possible at this location (eastern side of the range). These storms are driven by east coast lows – events that are totally random and can quickly change the situation from a pasture perspective.

This can be seen in the 2nd graph which shows the pasture response if a repeat of 2018 were to occur - note the 'kick' in pasture growth in October and again in December.

Soil moisture
(as of 4 September 2019)

10cm:	34%
20cm:	41%
40cm:	21%
60cm:	16%
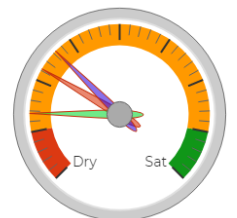
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Sutton Forest

Self-replacing beef enterprise, 10DSE, cocksfoot, perennial ryegrass and white clover pasture

Projected pasture supply for the 30 Aug to 31 Dec period
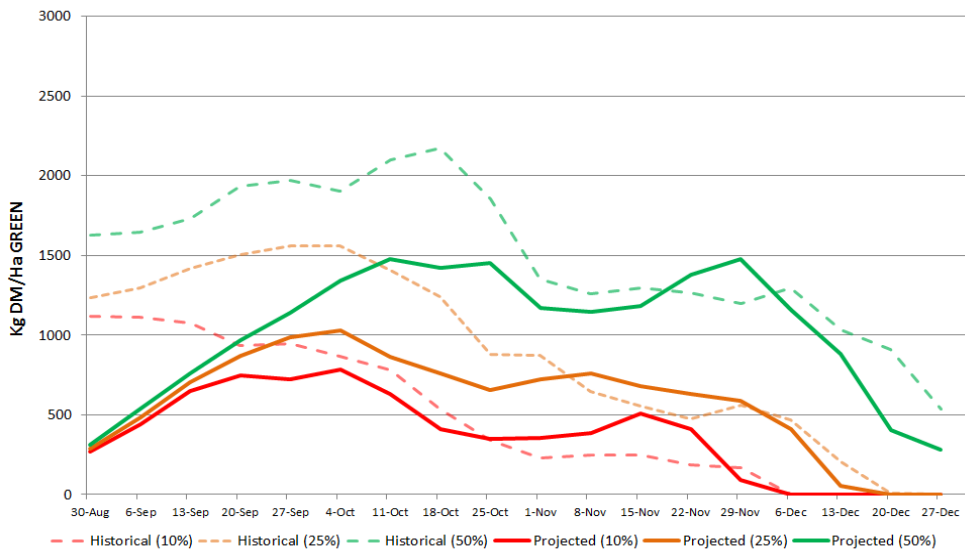
Like the other eastern fall sites, Sutton Forest missed out on the early August rainfall/snow and is starting spring with very little pasture. The site did however receive 20mm in the last week of August, increasing soil moisture down to 20cm (see bottom right)

The graph above shows that pastures will respond to this recent moisture, however follow-up rain will be needed by late September – this is the point where the solid lines start to separate.

Given the recent dry spring outlook, a tough spring is likely and significant changes to normal management will be required. For example selling young stock early, doing a 'clean up' cull of breeding females etc.

One of the major concerns at this site is the lack of carry-over feed and managing ground cover during the summer/autumn period. These risks need to be managed

However, it's important to remember that due to its location and proximity to the

Projected pasture supply using 2006 and 2018 weather for the 30 Aug to 31 Dec period

