

Project Progress Report

February 2021

The first annual project review was completed by Coutts JR in October 2020. The project is making good progress with all milestones on track despite some challenges to face-to-face communication / extension presented by COVID-19. Management and governance have been working well with a high level of communication between all parties. R&D activities are on track with no major issues despite a slower than anticipated start due to contract finalisation. Engagement and communication activities were mainly in the development phase, with initial activities including distribution of the e-newsletter and presentations at crop walks. The regional innovators group (RIG) was initiated with 12 members recruited and was seen by stakeholders as one of the project highlights so far.



In paddock session of the second RIG workshop

Regional Innovators Group

The second regional innovators group (RIG) workshop was held in September and involved all 12 members of the RIG plus project members of the research, communications and extension teams, making up 25 attendees in total. The day was split between an in-paddock and an indoor session. The in-paddock session was held in one of the eight validation sites where discussions on landscape imaging, soil moisture probes, soil characterisation, crop growth, update on validation sites and future treatments were held. The indoors session focussed on weather data and seasonal forecasting tools, and a practical exercise on imagining the Eyre Peninsula data display application with the Square V team.

To help alleviate the information overload at future RIG workshops the management group decided to produce a regular RIG Update newsletter that provides ongoing reports on the progress of the research and development occurring in the project. The RIG members are also in constant contact with the project extension officer, Jake Giles, providing ongoing support and feedback.

Soil Water Sensor Network Development

The CSIRO's role in the project is becoming clearer as the datasets and resources available for predicting soil water in the region become apparent. There have been challenges in acquiring the required datasets due to a range of issues including probe function issues (3rd party provider), inability to frequently travel to the region (Covid-19 related) and some on-farm data layers not being available. A path forward has been developed which needs to be proposed to the RIG and project team.

An approach has been developed to (1) consider the optimised sensor network for today's number of probes, and (2) optimal placement of new probes accounting for the present-day network. This approach involves identifying representative combinations of covariates for different geographic units (quantiles). Discussion at the September RIG meeting suggested that effort would be placed on optimising the function and calibration of existing probes rather than locating new probes.

Preliminary analysis of sensor data quality and effects of temperature correction algorithms has been undertaken which is the first step towards the calibration of probe data to soil water to predict plant available water in mm's. Integration of the probe calibration and site characterisation information generated by the SARDI MAC team is the next step required to identify mm water. It is proposed that following an intensive effort on probe calibration that the CSIRO will use machine learning based approaches developed in other projects to generate soil water maps for testing with the project team.

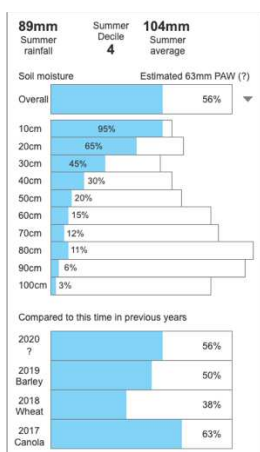
Protocols have been provided to EPAG Research to attain the required data and in the required formats for validation site mapping.

CSIRO have provided the Square V app development team with information regarding formats available and highlighted the capacity of the sensor data federator to support this activity.

App Development

Square V ran a participatory design session with the RIG in the September workshop. Participants were split into small groups to discuss and build their own "ideal user interface" for the proposed app from a selection of components of existing websites and their own sketches. They then explained their rationale for their designs to the group, including what was important to them at different times in the season and why. Following the session, sketches and notes were analysed to provide a clearer picture of the information that is important to participants and inform the design.

Subsequently, Square V provided a clickable wireframe prototype of the proposed site for review by the project team and then by the RIG. Development of the site began in the new year and is nearly complete and ready for demonstration in February 2021.



Clickable wireframe prototype of one screen

Soil Characterisation progress

All 2020 soil moisture probe pre-season, in-crop and harvest soil moistures have been undertaken and calculated for all 33 sites. Harvest cuts, grain yield and grain quality has also been assessed at sites with cereal in rotation. Eight full soil characterisations were undertaken in 2020 at 6 validation paddock sites plus two other sites. CSIRO supervised the initial sampling by SARDI to ensure sampling methodology is consistent for all soil characterisations. Yield Prophet® reports for the 2020 season on the eight validation paddock sites have been provided for early June, late July, August and late October.

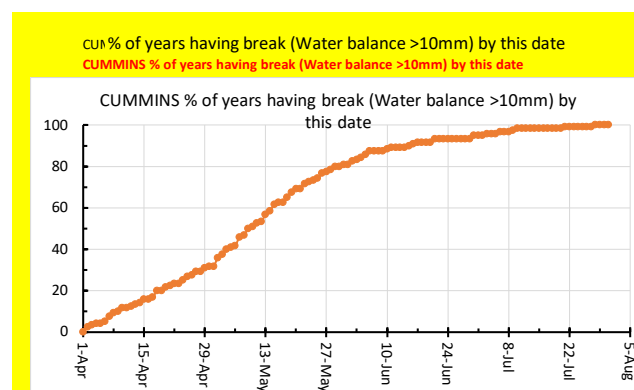
Development of Indices of Climate Risk

A summary of indices of climate risk for dryland farming on Eyre Peninsula (EP) including season break, spring rain, frost, heat stress and heat stress for sheep was circulated to the RIG for comment by the SARDI Climate Applications team. Feedback was provided by the RIG in a video conference and at the

second RIG workshop. A general response was that there is more interest in climate outlooks than monitoring the past. However, in 2020 there was frustration that the outlook for a wet winter didn't eventuate. Some of this concern has been addressed in a paper for the *EP Farming Systems Summary 2020* book.

