Our Changing Climate

Kojonup At A Glance

This agri-climate profile provides historical and projected climate information to support farm business decision-making in relation to a changing climate in the Kojonup area.

Introduction

Climate change and climate variability have already severely impacted on Western Australian (WA) broadacre crop and animal production over the past years, with serious rainfall deficiency and frost challenging farm profitability and sustainability. Historical data shows that a decrease in rainfall and an increase in temperature have already occurred over the last century. Climate projections for the south west of WA indicate further rainfall decline and higher temperatures.

The grain belt of WA contributes more than $4.5 billion to WA's economy per year. Kojonup (lat 33.8 S, long 117.1 E) is situated 250 km south-east of Perth on the western edge of the southern grain belt. This agri-climate profile provides a historical analysis and future projections for a range of climate variables relevant to farm businesses in the Kojonup area.

Changes at a Glance

Around the mid 1970s there was a shift to consistently drier winter conditions in south-west WA. Kojonup has experienced an eight percent decrease in annual rainfall and a ten percent decrease in growing season rainfall (April-October) from 1939-1974 to 1975-2010.

Since the mid 1970s there has been a change in the rainfall distribution. Kojonup has experienced fewer wet years and winter rainfall events are smaller.

The observed trends in climate include: a significant decline in winter rainfall, decline in annual and growing season rainfall, loss of wet years, more drier years and increase in maximum and minimum temperatures.

Adapting to Climate Change

Climate change and variability represents a significant challenge to grain production in Western Australia. Since the 1970s rainfall has declined significantly in agricultural areas, while day and night-time temperatures, particularly in winter and autumn, have gradually increased. Seasonal rainfall has also become more variable with later starts to the growing season and a general shift to more summer and less winter rainfall. To maintain viable enterprises growers require ways to successfully navigate these climatic and seasonal changes and the agronomic challenges they generate.

Adaptation requires technological and research based approaches to strengthen the resilience of farm businesses. Sustainable alternatives to maintain profits are needed – new establishment techniques, innovative farming systems or alternative crops may all help to address climate challenges.

Improved networks of communication, decision-making and knowledge production are also needed. Demonstrations of practical ways in which farming systems can adapt to climate change is the aim of the National Adaptation and Mitigation Initiative (NAMI) that includes demonstration sites in the WA grain belt.

The collaborative NAMI project led by DAFWA involves major grower groups across the WA grain belt, as well as the Commonwealth and Scientific Industrial Research Organisation (CSIRO), the University of WA and private consultants.

Project DAW00202 'Demonstrating adaptation to climate change in the wheatbelt of Western Australia through innovative on-farm and virtual farm approaches' is funded by the Department of Agriculture and Food, Western Australia, the Grains Research and Development Corporation and the Australian Government's Climate Change Research Program

Historical analysis

The following results provide a historical analysis for a range of climate variables. Given the observed shift in the mid 1970s, historic trends are shown for two periods of equal length 1939-1974 and 1975-2010 and for the last decade 2000-2010.

Rainfall

Total annual rainfall has decreased by eight percent from 1939-1974 to 1975-2010.

The growing season rainfall (April-October) declined by ten percent since the mid 1970s with a further seven percent decline since 2000 (Figure 1).

The chance of two consecutive drought years (decile 3 or below growing season rainfall) has increased from three percent in the period 1939-1974 to 15 percent in the period 1975-2010.

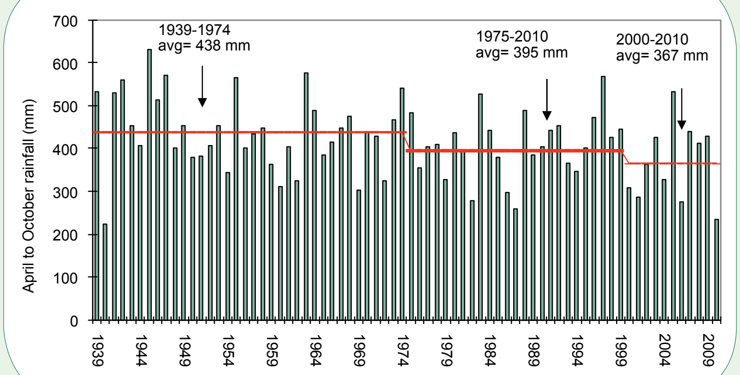


Figure 1: Time series of growing season (April-October) rainfall (mm). Horizontal lines represent averages for the periods 1939-1974, 1975-2010 and 2000-2010.

Around the mid 1970s there was a shift to consistently drier winter conditions. Figure 2 shows a significant decline in June rainfall from the period 1939-1974 to 1975-2010.

