Increasing Awareness and Knowledge of Improving Ground Cover with Plant Based Options on Eyre Peninsula

SUMMARY REPORT 2019-2023

1. INTRODUCTION

The Australian Government, through the Regional Land Partnerships of the National Landcare Program, funded the Eyre Peninsula Landscapes Board Regenerative Agriculture Program (RAP).

The RAP involved delivering a range of management activities to prevent and abate soil acidity, soil erosion, and improve soil carbon and on-farm biodiversity.

The RAP Mixed Species Crops and Pastures for Soil Management Demonstration project has been a component providing farmers with the opportunity to have 'farmer' scale larger plot demonstrations to reduce soil erosion, increase soil biodiversity and soil health across a range of soil types and encourage measuring and recording of key factors.

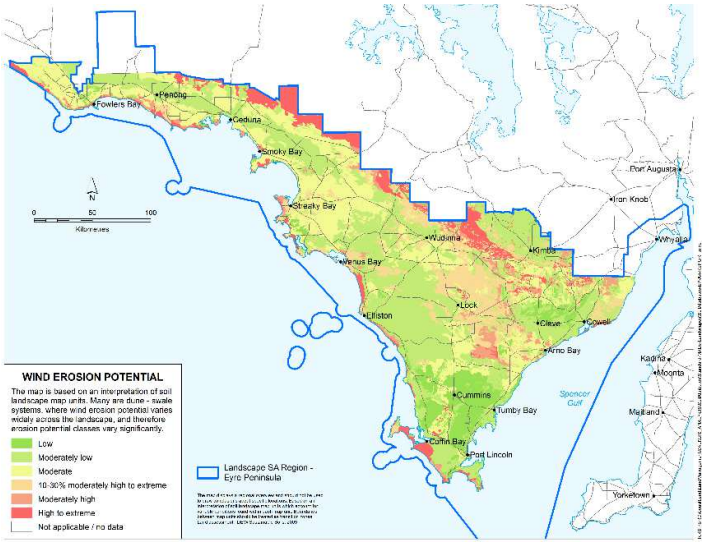
The project had a winter mixed species demonstration component (which could be sown for grazing, hay or grain production) as well as a summer cover crop demonstration component with data collected from the sites for up to 4 seasons. The pasture and cropping options aimed to have long term benefits to improve soil health.

The project was linked to the erosion protection field surveys produced annually through the Department for Environment and Water (DEW- SA Government).

Under the RAP by June 30 2023, 100 landholders would have increased awareness and knowledge of reducing erosion by improving ground cover through plant based options. The project involved a small grants program and workshops/field days to assist in sharing and increasing knowledge.

2. BACKGROUND

One of the greatest threats to land management on the Eyre Peninsula is degradation through soil erosion. Of the approximately 2.7 million hectares of cleared agricultural land on Eyre Peninsula about 2.4 million hectares (88%) are inherently susceptible to wind erosion (see map below) due to sandy textured soils. Around 690,000 hectares (25%) of sloping agricultural land on Eyre Peninsula, predominately in the Koppio and Cleve Hills, is also inherently susceptible to water erosion.



Wind erosion potential across Eyre Peninsula (Ref: DEW)

Erosion of 1 mm of soil from the soil surface can equate to losses of 10-12 tonnes of soil per hectare. As well as the soil loss there can be significant loss of nutrients and organic matter which are drivers of crop and pasture productivity. Wind erosion selectively removes the fine particles and organic matter from the soil surface as dust. Additionally, wind erosion can cause sandblasting of crops and form drift banks and 'blow outs' creating uneven paddocks which are difficult to manage and can reduce the aesthetic appeal of the land.

Dr Christine Jones, an internationally renowned and highly respected groundcover, and soils ecologist, with a wealth of experience working with innovative farmers to implement regenerative land management practices, spoke to farmers at one of the forums on EP. She emphasised the value of cover crops that enhance biodiversity, increase biological activity, sequester carbon, activate soil nutrient cycles, restore water balance, improve productivity, and create new topsoil.

Dr Jones believes that changes are needed to take place in the soil microbiome to enable farmers to reduce inputs and restore soil health and also to increase profit.

