PACKHORSE WHITE PAPER

PACKHORSE™

The Effect of Drought & Climatic Variability on Australian Agriculture

Take-home messages

- Agriculture in Australia is significantly affected by climatic variability.
- However, this varies by sector (cropping versus livestock) and location.
- The effects of drought are most pronounced in the cropping sector (compared to livestock) (Chancellor et al., 2021).
- The effects of drought on agriculture are most pronounced in southern and western Australia (where Packhorse does not operate).
- Packhorse's target property acquisition area is less affected by drought (Figure 1). In addition, Packhorse targets properties with clay soils (>35% clay) that retain moisture and soil carbon during drought.
- The management of Packhorse properties further increases drought resilience in comparison to an 'average' beef farm through regenerative practices (e.g. time-controlled grazing, mixed species pastures, incorporation of legumes, reticulated water).

The impact of drought on agriculture

There is still much uncertainty over what climate change will mean for agriculture in the future in Australia. However, the evidence points to more frequent and severe droughts due to higher temperatures and evaporation rates (McKeon et al., 2021).

A recent analysis by the Australian Bureau of Agricultural and Resource Economics and Sciences (2019) finds that changes in climate over the period 2000 to 2019 (relative to the period 1950 to 1999) have had a negative effect on the profitability of broadacre farms in Australia, including both cropping and livestock (Figure 1) (Hughes et al., 2019).

A reduction in profitability due to climate has been most pronounced in the cropping sector, reducing average profits by 35% for a typical cropping farm. Beef farms have been less affected, with an overall reduction in average profits of 5%. These average figures mask vast regional differences, with Western Australian and South Australia most affected by climatic conditions (Figure 1). Packhorse properties are marked by black dots demonstrating that they fall outside the regions severely impacted by climate.

Figure 1: The effect of climate conditions an average farm business profit

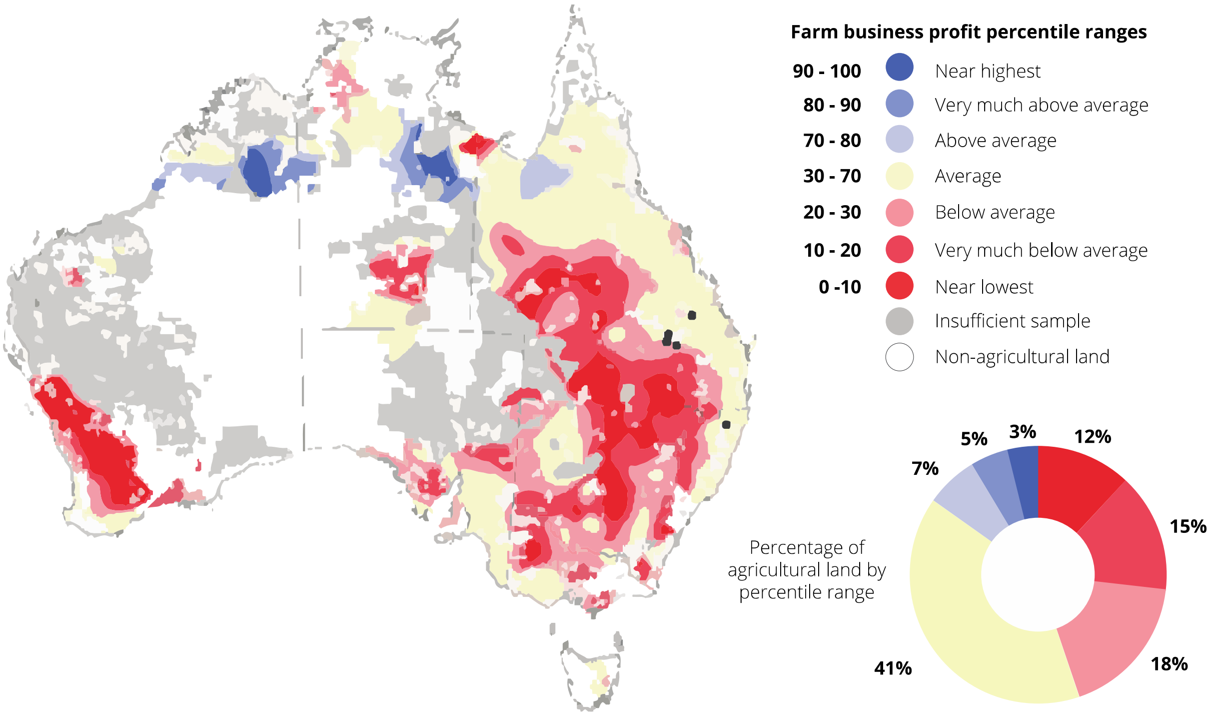


Figure 1: *The effect of 2000 to 2019 climate conditions (relative to the period 1950 to 1999) on average farm business profit. Black dots show current Packhorse properties. Source ABARES 2019 (Hughes et al., 2019).*

