

Local climate trends and implications

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Local climate trends and implications

Part 1


How trends have impacted on current production systems

Part 2

Outline of a workshop for managing climate risk



Part 1 - The data for analysis

- Location was Mildura
 - Trends will be same direction and similar scale
 - Actual records from 1947 for daily temp and monthly but from 1890 for rainfall
 - Some analysis over summer so not strictly calendar years
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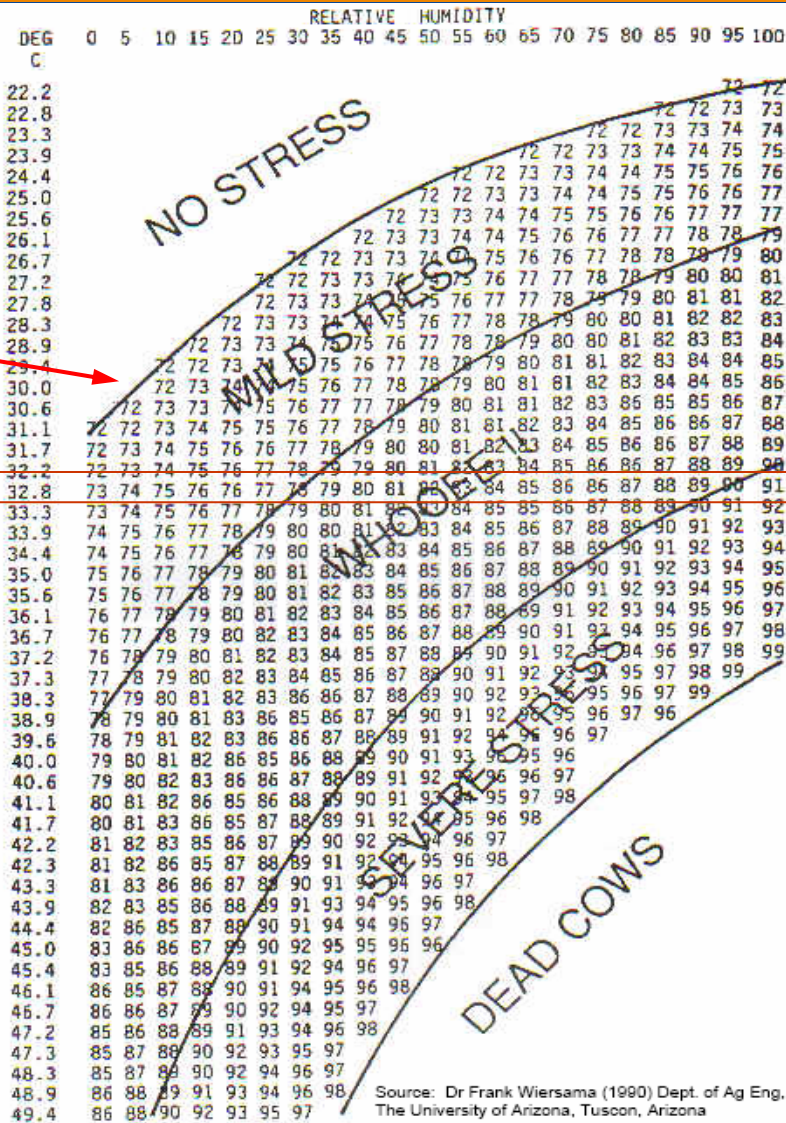
Climate indicators for agriculture

- A range of critical levels exist
 - Heat stress in livestock
 - Growing degree days
 - Temperature limits (high and low)
 - Chilling hours
 - Rainfall (rarely specific values)

Heat stress in livestock

Heat stress starts at 30°C

By 33 °C stress is mild to moderate



Source: Dr Frank Wiersama (1990) Dept. of Ag Eng, The University of Arizona, Tucson, Arizona

$$THI = T_{max} \text{ } ^\circ\text{C} + 0.36 \text{ dew-point temp}(\text{ } ^\circ\text{C}) + 41.2$$

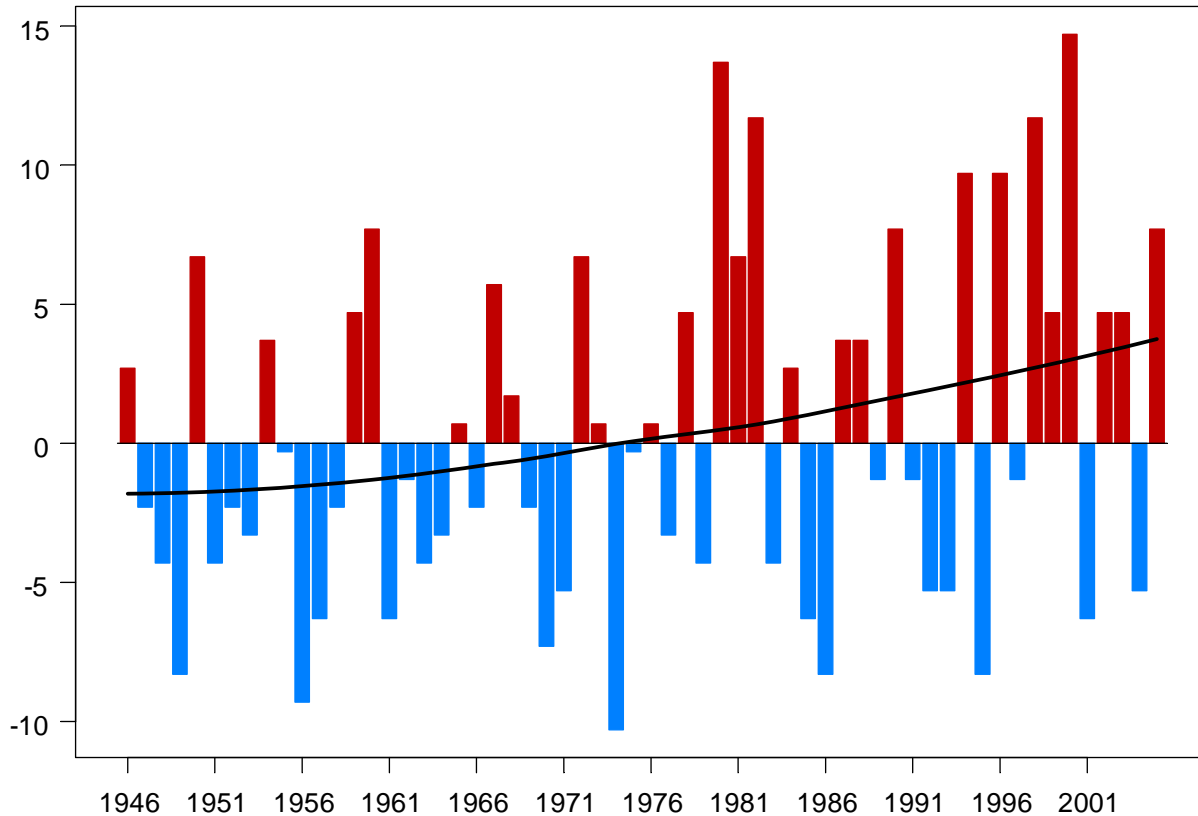
Large stock

- Increased sweating and panting
 - Increased loss of CO₂
 - Reduced carbonate balance of the blood
 - Increased acidification of tissues and rumen
 - Reduced digestion rate, intake and production
 - Organ function, hormones and enzymes affected
 - Reduced fertility, growth and production
 - Increased metabolic disorders
 - Less resistance to infection
 - At the extreme, increased mortalities



