

M&E REPORT

Resilient EP Final Evaluation Report 2023

March 2023

ACKNOWLEDGEMENTS

The information in this report is only possible because of the willingness of the project team, RIG members and other stakeholders who shared their experiences and insights through the various data collection methods used. The project manager, Mark Stanley provided excellent support during the ongoing monitoring and evaluation process.

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SUMMARY

Purpose	Project Objective	Evaluation Approach
The purpose of this report is to provide a final evaluation of the National Landcare Program's Smart Farming Partnerships Round 2 project: 4-CS70YDN A new paradigm for resilient and profitable dryland farming on the Eyre Peninsula using data to improve on-farm decision making.	The project aimed to contribute to Improved farm sustainability, productivity, profitability and ability to manage current and emerging climate risks by farmers and their advisers by improving understanding of seasonal climate forecasts and soil moisture management and decision-making.	Monitoring and Evaluation (M&E) data were collected throughout the life of the project based on the M&E Plan through annual interviews and feedback from project meetings and events. In the final year, five case studies were undertaken to explore the impact the project had on growers engaged in the project.

Findings

Long-term objectives

While it is too early to measure impact on resources and profitability, overall, the project has provided education and guidance to farmers, increased knowledge of crop growth and yields, and enabled better management practices through understanding soil limitations and opportunities for improvement. The project has focused on providing growers with a better understanding of their yield potential and strategies to achieve it, including the best ways to use and understand moisture probe information in dryland farming and to gain confidence in the use of seasonal climate forecasts.

Capacity, practice change and on-farm impacts

A strong feature of the project has been the strengthening of relationships between farmers, consultants and researchers. Feedback from engaged farmers and case studies of impact on host farmers for trials showed that this interaction provided the basis for a deeper appreciation of how a better understanding of plant available water and the role (and limitations) of forecasts can improve decision-making around crop and fertiliser management for optimal yields.

Engagement and communication

Project awareness was communicated broadly through the region through the AIR EP Newsletter, dedicated website and social media as well as an internal project newsletter called the RIG Report to update those most closely involved with what was happening and coming out of the project. Bi-annual RIG meetings provided a very effective opportunity for interaction with researchers and developing mutual understanding around soil water management. Broader messaging in relation to taking action was dependant on the findings from the project trials, with limited data available in the

early to mid-stages of the project – momentum in this area increased in the final year. Project outcomes will continue to impact on available information and advice and informing future projects and communication to farmers.

Discussion groups around the eight validation sites (focus paddocks) proved to be very effective in stimulating interest and discussion around soil moisture and crop management. The EP Innovation tour to validation sites which involved key farming systems scientists and advisers from across Australia was viewed as a very successful way of bridging the gap between farmer and research knowledge, and the Nitrogen Workshop was described as ‘one of the best conversations that has ever been had about our biggest [cropping] input Nitrogen’.

Research and development

While the intended development of the soil water sensor network did not proceed in the way that was initially envisaged due to technology limitations related to sensors and calibration requirements, the work undertaken was seen to have been successful in improving understanding and use of probes, as well as the challenges and limitations associated with them. A working product for data visualisation was co-designed and refined by researchers, RIG members, and the product developers. The validation sites were assessed as having added significant value to the project in improving the understanding of technology integration in farming practices and the use of soil moisture probes to make informed decisions. The climate risk team was seen to have successfully supported and liaised with others in the project to improve how climate risk and seasonal forecasts are communicated and understood.

Project management

Responsive project management and the involvement of the RIG was seen to have been a critical part of the success of the project and the learning that came out of it. Monitoring and Evaluation provided strong support and provided input into reporting and management decisions.

Going forward

The RIG was seen to have demonstrated its value and a similar approach has a positive role to play in future projects. Broadening extension activities beyond the validation sites was seen as a way of creating greater awareness and interest across the region.

Conclusions

- 1 While the project did not progress the water probe network, soil mapping and decision tools in the way that was initially envisaged, it effectively brought together growers, researchers and advisers to explore the gaps in technology and increase understanding around soil moisture, soils and climate forecasts – developing a much firmer base on which further gains can now be made. This momentum needs to be continued to capitalise on the work undertaken to date.
- 2 The RIG approach was a very effective way to include stakeholder input and ownership and this has applicability to similar projects going forward. It had a major and positive impact on the project and its direction. The experience and lessons learned during the process should be considered for future collaborative groups in future.
- 3 The Adaptive Management approach – through the interaction with the RIG and the regular project management meetings – ensured that the project was able to make those changes needed in response to emerging issues, more information and opportunities. Monitoring and Evaluation was an important part of providing structure and rigour around this iterative process.

Summary of Achievements

Table 1: Planned project outcomes/outputs and achievements against these

Planned Outcome/Output	Extent of Achievement	Comments
Improved understanding of climate risks	Moderate	The project helped participants to understand the climate factors that posed risk to their farm businesses and some steps that could be taken to minimise these.
A better understanding of seasonal climate forecasts	Moderate	Despite some of the forecasts not being consistent with actuals over the course of the project, exposure to climate forecasts, resources and expertise increased the grower understanding of the influences and most effective use of forecasts.
Improved decision making on cropping and grazing management in relation to soil and water.	High	The trials and discussions around plant available water, the role of soil moisture probes and climate forecasts provided a better understanding in engaged growers around the amount and timing of N, control of summer weeds and choice of crops and rotations – as well as the benefits of variable rate application.

Improved profitability	Moderate	Improved decision making around soil moisture and use of N was shown to have a significant impact on optimal productivity and hence profits.
Famers and advisers engaging to work together	High	The RIG approach was a significant factor in the effectiveness of the project and in pioneering how stakeholder input can maximise benefits from projects.
Increased social capital in the EP Farming system	High	All of the different stakeholder groups strengthened their networks, understanding, and social and technical resources for ongoing improvements to their farm and social resilience.
Communications strategy	High	There was good use of communication medium for external and internal stakeholders. The discussion groups proved very effective for those more closely engaged – there was a recognition that there was a need to even better communicate with the broader grower group networks.
Regional Innovators Group (RIG)	High	As above, the RIG was made up of regionally based growers, consultants, and researchers and provided a very effective mechanism for adaptive management.
Field Days/walks at trial sites	High	There were a number of field walks and discussion groups around the host farms with positive feedback about the value from participants.
Decision Support Tools developed/improved	Moderate	CSIRO assisted with the analysis and quality assurance of plant available water characterisations and refined APSIM outputs for the Eyre Peninsula and made them available for project use via Yield Prophet.
Review of soil characterisation	Moderate	As above, soil sampling at all probe sites undertaken to determine crop lower limits.
Soil water probes improved	Moderate	Probes were found to be limiting in some soil types and summers readings needed calibration to account for warmer temperatures. CSIRO tested a range of methods for extrapolating soil moisture probe data away from the probe location at paddock and potentially farm (and regional) scale. Strength of relationships between soils, PAW, rainfall and probe signals investigated to test reliability of probe signal to soil moisture. Regional gaps in soil moisture probes were identified by the CSIRO and in some instances filled.
User-friendly/mobile application for soil moisture data display	Moderate	Square V delivered a working product that was co-designed and refined multiple times based on RIG feedback – a large amount of time was spent trying to triage data issues caused by the probe hardware. Available on https://probes.airep.com.au/
Maps of production risks based on available soil moisture and production risk.	At farm level	Plant available water (PAW) data used in digital soil mapping to predict PAW across three focus farms at the paddock and farm level. Early project attempts to produce regional real time PAW maps proved to be too difficult due to lack of data.

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1. INTRODUCTION

1.1 Purpose of this Report

The purpose of this report is to provide a final evaluation of the National Landcare Program’s Smart Farming Partnerships Round 2 project: 4-CS70YDN A new paradigm for resilient and profitable dryland farming on the Eyre Peninsula using data to improve on-farm decision making.

Monitoring and Evaluation has been built into the project as an integral component from the outset to ensure that a comprehensive and holistic approach is taken.

1.2 Background

The Smart Farming Partnerships is funded through round one (2017-22) of the National Landcare Program’s Smart Farming Partnerships. The objectives were to:

- Develop, trial and implement new and innovative tools and farm practices that support industry practice changes that will deliver more productive and profitable agriculture, fishing, aquaculture and farm forestry industries;
- Protect Australia’s biodiversity;
- Protect and improve the condition of natural resources (in particular soils and vegetation); and
- Assist Australia to meet its obligations under relevant international treaties.

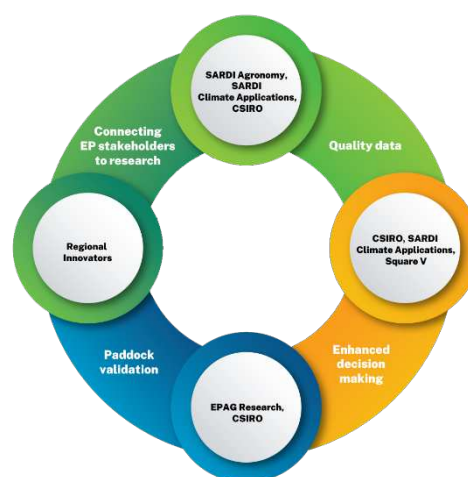


Figure 1: Collaborating partners (source: Resilient EP brochure)

In this project, the aim was to utilise new and emerging technologies to assist farmers make efficient use of soil moisture. The Eyre Peninsula has an extensive soil moisture probe network which was seen to be underutilised. A *Regional Innovators Group* (RIG) of farmers and advisers was established to engage with researchers and link in with the region’s farmers to develop techniques to integrate information generated from the probe network, satellite imagery, climate and yield models. The intention was that farmers would be able to make more informed, timely decisions to optimise the region’s productive potential while protecting soil and water resources in a changing climate.

1.3 About the Evaluation Process

This report used a variety of sources – listed in the table below – to build a comprehensive picture of project progress over its life. The structure of the report is based around the Monitoring and Evaluation LogFrame to reflect the project and contract objectives.

Table 2: Key information sources used in this report

Information Source	Details
Resilient EP Six-Monthly Progress Reports/Summaries	<ul style="list-style-type: none"> • Required six-monthly progress reports for NLP Smart Farming Partnerships. • Collated by the project manager from summaries submitted by each of the partner organisations. • Provides detailed information of overall project progress and for each of the activity components. • Six submitted between August 2020 and February 2023.
Annual and Final Stakeholder Interviews	<ul style="list-style-type: none"> • Annual project monitoring interviews with 30-40 stakeholders undertaken each year. • Aimed at developing an understanding of how comfortable key stakeholders were with project progress and any insights they could offer to guide future activities. • The summary of the final round of interviews (see appendix 4.4) was a key input into this final evaluation report.
Case Studies	<ul style="list-style-type: none"> • Five case studies were undertaken towards the end of the project to explore what impact the project has had on people’s understanding, thinking and practice. These replaced the previously planned basic economic analysis as this would have been too premature (see appendix 4.2).
Meeting/Event Feedback Sheets	<ul style="list-style-type: none"> • Developed to capture participant feedback on meeting/event usefulness and project progress. • Responses were received to eleven project team feedback sheets distributed post meeting (see appendix 4.3.1). • Feedback sheets developed for RIG meetings and other activities held over the life of the project (see appendix 4.3.2 for feedback received between July-December 2022). • Debrief session final project RIG workshop March 2023.
M&E LogFrame	<ul style="list-style-type: none"> • Developed to ensure that needed data is captured to assist in effective monitoring, evaluation and learning from the project (see appendix 4.1). • Used to guide the analysis and structure of this report.

2. FINDINGS

2.1 Long Term Objectives

Improved farm sustainability, productivity, profitability and ability to manage current and emerging climate risks by farmers and their advisers – also improving the Eyre Peninsula soils and water resources.

Approximately 1000 farm businesses in the region, covering 3.072 million hectares of farming land - consisting of dryland cereals, grain legumes, canola and pasture fed livestock. Approximately a third of the region is highly vulnerable to soil erosion.

Performance Measures: *Extent of improvement in soil and water resources in the vulnerable areas of Eyre Peninsula over time; Extent of improvement in farm productivity and profitability on farms in Eyre Peninsula*

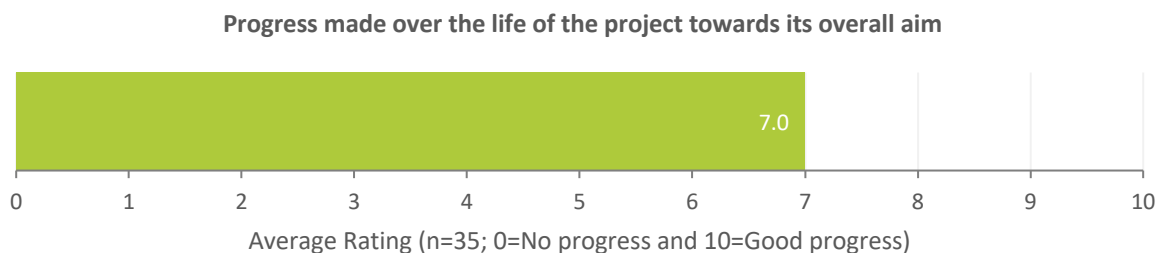
While it is too early to measure impact on resources and profitability, overall, the project has provided education and guidance to farmers, increased knowledge of crop growth and yields, and enabled better management practices through understanding soil limitations and opportunities for improvement. The project has focused on providing growers with a better understanding of their yield potential and strategies to achieve it, including the best ways to use different moisture probes in dryland farming.

2.1.1 Progress towards longer term objectives

These objectives go beyond the life of the project, however, the intermediate indicators can provide a measure of confidence that the project can contribute to these higher-level objectives.

Progress: In the final interviews with a range of stakeholders associated with the project, the question was asked about their assessment of the progress made towards the overall aim of the project. While the average was a healthy 7/10, it is interesting to see the break-up of the assessment across the different stakeholder groups.

Figure 2



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	8.3	7.1	5.8	6.2	6.9	7.0
n	7	7	4	6	11	35

Variability in assessment: It is noted that the project team and RIG members rated progress higher than the other interviewees. This is probably due to their more intimate understanding of what was achieved within the project scope. While there have been beneficial linkages established between growers, advisors, and researchers, the direct and short-term value of the project was seen to have been limited to those directly involved. Broader engagement with the wider community was not as evident (although there were articles distributed and field days at sites), potentially limiting project impact on a larger scale at this time. Also, it was not until the end of the project that findings/clear messages were ready for wider communication – with some questions still to be answered.

Challenges: One of the challenges of the project raised by some *research* stakeholders (reflecting the lower score of project achievement) was a lack of clarity around its technical goals and objectives. The project was seen to have been *slow to get going* with those involved grappling with *what exactly they were trying to accomplish*. It was suggested that *expectations of what could be achieved to some degree was based on a bit of naivety*.

2.1.2 Project contributions

The project made a number of significant contributions towards improved understanding and soil management. These are summarised below.

- **Use of soil moisture probes:** Stakeholders reported that the research has helped to better understand the benefits and limitations of using soil moisture probes and resulted in increased accuracy (reduced error to around 20-30ml) of stored water available to plants. Yield Prophet reports, and paddock meetings have increased grower understanding, and the ‘Stoplight System’ has made this easier to understand.
- **Mapping soil moisture:** The project aimed to map plant available soil moisture across the landscape and while it did not achieve this project goal, it provided valuable learnings about the limitations and capabilities of available technologies, as well as highlighting the complexities of landscape and farming systems and the importance of understanding paddock variability when making decisions. Techniques for mapping plant available water at the paddock and farm were tested and provided significant direction for future research. The project was seen to have been beneficial for growers and advisors, in lower rainfall areas, “changing their perspective on what they can achieve.” Formalized management processes, including PAW maps, have been implemented, including some equipment changes. Adjusting inputs into APSIM have resulted in more accurate Yield Prophet predictions for the region.
- **Improved soil management:** Project research has contributed to improved soil and water management on farms, enabling more informed conversations and decision-making about sowing time and techniques, fertilizer rates, and weed management. It has given farmers greater confidence in making decisions about crop management and monitoring plant available moisture throughout the growing season.

- **Local Soil Characteristics:** An additional 36 soils were characterised across the region which have contributed to the understanding of plant available water. While there are still unanswered questions, the project has contributed valuable information about soil characteristics in the Eyre Peninsula, soil types, reducing expenses on less reliable zones in the paddock and helped farmers understand the impact of soil constraints and reduced rainfall on soil moisture.
- **Improved understanding of climate risk and seasonal forecasts:** The project has led to an improved understanding of climate probabilities, forecasting, and the use of tools including Yield Prophet reports. The impact of climate change on plant available water is better understood, and in-season climate information is being used to inform on-farm decisions. There is also an increased understanding of climate drivers and the available models to aid in decision making.
- **Improved relationships:** The project's structure and the involvement of growers, consultants, and researchers from the onset, was seen as one of the strengths of the project. It was agreed to have successfully linked these different groups across the Eyre Peninsula, bringing them together to discuss regional issues and exchange knowledge. This base is an important one to continue on-going momentum towards achieving the longer-term goals of the project.
- **Decision-making:** The project's goal to improve decision-making and nitrogen management in crops was also seen to have met with some success. Moisture probes were reported to have helped farmers make decisions about efficient fertilizer use and gain a better understanding of their soil characteristics and plant available water. After three years of accumulated data across the Eyre Peninsula, farmers interviewed are more confident in their sowing decisions and have made a good start toward determining potential yield using plant available water data from the probes.
- **Researcher capacity:** From a researcher perspective, the continuity of meetings across the three years was acknowledged as "rare" and "extremely valuable" in discussing weather conditions and forecasts. Challenging growing seasons during 2020 and 2021 also highlighted the importance of using imperfect forecasts and communicating results more effectively.

There have been limitations and gaps identified in fully delivering on these longer-term outcomes as summarised below:

- **Gaps:** While the project has helped to improve understanding about plant available water and soil characteristics in the region, there was still some concern about the value of moisture probes and Yield Prophet tools, to support decision-making around weather forecasting.
- **Application:** While the probes are acknowledged as providing significant data, the team is still working to understand how to apply that knowledge. There are still gaps in understanding the meaning of specific soil moisture probe readings and appropriate responses. More work is also needed to manage for variability in data across paddocks and larger areas and it was agreed "there is still a long way to go in [achieving the ultimate goal] the project [producing real time sub-paddock scale plant available water (in mm) maps]."

2.2 Capacity, Practice Change and On-farm Impacts

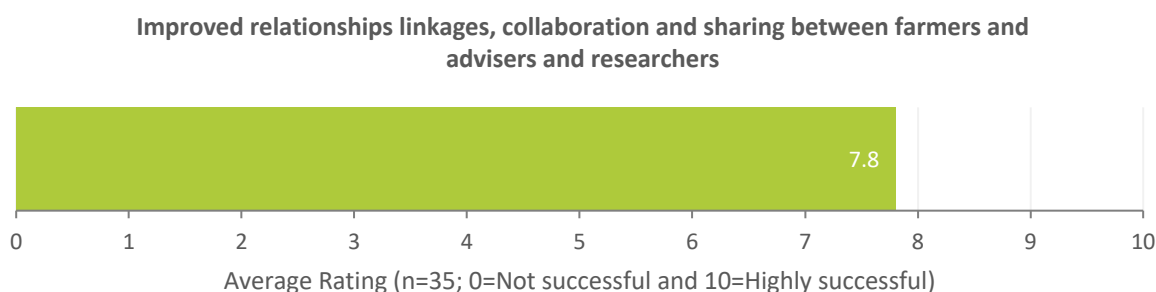
- **Improved understanding of climate risks** and how these risks have changed over recent decades and likely to change in future projections by researchers, advisers and farmers.
- **A better understanding of seasonal climate forecasts** by the EP farming community and improved communication between EP farmers and the Bureau of Meteorology via the SARDI Climate Applications Group.
- **Improved decision-making:** The project will enable farmers in the Eyre Peninsula to make more timely management decisions on cropping and grazing management that will optimise productivity from the regions soil and water resources, whilst protecting and enhancing the region's soils.
- **Improved profitability:** This will result in more profitable farm businesses through more efficient use of inputs, improved crop / pasture choice and enhancing productivity through more timely decision making.
- **Farmers and advisers will engage researchers and link with the region's farmers to develop techniques** to integrate information generated from the soil moisture probe network, satellite imagery, climate and yield models. Farmers will be able to make more informed, timely decisions underpinned by innovations in agronomy and livestock management.
- **Increased social capital in EP farming system**

Performance measures: *Extent of gain in understanding of climate risks, seasonal forecasts and their implications by advisers and farmers based on the groups targeted; Extent of farmers and their advisers accessing and making use of decision-making with respect to cropping and grazing management; Indicative gains in profitability on farms that improve decision-making as a result of project outputs; Factors impacting on engagement and take up of decision-making tools; Extent of improved relationships, linkages, collaboration, information sharing.*

A strong feature of the project has been the strengthening of relationships between farmers, consultants and researchers. Feedback from engaged farmers and Case Studies of impact on host farmers for trials showed that this interaction provided the basis for a deeper understanding of how a better understanding of plant available water and role (and limitations) of forecasts can improve decision making around crop and fertiliser management for optimal yields.

2.2.1 Improved relationships

Figure 3



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	8.7	8.4	8.3	6.7	7.4	7.8
n	7	7	4	6	11	35

The project was seen by stakeholders to have been valuable in bringing together growers, researchers, and advisors, providing a forum to discuss farming practices. It was noted that there is still work to be done in terms of using the data to make better decisions and connecting with the broader farming community. Relationships have grown through working and sharing knowledge, but messages have not connected with wider farmer communities.

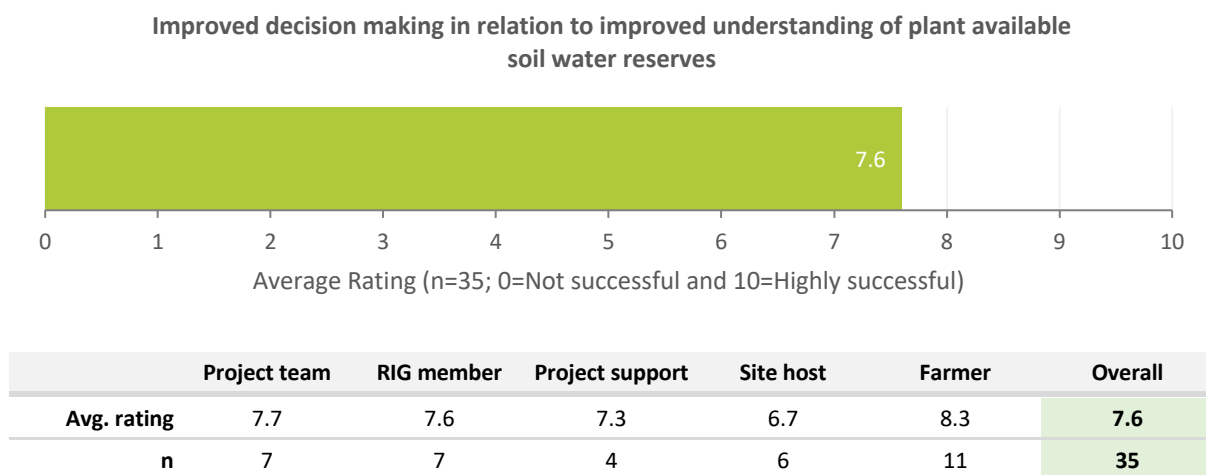
The **project team** noted that the direct involvement of farmers and advisors has improved relationships and had a positive impact. This was very helpful for researchers, consultants and growers and then the project as a whole because there was a much wider information base and potential flow of information throughout the duration of the project. It also was seen to have served as valuable in highlighting that frustrations experienced with forecasting are widely experienced challenges across all research projects. Actions taken included expanding partnerships and collaborations as well as replicating the participatory approach, demonstrated as successful via the RIG, into new project initiatives.

RIG members reported having a better understanding of where current research got to and of farmers' perspectives and the benefit of everyone coming together into one room and provided a platform for discussion. It was seen to have provided opportunities for researchers to directly engage with farmers on the Eyre Peninsula. Although seen as very successful in engaging and providing useful information to those directly involved, its impact on a broader constituency *remains to be seen*.

2.2.2 Improved understanding and decision-making

Interviewed stakeholders overall believed the project had been quite successful in terms of improving decision making in relation to improved understanding of plant available soil water reserves (7.6/10 avg.).

Figure 4



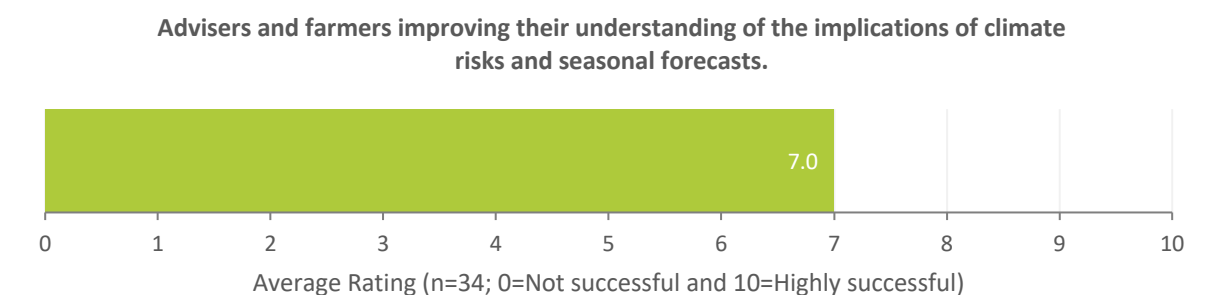
In this area, there was close agreement between the different stakeholder groups about the level of improved understanding about plant available soil water reserves – a key objective of the project. It was positive to see that in this case, farmers rated this very highly.

The project was seen by *interviewed stakeholders* to have helped improve understanding around soil moisture and decision-making: improving understanding about carried over soil moisture; how different crops impact stored moisture; and the importance of summer weed control. It was suggested that prior to this project, plant available water was not something growers considered (at all or to a much lesser degree), whereas now it is calculated into all decisions.

RIG members in the final workshop reported a number of impacts of the project on their own decision-making including: expanding thinking on what wheat yields were possible; better linking soil moisture to projected yields; altering rotations; better understanding of the limits of extrapolation from a single probe; making decisions around summer weed control; finding the ‘sweet spot’ for Nitrogen decisions; and increased use of variable rate application and technology.

Stakeholders also felt the project had been fairly successful in terms of improving adviser and farmer understanding around the implications of seasonal forecasts (7/10 avg.) – though farmers interviewed (both site hosts and others) were slightly less confident in the project’s success, providing comparatively lower average ratings.

Figure 5



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	8.6	7.1	6.7	6.3	6.4	7.0
n	7	7	3	6	11	34

The most recent **project workshop** received positive feedback from attendees, who noted having changed their thinking as a result of what they have heard over the project life. It was reported that regular visits from GRDC, Department of Ag and weather experts have helped keep participants engaged in the project. It has increased awareness of probe technology and nitrogen management and some farmers have been able to interpret data from installed probes and make decisions independently.

The **case studies** (see the full case studies in the appendices) provide real examples of where the project and its activities have impacted on individual growers. The table below captures the key features of the cases and the impacts on the producers involved. The cases show how involvement in the project validated some current practices, strengthened understanding and lead to confidence and improved practices around variable rate, nitrogen use and reducing risk in crops.

Table 3: Case study summary of impact

Case Study	Impact on awareness and understanding	Impact on decision making
Variable rate inputs on variable soil types based on yield potential		
<p>Using moisture probes to understand and manage soil variability across zones, paddocks and whole of farm, to mitigate risk.</p> <p>Bruce Heddle’s 1600-hectare - cropping focus and livestock – on-farm trial with project – had an existing soil moisture probe</p>	<ul style="list-style-type: none"> Understanding the variable PAWC across zones within his paddock has been beneficial with the use of VRT to optimise inputs. With the added knowledge of PAW and use of technology such as the soil moisture probe, yields can be optimised in season. The EPAG Research team were seen as thorough and disciplined in their process and Bruce places significant value on this data as a resource. He reported that conversation at farmer group meetings held at the site had been engaging and free flowing with people interested to see what comes of the two replicated trials. He feels the region is gaining a better understanding of the role and limitations of soil moisture probes. 	<ul style="list-style-type: none"> The Resilient EP project has served to validate his strategies. His move towards variable rate is happening concurrently with the Resilient EP project trial, “not necessarily as a result of it.” - the only major changes being towards variable rate, which have been in response to the zones.
<p>Variable rate technologies across variable soil types and sustainability impacts</p> <p>Todd Mathew’s - 6500 hectares - mixed enterprise cropping peas, lentils, canola and barley as well as running sheep – on farm trial on 180 hectares where there is a high level of variation in yield.</p>	<ul style="list-style-type: none"> The main value Todd has gained from his involvement in the project has been a result of the protein machine installed. While this was not the anticipated outcome, it has been worthwhile, and he has gained an added layer of data across his paddocks. Todd has a better understanding of soil moisture and when to push more inputs, accounting for deep N levels. Todd believes this project is contributing to improved understanding about soil constraints, different soil types and variability within paddocks and across farms. He said most growers in the district have visited his paddock and had in paddock discussions about nitrogen, which he believes will impact their nitrogen decisions. 	<ul style="list-style-type: none"> His involvement in the Resilient Eyre Peninsula project has also given him confidence to use variable rate technologies on his farm. From an environmental perspective he said this knowledge “helps in making more informed decisions and making sure we are efficient.” He is hopeful that as a result of his involvement he has locked in some higher yields.