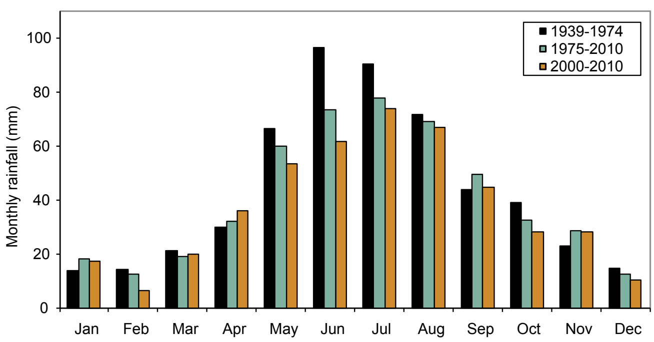


Figure 2: Average monthly rainfall (mm) for the periods 1939-1974, 1975-2010 and 2000-2010.

Figure 3 shows the reduction in June rainfall is due to fewer days with big rainfall events (greater than 5 mm). The average number of rain days per month has remained relatively the same for all months (Figure 4). For the period 1975-2010, the average size of rainfall events per rain day is significantly greater in April (Figure 5).

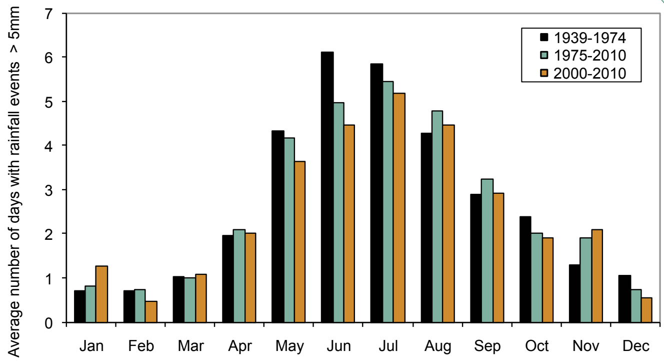


Figure 3: Average number of days with rainfall events greater than 5 mm per month for the periods 1939-1974 and 1975-2010 and 2000-2010.

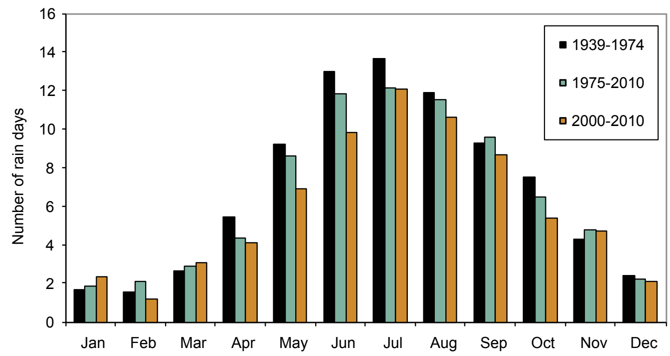


Figure 4: Average number of rain days per month for the periods 1939-1974 and 1975-2010 and 2000-2010.

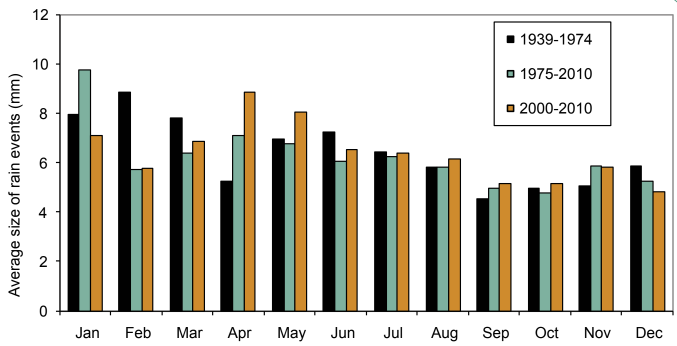


Figure 5: Average size of the rainfall events per rain day per month for the periods 1939-1974 and 1975-2010 and 2000-2010.

Temperature

Since the mid 1970s, mean monthly maximum temperatures have significantly increased in April and May (Figure 6).

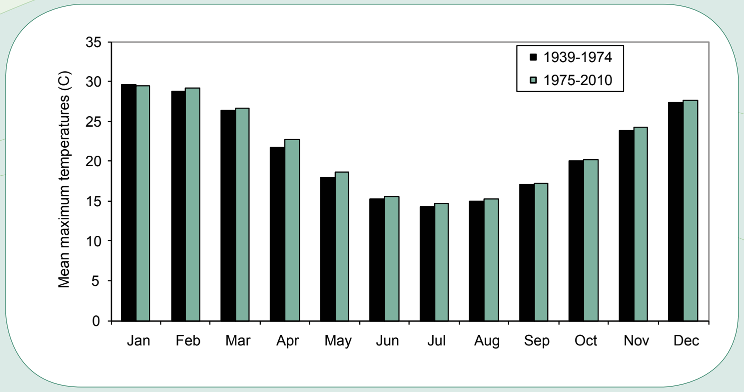


Figure 6: Mean monthly maximum temperature for the periods 1939-1974 and 1975-2010.