Dr Jones summarised the importance of:

- Regenerating your resource base, your soils.
- To restore function to soils you need living plants to do this, it's all about microbes.
- A plant's microbiome determines its health and productivity.
- Different plants activate different microbes.
- Poisons placed on or near seeds blow the microbial bridge, that is, interfere with communications between the plant and it's other half, significantly impeding both plant and microbiome function.
- Seeing 'rhizosheaths' on roots is good, if you can see a clean root, then half the system is missing.
- Diversity is key, the more species the more increased dry matter production.
- Need four plant families represented in a mix, not just four varieties.

One farmers' perspective, having successfully managed and improved soils, believes there are five key principles. These will build healthy soils, improve yields and quality, reduce synthetic inputs and reduce production risks:

- Keep the soil covered
- Minimal soil disturbance
- Diversity is the key
- Living roots are important
- Integrate livestock

2. OUTPUTS

Farmers were invited to apply for small grants over the life of the project, to assist in developing options for long term soil protection and production.

Workshops and field walks were held to demonstrate the project outputs to the broader community. COVID created some disruptions, particularly service delivery for several consultants and service providers. In addition, in 2020, there were no field days run by the EP Landscape Board. This was combined with the general stress of farmers and participants as the number of logistical

issues were significant, including obtaining seeds, fertilisers, contractors, and other inputs. This was most prevalent during 2020/21, and into the 2021/22 season.

To assist with communications during these times, social media was utilised extensively to ensure ongoing delivery of information and updates.

1. Small Grants Program

Farmers from across Eyre Peninsula accessed the small grants. These provided support to allow farmer led demonstration size planting of multiple species and timing of establishment. These sites were then used to share information with the broader community.

The applicants were invited to suggest what soil health issues they primarily aimed to address, and how the proposed mix might address, at least partially these issues. Examples of the issues raised by the applicates included, soil cover, poor infiltration, poor nutrient cycle, compaction and high soil strength and salinity.

The 24 farmers involved identified a range of improvements. Of the broad range of gains, 55% were related to improved production potential (including improved nutrition, reduction in input costs, increased stocking rates, profitability) and 44% were about improved soil condition and erosion protection (including water holding capacity, erosion risk, carbon levels, soil cover, soils fertility).

What were the farmer priorities?

- Growing a diverse mix of plant species and retaining the plant matter and soil cover to:
    - improve plant available water and nutrient holding capacity and soil health, reducing the negative influences that water repellence, nutrient leaching, toxic salts and boron and limestone has on plant growth. Three variables – summer fallow, single species summer cover crops and multi species cover crops were proposed.
    - achieve good soil cover, good grass control, improve the volume and diversity of pasture species for improve livestock production. Mixed species planting to reduce grass weeds through good competition.
    - create a succession over 2-3 years, improving ground cover and nutrient cycles, increasing organic carbon, water infiltration and retention.
    - improve soil health and productivity, increasing organic matter, increasing water holding capacity and nutrient cycling, including soil cover and improve overall fertility and health of the soil.
    - improve ground cover in the short term which would prevent erosion, allow better water infiltration, more grazing days and competition for weeds.
    - improve soil biology and improve nutrient cycling.
    - allow plants with the greatest tolerance to grow rapidly providing protection and symbiotic benefits to other species.
    - simultaneously improve soil health and nutrient cycling, increasing produce quality, reduce input costs, improve overall profitability and reduce environmental harm. Summer cover crop will take advantage of summer rain.
    - plant tillage Radish, to assist in building soil organic matter, vetch, to assist in nitrogen supply for grasses, grazing rye, for a grass that grows well on sandy soil.
    - increase carbon inputs and productivity on shallow constrained and low fertility soils.

