



Changing land management to increase surface cover

PRODUCER STORIES



Government of South Australia
Eyre Peninsula Natural Resources
Management Board



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This project is supported by funding from the Australian Government and Australian Wool Innovation Limited



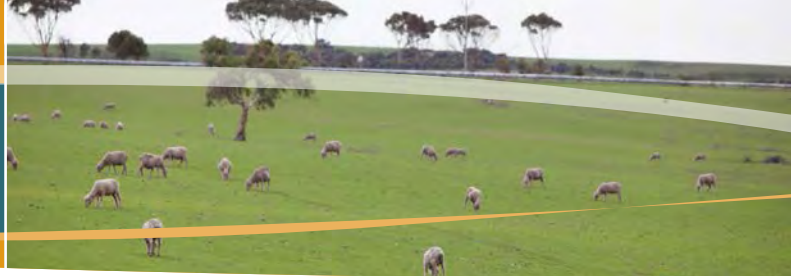
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Layout and design by: Woof Media www.woofmedia.com.au

ACKNOWLEDGEMENTS



Acknowledgements

This publication is a collaboration between the Eyre Peninsula Natural Resources Management Board's Sustainable Farming Systems program, Eyre Peninsula's Farming Systems Groups and farmers to assist the region's land managers to adopt farming practices that better reflect their land capability, minimise risk and maximise profitability.

Project Funders

This project was funded by the Australian Government "Caring for our Country" program through the Eyre Peninsula Natural Resources Management Board, in partnership with Department of Environment, Water and Natural Resources (DEWNR) "Sustainable Dryland Agriculture Initiative", Grain and Graze 2 (Grains Research and Development Corporation), Future Farm Industries Cooperative Research Centre and Australian Wool Innovation Limited.

Community Collaborators

Thank you to the farmers and farmer driven groups who provided sites and generously gave up their time to seed, fence, control pests and help monitor these demonstration sites over the four year time period.

Project Delivery

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The project commenced in July 2009 and was completed in June 2013.

Photographs - provided by Mary Crawford, Jodie Reseigh, Brett Masters and Neil Ackland.

Date of publication June 2013.



Controlling salinity by changing land use



Government of South Australia
Eyre Peninsula Natural Resources
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Foreword

The majority of our region is managed by individual land holders with over 60% of land under agricultural production. A significant area of Eyre Peninsula has been left in its natural state to protect biodiversity and the region's ecosystems. However, clearance of native vegetation for agricultural production in some areas has led to increased soil salinity, compaction and erosion.

There is an estimated 1.8 million ha of land that is classed "moderate to high" potential for soil erosion on Eyre Peninsula. This project focused mainly on the upper and eastern areas of the region and encompasses around 850,000 ha where soil is inherently at very high risk. This targeted area has a significant portion of light sandy dune-swale landscapes which are subject to increased erosion risk if not managed effectively. Due to the run of dry and well below growing season rainfall preceding this project and continually increasing input costs, there has been a trend for landholders to increase their livestock enterprise. This has increased the pressure on soil surface cover levels through grazing.

The Eyre Peninsula region covers approx 55,000km² and relies on the region's farming systems groups to assist the Eyre Peninsula Natural Resources Management Board (EPNRM) to engage its landholders.

The EPNRM program "Sustainable Farming Systems" consists of a number of program areas aiming to address land condition, soil health and degradation, improve productive capacity of natural resource dependant industries and facilitate community engagement in management of the region's natural resource base.

The aim of these projects is to help Eyre Peninsula producers achieve a balance between livestock and grain production for improved economic and

environmental outcomes. This is achieved by working with production focused landholder groups to implement innovative solutions and research outcomes into farm management practice.

This occurs in partnership with research and development organisations such as South Australian Research & Development Institute (SARDI), Future Farm Industries Cooperative Research Centre (FFICRC), Grains Research and Development Corporation (GRDC), Rural Solutions SA (RSSA), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Wool Innovation Limited (AWI), and Meat and Livestock Australia (MLA).

The EPNRM Board's "Sustainable Farming Systems" program aims to assist landholders to manage the risk of farming on Eyre Peninsula under a changing climate; by assessing the risks associated with agricultural production in this fragile environment and monitoring land condition across the region and to act on degraded areas and undertake rehabilitation measures.

Activities to achieve this aim include establishment and running of demonstration sites, workshops and field days. This program provides the avenue to access the technical knowledge and techniques required to increase the adoption of sustainable land management practices on Eyre Peninsula such as those highlighted in the following case studies.

The project was delivered in a partnership with the Eyre Peninsula Natural Resources Management Board, Rural Solutions SA and South Australian Research and Development Institute.

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Doubling stocking rate through better grazing management

SITE INFORMATION

Landholder: Emie Borthwick

Location: Pillaworta, Tumby Bay

Property Size: 1,400 ha

Annual Rainfall: 500 mm

Site Description

Emie's 1400 ha consists of 1085 ha of hills country, of which only 272 ha are arable and suitable for improved pastures. The remaining 315 ha of the farm consist of 167 ha of cropping (oats and barley) and 148 ha of native vegetation. Feed utilisation is often an issue in hill grazing, due to large paddocks and limited watering points consisting mainly of dams. This leads to livestock overgrazing areas of the paddock whilst leaving other areas relatively untouched. The overgrazing can result in low ground cover which increases exposure to erosion risk.

Aim and Objective

Pillaworta has been in Emie's family for six generations. Emie wanted to ensure she could hand-on a productive, sustainable farm to future generations. Emie also saw a need to adapt the property to manage climate variability which has hindered production on Pillaworta in recent years. A whole farm property plan for the 1400 ha was developed to focus their management efforts with the objectives of increasing stocking rates, improving grazing and pasture utilisation, reducing potential of erosion, fencing to land class, providing reliable water systems to each paddock and revegetation.

Before implementing any changes on the property, benchmarking of the sheep enterprise was undertaken to identify where changes could be made to improve profitability. One key indicator of livestock enterprise performance is stocking rates. The property started off running 3.9 DSE/winter grazed hectares (Wgha). With better paddock utilisation there is the potential, based on rainfall, to increase stocking rates to 9 DSE/Wgha.

Approach/Methodology

What was done?

Changing grazing management

Emie has recognised that improving pastures on the arable land by establishing perennial cocksfoot increases winter grazing potential. Italian ryegrass was established to provide high quality feed for weaned lambs in spring.

Low input cereals are being utilised for early feed at the break of season and then grazed as a standing crop in summer. Managing stocking pressure and rotational grazing is also being used as a tool to improve the native grass composition in the un-arable hills areas.

Using six line plain wire fences (a cheaper option than the traditionally used cyclone fences), two paddocks were subdivided to implement the first stages of the property plan. These constituted:

- A 154 ha hills grazing paddock with unimproved native grasses and annual grasses, which was divided into four paddocks incorporating a raceway. Shelterbelts of native vegetation were direct seeded into the raceway; and
- A 100 ha cocksfoot / medic pasture that was established in 2006, which was sub divided into three paddocks.