Mean minimum temperatures have significantly increased in April and November (Figure 7).

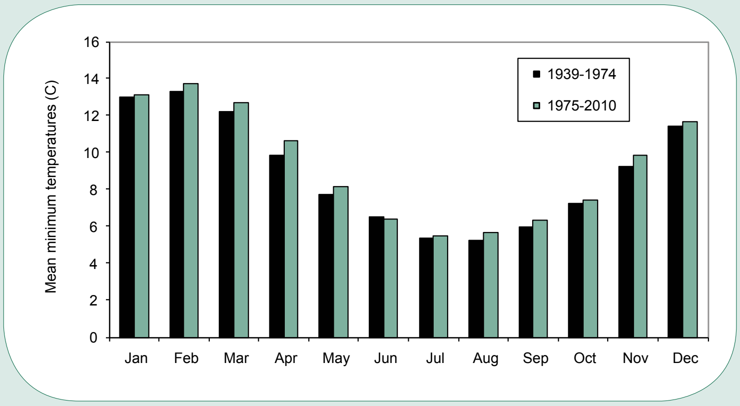


Figure 7: Mean monthly minimum temperature for the periods 1939-1974 and 1975-2010.

The number of days with extreme temperatures, or maximum temperature above 35˚C, has remained relatively the same (Figure 8).

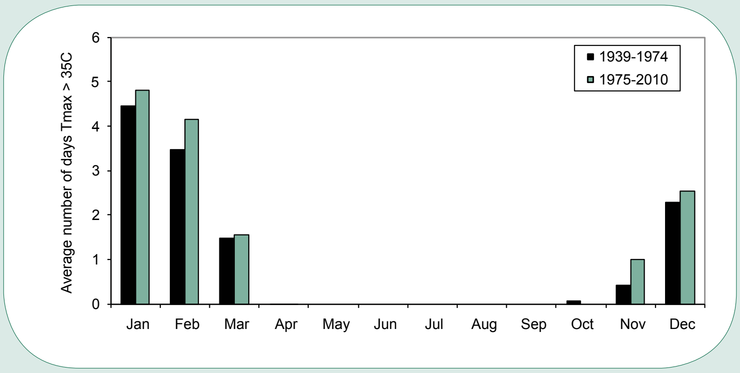


Figure 8: Average number of days per month with maximum temperature above 35˚C for the periods 1939-1974 and 1975-2010.

The number of frost days, or days with minimum temperature below 2˚C, has also remained relatively the same. The average date of the last frost was October 3 in the period 1939-1974 and October 13 in the period 1975-2010. Since 2000, the average date of the last frost is October 7. This indicates that the frost risk around flowering exists (Figure 9).

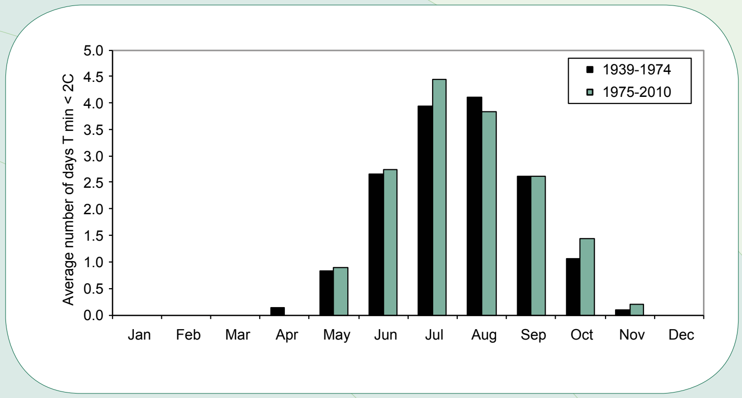


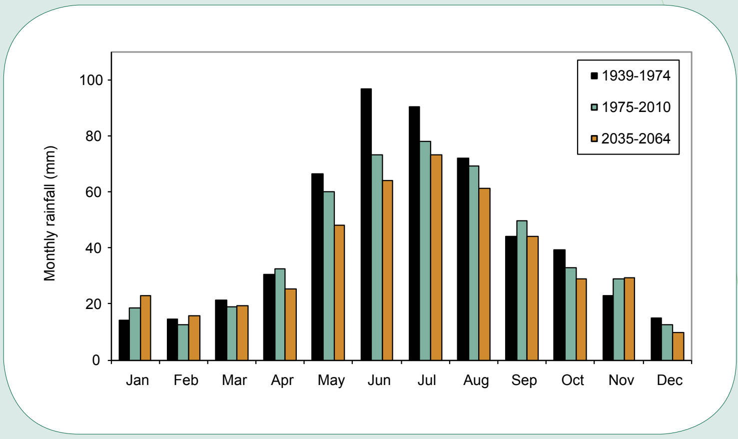
Figure 9: Average number of days per month with minimum temperature below 2˚C for the periods 1939-1974 and 1975-2010.