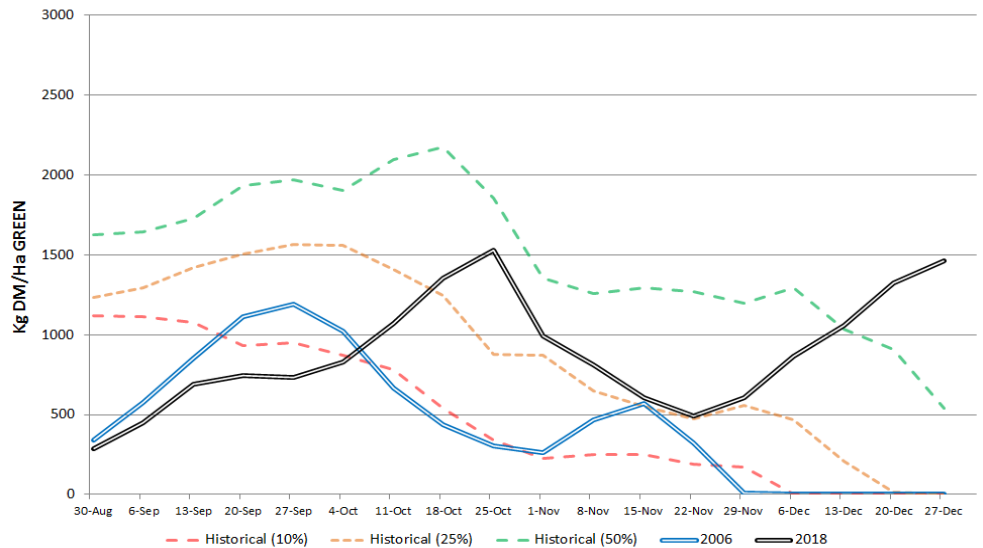coast, summer storms are possible and the late spring/ early summer period is often a key growth window in the Southern Highlands.

This can be seen in the 2nd graph which shows the pasture response if a repeat of 2018 were to occur. Note the significant kick in pasture conditions from late November onwards. This trend continued well into 2019, with the site recording 70mm of rain in January.

Soil moisture
(as of 4 September 2019)

10cm:	86%
20cm:	100%
40cm:	26%
60cm:	25%
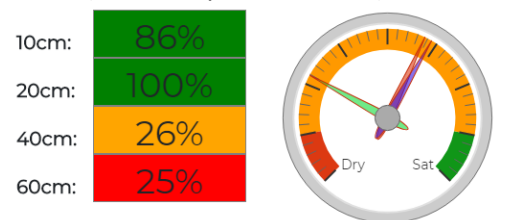
Red needle: current moisture (0 – 60cm)
Purple needle: 1 month ago
Green needle: 1 year ago

Appendix 1: Pasture benchmarks for sheep and cattle

Minimum herbage mass (kg green DM/ha) to maintain satisfactory production levels in sheep

Sheep Class	Pasture digestibility (green)		
	75%	68%	60%
Dry sheep	400	600	1200
Pregnant ewes			
mid	500	700	1700
last month	700	1200	ns
Lactating ewes			
single	1000	1700	ns
twins	1500	ns	ns
Growing stock, % of potential growth			
30 [116 g/d]*	400	700	1700
50 [194 g/d]	600	1000	ns
70 [270 g/d]	800	1700	ns
90 [348 g/d]	1600	ns	ns

*Predicted growth rates in brackets are based on a weaned 4-month old crossbred lamb of approximately 32 kg from a ewe with a standard reference weight of 80 kg.

Minimum herbage mass (kg green DM/ha) to maintain satisfactory production levels in cattle

Cattle Class	Pasture digestibility (green)		
	75%	68%	60%
Dry cow	700	1100	2600
Pregnant cow (7–8 months/ not lactating)	900	1700	ns
Lactating cow + 2 mth old calf	1100	2200	ns
Growing stock, % of potential growth			
30 [0.45 kg/d]*	600	1100	2900
50 [0.76 kg/d]	800	1600	ns
70 [1.07 kg/d]	1200	2600	ns
90 [1.37 kg/d]	2200	ns	ns

*Predicted growth rates in brackets are based on a weaned 13-month old steer of approximately 320 kg from a cow with a standard reference weight of 550 kg.

ns = not suitable, that is, at these digestibilities no matter how much pasture is available dry or pregnant stock are unlikely to maintain weight, lactating stock are likely to experience an unacceptable level of weight loss and growing stock will not achieve the targeted weight gain.

Note: The benchmarks relate specifically to the nutritional requirements of livestock. At lower herbage masses, particularly those indicated for sheep, there is a risk of excessive run-off and soil erosion through lack of ground cover.