One thousand five hundred ewes are run as one mob rotating through all the paddocks dedicated to grazing on the property. Ewes are set stocked in smaller mobs for lambing. Once the lambs are tailed at six weeks, the 1500 ewes with lambs at foot are then run as one mob again, resulting in a stocking pressure of 135 DSE/ha.

Emie's sharefarmer Andrew Cabot found that, shifting 1500 sheep every three to four days was easy once they got used to the routine.



Shifting 1,500 sheep.

PRODUCER CASE STUDIES



The advantage of moving sheep regularly is they do not become used to camping around dams, water troughs and on the tops of hills, thus avoiding over grazing one area of the paddock whilst leaving the remainder un-grazed.

As the property did not have a strong history of fertiliser use, it provided the ideal opportunity to investigate the response of pasture and native grasses to different rates of fertiliser and trace element application. Initial soil tests taken from the property indicated that soils were deficient in phosphorous, zinc and copper.

Two small demonstration sites were established in each of the two subdivided paddocks; a cocksfoot / clover pasture and a native annual grassy pasture. Each site was established to determine pasture response to either high phosphorus application at (30 kg/ha) or low phosphorus at (10 kg/ha), and three trace elements; Sulphur at 10 kg/ha, Zinc at two treatments (1 and 2 kg/ha) and Copper at (100 gm/ha). The Zinc and Copper treatments were applied as foliar sprays.

Pasture cuts were taken during the demonstration period to measure dry matter production response to fertiliser application. Also visual assessments were made for changes in pasture composition and analysis of pasture samples for the nutritional benefit of the dry matter produced for grazing livestock.

This trial was undertaken purely for demonstration purposes; however, some conclusions can be made. Soil nutrient analysis may help you in determining soil deficiencies by providing background levels to guide fertiliser decision making. Over the long term, this can save you money through not having to apply fertiliser unnecessarily or in excessive amounts.

Pasture growth at all sites responded to phosphorus applications both at low and high rates. As historical fertiliser applications had been limited this was not surprising.

The Pillaworta farm property plan was revisited in March 2012, reviewing the short and long term aims for the property and planning the next stages of paddock subdivision and revegetation.

The fertiliser response demonstration continued in 2012. Three new treatments were added to the site. Lime was spread at 1 t/ha and 2 t/ha with a zinc / copper mix sprayed on the soil surface. During spring, dry matter cuts were taken and samples analysed for nutrient levels and feed value.

The treatment with high phosphorus, copper and zinc applied at 1 kg/ha recorded the highest dry matter result of 3.44 t/ha.

Palatability dramatically reduced once the silver grass, soft brome grass and wild oats matured. High grazing pressure will be required early in the season to reduce these annual grasses when they are more palatable. Also, to increase the percentage of native grasses, grazing pressure needs to occur in mid spring, this reduces competition and seed set from other annual grasses. *Austrostipa sp* (spear grass), a perennial native grass, also needs to be grazed early before it goes to head and sets seed, to reduce livestock contamination by grass seeds.

The crude protein from the native grasses / annual grasses site varied from 13% -20% and recorded an average of 8 MJ ME/kg DM (megajoules of metabolisable energy per kilogram of dry matter) This site also lacked sufficient calcium and magnesium to maintain lactating ewes. The low ME may also be limiting for lactating ewes requiring further supplementary feeding to meet nutrient requirements.



Pastures responding to better grazing management.



Conclusions/Recommendations

What was achieved?

Managing grazing potential to utilise feed in the mix of pastures and the type of sheep is critical to improving production and maintaining soil cover.

High stocking rates and rotational grazing provides the ability to rest pastures, allowing pasture recovery and revegetation.

High stocking pressure has reduced annual weeds and increased native grass densities, thus providing more valuable livestock fodder reserves and dry matter throughout the year. It is important to undertake regular soil testing to monitor nutrient levels and “feed” the pasture with appropriate levels of nutrients to encourage robust perennial pasture growth.

To date the two large paddocks have been subdivided into seven paddocks with shelter belts established between the four paddocks. Emie is progressing to the next stage with three more paddocks being created by subdividing another paddock; water courses have been fenced off and revegetation is underway.

Emie intends to further increase grazing pressure and by better pasture monitoring will improve the amount of dry matter that can be produced during the growing season.

Through investing \$20,000 to \$30,000 per year, Emie has transformed this hill country into a more profitable and sustainable grazing system. This highlights the value of implementing property plans and benchmarking the sheep enterprise.

Emie and Andrew have been benchmarking the sheep enterprise for four years. As a consequence the winter grazed hectare stocking rate has doubled over the past five years. Adult sheep numbers have increased due to better feed utilisation, and there has been an increase in lambing percentage and a reduction in lambing deaths. This has resulted in more lambs produced per hectare and more stock for sale.

Over the life of the project Emie and Andrew have improved their operating efficiency by 18%.

Emie said, “We are now in a situation where due to our efforts in developing our pasture, we actually need to further increase our stock numbers to utilise the feed.”

Awards

Emie Borthwick won the 2011 SA Landcare Award for Sustainable Farm Practices and was a finalist at the National Landcare Awards in Sydney in September 2012, where Emie presented her story to the National Conference.

References/Acknowledgements

Acknowledging the work of the landholder Emie Borthwick, Natural Resources Eyre Peninsula officers and Rural Solutions SA consultants for the technical support to implement this demonstration site.



High stocking pressure on subdivided paddocks



Increasing stocking pressure to achieve even grazing

SITE INFORMATION

Landholder: Jason Brace

Location: Poochera

Annual Rainfall: 300 mm

Site description

The key soil type on these sites is a highly calcareous pink gradational sand to sandy loam.

The high levels of carbonate in these soils result in very low nutrient availability (particularly phosphorus and trace elements). The lighter textured topsoil also has low moisture holding capacity and a moderate to very high wind erosion potential.

The project focuses on three paddocks, Slagels (197 ha), Dusky Ute (110 ha) and Peppertree (129 ha). These large paddocks consist of dune swale systems with highly erodible linear dunes. There is a general lack of ground cover and the only watering point is poorly placed at the most southerly end of Slagels paddock. There are small patches of native vegetation along the southern and eastern boundaries and in the middle of the eastern fence line of Slagels paddock.



Aim and Objective

Jason was concerned by the high erosion risk on the paddocks and wanted to investigate alternative methods to reduce the effects of wind erosion on dunes, improve feed utilisation and reduce tracking to the single watering point at the most southerly end of Slagels paddock.

Jason's program is a two year (crop/ley pasture) rotation. He runs 900 sheep in small mobs. Mace wheat was planted on the site in 2012.

Jason met with farming systems consultants to develop a management plan for the site. One option considered was to clay spread or delve the worst sand dunes in Dusky Ute paddock to improve production and increase surface cover.

However, as the sand on the dune was greater than one metre deep, delving the site was ruled out (typically delving machines are only able to bring up clay from a maximum depth of 65 cm). Clay spreading was considered, however analysis of soil samples taken from the 10 - 50 cm layer in the soil profile of the flats showed that the soil texture contained only 8% clay (a sandy loam). This is not a high enough clay content to make clay spreading the site an economical option.