Hot days – no recovery

■ Nov – March days Max > 33, Min > 20°C

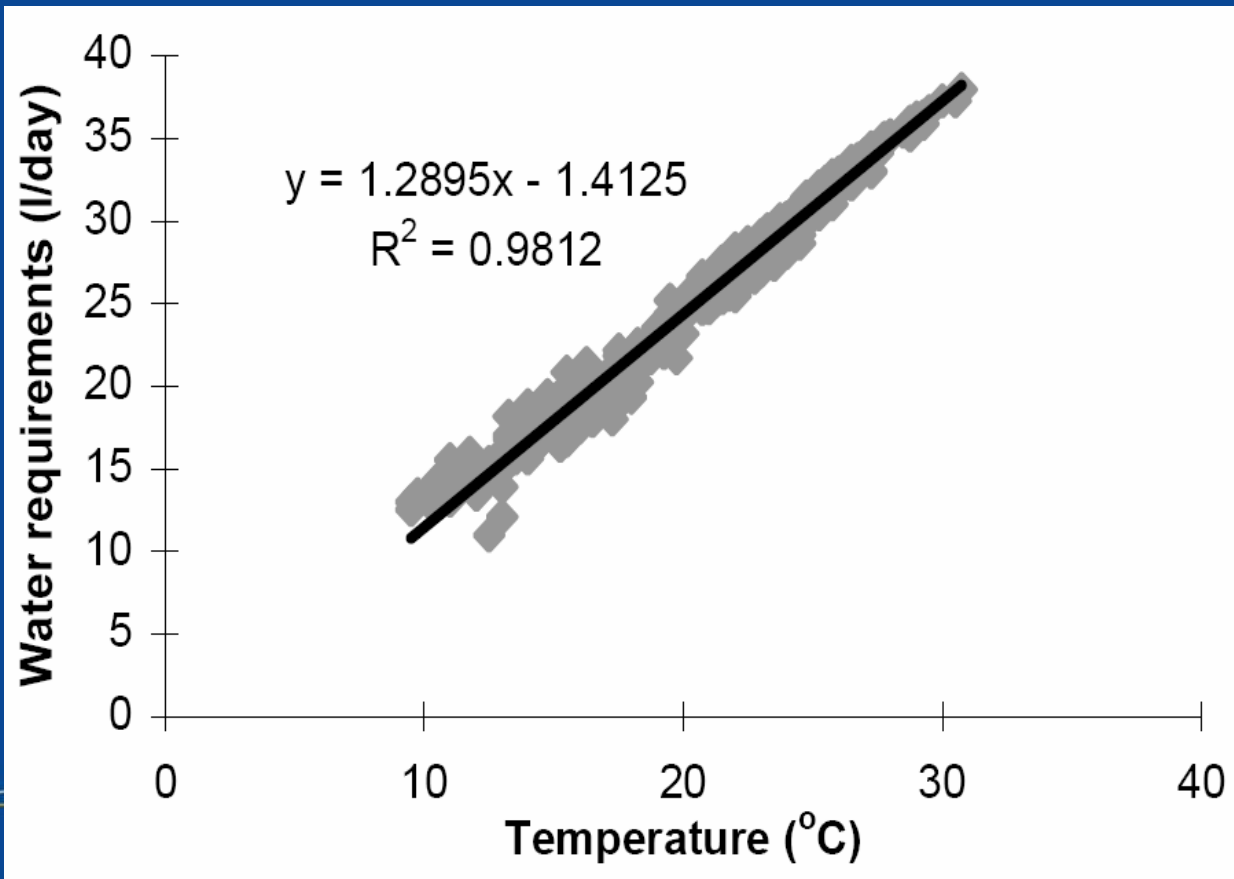


Year of starting date

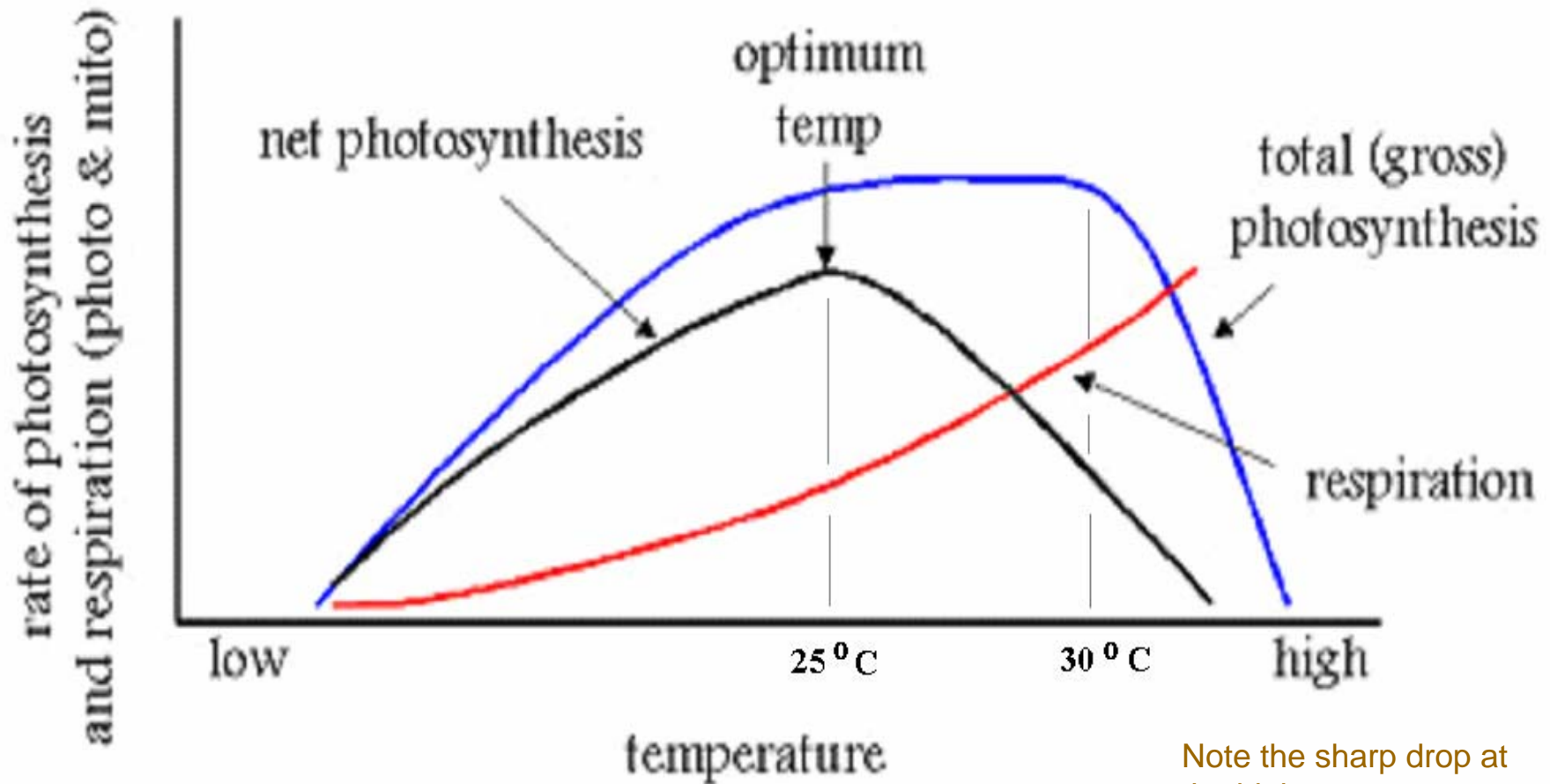


