G2021-5 Eastern Eyre Peninsula Soil Management Opportunities Project Final Report

Project Objective: To address erosion issues and to identify practices that would reduce the risk of further erosion occurring on eastern Eyre Peninsula following severe wind erosion events in 2020. This objective was to be achieved through the provision of financial and technical support to landholders.

Activities

Amelioration activities supported through this project were conducted on nearly 800 ha (Table 1).

Table 1. Activity by area

Objective	Activity	Area (ha)
Remediation of eroded areas	Levelling, ripping, delving.	390
Increasing vegetative cover in pasture systems	Mixed species planting, cell grazing.	330
Improving cover to support winter seeding	Seed provision for summer cover crops	77

Devolved grant funding was provided to 9 landholders with grants capped at $4,500 per landholder. The grant only covered only a portion of the expense and some landholders undertook considerably more work than the capped levels. This has resulted in an estimated in-kind contribution of $62,880.

A major component of the project included providing technical support to identify critical areas and opportunities for remediation. Technical support included:

- Initial site visits to inspect sites and discuss treatment options.
- Support to obtain equipment and follow up visits to advise and assess implementation of treatments.
- Dissemination of project results.

Several landholders commented that access to technical support provided the confidence to undertake more remediation work than initially intended.

The project also included a monitoring component with 2 key objectives being:

A. To ensure landholders had undertaken the work claimed and that the activities were successfully concluded.
B. To collect data to support future extension activities and improve landholder confidence in the outcomes.

Monitoring included:

1. *Ameliorating previously eroded areas through engineering techniques*

Soil engineering techniques employed included levelling, ripping with inclusion plates and clay delving. Apart from some isolated areas that were later resown, all of these techniques have resulted in improved soil cover (Figures 1 and 2). On the worst sites landholders have double sown to improve plant numbers.

Figure 1. Sand blowouts Landholder A site March 2021. Figure 2. Landholder A site August 2021

There have been concerns that ripping with inclusion plates may have a detrimental effect on plant numbers. On the Landholder B site ripping was undertaken on a slight offset to the sowing line that is considered to assist in maintaining control of sowing depth (Figure 3). At this site plant numbers at germination were highly variable within and between treatments (Table 2).

Figure 3. Rip lines offset to seeding rows.

Table 2. Plant numbers at the Arno Bay (Landholder B) site in 2021.

Treatment	C1	C2	C3	C4	Average/m row
Nil	39	55	37	22	38.25
Rip	32	31	22	40	31.25
Double sown	49	32	30	32	35.75
Double sown + Rip	50	35	47	44	44

Concerns have also been raised on the potential for increased erosion following ripping. In this study where ripping was undertaken without additional levelling operations there was very limited wind erosion or drift observed. The Landholder B

site was sown in very strong wind conditions with less “sweeping” observed than on nearby paddocks that had not been ripped.

Landholders considered that plant biomass and yield was generally higher on ameliorated treatments with one landholder reporting delved and ripped areas yielding between 2-2.5 t/ha compared to less than 0.5 t/ha on untreated areas.

In this project production data comparing ripped to unripped sites was only collected on the Landholder B site at Arno Bay. Data was collected comparing the southern (S) portion that had suffered no major erosion and the northern (N) portion where ripping was undertaken on eroded areas. Biomass at flowering was highest on the ripped treatments, particularly on the southern portion (Table 3). Yield was higher on the ripped portion of the southern treatment but not on the northern portion.

Table 3. Biomass and yield on the Arno Bay (Landholder B) soil amelioration site 2021.

Site	Average biomass (t/ha)	Average yield (t/ha)
Nil S	4.42	1.73
Rip S	5.48	2.26
Nil N	5.06	2.32
Rip N	5.37	2.09

2. *Monitoring the impact of summer cover crops on soil moisture and mineral nitrogen* – Soil samples were taken at three periods commencing in late January 2021 through to germination in late June. Samples were analysed to compare soil moisture levels under summer covers and adjacent areas under stubble. Samples were collected from four sites: Wharminda (Landholder C), Arno Bay (Landholder B) and Kimba (Landholder D). On the Arno Bay site an area without summer cover was compared to a summer cover desiccated in February and an area desiccated in March (Figure 4).

Figure 4. March desiccated cover on left, February desiccation on the right, 2021.

In the first two sample periods soil moisture levels were lower on all sites under the summer covers compared to the paired stubble. However, results were variable with the Kimba and Arno Bay sites with smaller differences than the Wharminda site. At germination there was little difference between soil water on the Kimba and Arno Bay sites. However, soil water levels under the cover crop were lower than under the stubble cover at Wharminda (Figure 5).