Jason then looked at including the two adjoining paddocks - Slagels (197 ha) and Peppertree (129 ha) - which also had the same issues. It was determined that given the lack of suitable clay for spreading or delving, the best way in which these objectives could be achieved would be to establish a central watering point for the three paddocks. It was also recognized that Slagels paddock was too large and that by subdividing the paddock, grazing could be better managed and damage to the remnant vegetation in the paddock could also be limited.



Site selected for the central water point.

Short and long term benefits

Grazing management is the key to improving feed utilisation as livestock can waste a lot of feed through trampling, fouling and selective grazing. Jason wanted to utilise these paddocks more effectively for cropping and grazing. By installing a new central watering point Jason saw an opportunity to manage grazing, reduce stock traffic over fragile dunes and improve feed utilisation through rotational grazing. Changing the way paddocks are managed and by splitting Slagels



paddocks to create two paddocks (Eaglehawk) gives longer term flexibility and also reduces the impact of sheep on the native vegetation.

Approach/Methodology

How and what was done?

The first step to improving grazing management over the 436 ha was to look at the most cost effective options to establish another water point.

Site selection of water points is critical to prevent erosion around the site. The topography and size of the paddocks, location of existing water pipes, native vegetation and existing tracks were assessed.

The site selected for the watering point is at the junction of Dusky Ute and Peppertree under scattered tall mallee on a rise with limestone rubble present.

A triangular paddock was fenced with Station Cyclone 5:70:45 and a top plain wire with posts 10 metres apart; also three large “cocky” gates were installed to enable stock and machinery to move around the site.

Jason made the decision to make the central watering point slightly bigger to include the mallee trees for shade and shelter. This also gave Jason the opportunity to use the area for hay and feeders and use the site as a short term confinement area.

A 4.2 metre concrete trough and a 22,500 litre storage tank was installed. Connected to mains water, this tank not only supplies water for livestock but is can also be used for spraying thus reducing travel time to water sources further away.

Slagels paddock was subdivided with 5:70:90 cyclone and top plain wire with one post and three droppers every ten metres and was sited to limit livestock access to protect native vegetation from sheep camps and unwanted tracking through the site to water.

The new paddock Eaglehawk is watered by the original water point.

The fencing and water points were completed at the end of the 2012 harvest, allowing Jason to trial his rotational grazing system with 200 maiden ewes in 2013. Volunteer wheat germinated in February following summer thunderstorms providing green feed over late summer and autumn.

In late February, Slagels was grazed for one month with 200 ewes, accessing water from the existing water point. The ewes were moved onto Dusky Ute for the

next four weeks. Just prior to lambing the ewes were moved into the Peppertree paddock with fresh feed and shelter. The fourth paddock will be used when the ewes finish lambing and the medic has established.

In April 2013 Jason used a snail bait spreader to spread the dunes with medic to further help improve feed and soil cover.

Successes

Jason is delighted with the new layout and has already seen many benefits.

In late autumn Jason now has an abundance of feed in the rested paddocks and is continuing the one month rotational grazing.

Jason has observed that there is a huge difference between the demonstration paddocks and the rest of his property where he has set stocked 200 to 300 ewes in paddocks ranging from 100 to 400 ha. Once he has marked the lambs, Jason aims to shift them all onto the trial paddocks to increase the grazing pressure. Higher stocking pressure will encourage more even grazing across the paddock, which will help to reduce weed competition, reduce weed seed set and promote better growth of the annual medics.

Tightening up the rotation during the spring flush will allow other pasture paddocks on the property to build up surface cover which reduces risk of erosion as well as increasing dry matter reserves for later in the season. It is hoped that with the change of management medics will produce a better seed set resulting in improved germination the following year. Jason now has the ability to discourage the sheep from tracking over dunes and camping in the native vegetation. Through better management of stock grazing he has increased soil cover over the summer period and the paddocks are less prone to erosion.

Jason has found that monitoring and managing the sheep is much easier.

The grazed paddocks are rested allowing pastures to recover and grow before being grazed again. He has been able to use one sheep feeder for four paddocks resulting in less wasted feed and reducing his work load by only having to check and monitor one trough.

Jason has been inspired to implement these ideas in other areas across the farm. He feels that the increased flexibility in this system allows him to make better management decisions.



Jason Brace inspecting the new water trough.

Jason said "I have found that shifting the sheep from paddock to paddock has been extremely easy with minimal stress on the sheep and myself and no lambs were left behind when I shifted the young ewes with lambs at foot through the wide gates".

This change in grazing technique allowed other paddocks on the farm to be freed up and as a consequence, Jason has also had the chance to control wild turnip by spray-grazing with low rates of MCPA.

Challenges and lessons learnt.

Even though the central water point site was in an excellent position it will need some maintenance from time to time with the addition of limestone rubble to keep the site stabilised and minimise erosion.

The mallee trees will need to be monitored for damage from stock by rubbing and ring barking, and may have to be protected to ensure they are not damaged as they provide invaluable shade and shelter.

The challenge will be to increase the medic cover during the pasture phase. The use of rotational grazing will allow the plants to flower and set seed instead of being selectively grazed. Jason would also like to establish a water point at the northern end of Dusky Ute paddock to improve feed utilisation and give more flexibility to manage the sheep grazing patterns.

Increasing the stocking pressure to achieve even grazing across the paddock, while still having confidence that there is enough feed available in other paddocks, will be a challenge. However, with continued monitoring of available feed and livestock condition, this process will become easier over time. It is important to leave enough vegetative cover to allow the pasture plants to recover and grow enough dry matter to be grazed in three to four months time

Conclusion/Recommendations

Central watering points are a cost effective method to supply water to several paddocks using a single infrastructure. It is vital that the watering point is established on a stable site with little or no erosion potential (laying a pad of rubble can help on lighter textured soils). A header tank at the trough supplies clean fresh water to the trough and can provide a reserve in case there is a break in supply. Ideal flow rate into the trough should be 1 to 1.5 litres per second.

Troughs between 2.4 and 3.6 metres in length are recommended and if the flow is good, sheep should be able to come in to drink without waiting for water. This practice reduces overgrazing and camping around watering points.

Matching stocking pressure to pasture growth by rotational grazing management is the key to improving feed utilisation. In spring, pasture growth is much faster and livestock rotation times can be reduced. Sheep are easily trained to be moved every few days or weeks.

Jason said "a central watering point helps with moving livestock, as opening the gate to the new paddock through this point will encourage the sheep to walk through into a fresh paddock with little time and effort".

Rotational grazing with high stocking pressures can also reduce preferential grazing of specific pasture species.