- Sowing pastures to:

    - overcome the crop limitations and provide high quality feed, replacing rye grass and to establish the pasture and bulk up prior to spray topping in spring.
    - increase biomass for high quality stock feed whilst improving organic nitrogen levels to track deep nitrogen levels. Increasing stocking rate and allowing other pasture to self generate,
    - grow and evaluate grazing cereal and legume pasture options to allow for a range of management options depending on the season.
- Improve surface cover on land to:
    - increase ground cover and organic carbon levels on sandy soils.
    - reduce acidity and temporary water logging resulting in reduced and poor plant growth and associated soils cover.
    - demonstrate the use of warm season grasses to provide protection against wind and water erosion.
    - Improve compared to monoculture, especially if left unharvested. Protect the soil from wind and water erosion and provide shade. Increase soil biological diversity and total activity compared to a monoculture.
    - reduce amounts of salts on the surface.
- Create a more resilient, responsive, and productive landscape by improving soil carbon levels and increase depth of root zone to access deeper mineral reserves.
- Long term improvements in soils biology while ameliorating sub soil compaction and toxicity.

What were the challenges?

Achieving positive outputs for the project sites over the life of the program varied, due to a range of seasonal challenges and impacts of COVID, restricting the ability of technical expertise accessing project sites to undertake measurements and assessments.

The summer of 2020 was dry for many with some deferring till the following year. Early establishment was good, although the season was extremely variable. One farmer provided a comprehensive summary of the challenges:

> *"Our early establishment was quite impressive; however, the rain didn't continue for many weeks and through the months of November to January we struggled to get enough growth on the trial to keep a good record of the dry matter and grazing capacity. The plants did surprise us in their ability to keep hanging on after prolonged dry periods. The standout plants were Millet and Sorghum. These both seemed to sit around underneath the ground and magically re-appear after only a few mm of rain.*
>
> *Site was sown with winter mix and grazed then terminated and planted with summer mix and grazed. Although the rainfall seemed sufficient there was still a massive moisture stress problem from late October onwards.*
>
> *Challenges that presented themselves were the seasonal conditions that were always going to be a challenge. Firstly, what seemed like a perfect opportunity to sow the summer trial turned out to be a nightmare for controlling weeds. It also gave our control plot a massive growth spurt. The chemical used to burn down the winter trial and the control plot was Paraquat which initially burned down the plants well but due to unseen rains well above what was forecast it all re shot at which point our summer trial was out the ground and looking good.*

Due to Covid19 the community engagement in a physical sense has not been possible and could not be planned for. Throughout the entire period we have actively engaged with the Farming community through social media."

What was measured?

Each project site was unique in the range of local conditions and the challenges to be overcome. Site assessments included:

- Testing multiple species, including district practice, single species summer crop and multi species summer cover crop.
- Plant counts and general observations of plant growth.
- Measured increase in dry matter production and visual assessments.
- Assessment of multi species demonstration over the 3 years - compaction, diversity of plant species and biological activity.
- Using a refractometer to monitor sugar levels etc on the different plants, compared to other farmers to gain a better understanding of feed values.
- Crop emergence counts at the 2-4 leaf stage undertaken. For crop/pasture - 50cm ruler placed between crop row, plants counted either side of ruler and recorded.
- Soil function assessments (particularly soil organic carbon), determination of root mass and depth and comparing plant productivity under different systems.
- Comparative form and costs of inputs measured plus any reduction in requirements for fungicide and herbicide application.
- Photopoints established to provide visual evidence of differences.
- Cover measurements over time through the growing season.

What was learnt?

Some farmer observations and measurements as a result of the grants and survey results included:

- *Far greater bulk of feed produced where there was a mixed species pasture present with an increase of 59% dry matter available for stock to graze. The pasture also looked much healthier and richer visually.*
- *The multi species demonstration site has improved its soil health over the 3 years by reducing compaction, increased diversity of plant species and increased biological activity (also with the aid of our biological inputs).*
- *Having diversity increases grazing quality and quantity.*

- *The winter cover crop was allowed to die off naturally and set seed resulting in tillage radish germinating through the summer months following rains which the sheep were happy to graze. The tillage radish also appeared to handle the insect pressure better than the hunter forage brassica while also leaving behind the little holes to catch rain fall.*

- *The use of Forage Rye in a mix to stabilise sandhills remains an outstanding option that has not been utilised previously. Having rye being very palatable up to tillering and increasingly unpalatable towards the end of the season is conducive to improved grazing and erosion management.*
- *Tillage radish grown as a summer crop has worked extremely well.*
- *From the data and observations throughout the season, believe that sowing mixed pastures will be an important part of the program going forward. It has showcased that is produces a lot more soil cover and early vigour. Producing early feed for the sheep. It is also an important part of soil health to introduce multi species into the system and host more microbials in the soil. Leading to more rapid chemical breakdown and availability of nutrients.*

