SA Drought Hub Impact Report

Supporting South Australian Primary Industries to prepare for future climates at a local scale

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SA DROUGHT HUB
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PROJECT SUMMARY

South Australian Primary Industries are exposed and vulnerable to rising temperatures and changes to rainfall but also have a high level of adaptive capacity. The impetus for this project was a shift in the Future Drought Fund from drought to climate resilience. An early challenge for this project was to identify a niche given previous and ongoing efforts on climate adaptation for SA Primary Producers. Since the start of the project there have been national and state level climate change risk assessments and adaptation plans that address Primary Industries.

We focussed on the main four industries of grains, livestock, viticulture and horticulture and divided climate change into six components: increased mean temperature, increased heat events, changes to frost, changes to seasonal rainfall, intensity of rainfall and elevated carbon dioxide. We found that the most sensitive industries were viticulture and horticulture followed by grains and then extensive livestock. The greatest risks were changes to water supply through rainfall or increased irrigation requirement / reduced availability of irrigation supply and changes in extreme heat. We also summarised the level of confidence from climate science in the physical climate threat and the confidence in agricultural science in the impact and adaptation options. This shows that a threat like change to water availability has lower confidence from climate science but very high confidence on impacts from agricultural science compared to the high confidence from climate science in the increase in heat waves but lower confidence from agricultural science in the exact impact of heat waves.

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PROJECT ACTIVITIES AND OUTPUTS

Background A crowded space. This project worked with SA Primary Industries to prepare for climate change. We used the PIRSA report card to focus on the more important land-based Primary Industries of dryland cropping, extensive livestock, viticulture and perennial horticulture. This is not the first nor the only current project addressing this challenge for SA Primary Industries. In many ways it is a crowded space, and we needed to find our niche. All the relevant RDCs (GRDC, MLA, Wine Australia and Hort Innovation) have programs that directly and indirectly address adaptation. The National Climate Risk Assessment and National Adaptation Plan were released in September 2025, each of them addressing Primary Industries. The South Australian government funded Deloitte to prepare a statewide climate change risk and opportunity statement released in 2026 to inform SA Climate Change Resilience and Adaptation Actions. The state government through PIRSA and DEW Landscape Boards have used FDF funding for regional drought resilience plans.

FDF broadening from drought to climate resilience: This project was in response to a change in the Future Drought Fund Act. The accompanying documentation with the Act identifies the object of the Act is to enhance the public good by building drought resilience. It acknowledges that building drought resilience is complex and long-term with no defined end point. It points to the need to adapt, reorganise or transform in response to changing temperature, increasing variability and scarcity of rainfall and/or changed seasonality of rainfall.

The main output is a ranking of adaptation pressures for six changes to climate x 4 industries (field crops, viticulture, horticulture and extensive livestock.

	Climate science confidence	*Field crops*	*Viticulture*	*Horticulture*	*Extensive livestock*
*Almost certain that **mean temperatures** will increase over next decades.*		*Moderate adaptation pressure*	*High adaptation pressure*		*Low adaptation pressure*
*High confidence that weather systems bringing **heatwaves** will be hotter.*		*High adaptation pressure*	*Extreme adaptation pressure*		*High adaptation pressure*
*Low confidence to changes in **frost** frequency in coming decades*		*Extreme adaptation pressure*	*Moderate adaptation pressure*		*Very low adaptation pressure*
*Worrying but uncertain reduction to autumn winter and spring **rainfall** and water for **irrigation**.*		*Extreme adaptation pressure*			*High adaptation pressure*
*High confidence that **intensity of rainfall** will increase*		*Relatively low adaptation pressure because SA currently has very low intensity of rainfall compared to NSW & Qld.*			
*Certain that **carbon dioxide** will increase*		*Mostly beneficial although expect a reduction in quality of some products.*			

Table 1. A high-level summary that ranking the impact of the six main climate risks between four key primary industries. Extreme adaptation pressure- major challenge to current production system, high adaptation pressure- challenge requiring substantial and costly changes, moderate adaptation pressure – requiring some changes to current system, low adaptation pressure – requiring relatively minor changes to the current system.

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In the following section we use the six changes to climate (Increased mean temperature, increased heat events, changes to frost, changes to seasonal rainfall, changes in intensity of rainfall and elevated carbon dioxide) as a framework to link advances in climate change science to primary industries. This discussion includes many of the conversations with stakeholders.