References/Acknowledgements

Acknowledging the work of the landholder Jason Brace, Natural Resources Eyre Peninsula officers, Minnipa Ag Centre and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Addressing soil constraints on shallow gravelly red/brown earth soils

PROPERTY INFORMATION

Producers: Isaac and Lisa Gill

Location: Aroona Park - Mangalo

Annual Rainfall: 420 mm

Site description

The site is located on the Gill's Mt Millar block, seven kilometres south east of Mangalo. It is a 96 ha paddock defined by two separate areas (Figure 1). The main paddock (Gill 1) is undulating, shallow gravelly red brown earth with sodic light clay subsoil segmented by a large patch of native vegetation in the middle. The soil is hard setting at the surface with high water erosion potential. The second area (Gill 2), has a shallow coarse sandy topsoil over sodic light clay. This site is a narrow sloping strip between a creek line and native vegetation.

Aim and Objective

The paddock is regularly cropped by the Gills, with average yields. Isaac often has major issues with trafficability over the site during wetter periods, thus impacting on the timing of spraying and seeding operations. The hard setting nature of the site when dry also limits root development and yield potential, particularly in seasons with a dry finish. These soil characteristics can reduce biomass production and also limit surface cover for protection against erosion. Isaac conducted trials with a range of gypsum applications in 2011 and was excited by the improved trafficability that he was able to achieve.

Short and long term benefits

Based on the results that he had seen from these gypsum applications, Isaac was keen to undertake further trials to determine the best application rate of lime and gypsum to address pH and soil structure issues to bring about improved crop and pasture

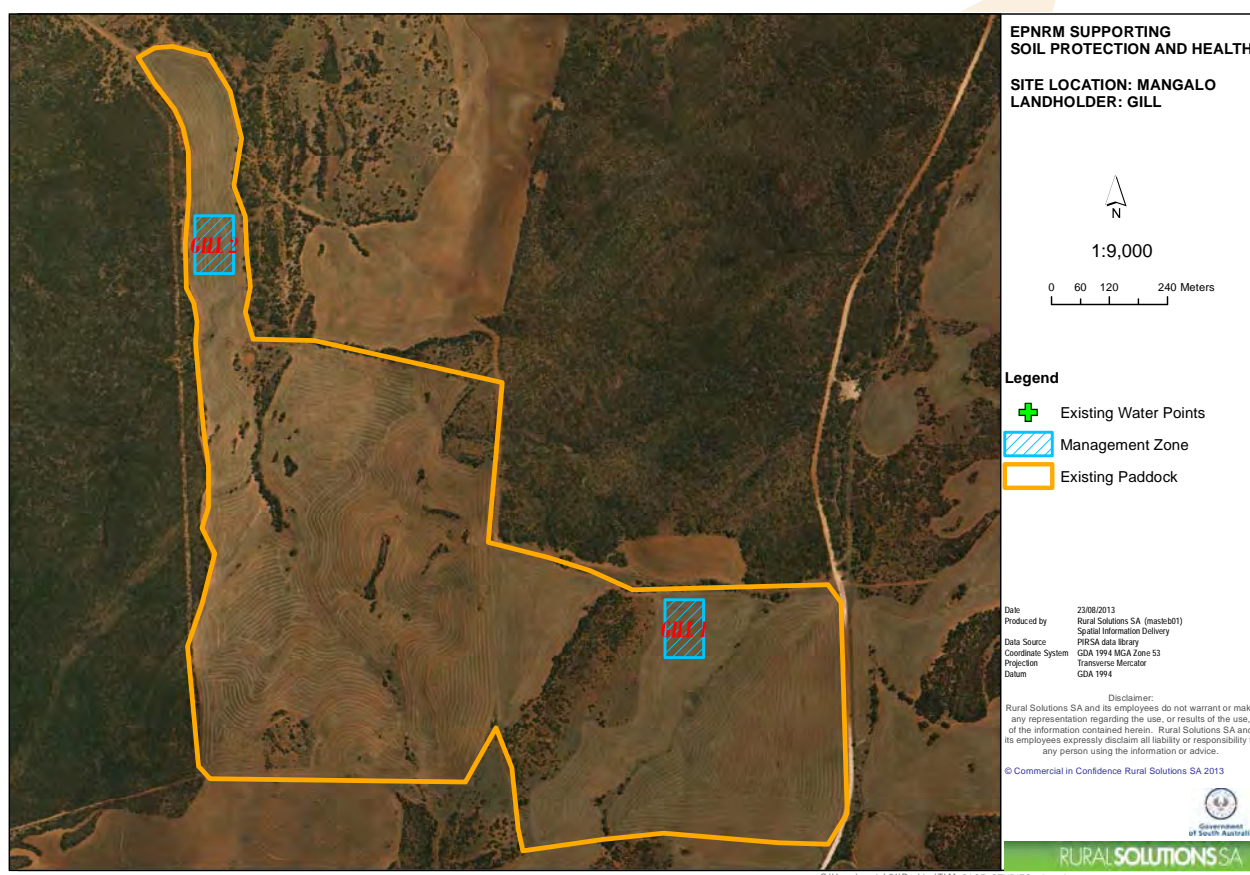
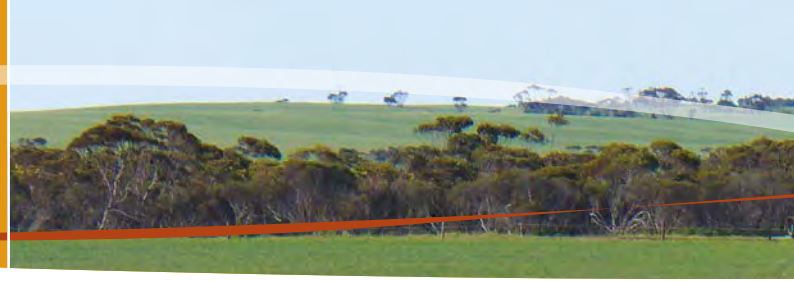


Figure 1. Map of Isaac Gill's demonstration site and gypsum trials at Mt Millar.



production. The key outcomes that Isaac was looking to achieve are; reduce waterlogging, improve trafficability when the soil was moist, improve plant water use efficiency on the site and increase surface cover and yield.

Approach/Methodology

How and what was done?

Soil testing

The soil profile was described in early 2012 to a depth of 90 cm. It comprised a shallow loam A horizon to 10 cm over gravelly light clay to around 60 cm, where weathered basement rock was encountered.

Soil samples taken from the 0-10 and 10-20 cm layers were analysed for dispersion, pH and electrical conductivity. Results at Gill 1 classified the soils as an acidic red clay loam (pH 5.3 CaCl) over a slightly acid mottled light clay (5.7 CaCl). Salinity levels were low to 20 cm (less than 0.15 dS/m). It was recommended that lime be applied at the site at 2.5 t/ha to increase pH into a more productive range. Samples from the 10-20 cm layer had moderate to high dispersion levels when placed in water. This indicated that the site would most likely respond to gypsum applications.

Results from Gill 2 had similarly low levels of salinity and dispersion in field soil analyses as Gill 1.

Management Actions

Trials on both sites were established in March with identical treatments. Treatments included; gypsum applications at rates of 4 t/ha, 5 t/ha & 8 t/ha and a combined 2 t/ha lime & 5 t/ha of gypsum, plus a control (no application). The remainder of the paddock was spread with gypsum at 5 t/ha. Isaac direct drilled the paddock in May with wheat at 100 kg/ha and 70 kg/ha of 18:20.

