

Communicating Climate Change

Module 4

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Wheat and sheep production in a changing climate: Western Australia

Australia's wheat - sheep production zone covers 35 million hectares in southern and eastern Australia. Its 15 700 wool-producing farms contain 55% of the nation's sheep. Annual rainfall in the zone is 300–600 mm.

Climate change threatens the productivity of Australia's wheat and sheep industries. It reduces the value of historical climate knowledge and increases uncertainty about the bounds of future climates, making farm decisions more complex.

While Australian farmers are already adapting to a highly variable climate, adapting to significant climate change is a challenge. Here we provide a case study of the Yarra Yarra-Greenough-Moore Hill region in the central west of Western Australia.

Key facts

- By 2030, the Yarra Yarra-Greenough-Moore Hill region is likely to experience an increase in temperature of at least 0.6°C and a decrease in rainfall of at least 5% (compared to 1980–99 averages). By 2070, temperatures could be 1.5–3°C higher and rainfall could be 10–40% lower.
- Predicted wheat yields in the Yarra Yarra-Greenough-Moore Hill region in 2050 could be 10% lower under a scenario of increased carbon dioxide, higher temperatures (+2.5°C) and less rainfall (-20%).
- Climate change is likely to have some negative impacts on the Western Australian wool and sheep meat industry. These include lower wool production, more heat stress, less reproduction, and lower growth rates.
- Adaptation strategies are available to help wheat and sheep producers offset the negative impacts of climate change. These strategies involve modifying current management practices to reduce the risks associated with climate variability.

Western Australia case study

The Yarra Yarra-Greenough-Moore Hill region

The Yarra Yarra-Greenough-Moore Hill region covers 91 750 km² in the central west of Western Australia (Figure 1). Geraldton, Mount Magnet and Moora Lancelin are the major population centres.

Land use in and around the Moore Hill catchment is predominantly dryland cropping, with average wheat yields about 1.7 tonnes per hectare.

A cooperative venture between



Australian Government
Department of Agriculture,
Fisheries and Forestry
Bureau of Meteorology
Bureau of Rural Sciences





Figure 1: The Yarra Yarra-Greenough-Moore Hill region, Western Australia

Climate change projections

Australia and the globe are experiencing rapid climate change. Average temperatures in Australia have risen about 1°C since the middle of the 20th century. We had one of the most severe droughts on record in 2002–2007. Prolonged high temperatures have increased evaporation rates, dehydrated soils, and increased stress on crops, animals and vegetation.

Projections are for continued warming, less rainfall and more intense drought episodes across the temperate regions of Australia throughout the coming decades. This will affect wheat and sheep production. Anticipating and dealing with these changes in climate is critical to protect our agricultural industries.

By 2030, temperatures in the Yarra Yarra-Greenough-Moore Hill region are forecast to increase by at least 0.6°C, while rainfall could decrease at least 5% below current annual averages (1980–99). By 2070, temperatures could increase by 1.5°C under a low carbon emission scenario, or 3°C under a high carbon emission scenario. Rainfall could decrease by 10% under a low emission scenario and by 40% under a high emission scenario.

For more information on climate change projections for specific regions of Victoria, see the fact sheet for Module 3: Glimpsing Western Australia’s Future Climate.

Impact of climate change on wheat production

If the concentration of carbon dioxide in the atmosphere reaches 550 parts per million (ppm) by 2050 (it was 379 ppm in 2005), wheat yields for the Yarra Yarra-Greenough-Moore Hill region could rise by 33% as a result of increased photosynthesis and water-use efficiency. However, increased levels of carbon dioxide will be offset by rising temperatures and lower rainfall.

The responses of wheat yields to the full suite of climate change are likely to vary with soil type and the timing of climate events. Higher temperatures will shorten the growing season, increase decomposition of soil organic matter and increase potential evaporation. These effects will counter the yield increase derived from increased concentrations of carbon dioxide (the carbon fertilisation effect). Wheat yields could be 10% lower in 2050 under a scenario of increased carbon dioxide, higher temperatures (+2.5°C) and less rainfall (-20%).

Wheat quality in the region could decline as a result of climate change. Models predict that an increase in carbon dioxide concentration to 550 ppm will lead to a 10% fall in wheat protein. A 20% decrease in rainfall by 2050, combined with increased carbon dioxide levels and higher temperatures, could decrease quality by 3%.

Impact of climate change on wool production

Climate change and variability is likely to impact the Australian wool industry. Growth of pasture and fodder crops in Western Australia could increase by 2030 under higher carbon dioxide concentrations. However, this increase may be offset by lower nutrient content and less rainfall. The strain on water resources will continue and water supplies will decline because of increased evaporation, reduced runoff into storages, and decreased and more variable rainfall.

A major concern for the wool industry will be reduced wool production and quality in some marginal areas where pasture growth is reduced. Nevertheless, there might be increased productivity in areas of high rainfall. Increased heat and water stress will reduce rates of animal reproduction and growth. Changes in climate could well change the spectrum of pests and diseases that affect sheep. Reduced rainfall and increased variability are likely to increase the risk of land degradation.

Competition from other agricultural industries (particularly for cropping and water/land resources) will be a significant concern for the wool industry. The future is brighter for some of our international competitors. In Canada and the Ukraine, where low temperatures currently limit the extent of the cropping zone, higher temperatures caused by climate change are extending the growing season and increasing crop yields. In New Zealand and China, sheep producers are likely to be advantaged as warmer and wetter regional conditions extend their grazing zones.

Adaptation strategies and opportunities

Many adaptation strategies are available to offset the projected impacts of climate change in Australia. These strategies involve modifying current practices to offset risk associated with climate variability. If widely adopted, they have the potential to offset negative climate change impacts and take advantage of positive ones. In the wheat industry alone, relatively simple adaptations may be worth \$100–500 million each year.

The most promising crop-management practices include:

- zero-tillage to reduce soil moisture loss and to protect the soil in areas of increased rainfall intensity
- using seasonal forecasts to manage production risks
- extending fallows to effectively capture and store soil moisture
- planting later in the season when there is enough water in the soil profile
- widening row spacing or skip-row planting
- lowering plant density
- staggering planting times
- developing efficient on-farm irrigation management
- monitoring and responding to emerging pests
- assessing fertiliser inputs

Higher temperatures are expected to reduce the risk of frost throughout the season. Reducing the incidence of frost may allow for earlier planting and lead to increased yields if there is enough soil moisture.

Selecting the best adaptation option is a difficult exercise because regional climate change projections are still so uncertain. Nevertheless, early adaptation strategies have the highest potential to reduce the negative impacts of climate change.

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Further information

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