- *Going forward, on the basis of this year's trial, I hope to use more tillage radish with vetch in these soil types, to improve surface cover and cover height, and also give myself more grazing and hay opportunities.*
- *There were very clear visual differences at late tillering with all the rip treatments having more growth and better colour than the comparative unripped treatments.*
- *Time of grazing has been a challenge; the medic looked like it could be grazed not long after sown plots emerged however a dry May and run of frosts in June held it back quite considerably. The sown plots once established grew well then slowed up with weather, the rye and triticale ran up to head in mixed species before grazing could commence.*

2. Workshops, field days and events

Workshops, forums and field days were held across the region. During COVID restrictions with logistical issues, particularly accessing speakers, workshops were run as online hybrid events. These focused on peer-to-peer learning as farmers shared their experiences, particularly in the multi-species pastures and cover crops. Farmers involved in the plant-based option grants were able to share directly some of their experiences from establishing the demonstration sites.

Some examples of the field walks included:

- The Lower EP WOTL field day, which was attended by 30 members, visited a site and talked in detail for 20 minutes about the trial, its aims and results with very productive discussions.
- Data from the site was presented at the Roberts/Verran Bureau Stickybeak day with around 40 farmers and Ag. Industry advisors attending, including the Lock Ag Group
- Navigator College students visited a site.
- Some farmers utilised Twitter to share some of their learnings, and to continue the discussion on the site over the during of the project.

Major forums were held and included detailed presentations and discussions:

Exploring Soil Health workshop June 2019, Ungarra

- Dryland legume pasture systems update by Jess Gunn
- Mixed species cover crops & pastures: what works and why?

Mixed Farming Masterclass Thursday 12th September 2019, Lock

Number (total): 34 (25 of the total were attendees, with 9 presenters)

- Decision making, assessing and managing risk in mixed farming systems
- Mixed farm fodder options - matching nutritional supply and demand with seasonal conditions and livestock requirements
- Livestock technology, innovations and data management options
- Managing soil cover in variable seasons
- Electric fencing and pasture meter monitoring demonstrations
- Mixed pasture species and dryland legume pasture system trials

Regenerative Agriculture Forum December 2019, Port Lincoln

Approximately 35 attendees from relevant industry associations and local agronomic advisory businesses heard presentations from local farmer Ben Ranford and soil scientist Dr Lukas Van Zwieten. They then considered, discussed and debated the concept of “Regenerative Agriculture” (RA), the perceptions of RA on the Eyre Peninsula (EP) and whether it might have an expanding role in the region in the years ahead.

Minnipa Soil health information session summary 3 March 2021

Dr Lukas van Zwieten, NSW DPI and David Davenport, Davenport Soil Consulting delivered a 2 hour information session to 19 Minnipa farmers and SARDI research staff about:

- Increasing soil carbon using amendments (e.g. biochar with phosphoric acid applied), how it works and benefits to the farming system.

- Advancements in testing for soil health ("We can test who is there in the soil, but we don't know what they are doing.").
- The impact of herbicides on soil biology, and how 'healthy (biologically active) soils' break down herbicide residues faster, reducing the impact on subsequent sensitive crops.
- Soil health cards for measuring the impact of practice change. Measurable changes can include water infiltration rates and the 'cotton undies' test (how long cotton takes to break down as a result of biological activity).
- Discussion on mixed/summer cover crops and impact on subsequent crops, and where the practice fits in a low rainfall environment.
- The new calcareous soils project was discussed.

Upon conclusion of the event, one farmer commented that it was the most interesting and enjoyable session they had been to for years. The event was successful in that it was put together at short notice, taking advantage of Lukas being on Eyre Peninsula for the AIR EP Lower EP Ag Expo, with a good attendance and excellent levels of engagement with the audience (lots of questions and shared experiences).

Regenerative Agriculture Forum 8 June 2021, Cleve

Speakers: Josh Telfer, Terry Young, Dr Christine Jones, Damien Elson, David Davenport.
Number of attendees: 45, including 3 extra previously unregistered. Several apologies received prior to the event (seeding).