Projected changes

The following results provide future projections for rainfall and temperature for the period 2035-2064. Projections were obtained using the emission scenario A2 and downscaled data from the CSIRO Global Climate Model CCAM.

Rainfall

Rainfall projections indicate a drying pattern from April to August (Figure 10).



Temperature

Temperature projections indicate increasing mean maximum temperatures (Figure 11).

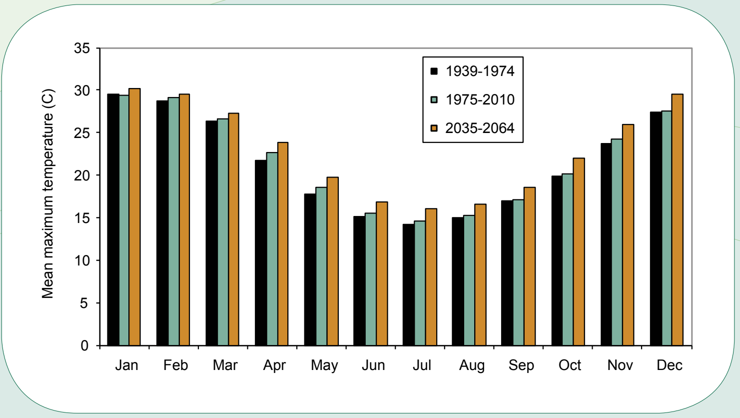


Figure 11: Historical mean monthly maximum temperature for the periods 1939-1974 and 1975-2010 and projections for the period 2035-2064.

What are the agronomic implications?

- Since 1975, the break of the season has stayed relatively the same (Figure 12). The average break of the season, derived from a sowing rule that uses a sowing window starting from April 25, has shifted from May 25 for the period 1939-1974 to May 24 for the period 1975-2010. For the last decade the average break was May 27.

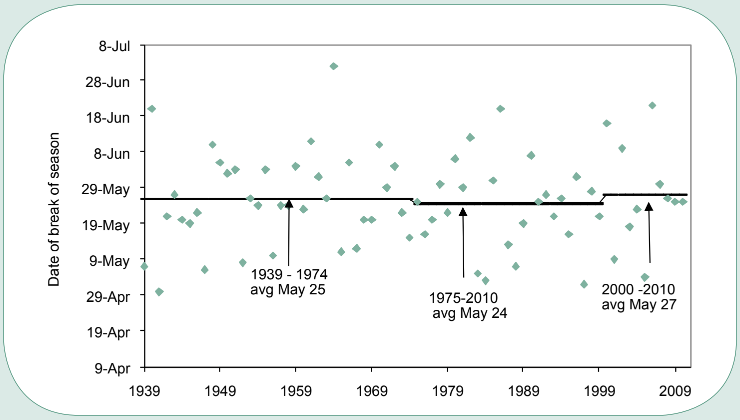


Figure 12: Time series of date of break of the season. Horizontal lines show averages for the periods 1939-1974, 1975-2010 and 2000-2010.

- The decline in the average number of days with rainfall events greater than 5 mm in winter has led to an important reduction in reliability of runoff into farm dams.
- The decline in growing season rainfall has led to greater evaporation losses and less water stored deep in the soil. This translates into less available soil moisture during spring, increasing moisture stress and resulting in flower abortion and reduced ability to fill the grain.
- Due to a decline in winter rainfall, pasture production will be reduced. Flexible lot feeding or confined feeding systems will need to be established to maintain or finish stock. Perennial pastures and native pastures should be viewed as a probable alternative to annual pastures.

In response to these climate challenges NAMI is exploring management options such as fallowing to conserve moisture in the following season, pre-seeding weed control to reduce the in-crop weed burden and varietal mixtures to manage frost risk.

Further reading:

Department of Agriculture and Food, Western Australia website: www.agric.wa.gov.au.

Climate Kelpie: www.climatekelpie.com.au.

Indian Ocean Climate Initiative: www.ioci.org.au

Climate Change in Australia: www.climatechangeinaustralia.gov.au.

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