Successes

What were the results? Cost/benefit

Gypsum costs were around \$20 /t (approx. \$15 /t product plus \$5 /t freight to Mangalo). Spreading costs were estimated at around \$25 per ha. Total cost of the treatments therefore ranged from \$65 /ha for the 2 t/ha to \$185 /ha for the 8 t/ha of gypsum. The addition of lime at 2 t/ha added an extra \$40/ha.

Biomass and Grain Yield

To determine biomass dry matter cuts were taken in August by cutting 5 x 1 metre rows and extrapolating the results to dry matter (t/ha) (Table 1 and 2). Grain yield data was obtained using the header yield monitor at harvest.

On Gill 1, all treatments showed an increase in dry matter compared to the control plot. The highest increase in dry matter was on treatments where 2 t/ha of lime and 5 t/ha of gypsum were applied. Biomass on that treatment was double that of the control strip. However, the differences in biomass production did not transfer over to an increase in yield; this could be attributed to the dry spring finish in 2012 affecting grain fill.

Gill site 1	Dry matter - 8/08/2012		Grain yield	
Treatment	DM (t/ha)	% of control	DM (t/ha)	% of control
2t/ha Gypsum	1.02	115	3.3	103
4t/ha Gypsum	1.16	131	3.1	97
5t/ha Gypsum	1.16	130	3	94
8t/ha Gypsum	1.24	140	3.2	100
Nil	0.89	100	3.2	100
2t/ha lime/ 5t/ha Gypsum	1.79	202	3.3	103
Paddock (5t/ha Gypsum)	N/A	N/A	3.6	113

Table 1. August biomass and grain yield data - Trial Site 1.

On Gill 2 there was no increase in production from the application of gypsum or on the treatment where lime was applied (Table 2).

Gill site 2	Dry matter - 8/08/2012		Grain yield	
Treatment	DM (t/ha)	% of control	DM (t/ha)	% of control
2t/ha Gypsum	1.46	90	3.5	90
4t/ha Gypsum	1.30	80	3.5	90
5t/ha Gypsum	1.49	92	3	77
8t/ha Gypsum	1.44	89	3.4	87
Nil	1.62	100	3.9	100
2t/ha lime/ 5t/ha Gypsum	1.58	98	4	103
Paddock (5t/ha Gypsum)	N/A	N/A	3.6	92

Table 2. August biomass and grain yield data – Trial Site 2



Challenges and Lessons Learnt

What problems did you encounter?

The key problem for ameliorating this site was sourcing the gypsum and lime. There are limited gypsum quarries in the region and freight is a considerable cost. The gypsum quarry is only open for a limited season in early autumn. While there is a lime quarry close by reducing the freight costs, the added cost of extracting the product (crushed dolomite) makes it more expensive than the commonly used lime sand spread on acidic soils in lower Eyre Peninsula districts.

How did you overcome the problem?

The key to sourcing cost effective gypsum for Isaac was early planning. By understanding the issues on the site, he was able to formulate a treatment plan and order the required gypsum well in advance of the time it was required. He was able to use his own truck and schedule his time to transport the gypsum back himself, thus reducing the freight costs and having the gypsum on hand when it was required.



High rate of gypsum in the foreground compared to nil.

Conclusions/Recommendations

What was achieved?

The key outcome for Isaac from these treatments was the increased trafficability on his paddocks even during very wet conditions. He is pleased with this outcome as it will afford him better timeliness of paddock operations. While there was not any yield increase recorded on the gypsum and lime treatments in 2012, the large differences in early spring biomass production (30-40%) was encouraging. It may be that the very dry spring conditions did not allow the crop to achieve its yield potential based on crop biomass.

Increased rates of gypsum increased production, but the largest production gains from this site were where lime and gypsum were applied together. If there were better conditions for grain fill, and the 30 to 40% increase in biomass production translated to similar

increases in yield, the treated areas may have afforded an extra \$120 to \$320 per ha (0.5-1.3 t/ha) for an investment of \$65 - \$185 /ha.

There was no difference in growth observed on the treatments on Gill 2 compared to the control. This may be a result of the coarse sandy topsoil that exists at this site. The gypsum applied at the surface of the sandy A horizon may not have had any apparent effect in this first year, however it may have a benefit on this site when it has infiltrated deeper into the sodic B horizon. These sites will require further monitoring to determine the long term impact of the treatments.

Recommendations

The key take home message from this demonstration is that optimum productivity can be achieved by knowing your soil structure and constraints. Isaac was able to use some basic field tests to determine the extent of the soil dispersiveness and to formulate management actions for this soil types. Isaac stated that "having the numbers in front of you on a soil test gives you the ability to make better management decisions. Otherwise you are potentially just wasting money on the wrong management actions". Isaac has also encouraged other landholders not to be afraid of having a go at trialing different management strategies, once they understand the problem.

Future potential benefits

Excited by the improvement in soil structure observed through these gypsum applications, Isaac is also hoping to address a plough-pan issue – compacted layer formed below the soil surface due to historic cultivation. He hopes to further improve soil structure and root growth. He plans to investigate techniques for breaking through the hard pan using deep ripping with gypsum and/or growing crops with strong tap roots (possibly fodder turnip). However, he is very aware of the amount of rock on his property and considers that it may be difficult to use a deep ripping machine on these sites.

Isaac would also like to spread more lime on his property to bring soil pH values into the desired range (5.5 to 6.5 CaCl). He considers that the gypsum and lime treatment gave multiple benefits, however he is concerned by the lack of options for cheap lime.

References/Acknowledgements

Acknowledging the work of the landholders Isaac, Lisa and Simon Gill, Natural Resources Eyre Peninsula officers and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Increasing production on poorer performing soils

SITE INFORMATION

Landholder: Mark and Andrea Hannemann

Location: Mt Rough - Mangalo

Annual Rainfall: 420 mm

Site description

The site is located within Paddock #2 on Mark and Andrea Hannemann's property, Mt Rough, in the Cleve Hills. It consists of a 23 ha area north west of a tree-lined creek defined by a flat low lying area sloping up to steep rising ground (Figure 1). The soil is predominantly sandy loam over a clay sub soil with a moderate to high risk of water erosion. Mark has alleviated some of the water erosion risk by constructing an interceptor contour to divert rainfall runoff into a dam.

Aim and Objective

The purpose of the demonstrations

The paddock has been cropped regularly in the past producing average to good crop yields. However, in recent years Mark has noticed a decline in production from this paddock. He now considers eight hectares of the low lying land near the creek as completely unproductive due to waterlogging and high levels of salinity (Figure 2).



Figure 2. Saline scald along the creekline at the site.