Feedback from participants was positive, with many thoughts on trialling and establishing mixed species plantings into the future. In summary, the main take home messages included:

- Try mixed species crops and families those plants belong to.
- Try to keep convincing family partners there is a better way to farm and diversify our business without paying huge money for more farmland.
- Continue our trials.
- Take more interest in the trials and crops on our farm. Probably increase the area and species diversity.
- Look at families of mixed species ensuring 4 are used to get best benefits.
- Try to change my chemical and high analysis fertilizer usage.
- Need to rethink whole farm program - especially companion planting in feed sown. Dry starts not conducive to stirring fragile soil.
- Concentrate on including pastures more in rotations and plan for those rotations to benefit the most nitrogen fixation to benefit future crops.
- Consider doing some more individual research into the topics presented.
- Continue current multi species crop/pasture.
- Increased understanding, to make more informed decisions.
- Reconsider current practices of fungicide and pesticide application.
- Look at different ways of monitoring/measuring benefits (or negatives) of growing mixed species compared to mono species.
- Improving diversity and total farm practices.

Streaky Bay Western Eyre Multi Species Cover Crops and Pasture Workshop March 2022

The participating farmers had a range of experience with multi-species pastures, from none to 12 years. The consensus was that there were opportunities for successfully establishing and using multi-

species winter pastures, and summer cover crops were mainly opportunistic depending on seasonal conditions. Summer crops were considered quite variable in the area, with lots of issues with summer weeds and bare areas.

All participants farmed or managed agricultural land, 70% currently use a multi-species approach in their management and 100% found the discussion about the use of multi-species crop, pastures, and cover crops helpful. This workshop was a new hybrid format with farmer presenters able to deliver from their home office either from elsewhere on EP or elsewhere in the state. This included in person experienced small grant holders in the room, as well as interested farmers "Zooming" in due to COVID restrictions at the time.

Fourteen farmers attended in person, two presented over Zoom, and an additional three participated via Zoom. Farmers appreciated the sharing of experience, particularly in the context of the soil and climate of western Eyre Peninsula.

Yallunda Flat - Lower Eyre Multi Species Cover Crops and Pasture Workshop June 2022

Following the success of the workshop in Streaky Bay, a similar style workshop was convened on Lower Eyre, at Yallunda Flat in June 2022. This was well attended, featuring a farmer from Victoria sharing his learnings and thoughts on the use of Multi-species crops and pastures. The presentation created significant questions and discussion around the different species mixed, and strategies they were using. A breakout session allowed for further sharing and learning from all the participants gathered (21 people).

Port Lincoln Regenerative Agriculture Forum 2022

"Good range of presenters and good networking with locals with similar struggles".

Two farmers spoke from personal experience:

- Having diversity increases grazing quality and quantity. Need to repeat practices over time to be able to see patterns, it's difficult to get concrete data that something is working, there's lots of variation each year and within seasons.
- Sowing multi species pastures, a philosophy of regenerative agriculture, building topsoil and reducing erosion. Chocolate cake vs concrete soils. Strong interest in soil biology.

Online - Summer Cover Crop Webinar November 2022

In November 2022, a Summer Cover Crop Webinar was held, including a facilitated presentation from a local agronomist, and farmer, discussing the concepts of using summer cover crops and pasture mixes both on the back of an extended wet spring but also as way to enhance plant residue and cover levels. It allowed farmers to participate at a more convenient time between 7:45 - 9:00pm, rather than having to take time out during the day (14 farmers participated).

A final survey of farmers indicated that over the last five years, 95% of respondents had an improved, to greatly improved knowledge and understanding of the roles of multiple species cover crops and pastures, improving ground over and other positive functions in their farming systems.

Joel Williams Mixed Species Workshop 3 April 2022, Wudinna

Joel Williams of Integrated Soils is an internationally recognised consultant in the Regenerative Agriculture Field. He is a soil health educator providing lectures, workshops and consultation on soil management, plant nutrition and integrated approaches of sustainable food production.