Case Study	Impact on awareness and understanding	Impact on decision making
Pushing the Benchmark		
<p>Pushing the Benchmark Kerran’s farm - 6500-hectare mixed farming enterprise, cropping 4500 hectares and running between 2500 and 4000 Merino sheep - deep N trials across his paddock and the impacts on input costs and yields</p>	<ul style="list-style-type: none"> • just starting to get results in terms of understanding nitrogen levels and soil available water to the plant, but suggested more time is needed to understand how that is driving yields and how the nitrogen is cycling through a whole rotation. He said, “while we are always building a better understanding, I feel like we've got a lot more to learn”. • He believes the results will be closely looked at locally, as a lot of growers are seriously looking at their systems and how much it is costing to put crops in. 	<ul style="list-style-type: none"> • Kerran will be looking at how he can use learnings from the harvest of nitrogen test strips to plan nitrogen inputs more broadly. • He said, “if we can get some good data out of this, and I think it's going to be, then there will be more uptake of variable rate technology to better match nitrogen inputs and be more cost effective. People will see the benefit if they can see the results in the data.”
Stored soil moisture, yield potential and how to mitigate risk		
<p>Understanding stored soil moisture Paul Schaefer’s 4,500 ha property - livestock as well as barley, canola, vetch, lupins and medic pasture rotations – on-farm mixed farming trial</p>	<ul style="list-style-type: none"> • The level of information available from the moisture probes was described as unexpected and its value has been “really excellent.” In the past he did not often make changes to set plans, whereas now armed with this type of information he would “base rotations on the moisture available rather than just a guess.” Previously, Paul said he had been caught out, letting pasture die off. He explained that having the two probes on paddocks, side by side, has shown that a wheat crop once it is ripe, stops using moisture, but the pastures can continue draining moisture for a long time, sometimes into January, which means a lot of moisture is needed to recharge the system. • Paul is more likely to spray pastures out earlier, even if there is some feed left, to conserve moisture. “This was something that we thought we knew we needed to do but didn't do as much as we should have in the past,” he said. 	<ul style="list-style-type: none"> • The moisture probes have given Paul confidence to do summer weed control, knowing that money spent on summer spraying is beneficial. He explained that after spraying a paddock and reviewing the probes data, several days later, he can see moisture has stopped draining out the soil profile. The moisture probes have given him confidence to make these decisions. • In terms of long-term planning, Paul is hoping to re-introduce canola back into his system after not sowing it for several years. He explained canola had generally been a risky crop in the region and has not been a huge part of his rotations. With the data from his moisture probe, he now has the confidence pre-sowing, to better understand available soil moisture.
<p>Using soil moisture data to make targeted decisions relating to inputs and yield potential Andrew’s 8,000 ha property – principally cropping wheat and lentils, as well as barley, canola and faba beans.</p>	<ul style="list-style-type: none"> • Andrew has gained a lot of insight about his soil type and how to manage his paddocks based on his attendance at the Resilient EP project meetings, where he has had the opportunity to meet with researchers and others involved in the project. He has found the information presented interesting, particularly at the higher level in terms of understanding different models and how to relate and scale information from the soil moisture probes to the rest of his farm. • As a result of involvement in the Resilient EP focus paddock, Andrew has gained an improved understanding of soil moisture in absolute terms and the characteristics of the soil releasing it. He said, having the soil moisture probe in the paddock has “reinforced understanding and given us the confidence to install at least one other soil 	<ul style="list-style-type: none"> • In terms of the payoff, he said, “there is no doubt in my mind it has been well worthwhile, and we have got our money’s worth back in information, particularly in terms of confidence about nitrogen management.” • He explained the investment has enabled more targeted decisions. Using data from the moisture probe has resulted in decisions that have saved on nitrogen applications. • He noted this had recently been a valuable piece of information to present to his bank. Understanding there is moisture

Case Study	Impact on awareness and understanding	Impact on decision making
	moisture probe on another soil type across our farm.”	available meant he could confidently show his lender that there is currently more soil moisture available than has been there in the past 5 years.

Feedback from project extension activities have also reinforced the learning that has come out of the project along with accompanying actions.

Participants in the **Innovation Tour** (August 2022) rated the value of the EP Project very highly (average of 8.6/10) in terms of helping farmers make efficient use of soil moisture. The tour itself was rated highly in terms of it identifying the RD&E gaps/opportunities to increase productivity/ profitability/ sustainability of broadacre rainfed farming systems on EP (8.3 avg.). Comments highlighted that the project is *generating great thinking and analysis of water use and has clearly stimulated a lot of deep thinking and effort around soils and WUE*. It was suggested though that the project needs to run longer so changes can be implemented and measured/modelled, while challenges associated with engaging late adopters and some problems with the probes and characterisations were noted.

A **nitrogen modelling workshop** was held in early July 2022 with the aim of being an *interactive discussion on current work being done to better understand nitrogen in EP farming systems*.

Feedback was provided by six attendees (15% of the total attending):

- There was a good increase in understanding of nitrogen in EP farming systems as a result of the workshop (7.2/10 avg. rating) – e.g. *learnt about the factors that influence mineralisation and to what extent they can influence mineralisation*. The presentation and discussion around mineralisation modelling was seen as particularly interesting.
- Four respondents indicated they would now take actions (change their advice) as a result of attending – e.g. *as an extension officer it gives me a stronger foot to stand on when talking in depth about N mineralisation and the gap between what is measured, then added and the resulting yield*.

Limitations: There is good evidence to show that the project has had a positive impact on those directly involved, but its benefit beyond this cohort is acknowledged to have been limited to date. Stakeholders generally agreed, project impact on a broader constituency remains to be seen. Relationships have grown through working and sharing knowledge, but messages are yet to connect with wider farmer communities.

2.3 Engagement and Communication

- Plan and implement a multi channelled communications and extension strategy including: social media channels; instructional fact sheets; YouTube videos; webinars; the annual trial result book; stakeholder newsletters; and radio and television media interviews.
- Convene the Regional Innovators Group of 12 trusted influencers - biannually.
- Field days/farm walks at trial sites.
- Promote Decision Support Tools developed/improved in project

Performance Measures: *Range and type of communication channels used and their effectiveness at raising awareness and encouraging engagement and use of outputs; Make up, effectiveness and process of Regional Innovators Group and its value in guiding the project and usefulness of outputs; Extent and type of engagement and their demographics.*

Project awareness was communicated broadly through the region through the AIR EP Newsletter, dedicated website and social media as well as an internal project newsletter called the RIG Report to update those most closely involved with what was happening and coming out of the project. RIG meetings provided a very effective opportunity for interaction with researchers and developing mutual understanding around soil water management. Broader messaging in relation to taking action was dependant on the findings from the project trials, with limited data available in the early to mid-stages of the project – momentum in this area increased in the final year. Project outcomes will continue to impact on available information and advice and informing future projects and communication to farmers.

Discussion groups around the eight validation sites (focus paddocks) proved to be very effective in stimulating interest and discussion around soil moisture and crop management. The EP Innovation tour to validation sites which involved key farming systems scientists and advisers from across Australia was viewed as a very successful way of bridging the gap between farmer and research knowledge and the Nitrogen Workshop was described as ‘one of the best conversations that has ever been had about our biggest input Nitrogen’.

2.3.1 Communications

Project communication activities were primarily delivered through existing AIR EP channels including the AIR EP website, e-newsletter, and social media accounts. This strategy was both simple and low-cost and allowed the project to benefit from AIR EP's established presence in the region and tapping into their network of members and subscribers. The latest project progress report (February 2023) indicated *communications activities are on track, with a focus on the 'products' such as YouTube videos and case studies still to be delivered in early 2023.*

AIR EP Newsletter

The AIR EP newsletter was one of the key communication tools used to promote and disseminate information relating to the project. The newsletter is distributed weekly during growing seasons (less frequent at the other times) to 273 recipients (closer to 400 prior to 2022 – a change in newsletter software resulted in a drop in subscribers) and while not every issue included information relating to the Resilient EP project, a number of editions included updates and news related to the project – sometimes as the lead article. For example, three editions in June/July 2022 led with the latest Yield Prophet updates and photos from Resilient EP engagement events were included in two newsletters during the same period.

The RIG Report

As a result of feedback provided by RIG members in early 2021, a newsletter was developed specifically to provide critical updates on project progress to RIG members. Eight 'The RIG Report' newsletters were distributed to 42 recipients (RIG members, wider project team, focus site farmers) between October 2020 and April 2022. Topics included: information on upcoming trials; notes from recent discussion group meetings; updates on focus site activities; soil sampling progress; probe audits; and upcoming events. The newsletters appeared to be of high interest, with an average open rate of 75% (i.e. the number of recipients who read the email).

Website

A dedicated Resilient EP page was launched early in the project on the AIR EP website (airep.com.au/research/resilient-ep). It provides information on:

- Project details including an overall summary, project activities, partners and steering committee members, and an impact pathway infographic.
- Links to the soil moisture probe data visualisation tools – two versions available: the project funded Square V developed app (probes.airep.com.au) and a version using the Wildeye software.
- Links to the most recent Yield Prophet Reports.
- Downloads of project outputs and papers (e.g. annual progress report summaries, Rainfall EP sites Oct 2020, The 2020 growing season Hayman March 2021, Trends in temp & rainfall on EP Hayman March 2021, Resilient EP summary of 2020 Ware March 2021).

The project is also featured on the AIR EP homepage (airep.com.au) with links to the project page and a section highlighting Resilient EP blog/news updates – the current post promoting the latest

Yield Prophet Reports and links to download. Links to the Resilient EP soil moisture probe data is also displayed prominently at top of the homepage.

Social Media

The official AIR EP Twitter (917 followers) and Facebook (614 followers) accounts were used to promote the project. Examples of Twitter posts made by the @ag_eyre account using the hashtag #resilientEP are included in the table below (each tweet also included a relevant image(s)).

Table 4: Summary of Tweets using the #resilientEP hashtag

Date	Tweet Details	Retweets	Likes
15/12/22	Harvesting the #ResilientEP nitrogen trial site at Goldmine Hill near Lock. Plot header makes the real header look tiny. All a matter of perspective!	2	13
5/9/22	Soil constraints was the hot topic during a first of its kind fact-finding mission on Eyre Peninsula. Experts from across Australia engaged with farmers, talking soil constraints, legumes, and the lack of labour.	4	16
3/8/22	A couple of great days with experts from across Australia on the #resilientEP innovation tour.		6
8/7/22	News from AIR EP - https://mailchi.mp/96070429cab/news-from-air-ep-6160784... Updated yield predictions for #ResilientEP focus sites		
14/9/21	#resilientEP project being presented at the MAC field day	2	10
9/9/21	Great start to Lock Murdinga Tooligie sticky beak day, soil moisture probe site #ResilientEP see AIR EP website for soil probe outputs https://airep.com.au		1
2/6/21	New long coleoptile wheat trialled on EP for first time. Find out more: https://airep.com.au/news/new-long-coleoptile-wheat-trialled-on-ep-for-first-time/...	6	17
26/5/21	New combo of genetics (courtesy CSIRO) have given us a long coleoptile wheat with a Mace type maturity. This allows sowing at depth to chase moisture to get crops going on time. Sown at around 100 mm deep at Coonra 7 May 2021, 2 leaf stage by 26 May.	10	31
17/3/21	Some smart cookies talking soil water, yield and rainfall predictions and how to make better decisions	1	1
3/3/21	Upper EP Farmer Meetings next week! Come and hear research outcomes of 2020 from the SARDI Minnipa Ag Centre team, the AIR EP crew and the EPAG Research gang.	5	4

Communication materials

Over the life of the project a number of supporting communication materials have been developed and distributed – a sample from 2021/22 includes: Yield Prophet reports (e.g. 9 paddock reports x 6 timings though the 2022 season); Pre-reading documents for the RIG workshop (e.g. Discussion paper on climate data; N economics and forecast; validation trials and focus paddocks 2022); Innovation Tour evaluation report and workshop notes; N Mineralisation Model Output Excel worksheets; PowerPoint presentations from the Nitrogen workshop; Summary reports of in-crop discussion groups; EP Farming Systems Summaries; articles for the 2022 EPFS Summary book.

Communications materials being developed for 2023 include YouTube videos and case studies – reported progress on the videos indicated *content has been developed, videographer contracted, and filming has commenced*.

Effectiveness of communications at raising awareness and encouraging engagement and use of outputs

There was a general appreciation amongst interviewed stakeholders that the project's communications strategy was reasonably effective in raising awareness of the project.

- **Most effective for those directly involved** – for example, farmers where the validation sites were and farmers in those immediate networks; and consultants involved discussing project learnings with their clients. One project team member described how the project *saw about 300 stakeholders and that has been similar each year by targeting a group in each area*. Dissemination of information to and engagement with the wider farming community was an issue raised often during the project. It was suggested that one of the issues was the project needing to generate data and results before clear messages could be communicated with confidence – *can't tell people what you don't know*.
- **Awareness seen to have improved as the project progressed** – this was attributed by many to farmer's participation in discussion groups and field days/farm walks. It can be assumed that promotion of these engagement events through the project's communication channels was beneficial and prompted some people to attend. Word of mouth was also seen as a driver, with RIG members and advisers seen as an important part of the communication process.
- **Branding consistent but competing in a crowded landscape** – While the branding was seen by team members as consistent, it was noted the project was operating in crowded landscape and in parallel to other similar industry initiatives, with farmers potentially unaware where certain information had come from or if they were engaged specifically by the Resilient EP project. The issue of attribution was considered to be a common issue with these types of projects.
- **E-newsletter a valuable communication tool** – the AIR EP newsletter were seen by the project team as one of the key communication resources, with the Yield Prophet report updates *always the most clicked on item*. Demonstrating the value of using e-newsletters as an effective channel to distribute project outputs.

2.3.2 RIG meetings

The Regional Innovators Group (RIG) was formed early in the project and consists of twelve influential farmers in the Eyre Peninsula with the goal to *engage researchers and link with the region's farmers to develop techniques to integrate information generated from the probe network, satellite imagery, climate and yield models*.

Meetings were held biannually, with six successfully run over the life of the project. RIG members also occasionally attended project management Zoom meetings and were also invited to attend the project's final workshop held at the end of March 2023. RIG Meeting participants provided feedback at the end of each meeting – a summary of this feedback is included in the table below.

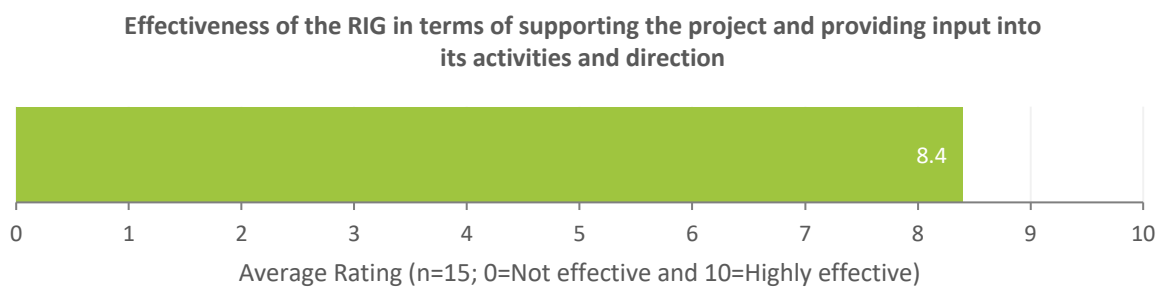
- **Meetings were an effective method of keeping RIG members updated** – Early on the meetings were highly rated in terms helping RIG members understand the project and the

role of the RIG, and as the project progressed, they remained highly useful in terms of continuing to update participants on the project.

- **Feedback from meetings used to improve future meetings** – Suggestions provided by RIG members on how meetings or communications with them could be improved were taken on board by project management and resulted in a number of successful improvements, including: the RIG report emails to keep members better informed between meetings; changes to the meeting format to include field trips and reduce the amount of time sitting in a room listening to presentations; and more time for discussion allocated after presentations.
- **High confidence project will meet objectives** – At the March and October 2022 meetings, there was overall high confidence from participants that the project was on track to achieve its panned objectives.

Effectiveness and process of the RIG and its value in guiding the project and usefulness of outputs

Figure 6



The Regional Innovators Group (RIG) was regarded by all stakeholders interviewed as an essential part of the project, with the success of the project largely attributed to the collaboration between the RIG and researchers.

- Overall, the RIG was described as highly active, engaging, and a valuable part of the project and was seen to have provided practical input and direction, helped shape the project, and facilitated interaction between farmers and researchers.
- RIG member feedback was seen as essential in ensuring research was relevant and useful to farmers in the Eyre Peninsula and allowed for interaction between farmers and researchers at a level that *had never been seen before*, resulting in meaningful outputs with practical applications.
- RIG members being local farmers themselves was seen as particularly important, as it ensured project outputs remained focused on regionally important issues and relevant to other local farmers.
- RIG meeting attendees consistently rated the RIG (and the RIG meetings) as being highly effective in supporting the project and providing input into its activities and direction.

Table 5: Summary of RIG meeting participant feedback

#	RIG Meeting	Participant Feedback Summary
6	October 2022	<ul style="list-style-type: none"> • 15 respondents • Workshop highly useful in terms of updating participants on the project (8.1 avg.). • High confidence the project is on track to achieve its planned objectives (8.0 avg.). • RIG seen to be highly effective in supporting the project and providing input into its activities and direction (8.4 avg.) – <i>the RIG has given the project direction and kept it meaningful.</i> • Comments described the great discussion session indoors on the value of the project work and the good wrap up session at the end with everyone having a chance to speak.
5	March 2022	<ul style="list-style-type: none"> • 17 respondents • Workshop highly useful in terms of providing an opportunity to provide input into the project activities and direction (8.5 avg.) – <i>great discussions and planning for the final year of the project.</i> • Extra discussion time allocated after sessions highly valued (8.8 avg.) and described as <i>absolutely key to the success of the meeting.</i> • High confidence the project will achieve its planned objectives (7.8 avg.)
4	September 2021	<ul style="list-style-type: none"> • 18 responses • Workshop highly useful in terms of providing an opportunity to provide input into the project activities and direction (7.7 avg.) – <i>a lot of opportunities to interact. Very well facilitated discussions.</i> • High level of clarity around the role of the RIG and its role going forward (7.4 avg.)
3	March 2021	<ul style="list-style-type: none"> • 20 responses • Workshop fairly useful in terms of providing an opportunity to provide input into the project activities and direction (7.0 avg.) – <i>a lot of time was spent going round in circles; appreciated the chance I got to better understand the project as well as giving input.</i> • Workshop felt to have too many presentations and despite some frustrations with the format and loss of direction, participants indicated that positives outcomes were achieved by the end. • Project seen to have a moderate level of value to growers in the Eyre Peninsula (6.1 avg.) – <i>only likely to be useful for a small number but will maybe get more onboard if they see a benefit. Majority never will go past much more than a passing interest.</i>
2	September 2020	<ul style="list-style-type: none"> • 17 responses • Workshop highly useful in terms of updating participants on the project (8.2 avg.) – <i>would have been a 10, but we ran out of time to cover everything.</i> • Moderate level of clarity on what’s happening (6.7 avg.) – <i>Needed time in the meeting for a summary of the days conclusions/actions/key messages.</i> • There was some concern whether the expectations of what the data can deliver are realistic and achievable – the complexity of the project was noted.
1	March 2020	<ul style="list-style-type: none"> • 22 responses • Highly useful in terms of understanding the project and the role of the RIG (7.7 avg.) – <i>great participation by all involved and some great outcomes for moving forward.</i> • Respondents quite clear on what happens next (7.0 avg.) – <i>vaguely clear - But I can see a rough guide that will be honed in over time.</i> • Participants were excited to be a part of the project and were enthusiastic about its goals – <i>very impressed with the collegiate atmosphere and the strong desire to do good things to improve outcomes; fantastic opportunity that will be great to see delivered.</i>

2.3.3 Discussion groups/validation sites

Eight validation sites (focus paddocks) were established across the Eyre Peninsula *to test different management strategies depending on seasonal conditions and potential yield predictions.* Baseline measurements were taken annually, allowing close analysis and monitoring of the paddocks, with data used in the development of trial work – including establishing 13 in-paddock small plot field experiments across varied soil/rainfall areas to determine if changing management practice can

improve yields. It was reported that *communication with farmers hosting focus paddocks occurs at least every three weeks, informing them of activities in their paddock and seeking feedback.*

Discussion groups involving RIG members and local farmers were held at these validation sites, with six discussion groups held prior to the 2022 cropping season. Participants were involved in in-depth discussion around the information gathered from each focus paddock and presented with ongoing project learnings. Stakeholders interviewed made the following observations:

- Validation sites were well chosen, providing a spread of farms across the region and were critical to the project's approach. They were useful in *testing project thinking* and providing measurements and background information on real-world situations.
- Successfully provided a focus for discussion groups, resulting in productive communication and engagement between growers, researchers, and consultants – participants described the sites as inspiring and valuable for knowledge sharing.
- Discussion groups facilitated knowledge sharing and the opportunities for ongoing in-depth discussions provided researchers valuable insights into how growers adapt to new technologies and practices.
- Access to soil moisture data was a key output from the validation sites, with the sites seen to have contributed to improved farmer understanding about soil moisture holding capacity – and as a result improved confidence and decision making particularly around nitrogen application.
- Validation site discussion groups and other activities (field days/farm walks) were described as helping *sync* knowledge and understanding across the region and it was felt the project had contributed to increased interest in using soil probes.
- Some stakeholders were uncertain how much of the project information growers and advisers had taken on board, but the sense was that people were at least asking more questions around the issues.

2.3.4 Other extension activities

A number of extension and engagement activities were undertaken during the project including an Innovation Tour in August 2022, N mineralisation virtual workshops in November and August 2022, and a Nitrogen Workshop in July 2022.

Team members also attended and presented project information at many other extension events being held in the region (e.g. field days/meetings hosted by existing EP farmer groups, Lower EP Crop Walk, Lower EP Ag Expo, Sticky Beak Days) – 107 events were attended between January 2021 to December 2022 reaching around 1,440 participants. Summarised below is feedback received from recent Resilient EP extension activities:

- **EP Innovation Tour (August 2022):** The tour involved key farming systems scientists and advisers from across Australia visiting six of the eight validation sites. RIG members also participated in components of the tour including the end of tour workshop in Kimba. The tour was focused around the question: *What are the RD&E gaps/opportunities to increase productivity/ profitability/ sustainability of broadacre rainfed farming systems on EP?* Participants found the discussions between researchers, farmers, and advisers, particularly

useful. This type of networking and interaction was a highlight of the tour for many, particularly in terms of *closing the loop between scientific research and real-world needs, raising researcher awareness of farmer issues and drilling down on what determines farming systems decisions.*

- **Nitrogen workshop (July 2022):** A nitrogen modelling workshop was held in early July 2022 with the aim of being an *interactive discussion on current work being done to better understand nitrogen in EP farming systems.* Thirty participants attended including advisers, researchers, and farmers. Overall, feedback was very positive, with comments noting it was a *great session and very useful to advisers,* with one participant praising the event as one of *the best conversations that has ever been had about our biggest input Nitrogen.*

2.4 Research and Development

- Review of soil characterisations in the region and fill in gaps
- Filling in soil water probe gaps as necessary and update technology in order to improve data quality
- Conduct 24 field trials to validate and demonstrate practices to ground truth decisions based on data
- Develop new decision support tools from data
- Develop a user friendly / mobile application for soil moisture data display and other information as identified
- Generate maps of 'production risk' as it relates to available soil water and yield potential, to improve decision making relating to ground cover management, feed on offer, crop management and options to optimise dry matter production and reduce erosion risk

Performance Measures:

- Extent to which planned research and development activities were undertaken as planned and with required rigour
- Extent to which planned outputs and tools are developed, their usefulness and user-friendliness.
- Extent to which management processes are implemented and effective. Extent of stakeholder support and input into the process.

While the intended development of the soil water sensor network did not proceed in the way that was initially envisaged due to sensor limitations and calibration needs, the work undertaken was seen to have been successful in improving understanding and use of probes, as well as the challenges and limitations associated with them. A working product for data visualisation was completed and refined by RIG feedback. The validation sites were assessed as having added significant value to the project in improving the understanding of technology integration in farming practices and the use of soil moisture probes to make informed decisions. The climate risk team was seen to have successfully supported and liaised with others in the project to improve how climate risk and seasonal forecasts are communicated and understood.

2.4.1 Soil water sensor network development

All activities relating to the development of the soil water sensor network were reported in the two latest six-monthly project progress reports (February 2023 and August 2022) to be on track with all milestones delivered to date.

The data generated by the probes was described in project reporting to be crucial to the project in helping to improve understanding the dynamic relationship that soil type, rainfall and plant water use have across the growing season. Interviewed team members highlighted how research had delivered improved readings and the accuracy of stored water available to plants to within 20-30ml and felt understanding and confidence in soil water management had increased.

RIG members interviewed believed the calibration of probes had been highly successful and farmers involved were overall positive about the probes' usefulness. Validation site hosts noted an improved understanding about ground water and interpreting data from the probes over time; and felt the probes had helped them make decisions about efficient fertiliser use and given growers confidence to make decisions on nitrogen application.

Project team members interviewed pointed out the project had improved understanding around the limitations and challenges of using soil moisture probes – it provided valuable learnings about the limitations and capabilities of available technologies and questioned the trust put in some of the technologies. While the research was seen by some involved farmers to still be in the early stages with many unanswered questions, the project had given growers a fair indication of their local area and helped them understand the impact of reduced rainfall on soil moisture.

Project reporting described how *inconsistency in soil moisture probe technology in the output they provide has proved to be very challenging and created issues with the implementation of probes as a 'tool' on farm and the use of the data they provide to drive the Square V platform*. It was noted in stakeholder interviews that while the probes are providing significant data, the team is still working to understand how to apply that knowledge. There still a lack of knowledge about how much water is in the soil and limitations in achieving the aim of understanding soil water across the landscape.

Reported key sensor network activities included:

- Three Case studies drafted (as of Jan 23) reporting on paddock scale analysis:
 - Adams focus farm at Cockaleeche (using digital soil mapping techniques to predict soil moisture dynamics).
 - Matthew's farm at Cootra (using cumulative NDVI and normalised farm yield to extrapolate soil water sensed with a probe).
 - Wilksch farm Yeelanna (currently being reworked due to analysis errors).
- Methodology developed by the CSIRO for extrapolating soil moisture probe data away from the probe location at paddock and potentially farm scale.
- Plant available water (PAW) data used in digital soil mapping to predict PAW across the focus farms.
- Strength of relationships between soils, PAW, rainfall and probe signals investigated to test reliability of probe signal to soil moisture.
- Twenty-six rain out shelters placed in the soil characterisation paddocks in spring 2021 and around 10 more added in 2022.
- Soil sampling at all probe sites undertaken to determine crop lower limits.
- Optimised the function and calibration of existing probes - many new probes installed have replaced faulty units.
- Probes found to need adjusting for warmer temperatures experienced over summer.
- CSIRO assisted with the analysis and quality assurance of plant available water characterisations and made them available for project use via Yield Prophet.

Data visualisation/application development

All deliverables and milestones for the data visualisation part of the project have been met with the February 2023 six-monthly progress report describing how *Square V have met their promised deliverables, delivering a working product that implements everything the science team has done, refined this product multiple times based on RIG feedback, and spent a large amount of time trying to triage the data issues caused by the probe hardware.*

The Soil Moisture Probe platform can be accessed from the AIR EP website (<https://probes.airep.com.au/>) – direct links are provided both on the AIR EP home page and the Resilient EP project page.

2.4.2 Data decision field validation sites

Based on the two latest six-monthly project progress reports (February 2023 and August 2022), all indications are the validation sites are on track and have achieved all planned milestones. Project reporting highlighted the value of the sites in providing baseline data used in discussion groups to provide reasons for what is/might occur in paddock; measurements that assisted growers to relate small-trial demonstrations to on-farm practice change; and for fine tuning Yield Prophet which has been used in analysing risk.