Water requirements

■ Beef cattle (Bos Taurus)



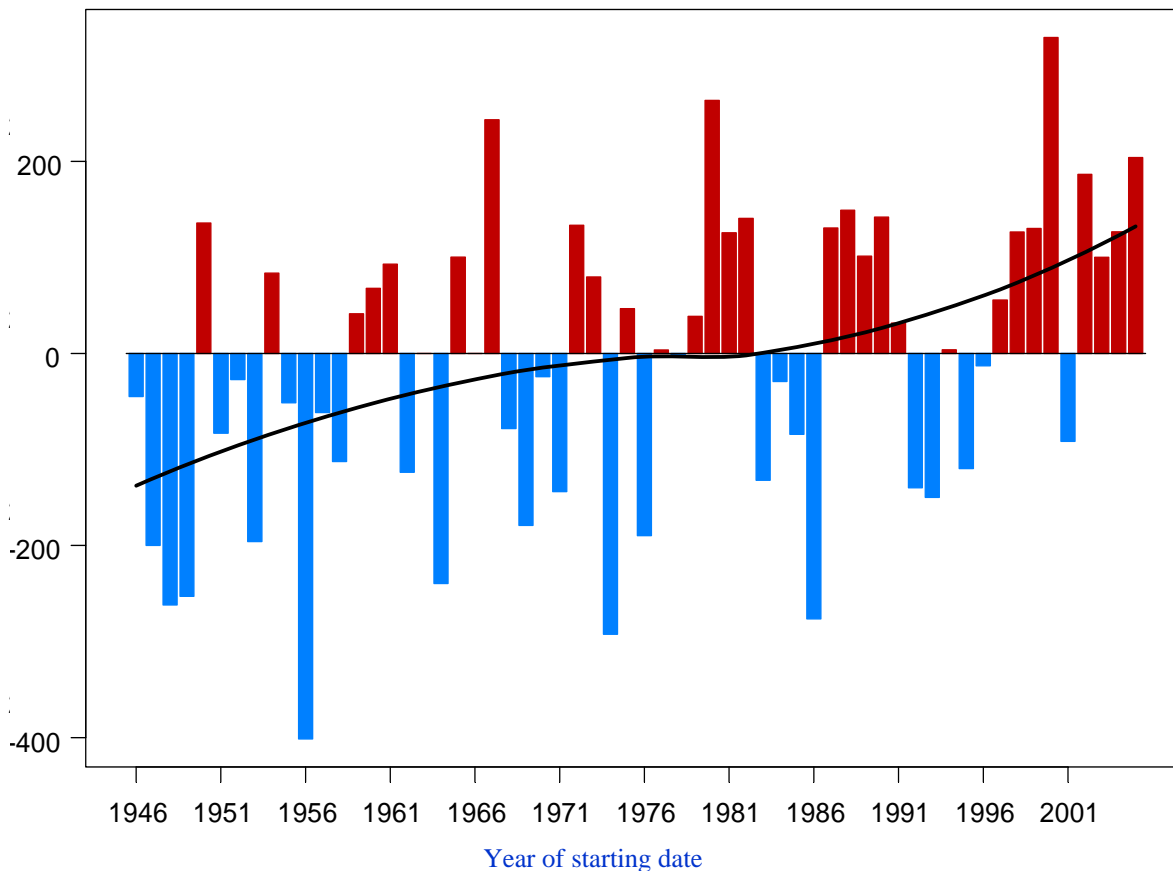
Temperature and photosynthesis



Note the sharp drop at the higher temperatures.