Packhorse: reducing the risk of drought

Long-term temperature and rainfall records are shown for the Packhorse property 'Lighthouse' in Figure 2, displaying a high rainfall variability around a mean of 559 mm per year. Numerous measures are taken to reduce the risk of drought that broadly fall into two categories (a) property acquisition and business model to reduce risk, and (b) management practices to increase resilience to drought. These are summarised below.

(a) Reducing risk across the portfolio

- The Grass Motel Agistment model: Packhorse does not own cattle; we can prioritise the asset's health, and cattle can be moved off the property if there is insufficient forage forecasted. For example, 2019 was a very dry year (Figure 2) resulting in a significantly reduced stocking rate to protect the land (Figure 3).
- The acquisition of Packhorse properties targets clay soils (>35% clay content, Vertosols) to ensure greater moisture and soil carbon retention during dry periods.
- The geographical dispersion of properties means that not all properties will experience drought conditions simultaneously, creating a buffer in the temporal variability in forage supply.
- Packhorse aggregates properties to achieve economies of scale and reduce the financial risk of small enterprises.

(b) Reducing the risk of drought through better management

- Regenerative grazing practices help maintain ground cover (to retain soil moisture and carbon) and ensure that the pasture 'bounces back' quickly after drought periods. This can be demonstrated during the 2019 dry period, where the property was destocked in 2019 but quickly restocked in 2020 at the break of dry conditions (Figure 3).
- Forage availability is carefully managed through Maia Grazing software, which incorporates predictions of pasture biomass (using Bureau of Meteorology data combined with remote sensing biomass cover) to assist graziers in better predicting their pasture reserves for feed budgets going into dry conditions.
- Time-controlled grazing combined with greater functional diversity and deep-rooted legumes increases soil organic carbon and water retention (Lange et al., 2015). The implementation of these strategies on clay soils leads to the accumulation of stable mineral-associated organic carbon that is much mor resistant to drought in Australian grasslands (Canarini et al., 2018).
- The adoption of a long-term strategy of pasture growth and conservative pasture utilisation promotes greater pasture system resilience.