The overall sentiment from those interviewed was the validation sites added significant value to the project in improving the understanding of technology integration in farming practices and the use of soil moisture probes to make informed decisions. The validation sites and discussion groups are discussed in more detail in section 2.3.3 of the report.

Reported key validation site activities included:

- 8 focus paddocks established across the Eyre Peninsula.
- 13 in-paddock small plot field experiments established across varied soil/rainfall areas (2022) to determine if changing management practice can improve yields.
- Baseline measurements taken yearly – allowing close analysis and monitoring of focus paddocks.
- Baseline data used in the development of trial work – aimed at improving grower sustainability/profitability.
- CSIRO and RIG heavily involved in the development of annual field validation plans.
- Validation site maps produced in-season on an as-needs basis.
- Validation sites modelled with APSIM and Yield Prophet – improved predictions in 2021 as a result of adjustments to the PAW extrapolation methodology.

2.4.3 Climate risk indices and forecast

The six-monthly project progress reports indicated the climate risk indices and forecast part of the project is on track with all milestones met. The climate risk team (Peter Hayman) successfully supported and liaised with others in the project to improve how climate risk and seasonal forecasts are communicated and understood. An interviewed RIG member felt the project had helped those engaged understand the variability in climate forecasts and how to use them as a management tool. It was noted in project reporting that *communicating uncertain climate information remains a challenge*. Key activities and highlights included:

- Over the three-years of the project, annual forecasts were presented to and discussed with RIG members, with this interaction seen as particularly valuable in terms of learning how to improve communication of probabilities. Participants were asked at the March 2022 RIG meeting how the project had improved their understanding of climate risk and season forecasts, with comments overall positive and many noting improved knowledge and understanding – e.g. *better understand context of risks and forecasts for the EP; better understanding the process and complexity of forecasting; and now have a fair grasp and improved understanding of climate risk and seasonal forecasts specific to the EP*. Some though were still concerned with the forecasts' reliability – e.g. *reinforces that we still cannot rely on seasonal forecasts to base decisions*.
- Twenty participants attended a Climate Change on the EP workshop in December 2021 discussing the topic *Making sense of climate change projections for upper Eyre Peninsula* which was presented by project team member Peter Hayman. Of those that provided feedback (16), 100% improved their knowledge and understanding of climate projections for the EP as result of the event.
- Presentations at extension events, including the Minnipa Field day in September 2022 attended by 120 farmers and industry people and at the July 2022 Nitrogen workshop attended by 30 growers, advisers, and industry representatives. Feedback from the Nitrogen workshop was positive with comments including *Peter was well thought out and would like a look at [the] spreadsheet*.
- Two reports were also produced and made available on the AIR EP website and Resilient EP blog. The first a report on *climate indices and trends* that outlines feedback on indices of climate risk and trends in these indices; and the second around developing a better understanding of what seasonal climate forecasts are available and improved feedback to BoM from EP farm advisors and farmers, using a root cause analysis to identify underlying reasons.
- Continued development of the economic analysis spreadsheet – now in version 2 and work continuing with RIG members to create a simpler version.

2.5 Project Management

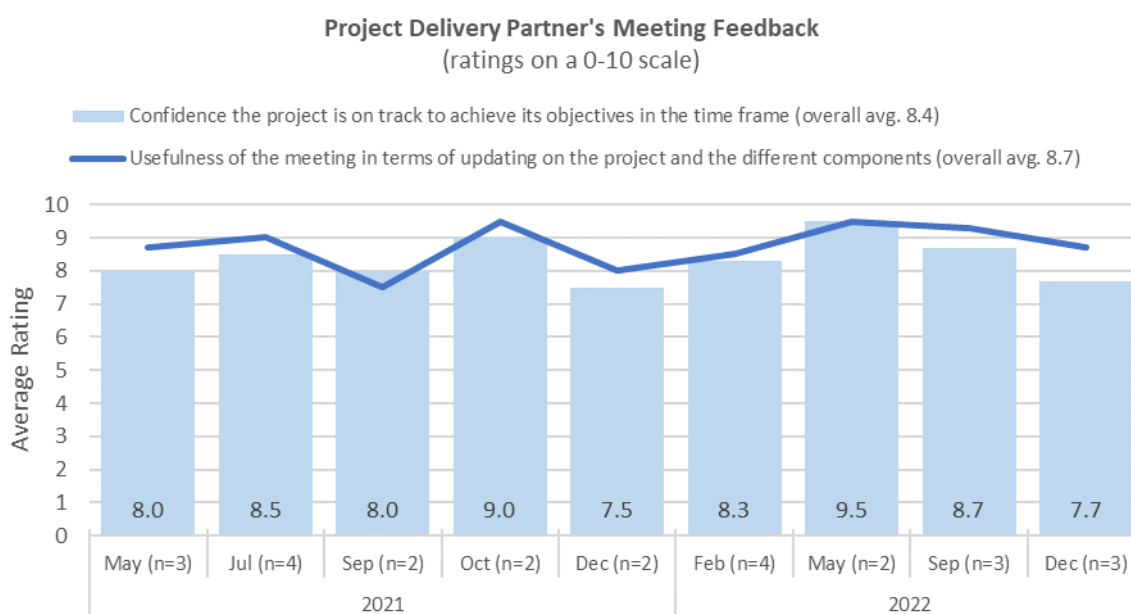
Project management and the involvement of the involvement of the RIG was seen to have been a critical part of the success of the project and the learning that came out of it. Monitoring and Evaluation provided strong support and input into reporting and management decisions.

The latest six-monthly project progress report (February 2023) described the project management activities as being *on track*, with all *invoicing and payments up to date and expenditure on track*. Across the three years of the project, a total of six progress reports were submitted to DAWE – one every six months (February and August). All were *accepted as meeting milestone achievements of the work plan*.

The quality and effectiveness of the project management was consistently highly rated over the life of the project, with the monthly meetings a key activity that kept everyone informed of progress and clear on what needed to be achieved going forward. Feedback from these meetings is discussed further in section 2.5.1 below. The organisation and running of the RIG meetings was also highly praised by those involved and considered a highly successful part of the project – the RIG meetings are discussed in detail in section 2.3.2.

2.5.1 Partner meetings

Figure 7



Monthly delivery partner meetings (the project team) were held online over the life the project. Attendance was consistent with key partners involved and others (e.g. RIG members) occasionally attending.

A short online survey was provided at the end select meetings to capture participant feedback on the meeting as well as project progress, issues, and opportunities. The graph above shows average

participant ratings around their confidence the project is on track (light blue columns) and the usefulness of the meetings in updating them on the project (dark blue line).

- Meetings were generally seen as highly useful in terms of updating participants on the project and its different components; and confidence remained fairly high across meetings that the project was on track to achieve its objectives in the time frame.
- Comments from the December 2022 meeting found the meeting *useful as always to touch base and catch up on progress* and noted that *everyone seems to be positive on where the project is at and are addressing issues as they arise in a collaborative manner*. One team member was *confident that all is in train to complete the project in the first half of 2023*.
- RIG members also rated the project (October 2022) highly in terms of being on track (8.0 avg.) to achieve its objectives *the project has come together and can deliver the meaningful outcomes it set out to do*. The RIG was also seen to be highly effective in supporting the project and providing input into its activities and direction (8.4 avg.) – *the RIG has given the project direction and kept it meaningful*.

2.5.2 Monitoring and evaluation

Monitoring and Evaluation (M&E) activities were successfully undertaken over the course of the project with the M&E team (Coutts J&R) supporting the project to capture the required data. The M&E reports were a key source of information for the six-monthly project reports submitted to DAWE. Interviewed project management felt there was an *effective M&E plan and detailed evaluation throughout the project* and that feedback captured at *regular meetings of key players* contributed to a *continuous improvement loop*.

Below is a summary of M&E activities undertaken over the life project:

- **M&E reports:** Five M&E reports were produced – including three annual reports (October 2020, December 2021, and this report April 2023) and two mid-year update reports (June 2021 and August 2022).
- **M&E summaries:** The M&E reports and activities were summarised and provided to the project manager for inclusion into the project six-monthly progress reports submitted to DAWE.
- **Feedback surveys:** Fourteen surveys were distributed post project partner meetings for a total 43 responses (one survey had no responses); six surveys developed for RIG meetings with a total of 109 responses; and six surveys developed for project extension activities with a total of 22 responses (one survey had no responses). The table below shows all M&E surveys developed over the life the project.
- **RIG meetings:** Attended both the March 2022 and March 2023 RIG meetings – providing input over the meetings, with Jeff Coutts running sessions at both meetings (e.g. a session on project reflection at the March 2023 meeting). An update on the 2021 M&E report findings was presented at the March 2022 workshop with positive feedback received from attendees in terms of the update's usefulness (7.3/10 avg. rating).

- **Case studies:** Five case studies were undertaken in November 2022 to highlight how producer collaborators are viewing the project work in terms of impacting on their thinking and potential future actions – seen by project management to be highly valuable and demonstrated that farmers can apply information in their own farms.
- **Baseline survey:** Baseline web surveys were undertaken over April-July 2020 with 54 Farmers, 7 Consultants and 22 Informed Persons in the Eyre Peninsula – aimed at understanding grower/producer awareness and use of soil moisture information and decision aids.
- **M&E log frame:** Developed at the beginning of the project to ensure the needed data is captured to assist in effective monitoring, evaluation and learning from the project – used to guide the analysis and structure of the M&E reports.

Table 6: Summary of M&E surveys developed over the life of the project

Survey Type	Survey Name	Respondents
Partner meetings 14 total surveys 43 total responses	Project Delivery Partners' Meeting (Dec 22)	3
	Project Delivery Partners' Meeting (Oct 22)	2
	Project Delivery Partners' Meeting (Sep 22)	3
	Project Delivery Partners' Meeting (Jun 22)	0
	Project Delivery Partners' Meeting (May 22)	2
	Project Delivery Partners' Meeting (Feb 22)	4
	Project Delivery Partners' Meeting (Dec 21)	2
	Project Delivery Partners' Meeting (Sep 21)	2
	Project Delivery Partners' Meeting (Jul 21)	4
	Project Delivery Partners' Meeting (Jun 21)	4
	Project Delivery Partners' Meeting (May 21)	3
	Project Delivery Partners' Meeting (Apr 21)	6
	Project Delivery Partners' Meeting (Feb 21)	5
	Project Delivery Partners' Meeting (May 20)	3
RIG meetings 6 total surveys 109 total responses	Regional Innovators Workshop (Oct 22)	15
	Regional Innovators Workshop (Mar 22)	17
	Regional Innovators Workshop (Sep 21)	18
	Regional Innovators Workshop (Mar 2021)	20
	Regional Innovators Workshop (Sep 20)	17
	Regional Innovators Workshop (Mar 20)	22
Extension activities 6 total surveys 22 total responses	N mineralisation session with Murray (Nov 22)	0
	Innovation Tour (Aug 22)	8
	Nitrogen Workshop (Jul 22)	6
	Lower EP Crop Walk (Sep 21)	1
	Resilient EP Information Session (Dec 20)	5
	Resilient EP Information Session (Jul 20)	2
M&E Interviews 3 total surveys 93 total responses	Final M&E Interview Questions (Feb 23)	35
	Second Annual Stakeholder Survey (Oct 21)	37
	First Annual Stakeholder Survey (Aug 20)	21
Other M&E	Project Team Event Reflection Sheet (Aug 20)	7
	Baseline Data 2020 - Individual Farmers or Consultants (Mar 20)	62
	Baseline Data 2020 - Informed Persons (Mar 20)	22

2.6 Going Forward

The RIG was seen to have demonstrated its value and a similar approach has a positive role to play in future projects. Broadening extension activities beyond the validation sites was seen as a way of creating greater awareness and interest across the region.

When asked towards the end of the project (October 2022) what the key issues were going forward, **RIG members** nominated: Communicating to and engaging a wider audience outside of the RIG including *getting a greater understanding of the value of the project outputs to on farm decision making; Soil water extrapolation; more work on the cumulative NDVI method of assessing plant available water across the landscape; and refining the n mineralisation calculator* were other issues identified. It was suggested the effectiveness of the project should be assessed by how well it is *seen, valued, understood and used by the farming community.*

2.6.1 Role of RIG in the future

When stakeholders were asked about what could further improve the value of the RIG or a similar group they suggested: *clarifying expectations from the start; improving communication and input; maintaining good group dynamics; and ensuring effective leadership and organisation.*

At the start of the project, it was felt there was a lack of clarity in terms of expectations placed on the RIG. It was acknowledged that as the project progressed, communication and expectations improved, and the project gained momentum.

The large size of the group was discussed as both a strength and a weakness, with attendance fluctuating due to busy schedules. The RIG meetings were also noted to be sometimes unproductive and not always focused on the project. Although the group was large, it was well attended, and one of the strengths was that it did not rely on everyone being present at each meeting.

This project approach was generally viewed as effective, with a focus on practical outcomes that were relevant to the region. RIG members' knowledge and understanding of regional issues were critical in driving these outputs. It was suggested to form smaller groups for more productive meetings and to improve RIG member connections in-between the six-monthly meetings.

2.6.2 Improved communications

From a farmer perspective, it was suggested that communication about the project's decisions and progress was sometimes lacking and improved communication with growers and more frequent get-togethers with farmer groups would have been beneficial. The most effective method of communicating with farmers was found to be through discussion groups, and with advisors through workshops. However, delays in defining project messaging from the onset, impacted initial progress.

In discussing strategies to increase engagement with farming communities, stakeholders highlighted the importance of targeted activities and involving key influencers. It was pointed out that as well as being busy, farmers have information "thrown at them from all different directions." While some are just not interested, if there are "game-changing findings," these will filter through and get picked up

by early adopters and innovators. They also agreed: the question on how to connect with the middle and bottom region of farmers that are not engaged in extension, is still unclear.

2.6.3 Key learnings

Key learning from stakeholders interviewed towards the end of the project are summarised in the following table.

Table 7: Stakeholder identified project learnings

Activity	Description	Suggestions
Project design and objectives	<ul style="list-style-type: none"> Clarity around project objectives is crucial. Explore work from other research organizations to align goals (try not to re-invent the wheel) 	<ul style="list-style-type: none"> Achieving as much exposure prior to projects starting (e.g. via a series of meetings) could result in “fairly instant” engagement. Asking growers what they want to be investigated, rather than what they can get money for.
Key influencers	<ul style="list-style-type: none"> Targeting key influencers or trusted advisors: they are increasingly important gatekeepers for spreading information and engaging with farmers. 	<ul style="list-style-type: none"> An effective strategy but would require social research to understand who is missing out and how to reach them.
Discussion groups	<ul style="list-style-type: none"> Discussion groups with growers are critical to engagement. 	<ul style="list-style-type: none"> Small and frequent (requires more resources). Having a core group made a difference in this project.
Broader activities	<ul style="list-style-type: none"> Engage more farmers through broader activities (e.g. not relying solely on validation sites). 	<ul style="list-style-type: none"> Discussion groups are effective.
Briefing meetings	<ul style="list-style-type: none"> To achieve wider involvement, there should be briefing meetings held in individual farming communities to explain what the project has done and what the outcomes are. 	<ul style="list-style-type: none"> Farmer involvement in this project was very good. They presented information from a farmer’s perspective.
Accuracy in data	<ul style="list-style-type: none"> Accuracy in data is important and using historical data to verify. 	<ul style="list-style-type: none"> Demonstrating past success (e.g. being able to increase yield by a certain amount).
Mentoring and guidance skills	<ul style="list-style-type: none"> The engagement of skilled advisers is important. Additional agronomists willing to offer their services can help with engagement. 	<ul style="list-style-type: none"> Researchers involved in this project may have lacked mentoring and guidance skills, which if addressed could improve engagement.
Social Media	<ul style="list-style-type: none"> Use of social media and people's networks, such as farmer group networks. 	<ul style="list-style-type: none"> Farmers accessing technology more often: great way of keeping them in the loop. Invite growers to join online workshops.
Field Days	<ul style="list-style-type: none"> More field days and crop walks. More weather stations and reliable moisture probes. 	<ul style="list-style-type: none"> More field days and crops walk, tied in with discussions. More weather stations would be beneficial since some moisture probes do not have the weather stations on the probe sites. More reliable moisture probes are necessary as they struggle with different soil types.

3. DISCUSSION

3.1 Adding Value

As stated in the Background section of this report, the aim of this project was to *utilise new and emerging technologies to assist farmers make efficient use of soil moisture*. It was noted that Eyre Peninsula *has an extensive soil moisture probe network which was seen to be underutilised*. The intention was that farmers *would be able to make more informed, timely decisions to optimise the region's productive potential while protecting soil and water resources in a changing climate*.

In the Findings section looking at these longer-term impacts, it was shown that the stakeholder groups involved considered that the project had gone some way towards meeting this aim. The researchers were less clear about the objectives and less sure about progress towards them in terms of technical research outputs. The strength of the project, however, was the engagement focus to bring together the growers, extension, consultants and researchers to take stock of the current situation, gaps and to start to address these in a cohesive manner.

Although there had been a view that the project was focused on better linking and utilising the network of soil moisture probes, a key finding was that there was a lot of work yet to build and link such a network and also to correctly calibrate the existing probes. There were even questions raised around the usefulness of single probes on farms and hence how to best use and interpret the data. This finding in itself provides a clear way forward. The underlying challenge continues for farming in the region and this project showed itself as an important step in tackling these long-term issues: *Approximately 1000 farm businesses in the region, covering 3.072 million hectares of farming land - consisting of dryland cereals, grain legumes, canola and pasture fed livestock...with approximately a third of the region highly vulnerable to soil erosion*.

The project *was* effective in better providing and interpreting information around seasonal forecasts and the importance of better understanding soil water conditions in decision-making. A number of contributions were made towards better tools, information and understanding emerged from the project, providing a more solid base on which to move towards the longer-term objectives for Eyre Peninsula. In summary, these included:

- Better understanding and use of soil moisture probes – including their limitations.
- Understanding of the limitations and capabilities of available technologies used for soil water mapping, the complexities of landscape and farmer systems and the importance of understanding variability when making decisions.
- Improved soil management by enabling more informed conversations and decision-making about planting, fertiliser rates, and weed management.
- Improved understanding of the soil characteristics in the Eyre Peninsula, soil types and reducing expenses on less reliable zones in the paddock.
- Improved understanding of climate risk and seasonal forecasts.
- Improved relationships between growers, consultants, and researchers.

As noted earlier, the case studies (in full in the appendices) show *how involvement in the project validated some current practices, strengthened understanding and lead to confidence and improved practices around variable rate, nitrogen use and reducing risk in crops*. These case studies came from growers who had provided paddocks for on-farm trials and so were in a good position to see first-hand what was coming out of the project. There was a recognition that there had been limited engagement outside of the field trails and extension activities around them and there was a need for broader extension – beyond the communication outputs to raise awareness of the project. This project however, while directly providing new understanding and better tools, was still very much in the exploration and learning phase and there was a lack of clear messaging for extension until towards the end of the project – and even then, there is more work to do.

CONCLUSION 1

While the project did not progress the water probe network, soil mapping and decision tools in the way that was initially envisaged, it effectively brought together growers, researchers and advisers to explore the gaps in technology and increase understanding around soil moisture, soils and climate forecasts – developing a much firmer base on which further gains can now be made. This momentum needs to be continued to capitalise on the work undertaken to date.

3.2 Stakeholder Input and Engagement

A significant contribution to research and extension projects was the establishment and use of the *Regional Innovators Group (RIG)*. This group of farmers and advisers was established to engage with researchers and link in with the region's farmers *to develop techniques to integrate information generated from the probe network, satellite imagery, climate and yield models*.

There is a lot of current interest in the use of greater collaboration across the Agricultural Innovation System between the different stakeholders. Terms such as co-design are now used regularly to highlight the practice of better involving 'end-users' in the RD&E and producing more relevant and useful outputs and outcomes. Similar approaches have been used for Focus Farms in dairy and in other industries.

There were six RIG workshops over the course of the project (a 7th final workshop in March 2023) (see Section 2.3.2). At each workshop short surveys were used to gain feedback from individual members and those researchers who attended. Members were very clear about their role and positive about how that worked in practice...*very impressed with the collegiate atmosphere and the strong desire to do good things to improve outcomes; fantastic opportunity that will be great to see delivered*. Meetings were seen as useful with changes made to subsequent meetings based on feedback. Importantly, RIG members and the project team saw the RIG as highly effective in supporting the project and providing input into its activities and direction and *kept it meaningful*. In the final survey, stakeholders rated the RIG as highly effective and an 'essential part of the project'. Feedback from the final workshop was that all members were equally valued and this provided a basis for effective sharing and building trust.

There was some feedback from researchers that had been prompted to use a similar approach in other projects.

When asked to consider what had been learned from the project and what should be taken forward, the RIG approach was strongly endorsed with some suggestions made around improved role clarity, stronger communication (between meetings), having effective leadership and balancing the size.

CONCLUSION 2

The RIG approach was a very effective way to include stakeholder input and ownership and this has applicability to similar projects going forward. It had a major and positive impact on the project and its direction. The experience and lessons learned during the process should be considered for collaborative groups in the future.

3.3 Adaptive Management

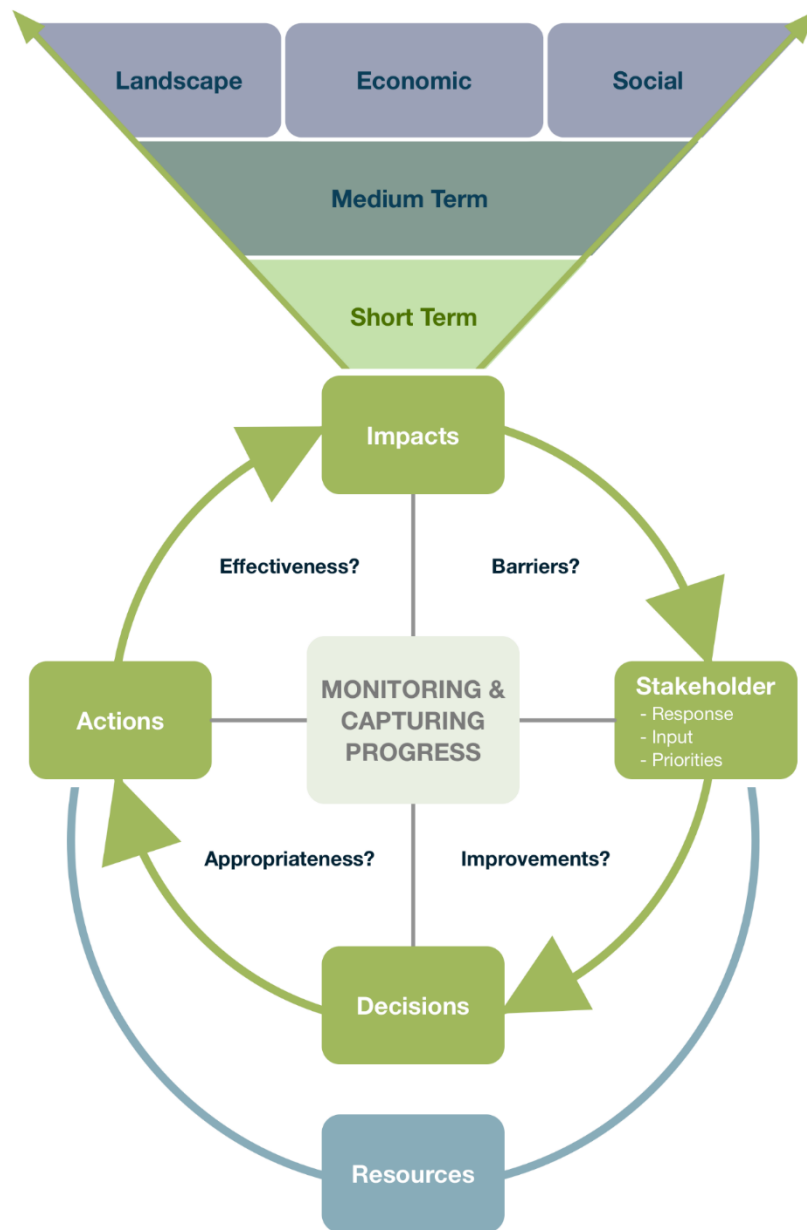
The main purpose of having a mechanism like the RIG is to allow changes to be made as new information is available. Adaptive Management is recognised as the basis of good RD&E outcomes – making changes as new issues and opportunities are presented to maximise the project effectiveness and contribution to project outcomes.

The RIG clearly provided opportunity for input into this process as reported by management and RIG members. There were also regular project team meetings who considered progress and changes needed. In this project, it was quickly apparent that the originally envisaged stronger soil moisture probe network was not the most viable direction, so changes were made in direction to focus on better understanding the use of those probes in place, the use of forecasts and the decisions around the use of nitrogen to optimise yields. These changes were in line with the intent of the project but took a more effective and practical route. The results reflected the value of the changed emphasis and the ‘unintended’ consequences of the RD&E community having a better appreciation of the role, use and limitations of single soil moisture probes was realised and provide a strong basis for future work in this area. Other changes included reduced attention to livestock in the rotation system and reducing the focus on regional soil mapping.

Some feedback about the role of RIG was that they could have been involved earlier in the planning of the project itself. However, there was a significant period of time taken by the (potential) project team to engage in the region in the development of the project proposal by stakeholders with the RIG providing that on-going stakeholder forum essential for effective adaptive management.

The diagram on the next page illustrates the role of stakeholders in the adaptive management process – as well as the on-going role of Monitoring and Evaluation to bring structure and rigour into the process.

Figure 8: Adaptive Management Process (Coutts J&R)



CONCLUSION 3

The Adaptive Management approach – through the interaction with the RIG and the regular project management meetings – ensured that the project was able to make those changes needed in response to emerging issues, more information and opportunities. Monitoring and Evaluation was an important part of providing structure and rigour around this iterative process.

4. APPENDICIES

4.1 M&E LogFrame

Level	Details	Performance Measures	M&E Activities
Higher Level Objectives	<ul style="list-style-type: none"> Improved farm sustainability, productivity, profitability and ability to manage current and emerging climate risks by farmers and their advisers – also improving the Eyre Peninsula soils and water resources. <ul style="list-style-type: none"> Approximately 1000 farm businesses in the region, covering 3.072 million hectares of farming land - consisting of dryland cereals, grain legumes, canola and pasture fed livestock. Approximately a third of the region is highly vulnerable to soil erosion. 	<ul style="list-style-type: none"> Extent of improvement in soil and water resources in the vulnerable areas of Eyre Peninsula over time. Extent of improvement in farm productivity and profitability on farms in Eyre Peninsula. 	<ul style="list-style-type: none"> Extrapolation from project outcomes and M&E Recorded incidences and types of change in the region Practice and economic case studies of farms making early changes
Farmer and consultant capacity and practice change and on-farm impacts	<ul style="list-style-type: none"> Improved understanding of climate risks and how these risks have changed over recent decades and likely to change in future projections by researchers, advisers and farmers. A better understanding of seasonal climate forecasts by the EP farming community and improved communication between EP farmers and the Bureau of Meteorology via the SARDI Climate Applications Group. Improved decision-making: The project will enable farmers in the Eyre Peninsula to make more timely management decisions on cropping and grazing management that will optimise productivity from the regions soil and water resources, whilst protecting and enhancing the region’s soils. Improved profitability: This will result in more profitable farm businesses through more efficient use of inputs, improved crop / pasture choice and enhancing productivity through more timely decision making. Farmers and advisers will engage researchers and link with the region’s farmers to develop techniques to integrate 	<ul style="list-style-type: none"> Extent of gain in understanding of climate risks, seasonal forecasts and their implications by advisers and farmers based on the groups targeted. Extent of farmers and their advisers accessing and making use of decision-making with respect to cropping and grazing management. Indicative gains in profitability on farms that improve decision-making as a result of project outputs. Factors impacting on engagement and take up of decision-making tools. Extent of improved relationships, linkages, collaboration, information sharing 	<ul style="list-style-type: none"> Base line survey Reports and feedback sheets from Regional Innovators Group, project team and collaborator meetings. Extension activity reports and feedback sheets from participants. Interviews with key persons Final survey of researchers, consultants and producers engaged in project activities. Analysis of statistics associated with on-line tools. Use of social capital matrix

	<p>information generated from the soil moisture probe network, satellite imagery, climate and yield models. Farmers will be able to make more informed, timely decisions underpinned by innovations in agronomy and livestock management</p> <ul style="list-style-type: none"> • Increased social capital in EP farming system 		
Farmer & Advisor engagement and communication	<ul style="list-style-type: none"> • Plan and implement a multi channelled communications and extension strategy including: social media channels; instructional fact sheets; YouTube videos; webinars; the annual trial result book; stakeholder newsletters; and radio and television media interviews. • Convene the Regional Innovators Group of 12 trusted influencers - biannually. • Field days/farm walks at trial sites. • Promote Decision Support Tools developed/improved in project 	<ul style="list-style-type: none"> • Range and type of communication channels used and their effectiveness at raising awareness and encouraging engagement and use of outputs. • Make up, effectiveness and process of Regional Innovators Group and its value in guiding the project and usefulness of outputs. • Extent and type of engagement and their demographics. 	<ul style="list-style-type: none"> • Analysis of reach and effectiveness of the different communication channels. • Reports, feedback sheet questions and interviews with 12 members of RIG and project team working with them. • Expert review of communication products used to raise awareness and encourage engagement. • Activity reports in relation to attendance at extension events.
Underpinning research and development	<ul style="list-style-type: none"> • Review of soil characterisations in the region and fill in gaps • Filling in soil water probe gaps as necessary and update technology in order to improve data quality • Conduct 24 field trials to validate and demonstrate practices to ground truth decisions based on data • Develop new decision support tools from data • Develop a user friendly / mobile application for soil moisture data display and other information as identified • Generate maps of 'production risk' as it relates to available soil water and yield potential, to improve decision making relating to ground cover management, feed on offer, crop management and options to optimise dry matter production and reduce erosion risk 	<ul style="list-style-type: none"> • Extent to which planned research and development activities were undertaken as planned and with required rigour. • Extent to which planned outputs and tools are developed, their usefulness and user-friendliness. 	<ul style="list-style-type: none"> • Project team meeting records and feedback sheets. • Milestone and other reporting from project team and researchers. • Peer and expert review of process and outputs.
Management and Resources	<ul style="list-style-type: none"> • Project Manager and Management Committee • External Project Funding • In-kind contributions from the two grower groups involved through 	<ul style="list-style-type: none"> • Extent to which management processes are implemented and effective. 	<ul style="list-style-type: none"> • Records of project team meetings and communication. • Annual Interviews with collaborating

the use of their networks and the work of the volunteer committees that operate the groups; the private adviser network through their engagement with their grower clients; the linkages with other research and development projects operating in the region; and the automatic weather station network that already exists in the region. The knowledge partners, CSIRO, SARDI and Natural Resources EP, will also be providing in-kind contributions to the project.

