



IMPROVING SEASONAL FORECASTING



Improved seasonal forecasts are an essential part of helping Australian producers manage climate risk and successfully mitigate the impact on farm production and income.

The challenge

Australian farmers and agribusiness operate in one of the most variable climates in the world, with extreme events and climate variability the largest drivers of fluctuations in annual agricultural income and production.

The Centre for International Economics (2014) estimated that the benefit to Australian agriculture from seasonal forecasting ranged from \$958 million to nearly \$1.9 billion per year, and that was without knowledge of extreme events included in the analysis.

Demand for improved seasonal forecasting tools has grown significantly in recent decades in the wake of improvements in technology and connectivity.

Development of improved forecasting services and tools, particularly with regards to extreme

events, is an area in which GRDC has co-invested with other research and development corporations to assist growers in the management of their cropping program and farm business within a changing climate.

The response

For more than 20 years, Australian agricultural industry organisations including the GRDC have collaboratively invested in the national Managing Climate Variability Program (MCV) which has aimed to:

- Improve the accuracy of forecasting on time frames of value for primary producers.
- Provide climate products, services and tools for managing climate risk.
- Increase primary producers' knowledge and confidence to adopt climate risk management strategies.

The MCV program has been instrumental in bringing together a wide cross-section of industry bodies and research institutions to strengthen the link between climate research and the on-farm application of seasonal climate forecasts. Key co-investors in MCV include the GRDC, Meat and Livestock Australia (MLA), Cotton Research and Development Corporation, Sugar Research Australia and AgriFutures. This collaborative approach has enabled the grains industry to leverage better value for the investment in climate research and encouraged cross-industry learning about climate risk management.

Independent evaluations show that the benefit-to-cost ratio of industry investment in the MCV program is substantial - for each dollar spent, it's estimated there has been a return of over \$6.60 (Agtrans Research 2015).

The most recent phase of MCV is building on the significant work



undertaken since the mid-1990s and is focused on four key areas:

- Climate forecasting research - climate science projects aimed at improving the skill and value of seasonal climate forecasts, particularly from multi-week to intra-seasonal periods. The projects specifically focus on issues affecting growers' and producers' bottom lines, such as the ability to forecast extreme events including heatwaves and frosts.
- Climate forecasting services - translating climate forecasting research outputs into new forecasting products and services for Australian agriculture.
- Climate risk management tools for growers and producers - specifically research to progress decision-support apps and products such as the CliMate app.
- Climate-based extension and communication resources - increasing awareness and promoting adoption of climate risk management practices on-farm through initiatives such as the Climate Kelpie website www.climatekelpie.com.au and 'The Break' e-newsletter on seasonal climate updates <https://agriculture.vic.gov.au/support-and-resources/newsletters/the-break>

Projects conducted under the MCV program include the completed Seasonal Forecasting project - led by AgriFutures - which focuses on the improved use of seasonal forecasting to increase producer profitability, and the Forewarned is Forearmed project - led by MLA - which aims to improve the forecasting of extreme climate events including high or low rainfall, heat, cold and frost.

The projects are supported by funding from the Australian Government Department of Agriculture and Water Resources through the first round and third round of the Rural R&D for Profit program.

The Seasonal Forecasting project has been helping bridge the gap between seasonal climate forecasts and farm business decisions to ultimately improve farm productivity and profitability.

This has centred on defining the critical seasonal climate risk information needed by Australian producers, improving understanding of the usefulness of seasonal climate forecasts and how to incorporate these into business decision making, providing seasonal climate information which can be tailored to individual needs, and improving the skill of seasonal climate forecasts.

The Forewarned is Forearmed project is a significant investment within phase 5 of MCV and was developed with cash and in-kind support from 14 project partners including GRDC.

It draws together the extensive knowledge, experience, skills and contact networks of all major Australian rural research and development corporations, key research organisations, farming systems groups and the Bureau of Meteorology (BoM).

The project will deliver improvements in seasonal forecasts via the BoM's ACCESS-S seasonal forecasting system, new extreme weather/climate forecast products for use in agricultural decision-making, and further industry awareness and uptake of both new and existing products and services.

The impact

Improvements in the awareness, skill and adoption of seasonal climate forecasting has potential to deliver dramatic benefits to the risk management and profitability of Australian agribusinesses.

An example of practical outputs from the work is the BoM's release of the first set of extreme heat forecasts through the Forewarned is Forearmed project. This includes charts/graphs for:

- Top/bottom decile probability maps (Tmax, Tmin, Rainfall).
- Decile probabilities (bars) for stations (Tmax, Tmin, Rainfall).
- Daily distributions (distribution of daily Tmax, Tmin, rainfall for a given period) for stations.
- Heatwave probability maps.



- Probability maps of hot days/nights (for Tmean, Tmin and Tmax).
- Hot days timeseries/plumes (for Tmean, Tmin and Tmax) for stations.
- Probability of Exceedance (POE) by probability maps.
- Climagrams for Tmax, Tmin, Rainfall for stations.
- 2D Consecutive POE - probability of exceeding a threshold for x consecutive days for Tmax, Tmin, Rainfall, THI.
- Temperature-humidity (THI) maps.