Summer crops - Temperature

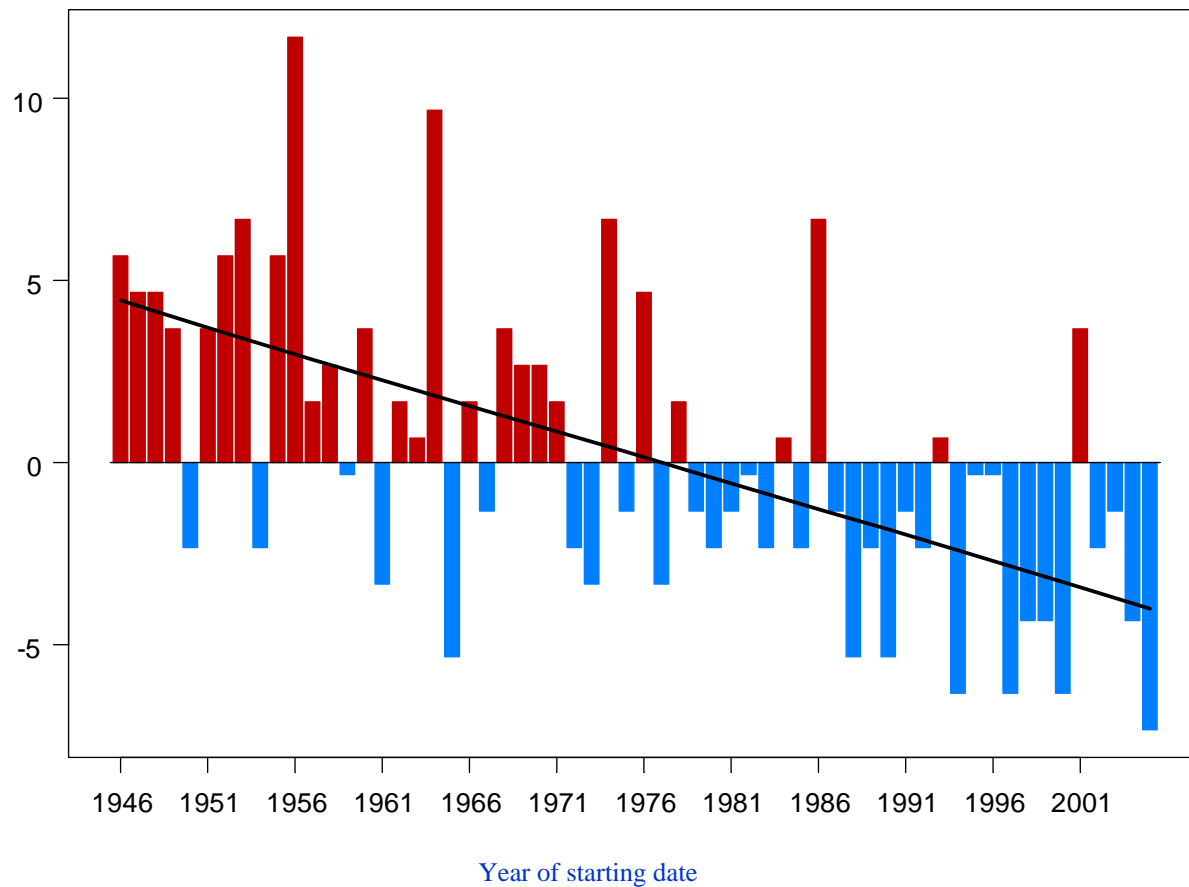
■ GDD summer – Sep to April



$$GDD = \frac{T_{max} + T_{min}}{2} - 10$$

Corn maturity - Temperature

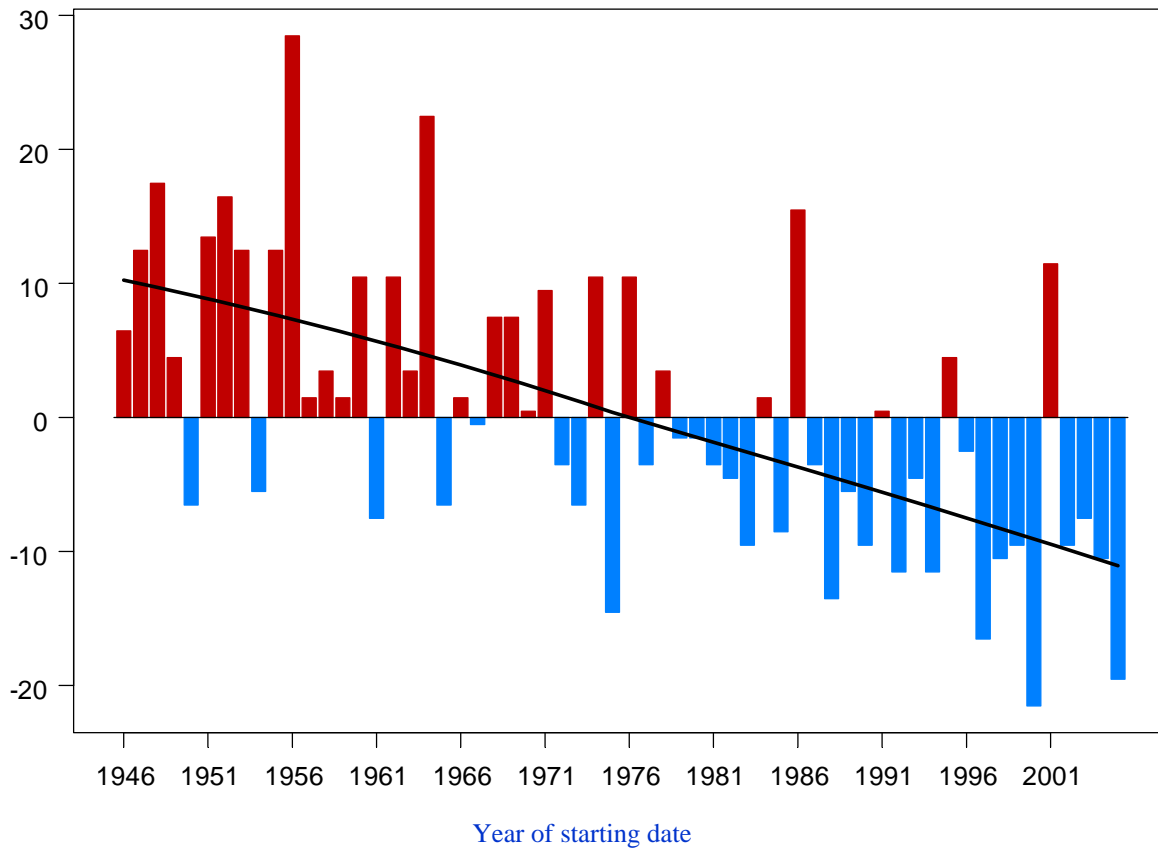
■ CHU (corn formula) – Oct 1st to 2400



$$CHU = \frac{1.8x(T_{min} - 4.4) + 3.3x(T_{max} - 10) - 0.084x(T_{max} - 10)^2}{2.2}$$

