

Communicating Climate Change

Module 4

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Wheat and sheep production in a changing climate: South 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 Lower Eyre Peninsula, Yorke Peninsula and Upper South East regions of South Australia.

Key facts

- By 2030, the Lower Eyre Peninsula, Yorke Peninsula and Upper South East regions are likely to experience an increase in temperature of at least 0.6°C and a decrease in rainfall of at least 2% (compared to 1980–99 averages). By 2070, temperatures could be 1.5–3°C higher and rainfall could be 5–20% lower.
- Predicted wheat yields across South Australia in 2080 could be 5–41% lower if adaptation strategies are not implemented.
- Climate change is likely to have some negative impacts on the South 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.

South Australia case study

The Lower Eyre Peninsula, Yorke Peninsula and Upper South East regions

The Lower Eyre Peninsula, Yorke Peninsula and Upper South East regions (Figure 1) are located in the mid-rainfall zone of South Australia. The Lower Eyre Peninsula is bounded on the east by Spencer Gulf and on the west by the Great Australian Bight. Yorke Peninsula is west of Adelaide between Spencer Gulf and Gulf St Vincent. The Upper South East is south-east of Adelaide and extends to the Victorian border.

Predominant land uses include winter cereal cropping, sheep for wool and meat production, and irrigated cropping for hay production. Vines and horticulture account for less than 3% of the total area in the Upper South East. Average wheat yields for South Australia are about 1.4 tonnes per hectare. The region supports 7 million sheep and small areas of commercial plantation forestry.

A cooperative venture between



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





Figure 1: The Lower Eyre Peninsula, Yorke Peninsula and Upper South East regions, South 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 Lower Eyre Peninsula, Yorke Peninsula and Upper South East regions are forecast to increase by at least 0.6°C, while rainfall could decrease at least 2% 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 5–10% under a low emission scenario, or by 10–20% 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 South Australia's Future Climate.

Impact of climate change on wheat production

The concentration of carbon dioxide in the atmosphere was 379 parts per million (ppm) in 2005.

Wheat yields across South Australia are predicted to decline by between 5% (where carbon dioxide = 527 ppm; temperature = +1.1°C) and 41% (where carbon dioxide = 786 ppm; temperature = +3.8°C) by 2080 unless adaptation management practices are implemented.

Plant growth could increase with higher carbon dioxide concentrations in the atmosphere (the carbon fertilisation effect), but this will be offset by rising temperatures and lower

rainfall. In low to medium rainfall areas such as Roseworthy, changes in rainfall will affect grain yield to a greater extent than changes in temperature or carbon dioxide. In high rainfall areas such as Naracoorte, temperature will affect yield to a greater extent than rainfall. In other words, decreased rainfall or increased temperature will have a much more significant impact on yield than increased carbon dioxide concentration.

Wheat quality in the three regions could decline as a result of climate change. Models predict that an increase in carbon dioxide concentration to 550 ppm will lead to a 7% fall in wheat protein content. An additional fall in protein by 20% is predicted if temperatures increase by 2.5°C. If rainfall decreases by 20% and carbon dioxide levels and temperatures continue to rise, wheat quality in these regions could be 17% lower by 2050.

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 South 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 practices 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.

Sources

ABARE 2008, *Australian Commodities 08*:

http://www.abare.gov.au/publications_html/ac/ac_08/ac_08.html

Australian Wool Innovation Limited: <http://www.wool.com.au>

Bureau of Rural Sciences 2006, *Science for Decision Makers: Climate Change: Adaptation in Agriculture*: <http://www.affashop.gov.au/product.asp?prodid=13352>

Crimp, S, Howden, M, and Gaydon, G 2008, *On-farm management in a variable and changing climate: A participatory approach to adaptation*:

http://www.bcg.org.au/cb_pages/images/climate%20risk%20management%20-%20Steve%20Crimp.pdf

CSIRO, Bureau of Meteorology and Australian Greenhouse Office, *Climate Change in Australia*: <http://www.climatechangeinAustralia.com.au>

CSIRO 2008, *An Overview of Climate Change Adaptation in the Australian Agricultural Sector – Impacts, Options and Priorities*:

<http://www.csiro.au/files/files/plhg.pdf>

CSIRO 2008, *Murray-Darling Basin Sustainable Yields Project*:

<http://www.csiro.au/content/pt9n.html>

Department of Agriculture, Fisheries and Forestry 2007, *At a Glance. Australia - Our Natural Resources*: <http://www.daff.gov.au/brs/publications/series>

Grace, P 2006, *Farming in a Changing Environment*, Institute of Sustainable Resources, Queensland University of Technology:

http://www.isr.qut.edu.au/publications/public/rm_5.jsp

Harle, KJ, Howden, SM, Hunt, LP and Dunlop, M 2004, *The Potential Impacts of Climate Change on Wool Growing in 2029*, a research brief conducted by CSIRO Sustainable Ecosystems for Future Woolscales:

http://www.wool.com.au/.../attachments/Wool_production/Natural_resources/lww_climate_change.PDF

Meat & Livestock Australia: <http://www.mla.com.au>

Further information

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