

Climate change impacts factsheet:

4. Primary industries

Australia's primary industries sector, including primary producers and associated industries, contribute significantly to the country's economic, social and environmental well-being. The sector includes the agricultural, forestry and freshwater aquaculture industries and the rural communities that support them. Together they contribute \$48.1 billion per annum to Australia's gross domestic product.

Climate and primary industries

Climate is one of the fundamental factors that determines where different types of primary production can be successfully pursued. For many primary industries, climatic conditions – including climate variability – determine seasonal or annual production and actual profitability. Climate variability is nothing new for Australian agriculture – producers have always managed and adapted to a highly variable and challenging climate, including drought, heatwaves, frost, bushfires and flooding.

Future climate trends

Key climate variables affecting the profitability and sustainability of primary industries include temperature, rainfall, increased atmospheric carbon dioxide (CO₂) levels and extreme weather events.

- By 2030, annual temperatures across Australia are projected to increase by about 1°C relative to 1990, with greater warming in inland Australia and less in coastal regions. There will be more heat stress days.
- Rainfall is projected to decrease by 2–5% across Australia by 2030, except in northern Australia where little change is expected.
- The frequency of drought is projected to increase, particularly in the south and south-west, with up to 20% more drought months over most of Australia by 2030 relative to 1990. The occurrence of heavy rainfall events and severe tropical cyclones is expected to increase.

Box 1: Effects of increased atmospheric CO₂ concentrations on plants

Increased atmospheric CO₂ concentrations in the atmosphere increase plant photosynthesis, causing plants to develop faster and increase their biomass. This can be observed in the laboratory but is harder to discern in open country where factors such as water limitation, pests and diseases can be important. Some plants are more affected than others. So-called C3 plants (trees and grasses) respond better to this enrichment effect than do C4 plants (crops such as sugar cane and maize), suggesting that a world of higher CO₂ concentrations may favour C3 plants. However, it appears temperature increases may have the opposite effect, so the net result remains uncertain.

Climate change impacts and vulnerabilities

Changes to climate will result in reduced productivity and profitability in some locations and industries, and new opportunities and improvements in others. Reduced rainfall and runoff will decrease broadacre cropping and pasture yields and limit water availability and allocations for irrigation. The sensitivity of irrigated agriculture to reduced rainfall is evident in the recent drought in south-eastern Australia, which saw the area of irrigated land in the Murray Darling Basin reduce 42% between 2005–06 and 2007–08.

Increased temperatures may cause reduced productivity and reproduction rates in livestock industries. Some plant industries may experience decreased product quality with extreme high temperatures, particularly viticulture and horticulture. In present-day cooler climates, crops may benefit in future from longer growing seasons and fewer severe frosts, increasing yields and allowing plantings in areas previously considered too cold.

Increased atmospheric CO₂ concentrations are likely to affect the productivity of primary industries directly (see Box 1).

The plantation and native forest sectors are likely to be particularly vulnerable to increased occurrence and severity of fire weather i.e. extreme heat, dryness and wind, particularly if CO₂ fertilisation increases plant biomass.

Changed climate conditions will alter the spread and impact of weeds, pests, diseases and predators. Tropical weed species may move further south under a warmer climate. Some pests and diseases already present in a region are likely to become more virulent and widespread while higher temperatures and reduced rainfall may reduce fungal infections or preferentially promote pest predators.

Social and economic impacts

The socio-economic effects of climate change are likely to be complex and far-reaching. In addition to potential major impacts on production, climate change is likely to increase the demand for services, commodities and resources such as water, energy, land, fertiliser and oil from both the primary industries and the wider economy. This could expose primary producers to increased input costs.

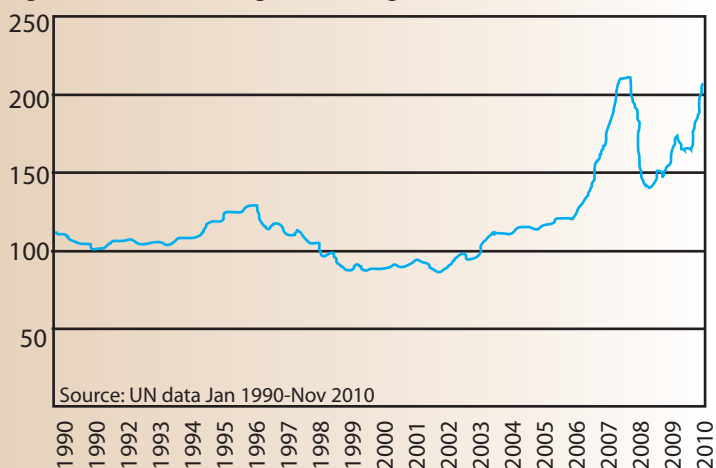
Climate change – particularly extreme events – will affect the well-being of rural communities and the industries associated with them. Ultimately this may threaten the long-term sustainability of many rural townships.