1 Mean temperature – a first order response to greenhouse gasses. The National Climate Change Risk Assessment used Global Warming Levels (GWL) of 1.5, 2.0 and 3.0 degrees. The Paris agreement aims to keep global temperatures below 2.0 and most commentators estimate that about 2.6 degrees is the most likely end of century global temperature. We have used GWL and the National Climate Change Risk Assessment in our discussion with industry and policy and found most users are more accepting of GWL than representative concentration pathways RCP) or shared socio-economic pathways (SSP). Although there are some critiques of GWL another advantage is that they show the link between global emission targets and the adaptation challenge. This avoids the temptation to separate the more palatable subject of adaptation from the more challenging topic of emission reduction. Primary Industries need to prepare for the physical aspects of climate change as well as policies to reduce emissions. It is also important to be aware of maladaptation that increases emissions such as switching from a relatively low emission land use of cropping to a higher emission land use of grazing.

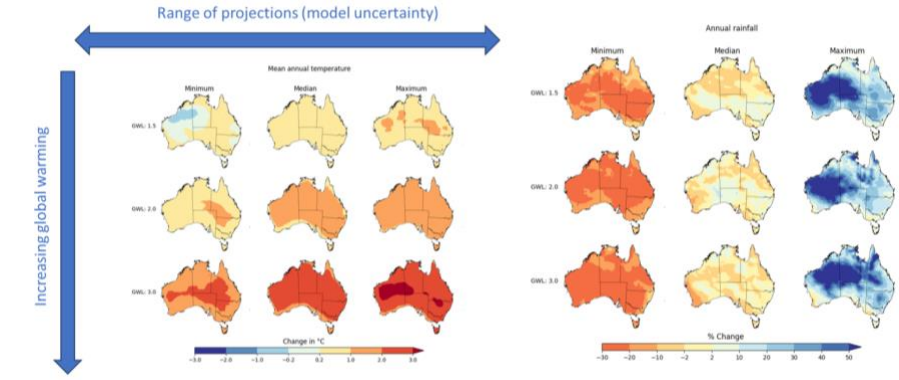
2 Extreme temperature and heatwaves are the most obvious effect of a warmer world. There is substantial ongoing climate science into the trends and causes of heatwaves due largely to their importance to human health and bushfire risk. SA Primary Industries benefit from the forecasting and communication of heat waves. RD&E on the impact of heat on agricultural production is continuing. For example, CSIRO has recently published a new set of damage functions to be used in modelling of heat and frost events in cereals and canola (gaps remain for pulse crops and pastures). Other CSIRO research in SA and WA has drawn attention to the impact of early autumn heat on canola. The winegrape and horticultural industries continue to experiment with sprinklers, canopy management and in some case shade cover and spraying sun-blocking compounds. One innovative approach is the use of solar panels as shade for grapevines. The livestock group at Adelaide University is researching ways that sheep genetics and shrubs might alleviate the impact of heat. This work will provide more information on thresholds for the damaging effects of heat on fertility. An important development highlighted by the National Climate Change Risk Assessment is the impact on the safety and human performance of agricultural workers.

3 Damaging frosts in South Australia are radiative frosts which are sensitive to the synoptic conditions of cold dry air trapped in a high pressure system and less sensitive to overall warming. This process is not well represented in global climate models which predict a steady reduction of frost. A general view of climate science is that frost will decrease in the long term (> 3 decades) but may increase in the short term. Frost continues to have a direct and indirect impact on cropping. Recent research confirms the poor relationship between minimum

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temperatures and frost damage, with one possible reason being the role of ice nucleating bacteria.

4 Rainfall remains the most worrying but uncertain risk. The recent drought leaves no doubt about the vulnerability of primary producers to water scarcity. The very dry autumns, winters and springs lead to questions about climate change and increasing aridity. Detecting the changes in rainfall and attributing them to climate change is difficult. There is a danger of over attribution during a drought such as the Millenium drought (2002-2009) when it is followed by the very wet 2010. Likewise, the very dry autumns of 2024 and 2025 were followed by one of the wettest autumns on record. The matrix of nine maps below from the National Climate Change Risk Assessment show that most of the uncertainty in future temperature (left) comes from the GWL (rows) compared to the uncertainty in future rainfall (right) where the uncertainty comes from the models (columns).



Uncertainty on rainfall is sometimes misunderstood as a message that rainfall will not change. One view put by Darren Ray, climate scientist from DEW, is that the agricultural areas of SA are in a cross-roads between wetter conditions to the north and drier southern conditions.

The recent drought in the Mallee showed that no matter how efficient farming systems and new crop varieties might be, there are limits when rainfall is extremely low. The rest of the state was able to produce remarkable crops considering the late start. As mentioned earlier irrigated wine grapes are facing catastrophic oversupply and low prices. However, a series of interviews conducted by SARDI Irrigated crops program as part of a OneBasin CRC project found that almond growers and wine grape growers can find ways to maintain production with lower water availability.