Note: The predictions in Tables 2.1 and 2.2 are based on a pasture which also includes 500 kg DM/ha of dead pasture with a digestibility of 47% and a legume content of 15%.

Source: *PROGRAZE^(TM): profitable, sustainable grazing*, Ninth edition, NSW Department of Primary Industries 2017.

Appendix 2: What drives spring rainfall in southern NSW?

The two key drivers of spring rainfall in southern NSW are:

1. El Nino Southern Oscillation (ENSO)
2. Indian Ocean Dipole (IOD)

El Nino Southern Oscillation Index

The El Nino Southern Oscillation (ENSO) takes place in the **Pacific Ocean**. Due to its large size and proximity ENSO has a significant influence on rainfall in south eastern Australia during the winter and spring periods. Typically ocean temperatures on the eastern edge of the Pacific (South America) are cooler than those on the Western Pacific (Indonesian Archipelago) creating a temperature and pressure differential which drives south easterly air flow, known as 'Trades' towards Australia. This circulation pattern (known as 'Walker' circulation) can either be enhanced or inhibited by changes in sea surface temperatures.

There are three distinct phases of ENSO:

1. Neutral
2. La Nina (wet)
3. El Nino (dry)

Neutral

This is the most dominant phase, characterised by sea surface temperatures within a ±0.8 °C anomaly at the mid-Pacific equator. While ENSO sits in the 'neutral' phase for more than half the time, droughts and floods are still possible.
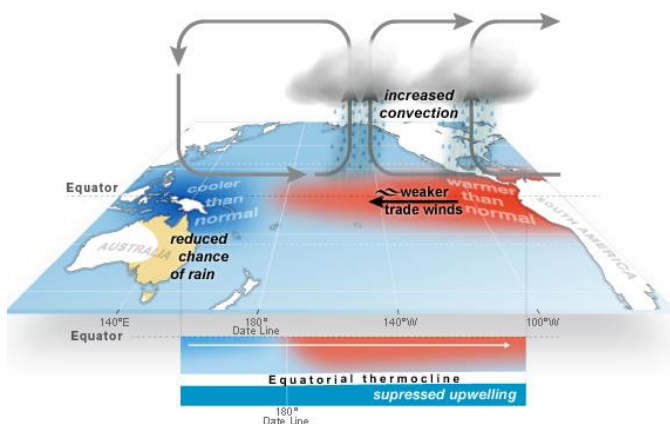
La Nina (wet phase)

La Nina is characterised by cool sea surface temperature anomalies below -0.8°C at the mid Pacific equator at Nino 3.4. These cooler ocean temperatures enhance the trade winds air flow towards Australia and increase the probability of rainfall over south eastern Australia during winter and spring.

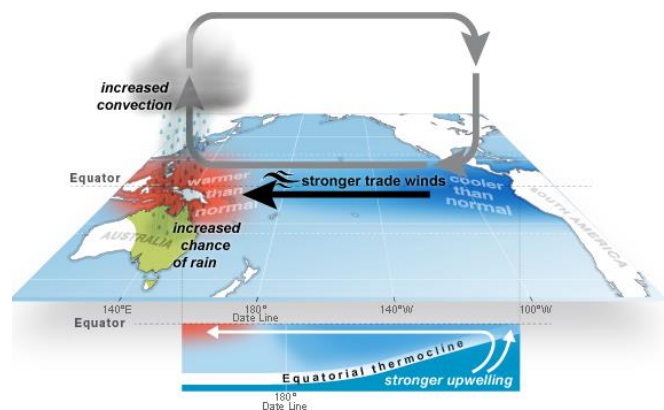**El Nino (dry phase)**

The El Nino is characterised by warm sea surface temperatures above +0.8°C at the mid-Pacific equator at Nino 3.4. The warmer ocean temperatures reduce the south easterly trade winds air flow, and reduce the probability of rain during winter and spring.