Cotton – temperature criteria

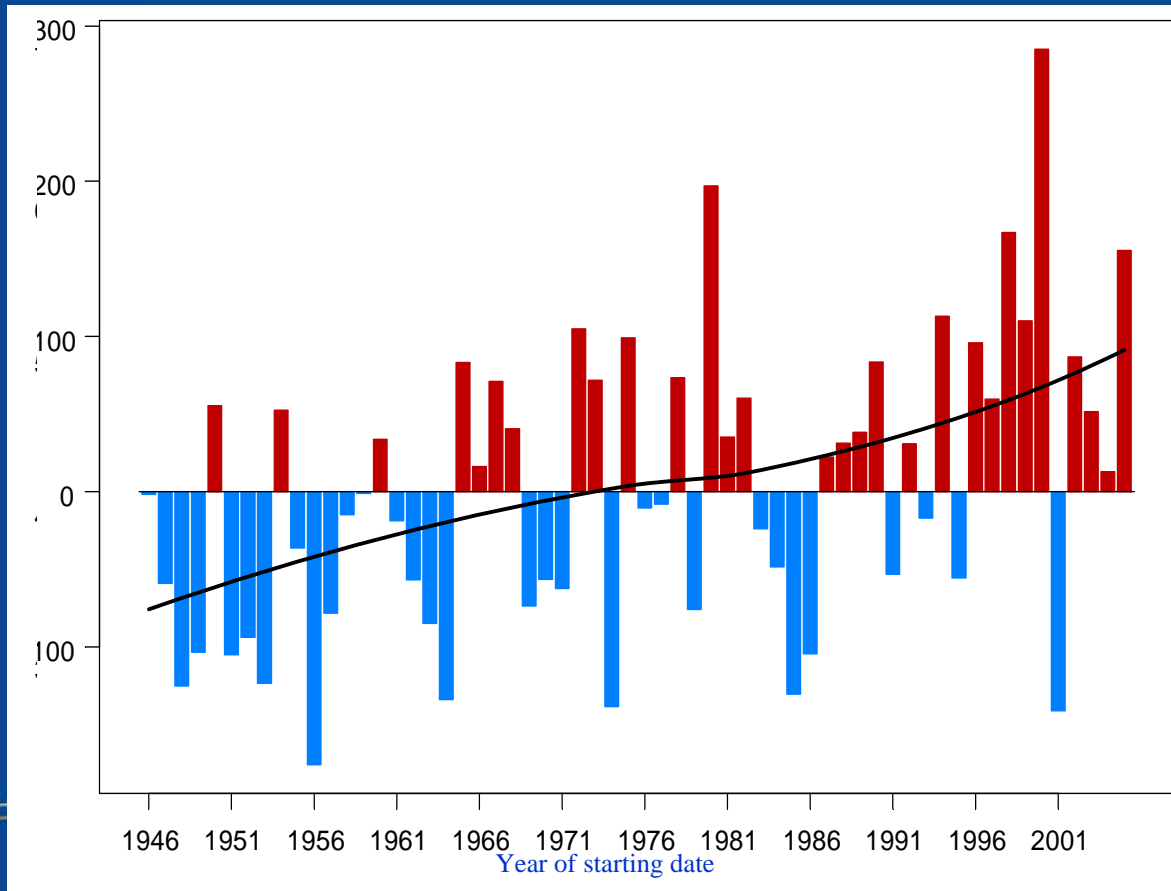
■ Cold shock days – Oct to Feb



T_{min} < 11 °C

Cotton – temperature criteria

■ HDD (Cotton formula) – Oct to Feb

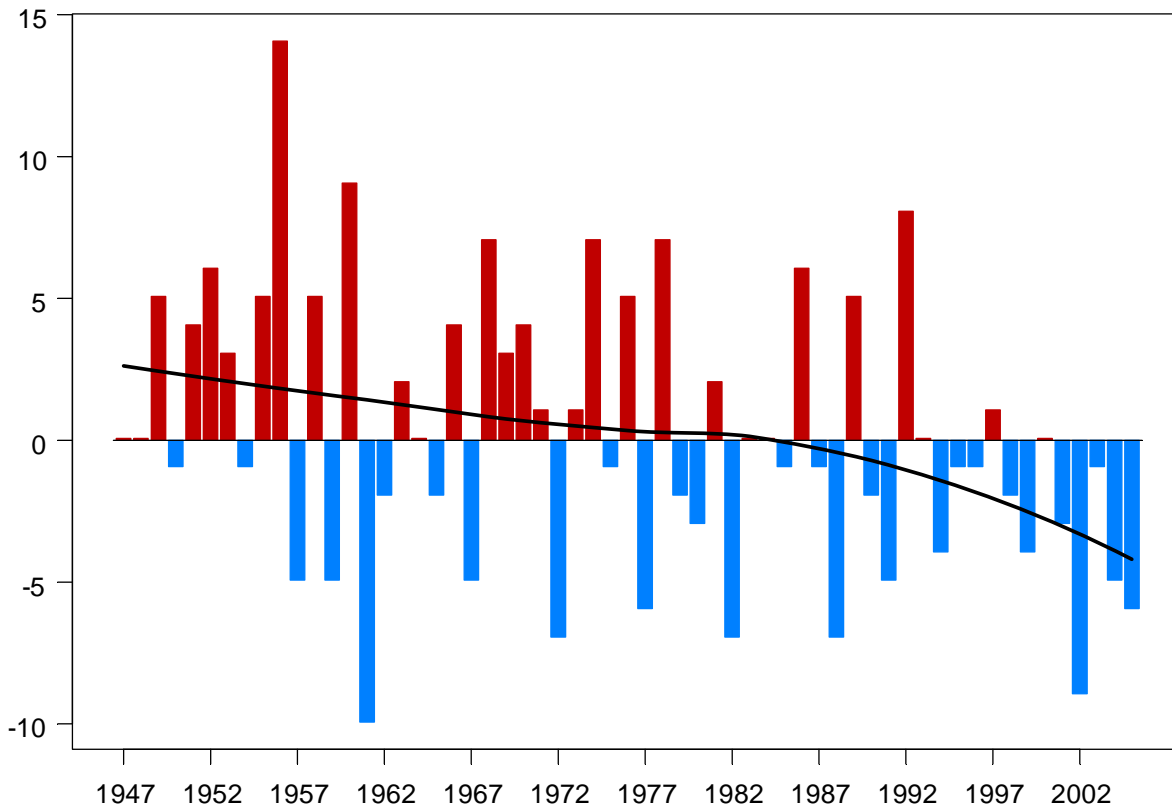


$$\text{HDD} = \frac{(T_{\text{max}} - 12) + (T_{\text{min}} - 12)}{2}$$

Note:
If $T_{\text{min}} < 12$ then 0

Winter crops - Temperature

■ GDD wheat – May 14 to 1400

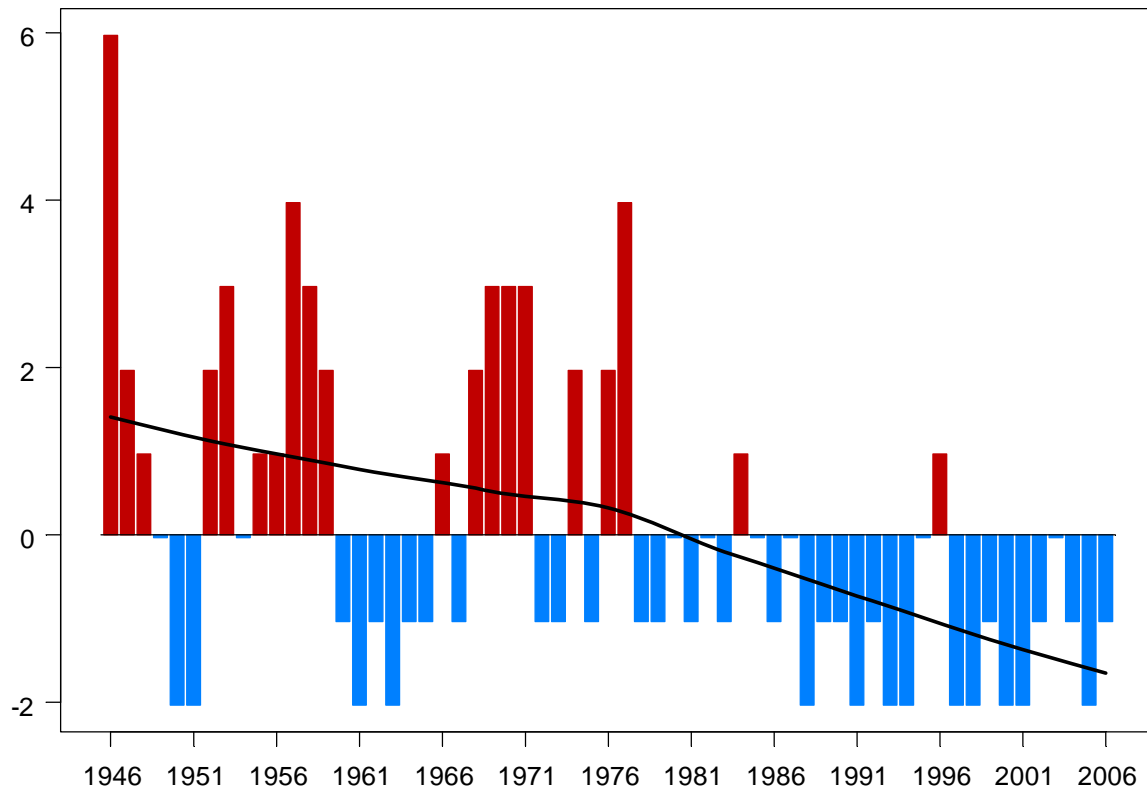


$$GDD = \frac{T_{max} + T_{min}}{2} - 10$$



Wheat - Temperature criteria

■ Frosts in September

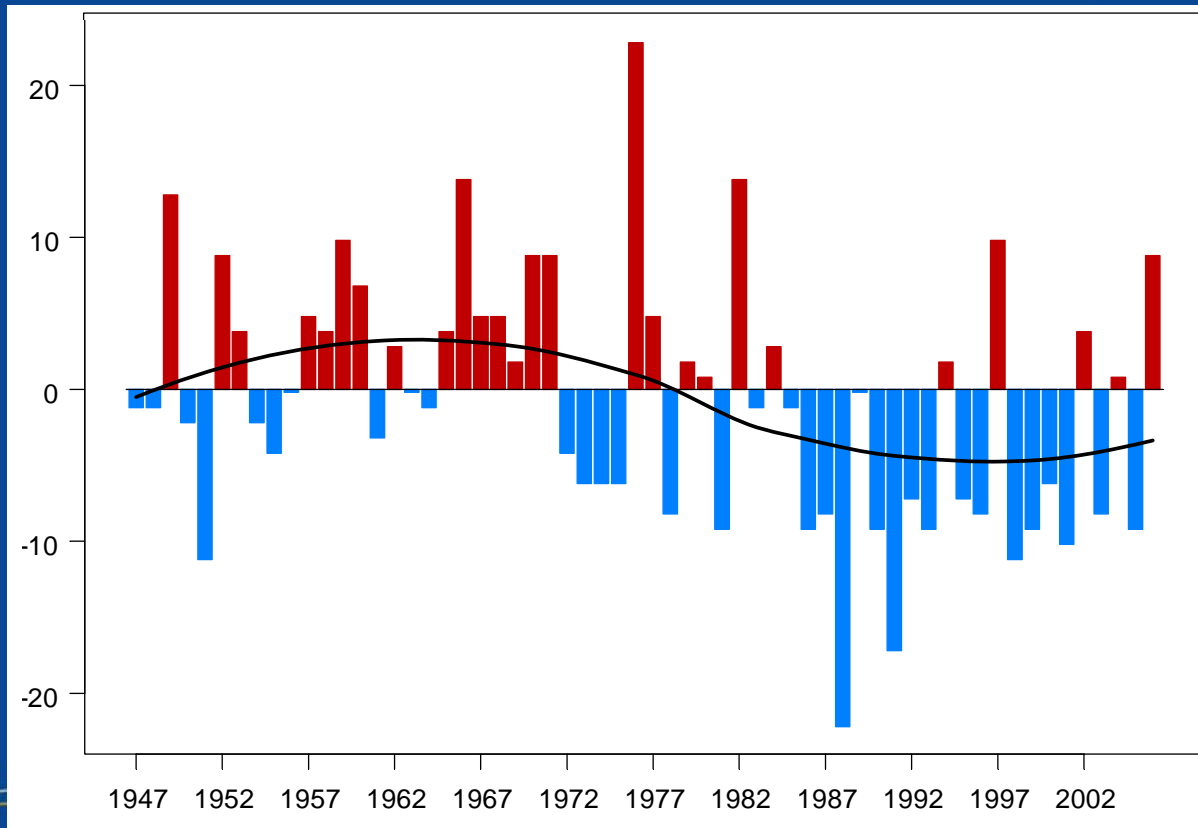


$T_{min} < 2^{\circ}C$