5 Extreme rainfall will increase but from a low base. South Australia has relatively low levels of rainfall intensity compared to the eastern states and northern Australia. Nevertheless, a change in intensity is relative to expectations and design of roads and culverts. Localised flooding is raised as an issue in discussion with growers, and the National Environmental Science Program (NESP) are funding interesting research on sub-hourly changes in rainfall intensity in Eastern states. There is interest in some of this work being conducted for South Australia.

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6 Carbon Dioxide levels will increase and one of the impacts will be slight increases in the water use efficiency of plants, but there will also be changes to pests and disease.

OUTCOMES AND IMPACT

Although this project wasn't intended as an extension project there have been opportunities to present directly to about 117 producers, 123 advisers, 98 researchers, 97 policy advisers and 40 students.

Primary producers focused on their business are the most important audience or end-user of information. We have used aspects of this framework in climate adaptation workshops and the GRDC update in February 2026. We have tested this product with a number of these farmers and the feedback has been positive. However, we are less sure that Primary Producers are likely to be the most common end user. They are more likely to access the information through intermediaries such as Farming Systems Groups, Research and Development Corporations, Landscape boards and agribusiness. Farmers do make major strategic decisions on enterprise choice and succession planning. A scan of the literature and conversations with advisers suggest that climate change is a relatively small component of these discussions. Nevertheless, it is important that basic information is made available.

Farming systems groups are important gate-keepers to the target audience of farmers. Their primary focus are trials, field days and workshops addressing local and immediate issues, but they also have a longer-term sustainability horizon and are increasingly seeking funds to deliver projects that include climate adaptation. The response has been positive but being closely aligned to farmers they are mostly focused on local and immediate problems. Not all farmers interact with farming systems groups or RDCs, but every farmer interacts with **retail and independent advisers.** The opportunity to present to the GRDC advisor update in February 2026 was one way to reach agribusiness. Although not comprehensive, this could be useful for the occasional request that PIRSA and SARDI Climate Applications and possibly SA Drought Hub get from **potential investors** in agriculture in SA. A succinct summary provides background for **media** requests. For example, the story on adaptation in the Riverland wine industry. **Landscape boards** play an essential role in Primary Industries adaptation. The sustainable Ag teams have regular interaction with farmers and farming systems groups. Penny Schulz (chair of chairs and SA Drought Hub colleague) facilitated an opportunity to present to the chairs of the Landscape boards. There is an opportunity to link this work to the regional drought resilience plans.

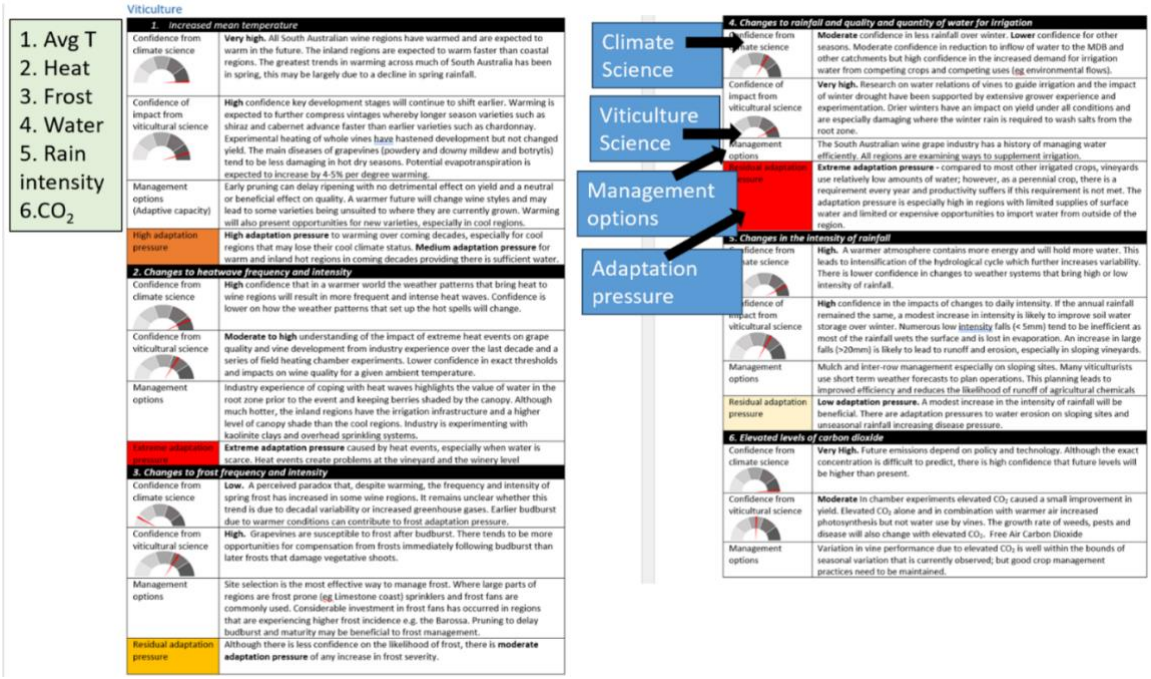
SA Peak industry groups. Primary Producers SA (PPSA) has a direct interest in conversations about the future of agricultural industries, especially as it relates to policy. PPSA have provided positive feedback in meetings and are supportive of the SA Drought Hub in general and this project in particular. **PIRSA's** climate change strategic objectives include 1) Ensuring primary industries and communities are prepared for and can adapt to the changing climate and 2) Providing accurate climate information and decision-making tools that are clear, concise and