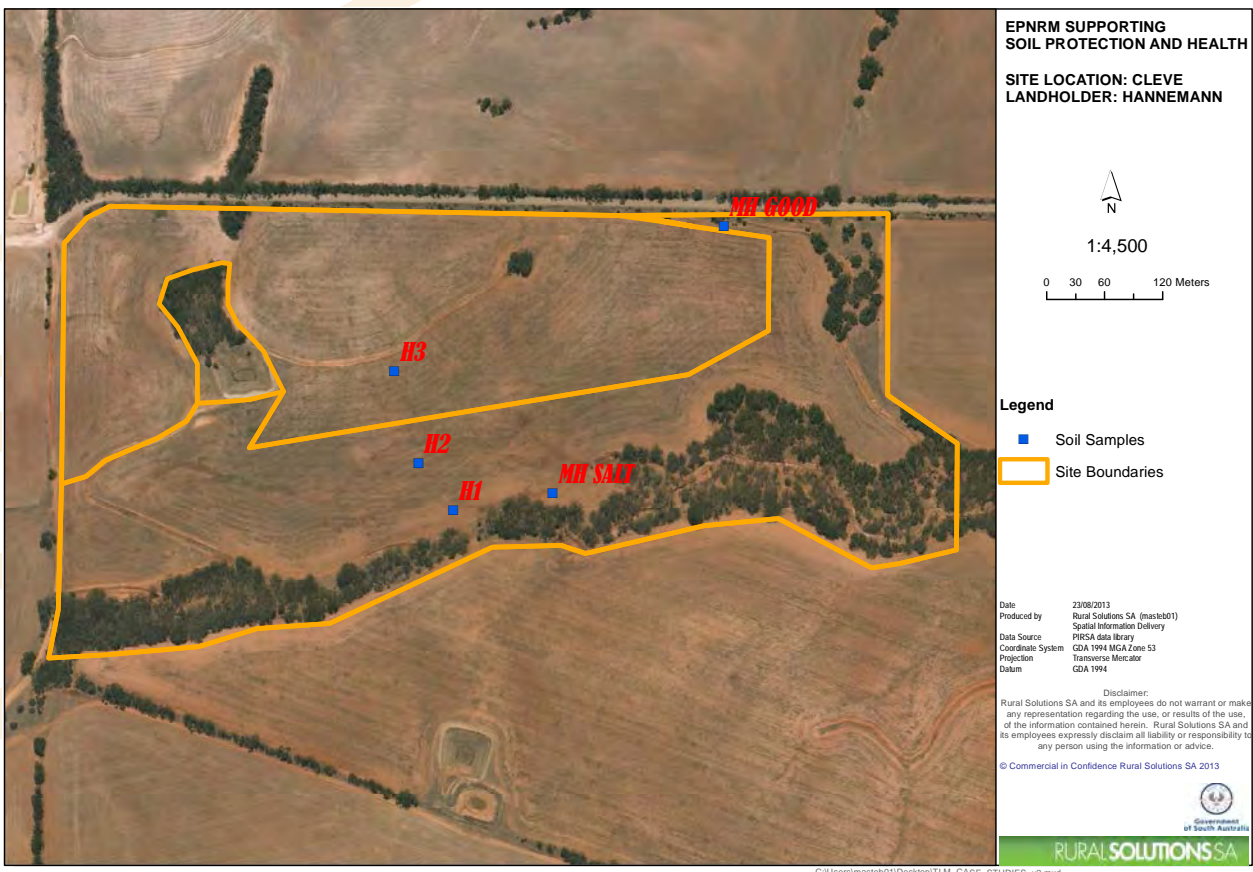


Figure 1. Map of Paddock #2, Mt Rough



Short and long term benefits

Mark was very concerned that, if left untreated, the saline areas would expand, making more of the site unproductive. He identified four key outcomes for this area that he was looking to achieve by changing management on the site. These were to reduce waterlogging, prevent further encroachment of salinity, increase surface cover for erosion protection and increase production.

It was determined that these objectives could only be achieved by improving water use efficiency on the site. In order to do this, his normal shallow rooted cropping program needed to be replaced with a permanent deep rooted perennial grazing system. Mark saw this as an opportunity to address the salinity issue, meet an autumn feed gap for his livestock and increase production.

Approach/Methodology

How and what was done?

Soil testing

Soil samples were taken from three locations (H1 – H3) in May 2012 (Figure 1). The salt levels in the soil profile on the scalded flat (H1) were high enough to impact on crop and pasture growth (1.5 dS/m EC1:5). Salinity levels reduced further up the slope (H2 and H3), however, there was moderate to high dispersion observed on soil samples from H3. This is an indicator of very poor soil structure, which can considerably impact drainage and root growth. Applications of gypsum can be effective in improving soil structure on dispersive soils. Field pH analysis indicated neutral soil pH at samples points H1 and H3, however, topsoil at H2 was acidic (field pH 6.0).

Pasture establishment

The paddock was sprayed on the 16th of June 2012 with 2 L/ha of Glyphosate and an insecticide spray (chlorpyrifos @ 300 ml/ha), then sown with a mix of perennial pastures along with 100 kg/ha of 27:12 using a disc seeder. The flat area in the southern portion of the site (Figure 1) was sown with cocksfoot and phalaris (4 kg/ha). The remaining sloping, northern portion of the site was sown with Lucerne (5 kg/ha). At sowing, Mark said that the site was very wet particularly in the lower flats. The cost of weed control and pasture sowing on the site was \$180-250/ha.

Results

Initial germination of the cocksfoot and lucerne was good. The phalaris, however, was a little disappointing. This is likely to be due to the salinity. The site was quickly overtaken with annual grasses and broadleaf weeds, requiring a post emergent herbicide (Leopard 500 ml/ha) and insecticide application (Chlorpyrifos 300 ml/ha and Alphascud 100 ml/ha) in late August. Despite this, an incomplete control and later weed germinations out competed most of these sown perennial pastures.

Challenges and Lessons learnt.

What problems did you encounter?

A key problem on the site was poor establishment of the sown pasture. Mark attributes this to combination of poor weed control and inappropriate time of sowing. Due to very wet conditions in mid June, the site was difficult to work and waterlogging on the flats restricted pasture emergence. However, the main problem was the high level of weed competition. There was no weed control prior to seeding which meant that by the time the site was sown in June there was already a good establishment of highly competitive and difficult to control weeds (wild oats, silvergrass, ryegrass, wireweed, annual medic and wild turnip).

How did you overcome the problem?

Monitoring of the site in spring showed only very low densities of perennial pasture plants survived and it was decided to spraytop the site in October to reduce weed seed set and re-sow in 2013. The site continued to be monitored over spring and summer, very dry conditions over this period further impacted on survival of any sown perennials. This was further compounded by the dispersive clay subsoils and salinity on the site with surface crusting of soils on the slopes and extensive areas of saline scald on the flats. The shallow and hard setting soils at the top of the slope (against the road) severely affected lucerne establishment, however, better establishment occurred where the soil profile was slightly deeper along the mid slope of the site.

What would you do differently next time?

This poor pasture establishment led Mark to consider how to achieve a better result in 2013. He has concluded that it is best to sow the pasture early to help get a good germination before conditions



become cold and wet (this also helps with paddock trafficability) and that it is vital to get good weed control on the site prior to sowing. In addition to the October 2012 herbicide application to reduce weed seed set, Mark will use a knockdown application of Glyphosate in early autumn 2013 to better prepare the site for sowing.