These are initially released as experimental products with user feedback being channelled through the industry reference groups. Once feedback is received and integrated, selected forecast products which can be directly used to mitigate on-farm climate risk, will become operational. These will be available to growers and producers on an ongoing basis. Those interested in reviewing and providing feedback on the products should email Dr Peter Hayman at SARDI peter.hayman@sa.gov.au

The long term investment in the MCV program has also delivered the CliMate website and app <https://climateapp.net.au/> which has been downloaded by more than 20,000 users across Australia since its release in 2013.

The app contains a suite of climate analysis tools that enable users to

quickly interrogate the past 65 years of weather statistics, forecasts and climate probabilities for their specific location.

CliMate enables users to determine where the current season sits historically by tracking current season rainfall, temperature or heat sums for any specified period. This takes some of the guesswork out of assessing seasonal conditions relative to other years and allows growers to adjust inputs and yield expectations

It also allows users to explore a range of 'what if' scenarios and ask questions about rainfall, temperature and radiation, as well as heat sums, soil water and soil nitrate status.

Another tool which has been developed by Agriculture Victoria, SARDI and the Federation University with investment from GRDC, is the Forecasts for Profits website <https://forecasts4profit.com.au/> which enables growers in south-eastern Australia to quickly visualise the impact of climate drivers such as El Niño or the Indian Ocean Dipole on local rainfall over the past 100-plus years.

This allows growers to determine the probability of wetter or drier seasons in their district under different climate driver scenarios which assists in farming system planning and management.

Investments generated through the MCV program such as the Forewarned is Forearmed project

play a key role in helping growers and producers manage climate risk on-farm and ultimately manage sustainable and profitable farm businesses amidst a variable and changing climate.

Climate tools enable growers to respond to short-term weather events for critical decision points including sowing time, seeding depth, spray program or frost and heat response.

Improved forecasting can potentially allow growers to save on inputs by having the right information at the right time. Being informed and able to respond to weather events could save between \$8/ha to \$16/ha for weed or pest spray event to \$80/ha or \$100/ha for a frost event where a crop could be cut for hay.

Validation

South Australian grower and farm business consultant Barry Mudge knows all-too well the challenges of farming in an 'unreliable' environment, cropping 1600 hectares across properties at Mambray Creek, Baroota and Port Germein with a mean annual rainfall of 330mm and average growing season (April-October) rainfall of 220mm.

However he says unreliability does not imply non-viability, with growers like those in low rainfall zones already well versed in managing a variable climate.



“The keys to managing the impact of climate variability are adaptation, flexibility and innovation,” he said.

While he has used seasonal forecasts over the years to help guide seasonal expectations and planting decisions, he firmly believes it’s important to take into account the skill level behind the forecast before relying on it to guide farm management decisions.

“We are very fortunate in Australia to have comprehensive climate records dating back at least 100 years. This provides us with an excellent starting point in understanding what the variability of our seasons looks like - all a seasonal outlook forecast does is potentially alter the probabilities of the various outcomes occurring,” he said.

“Too often we tend to allow forecasts to subjectively invade our sub-conscious and affect our decision making, however a little bit of analysis of the range of possibilities and how a seasonal outlook forecast could change these is usually a worthwhile exercise.

“We accept that we farm in a highly unreliable and climatically variable region. Seasonal outlook forecasts will not change this.

“But used cleverly, they can enable us to at least be more comfortable with the many climate sensitive decisions that we need to make in the course of our farming careers.”

The outlook

Helping growers manage climate risk will continue to be an investment priority for GRDC.

In addition to climate related R&D, GRDC has recently released an investment strategy aimed at improving the accuracy of weather forecasting.

The strategy is available on the GRDC’s website and includes outcomes based on improving the understanding of weather forecasts, extracting greater value from current forecasting capabilities and improving the skill of one to 14-day forecasts.

Growers and producers across the agricultural industry face similar challenges in managing climate-risk, many of which are so complex and challenging that they cannot be addressed without key partnerships.

As such, GRDC will continue to work and co-invest with other RDCs and broader industry stakeholders to deliver new and innovative RD&E outcomes that help growers manage climate risk to run profitable and sustainable farm businesses.

References and resources

Climate Kelpie

www.climatekelpie.com.au

CliMate

<https://climateapp.net.au/>

Forewarned is Forearmed project overview

<http://www.climatekelpie.com.au/index.php/forewarned-forearmed/>

Forecasts for Profit website

<https://forecasts4profit.com.au/>

and overview

<http://www.climatekelpie.com.au/index.php/2020/02/12/visualising-the-impact-of-climate-drivers-in-your-backyard/>

Improved seasonal climate outlooks - the benefits for agriculture

<http://www.climatekelpie.com.au/index.php/iscf-benefits-for-agriculture/>

BoM Climate Outlooks

<http://www.bom.gov.au/climate/outlooks/#/overview/summary>

BoM agriculture services

<http://www.bom.gov.au/watl/index.shtml>

Climatedogs national forecast

<http://www.climatekelpie.com.au/index.php/forecast/>

GRDC Update paper

<https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2020/02/impact-of-climate-change-on-southern-farming-systems>

GRDC Update paper

<https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2018/08/climate-sensitive-decisions-fast-graphs-for-slow-thinking>

GRDC media release on climate guides

<https://grdc.com.au/news-and-media/news-and-media-releases/north/2019/10/growers-get-up-to-date-climate-and-seasonal-guides>

GRDC codes: MLA1805-001OPX