- Extent of stakeholder support and input into the process.

and contributing stakeholder representatives.

- Feedback from government on reports provided.

4.2 Case Studies

4.2.1 Variable rate inputs on variable soil types based on yield potential

1. Case Study: using moisture probes to understand and manage soil variability across zones, paddocks and whole of farm, to mitigate risk

Summary/Purpose

Bruce Heddle invested in a soil moisture probe for his paddock prior to his involvement in the Resilient Eyre Peninsula project. He understood its potential to add value and to inform decision making, but he was uncertain and lacked the expertise to fully appreciate the significance. He offered his probe to be included in the region's moisture probe network and became involved in the project as one of the focus paddocks. His move towards variable rate is happening concurrently with the Resilient Eyre Peninsula project trial and he hopes to further explore variable rate P application. While he appreciates the value of replacement-based systems, applying fertilizer in response to production, he would like to further investigate phosphate (P) responsiveness and how this might impact his inputs.

Context

Bruce Heddle's 1600-hectare farming operation includes a cropping focus as well as a livestock enterprise. Prior to his involvement in the Resilient Eyre Peninsula project, he had invested in a soil moisture probe because he believed it could support his operations: helping to inform management decisions, but he lacked the knowledge to convert findings into useable data. His participation in the Resilient Eyre Peninsula project came about through the network of soil moisture probes that began to assemble across the Peninsula, and he offered his to be included as part of that network. His involvement in the project evolved to include his property being chosen as one of the focus paddocks.

Focus Paddock	<ul style="list-style-type: none">• 96 hectares• Continuous cropping system (lentils; wheat; canola)• Location: Minnipa
Paddock characteristics	<ul style="list-style-type: none">• Site is highly productive for the area, with a yield almost double that of what other growers achieve in any given year.• pH is alkaline with levels ranging from 7.5-8.5 (CaCl₂).• Soil constraints: Boron, calcium carbonate.• Biotic stresses: Ryegrass, Barley grass.• Low-lying areas of paddock are a poorer soil type with a shallower rooting depth (this brings paddock averages down).• Sub soil constraints such as high boron and calcium carbonate levels significantly decrease the PAWC of a soil type.

	<ul style="list-style-type: none"> • The paddock has some deeper soils with considerably higher PAWC. These zones yield much higher and consequently raise paddock averages.
Plant Available Water and yields	<ul style="list-style-type: none"> • Median PAWC of approximately 100mm present through large areas of the paddock. • Yields indicating this shifts a long way either side of this across the paddock. • Bruce uses variable rate technologies (VRT) to match inputs to yield potential based on yield potential throughout the season. • Yield patterns from one zone to the next are similar across different seasons. • Lower PAWC is generally seen in lower lying areas of the paddock with higher clay content, calcium carbonate and boron constraints at depth.

Bruce understands the benefits of stored moisture and using it to his advantage by maintaining adequate nutrition year to year across all zones. Variable rate technologies (VRT) have worked to his benefit as a result. On average, the soil type across the focus paddock has a high Plant Available Water Capacity (PAWC), compared to many other paddocks across the district. While parts of this paddock struggle in poor finishes, overall, yields are high and Bruce’s ‘zero summer weed’ policy was considered by him to be beneficial because maximum summer rainfall is preserved in the soil profile for the coming season.

While this paddock has large variation in yield potential, the patterns in variation are consistent across different crops and years with variable rainfall yield patterns remaining the same. Bruce places a heavy weighting on the high yielding areas of the paddock when applying inputs (both N and P).

The clear-cut variation in PAWC and yield from one zone to the next across his paddocks makes yield and therefore input estimation more simple according to EPAG Research agronomist Jacob Giles. He explained, “the use of soil moisture probes can also be useful in this context. If we know how one zone will yield relative to another, then estimates at the probe can be related to the other zones within the paddock.”

While being exposed to hot finishes, this paddock has a relatively low frost risk (yield predictions in season are more certain and the risk involved is less). Timely sowing is the best approach to mitigate heat damage and can be done so if there is adequate moisture. He said, “understanding soil moisture and the benefits of deeper sowing could be one way that soil moisture is exploited to mitigate the end of season heat risk in particular years.”¹

Approach and methodology

In terms of the commercial scale response to variability, this focus paddock is on a full variable rate for both phosphorus (P) inputs and nitrogen (N). In addition, post seeding N has been by zone. Bruce has driven decision making across the paddock and believes the replicated work that is being done on the focus paddock will be of significant value to growers in his area.

There has been a lot of valuable and useful data collected, some of which has been used to make decisions. But Bruce feels there is a lot more data yet to be used and the implications further investigated. For example, the most obvious variable to change by soil type and bucket size (yield potential), was N nutrition. Bruce currently has replicated trials sites on both the most productive area of his paddock and the most constrained area of the paddock for N responsiveness. He feels there ultimately needs to be P responsiveness included in that picture, as he suspects P responsiveness is driving some of the underlying issues.

¹ Resilient Eyre Peninsular: Focus Paddock Summary. October 2022

He said the trial is delivering really useful work and that everybody is looking forward to the response, particularly in light of the fact this has been the “single most N responsive production season, in anybody's memory.” According to Bruce, “production potential is so high that we should have hopefully stretched the boundaries to actually get some really clear messages about N response.”

He also highlighted several layers of data coming out of the trial where he believes there is potential for further “scrutiny and external expertise”. For example, there have been soil tests done to depth; a lot of grid sampling; as well as radio spectrometry (EM38) testing, which he said to date he has paid little attention to due to lack of understanding. He believes these additional layers of data offer potential scope for experts to explore further and determine whether there are correlations or potential commercial applications.

Impacts/Benefits

Bruce said his strategy going forward will remain reasonably stable, with some refinement of zoning, but generally “finessing,” as the basic strategy is in place. The quantification of the variability between the zones and the implementation of variable rate fertilizer application, where it is needed, with good data to back it up, has been a “significant step forward.” He said targeting N inputs has been successful and had a lot of upsides on this paddock.

Understanding the variable PAWC across zones within his paddock has been beneficial with the use of VRT to optimise inputs. With the added knowledge of PAW and use of technology such as the soil moisture probe, yields can be optimised in season. This is especially true as the frost risk at this site is lower than many in the area. The hot finishes characteristic of the area however is frequent, and this can be mitigated by correct time of sowing matched with the correct variety of crop.²

Bruce explained there is a P constraint on his soil type, and there needs to be a clearer idea of what the P responsiveness might be. He believes there may be scope to get more out of those constrained soil types with a change of mindset. Bruce discussed the phosphate application dynamic as being an area which is not yet fully understood and feels there is “significant learning to happen in this space. The whole business of variable rate phosphate is a work in progress for us. And it may be where the next attention goes on that paddock.”

If the project were to continue, that would be part of the process Bruce would like to further investigate. He explained that fertilizing in response to productivity, replacement-based systems, may not necessarily fit with phosphate and it may be that there is production potential in the poorer producing zones by significantly increasing inputs rather than assuming they only deserve low inputs.

Bruce and others in similar situations on the upper EP which have higher yielding areas will have a lower water use efficiency in high decile years. Jacob (EPAG research) said the exact cause of this is unknown and while there are some who suggest insufficient N, he explained there are many other limiting factors that could potentially be the cause, “as well as N, calcareous soils can decrease P use efficiency. Lack of P and low sowing rates can limit tiller and therefore head counts per area.” These are all significant drivers of yield and hence inadequate nutrients, and tillers may limit yield in good

² Resilient Eyre Peninsula: Focus Paddock Summary. October 2022

areas in high rainfall decile seasons. These may all be a cause of low WUE in high rainfall decile years.³

Adoption and practice change

For Bruce, his involvement as a focus paddock in the Resilient EP project has served to validate his strategies. He appreciated the value gained from the soil test data that was collected. He said the EPAG Research team were thorough and disciplined in their process and Bruce places significant value on this data as a resource.

His move towards variable rate is happening concurrently with the Resilient EP project trial, “not necessarily as a result of it.” He explained the paddock is in a reasonably steady state system with a continuous crop rotation (lentils, wheat, canola, wheat, lentils), and the only major changes being towards variable rate, which have been in response to the zones.

He said even if the current harvest provides a different response, he does not plan to change zones too much. The reason being there are seasons where the soils in the paddock will perform extraordinarily well, especially when they are loaded with moisture. He feels there is enough yield data and enough length of experience that zones are reasonably well set in that paddock.

Value of moisture probes to farm decisions: Bruce highlighted the role of moisture probe data to his operations. He feels the region is gaining a better understanding of the role and limitations of soil moisture probes. While they provide useful information to go with all other data collected, he explained, “they are very spatially narrow.” They represent a single point in a paddock or a farm. He noted that originally it was anticipated the soil moisture probes would provide really hard, quantifiable and precise information, however, he does not believe that is the case.

Instead, they provide trends and indicators and during certain times in a year they may provide critical information. For example, the time of year where Bruce has gained the most value has been in the crop finishing period through spring. During a dry spring, moisture probes provide valuable information about the amount of moisture available and the general trajectory for the remainder of the year. Assessing through autumn, instead of accessing a precise reading, Bruce uses data to determine whether there is “a lot, a bit or not much at all. And that’s about as precise as they are.”

He believes this would be the sentiment amongst most of his peers using moisture probes: that their role is perhaps not what was originally anticipated. He acknowledged this may differ in irrigation areas, where there may be cotton or lucerne fields and there is a need to monitor moisture intensively and continuously: where there is a need to have x millimeters of water applied during a period to reach yield potential. This has not been their application in the Eyre Peninsula, or on his property.

Relevance to others

There have been a number of well attended farmer group meetings held at Bruce’s paddock. He said the conversation has been engaging and free flowing with people interested to see what comes of the two replicated trials. He said there has been animated discussion about the role of nitrogen. There is also interest from local agronomists who watch the soil moisture probe data online and are well aware of his site. He believes there is significant interest across all the Resilient EP sites.

³ Resilient Eyre Peninsula: Focus Paddock Summary. October 2022

2. Case Study: variable rate technologies across variable soil types and sustainability impacts

Summary/Purpose

Todd Matthews first became involved with moisture probes in an earlier project in 2016 when the region first obtained grant funding for moisture probes and continued his interest through the current Eyre Peninsula project. In this case study he shares his experiences of with moisture probes and the importance of choosing the right technology to suit soil types. He also shares the value he has achieved as a result of his involvement as a focus paddock provider including gaining a better understanding of deep nitrogen (N) levels, soil constraints and variability across paddocks.

Context

Todd Mathew's property at Cootra is 6500 hectares. He runs a mixed enterprise cropping wheat, peas, lentils, canola and barley as well as running sheep. The Resilient Eyre Peninsula focus paddock is on 180 hectares where there is a high level of variation in yield across the paddock.

Focus Paddock	<ul style="list-style-type: none"> • 180 hectares • Cropping system (mixed farming system) • Location: Cootra
Paddock characteristics	<ul style="list-style-type: none"> • Site is classified as dune swale land with high levels of variability throughout paddocks. • There are consistent patterns that can be easily mapped. • Deep sand over clay features on the top of dunes. • Sand over sandy loam clay with calcareous clay at depth on mid sections of dunes. • Swale or low-lying areas feature clay loam over clay with calcrete layers being an issue. These areas finish particularly poorly in dry finishes.
Plant Available Water and yields	<ul style="list-style-type: none"> • High level of variation in yield across paddock may be a limitation (for optimum profitability and sustainability inputs must match yield. However, Todd benefits from the patterns in yield being fairly consistent. • By implementing VR technology, he can keep inputs optimal to allow high yielding areas to reach their potential and not spend too much on lower yielding zones. Overall, this increases economic and environmental sustainability in the paddock. • Soil type at Cootra is highly beneficial to crops. While it is not perfect, the lack of sub-soil constraints means rooting depth for large parts of the paddock is quite deep with roots found at 100-110cm. • This increases PAWC and finishing ability. When making input decisions in season the increase in PAW can decrease the level of risk. • Lack of subsoil constraints could also lend itself to growing alternative break crops such as canola and lentils. • Situated on the upper Eyre Peninsula, both heat and frost risk can be detrimental to crops. The southwest corner of the focus paddock at Cootra has experienced frost in the past. • While modern genetics and timely sowing are used to mitigate heat risk, hot days of 30 degrees and more can occur while crops are filling and can have a negative impact on yield.

Approach and methodology

Initially Todd had little involvement in the focus paddock process, apart from providing details about fertiliser use and yield outcomes. It took a couple of years before data began to come in from the moisture probe. When EPAG Research agronomist Jacob Giles came on board, Todd installed a

protein machine on his header. They started to use yield and protein data to build maps and test strips throughout his paddock to identify the paths where they could achieve more reliable responses from varied N and P and inputs.

Todd was primarily focused on N input rates and improving his land use: looking at strategies to achieve “more bang” from his investment; by reducing risk and increasing profits. He has now built these maps and is collaborating with CSIRO on data processing.

As part of the trial, the project has completed soil sampling and deep N tests, gaining a better understanding of different zones, including reliable areas and non-reliable areas. Todd has gained considerable value in understanding his paddocks better. He has appreciated the support of researchers during the trial process, being able to talk about his soils, as well as the discussions he has had with other farmers, sharing what they are doing and trying to adapt new technologies to achieve better responses and improved gross margins across his enterprise.

Challenges: One of the biggest issues Todd encountered relates to the type of moisture probe installed. He explained, “data coming out of the probe wasn't great, it just wasn't the right probe.” While the probe may have been appropriate in an irrigation scenario, unfortunately it was not suited to Todd’s soil type. This was a decision made in 2016 at the start of the project when Todd suggested there was less knowledge and understanding of what the best options. He said, there are “different probes available now that would have been better, but that was where the technology was in 2016.” He stressed the importance of being able to choose and install the right probe from the onset. The technology requires a commitment to a platform and service provider, where growers are locked into a telemetry unit, backend and software. If he was to install a different probe, this would require operating two different platforms.

Todd owns his probe and telemetry unit, and post calibration is not an option. Unfortunately, it has taken since 2016 to determine these issues, however there is the possibility that he will receive a replacement probe soon.

Impacts/Benefits

The main value Todd has gained from his involvement in the project has been a result of the protein machine installed. While this was not the anticipated outcome, it has been worthwhile, and he has gained an added layer of data across his paddocks.

His involvement in the Resilient Eyre Peninsula project has also given him confidence to use variable rate technologies on his farm. According to Jacob Giles (EPAG Research), variable rate technology is “a practical way of optimizing inputs and increasing sustainability if done correctly.” Todd now has a better understanding of the impacts of stored soil moisture, how to account for deep N and ways to optimise inputs. From an environmental perspective he said this knowledge “helps in making more informed decisions and making sure we are efficient.” He is hopeful that as a result of his involvement he has locked in some higher yields.

Relevance to others

Todd believes this project is contributing to improved understanding about soil constraints, different soil types and variability within paddocks and across farms. He said most growers in the district have visited his paddock and had in paddock discussions about nitrogen, which he believes will impact their nitrogen decisions.

4.2.2 Pushing the benchmark

1. Case Study: Pushing the Benchmark

Summary/Purpose

Kerran Glover understands that yield potential is a lot higher than it once was, due to changes in genetics and farming practices. He understands the ‘benchmark’ will change and needs to be pushed to realize true potential and that inputs must change to match new higher potential. Research Agronomist at EPAG Research, Jacob Giles explains, “deep N testing and the use of soil moisture probes are amongst some of the tools that can help ensure inputs are as accurate as possible.” Kerran was interested in learning more about pushing the benchmark. In this case study he shares his learnings based on deep N trials across his paddock and the impacts on input costs and yields.

Context

Kerran’s farm *Goldmine Hill Farms* is a 6500-hectare mixed farming enterprise, cropping 4500 hectares and running between 2500 and 4000 Merino sheep.

He was interested in adjusting his prescriptions and fertilizer rates with phosphorus replacement in his cropping as well as nitrogen application. Cropping accounts for 60-70% of his operations and includes wheat, canola, vetch and barley. Kerran was looking at ways to increase profits from his crops, without spending more on inputs.

His business approach is closely aligned to the objectives of the Resilient Eyre Peninsula project in that he is trying to build resilience and achieve the best possible results for the least amount of inputs; by making sure to maximize yield using the same amount of the inputs; “being careful to not waste or spend more money than we needed to get those maximum yields.”

Focus Paddock	<ul style="list-style-type: none">• 117 hectares• Cropping system: Vetch, Canola, Wheat• Location: Palkagee (Lock)
Paddock characteristics	<ul style="list-style-type: none">• Soil in this paddock is good for the area.• Sandy loam dominates with higher clay content in better parts of the paddock and calcrete layers at 30-60cm depth in the poorer areas of the paddock.• The soil is highly calcareous in parts.• The pH in 0-10 cm is around 7.5 (CaCl₂). This rises to a pH of 8-9 deeper in the profile.• Paddock has good elevation and frost is not an issue.• While boron is not an issue at some points it is quite high at others. Levels of 30mg/kg can be found as shallow as 40cm which could impede yield potential especially when paired with calcareous soils.• Soil issues: Calcareous soils, boron, calcrete layers.• Biotic stresses: ryegrass, barley grass, foliar disease (yellow leaf spot, SFNB), heat.
Plant Available Water and yields	<ul style="list-style-type: none">• Canola yields at this site in 2021 were exceptional for the area. Timely crop establishment, appropriate nutrition and the selection of a high-yielding hybrid variety all contributed to this.• The benchmark for canola prior to this was approximately 1t/ha. Through the use of Yield Prophet® in conjunction with discussion groups amongst the regional innovators group and Kerran, the high potential of the crop became apparent in season.

- PAW of 100% paired with the most likely outcome of an average finish saw a 2.4t/ha yield prediction in late July. August and September were very dry which had a detrimental effect on yield potential. Yields still well exceeded the 'normal'.
- This has now shifted the benchmark for this grower and others in the area for what can be expected of canola.
- It is also well understood that crop nutrition must match yield expectations. The Regional Innovators Group believes that growers in the area have taken a more bullish yet calculated approach to N applications because of the Resilient EP project.
- Yield maps and EM38 show considerable variation across this paddock. However, patterns are not consistent from season to season and it is difficult to come to any conclusion as to what may work best in any particular year until it is too late. For this reason Kerran does not use VRT for N, but does implement a P replacement program based on previous year yields.

Approach and methodology

To date Kerran has applied different rates of nitrogen across the soil types in his focus paddock, based on data collected from soil sampling. He is yet to determine how those different N rates are going to affect yield and protein.

He felt the project team and EPAG Research agronomist Jacob Giles, kept him in the loop on what was happening as well as seeking out his feedback and working to understand what he was aiming to achieve. He said the project had been a great “team effort” where Jacob has done all the monitoring and Kerran has got on with planting his crops. While he said he did not bring any technical knowledge to the table, Kerran appreciated being consulted on his practical observations gained over years of experience with his cropping program.

Kerran has been impressed by the project model and the differences he has experienced compared to other research projects he has been involved in, where the farmer is left overwhelmed by additional workload. In contrast, he has felt supported throughout the trial and has not spent additional money on crops as the trials have integrated with regular business operations, eliminating financial risk.

He has appreciated the regular communications and effort on the part of the project team to understand his aims, working collaboratively to come up with solutions and alternative options. He said overall it has been “really seamless.” For example, nitrogen prescriptions came through relatively quickly as a result of access to the project’s network of people. To run these activities on his own, this would have taken a lot longer.

Impacts/Benefits

As of November 2022, Kerran was only just starting to get results in terms of understanding nitrogen levels and soil available water to the plant, but suggested more time is needed to understand how that is driving yields and how the nitrogen is cycling through a whole rotation. He said, “while we are always building a better understanding, I feel like we’ve got a lot more to learn. And hopefully, the project will run for longer.” Kerran noted, some of the results relating to deep nitrogen being observed, “have been a bit surprising.” The longer the project can run, the better the data and outcomes at the end of it and, “the better we will understand how that nitrogen cycles.”

He is keen to continue the process to determine how he can replicate outcomes on a broader scale, and potentially include the rotation on other areas of the farm. He explained that following his legume with canola and a wheat crop, his nitrogen levels were “through the roof in that rotation,”

without having to apply a lot of nitrogen. He would like to keep tracking this rotation to better understand the build-up in resilience and sustainability that can be achieved as a result.

Yield and deep N at sampling points

Kerran is involved in ongoing discussions with consultants around the amount of plant available water (PAW) stored in the soil and how to match this to seasonal conditions and nitrogen levels. He has been running trials across sections of paddock where he applies a high rate of nitrogen versus zero, and others with a cross section of different applications to compare.

In terms of how well Yield Prophet® data lines up with yields, Kerran again suggested the need to continue monitoring, to be able to collect more data and more accurately assess outcomes across a period of time. To date, he is satisfied that data is delivering a bit more confidence in the model.

He feels these trials are addressing a knowledge gap and a lack of understanding around stored nitrogen, and how much that can vary between different rotations in farming practices. He said this information is now becoming clearer, “it is also reinforcing the need to do soil tests and deep N tests.”

He explained the importance of understanding how much moisture is stored and how that drives decision making. For example, if the aim is to achieve a certain yield and a deep N test comes back with high nitrogen levels, then there is no need to apply more because it is already present.

Adoption and practice change

Kerran will be looking at how he can use learnings from the harvest of nitrogen test strips to plan nitrogen inputs more broadly. He believes the results will be closely looked at locally, as a lot of growers are seriously looking at their systems and how much it is costing to put crops in. He said, “if we can get some good data out of this, and I think it's going to be, then there will be more uptake of variable rate technology to better match nitrogen inputs and be more cost effective. People will see the benefit if they can see the results in the data.”

He commended the project on running focus paddocks across different regions, tailoring objectives to the area. He said involving farmers in the process has allowed the project to be far more focused, “to hit the ground running, because they have connected with the local knowledge and experience of farmers in the district, who know their soils and the long-term ability of those soils.” They have also taken the time to ask for input before starting the project, instead of waiting until part way through.

The standard of networking across the project was also noted to have been exceptional and unlike any project Kerran has been a part of in the past. He said, “I think it is an absolutely perfect model to get the best chance of a good result for the money that is invested in it.” He suggested it is a model that should be replicated in future projects and in projects in other states.

Relevance to others

Kerran has been pleased to see the level of interest in the project. There has been national interest with consultants visiting his focus paddock from interstate, including CSIRO delegates. He said this was encouraging as it made him feel like the work and effort being put in was noticed and “has some importance. I feel like this is a worthy project to be a part of and am happy to be a part of it.”

He also mentioned several farmer groups have visited his paddock. He has presented to local farmer groups and held four meetings over the last two years, with local farmers who are interested to see his paddock. He has been more than happy to open the trial site to anybody that wants to have a look.

He has a diagram which he shares showing “a mud map,” of what has been done where; what varieties have been sown; and the timing of sowing. He said this has “created quite a bit of discussion.”

With the rise in input costs, including high fertilizer prices, people are looking at what they are spending and trying to get the “best bang for their buck.” This is aligned with the objectives of the Resilient EP project.

Kerran explained, change takes time and growers may not necessarily rush home and update their spreader so it has variable rate technology: “the adoption of a technology is quite slow”; it can be costly and takes time to fit into a growers existing program. However, he feels that based on discussions he has had with people, they are certainly looking at it, and next time they upgrade a piece of machinery, they will make sure it has the ability to use variable rates.

4.2.3 Stored soil moisture, yield potential and how to mitigate risk

1. Case Study: Understanding stored soil moisture

Summary/Purpose

In this case study, Paul Schaefer shares his experiences and insights on his involvement as a focus paddock for the Resilient Eyre Peninsula Project. Running livestock on his property as well as cropping barley, canola, vetch, lupins and medic pasture rotations, the success of his operations is heavily influenced by stored soil moisture leading into the growing season. Chasing yields with high inputs is risky due to the impacts of potential frost and heat events in the region. To mitigate this risk Paul has strong medic rotations to ensure a good N background.

Context

The Schaefer family's 4500-hectare enterprise, *Nalino*, in the Pinkawillinie region on the Eyre Peninsula, includes livestock as well as barley, canola, vetch, lupins and medic pasture rotations. Paul's involvement in the region's moisture probe network came about following communications via the team at EPAG Research. At the time, Paul was looking to investigate challenges he was experiencing with his crops. Unsure whether they were related to nutrition or moisture, he wanted to know more about what was happening underneath his soil surface.

EPAG Research agronomist Jacob Giles explained, focus paddocks were chosen based on the willingness of growers, but more significantly due to the ability to represent a district and to achieve demonstrable outcomes that would be beneficial to other growers similarly affected. Paul's site at Pinkawillinie was felt to be representative of other properties in the area where growers implement mixed farming systems to help offset risk as best as possible.

While soil type variation is a challenge across Paul's property, he does not apply variable rate application of N. He feels the size of the variable areas and the input of time and cost does not represent a worthwhile return. According to Jacob (EPAG Research), this is a common view amongst growers on the upper Eyre Peninsula, as inputs are generally low to begin with and areas of land farmed are large. The grower does use a variable rate at sowing for phosphorous and nitrogen.

The mixed farming system on the upper Eyre Peninsula has seen many growers succeed with a sustainable business structure. Sheep provide income in poor years to maintain cashflow. Failed crops can be cut for hay to be fed out in dry spells and annual cropping input costs are moderate as input costs (fertiliser, chemical and fuel) are required over a smaller proportion of land.

Focus Paddock	<ul style="list-style-type: none">• 125 hectares• Cropping system ()• Location: Pinkawillinie: northernmost area of cropping in SA, nearing the Gawler Ranges.
Paddock characteristics	<ul style="list-style-type: none">• Soil types across paddock include sandy rises, low clay flats and clay loam rises/ mid slopes.

	<ul style="list-style-type: none"> • The soil type is generally very good in the paddock although sub-soil constraints (boron and/ or calcium carbonate) limit effective rooting depth to 80cm, even in better parts of the paddock. • The pH ranges from 7.5-8.5. • Medic pastures dominate the break crop phase as they are the most reliable feed source for livestock in such an environment and fix high levels of N for following crops. • Soil issues: boron, calcium carbonate • Biotic stresses: heat and frost, brome grass
Plant Available Water and yields	<ul style="list-style-type: none"> • Good soil structure for large parts of the paddock mean PAWC is large (approximately 100mm to 80cm depth). • The use of stored soil moisture from summer months into the growing season can redeem poor years. 2021 was an example of this. The paddock experienced a decile 2 year with only 130mm growing season rainfall (GSR). This would generally result in low yields however with the 60mm of measured stored water included, the resulting paddock yield was 2.9t/ha of barley. This high PAWC means that yield potential estimates can be quite useful during the season. However, heat and frost can strongly affect such estimates. • The weather patterns in spring when crops are at their most vulnerable bring cloudless day and nights which bring heat and frost. Both events can have severe effects on yield. This makes decision-making more difficult as yield potential may be great, however large inputs come with larger risks. • Sub soil constraints are an issue at this site. If rooting depth could continue further, PAWC would be greater and so would yield potential in some years.

