Quantifying climate change on a regional scale

CLIMATE change gets the blame for just about everything these days. Droughts, fires, floods, cyclones (if only), future famines, anxiety, depression asthma etc. It seems more than likely that some of the claims are true, but which ones? And how can farmers measure the extent of climate change in their own area and on their own farm?

The Bureau of Meteorology (BOM) and CSIRO have managed to put some hard numbers on climate change at a regional level. After all, individual farmers, and maybe even individual countries, can't do much about the problem. The best they can hope for is to quantify it and maybe tailor their management practices around it.

The regional climate guides (see next story) are a good first step in providing detailed information that farmers can use in crop and livestock management – rather than just saying the climate is warming. For farming, the climate devil is in the detail, and the more detail that can be provided on a local level, the better.

We picked three of the 56 Natural Resource Management (NRM) regions in the regional climate guides, which are downloadable from the BOM website, to give a good spread across the Australian cotton belt. The three regions were Fitzroy Basin (Emerald), North West NSW and the Riverina. Most of the analysis consists of a comparison between the past 30 years (1989-2018) and the previous 30 year period (1959–1988).

What they had in common

Despite the concentration of everyone's mind at the moment on the current drought, the annual rainfall over time has remained relatively stable in all three regions. It fell by only three per cent at Moree and four per cent in the Riverina and Central Queensland between the two 30 year periods.

While the total rainfall may have been similar, the timing and distribution have shown some major changes, which have a significant impact on farm management. In all cases, there have been fewer wet years and more dry years over the past 30 years than in the previous 30.

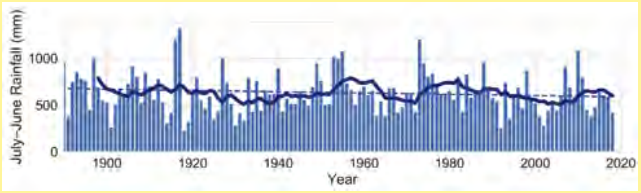
All areas had higher evaporation rates over the past 30 years and significantly more hot days (over 38°C). At both Hay and Moree, there was a clear trend to higher frost risk later in the winter cropping season – possibly due to less spring rain and more clear sunny days.

Central Queensland

Annual rainfall (July to June) in the Fitzroy Basin has been relatively stable, decreasing by around 30 mm (4 per cent) from about 700 mm to about 670 mm over the past 30 years (1989–2018) when compared to the previous 30 years (1959–1988). Figure 1 shows annual rainfall (blue bars), with a 10-year running average (solid blue line) for Emerald. Although the average annual rainfall has been relatively stable, it still fluctuates from year to year with natural variability.

In the past 30 years (1989–2018), dry years (lowest 30 per cent) have occurred 11 times and wet years (highest 30 per cent) have occurred five times, while the remaining years were in the average range. During the previous 30-year period (1959–1988), drier seasons occurred eight times and wetter seasons occurred nine times.

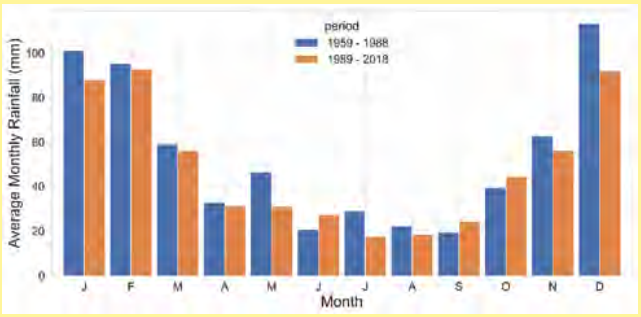
FIGURE 1: Emerald Post Office annual (July to June) rainfall 1889–90 to 2018–19



Rainfall decreased in the summer months at Emerald (Figure 2). Over the past 30 years, summer rainfall (December to April inclusive) for Emerald was 360 mm; 42 mm lower than the 402 mm average for the previous 30-year period (1959–1988).

Over the same 30-year periods, winter rainfall (May to November inclusive) decreased by 21 mm at Emerald, from 240 mm to 219 mm.

FIGURE 2: Emerald Post Office 30-year average rainfall by month



At both Emerald and Taroom, the monthly average evaporation rates have increased by about 10 mm per month in the spring months. Taroom has also seen an increase in summer. This pattern is consistent with other sites across the Fitzroy Basin region.

The Fitzroy Basin has experienced more hot days in the past 30 years. For example, Taroom experienced an average of 11 days per year above 38°C between 1989–2018, compared to an average of six days per year above 38°C between 1959–1988.

North West NSW

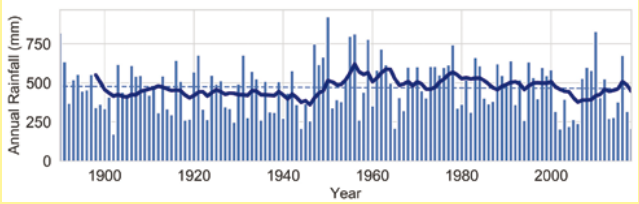
In the past 30 years in North West NSW:

- Annual rainfall has been relatively stable;
- Dry years have occurred seven times and wet years have occurred nine times;
- Rainfall has decreased in the autumn and spring months;
- Summer rainfall has been reliable, winter has been unreliable;
- Spring frosts have been more common and have been occurring later; and,
- There have been more hot days, with more consecutive days above 38°C.