In developing a 'break of season' indicator, the RIG group said that there was general acceptance that indices relating to the break of season are imperfect. Rainfall observations can be easily obtained from farmer observations, AIR EP stations (<https://airep.com.au/research/moisture-probes-weather-stations>), or from BoM weather. Rainfall maps (of what has occurred – day, week, month, months) including RMSE (error) analysis (day and month) are available at <http://www.bom.gov.au/climate/maps/rainfall/>. The Bureau of Meteorology provides evaporation (ETo) information in the form of daily ETo for numerous weather stations (<http://www.bom.gov.au/watl/eto/>). ETo over weekly periods and to a less extent over daily periods is relatively stable between nearby locations such as broad areas of Eyre Peninsula so ETo could be approximated fairly simply from the available BoM data.

Rules based on soil type (more rain required for clays than sands) require user input unless a standard for different soil types is developed. The CSIRO is currently publishing some work on break of season and the SARDI Climate Applications will follow this up.

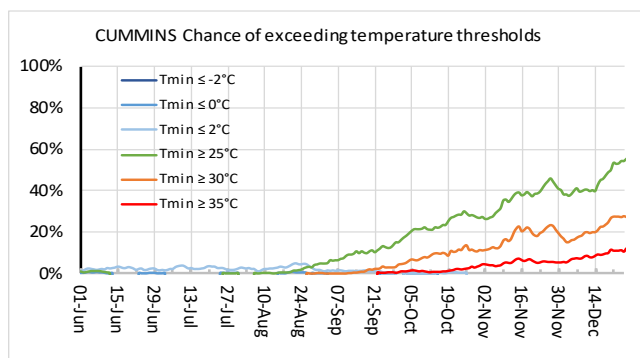


Break of season as measured by a simple water balance (Cummins)

There was a general acceptance by the RIG of plumes of rainfall as a useful guide to seasonal progress, and these are available from Yield Prophet® and Climate®. The new concept is to include climate drivers. A summary of seasonal tracking with the use of colour to show the deciles was seen as useful by the RIG. Growing degree days was seen as less useful because it was harder to make sense of the information. Yield Prophet® provides a better summary based on APSIM modelling for wheat.

The RIG also expressed concern regarding wind effect on harvest losses and erosion risk after sowing especially if the soil is bare and/or dry. Wetter soil or rain would reduce erosion risk at and following sowing.

Forecast accuracy of both wind and rain in days to weeks around sowing would be desirable. There was significant frost damage in 2019 and 2020 and some extreme spring heat events in September 2020. Michael Hind, a member of the RIG, has contacted SARDI Climate Applications with ideas on frost measures.



Chance of exceeding extreme temperatures of frost and heat at Cummins

A framework for economic analysis using the Value of Information (VoI) is proposed which is an established tool from applied economics to focus on how information can be used in a specific decision context. The VoI is the amount a rational decision maker would be willing to pay for extra information prior to taking action.

Discussion with the RIG has focussed on cropping. However, livestock are recognised as an important part of sustainable agriculture on Eyre Peninsula. We will continue to pursue whether measures of Thermal Heat Index for sheep are useful for decisions on joining.

Paddock Validation

Field work at the eight validation paddocks for the 2020 growing season has been completed, largely as planned. Eight validation paddocks were selected in conjunction with the RIG with the following aims:

- To collect detailed information that will help to calibrate soil moisture probes.
- To collect information on variation of plant available water holding capacity within a paddock and how that impacts on production.
- To determine how well APSIM/Yield Prophet® correlates with water use/plant growth in eight environments.
- To determine if changing management practices has the ability to improve yields.

The considerable data collected is being compiled, analysed and interpreted. A summary of this will be distributed to the regional innovators group prior to the March 2021 RIG workshop.



Adjustments to the validation plans are constantly evolving as new data layers are gathered and the growing season progresses. Sites were partially zoned using available information (Yield maps, historical NDVI, soil survey information – EM38, and farmer input). Sampling and measurements have been taken at 15-21 waypoints in each of the 8 focus paddocks.

Validation trials have begun at all 8 validation paddocks looking at how robust the technology used is, as well as providing a core understanding of the limitations to crop and pasture production across each paddock.

Jake Giles, the project extension officer, has engaged closely with the eight validation site farmers and was able to visit the majority of growers hosting a soil moisture probe (n=35) to capture all data required to provide an improved understanding of soil water holding capacity of their soils and how that relates to crop/pasture production.



Influencers Information Session

The first key regional influencer information session was held in December in Port Lincoln. This was the first of three information sessions to be held over the course of the project to inform interested stakeholders not directly involved in the project. There were 14 participants at the workshop. Feedback on relevance and usefulness of the Resilient EP project to the industry and growers included, *“at the moment the relevance is being discovered but the potential is vast”*, and *“a great opportunity to increase value of the monitoring sites across EP & beyond”*.

The Resilient EP project is now featured on the home page of the newly created AIR EP website <https://airep.com.au/>