Approach and methodology

In setting up the focus paddock, Paul has been left to run the paddock based on his chosen rotation and treat the site as any other normal paddock. The team at EPAG Research have done the leg work involved in set up and analysis. Paul has had the opportunity to provide as much or as little feedback or input into the process and he has found the overall experience of working one-one with researchers to have been extremely valuable.

He has appreciated the connection to researchers and the space to bounce ideas around as well as to provide feedback and help to “steer them” as to where growers feel they need to direct their efforts. Often trial sites are set up on growers’ properties with no further communication. Paul said the “direct contact with researchers has been excellent.”

Based on involvement in the process, Paul made the decision to add an additional probe in the paddock adjacent to the project focus paddock, at his own expense. He said this has been really interesting in being able to observe how different crops react to the same amount of moisture. He said this has been really important to their pasture management system, ‘to make sure we spraytop, late in spring to avoid using precious summer moisture.’

Impact/Benefits

The moisture probes have given Paul confidence to do summer weed control, knowing that money spent on summer spraying is beneficial. He explained that after spraying a paddock and reviewing the probes data, several days later, he can see moisture has stopped draining out the soil profile. The moisture probes have given him confidence to make these decisions.

He said, the level of information available from the moisture probes was unexpected and its value has been “really excellent.” In the past he did not often make changes to set plans, whereas now armed with this type of information he would “base rotations on the moisture available rather than just a guess.” Previously, Paul said he had been caught out, letting pasture die off. He explained that having the two probes on paddocks, side by side, has shown that a wheat crop once it is ripe, stops using moisture, but the pastures can continue draining moisture for a long time, sometimes into

January, which means a lot of moisture is needed to recharge the system. Paul is more likely to spray pastures out earlier, even if there is some feed left, to conserve moisture. “This was something that we thought we knew we needed to do but didn't do as much as we should have in the past,” he said.

In terms of long-term planning, Paul is hoping to re-introduce canola back into his system after not sowing it for several years. He explained canola had generally been a risky crop in the region and has not been a huge part of his rotations. With the data from his moisture probe, he now has the confidence pre-sowing, to better understand available soil moisture. He can sow canola dry and given an average season he can expect to still realize a return.

Adoption and practice change

Moisture probes have highlighted there is still a lot to be learned about what is happening beneath the surface. They are relatively inexpensive to install, and Paul said they have provided him “really good insight into what moisture is available.” They have allowed him to track moisture over time; demonstrated how much water he has saved and how much can potentially be lost due to poorly timed spray applications.

Paul has a better understanding of his soil's PAWC, which is noted to be good relative to rooting depth. Stored soil moisture at this site is highly valuable. The ability to measure in season is less valuable to Paul. Related outcomes are often dictated by weather during critical stages rather than any other factor. Inputs are also relatively small due to a strong medic pasture history. The value in these decisions becomes more important as larger areas, having a greater variability, are farmed and the scope to scale decisions based on PAWC is opened up.

Relevance to others

Several groups of researchers and farmer groups have visited this focus paddock, as well as regular crop walks organized through the local Ag Bureau. Jake Giles and the EPAG Research team provide updates at local Ag Bureau days about what is happening on the paddock and how that affects other growers in the area. According to Paul, the region has seen a “pretty big uptake” of moisture probes off the back of this project. In addition, the local Ag bureau is developing a moisture probe network. He said there has been a lot of interest in general with “growers extremely interested in what's happening and how that might affect their farms.”

2. Case Study: Using soil moisture data to make targeted decisions relating to inputs and yield potential

Summary/Purpose

In this case study Andrew Polkinghorne describes the value he has gained from better understanding his soil moisture in absolute terms as well as the characteristics of the soil releasing it. In the past, his nitrogen management decisions were based on crop observations and rotation strategies and some “guesswork.” Now armed with data and evidence to show the depth of soil moisture across his paddock, he feels better informed and equipped to make targeted decisions relating to inputs, including nitrogen use and decisions on grain marketing. He is able to present a more resilient and risk-averse option to finance providers. In addition to sharing his learnings from the project, Andrew is also invested in the challenges faced by the project in sharing the message and beneficial outcomes with other growers.

Context

Andrew’s 8000-hectare property, *Kingara Farms*, is near Lock on the Eyre Peninsula. His enterprise is principally cropping wheat and lentils, as well as barley, canola and faba beans. He was initially interested in the Resilient Eyre Peninsula project because it involved installing soil moisture probes to gain a better understanding of the water storage capacity of soils. At the time, he was looking to achieve a better understanding of his soil characteristics in absolute terms, to be able to make more informed and better paddock decisions relating to nitrogen and to a lesser extent, grain marketing (forward selling).

Focus Paddock	<ul style="list-style-type: none">• 56 hectares• Cropping system (wheat, lentil)• Location: Lock
Paddock characteristics	<ul style="list-style-type: none">• Red loam of varying depth over calcareous loam with high levels of rock (calcium carbonate)
Plant Available Water and yields	<ul style="list-style-type: none">• Difficult to measure and find an absolute number for throughout the project.• Yield within paddock surprisingly even despite varying depths to rock and amount of rock. 3t/ha general wheat yield.

Approach and methodology

Andrew has continued to carry out normal farming activities on the project focus paddock. He contributed funds to cover half the cost of the weather station, which the Resilient EP project team had installed. EPAG Research agronomist Jacob Giles carried out an intensive soil sampling program across his paddock. From this Andrew learnt a lot about his soils and was particularly surprised by how much the available phosphorus levels varied across the paddock. They recorded a variance of between 9 and over 105 parts per million, averaging approximately 40 parts per million. This highlighted to Andrew a lot more variation in the paddock than he had anticipated.

Understanding nitrogen management across paddocks has been difficult due to the nature of different soil types. In many parts of his paddocks this would require coring to between 60

centimeters to a metre below the surface to test nitrogen levels, which he said is “impossible.” Instead, he has had to rely on rotations and available soil moisture according to the moisture probe. He said, “decisions are often based on intuition and knowledge of the rotation and crop types and expected rainfall.”

Andrew has been particularly happy with the level of involvement he has had in the trial process. He has had direct access to Jacob Giles at EPAG Research and opportunities to discuss the project, his involvement and how the message might be extended to other growers. He has also been able to talk with the project manager, Mark Stanley on occasions where he has had any concerns.

Impact/Benefits

As a result of involvement in the Resilient EP focus paddock, Andrew has gained an improved understanding of soil moisture in absolute terms and the characteristics of the soil releasing it. He said, having the soil moisture probe in the paddock has “reinforced understanding and given us the confidence to install at least one other soil moisture probe on another soil type across our farm.”

Based on observations over several years Andrew now knows that if the soil moisture probe says moisture is at 88 millimetres, and there is no prospect of rain ahead, then crops will be going into moisture stress. He also knows that if there is over 100 millimetres, and there are prospects of rain ahead, there will be opportunity to look at nitrogen application as a lower risk opportunity than when it is at 88 millimetres. He understands that if he gets to the end of the season (August, September) and there is well over 100 millimetres moisture available, he can forward sell some grain off that paddock with a reasonable degree of confidence that he will be able to meet contracts.

Not only has it been valuable to better understand soil moisture overall, but Andrew has a better sense of soil moisture deeper in the soil profile, which he said has improved his confidence regarding moisture availability. He explained the importance of being able to see soil moisture extraction by crop, and what depth roots are at. He currently has roots down to a metre, which he said is somewhat unusual, but useful to demonstrate where the crop is drawing moisture from. “The benefit is knowing there is a bigger bucket of water for the crop to draw from and we can expect better yields if that is where roots are getting water from.”

He noted this had recently been a valuable piece of information to present to his bank. Understanding there is moisture available meant he could confidently show his lender that there is currently more soil moisture available than has been there in the past 5 years. This shows resilience and reduces risk as “they know there is a good probability that we should get a get return on their inputs.”

Moisture Probe Network: Andrew highlighted the opportunities available through the network of probes and weather stations attached to this project. The network is sharing information online, allowing for a level of cross farmer learning and a sense of collaboration. Information from moisture probes is publicly available, which means growers can login and view moisture and rain levels, understand how others are responding and decide how outcomes could fit their own systems.

Weather station fire index: The fact that a weather station is fitted with fire danger indexes has been an added benefit, which Andrew said he hadn’t expected, but which is really useful. It has been helpful throughout the district due to a local system of high fire danger days. A local committee are tasked with issuing harvest bans when necessary. This halts harvest work for several hours during the riskiest times of the day. Using the fire danger index off the weather stations, they are able to make those decisions and to call exactly when conditions are safe again. In the past this has been a

subjective decision. Now based on data, it is more objective, which takes a lot of pressure off the committee, and they can more accurately issue thresholds where it is too dangerous to harvest.

Knowledge gains: understanding volatile soil types and how to optimise yields

Andrew has gained a lot of insight about his soil type and how to manage his paddocks based on his attendance at the Resilient EP project meetings, where he has had the opportunity to meet with researchers and others involved in the project. He has found the information presented interesting, particularly at the higher level in terms of understanding different models and how to relate and scale information from the soil moisture probes to the rest of his farm.

He has also found considerable value in learning about new and alternative models to help predict soil moisture across his property. For example, using NDVI information to feed into existing models, to help assist decision making relative to soil moisture and zones in paddocks. This was something he previously only had a basic understanding of, and it was not something Andrew had considered.

Andrew explained the capital involved in installing soil moisture probes across an entire farm, would be too costly, which is why he is interested to learn more about nitrogen response or yield response to nitrogen application and relating this back to seasonal conditions at the time. He described new information coming from work being done by Rob Bramley at CSIRO and the interesting possibilities available on how this could be applied to his farm. He is specifically interested in the scalability of knowledge across his property based on understanding variance across soil types.

He also found information from climate scientist Dr Peter Hayman (SARDI) particularly useful. He provided background information on rainfall probabilities as well as explaining what long-range forecasts actually mean: how they are very low probability forecasts, not an actual forecast. These are topics and issues where Andrew has gained a lot of value from his participation in project activities.

Adoption and practice change

Andrew's financial contribution to the Resilient EP focus paddock was approximately \$3600 towards the weather station. In terms of the payoff, he said, "there is no doubt in my mind it has been well worthwhile, and we have got our money's worth back in information, particularly in terms of confidence about nitrogen management."

He explained the investment has enabled more targeted decisions. Using data from the moisture probe has resulted in decisions that have saved on nitrogen applications. For example, costing out urea @50 kg/hectare (lower end) and a saving made across 1000 hectare of spreading @ 50 x urea at \$1300/tonne, Andrew estimated a saving potential of over \$60,000 (depending on the season). He said, on the flip side it might also be an advantage to spend the \$60,000, "in the hope we get extra yield back as a result."

Challenges: The only issue Andrew had experienced was regarding yield monitoring equipment. When the trial began, he had one harvester and yield monitor. As his enterprise has grown and he now has two harvesters, there have been instances when the yield monitor in one of his paddocks was not working and information delivered to the project was incomplete. He also has a contract harvester who uses a different yield monitor. While not directly related to this trial, he has experienced technical challenges in integrating data. Jacob (EPAG Research) has helped to

interpolate some data, but from a grower point of view, this highlights a need for commonality across systems and reliability of yield monitoring systems.

Relevance to others

Andrew believes the project is extremely useful to scientists and researchers, he said “they've developed a lot of knowledge and information. Just not yet convinced that it's really useful to growers.”

He sees a major challenge for the Resilient EP project as being how to extend project messages to other growers. He feels the goal of the project was to inform growers, to help in making better decisions about their paddocks. Nearing the end point of the project he feels this challenge still exists. He compared the Resilient EP trial outputs to those of projects being run across northern sandy soils of the Eyre Peninsula, which have produced useful information to help growers understand opportunities and risks in terms of cropping inputs, including phosphorus and nitrogen. He suggested the Resilient EP project needs a similar approach in terms of extending information and findings to growers.

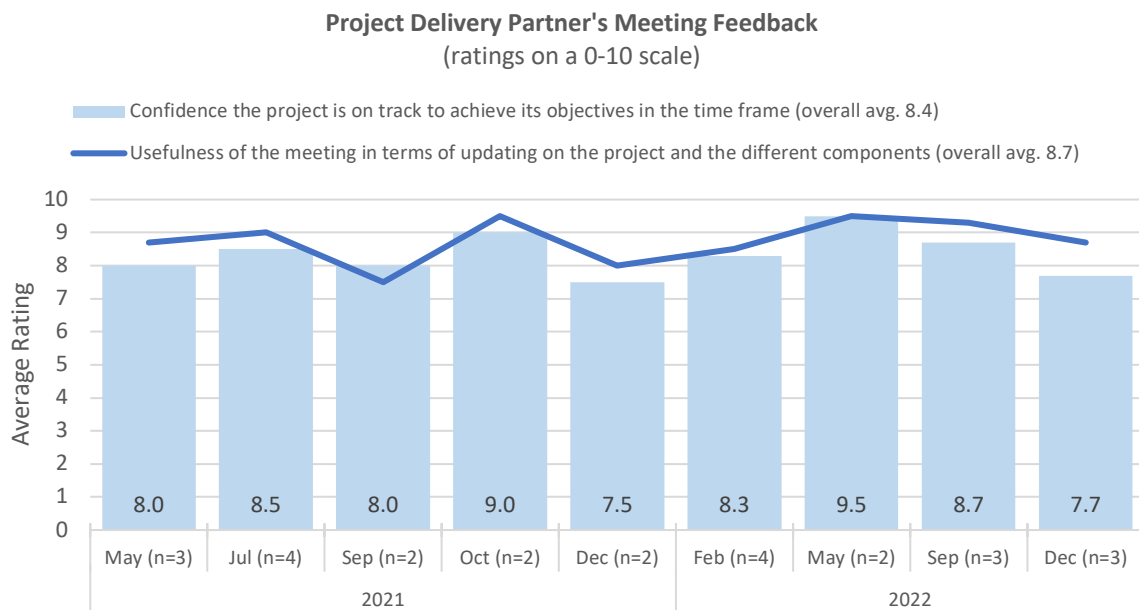
He did note the project team had brought in researchers to the area to spend several days demonstrating the conditions and farming systems in the Eyre Peninsula, assessing possibilities for further research. He got the impression this process was extremely useful, and more developments might come out of that.

He is also aware of growers monitoring the output from the moisture probe network online. He feels the public access to information is really good and “gives some degree of confidence as to whether they can relate the information to their soil types.” Andrew said he would strongly encourage other growers to have a look at the information and learn how others have used data and to make their own decisions.

4.3 Feedback Sheets

4.3.1 Project Delivery Partners' Meetings

Overall Ratings 2021-2022



	Responses	Usefulness of meeting	Project on track	Clarity going forward
Feb-21	5	7.6	-	7.0
Apr-21	6	7.6	-	-
May-21	3	8.7	8.0	9.5
Jul-21	4	9.0	8.5	8.8
Sep-21	2	7.5	8.0	9.0
Oct-21	2	9.5	9.0	10.0
Dec-21	2	8.0	7.5	7.0
Feb-22	4	8.5	8.3	8.7
May-22	2	9.5	9.5	9.0
Sep-22	3	9.3	8.7	9.3
Dec-22	3	8.7	7.7	8.7

December 2022

Summary

- Three participants responded and all found the meeting highly useful in terms of updating them on the project (8.7 avg. – e.g. *good meeting with good input by all in attendance. Good to be able to clarify a few things*).

- All were confident the project is on track to achieve its objectives (7.7 avg. – e.g. *confident that all is in train to complete the project in the first half of 2023*).
- The impact case studies and videos were particularly of interest and seen to *provide a wrap on the findings and value of the project*. It was considered important *to get them out to a wider audience*.
- One respondent expressed concern with the *issues around confidence in probe data display* and noted that while *these are being addressed* it will *always be an issue to some degree*. Extension of the project to *wider growers on the EP* was an issue the project needed to address, with the importance of completing the videos/case studies reiterated – ensuring they *provide value to the broader industry in understanding the outcomes of the project*.
- All were very clear on what is happening next in the project (8.7 avg.) and final comments found the meeting *useful as always to touch base and catch up on progress* and noted that *everyone seems to be positive on where the project is at and are addressing issues as they arise in a collaborative manner*.

Question	Response Summary
Respondents	3
Usefulness of meeting in terms of updating the team on the project and the different components	8.7 avg. <ul style="list-style-type: none"> • <i>Good meeting with good input by all in attendance. Good to be able too clarify a few things</i>
Confidence that the project is on track to achieve its objectives in the time frame	7.7 avg. <ul style="list-style-type: none"> • <i>Confident that all is in train to complete the project in the first half of 2023</i>
Thing of particular interest or new insight gained about the project	<ul style="list-style-type: none"> • <i>Very keen to see the case studies and videos being developed, and to get them out to a wider audience.</i> • <i>The technical and impact case studies shoals provide a wrap on the findings and value of the project.</i>
issues/concerns the project needs to address	<ul style="list-style-type: none"> • <i>Still some issues around confidence in probe data display, these are being addressed but will always be an issue to some degree.</i> • <i>Ensuring the videos are completed and provide value to the broader industry in understanding the outcomes of the project.</i> • <i>Extension to wider growers on EP</i>
Opportunities that will help the project achieve its aims before it concludes	<ul style="list-style-type: none"> • <i>Getting everyone involved in the video production as required</i>
Clarity about what happens next	8.7 avg.
Other comments	<ul style="list-style-type: none"> • <i>Useful as always to touch base and catch up on progress, and work yet to do.</i> • <i>All good. Everyone seems to be positive on where the project is at, and are addressing issues as they arise in a collaborative manner.</i>

September 2022

Summary

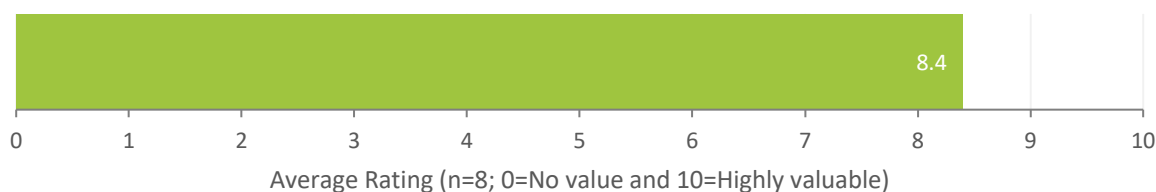
- Three participants responded and all found the meeting highly useful in terms of updating them on the project (9.3 avg. – e.g. *meeting was very valuable. Sorted through a range of issues that will see the project through to a successful conclusion in early 2022*).
- All were very confident the project is on track to achieve its objectives (8.7 avg.), with comments on interesting/positive aspects including: *a common theme of decision making with uncertainty - probes are dealing with a point measure of spatially variable soils; we know a lot more than we did at the start of the project; and the RIG has been a critical success factor for the project.*
- There were no issues/concerns going forward and all were very clear on what happens next (9.3 avg). Everyone was seen to be *motivated to ensure a great conclusion to the project and going forward the focus will be on getting all aspects tidied up and finalised.*

Question	Response Summary
Respondents	3
Usefulness of meeting in terms of updating the team on the project and the different components	9.3 avg. <ul style="list-style-type: none"> • <i>Yes, good to hear what is happening</i> • <i>The meeting was very valuable. Sorted through a range of issues that will see the project through to a successful conclusion in early 2022.</i>
Confidence that the project is on track to achieve its objectives in the time frame	8.7 avg. <ul style="list-style-type: none"> • <i>Very confident. Whilst not achieving everything we set out at the beginning we have the evidence for decisions made along the journey that allowed us to review and redirect our efforts to ensure the overall objectives will be achieved.</i>
interesting/positive aspects of the project to highlight	<ul style="list-style-type: none"> • <i>A common theme of decision making with uncertainty - probes are dealing with a point measure of spatially variable soils</i> • <i>I feel like we know a lot more than we did at the start of the project!</i> • <i>The RIG has been a critical success factor for the project - feedback from Therese this morning again emphasised this.</i>
issues/concerns the project needs to address	<ul style="list-style-type: none"> • <i>Not at this stage. Everyone seems motivated to ensure a great conclusion to the project.</i>
Opportunities that will help the project achieve its aims before it concludes	<ul style="list-style-type: none"> • <i>Focus on getting all aspects tidied up and finalised.</i>
Clarity about what happens next	9.3 avg. <ul style="list-style-type: none"> • <i>Yes - the next steps are clear</i> • <i>We have a set of actions out of this mornings meeting to address a range of issues going forward.</i>
Other comments	<ul style="list-style-type: none"> • <i>Everyone is working hard to make it all work!!</i> • <i>Making excellent progress. Open discussion is a key to addressing issues and progressing the success of the project.</i>

4.3.2 Other Activities (Jul-Dec 22)

Innovation Tour (August 2022)

How valuable the Resilient EP project is in terms of helping farmers make efficient use of soil moisture

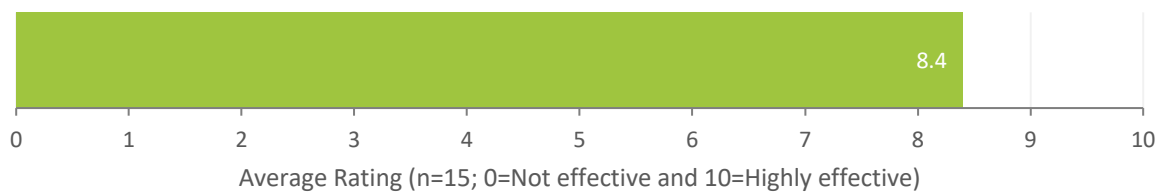


- Eight participants provided feedback and overall, the tour was rated highly in terms of it identifying the RD&E gaps/opportunities to increase productivity/profitability/sustainability of broadacre rainfed farming systems on EP (8.3 avg.). Comments on the tour's success included: *Quite successful, visited very good farmers in a very good season; highlighted that a significant amount of RD&E is occurring to address productions challenges; broad themes were identified successfully. Perhaps the topics were too fragmented; extremely successful initiative; focus was on paddock level problems – the tour defined these well.*
- Based on participants' understanding of the project and insights they gained on the tour; the project was seen to be highly valuable in terms of helping farmers make efficient use of soil moisture (8.4 avg.). Comments highlighted that the project is *generating great thinking and analysis of water use and has clearly stimulated a lot of deep thinking and effort around soils and WUE.* It was suggested though that the project needs to run longer so changes can be implemented and measured/modelled, while challenges associated with engaging late adopters and some problems with the probes and characterisations were noted.
- Participants found the discussions between *researchers, farmers, and advisers*, particularly useful, with one describing how it was *great to interact with growers, advisors, and scientists in a very collegiate atmosphere.* The enthusiasm of those involved and their willingness to share learnings was praised.
- The networking, discussion and interaction of all involved was reiterated as one of the main benefits of the tour – particularly in terms of *closing the loop between scientific research and real-world needs, raising researcher awareness of farmer issues and drilling down on what determines farming systems decisions.*
- The main challenges the project needs to address were around *distilling relevant key issues to the broadest audience (particularly late adopters), generating information that adds value to what the local operators already offer, and highlighting the different approaches used to ameliorate soils.* The *variability in soils/farming systems* and the need for *effective and efficient zoning of soils* was also noted.

- Given the opportunity to provide any final comments, many respondents took the opportunity to praise the tour and the project – e.g. *Great vision to conceive of the idea; great concept that enabled a greater understanding of issues and opportunities between farmers, researchers and advisers; Well run by enthusiastic team and project work well respected by growers; Excellent initiative; for scientists it is enlightening and help us focus our research, and align our effort more closely to industry needs; Congratulations on an superb event that showcased all levels of EP ag capacity in such an incredibly positive way.* There was some suggestion that the tour could have been improved by visiting less farms, having more time for final discussion, and increasing the diversity of those involved to help avoid ‘group thinking’.

RIG Workshop (October 2022)

Effectiveness of the RIG in terms of supporting the project and providing input into its activities and direction



- Fifteen RIG workshop participants provided feedback and overall found the workshop highly useful in terms of updating them on the project (8.1 avg.). The *good amount of useful discussion* was praised, with the information presented described as *accurate, succinct and informative*.
- While the afternoon focus site visits were cancelled due to poor weather, the morning sessions were highly rated in terms of usefulness (7.7-8.3 avg.). Comments described the *great discussion session indoors on the value of the project work* and the *good wrap up session at the end with everyone having a chance to speak*.
- Highlights from the day that were particularly interesting included: *mineralisation discussion; N calculations and paddock review; Peter Hayman’s session on climate and uncertainty; info on the Square V platform; and the data extrapolation presentation*.
- Extra information that would be beneficial included: *more feedback on the value of the outputs of the project (data and tools) in on farm decision making; better understanding of soil type classification at the probe sites and how soil types in general affect nitrogen movement through the profile and retain/don’t retain moisture; and the extrapolation of soil water across paddocks and what will be helpful to make decisions*.
- There was high confidence that the project is on track to achieve its planned objectives (8.0 avg.) – *the project has come together and can deliver the meaningful outcomes it set out to do*.
- The RIG was seen to be highly effective in supporting the project and providing input into its activities and direction (8.4 avg.) – *the RIG has given the project direction and kept it meaningful*.

- Communicating to and engaging a wider audience outside of the RIG was seen as a key issue for the project going forward. A key part of this included *getting a greater understanding of the value of the project outputs to on farm decision making*, with the need to develop *several KIS (keep it simple), sentences/paragraphs/summaries*. It was suggested the effectiveness of the project should be assessed by how well it is *seen, valued, understood and used by the farming community*. *Soil water extrapolation; more work on the cumulative NDVI method of assessing plant available water across the landscape; and refining the n mineralisation calculator* were other issues identified.
- Providing final comments, the workshop was described as *an enjoyable day with everyone contributing positively, with positive sentiment amongst the RIG workshop participants*.

4.4 Stakeholder Interviews

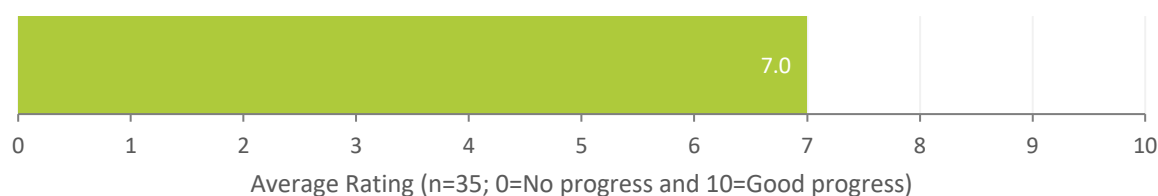
4.4.1 Respondents

Role	No. Respondents	Organisations represented
Project team	7	2 x EPAG Research 2 x SARDI AIR EP CSIRO Regional Connections
RIG member	7	4 x Private Farm Consultant BFIG Nominee EPARF nominee Cummins AG Nominee
Project support	4	AIR EP EPNRM / AIR EP 2 x Farm Consultant
Validation site host	6	6 x Farmers
Farmer	11	4 x Farmer (Cootra) 3 x Farmer (Minnipa) Farmer (Buckleboo) Farmer (Lock) Farmer (Other)
Total	35	

4.4.2 Progress made over the life of the project towards its overall aim

Project Aim: To better link growers, advisers and researchers to assist growers and advisers to better understand the implications of climate risk, seasonal forecasts and to more effectively use available ground water for their crops.