Australia's primary producers in the global context

Primary industries in Australia are affected by national socio-economic factors, and also interact with wider global factors. In 2006/7, agricultural products including processed food and beverages accounted for 16% of Australia's merchandise exports. There have been two historic highs in global food

prices in the last decade: one peaking in 2007, and one beginning in 2010 and continuing in 2011 (see Figure 1). These trends are at least in part driven by natural hazards, for example the ban on grain exports imposed by the Russian government in response to the drought of 2010 contributed to the recent rise in grain prices. Globally, rising food prices have resulted in a spike in the number of people considered 'food insecure'. In Australia, global food prices have not yet threatened food security, and prices received by farmers have risen substantially as a result of global trends. With climate change likely to exacerbate price rises, global food insecurity may cause other countries to close their food markets and ban exports. Although higher world food prices will help Australian farmers' incomes, the negative impacts of climate change locally on production may prevent farmers taking full advantage of higher prices.

Figure 1. UN Food and Agricultural Organization Food Price Index



Adaptation options

Primary industries have a range of adaptation options that can be applied, many of which can generate additional benefits by maintaining or increasing the profitability and/or sustainability of primary industries.

i) Adjusting existing practices and technologies. Australia's primary producers are experienced in adjusting production practices, genotypes and breeds without new infrastructure and expertise. Adjusting to climate change impacts will require regional research and validation and attention to specific market requirements. This type of response will be ongoing, even if more fundamental or transformative responses are required.

ii) Changing the primary production system or mix of activities undertaken. Production system responses will be required where climate change either:

- reduces productivity or quality to the point where current systems become unsustainable despite adjustments to production practices; or
- results in new production systems becoming more profitable than existing systems.

Examples include changing plant or animal species or the mix of production activities on a farm or in a region. Drier conditions in recent years have allowed the expansion of grain crops into western districts of Victoria which were previously too wet in winter.

iii) Transforming primary production enterprises and industries. Where climate change results in new regions or industries becoming more profitable or sustainable than

current regions or industries, or existing primary industries in a region become unsustainable, a fundamental redesign or transformation may be required. With careful planning and management, transformative changes might yield multiple natural resource benefits.

Adaptation-mitigation interfaces

With the land sector a major contributor to greenhouse gas emissions, government mitigation policies will have considerable implications for primary industries and rural communities. The federal government's Carbon Farming Initiative may provide economic incentives for farmers and foresters to reduce emissions and sequester carbon, allowing some diversification of income.

Costs

Australian agriculture is sensitive and exposed to climate. Projected changes to a warmer and, in many regions, drier future will impact production. It is difficult to estimate the resulting costs because prices fluctuate to reflect supply, and because of the industry's high adaptive capacity. Farmers are likely to change practices and varieties to adapt to new climates. However, climate change increases the uncertainty about future conditions, which has costs in terms of delaying investment.

Research priorities

The National Climate Change Adaptation Research Plan (NARP) for Primary Industries prioritises research around:

- what adaptive capacity means in the primary industry sector and how it can be measured and increased;
- how governments, producers and other stakeholders can identify the type of adaptation response that is most appropriate to the circumstances of a producer, industry or region;
- the options that are available for adjusting current production practices and technologies; changing production systems; and transforming enterprises and industries.

Research must address stakeholder awareness, social and cultural factors, management practices, production technologies, production systems and industry transformation, as well as the biophysical and technical aspects of climate change adaptation.

About the Network

The Primary Industries Adaptation Research Network was established to provide a gateway to climate change adaptation research in primary industries. It aims to improve the coordination, development and accessibility of climate change adaptation research in the sector.

It brings together stakeholders from Australia's primary industries, associated organisations, rural communities and governments to make sound decisions about climate change adaptation responses. For more see

<http://www.piarn.org.au>