Annual rainfall in north west NSW has reduced by around 20 mm (three per cent) from about 610 mm to about 590 mm over the past 30 years (1989–2018) when compared to the previous 30 years (1959–1988). Figure 3 shows annual rainfall (blue bars), with a 10-year running average (solid blue line) for Walgett.

Although the average annual rainfall has remained unchanged, there have been fewer wet years in the latest period.

FIGURE 3: Walgett Council annual rainfall 1889–2018



Rainfall decreased in the autumn and spring months at Moree between 1989–2018 compared with 1959–1988. Over the past 30 years, winter growing season rainfall (April to October inclusive) for Moree was 35 mm lower than the previous 30-year period (1959–1988).

Later and more frequent frosts

The number of potential frosts has increased at Tamworth between 1989–2018 (Figure 4 – orange bars) compared with 1959–1988 (blue bars). The largest frost frequency increase was in late winter and early spring. There were an average of eight more frost nights in August-September between 1989–2018 compared to 1959–1988.

More frosty nights tend to occur through dry winter and spring periods, when soil moisture is low, and cloud cover infrequent. On average, the North West region has had 15 more cold season (April–October) frost nights during dry winters compared to wet winters.

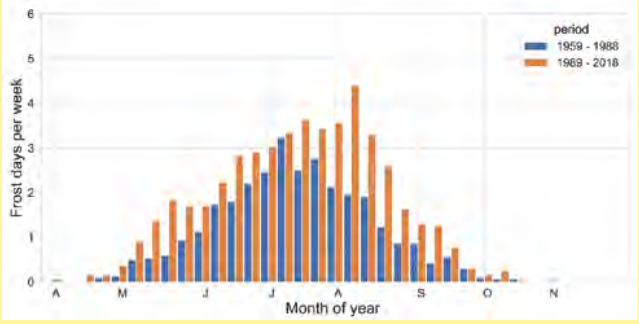
The North West has experienced more hot days (over 38°C) in the past 30 years.

The Riverina

In the last 30 years in the Riverina:

- Annual rainfall has been relatively stable;
- Rainfall has decreased in the autumn and spring months;
- Winter rainfall has been reliable; autumn has been unreliable;
- Dry years have occurred 10 times and wet years have occurred 11 times;
- Spring frosts have been more common and have been occurring later; and,

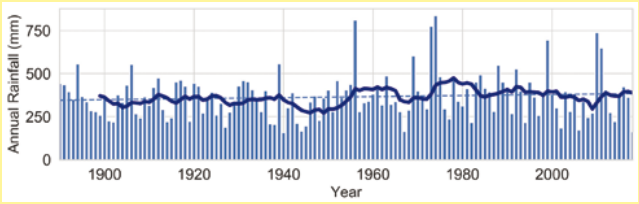
FIGURE 4: Tamworth Airport frost occurence and likelihood by week



- There have been more hot days, with more instances of consecutive days above 38°C.

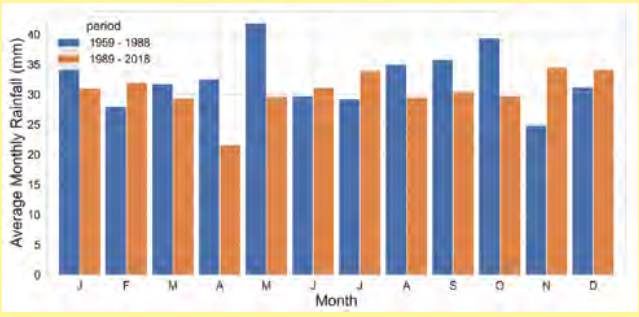
Annual rainfall in the Riverina has fallen by around 20 mm (four per cent) from about 520 mm to about 500 mm when compared to the previous 30 years (1959–1988). Figure 5 shows annual rainfall (blue bars) with a 10-year running average (solid blue line) for Hay. Although the average annual rainfall has remained stable, there have been almost twice as many dry years in the recent period.

FIGURE 5: Hay annual rainfall – 1890–2018



Rainfall in the autumn and spring months decreased at Hay (Figure 6).

FIGURE 6: Hay 30-year average rainfall by month

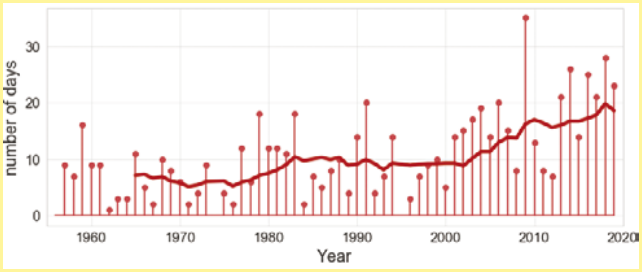


The number of potential frosts increased at Hay, with an average of five more spring nights with the potential for frost between 1989–2018 compared to 1959–1988.

The Riverina has experienced more hot days in the past 30 years

Figure 7 shows the annual number of days above 38°C (red bars), with a 10-year running average (solid red line) for Griffith. Griffith experienced an average of 14 days per year above 38°C between 1989–2018, compared to an average of eight days per year above 38°C between 1959–1988. Other locations around the region showed a similar pattern.

FIGURE 7: Griffith Airport AWS days above 38°C



Over the past 30 years, unprecedented temperatures of 45°C have been recorded at Griffith 15 times and there have been more instances of consecutive days per year above 38°C.