Figure 2: Rainfall and temperature, Roma, QLD

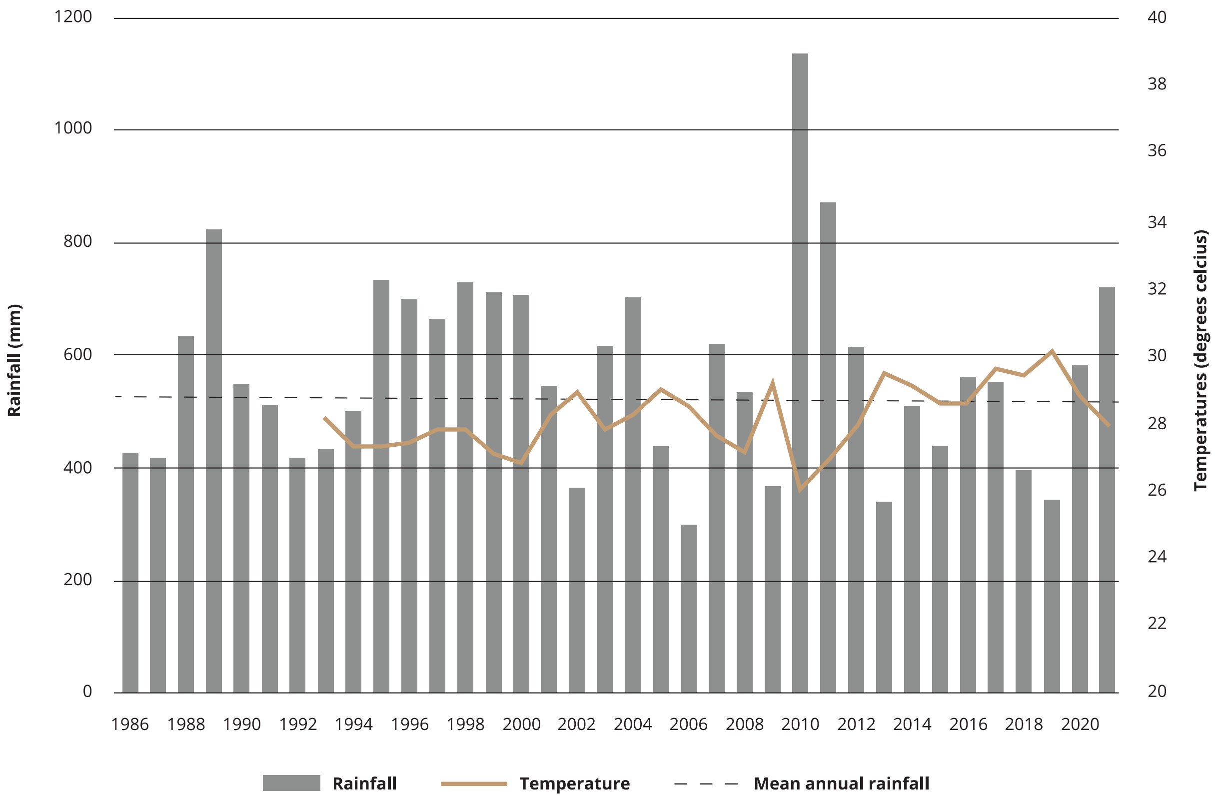
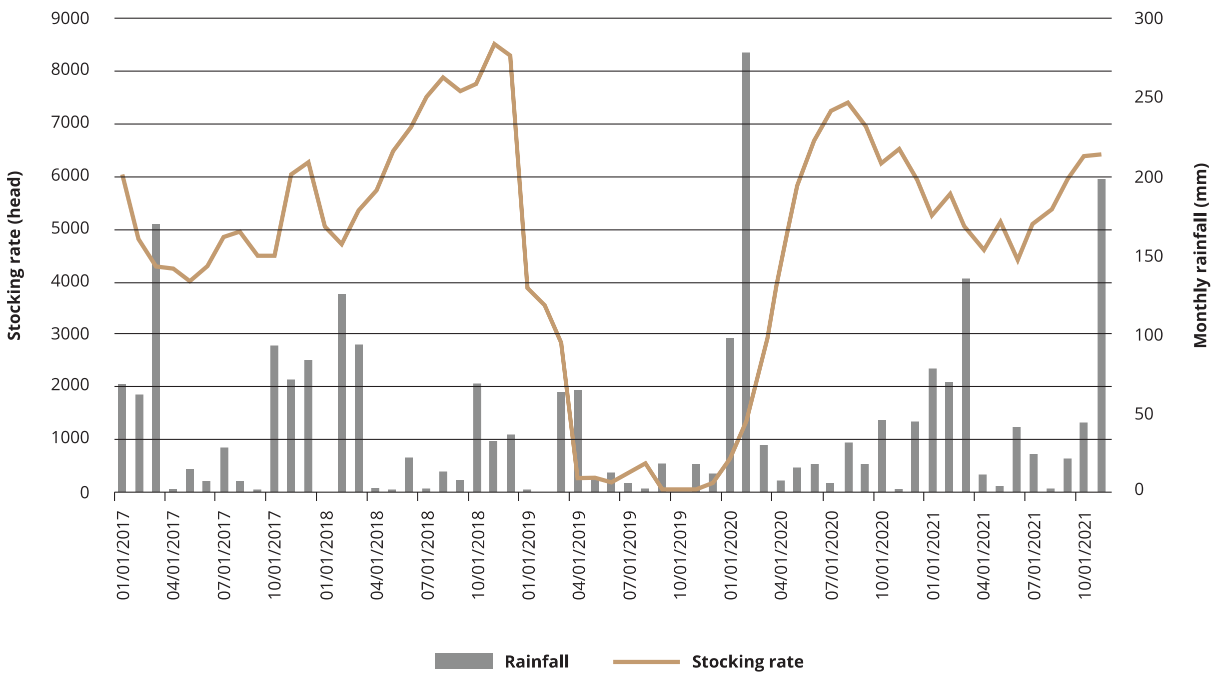


Figure 3: Monthly rainfall verus stocking rate at Lighthouse 2017-2021



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