The full day workshop was hosted in collaboration with South Australian No till Farmers Association (SANTFA). The focus of the workshop was to investigate building plant immunity to pest and diseases, integrated pest management and nutrition. There were 14 farmers, 3 advisors and 4 research/extension officers in attendance at the workshop.

Key issues and practices that were discussed included the importance of adequate nutrition in soil and plants to improve immunity in plants. As well as alternative sources of nutrition including compost and its uses, advantages and DIY options.

Regenerative Agriculture Forum June 2023, Cleve

About 33 people attended the Regen Ag Forum at Cleve on Thursday 15 June, to hear from:

- Dr Craig Liddicoat on soil microbiology (via zoom) – how it can impact plant growth, how different microbial communities are impacted by different farming practices, and how microbes can be used to measure soil health, once you know the soil physical and chemical characteristics.
- Dr Michael Nash on invertebrates – who does what, how to look after the good guys, what pests might be saying about paddock soil nutrition and key tips including:
    - Diversify tactics to reduce pest populations
    - Diversify rotations
    - Use crops tolerant to pests
    - Ensure sowing at optimal times
    - Shrewd use of pesticides
- Local farmers Ben Pugsley and Ben Ranford, on their journeys to improve their farm sustainability, with quite different goals (continuous cropping focus compared to a trade lamb focus).

Farmers in the room shared their experiences with the small grants projects they undertook as part of the EP Landscape Board's Regenerative Agriculture Program funded by the Australian Government's National Landcare Program. Interestingly, each farmer had different aims or issues they wanted to overcome with their small grants, but the practices used were quite similar across many of the projects (using mixed species pastures in both winter and summer, and/or soil amelioration activities), and all had positive outcomes. The small grants program provided the catalyst for many of the farmers involved to give something a try and measure the outcomes, which has resulted in expanding some of the practices further in their farming systems.

A small group of Cleve Area School agriculture students and their teacher attended to hear Dr Nash present on invertebrates – the group was very appreciative of the opportunity to hear a great speaker on a topic of interest.

Thanks to the Cleve Golf Club for exceptional catering and venue, Josh Telfer, Sustainable Agriculture Officer for organising and hosting, and to all the farmers involved. This project comes to end on 30 June 2023, we are awaiting announcement of possible future opportunities to continue the momentum gained in this current program. Evaluation forms were completed by participants, all feedback was positive.

When asked 'compared with five years ago, how would you rate your knowledge and understand of increasing **soil health** and **production** through management of **soil carbon**?', 72% of participants responded with greatly improved, 22% with improved and 5% reported somewhat improved knowledge.

We also asked 'compared with five years ago, how would you rate your knowledge and understanding of the roles of **multiple species cover crops and pastures** improving **ground cover** and other positive functions in your farming system?', 77% of responses said their knowledge was 'greatly improved', 16% improved and 5% somewhat improved from five years ago.

3. Case studies

A series of mixed species farmer case studies were generated throughout the RAP, which are housed on both the EP Landscape Board and AIR EP websites.

- Colman, Tumby Bay: multispecies pastures on sloping land
- Damien Elson, Cleve district: mixed species pastures for grazing
- Pugsley, Ungarra: mixed species + soil modification
- Schaefer, Pinkawillinie: mixed species pastures for grazing
- Williams, Elbow Hill: mixed species for drought resilience
- Terry Young, Ungarra district: mixed species for soil health

3. WHAT FUTURE?

- While the plant based small grant scheme faced challenges both administratively and COVID related, it demonstrated the benefits of supporting farmers trying and comparing a multi-species approach and encouraging them to take ownership of both the design, measurement, and results.
- The grant process was successful with many farmers then becoming advocates, and promotor/encouragers for others.
- Some (many) grantees struggled with the monitoring and reporting requirements. Future programs will need to provide more support to farmers to complete project requirements.
- Some farmers were able to work closely with their agronomist to be able to deliver great outcomes, both in the quality of their delivery, but also in the timely and systematic nature of their reporting. This partnership would be a benefit if included in the application for a similar program design in the future.
- As shown by attendance at workshops held in throughout the project, there is growing interest in the multi-species approaches, particularly in with pastures. However, the benefits to soil health are not as easily quantifiable, requiring a sound understanding of soil health.