El Nino (dry phase)   **La Nina (wet phase)**

Source: Bureau of Meteorology (2016)

Southern Oscillation Index

The Southern Oscillation Index (SOI) gives an indication of the development and intensity of El Nino or La Nina events in the Pacific Ocean. The SOI is calculated using the pressure differences between Tahiti and Darwin. Sustained negative values of the SOI lower than −7 often indicate El Nino episodes. Sustained positive values greater than +7 are typical of a La Nina episode.

Indian Ocean Dipole

The Indian Ocean Dipole (IOD) is a similar ocean-atmosphere phenomenon like ENSO operating in the Indian Ocean at an inter-annual time scale. It appears to impact on rainfall in south eastern Australia from June to November, before fading with the onset of the tropical monsoon. The IOD also has three distinct phases:

1. Positive
2. Neutral
3. Negative

Positive IOD (dry phase)

The positive phase is characterised by cooler sea surface temperatures in the south eastern equatorial Indian Ocean off the coast of Sumatra and warmer sea surface temperatures in the western Indian Ocean off the coast of Madagascar, Africa. This temperature differential enhances westerly air flows across the Indian Ocean, decreasing the probabilities of rainfall for south eastern Australia during winter and spring period.

Negative IOD (wet phase)

In its negative phase IOD is characterised by warmer sea surface temperatures in the south eastern equatorial Indian Ocean near Australia and cooler sea surface temperatures in the western equatorial Indian Pacific near Africa, increasing the probability of rainfall over south-eastern Australia during winter and spring.

Positive IOD mode (dry phase)
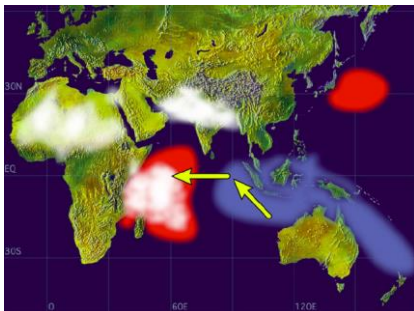
Negative IOD mode (wet phase)
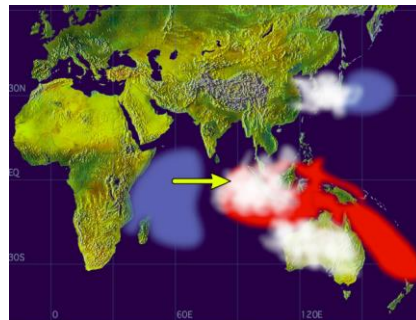
Source: NSW DPI (2011)

Impacts of ENSO and IOD events

Studies have shown a strong link between rainfall variability in eastern Australia and sea surface temperatures around northern Australia and Indonesia. ENSO and IOD both influence rainfall over south-eastern Australia.

Often our wettest winter/spring periods occur when a La Nina and negative IOD interact. Often our driest winter/spring periods occur when El Nino and positive IOD interact. It is important to note though there are exceptions to this e.g. 2006 was a neutral ENSO and neutral IOD year and in many locations was recorded as one of the driest years on record.

Appendix 3: Managing ground cover to reduce erosion and protect pastures

Drought puts significant pressure on the whole farming system, including pastures and soil. Managing pastures to maintain adequate levels of ground cover is the most cost-effective way to reduce soil erosion and nutrient loss. Your soil is your most valuable asset. Eroded soil cannot be readily replaced and will have a major impact on the future productivity of your property. Bare soil also presents a big opportunity for weeds to invade pastures.

Research done at Scone (625mm rainfall) shows that at least 70% ground cover is required to prevent excessive run-off and erosion. As shown in Figure 1, once groundcover falls below the 70% mark the risk of soil loss via erosion increases exponentially.

While the 70% is the general rule of thumb, the minimum amount of ground cover required to prevent excessive erosion will largely depend on soil characteristics, slope gradient and length of slope (Table 1).

The following page contains some examples of varying levels of ground cover.

For further information refer to the NSW DPI Agfact: *Maintaining groundcover to reduce erosion and sustain production* (available here).