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easily accessible. PIRSA has many activities relating to both emission reduction adaptation. This framework has a potential role in providing a simple succinct summary. This framework has also been useful to discuss R&D from **research providers** for SA Agriculture including universities, CSIRO and SARDI. There are also researchers working at different aspects of impacts and adaptation in agriculture such as supply chain risk or different levels (landscapes or regional level) that could find this useful.

The National Adaptation Plan is clear on multi-level planning for climate change adaptation. This project driven by SA Drought Hub fits in at a state level but there are opportunities to learn from other states and other jurisdictions.

The structure of this document with the six key risks and the assessment of confidence seems to be popular. No one has given us the feedback that it is too short or lacking detail. There is strong support for being clear on the different levels of confidence and including brief adaptation options.



Ranking adaptation pressures and industries is easier than rating. In other words, it is easier to say that viticulture faces more adaptation pressure than livestock than say viticulture is 2.5 (or some oither multiplyer) times more vulneable than livescock. One of the more positive responses from Primary Producers SA and conversations with farmers is the use of the phrase adaptation pressures indicating a headwind rather than refering to vulnerabilty, risk or damage reports. It is accepted that an adaptation pressure may be a headwind that topples an already vulnerable enterprise.

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Talking with farmers about climate change can be difficult. An influential paper discussed why it was difficult to talk to Australian farmers about climate change (Robertson and Murray-Prior 2016). Reasons included i) Climate change is a slow-moving variable and changes are uncertain ii) there are many immediate time horizons and non-climate factors involved in running a farm business iii) farmers are technological optimists, iv) agricultural scientists may not have much to offer on transformational change and v) communication is difficult on a contentious topic.

Ten years after Roberston and Murray-Prior's paper the **politics** of climate change have heated up. Although many interpret droughts, fires, floods and heatwaves as evidence for climate change the strongest evidence comes from slower moving variables of average temperature. The **uncertainty of rainfall projections** for South Australia adds to the communication challenge. **Non-climate stressors** such as the collapse in grape prices, extreme volatility in livestock prices and recent increases in fertiliser costs all make climate resilience more important but are also immediate and understandable distractions. One of the most consistent findings of this project is that farmers are **technological optimists** when it comes to adaptation and are less interested in **transformational change**. The argument for transformational change comes from policy and some sections of academia.

Interfacing with transformational change. It is important that research is conducted on new crops and livestock and that innovative farmers and entrepreneurs are supported. The work by Professor Rachel Burton, Adelaide University on Agave and Plantago is a good example. A common finding in discussion with farmers and farming systems groups is the technical optimism based on past-experience. It is hard to make the case that farmers should be abandoning what is currently best practice in dryland cropping, extensive livestock, viticulture and horticulture and transforming to new land use.

Adjusting the end of century 2 to 2.5 degree warming from preindustrial to 0.8 to 1.3 degrees from current temperatures tends to focus more on risk management than transformational change. Most of the main agricultural industries in South Australia are practiced at warmer locations nationally and internationally but not many are practiced in drier locations. Possible exceptions are grape production in the Riverland and cherry production in the Adelaide Hills which are likely to become limited by insufficient winter chill. However similar grape production is carried out in Riverina and Sunraysia which have mean temperatures about 1 degree warmer than the Riverland, and there are varieties of cherries used in warmer conditions and there are treatments that help synchronise flowering in cherries. Recent SARDI research on grape phenology shows that the impact of phenology on grapevines is not linear and that increased warming is likely to cause a greater shift in phenology in cool regions than warm regions. These changes fit the description of adaptation challenges. In comparison, a significant step change in rainfall would be catastrophic for SA farming, but there is less confidence in that change.

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If the number of phones taking a photo of a slide is a measure of interest, the winner is the emotion wheel relating to climate change.



Climate change depends on science, but it is more than a science lesson as it involves a potential existential threat to farming communites. Using the phrase ‘adaptation pressures’ rather than damage or vulnerabiltiy might be pandering to perceptions of invincibiltiy. However, it does seem to be a more effecive way to joing the conversation and to find the limits to adaptation. Industry experience in grains, livestock, horticulture and viticulture in SA keeps finding ways of adapting. R&D also struggles to find clear limits.

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