Frost - Temperature criteria

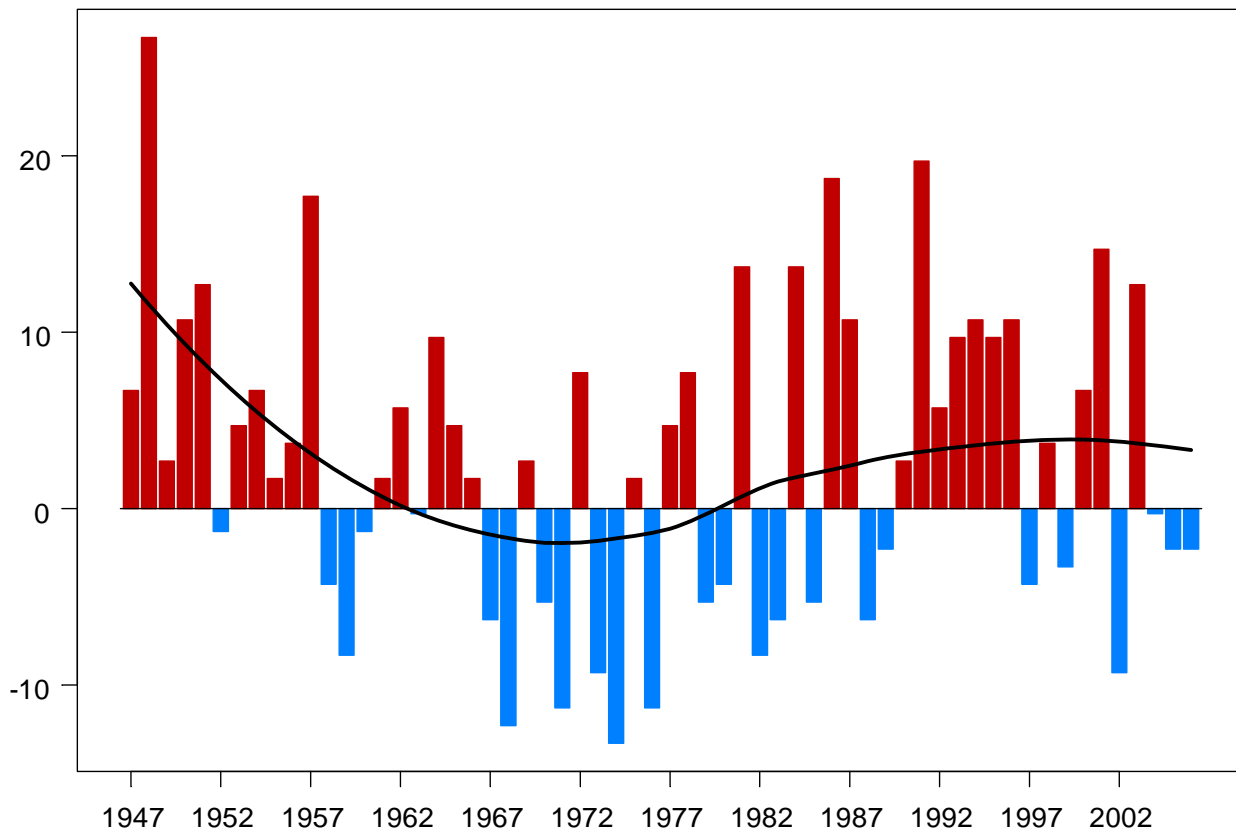
■ Frosts in total



$T_{min} < 2^{\circ}C$

Tree crop chilling requirements

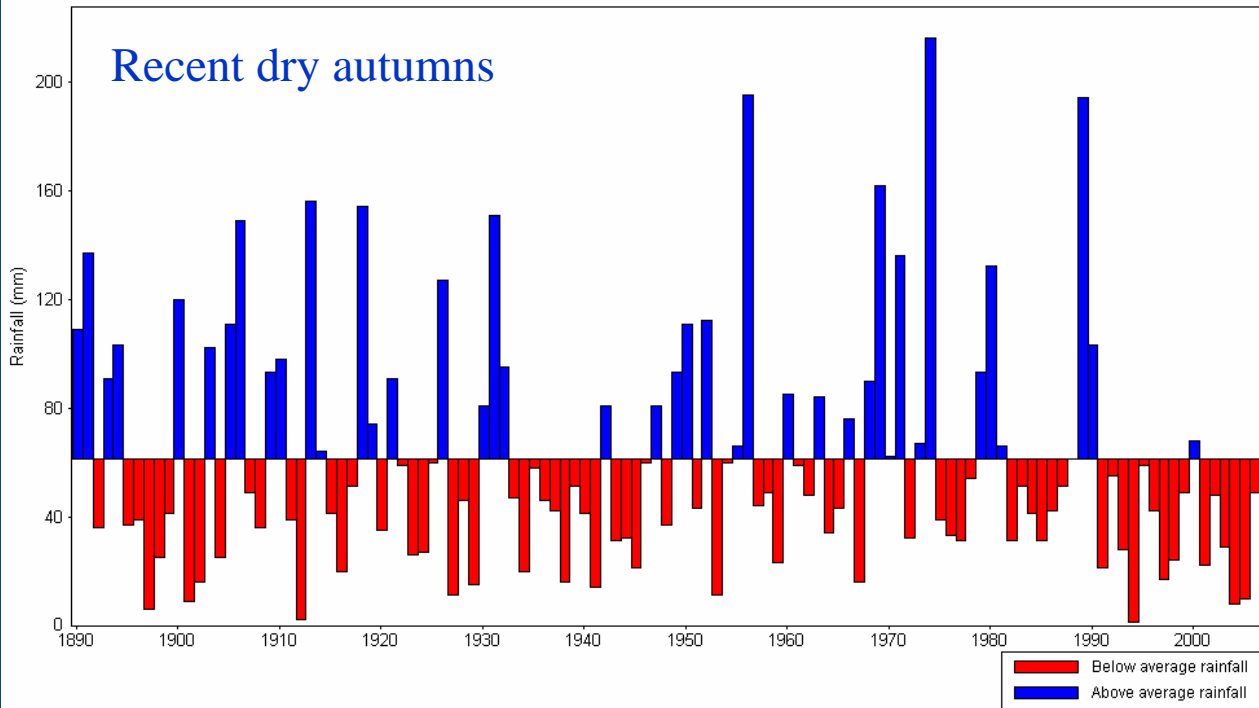
- Days from March to Oct – $T_{min} > 2$ and < 10 °C



Local rainfall patterns

Historical record of seasonal rainfall (mm) at MILDURA AIRPORT AMO COMPOSITE*

Long-term average rainfall (Mar to May) is 61 mm
Rainfall period: Mar to May



Starting year of rainfall period

Source: Rainman StreamFlow



Local climate trends and implications

- Temperatures have risen locally