Progress made over the life of the project towards its overall aim



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	8.3	7.1	5.8	6.2	6.9	7.0
n	7	7	4	6	11	35

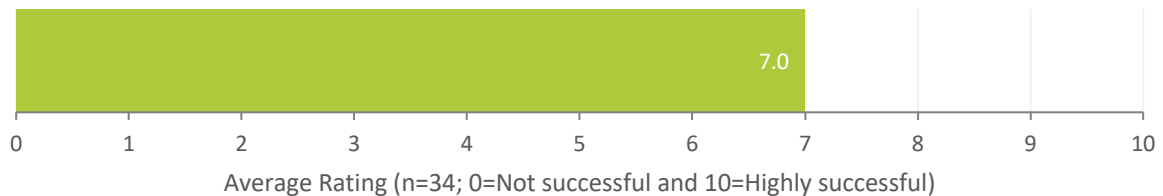
12 Project team	Fundamentally there was a problem with this project in that it was conceived on the basis that the Eyre Peninsula team had a network of moisture probes, which they were going to enhance and make use of. But in actual fact they didn't have a network to start with. They had about 24 sensors that were not in any way linked, and most of them either didn't work or hadn't been calibrated correctly. Even enhancing the number of moisture probes was not going to result in there being a network at the end of the project. Feel it was setup on a false premise. In addition, it was managed by a local extension group rather than people who are used to conducting research. There were never any research questions posed. Acknowledge it wasn't supposed to be a research project, perhaps it was purely an extension type project, but it didn't seem to understand at the outset what it was going to be able to do, because there was a lack of clarity around the starting position. Whether it's done what it set out to do, unsure. While there has been some linkage between growers, advisors and researchers, that's only true of the growers and advisors and researchers who are explicitly attached to the project. Do not believe there's been broader engagement.
18 Project team	I think it's been a good project to link everyone on EP together - they have done better than previous projects.
35 Project team	Have come a long way from the concept to where we are now. Some things haven't panned out the way we thought they would at the start. Definitely achieved that aim of getting researchers and farmers together and talking through information they need and how to use
36 Project team	There was good discussion as well as skepticism. But as the project went on, the discussions and conversations improved and there were some really good learnings for everyone.
37 Project team	Moved along, but there's room to improve
38 Project team	The way the project was structured from the beginning with the involvement of growers, consultants and researchers from all different facets and bringing them all together has been one of the strengths of the project. Have had a lot of feedback directly from growers and consultants saying that it has been one of the better projects they've seen in a long time in regards to that and the flow of information: from the top down and vice versa.
39 Project team	There was a real advantage in having group of people you keep meeting with through different seasons. Is extremely valuable: very common to get people in the room and talk about seasonal forecast; very rare to spend three years doing that and having that continuity. What was challenging, but in another sense helpful was the growing season of 2020 and 21 and the promise of weather conditions that didn't eventuate. And then in 2022, a promise that did eventuate, highlighted the notion of how to use forecasts: which are imperfect. As a result there has been a lot of discussion about how to communicate forecasts and put them into context.
11 RIG member	It has brought consultants, researchers and farmers together in a positive way.
16 RIG member	I have never seen a project like it where they coordinate the 3 together. All working so close together and understanding each other so they have all adapted really well. I don't think it is widespread enough but the people in the project have been phenomenal.
20 RIG member	It is a very complicated project and it is hard to pull all the researchers together early on but I think we have achieved fairly well. There are still some areas where we could have done better, it's not a criticism of the project, it's just the complexity of it all.
24 RIG member	It was quite difficult to understand what our objectives were.
28 RIG member	There is good linkage for swaying the advisers, researchers and from there to the farmer but it is more for the adviser department apart from the farmers that were directly involved with the project.
29 RIG member	At the start we wanted to talk and collaborate about the probes and getting an idea and better understanding on how water capacity works and what implications that had on decision making and also on nitrogen management within the crops, from my point of view the things I was going to get out of it has been at the start of the project that been very successful.
34 RIG member	One of the main purposes is to explore the use of probes and yield profit tools for weather forecasting to improve farm decision making but I still think there is some confusion about the value of probes and yield profit.
4 Project support	Comments: the significant knowledge that the probes are telling us, and we are still learning how to apply that knowledge.
17 Project support	While we helped some growers gain more confidence I feel we still have a long way to go.
21 Project support	I haven't been involved in the project much lately.
32 Project support	If the project had clear strategies on how they were going to implement that aim. The wheels spinning on what it was all about and what the project was there to do.
7 Site host	How many mil of water was in my soil. We don't know what that means.
9 Site host	There are gaps in our understanding of the meaning of what specific soil moisture probes are and the range of responses that are to be made to what we observe.
15 Site host	There is so much more work to do to gain the right technology into the right paddock and managing the variabilities and clear and legible data.
26 Site host	Over the period of time, we learn more about how to understand the data that is coming from it.
27 Site host	My probe is lower, so my water use is pretty ordinary. I feel it has given people the confidence to fertilize efficiently. I know by looking at it, I can't put too much on. so, helps to decide to apply or not apply nitrogen utilizing the water if it is there or not.

30 Site host	Some progress has been made with understanding ground water, but I don't think as much progress has been made between advisers and growers and the climate risks stuff. I think there is a little better progress on that but not as much as ground water.
2 Farmer	It is progressing and going along well.
5 Farmer	
6 Farmer	I don't think they have come out with usable outcomes. I will wait and see.
10 Farmer	It was quite good. You know what you have got and can manage inputs.
13 Farmer	There are still a few questions to be answered. We have made a little bit of headway in where they want to go.
14 Farmer	We are starting to understand what is in the soil and what is available and starting to get a gauge over 3 years. Thats giving us good knowledge for going into the season and have confidence with what you can sow or not.
19 Farmer	Now we are getting more of an idea of water efficiency and learning about plant available water and leads to enabling us to make decisions on fertilizing.
22 Farmer	It is very handy but not everything..
25 Farmer	Have not used it
31 Farmer	There is still early days and a lot of improvement to be had. They have made a good start to what our potential yield is with the probes.
33 Farmer	It started on one path and then changed to another. I didn't find it favourable my soil type I have been put off and left out of the loop and struggle to get a huge benefit out of it yet.

4.4.3 Project success in delivering impacts

Climate risk and seasonal forecasts

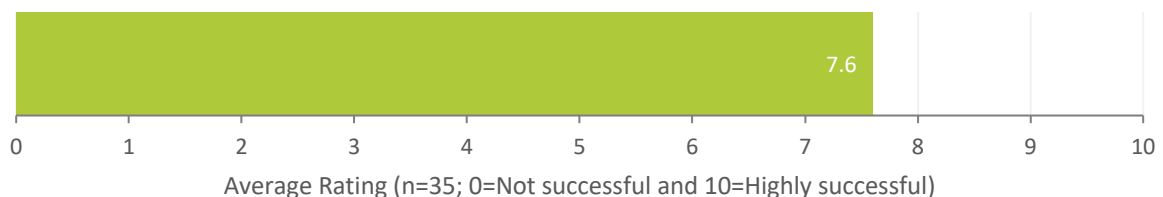
Advisers and farmers improving their understanding of the implications of climate risks and seasonal forecasts.



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	8.6	7.1	6.7	6.3	6.4	7.0
n	7	7	3	6	11	34

Plant available soil water reserves

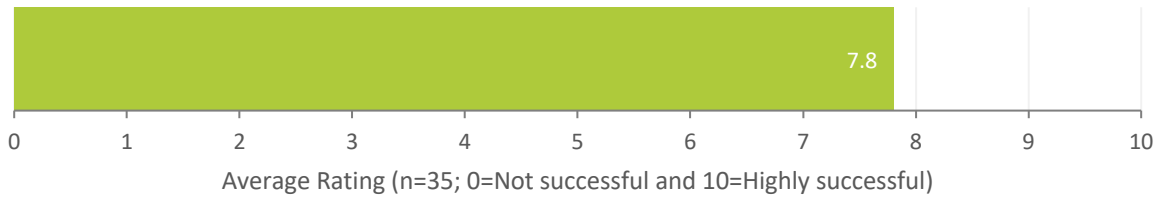
Improved decision making in relation to improved understanding of plant available soil water reserves



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	7.7	7.6	7.3	6.7	8.3	7.6
n	7	7	4	6	11	35

Collaboration and sharing

Improved relationships linkages, collaboration and sharing between farmers and advisers and researchers



	Project team	RIG member	Project support	Site host	Farmer	Overall
Avg. rating	8.7	8.4	8.3	6.7	7.4	7.8
n	7	7	4	6	11	35

Comments and Examples

12 Project team	Qualify these ratings as being within the cohort attached to the project (rating 7): the advisors and farmers who were explicitly engaged in the project, farmers who were hosting field sites, or advisors who were part of the RIG group: it's been quite successful. But limited impact beyond this cohort: has not been successful in the context of a broader constituency.
18 Project team	Didn't get as far as we wanted with understanding soil water across the landscape It was good concept but we couldn't quite achieve the aim. Overall the project definitely pulled everyone on EP together
35 Project team	Caveat is it's only the ones that have been directly involved that I'd give a 10 for. There's still a lot of work. Outside of the people directly involved in the project.
36 Project team	The understanding and engagement in the project improved as it went on and people began to understand the implications of the information being provided in the project. Some good learnings, in the end.
37 Project team	the farmers and advisers that have been involved directly, yes there has been impact. But whether that extends beyond them, would suggest that has been one of the project failings: not gone much wider. In terms of collaboration and linkages, it has sometimes been frustrating. Some of the groups and collaborators just came to do their part of the project rather than collaborate. Ticking boxes rather than genuinely looking to engage.
38 Project team	Improving Understanding: The work Peter Hayman did was very valuable and that went directly to the consultants because of the way the project is structured and so for them to be able to understand that and feed it back to their clients is very valuable. Decision making: for a lot of growers prior to this project, it was something they didn't think about at all or to a much lesser degree, whereas now it's almost calculated into the decisions they make. Relationships: One of the strengths of the project. Was helpful for researchers, consultants and growers, and then the project as a whole because there was a much wider information base. It had a really good of flow (circular motion from one to the next), throughout the duration of the project.
39 Project team	The last workshop we had people were saying: this has changed my thinking. That's not a common thing for people to say. Came from a situation at the beginning of the project where there was concern about where the project was going yet at that last the last meeting we had there was were a lot of positive aspects about the project and the discussion.
11 RIG member	As advisers we have a reasonable handle on the basics of seasonal forecasting and climate change, while I enjoy listening about it I am not sure that I have learnt any more but I do see the value in it. I have a better understanding of the variability across landscapes and understanding the limitations and also understanding that soil water is critical.
16 RIG member	It has been really well done
20 RIG member	We know more now that the complexity of things is better than before and we have done well with the probes themselves but we haven't moved into the paddocks that much. Overall things have been done well but it took

a while for it to develop. At the beginning of the project it needed to be looked at how more things could be achieved more quickly than it did.

24 RIG member	We understood where current research got to and we probably understand farmers differently.
28 RIG member	We have a better understanding but not sure if we have got better decisions from it. I guess it's bringing everyone together and got everyone in one room to talk to discuss things so that was really helpful.
29 RIG member	I think in regards to climate change there is still a lot of variability within the forecasts so while we might understand it we now understand there is variability in the forecast and has helped to use them as a management tool. The plant available water resource will calibrate the probes and think that has been highly successful in the project. With the linkages we get to meet people like Peter who took the road show around for us as well so it's just about getting that information out to the wider farmers now. The farmers that are in the project got an awful lot out of information through to them.
34 RIG member	It has been a good project and there has been an opportunity for researchers to be involved with that project, to chat directly to farmer audiences on the Eyre Peninsula.
4 Project support	We still have a way to go, learning how to make better decisions with the data we have got.. That is using the point information and applying. There is more work to be done.
17 Project support	We have been able to send out messages to large groups but as a whole we still have not connected with the broad aspects to the farmers. The people that have been in the project have really benefited with the structure of the project within our region and on field discussion groups.
21 Project support	The relationship has grown because people have been working and sharing together, in terms of the outcomes of the project it would be harder to judge.
32 Project support	
7 Site host	We have had some good sessions here for the last 2 years. But one thing we don't know, the figure, is on how much water is in our soil.
9 Site host	We have had such a range of favourable seasons and had a very good run on favourable circumstances in the last few years so the focus was maximising our site rather than miss gauging other sites. I think we have to respond aggressively to what we know is good soil moisture as in to to the life of the project.
15 Site host	We had a good group session with the researchers in the paddock with the probe and accessing the data and talking about decisions.
26 Site host	The understanding is emerging about carried over soil moisture, still from a low base. We weren't measuring it and people were not understanding the soil moisture, the summer rains and certain crops and carried moisture differently from a legume to a cereal crop and. understanding how different crops impact stored moisture and summer weed control. Reinforcing good farming practices. They couldn't see the value of it.
27 Site host	Once the probes are out there, they can use it themselves. You don't have to hold hands with researchers. I can interpret this myself, Independently.
30 Site host	The main understandings are the soil moisture and decision making. With our own business quite significantly improved our understanding but not convinced they have got the message to farmers as a whole.
2 Farmer	We have regular visits from GRDC, Dept of AG, weather
5 Farmer	It has opened our eyes as to what is possible in the future with the probes and moisture nitrogen management.
6 Farmer	
10 Farmer	The information is not widely shared. Some people keep their information guarded to get an edge on the next farmer so not going to give out the full detail of what I am doing. They feel it is healthy competition.
13 Farmer	I haven't really seen a lot of the results back. Not many of the result have communicated back to me.
14 Farmer	
19 Farmer	It is a good talking point and referred to our probe..
22 Farmer	
25 Farmer	All neighbours get along and all information is getting shared pretty well
31 Farmer	The general population of farmers and relies on everyone able to get the information. Not sure the farmers understand what they are trying to achieve. I haven't seen what the conclusion of the project is.
33 Farmer	

4.4.4 Value of project research in adding to new understanding or tools towards improving soil and water management on farms

12 Project team Serious limitations in terms of both accessible data and project resourcing. As a CSIRO researcher, this project was seriously under resourced. Looking at the budget for the whole project in total, it's quite well resourced, but the amount that was allocated to do the things that we were asked to do: it was under resourced.

18 Project team	Increased growers understanding. The yield profit reports, and the paddock meetings were very interactive between with growers and consultants and the researchers. That was really good. Didn't get as far as we wanted with mapping soil water across the landscape. The yield profit reports provided good discussion at those groups with growers. The soil characterization and square V are being used in creating the new website. Still have a bit to finalise on that. Comments from growers: it is much easier to understand with the stoplight system.
35 Project team	It has got us to the point of around 20 to 30 ml accuracy of stored water that's available to plants . That's been a big improvement. Understanding and confidence was really low at the start and that has improved. There's still more to go in this space, even nationally. Others have been trying to approach this topic in different ways, and they're at about the same point (within 20 ml accuracy). It's encouraging that a local project has got to the same point as some of the larger, more national projects, and using different approaches.
36 Project team	There's been some really good learnings. Did not get to the ultimate aim of what we thought we might be able to achieve in the project in terms of mapping available soil moisture across the landscape. But learned a lot about the limitations and the capability of a lot of the technologies that are available. There is good accurate data, as we delve into aspects of the of the technology through the research and reviews. We found that what the technology was delivering wasn't quite as accurate as what we thought. The trust we put in some of the technologies should be questioned.
37 Project team	We are getting there. At the start of the project, we didn't realize or recognise the size or how hard it would be to get to the end.
38 Project team	Main and most obvious value was having the sound numbers behind lessons learned. Those numbers being value of stored moisture and the value of having that knowledge. Then the research by SARDI, EP AG and the output by Square V to display the value of soil moisture stored and the influence on farm decisions. Followed by working to demonstrate that value via discussion groups: tied into a neat package.
39 Project team	One of the understandings there is: some of the limits and challenges of using soil water probes and the benefits. There has been a better understanding of what soil water probes are useful for, but also that they don't give a perfect measure. You need to think about the spatial component of it and whether that probe is making is an accurate reading. It's easy to go from soil probes don't work or soil work probes work perfectly. Feel the project did a good job of saying these are beneficial and this is how they can be beneficial and used.
11 RIG member	Their research is useful in that it really shows how complex landscape and farmers systems are and to be aware of having an appreciation of the variability in making decisions.
16 RIG member	The researchers have done a really great job. Jake and Andrew's team have really drilled down into the moisture probes and are great with one on one but I feel as a general things aren't explained well enough. Shane Oster has been really poor as he is set and forget, he has a business but this is just a side line for him.
20 RIG member	I would say in understanding how complicated some of the work is.
24 RIG member	We have more questions than answers sometimes but it did clarify things to some extent. I wouldn't say it was straightforward, it can either get too complicated or too simplified.
28 RIG member	Understanding more on moisture probes in large areas, the CSIRO's work showed that we can't do that so even though it's not the answer we want it an answer none the less. It had made us more aware how much faith to put in the moisture probe data and there has been a lot more soil research that has happened along the way and it is adding to our knowledge of what's happening in our soils.
29 RIG member	We collaborated for probes so now we know what plans available for water capacity is for the sites where the probes are. We can use that as a generalisation across the rest of the farm and landscape, it's not always right though but it's better than what we had before.
34 RIG member	Because of my background and training plus previous work on the models like yield profit this project didn't have much value for that but the strong point I want to make is that we have two members of the group supply soil moisture probes data and my understanding of that is it is not of much value.
4 Project support	We have learnt with limitations, the point sources soil moisture information and better understanding of prophet reports as well has increased significantly.
17 Project support	It has given me confidence to send messages with more understanding and I have had more conversations with farmers about the soil water use.
21 Project support	It feels like they are going around in circles at times and probably more so than is hoped. They are trying to solve problems everywhere, maybe it was a bit much for them and limited the application.
32 Project support	not much
7 Site host	The value is good information. Weeds use the moisture that has been proven so making sure the summer weeds are out.
9 Site host	This goes for me and my peers, a greater confidence to respond to any input, other than that I am not sure.
15 Site host	If you can improve the understanding, my interpretation is to reward on relying on soil types and reduced expenses on less reliable zones in the paddock. And improved water use.
26 Site host	It gives me some confidence, leading into seeding, what available moisture we have. If we have good soil moisture, then certain varieties can be planted or planted earlier. It says if we have moisture stored. The information to base the fertilizer rates as well. If I have a lot of stored moisture towards the midway of the season, then apply extra nitrogen to match the yield potential that I see given that we have stored moisture to finish the crop.
27 Site host	it has given people the confidence to make use of the opportunities from a moisture perspective. last year people in the upper given us the incredible yield and make the most of the moisture that was in the system. Yields people don't seen these yields in this country.
30 Site host	pretty significant

2 Farmer	SARDI gives a fair indication of our own local area.
5 Farmer	With the soil moisture for crops and reduced rain fall time and the amount of moisture is lost to weeds.
6 Farmer	Moving towards understand soil moisture but there is a lot of questions unanswered.
10 Farmer	Sorting summer moisture. It is critical for drought proofing a winter crop.
13 Farmer	Just being able to monitor what we have in the soil coming into the cropping season and what is remaining in the end so we can make some decisions.
14 Farmer	It's a great tool. it sort of given us confidence to purchase one and the information is bringing to us as growers is outstanding.
19 Farmer	It has given us enormous value and soil characteristics. It has raised the awareness of the nature of the soil and location of the soil probes on nearby farms are like, and how those soil types are and how they hold the moisture and where it goes and the capacity.
22 Farmer	It has been about more about how much is going to be available for crop yields more decisions on fertilizers and nutrients.
25 Farmer	
31 Farmer	It has certainly given me an understanding about the way the probes can measure water content in soil and more awareness of what impact the risks are in growing my crops. It is also given me a better understanding our potential yield.
33 Farmer	It is still in the early stages, and it is different out of our area. I am still learning..

4.4.5 Usefulness of the validation sites and related activities in communicating and engaging with farmers and advisers

12 Project team	Whether or not they were useful in the specific context of what that the project was set out to do, "that's probably a moot point." The eight sites without a doubt resulted in good communication and engagement. Within the eight sites, there were three focus sites, which probably delivered valuable impacts to the three farmers who own and manage those sites. Understand there have been good discussions around the broader 8 sites and this would have been valuable to a broader constituency and as a vehicle for starting discussion.
18 Project team	Highly successful. Good discussion around soil water and nitrogen management. Haven't seen some of the results of the trials this year, there are still things to come out of the project. The nitrogen management data is good. Definitely good interaction between growers, researchers, consultants and good paddock discussions around the issues.
35 Project team	Really important in providing a point of interest and focus for discussions and being able to provide background information of what's going on in real terms. Not all discussions were necessarily just about what was happening, but they were a good conversation starter
36 Project team	They were critical to the approach. Having that spread of validation farms or paddocks across the region was a feature of the project. Could have used them more effectively but overall, they were a great way to test some of our thinking and to be a focus for discussion groups that happen over the life of the project.
37 Project team	Very effective: the growers and advisers that participated seemed well engaged and were looking for the information.
38 Project team	The discussion groups were a great way to start to get out and see the sites. They covered different topics around nitrogen, variety selection and sowing and built into that the big questions around yield potential around stored soil moisture. The value was in the numbers and also the demonstration of the value at the sites.
39 Project team	Extremely: the validation sites were well chosen and were excellent focal points for discussion.
11 RIG member	You have to ask the farmers but with the ones I was involved with I don't think we exposed ourselves enough but the serious discussion groups we had were incredibly well received. This is the best work that I have seen in the last 10 years.
16 RIG member	They are exceptional.
20 RIG member	They were very successful.
24 RIG member	It was ok.
28 RIG member	There was three in the area where I worked and all three got engaged and one of them was less relevant to the surrounding soils. There was still alot of issues on that site but it was all valuable research.
29 RIG member	We want more farmers to come to the validation sites but then again the bigger impact on those sites is through the RIG group. It's the RIG group members that gives information back to the wider farming community, it is very difficult to get a lot of farmers to those sites.

34 RIG member	We put too much emphasis on probes with the project and are unable to deliver what we thought it would and is not as good as I am led to believe.
4 Project support	I have a limited amount to do with these people, but with likeminded famers to share their knowledge. inspired them and their consultant.
17 Project support	It has been a great way to connect with growers that come to the major events in a comfortable atmosphere.
21 Project support	Reasonable I think.
32 Project support	The real value is getting the attention of people than it was ever before. Putting some measurements behind it has been a valuable process.
7 Site host	With the Yield prophet, we should have got 7 ton but we got 5. Not enough plants not collated right for out soil type.
9 Site host	There is certainly a greater awareness of what their existence is. They are very aware of the limitations and it is a representation of a single point and what the measurements mean.
15 Site host	see above
26 Site host	The using of that information through the season to make decisions. Before, we were just making assumptions about what stored moisture we have without any data to back it up and vise vera, or we might apply more nitrogen or not based on that information.
27 Site host	Helps people understand their bucket size to hold moisture or not. My 500-mil moisture of capacity is worse than some of the others and once my bucket is full in spring there is only one of two weeks before it runs out and into a drought situation.
30 Site host	It has given us a much better understanding of how much moisture the soil will hold as well as the what the lower thresholds are and the decision with nitrogen and what limits are in the grain marketed if we know the moisture is there to produce the grain.
2 Farmer	CSIRO and GRDC and the local research from SARDI.
5 Farmer	the weeds suck out a lot more moisture than you think and there are a lot more weeds there than you think.
6 Farmer	moderate
10 Farmer	How much draws down from the probes have been drawing a lot deeper down. The crops will finish if knows it has a certain amount of moisture.
13 Farmer	The access to the moisture data is the main tool we have gotten out of it.
14 Farmer	added value
19 Farmer	It has added a lot of value.
22 Farmer	It is more of an understanding on the summer weed control and how much is taking the moisture way and what your potential is.
25 Farmer	
31 Farmer	It has helped me to understand the Yule potential on how moist the soil is.
33 Farmer	It helps confirm and giving us some data on the available water and confirming gut feel on nitrogen decisions how much water is in the soil.

4.4.6 Examples of impacts of validation sites on farmers/advisers

12 Project team	
18 Project team	
35 Project team	
36 Project team	Creating a link between research and farmers on the ground, how they put technology into practice and what/ how they use the information. The work and cell characterization and measuring soil moisture at these sites led to a lot better understanding of what we're dealing with across the region, in terms of our ability to measure soil moisture and how we can use that information to make better decisions.
37 Project team	
38 Project team	
39 Project team	
11 RIG member	We are trying to apply field research with modelling in all different areas with both retail and independent agronomists but we really haven't got the financial backup.
16 RIG member	They set up these little discussion groups and that's where the huge value is.

20 RIG member	We had a very good roll up at these meetings with local bureaus and gave great awareness about the project, quite a few farmers went and listened to talks around these sites and that had been successful.
24 RIG member	It just provided practicality in that kind of set up. We talk to people that have got it but also to the people that are monitoring and trying to understand it a lot better
28 RIG member	No, I can't think of anything.
29 RIG member	The RIG members spreading their information to the farmers.
34 RIG member	I have two probes on my farm and might look at the probes outlook once or twice a year to make decisions.
4 Project support	a greater utilizing of moisture probes for decisions making.
17 Project support	The ongoing session on field had been really helpful and seeing if growers have adapted plus it gives the researchers a real understanding of what is happening on field.
21 Project support	On some of the sites they are asking sensible questions and it was starting to get traction in terms of getting people involved.
32 Project support	The soil moisture probes in extremely high rainfall areas, we were able to look at the data which farmers have looked at and some have used it or squandered it with the summer weeds.
7 Site host	It has shown to use more nitrogen. So, fertilizer decisions.
9 Site host	Creating awareness of soil moisture probes, a lot of our growers have them and the growers that don't are looking at the available sites and are knowledgeable of what it all means.
15 Site host	no
26 Site host	I know that it created more discussion with farm advisers and farmers with the information coming from my probe. It created far more interaction across the industry. They are talking to other researchers has been quite significantly involving farmers as part of the process which is a great idea. I see people changing and making slight adjustments to better understand certain crops with stored soil moisture and summer weeds. Before then, the farm consultants were telling farmers of the importance of these things but did not have the data is backing it up.
27 Site host	It help me save dollars. I get to spring look at the crop and look at the bucket size it is not a good decision to fertilize with only 6 days of moisture there. So I am not wasting money on fertilizer and not degrading the value of my crop putting to much nitrogen on.
30 Site host	We have made decision both to apply extra nitrogen and in other seasons, not to apply, as to what the information is telling us about our soil moisture.
2 Farmer	Summer weed control in areas of sowing. Disease management and getting rid of the green ridge before sowing time.
5 Farmer	It gave us confidence to apply more nitrogen when we have a soil profile and had more moisture than we thought.
6 Farmer	Improved nitrogen application and grain decision making processes..
10 Farmer	When people know this, they are confident to spread extra fertilizer..
13 Farmer	It is giving you confidence towards the back end of the season in making grain marketing decisions.
14 Farmer	The agronomist's involved in the program as we were concerned with costs and soil moisture from one of the probes. It took us back 3 year and this year we start with the most soil moisture.
19 Farmer	This morning we did an annual review with the agronomist, and we did the moisture probe with the understanding of where the moisture levels are if we should do dry sowing out there, or if we should keep spraying the summer weeds of not.
22 Farmer	A lot more people are doing a lot more spraying for summer weeds.
25 Farmer	
31 Farmer	I think the project and the data coming from the project, gave me the confidence to push my yields more last year where we had excellent growing conditions.
33 Farmer	giving us more confidence to spray nitrogen without data the yield we can achieve using more nitrogen and data backing up how much water we are loosing for summer weeds. It backs and confirms that data

4.4.7 RIG contribution to the project being more useful and relevant to farmers

12 Project team	For the first 18 months of the project, the RIG was a significant contributor to the dysfunctionality of the project: they didn't have a focused idea of what the project was doing. Towards the end of the project, the contribution of the RIG was more valuable because it had become more focused on what the project was about.
18 Project team	By engaging the consultants in the project they have the ability to extend the information to their client base. Good way to get useful information adopted by farmers.