Figure 1: Effect of groundcover on the amount of soil loss and water run-off from pastures.
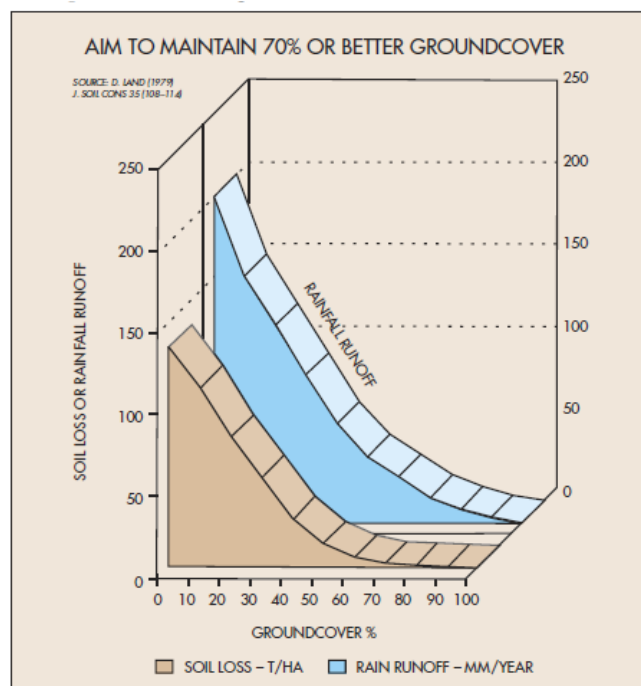
Source: Lang 2005

Table 2: Estimates of minimum amounts of groundcover (%) required to reduce excessive run-off and erosion in Tableland regions

Armidale, Orange		Paddock slope			
Erodibility	Typical soil types	Flat	Gentle	Moderate	Steep
Low	• deep sands	60	65	80	90
Low—moderate	• sandy loams, light clays • uniform clays, kraznozems and euchrozems (ferrosols)	60	70	85	95
Moderate—high	• loams • self-mulching black earths (vertosols)	60	75	85	100
High	• silts, fine sandy loams • red-brown earths (chromosols), red and yellow earths (kandosols) • solodics (sodosols)	60	80	90	100
Low—high	• drainage lines (all soil types)	100	100	100	100

Source: Lang 2005

A guide to estimating of ground cover

Ground cover levels will vary across a paddock, so it's important to assess a representative part of the paddock. A visual assessment of ground cover involves standing with your feet around half a metre and looking down on the pasture. Visualise a 0.5 x 0.5m square in front of your feed and assess the proportion of area covered by plant material and litter. 100% ground cover means you can't see any bare ground. 50% ground cover means that around half of the area is bare ground.

Photo 1: 90% ground cover

Photo 1 is a very short native pasture that still has a good amount of ground cover – approximately 90%.

When referring to Table 2, this would be a safe level of ground cover for all soil types and slopes, except for really steep country (slope gradient > 20%).

Photo 2: 50% ground cover

In photo 2 we are starting to see some bigger gaps. Ground cover is estimated to be around 50%.

Going from the previous table, even on flat country this level of ground cover is below the minimum 60% level required to prevent excessive erosion.

Further information

For further information on weather forecasting and climate drivers see:

NSW DPI fact sheet "Drivers of Climate Variability in the Murray Darling Basin"
http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/402863/climate-variability-drivers-in-mdb.pdf

Tablelands Farming Systems fact sheet "Weather forecasting explained"
http://www.tablelandsfarmingsystems.com.au/wp-content/uploads/2016/07/TFS-Factsheet-no1_April-2016_weather-forecasting-explained.pdf

Bureau of Meteorology ENSO wrap up: http://www.bom.gov.au/climate/enso/

Bureau of Meteorology Climate Outlook:
http://www.bom.gov.au/climate/outlooks/#/overview/summary/

NSW DPI Agfact: "Maintaining groundcover to reduce erosion and sustain production":
https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/162306/groundcover-for-pastures.pdf