 - Many agricultural critical indicators are being surpassed more often
 - Rainfall patterns have changed
 - Plant water requirements appears steady

 - Local agricultural production is being affected
 - Current production systems are at increasing risk
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How can you Manage
the increasing risk




“The Farmers’ Guide to Managing Climate Risk”

A NSW DPI workshop assisting farmers to:

- *better understand weather, climate variability and climate change and*
- *improve their skills in climate risk management*



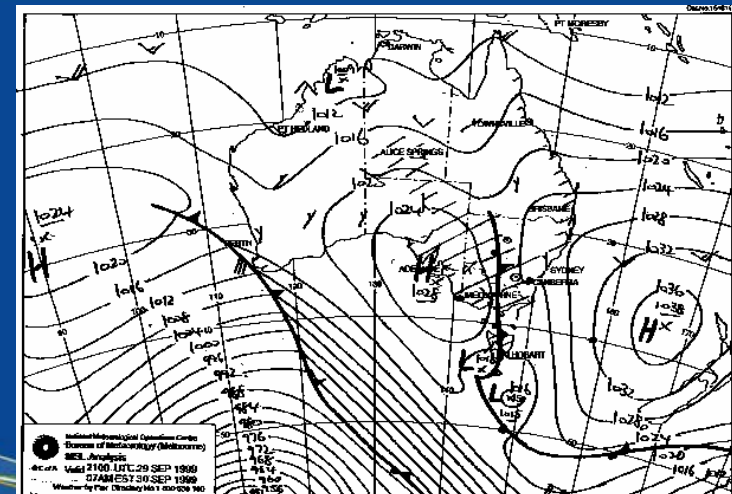
What does this workshop cover ?