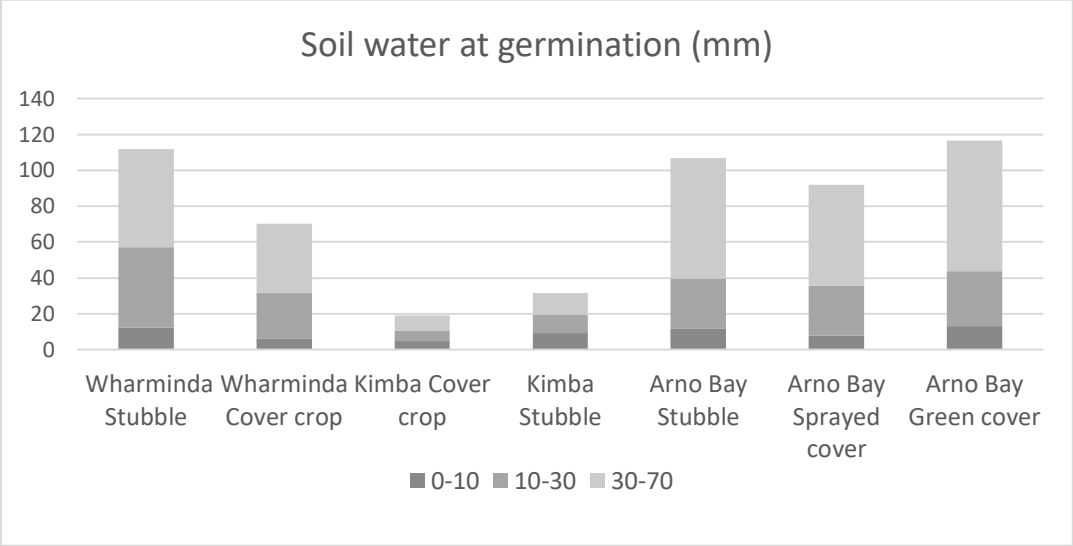


Figure 5. Soil water at different depths (cm) at germination in autumn 2021. Note that higher rainfall occurred in April at the Arno Bay and Wharminda sites than at Kimba.

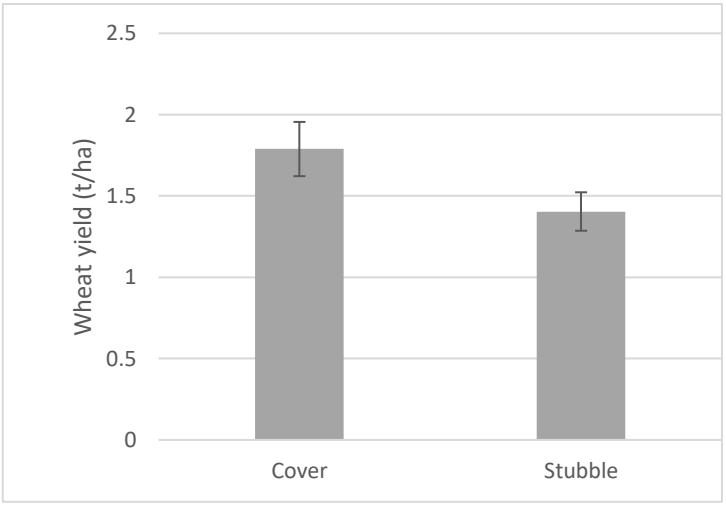
To determine if summer covers impacted on the amount of soil nitrogen available for a following crop laboratory analyses were undertaken on soil samples collected at germination at three sites. Soil mineralised nitrogen at seeding was lower under summer cover crops on the Kimba and Arno Bay sites but higher on the Wharminda site (Table 4).

Table 4. Soil mineralised nitrogen at germination, autumn 2021.

Site	Nitrate N (mg/kg)	Ammonium N (mg/kg)
Wharminda stubble	11	5
Wharminda cover crop	21	33
Kimba stubble	20	1
Kimba cover crop	6	1
Arno Bay stubble	48	2
Arno Bay sprayed cover crop	14	2
Arno Bay cover crop	13	1

Due to differences in crop type yield data was was only collected on the Wharminda site and showed that despite lower soil water levels the cover treatment yielded as well as or better than the stubble treatment (Figure 6).

Figure 6. Wheat yield (t/ha) at the Wharminda site in 2021, error bars represent error of the mean.



3. *Improving pasture growth to increase soil cover* – Grants and technical support were provided to several landholders to trial mixed species pasture systems. Landholders are reporting excellent results with Landholder E (Elbow Hill) reporting double the stocking rate with faster recovery on his mixed species pastures compared to the volunteer pasture systems that are the normal pasture in his rotation. These systems are relatively new to this region and there is limited data on suitable species mixes. To develop further knowledge detailed monitoring was conducted on the Williams property at Elbow Hill. Three paddocks were sown to different mixes of species (Table 5).