The surface crusting observed on the sloping ground together with the dispersion tests at H1 indicate that this area may respond to a gypsum application. After discussion with farming systems consultants it has been recommended that Mark address the hard setting soil on the sloping land by applying gypsum at approximately 5 t/ha to improve drainage and reduce the surface sealing. However, on the saline flat gypsum will not have any benefit as high salinity levels will already be causing flocculation of the clay particles.

Due to a lack of significant summer rain, there was poor production on this site over summer. Although some cocksfoot and lucerne plants exist, plant density is too low to make it a productive stand. The pasture will be re-sown in 2013 with lucerne above the contour and cocksfoot and phalaris on the remaining sloping ground. The high salinity levels on the flat limit pasture options.

A long term recommendation for the saline area of the site is to establish an alley grazing system, incorporating tall wheat grass, puccinellia and/or saltbush and fencing off the creek line to minimize grazing damage to the native vegetation. Mark plans to establish fodder shrubs in an alley system by firstly spraying out the area with 1 L/ha paraquat and planting multiple blocks of two rows of fodder shrubs between 26 metre wide alleys, where Mark plans to sow perennial grasses using an air seeder.

This site should not be grazed for at least eight months after establishment. It is recommended that once grazing is commenced the site should be grazed rotationally using a high stocking rate (50+ DSE/ha) for short periods (3-5 days). The use of temporary electric fencing running from the creek to the road could help to divide the site up into grazing strips to achieve the required stocking rates and rotations.

Conclusions/Recommendations

What was achieved

This site highlighted the importance of planning to successfully establish perennial pastures. The take home messages from this site is that good weed control is essential and selection of the right pasture species in relation to rainfall, soil type and soil management issues are essential in establishing perennial pastures. Perennial pastures are highly susceptible to weed competition during establishment, consequently weed control should begin on the site at least in the year prior to establishment. Lucerne can be affected by waterlogging, salinity and/or low pH soils that are high in aluminium and it does not persist in heavy, hard-setting soils. Although cocksfoot is more tolerant of waterlogging and high levels of aluminium, it does not tolerate high levels of salinity and a salt tolerant species should be used on salt scalded areas.

Future potential benefits

The deep rooted perennial pastures and fodder shrubs will increase water use on the site, reducing the amount of water infiltrating to the elevated water table. Over time it is envisaged that this water table will be lowered, with increased production due to the perennial grazing system. This will allow Mark to focus on grazing management of the site rather than managing poorly performing crops. One of the major benefits Mark is hoping to achieve is using perennial shrubs in the grazing system to fill the autumn feed gap.

However Mark still has some questions about the best way to control waterlogging at this site and is wondering whether drainage may be an option for removing some of the excess water that lies on the flats.

References/Acknowledgements

Acknowledging the work of the landholders Mark and Andrea Hannemann, Natural Resources Eyre Peninsula officers and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Changing paddock management to increase stocking rates

SITE INFORMATION

Landholder: Neville Hoffrichter

Location: Ceduna

Property Size: 2,100 ha

Annual Rainfall: 275 mm

Site Description

Prior to 2008, Neville's farming enterprise mainly focused on cropping. However, after a run of droughts, Neville realised he needed to decrease his risk and better look after his livestock enterprise. The property of 2100 ha is mainly calcareous sand to sandy loam. Approximately 1,500 ha is planted to cereals annually, of which 1,000 ha is harvested for sale and seed (wheat and barley). The remainder is sown to mixed oats and barley for grazing and/or harvested for stored stock feed.

Aims and Objectives

Neville has been farming west of Ceduna for over 17 years and wanted to reduce the financial risk of poor returns from cropping in dry years.

He identified that in order to increase his stocking numbers and spread his risk this would require a number of changes across the farm. Ideally Neville wanted to move towards a 50:50 sheep / crop enterprise, with the ability to sell off all wether lambs and non replacement ewes in a six month period.

The first step was to assess returns from the whole farm business, and then identify; the areas of his property most likely to give a return for cropping, those areas where returns from input costs were more variable, and those areas of his property not suitable for cropping.

Each year Neville benchmarks his sheep enterprise as a management tool to review his program. Stocking rates increased from 1.5 DSE/Winter grazed hectares (Wgha) to 1.8 DSE/Wgha in 2009. The gross margins increased in that first year from \$16.56/DSE in 08/09 to \$25.59/DSE.

In 2011 Neville ran 1,000 ewes (SAAMs and Dorpers) in four paddocks at 2.5 DSE over 12 months on a mixture of pasture and cereal (oats) planted for grazing. Neville now has two years fodder reserve on hand with hay and grain.

Neville's key exit strategy in the drier seasons, when paddock feed and ground cover is low, is to establish a confined feeding area to finish off lambs and maintain ewe condition. However, to reduce the impact, both on ground cover and livestock health, this plan needs to be implemented early if seasonal conditions are below average.

Approach/Methodology

How and what was done?

A simple grazing stubble trial was conducted for two years in a row. In both years extra grazing and feed utilisation was achieved by rotating livestock through smaller paddocks at higher stocking pressure every one to two weeks.

Temporary electric fencing may be used to subdivide paddocks further to intensively graze cereals.

In 2009 Neville sowed oats and barley at 50 kg/ha without fertiliser. He subsequently subdivided a 240 ha paddock into four cells using permanent and temporary electric fencing. The electric fence was constructed using three rows of 2.5 mm fencing wire and steel tread-ins with steel posts every 200 metres. This system costs \$750 / km, plus the energiser. Neville's plans are to leave the fence in place for two to three years, after which it will be removed and used for the same purpose in another area of the farm.

One thousand one hundred and seven Dry Sheep Equivalent (DSE) were grazed in the system from August to November and 570 DSE until January resulting in a stocking rate of 4.6 DSE/Wgha and 1.5 DSE over the year. Due to a favourable season, one cell was not needed for grazing, allowing 30 tonne of grain to be harvested. The gross margins for sheep averaged \$38.75/ha across the 240 ha.

On the stubble trial area in 09/10 Neville was able to stock the site with 257 dry ewes set stocked at 2 DSE/ha in a 152 ha paddock, utilising 150 kg DM/ha for 51 days in February/March. Sheep had to be removed as they had started to bare out some areas of the paddock. However, in the other split paddock, 287 ewe lambs at 2 DSE/ha rotated through two 80 ha paddocks every one to two weeks, utilised 240 kg DM/ha for 89 days.

Neville sowed barley and oats in the same paddock again in 2010 at a rate of 50 kg/ha with 18:20 fertiliser applied at 10 kg/ha. The four cells were rotationally

grazed with 800 ewes with lambs at foot for seven months. The system supported 2400 DSE resulting in 10 DSE/Wgha and 5.7 DSE over the year. The gross margin in 2010 was \$159/ha.

During the 2010 spring flush the sheep could not utilise all the biomass grown and again 60 hectares was harvested and kept as feed on hand. These favourable seasonal conditions for grain production and ample standing feed reserves, allowed the sheep to be rotationally grazed through the four paddocks over summer and autumn.