- The principles of Risk Management
 - How weather works
 - El Nino and SOI
 - Climate Change
 - What are the risks?
 - How big are the risks?
 - How can you manage the risks?
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Understanding the weather

The basics of how local weather systems work:

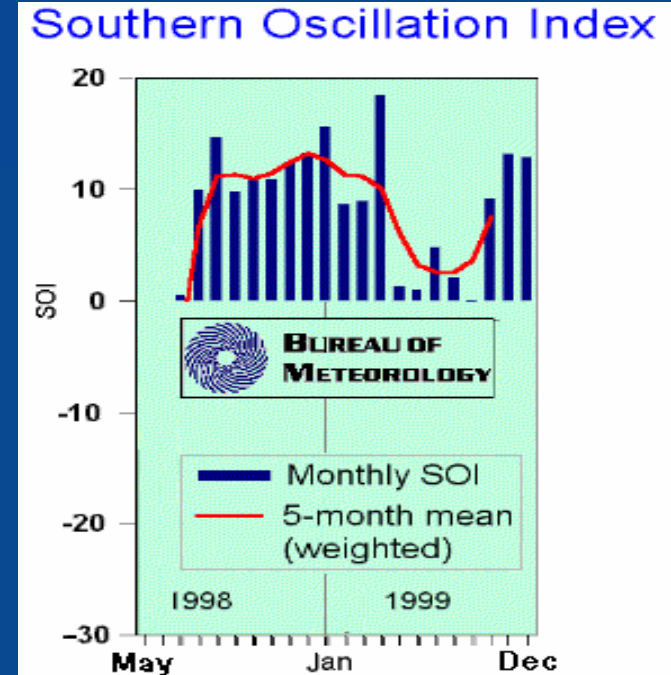
- where the moisture comes from
and what triggers it to form rain in your area
- where wind comes from and what comes with it
- how frost and hail develop.



Understanding seasonal patterns

We explore:

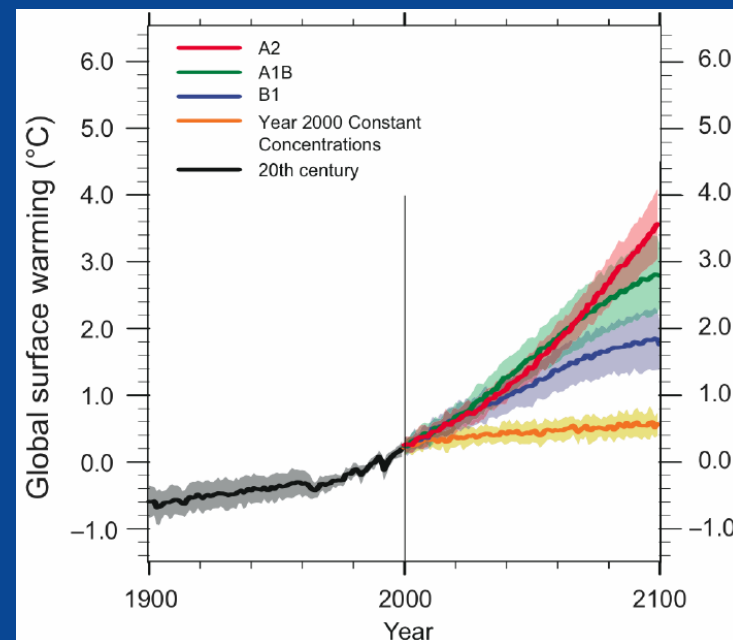
- Southern Oscillation Index
- El Nino/ La Nina
- Sea Surface Temperature (Pacific/ Indian Oceans)
- Other seasonal influences and
- When these are relevant to you and why



Understanding Climate Change

In this step we look beyond seasonal variability, and consider the potential longer term changes to climate. We explore:

- likely changes in seasonal average temperature, rainfall, evaporation, stream flow etc.
- predicted changes in extremes
- CO₂ fertilisation
- the potential impacts of climate change on agriculture generally, and your enterprise in particular



Making real and personal decisions to manage climate risk

In this step we explore:

- the principles of climate risk management
- What risks your business is exposed to, the probability of their occurrence and the impact they might have.
- the development of personalised strategies to
 - minimise their impact on your business
 - or recognise opportunities

So invest some time in your future!

Enrol in the next workshop while you are here today.

The cost is \$30/head and includes lunch and morning tea.

The training is completed in one day with all resources provided, including:

- a take home workbook and planning tool,
- local historical climate data, and
- current weather details

Register over lunch or before you leave today.



Other critical temps

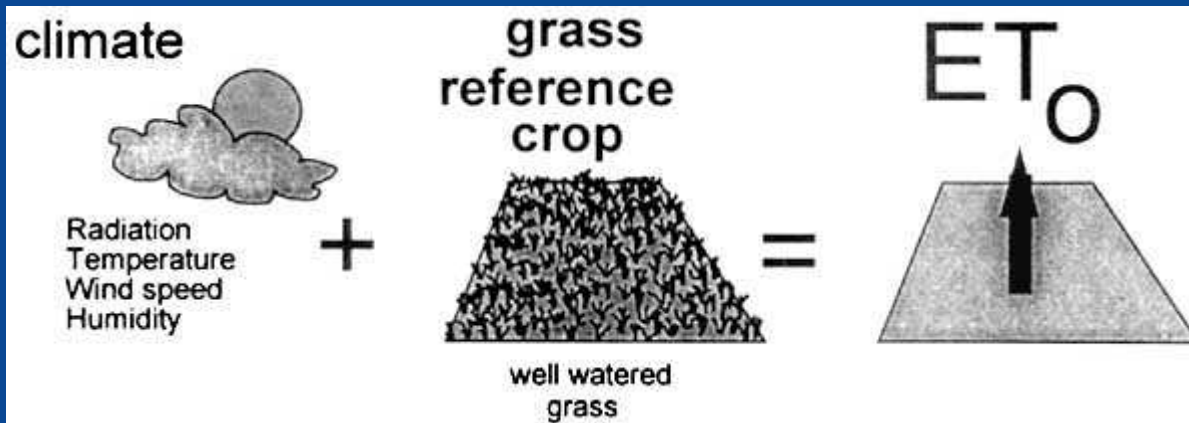
- C3 plants 30 °C
- C4 plants 40 °C
- Lucerne 25 °C
- Egg birds 34 °C
- Pigs 25 °C
- Citrus trees 37 °C
- Olives (Chilling) 150 hours <9 °C



Estimated plant water use

■ ET_o FAO56

Uses the FAO 1990 modified Penman – Monteith equation.



Wind speed the major unknown