Table 5. Elbow Hill species mixes sown for winter 2021.

Paddock name	Base species mix
Little Ducks	Smart radish, oats, vetch, plantain, field peas
Fox Hole	Tillage radish, barley (Spartacus), vetch, chicory, field peas
One Pole	Smart radish, barley (Spartacus), vetch, kale, field peas

Stock exclusion cages were established prior to grazing at 2 locations within each species mix (Figure 7). A pictorial record was collected throughout the season with dry matter data collected from each cage in July and September 2021.

Figure 7. Stock exclusion cage on Little Ducks paddock

Biomass data showed great variability both within and between the paddocks (Table 6). Whilst site differences appear to be a major factor, the dry September and early August visually appeared to impact more on species such as plantain, kale and chicory than other species.

Table 6. Winter mixed species biomass (t/ha) at Elbow Hill in 2021.

Site	Dry matter 9 July (t/ha)	Dry matter 11 September (t/ha)	Total dry matter (t/ha)
Little Ducks North	2.1	6.4	8.5
Little Ducks South	2.6	11.7	14.3
Fox Hole SW	0.7	4.7	5.4
Fox Hole SE	0.9	6.0	6.9
One Pole NE	0.8	4.6	5.4
One Pole W	1.7	3.4	5.1

The major objective of this project was to improve cover and soil protection on bare soils. The difference in groundcover between an adjacent lay pasture and a mixed species pasture following grazing in late spring is clear (Figures 8 & 9).

Figure 8. Conventional lay pasture.

Figure 9. "Little Ducks" mixed species pasture.

The benefits from these systems may extend greater than the current growing season. Experience from elsewhere suggests that species such as plantain and tillage radish can re-establish in following seasons. Landholders can rejuvenate the paddock with low rates of vetch and a cereal at a low cost. This provides an opportunity to establish highly productive pastures that respond quickly to opening rains, further reducing the risk of erosion on these soil types.

There may also be beneficial soil impacts with the tillage radish forming larger tap roots that may improve the poorly structured soils in these paddocks (Figure 10).

Figure 10. Tap root on Tillage radish.

Dissemination of results

A field visit to the Elbow Hill site was undertaken during the Franklin Harbour Bureau Stickybeak day (crop walk) on 17 September 2021. Approximately 27 farmers and advisors attended. The interest shown was extremely high. Information on other project activities was presented on this day and at the Roberts/Verran Stickybeak day on 16 September 2021 (47 attended).

A summary of the project outcomes was presented at the SARDI upper EP farmer meetings at Cowell and Kimba in March 2022.

An article has been prepared for the EP Farming Systems Summary 2021 book, due to be published in April 2022.

Conclusions and outcomes

This project has supported landholders to undertake a range of activities that have directly addressed eroded areas in these districts. Results of monitoring have provided increased confidence in the benefit of these techniques and reduced concerns of risk including:

1. Soil amelioration:
    - Where ripping was undertaken without additional levelling operations there was very limited wind erosion or drift observed. Crop biomass and yield have been improved with other research suggesting that benefits will last 4 + years.

- Landholders considered that ripping at a slight angle to the seeding line appeared to improve management of sowing depth and subsequent establishment of crops.
- Delving in appropriate soil types addresses issues long term and is cost effective.

Outcome - Following this work; one of the landholders involved has purchased new equipment to undertake soil amelioration; three others are currently involved in a joint purchase of equipment, and another is considering options. All involved in soil amelioration work are or will be undertaking further soil amelioration.

2. Summer covers
   - A reduction in soil water following summer covers may not have a negative impact on a subsequent winter crop. However, this is only a small study conducted in one season and further research is required.

Outcome – summer covers will continue to be an opportunistic option in this region however, the landholders involved consider that this study has provided some data that improves the potential for adoption.

3. Mixed species pastures
   - Appear to be an option to replace volunteer pasture phases in low rainfall environments. They appear to provide greater biomass, improved soil cover and grazing.
   - Anecdotal reports suggest they also may support increased soil biological function and improve soil structure. Further research needs to be undertaken on the best mixes for different soils and climates and the most cost-effective pasture systems.

Outcome - The two landholders with mixed species pastures intend to maintain and extend the use of mixed species pastures in the 2022 season. Several others are planning to trial some on their own properties this year.

Although there were issues with project timing this project has assisted landholders to implement and monitor techniques to improve soil cover and reduce soil erosion in these districts. Also, these techniques reduce risk to adverse seasons and in areas that appear to be of highest risk to climate change are practices that can increase farm resilience.

Acknowledgements
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