35 Project team	First time we've done a project using a regional innovators group, think it was critical to the success of the project. The range of experiences and input and what each of them brought to the discussion was really valuable and directed the project in terms of areas of importance to focus on as well. Provided focus and direction.
36 Project team	They were good. They fulfilled the function and concept planned for the project. The idea of the RIG was to keep the focus on what we were trying to achieve in the project to keep it practical relevant to farming across the region. They were excellent in terms of pulling up researchers where they thought thinking had gone off target and raising issues they thought the project could focus more on as the project progressed. They were key to the project remaining relevant to farmers in the region.
37 Project team	Really useful. Possibly a bit big and unwieldy at times.
38 Project team	That RIG was great and were good at attending discussion groups. There was always more than one attending each group in the different areas. They were good grounding information and growers looked to them to know what was being said was worth listening to. Really added value there as well as feeding into what went into trial work and shaped that process from the beginning.
39 Project team	They were an inseparable part of the project. The project was designed as an interaction between the regional innovators group and the researchers. It wouldn't have been a project without that.
11 RIG member	At times we did feel we were without a helm because there were multiple projects and it felt like people were responsible for different areas of the project so it never really felt like we were a group but it did work.
16 RIG member	Each had a discussion group where growers came along as well as the RIG group. The RIG work was exceptional and this really contributed well with the overall project.
20 RIG member	Obviously I am part of the RIG group so I think we contributed well in that space.
24 RIG member	Yes they were useful to a certain extent. There needs to be a pre understanding but also to make things clearer of what we are actually looking at and making sure everyone is on the same page and understand where we want to get to. They have been quite useful but also confusing at other times.
28 RIG member	Significantly by bringing a practical approach to the direction of the project, the knowledge and ideas and making sure that is coming back to things that we can practically do on the farms.
29 RIG member	We have to be very practical minded and I am commercially driven to achieve good aim for my clients so they achieve the most money so I can concentrate on what I want around being able to generate the big amount of incomes. The RIG was good for the group because it gave directions.
34 RIG member	The RIG was true value for the farmers and growers with the discussion groups. A lot of the men were saying that those who had paddocks that were included actually got a lot of data collected and analysed which was great for them.
4 Project support	An excellent part of the project. It allowed feedback to the management team to shape the project for what the needs were of the RIG and so they were able to get some excellent learning out of the research done.
17 Project support	Consultants and advisers have links that don't quite connect with growers, it would be good if better understanding and information is received to their clients so they have a better understanding of what is happening.
21 Project support	It helped a bit, I think it is a bit tricky with different personalities and thought it was an interesting way of doing things and if the same people run it again they should take learnings from that but also it has created some problems as well because you have got a lot of effort and oxygen to get things moving. I was enrolled with the RIG once or twice and at the end of the day a lot of people were rivals as well as different mindset of what the outcomes were.
32 Project support	Without RIG, there was not a project. The feedback to the researchers and extensions on what they were doing was an integral part of the project.
7 Site host	don't know that group..
9 Site host	I have had these conversations with the management committee before, that part of the process is not a part of the whole project that worked particularly best. There were 8 cooperates that I felt was inputting much more with the strategic thinking and innovation more than the innovators group and that's my opinion.
15 Site host	I thought it was helpful and brought a wide range of ideas across the peninsular from different climate and farming zones. It helped build ideas.
26 Site host	The RIG has taken, in more depth, to another level, the interaction between farmer and the researcher. It is at a level I have never seen before with meaningful data the farmers can use with practical outcomes.
27 Site host	They have given the capacity to look at focus groups to see what can be done or what can't be done so we can use it on our farms or not. Sample farms we can view without doing the work ourselves.
30 Site host	It did help quite significantly with the relevance of the project.
2 Farmer	It has been beneficial for that. Being localized gives a lot better data to local growers.
5 Farmer	I think it was very valuable. The next frontier of agronomy to make big decisions on how you grow the crops for the next season on how you read that soil moisture.
6 Farmer	a little
10 Farmer	I am not sure of the name, but I think that was the stuff Jake Giles was doing. It was good as historical drafts and percentages of good and bad years and what the probes are telling you.
13 Farmer	I am not sure as I haven't heard of them.
14 Farmer	I would say highly active and engaging.

19 Farmer	They contributed quite a bit.
22 Farmer	it offered the opportunity to learn all about and have a better understanding of what is happening under the soil.
25 Farmer	
31 Farmer	I don't know who Rig is
33 Farmer	It has been useful and needs to continue on for a few more years yet to fully understand it.

4.4.8 Changes that could make the RIG even more effective

12 Project team	The meetings I attended; the RIG would talk about whatever they thought were the issues of the day for half the meeting before getting on to the more focused project issues. Feel the RIG needed to be coached to be properly focused on the project, rather than a raft of peripheral issues that might or might not have related to it. It was a shame because there were some really good people on the RIG whose opinions were worth listening to, but a large part of the discussion wasn't properly focused. The facilitator seemed to be focused on what the rig wanted rather than what the project had to deliver.
18 Project team	Farmers that were targeted. There is always an issue of making contact with other growers that may not necessarily enjoy those workshops or paddock discussions. There are still a lot of farmers in each region that weren't there. We have to get that information to the growers that don't necessarily attend those workshop
35 Project team	While it was a big group, which can sometimes be harder to manage, believe this was actually on of the strengths. It did not rely on everyone being there 100% of the time. Everyone's has busy times, so people came in and out. Always well attended.
36 Project team	One of the issues is with the group like that including farm advisors and leading farmers who are busy people anyway: asking them to engage in an RD&E project, is adding to what they are already doing in terms of running their businesses. Even though we were paying RIG members to be involved in the meetings and the discussion, their farms and advisory businesses always took top precedent. Means it is difficult to get all in the one place at the one time which was a pity. In terms of learning, their knowledge and understanding of the issues in the region was critical to driving the project. Really need their input.
37 Project team	Due to the size, having some clear expectations from the project - they didn't recognise what was expected of them.
38 Project team	Got better as the project went along, in terms of communication and expectations and as they saw more value in the project their level of input increased, it was an upward momentum.
39 Project team	Was really well run by Mark and Naomi were really efficient. Perhaps early in the project there was a lack of clarity, but don't think that was a problem because in some ways that clarity evolved as part of that interaction with that group. Understand there was an element of frustration very early in the project, but the strength of the project is that it worked through that frustration.
11 RIG member	It doesn't matter what the leadership or organisation is, it is always the key to success but sometimes we just feel directionless.
16 RIG member	Being honest, the one thing I would change is with researchers, CSIRO in the process probably ate up a lot of the money, apart from Teresa there was a lot of money wasted in that area. Apart from her I think there was a lot of money wasted. The value for what they gave compared to what they were paid with the project was a huge difference.
20 RIG member	To run another project after this one and then we will be starting in a better and more positive position.
24 RIG member	Farmers are an important part of it but there is a big gap between what researchers and farmers do understand. We have to get a practical outcome on these things too, you can't just have a theatrical situation that is not going to translate to farmers.
28 RIG member	Nothing comes to mind.
29 RIG member	I thought it was pretty good as it was, there was a good balance between science and farmers and people that advised farmers. You have got everyone's perspective, they don't always agree with each other. I am quite happy with the dynamics of how that group works.
34 RIG member	I know there has been attempts to find a little more expertise outside of the group.
4 Project support	what the group ended up in the last year was excellent. It got better and better and I was very happy where it ended up.
17 Project support	More information and guidelines given to the farmers, the farmers need this information maybe in different formats so they can have a better understanding of things.
21 Project support	I am not entirely sure of how Jake ran it in the end, I thought that maybe smaller groups would be better so it wasn't such a big deal when they met in person.
32 Project support	There was a real disconnect in the 6 monthly meeting and what happened in between. It was not a good enough connection between RIG and the people who come along to contribute one or two days and they don't think it about it until the next rig meeting.
7 Site host	

9 Site host	Everyone to pull their weight because everyone has a certain job to do.
15 Site host	More days in the year so I can attend.
26 Site host	It is already quite affective as it has a focus on the practical outcomes. That is what RIG needs, to be relevant. Straying away from that it would become less relevant. I am a big fan of it. It is one that I have been the happiest I have been involved in. Monitoring with prescriptions on precision AG with practical data that will be useful to the region and tracking that over a period of time is imperative to a broader range of seasons. The longer it goes, the better information we will get out of it. The practical outcomes. The researcher will look at things differently focused on the outcome the farmer can use on a day-to-day basis using the initiatives that need to be profitable over a broad range of seasons.
27 Site host	Looking at farms that represent areas or other farm types and operators that are capable and respected by the rest of the community. Soils that people will recognize that are relevant, it gives something to aspire to and I can learn from that.
30 Site host	Some communication about what they are actually doing for farmers to make general decisions and why they were made, were not communicated to the rest of the community. Some of those decisions, through air EP and Yuel EP, were communicated through them. It would bring more relevance and interest to the projects.
2 Farmer	Getting totally accurate weather forecast.
5 Farmer	Over a longer term of examples to run over more seasons more variants in the years.
6 Farmer	wider communication with growers
10 Farmer	
13 Farmer	
14 Farmer	possibly could do more getting there project out nd about more advertising.
19 Farmer	
22 Farmer	The more we get together and talking about it. Any speakers available so more people talking about it the better so there are more people skilled up.
25 Farmer	
31 Farmer	
33 Farmer	We need more get togethers with the farmer groups to really understand what the readings are telling us. I would like to get together more with the group to see the value we will get out of it and what we can achieve.

4.4.9 Increase in awareness over the last few years in the EP farming community about the project, its purpose and activities

12 Project team	
18 Project team	We have contact with those top growers and consultants, but there's still a lot of the community that don't get the information and how we get it to them - still not sure. This was the first project that air EP was involved in: there was probably a big push to get the name out there and get the project out.
35 Project team	There was a fair bit of effort in trying to extend the project, generally through those mechanisms. That was my job and I'm not 100% confident that we have. The issue of attribution to work is always a problem with these projects. People are seeing parts of it, but don't think they would know that that was specifically this project.
36 Project team	Those people directly involved in the project: the farmers where the validation sites were and farmers in those immediate networks, certainly benefited and were well aware of the project. In terms of the farm consultants involved, the learnings from they gained would have been discussed more broadly with their client base, increasing the spread and reach. Researchers, both on the Eyre Peninsula and from CSIRO and SARDI would have benefited from their access to the farms and farmers on ground and the practical application of their research. .
37 Project team	There's this dichotomy in that the people that were directly involved in the project have got a really good understanding. The communication to a wider audience has probably been lacking. the strategy is right it just too longer than anticipated to have a message. That participatory approach is fantastic but to get to a wider audience, the project needed messages lined up first and that part took longer. That was a bit frustrating: can't tell people what you don't know.
38 Project team	Just done a report back to the Commonwealth. We saw about 300 stakeholders and that has been similar each year by targeting a group in each area through discussion groups and having a core group in each area of the EP. Others caught wind along the way as they head of people putting in more probes or wanting more information.
39 Project team	Due to the regional innovators group, and more than most projects. The link with the regional innovators and Air EP helped, but there is room for improvement there.

11 RIG member	The best form of communication to farmers was definitely in our discussion group and to communicate to advisers, we have a lot of workshops and I think overall they are valuable.
16 RIG member	I still think we haven't hit everyone, the awareness of it is definitely there but it's just a matter of the awareness or the outcomes are there but they have done a really good job. There have been some people that make big decisions that changes the way of thinking.
20 RIG member	It was based around the farmers visiting the sites as well and that is when most things changed.
24 RIG member	There was a little bit. There were people that knew what was going on but I don't think it was something that people could really put their finger on and say yes that's exactly what they are doing.
28 RIG member	Not hugely, the people that were interested in it would have known about it within the first year and then after that it wouldn't have been for people that work and engage.
29 RIG member	I can only speak for my clients, I know there were about three that took an interest in it but most of them unless I spoke to them about it they didn't know what was going on and that's why they had RIGS in the group so they can take that information back to the farmers.
34 RIG member	There was quite a lot of information about the project but people look for specific outcomes. Yes it was communicated well and people knew the RIG was worth happening and there were discussion groups going on.
4 Project support	It really only captured the innovated growers with moisture probes but there were still some that did not pay a lot of attention and still need to be picked up.
17 Project support	The ongoing discussion groups is really important but the side of the RIG was a little bit large.
21 Project support	Hard to say, those who were involved understood it and those not involved not so much and found it harder to get their head around all the information.
32 Project support	I really don't know as I am not based on the Eyre Peninsular. Not enough connection with the growers there.
7 Site host	It has been good locally and more people are looking into it. I am not sure how much it has grown more than when first started but some more are getting installed more each year.
9 Site host	This is creating an awareness but that awareness was in parallel to a whole lot of other industry initiatives from all of the consultants, that we have agronomists and consultants industry. We had a once in a life seasonal life last year and by default increased awareness and made people think how to capabilities on this opportunity.
15 Site host	It was reasonably well known about.
26 Site host	it certainly people are quite aware of it Locally local farmers group coming to some meetings. creating more awareness around it more creditable in the region it is growing not everyone would be aware of what is going on . still some have fallen through the cracks
27 Site host	You need to be speaking individually to farmers. The response at the field day meets, more people were interested in or supported of it. Sometimes you just want good data. With agronomists it is how they are seen in the community as to how valuable they are.
30 Site host	I am sure awareness of the project grew, but also there as so many projects and farmers get a bit confused about what bit of research belongs to what project and what project the information is connected to and wouldn't have a clue. Farmers were aware of the final results of the project and a lot wouldn't know what project it came from.
2 Farmer	quite a lot
5 Farmer	A lot of people have known about it but could have been better attended. In the longer term it will grow.
6 Farmer	No doubt, there was a lot of information out there and they attempted to work with the growers.
10 Farmer	Probably didn't grow because of EP changing to Air EP there are not as many people following Air EP
13 Farmer	There has been more awareness over the last couple of years.
14 Farmer	It was adequate maybe could have put it out there a bit more and more social media.
19 Farmer	Quite a bit made on farm walks I went to. There was mention of the project with Andy Whear and his crew, that they had found through that project, that they had gained good knowledge and that came out every field day I went to.
22 Farmer	It grew very much, and most farmers understand exactly what it is even if they didn't attend, they know about it and what it is happening.
25 Farmer	
31 Farmer	It grew as I became aware of it. There is a lot more scope to get the work out there within the Ep community. There are a lot more farmers that need to know about it.
33 Farmer	It has grown but we still striving to get huge benefits out of it because of the variability of soil types and how the moisture probes are working as we are getting funny readings in our limestone soil or inconsistent readings.

4.4.10 Impact of project communications on farmers and advisers in the region engaging more in the project and understanding/using its information

12 Project team	The Air EP newsletter covered a range of things, not just this project. Don't think it covered anything in in any depth.
18 Project team	It is a great project to bring the consultants the top growers in EP and the researchers all together in a project. That worked really well and would like to see more of those type of projects with everyone involved, including SARDI MAC
35 Project team	We kept the branding consistent through the whole project. There would be a fair amount that would be aware. When we put things up like a yield profit reports through the newsletter, they're always the most clicked on item. We have those stats (if needed). The content generated was very popular.
36 Project team	The broader information distributed through social media and newsletters creates a deeper understanding of the project. It may have generated questions for that weren't directly engaged in the project to seek more information, but unsure of this being this case. It was more about creating awareness with a broader you farmer audience.
37 Project team	
38 Project team	
39 Project team	The notion of branding is people are getting the messages successfully out there, but there's a naive idea that busy people know the brand of where it's come from.
11 RIG member	Immensely, everyone is syncing with each other and learning through discussions and workshops.
16 RIG member	Holding those field days was a huge progress, the weakness of it was it was over communicated which sounds silly, they heard so much about that they actually came immune to it.
20 RIG member	It was very important.
24 RIG member	I take a lot more notice and interest in what I do with my soil probes so I make sure that I understand that. I am actually able to talk to other farmers about it which is part of the situation.
28 RIG member	The female that spoke about it in Industry days said there is so much you can do and advisers were speaking with people that they deal with.
29 RIG member	I don't know how widely the app has been going and all I can tell you most of my farmers haven't got it so I don't think that has been taken up very well.
34 RIG member	There was real value for those in the project.
4 Project support	It gave them the knowledge.
17 Project support	Greatly, yes it was a big help.
21 Project support	It's always in the legacy of the project that you find these things out plus there hasn't been enough work in this area to focus on it.
32 Project support	
7 Site host	It has gotten better. People were not taking any notice of it and now people are asking questions.
9 Site host	Communications is everything and the farmers have been taking the opportunity to gain knowledge in all aspects.
15 Site host	It defiantly helped but whether growers and advisers took it on board, I am not sure.
26 Site host	without communication no one knows it is vital across the 3 it is very important farm consultants, in their network by far the most efficient way of spreading the information. Initially to get the information out . Local farmers group at certain sights 50 people in one day so spreads the knowledge even quicker.
27 Site host	not as much as the agronomists. it depends on individuals listening to the agronomist or if they rely on an agronomist . I think we as a farming industry can get lazy and rely too much on agronomists. they you are on your own. we need to get our heads around this as much the agronomists do.
30 Site host	It made a significant difference. If the communication did not exist, we wouldn't know.
2 Farmer	100 percent
5 Farmer	about a number 7 in a scale of 1 to 10. as the work grew the interest grew.
6 Farmer	a lot
10 Farmer	It was very engaging it was good.
13 Farmer	There was a contribution there towards that.
14 Farmer	It took a bit to get your head around it for sure and if you weren't fully committed to the project, you would have had a misunderstanding and some of the growers might have gone not understanding. The ones that were interested would have understood.

19 Farmer	Quite a lot a lot of people I talked to, who are not part of the project, are often going on and looking up the sites. They are looking up the probes and looking up what is going on in other parts.
22 Farmer	I thought it would have majorly helped that way.
25 Farmer	
31 Farmer	It was pretty good. I got what I needed out of it. I wasn't aware it has finished and have not got a final report.
33 Farmer	Not enough communication more to understand the information.

4.4.11 Actions taken as a result of engagement with the project

12 Project team	There are issues that have been raised and discussed about as possible avenues for further projects down the track. But none of those have reached anything approaching implementation.
18 Project team	New collaborations - it was good to work with other people in the regions and I definitely learned a lot more about the soil moisture probe network. This was the first project worked on involving the soil moisture probe. Still don't know where we are going with that in the future (platform on the website), but what research is going to happen around it going forward?
35 Project team	Influenced how we've been writing project submissions going forward. Discussion groups and how we've used the focus sites, with advisors being involved - this is a model that I'm extending across other projects. That is a direct outcome and an effective way of engagement. In general, the improved relationship with advisors across Air Peninsula means that I can ring any of them now and have a chat about a particular project or if I'm seeking land holders that are doing a specific thing for a project, I can get them involved in. It has been enabling for a lot of other things.
36 Project team	GRDC have a tender out in November last year around a risk initiative. It tied very closely in with what we've been doing in the Resilient EP projects. We put together a project to the GRDC Risk initiative and got funding. That gives us the ability to take some of the learnings from the resilient EP project and to continue some of that through the risk project. We learned a number of things from the EP project and now we've got that ability to further investigate and discuss what we're doing.
37 Project team	We are moving forward into another project will complement this one. We are continuing with the participatory type approach and trying to do it with different partners as we keep expanding the sphere that we work in.
38 Project team	Direct understanding of farm and yield potential is different as a result. My knowledge has grown a lot in that regards. Will be doing similar but different work including economics so farmers can relate more at business level.
39 Project team	The opportunity to keep working with the same group was great. We [SARDI] were involved in a much larger Forewarned is Forearmed project with the Bureau of Meteorology, and there's a lot of work on providing climate information, for example, Climate Services for Agriculture. The experience of sharing the frustration of the forecast not working in the way that people were hoping it would, is an extremely valuable part of that. The misunderstanding of some people in the RIG that the forecasts were the opinion from the Bureau in the way that an economic forecast would be, rather than just reporting the output of a supercomputer. We have tried to say to the Bureau it would help if they were clearer that what's being reported in the forecast is just the output of computer runs (e.g. 70% of the computer runs went for wetter and 30% went for drier. And those 30% then went for drier are just as valid as the 70% for wetter). It is not a matter of the forecast being right or wrong, it's just saying those were the future pathways that the computer model with the best information saw and all are plausible pathways. First thing is to communicate that that that's what's being reported rather than with 70% confidence that it's going to be wet, which is a natural misconception. People tend to read the headline without realizing that a 30% chance of it being dry is still a big number and we need to plan for both. We need to adjust things in that way and understand that process. And also linking that information to decision making and the challenge of using that information in decision making. That will lead on to the GRDC risk initiative.
11 RIG member	I have been supportive of the push to extend the project, there are probably lots of little ideas that has helped build along the way that has helped me work with farmers, The upside for me is the yield targets, are we looking high enough based on the soil types that can achieve those higher yields.
16 RIG member	It contributed greatly and especially to the growers, advisers as well but especially growers. I have growers around the Lock area and I would suggest that lower rainfall climate has changed their perspective of what they are doing and what the potentials are.
20 RIG member	My thoughts are where we are going and what we still need to do and that has a huge effect of formularising that process. We are always trying to get a PAW map which is part of our water map across the landscape and we have initiated that but we are still trying to fulfil what we are trying to achieve.

24 RIG member	Trying to think what we still need to do and processing the information. Like I said before things can get a little confusing.
	The discussion groups we very helpful and helped me have a clearer understanding which was helpful.
28 RIG member	Probably taking less notice of some of the water probes after finding out more about the variabilities and how the outputs of some of those can be.
	Through some of the climate information with Peter Hayman I am overseeing things a bit more and have taken more notice.
29 RIG member	I certainly have a closer working relationship with the scientific group.
	I have changed some of the management practices around the soil probes because I can now look at them with great confidence and say there is a heap of soil moisture there, I could put a value on a risk which I couldn't do before.
34 RIG member	I used one of the sites in particular for our outputs and use that for nitrogen precision in the last couple of years.
	This gave me a lot more confidence to make decisions around applications and last year it paid off big time. Thanks to my decision we applied lots of nitrogen and got outstanding results and I know our quality and quantity was above average.
4 Project support	No but I collaborated with more that were in the group.
	further discussion of soil moisture probes about soil information.
17 Project support	Not applicable
21 Project support	I haven't but I have pointed out to farmers in my discussions to look at the outcomes of the RIG.
	No more than that, I did talk to someone about it before and he said I should look at what the outcomes were.
32 Project support	I have made changes to some of our equipment. The reporting has been useful working out how people like their data presented to them.
	It certainly brought to our attention the importance to sorting our temp and moisture. What the project was supposed to do but didn't but did bring it more to our attention.
7 Site host	The action I have taken is to put out more fertilizers and learnt the importance of more moisture and taken information and consolidated what we knew anyway.
	People didn't realize how much summer weeds take the moisture out of the soil.
9 Site host	Site specific fertiliser variable rate application were things I was already doing but the project has been extremely useful in validating those approaches which are becoming more widespread.
	I can say I haven't changed things in response to the project but there are certainly things that I have implemented that the project has been critical in getting validation for.
15 Site host	Gave me confidence regarding making maps.
26 Site host	We are continually working with the researchers and collaborating with the farmers in the RIG group, and what we think we should be doing. It is a mix of ideas. It evolves with the season and the crops at the side at the time.
	Tracking nitrogen with soil moisture and matching yield with that. We haven't done that previously. We were able to see last year's tracking now to analyze the data.
27 Site host	I changed some of my practices. It has given me confidence to go with the actions that I have. made. I am in high rainfall area and yet I get burnt. The confidence in the decisions I made which were controversial yet worked.
	It gave me the confidence to challenge the experts when it doesn't work. and why.
30 Site host	Yes. we have changed the way we manage the nitrogen, and it forearms us for the risks we are taking of not. It helps us quantify the risks and relate that to seasonal forecasts. We have changed a few things in terms of our crop management.
	It helps us quantify manager risks.
2 Farmer	No but I adopted what was coming out of those projects and implemented what we were finding.
	We are all summer spraying after the rain fall and spring water getting rid of the green ridge. That is the main one.
5 Farmer	I haven't as yet but we are thinking about it. It has been a whole new way of thinking.
	A moisture probe and a harvester with a protein machine fitted.
6 Farmer	We are using it to help nitrogen decisions. I thought I would utilize it with more confidence but there are more questions unanswered.
10 Farmer	I am probably more aware of how important summer weed spraying is.

	If you don't spray the summer weeds, they will rob so much moisture and the bucket of soil moisture is much smaller.
13 Farmer	no not really not as yet
14 Farmer	Yes, with in our business we discussed the pros and advantages on what it can bring to our business. buying a moisture probe.
19 Farmer	Not at this stage we have not put any plans into action but talking about things that have been flagged and looking into that.
22 Farmer	It changes different ideas with the spraying and nutrient applications so you can predict how much crop you can grow.
25 Farmer	If there was a large moisture bank, then we would not be nervous amount how much crop, fertilizer and nutrients.to put in the soil..
31 Farmer	I spread more fertilizer and now growing better crops. I have increased production and have fertilizer history plus trying to make good soil that holds a lot of water. It has given me a more confidence on how much our soil is actual holding. It has been proven to push the limits even further and given us the confidence we are heading in the right direction.
33 Farmer	We have got a moisture probe but haven't changed nitrogen decisions but appreciate the summer weed control that we made a change in and early summer weed control. The weather station I have used a lot more than I do the moisture probe found that quite useful.

4.4.12 Project's key achievements or highlights

12 Project team	Identifying other things that needed to be done. Feel most of the project was quite superficial because we simply didn't have the time or resources to go into things in more depth. The original purpose of the of the project was enabling farmers to make better use of soil water information and have better understanding of climate risk. Feel right from the start, the project went off at a tangent with some agronomic trials that individually had some merit, but whether they were a core part or needed to be a core part of the project "is a really moot point in my opinion.
18 Project team	The biggest one was to get the top growers, consultants and researchers in a room together. like you definitely get like I'd like to see it more a ideas session of developing new projects as well. Like where are we going from here with those people in the room which I don't know whether that's going to be. You know part of the last. We still have meeting coming up in March, where that's going to be part of like where what else do we want to see on EP? Where are we going like? What else do you need to know about? Sort of a brainstorming session would be good to go forward and develop new projects up for Eyre Peninsula
35 Project team	The development of discussion groups and that that engagement model in Eyre Peninsula. That's certainly been a highlight from my perspective and something we'll plan to do going forward. The capacity that's been built within the project team as we've gone along has been a highlight. The facilitator was pretty much at the start of his career and he's gone on to develop, from a research perspective. Knowing the for plant available water and the climate risk discussion has matured over the life of the project. We have a lot better understanding of climate probabilities and what forecasting really means: predicting yield and the use of yield profit and other tools.
36 Project team	Working with the RIG and farm advisors was a highlight; Setting up the 8 sites was a highlight; The discussion groups around those sites and being able to dig down and have in-depth conversations around those sites; Improved understanding of moisture probe network and capabilities was a significant highlight; People are spending more on tech without understanding the value. We were able to discuss a number of shortfalls in the tech and allowed investigations into those and helped to rectify some issues; CSIRO work set out to produce plant available water maps across landscape using the moisture probes, but it was too big an ask. We learnt a lot along the way and there is some tech out there to develop further to achieve that end; Expanding the number of soils characterised on the EP and the ability to better understand soils and water across the region and barriers to root growth in those soils provided very valuable data. Having PM group discuss the project every 6-8 weeks was valuable in bringing key players together and taking note of evaluation along the way through the M&E. There was a continuous improvement loop to make better decisions on project progress. M&E was excellent. It was good to have a detailed plan at the beginning and to follow through the life of the project, to better make decisions, was good. As the people delivering on-ground see there are opportunities in the future to provide better data back to M&E, to help make even more informed decisions. The National Landcare (NLP) program was excellent and the funding available provided the flexibility to look at work other funding bodies are not putting money into. To explore technologies and determine if we could produce these maps across the landscape The climate work was good: having the ability to dig down into scenarios for the Eyre Peninsula; understanding how changes might affect plant available water; how change in temperatures impact and what it means to the region. The in-season climate information was valuable. To be able to know

what was happening 2-3 months ahead to make better decisions and to input information into the context of managing risks when making on farm decisions.

37 Project team	Helping give growers a better idea of their yield potential and some strategies on how they might be able to achieve that.
38 Project team	The different moisture probes on the EP and figuring out how to best use them in a dryland farming sense. Understanding there is more to learn, even though we have learnt more than 3 years ago.
39 Project team	The regional innovators group was really good and was skilfully managed by Mark and Naomi. Obviously one of the challenges of that regional innovative group and any steering committee on a contracted project is they see themselves as having influence but they can't really redirect resources greatly because the contract is already signed up before the groups are set up. Feel that was handled skilfully. In the end, they're more a reference group than a steering committee, because actually they can't put their fist down on the table and say 'stop doing that and then start doing this' because there is a contractual obligation already in place with the Commonwealth. Being able to work with Therese Macbeth and the CSIRO group has been really effective. Everybody talks about collaboration in project, but you really need to fund collaboration because everyone is too busy. The funding for that was a was very helpful.
11 RIG member	Bring researchers, agronomists and farmers together, regular interactions with groups is a highlight and on farm discussions that the sites have enabled have been great and we have had access to great researchers.
16 RIG member	I would say the discussion groups and the RIG groups but when we actually corporate together it was mainly the RIG groups but as the project went on we asked other local farmers to come along and listen and they really appreciated that.
20 RIG member	A better understanding of the use of moisture probes and understand how they work and their limitations and understanding variation and what can capture that variation. What is causing farmers yields to go up and down so at this stage it a focus of where we need to go to.
24 RIG member	The highlights were out in the paddock, we had a discussion out there and I thought that was very good, we found we could understand it a lot better after that.
28 RIG member	More about the moisture probes and refining some of the outputs of those and finding out the shortfalls of that technology and what can be done to improve that.
29 RIG member	Nitrogen management within the soil and an understanding of what climate change means and the sort of models that are available. We all have much better knowledge of the climate drivers that I had before I started.
34 RIG member	
4 Project support	Increased knowledge on crop growth and yields and better understanding of how we can measure that and make decisions on the information we have.
17 Project support	Achievements in the better understanding of what is going on at the project sites.
21 Project support	I haven't been engaged with the project in the last 6 months.
32 Project support	The key is giving the advisers a far better idea of how to use the soil probes in their business.
7 Site host	The maximin amount of water that is there, having a unique soil type, and my sowing. I am not sure how well calibrated my moisture probe is.
9 Site host	It would be the understanding of the stored soil water/nitrogen dynamics.
15 Site host	A really good working relationship between researcher and growers in the paddock and regarding grower practices.
26 Site host	The understanding nitrogen cycling, soil moisture and good farming practices. There is more to be done on the nitrogen cycle. A deeper understanding of that and seeing the change in farming processes. They were not testing for deep end 5 to 10 years ago so that that would not be happening without the project. They are all doing it now to a certain degree.
27 Site host	It is giving us the understanding of what our soils can really provide in moisture and what sort of crops we can grow and what the limitation are of our soils are. The look at improving soils.
30 Site host	It has a network of moisture probes across the Aye Peninsular plus weather stations. This is useful not only for farmer other such as CFS uses the weather stations. it is a spin off that was unexpected. It got growers thinking about their moisture and risks and provided researchers with more concrete data about moisture and data in this region. We have accurate rainfall and temp data. Another one with having the weather stations there, we can make a decision about spraying. Lots of side benefits.
2 Farmer	Understanding how much water you have in the soil given a certain scenario and when the weather forecast is near accurate.
5 Farmer	Educating farmers on how much soil moisture we have and how much it can be depleted by weeds. and the potential for nitrogen management.
6 Farmer	The installation of the moisture probe network
10 Farmer	The network of moisture probes on EP.
13 Farmer	Being able to look forward to and make decisions earlier and knowing the soil moisture. It helps with marketing and matching inputs.
14 Farmer	We are gaining more knowledge around the soil probes and what they can bring to the growers and how they work. More so, it is what can we do with this data and now understand them a bit more and what they can bring to the business.
19 Farmer	Just providing education and when to apply the nitrogen and working more efficiently than current practices.

22 Farmer	By giving farmers a better understanding on what is happening in their soil and to be able to make more informed decisions. It's another tool in the toolbox.
25 Farmer	
31 Farmer	I guess the vision to push the production potential to the limits. It doesn't happen in other projects. And what can be grown in these circumstances. A lot of the other projects they do not aim for this. Through this project there are various sites that give me local relevance to my farm. It has been spread out and gives the relevance to others as well.
33 Farmer	Highlighting that we still have a lot to learn with moisture probes in variable soil types and Yule potential if nitrogen wasn't a limitation.

4.4.13 What worked particularly well for the project as a whole

12 Project team	Improved understanding about the current situation: they thought they had a network of sensors, they didn't actually. Also drawn attention to things that require further discussion and where questions need to be asked of commercial providers who sell moisture probes. For example, many of the probes bought by the farmers, that underpinned the starting position of the project, had not been configured correctly.
18 Project team	The collaboration and ideas session of developing new projects
35 Project team	
36 Project team	
37 Project team	
38 Project team	
39 Project team	
11 RIG member	I have already explained.
16 RIG member	The discussion groups were a big highlight for me and I think traditionally what has worked best but generally a lot of farming partners went against that and went away from that.
20 RIG member	What has been done already with the farmer groups, scientists and researchers was the best way to get things moving and that went well.
24 RIG member	As much as anything we identify far more additional things that needs to be looked at and understood because there was never a straight forward answer to anything.
28 RIG member	The RIG group and the scientists coming together and all that sort of thing.
29 RIG member	I thought the small group meetings went really well.
34 RIG member	
4 Project support	The meetings we did have and the sharing between growers and advisors was excellent.
17 Project support	
21 Project support	
32 Project support	The thing is the usage of the RIG. That model of having those advisers and key growers' is an exceptional system and the basis of that system is excellent.
7 Site host	It has been well communicated having people coming on the sticky beak days and sparked more interest lately from people who have been wanting to learn and find out more about it.
9 Site host	To have field days at the sites and to organise a group of highly profile consultants from across the country to come and look at the sites.
15 Site host	They were a good group working together.
26 Site host	The collaboration between research consultants and farmers. That is critical to the success of it.
27 Site host	Choose some good operators and people who are willing to share and work with the team. Plus getting experts to talk about these issues. Getting people in from outside the area to debate and talk about issues and getting these great minds in the room.
30 Site host	The collection of paddock data and the application of the Yule profit margin is working quite well. The communication through Air EP worked quite well.
2 Farmer	The soil probes being local is a key driver to it all. To show the water storage left.
5 Farmer	as mentioned previously.
6 Farmer	Not a bit fan of the project. It did create collaboration between growers, researchers and advises.

10 Farmer	There is always a probe nearby even if you haven't got one yourself.
13 Farmer	covered it all.
14 Farmer	
19 Farmer	Any farmer can access the information and look up any of the probes and they are not hidden information but there for everyone to benefit from.
22 Farmer	
25 Farmer	
31 Farmer	I know in the instance of one of the key successes would have been, the farmer that had it on his land and had his willingness to work with the term and offer up his sight.
33 Farmer	It has us thinking about the plant available water and how much nitrogen we need. Helped networking with different growers but we need to do more.

4.4.14 Key project learnings that could be applied to a follow on or similar project in the future

12 Project team	If it is an extension project, then design it as an extension project. But if it is a research project, then it needed to be managed by people who understand a research project. Unfortunately thought this project was managed very, very poorly. There was almost no project leadership and that was a real constraint to us. From the research side it was terribly frustrating because we thought we understood what it was we were being asked to do, and that kept changing. The people running the project were not trained in the business of identifying research questions.
18 Project team	Still have meeting coming up in March, where that's going to be part of the discussion - what else do we want to see on EP? A brainstorming session would be good to go forward and develop new projects up for Eyre Peninsula
35 Project team	One of the things the project was unable to do, is extrapolate across paddocks, or to point data across regions, or bigger farms. Getting better at getting across paddocks and hopefully by the end we'll have actually done that. Extrapolating wider is too hard and there's too much variation (across soils).
36 Project team	How do we engage these key experts in a region (leading farmers and advisors), are there better ways. This is something to explore in the future. Having the M&E throughout the project collecting information to help make better decisions as the project rolled out. To be able to tweak and change thinks to make it more relevant was very important. While we learnt a lot about probes and their effectiveness. CSIRO being able to create risk maps / moisture maps across the landscape, turned out to be much more complex than originally expected.
37 Project team	The collaboration of the key research partners is the trickiest thing to get right. Having a clearer picture going into the project about who, how and what expectations are of everyone would help to work together a bit more effectively.
38 Project team	Some of the most valuable key learnings came from the case studies Coutts J&R prepared. These showed that farmers took information and applied it on farm. Really demonstrated the value of the project.
39 Project team	
11 RIG member	Tour of the researchers around Australia which were flown in and a couple of guys explained how to do applied research. You get on the ground stuff with agronomists and farmers involved.
16 RIG member	I would love to see the project extended out, the first two years of the project we have spent a lot of that time getting our head around the probes, now we have done that so it would be good to keep the project similar but expanding on it would be huge for growers
20 RIG member	I think we have set ourselves up for another project to fast track from that.
24 RIG member	Their whole plan was to get something that was translated to the paddock, something like an app or a dashboard type of thing. The app would be a useful way on how we treat paddocks.
28 RIG member	All that soil data they collected and all that other information that could be relevant for ongoing projects.
29 RIG member	To work around nitrogen management that came out of this project which could be followed on to another project.
34 RIG member	
4 Project support	The structure of the group. That was an excellent part of the project.
17 Project support	We have got a long way to go with understanding different soil types and how the soil moisture interacts with soil types.
21 Project support	More on the quality of the moisture probes and the integration of information around in the paddock. The project is really good at integrating data and more can be done in that space.
32 Project support	They need to have more clearer objective to what they want to achieve out of the project. They just started with lofty goal of what they were going to be and cost them a fair bit of time and momentum. then the

resetting of the direction 6 months in, then they changed direction. Sort a bit more advise from the key personal before the project starts.

7 Site host	To continue on and work out what the moisture probe tells me. I don't know that answer.
9 Site host	More about variable responses to phosphate specifically across the landscape. We thought we knew everything about key response but I am not sure, we seem to focus more on nitrogen because it is the easiest one to respond to.
15 Site host	More interpretation of the yield data with climate data.
26 Site host	To have a clear objective to start with. Don't be afraid to change. If you need to and adapt retaining the focus as you progress through the project with a practical outcome in mind
27 Site host	Good growers who are respected, soils that are seen as representant and engagement and debate with a variety of industry people off the side of the agronomists or forecasters and getting them in the room to debate the question. Experienced people who have been in the industry a long time and key farmers who have had experience and understanding.
30 Site host	One of the learning is that it is possible to run projects that encompass the key stakeholders and researchers that work together, plus the extension people and the advisers have become involved. You can deliver something, a range of interests and skill brought together. One of the deficiencies is that I am not convinced there it was a clear what they were trying to achieve to begin. We should start with a clear aim.
2 Farmer	The project backed up by truth data and not just thought process but actual data. It has been truth data in this project.
5 Farmer	On different soil types and different seasons. More data the more you have the more you learn.
6 Farmer	A better understand dynamics of soil store moisture.
10 Farmer	To get more probes west of Minnipa as there are not many near here.
13 Farmer	Trying to calibrate the individual moisture probes with each other so when you look at it from here and look at it from another site you can compare it. Now you can only compare your site as they are not calibrated. More data on each site on the web site to see what is happening on other soil types.
14 Farmer	The usage of certain plants in the growing season how much the plant needs and what plant needs so much in a growing season.
19 Farmer	What the future project might be one to come from the learnings from the grower and the easy access to the data.
22 Farmer	Just similar to what has happened with this one.
25 Farmer	
31 Farmer	Maybe the project could move into more about the rotation benefits of soil moisture. The project has so far, focused on individual crops but to help evaluate rotations and how it interacts with the soil moisture.
33 Farmer	There still needs to be plant available water to some crops in some soils.

4.4.15 Strategies for future projects to increase engagement with the farming community

12 Project team	The question of project design and clarity around project objectives: would have made a huge difference.
18 Project team	We are relying on the grower to grow learning, looking over the fence. We still work on getting those top farmers engaged, change their systems, and then hope the ideas that are good and progressive and economical will happen in their own time because other farmers will adopt them by just looking at what someone else is doing. But how we get that middle and bottom region of farmers that are not engaged in extension and learning and farmer meetings- don't know.
35 Project team	Keen to see the videos that are going to be produced and which will certainly extend what we've found a lot wider. There is still a little bit more in that communication space through this project.
36 Project team	How to keep leading farmers engaged is key and how to achieve this. The discussion groups are good but could do better. There must be ways to engage more through this process. Maybe more broader communication activities than just the validation sites to reach more farmers in the community. Discussion groups were still effective and are an opportunity to look at that operating more effectively. In terms of the soil water monitoring, there are a lot of other institutions across the country looking at the issues and real time moisture information is being made available, eg broadacre farming. It would be good to explore other work from other research organisations to marry up what they are doing with what we are doing and move towards a common end goal.
37 Project team	
38 Project team	The discussion groups were critical. Keeping it small and often would be best, but that requires a lot more resourcing. Having a core group made a difference.
39 Project team	Targeting the key influencers (trusted advisors) is key, they are increasingly important gatekeepers and its an effective way to work. I suppose it is important to conduct. Some level of social research to understand who's

missing out under that model is still necessary. When dealing with production, the ones missing out might not be that important for production, but when dealing with sustainability issues and practices, it might quite important. Having someone like Jake going out building the trust and talking and getting grower together to talk is still more valuable than lots of communication products.

11 RIG member	Farmers really respond to the personal inground activities, mabe if we invite them more onto farmer zoom projects or a member based zoom workshop because farmers are being more accessible to technology now and that's a way of keeping them in the loop.
16 RIG member	The grower discussion groups.
20 RIG member	You have to have outcomes that can go across the landscape and the farmers paddocks, one that you can achieve where the engagement becomes fairly instant.
24 RIG member	It is just a matter of having no limitations, there are limitations with soil probes but it is the case of what we have got the best use of.
28 RIG member	Farmers are very busy and getting information thrown at them from all different directions, the ones that are right into it are probably looking more but there is a fair portion of them that are just not interested anyway, if there were some game changing findings it will filter out and the smart ones will soon pick up those things.
29 RIG member	The farmer involvement in this project was very good, they put a lot of information into the project from a farmers perspective, if you want to get the process more widely spread and get more farmers involved in it you have a briefing meeting where you could take a half a day and take it to the individual farming communities and ask what the project has done and explain what the outcomes are. It's one thing to put it on a newsletter but another thing to have a general meeting to explain things.
34 RIG member	
4 Project support	I would be happy to have the project run similar to this one. No changes to be made to get a good outcome again.
17 Project support	What was done with this project was the initiation of RIG as well as the discussions groups and I feel this was really valuable and I would like to see that continue.
21 Project support	It's hard to know which is going to be an effective site, you don't know how it is going to run until you start things.
32 Project support	Having an on the ground up approach and asking growers what they want to be investigated and not what you think you can get money for.
7 Site host	Accuracy in data and yule prophet. We know more now than we did a few years ago.
9 Site host	This is a question that is on a lot of people's mind, I feel that engagement has probably backed off with a number of factors and I don't know the solution to the problem. There is a hesitancy to engage.
15 Site host	Perhaps need more agronomists and more people willing to offer their services.
26 Site host	The use of social media and people's network. I am not sure there could be too much more done that hasn't been done already. The farmers group networks, which are based in every area, like ZG groups. It is done pretty well.
27 Site host	Showing successes of the past such as, being able to increase by yield x amount.
30 Site host	The engagement of some very skilled advisers. There is another project who has done a lot of work on a similar project. The analysis is first class and provides very good information using particular strategies. I don't think this project was analysed as much. Some of the Researcher doing the work on this project, lack a bit of mentoring and guidance skills. I think that is lacking in this case.
2 Farmer	Everyone has email and internet plus the group that is there from the research center are there and it includes each farmer if they want it.
5 Farmer	The practical field days that really show the differences in the field. You could see the variants due to different moisture.
6 Farmer	Collaboration amongst groups internationally
10 Farmer	To try to get all farm merchant companies agronomists on board to get it to more people involved.
13 Farmer	The outcomes be made relevant to what we have on the ground for decision making and making people aware of that. If it is called data people don't think it will help us.
14 Farmer	social media, forms of tweeter
19 Farmer	Getting as much exposure out there, prior to the project starting, for those who are starting out or those who have an interest in it. It could be a series of meetings prior to the project starting.
22 Farmer	I am not sure what you could do different. A lot of people are either in or out and those that are not in the group, use the agronomist for everything and not try to learn.
25 Farmer	
31 Farmer	
33 Farmer	Having more field days and crops walks. That works well for me and tied in discussions. More weather stations, as some moisture probes do not have the weather stations on the probe sites. People can log in and see, that works well. More reliable moisture probes as it struggles with different soil types.

4.4.16 Other comments

12 Project team	A bit frustrated because I think this project was a missed opportunity. There could have been a bit more clarity of thought; shifts to the resourcing, so the parts of the project that really needed to be done were invested in. A bit more effort on project design would have been good.
18 Project team	SARDI MAC definitely want to be involved in future EP projects.
35 Project team	Was an enjoyable project to work on and a good team and group of people to work with.
36 Project team	
37 Project team	
38 Project team	
39 Project team	In the Eyre Air Peninsula, there is the opportunity to link in with Minnipa Research station: that's an asset there on EP that was utilized a little bit in this project, but not extensively.
11 RIG member	
16 RIG member	Less CSIRO involvement going forward and also I would like to say how great a job Jake has done, himself and Andrew have done an exceptional job in the project.
20 RIG member	
24 RIG member	It needs good leadership and good facilitators to make sure everything makes sense, not everyone was on the same page when it started.
28 RIG member	
29 RIG member	
34 RIG member	
4 Project support	I think it was excellent.
17 Project support	
21 Project support	
32 Project support	Jeff, over the years changed my view of evaluation. Some of the things Jeff has taught us in the past, need to be built into the project. Such as people need to be told things 3 times before it sinks in. On 3 completely different events, where they are going to tell people different things, be mindful of how people learn. and picking up people along the way and working out where the key people are.
7 Site host	I would like to see that space continue on to learn what they can ongoing.
9 Site host	
15 Site host	
26 Site host	It is a project I am really happy to be involved in. It is the best model I have come across in industry. Happy to be involved and I hope it continues to be supported and funded.
27 Site host	I think engaging with a group or panel of experts such as people who have done this before, we can learn from this aspect. These people are very rational and with this new information we can use this data without reinventing the wheel.
30 Site host	There is now quite a body of data could be built on or a continuation of the project it could be managed a bit differently. It was a very useful project.
2 Farmer	no. it has worked very well.
5 Farmer	It is a very worthwhile project.
6 Farmer	I think some of the project was trying to reinvent the wheel instead of using existing research and collaborating with other projects outside the region.
10 Farmer	
13 Farmer	
14 Farmer	
19 Farmer	
22 Farmer	It was good.
25 Farmer	
31 Farmer	
33 Farmer	

4.5 Progress Reports Summary

(Note: all data sourced from the Six-monthly Project Progress Summaries – 6 in total from August 2020 to February 2023)

Engagement/Extension

Type	Details/Progress	Feedback/Benefits
RIG Workshops 6 workshops	Sixth workshop (October 2022) <ul style="list-style-type: none"> 26 attendees (15 provided feedback) 	<ul style="list-style-type: none"> Highly useful in updating participants on the project (8.1 avg.) <i>Useful discussion</i> praised – presentations <i>accurate, succinct and informative</i>. High confidence the project is on track to achieve its planned objectives (8.0 avg.).
	Fifth workshop (March 2022) <ul style="list-style-type: none"> 30 attendees (17 provided feedback) Key project learnings from 2020/2021 summarised and presented. 	<ul style="list-style-type: none"> Highly useful in terms of providing an opportunity to provide input into the project activities and direction (8.5/10 avg. rating)
	Fourth workshop (September 2021) <ul style="list-style-type: none"> 30 attendees Visit to local validation site and Agricultural centre (Minnipa) to gain a better understanding of the soil characterisation process and the use of data layering to produce maps for applying VRT 	
	Third workshop (March 2021) <ul style="list-style-type: none"> Project objectives and component roles reaffirmed and mapped out for the remaining term of the project. 	<ul style="list-style-type: none"> RIG member feedback resulted in the following improvements: <ul style="list-style-type: none"> Distribution of regular the RIG Report e-newsletters providing critical updates on project progress. Inviting RIG members to the monthly online project research partner meetings. RIG workshops with more in-paddock activities.
	Second workshop (September 2020) <ul style="list-style-type: none"> 25 attendees Day split between an in-paddock and an indoor session. Outdoor discussions on landscape imaging, soil moisture probes, soil characterisation, crop growth, update on validation sites and future treatments were held. Indoors session focussed on weather data and seasonal forecasting tools, and a practical exercise on imagining the Eyre Peninsula data display application. 	<ul style="list-style-type: none"> Discussion at the meeting proposed that effort would be placed on optimising the function and calibration of existing probes rather than locating new probes. Participatory design session with participants helped guide the design of the probe visualisation tool prototype. Summary of indices of climate risk for dryland farming on the EP presented to RIG members – more interest in climate outlooks than monitoring the past.
	First workshop (March 2020) <ul style="list-style-type: none"> Purpose was to clarify the role of the RIG, and to work through each component of the workshop with the relevant 	<ul style="list-style-type: none"> Feedback was very positive about the process and the project and having a good clarity about the project and their role in it.

	<p>researchers to determine priorities for action and clarify expectations from each of the collaborators with the RIG.</p>	
Discussions Groups	<ul style="list-style-type: none"> • 6 discussion groups held prior to the cropping season commencing in 2022. • Involving RIG members and local farmers at the validation sites across the region • Used to dissect the information collected in the validation paddocks. • Ongoing project learnings presented and discussed. 	<ul style="list-style-type: none"> • Validation sites an integral part of small group discussions in the field. • Extensive, in-depth discussion around the information gathered from each focus paddock. • Providing insights into how management decisions are formulated, and where opportunities may lie for where sustainable and less risky production increases can be made. • Field experiments at validation sites being used to test the hypothesis developed as part of the discussion groups, with in-field visits used to evaluate the success of the hypothesis and improve understanding of where gaps of knowledge exist. • Very well received.
EP Innovation Tour August 2022	<ul style="list-style-type: none"> • Focused around the question: <i>What are the RD&E gaps/opportunities to increase productivity/ profitability/ sustainability of broadacre rainfed farming systems on EP?</i> • Involved key farming systems scientists and advisers from across Australia visiting six of the eight validation sites. 	<ul style="list-style-type: none"> • Networking, discussion and interaction was one of the main benefits of the tour – particularly in terms of <i>closing the loop between scientific research and real-world needs, raising researcher awareness of farmer issues and drilling down on what determines farming systems decisions.</i>
Nitrogen workshop July 2022	<ul style="list-style-type: none"> • 30 advisers, researchers and growers (6 provided feedback) • A result of RIG members wanting to better understand nitrogen availability in their farming system. 	<ul style="list-style-type: none"> • After the workshop 8 farm sites selected to test the model and to continue the dialogue with growers. • Feedback was very positive – e.g. ‘This was a cracking day. The best conversation that has ever been had about our biggest input nitrogen’.
Climate Change on EP Workshop December 2021	<ul style="list-style-type: none"> • 20 participants • Topic of “Making sense of climate change projections for upper Eyre Peninsula.” – presented by Peter Hayman. 	<ul style="list-style-type: none"> • 100% improved their knowledge and understanding of climate projections for the EP as result of the event (n=16) – 50% a bit and 50% a lot.
Influencer information session December 2020	<ul style="list-style-type: none"> • First (of 3) key regional influencer information session held in December in Port Lincoln • 14 participants 	<ul style="list-style-type: none"> • 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”.
Presentations	<ul style="list-style-type: none"> • Extension events have been attended where presentations on the project have been made and discussed with growers, researchers, and farm advisors (e.g. Lower EP Expo, Upper EP farmer meetings) <ul style="list-style-type: none"> ○ 25 events with 340 participants (Jul-Dec 22) ○ 20 events with 200 participants (Jan-Jun 22) 	

	<ul style="list-style-type: none"> ○ 40 events with 600 participants (Jul-Dec 21) ○ 23 events with over 300 participants (Jan-Jun 21) ● Existing EP farmer groups used to extend project information – existing groups seeking updates via presentations at field days on developments in the project 	
Website	<ul style="list-style-type: none"> ● Project website continually updated (airep.com.au/research/resilient-ep/) ● Project blog established and maintained on AIR EP website. 	
Other comms activities	<ul style="list-style-type: none"> ● All communication structures in place (website, twitter, Facebook, YouTube, e-newsletters, RIG meetings and extension events). ● Video equipment at discussion group meetings to develop stock footage for videos and photos for communication opportunities. 	

Outputs

Type	Details/Progress	Feedback/Benefits
Soil characterisations	<ul style="list-style-type: none"> ● Soil characterisation document compiled yearly (2019-2022) ● 33 soil characterisations undertaken over the life the project. ● All provided to CSIRO for integration into APSOIL. 	<ul style="list-style-type: none"> ● APSIM and Yield Prophet updated with all available new soil characterisation, significantly improving the performance of APSIM and Yield Prophet for the project sites.
Yield prophet reports	<ul style="list-style-type: none"> ● 2022 reports on the 8 focus sights provided fortnightly (during growing season) and available on the AIR EP website. ● All reports uploaded to the Resilient EP Google Drive for the project team to access. 	<ul style="list-style-type: none"> ● Used as the basis for extension articles in the AIR EP Resilient EP newsletter.
Data Visualisation / Application Development	<ul style="list-style-type: none"> ● Website live at: probes.airep.com.au ● Updates/fixes include: <ul style="list-style-type: none"> ○ Implemented temperature correction algorithm and the conversion of probe-reported conductivity readings to Plant Available Water readings. ○ Conductivity graph added to diagnose hardware causing strange readings. ○ CSIRO team members worked with Square V around data visualisations including making plant available water capacity (PAWC) and PAW visualisations available. ○ New section added as a result of RIG feedback allowing direct comparison over the past 4 years of probe data at a specific time of year. ○ All AIR EP probes added to the site. 	
Climate Risk Indices and Forecasts	<ul style="list-style-type: none"> ● 3 yearly forecasts presented/discussed with RIG members. 	<ul style="list-style-type: none"> ● Valuable working with RIG members over the three years

	<ul style="list-style-type: none"> Two reports have been produced by SARDI and made available on the AIR EP website and Resilient EP blog: <ul style="list-style-type: none"> Climate indices and Trends report that outlines feedback on indices of climate risk and trends in these indices. Second report produced around developing a better understanding of what seasonal climate forecasts are available and improved feedback to BoM from EP farm advisors and farmers, using a root cause analysis seeks to identify underlying reasons. 	<p>discussing forecasts – learning how to improve communication of probabilities.</p> <ul style="list-style-type: none"> Work informs how to better communicate with users of climate forecasts.
Other outputs/tools	<ul style="list-style-type: none"> APSIM simulated wheat production used to develop a <i>framework for economic analysis</i> of the value of information from seasonal climate forecasts and soil moisture monitoring for decision making. 	
	<ul style="list-style-type: none"> CSIRO collaborated with SARDI Climate Applications and EP Ag Research to test a APSIM x soil water probe visualisation x N decision tool. 	
	<ul style="list-style-type: none"> CSIRO team delivered several requested outputs around the regional soil water objectives – e.g. probe location optimisation, regional soil water map Protocol developed for field sampling on focus paddocks and farms to allow extrapolation of soil water from probe site. 	<ul style="list-style-type: none"> Demonstrated that the ‘network’ is not currently well suited to regional-scale predictions. discussion with RIG decided that the current distribution of probes means that their best use is to extrapolate at the paddock and farm level rather than regionally.
	<ul style="list-style-type: none"> Two baseline surveys (Farmer and Consultant survey and Informed Persons Survey) successfully highlighted current use by producers and consultants of tools and information to manage soil moisture. 	<ul style="list-style-type: none"> Need for accurate and reliable data - particularly at an individual farm level and for long-term forecasts and user-friendly tools was highlighted along with increased training and support to help interpret and understand the data.
	<ul style="list-style-type: none"> Literature review completed by the CSIRO and algorithms selected to consider the optimised sensor network for today’s number of probes, and optimal placement of new probes accounting for the present-day network. 	

Research

Type	Details/Progress	Feedback/Benefits
Overall project R&D	<ul style="list-style-type: none"> Information gained from R&D within the project has formed content used to inform and educate RIG members and growers/advisors. 	<ul style="list-style-type: none"> Basis for the quality and depth of extension being delivered – allowed conversations to be accurate, in depth and relative to the grower. Led to practice change as growers and consultants take information away from

		discussion groups and apply it on farm.
Soil Water Sensor Network Development	<ul style="list-style-type: none"> • 3 case studies drafted (as of Jan 23) reporting on paddock scale analysis: <ul style="list-style-type: none"> ○ Adams focus farm at Cockaleeche (using digital soil mapping techniques to predict soil moisture dynamics) ○ Matthew’s farm at Cootra (using cumulative NDVI and normalised farm yield to extrapolate soil water sensed with a probe) ○ Wilksch farm Yeelanna (currently being reworked due to analysis errors) • Methodology developed by the CSIRO for extrapolating soil moisture probe data away from the probe location at paddock and potentially farm scale. • Plant available water (PAW) data used in digital soil mapping to predict PAW across the focus farms. • Strength of relationships between soils, PAW, rainfall and probe signals investigated to test reliability of probe signal to soil moisture. • 26 rain out shelters placed in the soil characterisation paddocks in spring 2021 • Soil sampling at all probe sites undertaken to determine crop lower limits. • Optimised the function and calibration of existing probes - many new probes installed have replaced faulty units. • Probes found to need adjusting for warmer temperatures experienced over summer. • CSIRO assisted with the analysis and quality assurance of plant available water characterisations and made them available for project use via Yield Prophet. 	<ul style="list-style-type: none"> • Data generated by the probes is crucial to the project - helping to improve understanding the dynamic relationship that soil type, rainfall and plant water use have across the growing season.
Data decision field validation (focus) sites	<ul style="list-style-type: none"> • 8 focus paddocks • 13 in-paddock small plot field experiments established across varied soil/rainfall areas (2022) to determine if changing management practice can improve yields. • Baseline measurements taken yearly – allowing close analysis and monitoring of focus paddocks. • Baseline data used in the development of trial work – aimed at improving grower sustainability/profitability. • CSIRO and RIG heavily involved in the development of annual field validation plans. • Validation site maps produced in-season on an as-needs basis. • Validation sites modelled with APSIM and Yield Prophet – improved predictions in 2021 as a result of adjustments to the PAW extrapolation methodology. 	<ul style="list-style-type: none"> • Baseline data used in discussion groups to provide reasons for what is/might occur in paddock. • Measurements assisted growers to relate small-trial demonstrations to on-farm practice change. • Provided a valuable resource for fine tuning Yield Prophet which has been used in analysing risk.