Currently Neville sows 23% of winter grazed pasture to barley and oats for grazing and the intention is to increase this in the future.

Neville is also upgrading existing watering points and adding more efficient central watering points with 2,500 litre tanks. To allow livestock access to a high water volume these tanks have a 50 mm ID Rural B' Class diameter pipe from tank to trough and a 40 mm float valve. Flow rates into troughs of over one litre/sec, provide a large mob with clean cool water, thus, eliminating the issue of stock camping around watering points.

Water is a major issue for this enterprise. Problems with mains water quality (calcium build up) and the future rising costs of reticulated water has made

Neville look at alternative sources. In 2011-12 Neville replaced a large amount of the water infrastructure to accommodate the subdivision of more paddocks divided by raceways. Most perimeters will require electric fencing. In some instances installing two water points located at each end of the paddock will help manipulate grazing pressure. Other paddocks will have one central water point allowing livestock access from each connecting paddock.

Neville's aim is to become mostly self sufficient. He has consequently installed a water catchment system on his property during 2012-13. On a sloping corner in one of his paddocks, Neville has laid out 500m² of plastic on ground to collect water into two underground tanks. He then uses a solar powered pump and windmills to pump this water up into larger holding tanks located on top of hills. This facilitates distribution to the required watering points around his property.

This system enabled Neville to turn off his mains water in March 2013 due to a rainfall event (15mm) that caught enough water to carry him through to the opening rains. Neville indicated that by the end of June 2013 he would achieve his maximum water holding capacity and is anticipating that during most seasons, he would be able to rely solely on this water catchment for livestock water.



Central watering point and electric fence servicing four paddocks.



Conclusions/Recommendations

What was achieved?

Neville showed that grazing efficiency can be increased by splitting the paddocks and rotationally grazing the area compared with set stocking paddocks. With smaller paddocks his sheep are grazing less selectively and using less energy walking to water and looking for the best feed.

Neville observed that when mobs were set stocked in the larger paddocks, they would come into water and then walk all the way back to the other end of the paddock before starting to graze which resulted in tracking and trampling of feed. Changing to rotational grazing in smaller paddocks meant that they were trampling less feed in the process.



Solar electric fencing to subdivide a paddock.

Neville has continued this grazing program of rotating large flocks through smaller paddocks thus maintaining good ground cover. He is continuing to subdivide more paddocks and establish raceways on the property over a two to three year program. The sheep enterprise is in the process of changing from a wool and prime lamb enterprise to solely meat production.

By conducting a number of small on-farm trials, Neville has shown that subdivision of large paddocks and combining rotational grazing with increased water flow rates to troughs wastes less feed.

Increasing the stocking rate is the key to increasing income and livestock gross margins. However, this can only be achieved through better grazing management such as rotational grazing. It is also very important to have an exit strategy to deal with variable seasons. As a risk management strategy, Neville has established grain and hay as fodder reserves for 12 months in advance and continues to monitor and maintain a feed strategy well in advance of his livestock needs.

Neville will continue to develop further innovative ideas on his property as he gradually reduces his risks, cropping only the lower risk areas and increasing his livestock enterprise.

References/Acknowledgements

Acknowledging the work of the landholders Neville Hoffrichter and Rural Solutions SA consultants for the technical support to implement this demonstration site.



Farming generations plan for future farm landscapes together

SITE INFORMATION

Landholder: Wendy, Geoff and Jim Holman

Location: Cockaleeche - Eyre Peninsula

Annual Rainfall: 390 mm

Site Description:

Enterprises

Mixed farming: 1200 ha Cropping (Wheat/Canola/Barley/Lupins)

300 Merino Ewes crossed with White Suffolk

Total Area Farmed: 1267 ha

Soils

Soil types across the property range from saline sandy loams and ironstone gravelly loam over red clay to ironstone soils over calcareous lower subsoils.

After participating in a Property Management Planning Course 15 years ago, Wendy and Geoff Holman realised the value of management planning on their 1267 ha property at Cockaleeche. When the Holman's developed their first plan, their son Jim was still at school. Jim is now an integral decision maker in their mixed cropping and sheep business. When the opportunity presented itself to revisit their farm plan, they decided to participate with both generations.

"We are always looking to set up a better farming system. We felt that the Future Farm Landscapes program would allow us to update our farm plan and assist us in identifying critical areas that we need to address," Wendy said. "Our business situation has now changed, with Jim being more involved in the decision making and it is important to update our plans for the future."

The Project

The Future Farm Landscapes project is funded through the Eyre Peninsula Natural Resources Management Board in partnership with Australian Wool Innovation Limited and Federal Government's Caring for Our

Country initiative. The program aims to assist producers to plan for the future by developing strategic property plans for their business and providing technical support to identify key areas that require on ground action as well as opportunities for the ongoing development of a sustainable farm business.

Producers were supported through the project by technical specialists who assisted them to identify emerging opportunities, identify risk, and changes and actions that could be addressed now as well as in the future. Plans were developed that covered agricultural productivity, carbon assessment, biodiversity and natural resource sustainability.

Identifying the Risk

Individual property assessments identified areas of low, medium and high production and the associated risk level in these zones. Action plans were developed to assist producers to improve productivity. This included addressing low production areas with high risk as well as making sure high production areas were maximising returns.

"We identified that we needed to increase the production capability of our soils by whatever means. Having productive soils is a financial benefit to our farm, as well as increasing the future longevity of our business," Jim said. "We seem to be doing a lot of taking from the soil and now we see the value of giving back."



Saltbush planted in the low production areas.



Action on Ground

An assessment of agricultural production on the Holman's property identified that the low production deep sandy soils were at risk of crop failure 50% of the time. To increase the productivity of these areas, the Holman's will undertake delving and clay spreading.

"We are hoping to run trials to pin point which particular method, claying or delving would best work for us," said Jim "We have delved the light country and you can see a significant difference. We planted feed barley this year on this area and you can see where we had delved and where we hadn't, right up to the last plant line."

Incorporating clay into the soil profile of these sandy soils assists in increasing the overall productive capacity as well as the percentage of organic matter, reducing the risk of production failure. If the clay option is too expensive or doesn't yield the expected results, the Holman's will trial using a green manure crop or incorporating straw into the soil profile.

The Holman's also have areas of saline seepage which they have been trying to manage for the past 50 years. Ten to fifteen years ago they attempted to address the issue through establishment of salt tolerant species such as puccinellia, tall wheat grass and salt bush.

"We do have the majority of our salt areas contained, but we have undulating country and the salt in a few areas has crept past the tree line," Geoff said. "The technical personnel who undertook the biodiversity

assessment on our property as part of Future Farm Landscapes project have suggested a few different grass species for us to try which I think we will pursue, to keep the issue under control."

Biodiversity Assessment

The Holman's have been very active in restoring native vegetation cover to their property, with Geoff and his brother's receiving a Landcare Award for their efforts in the 1990's. A biodiversity assessment conducted as part of the Future Farm Landscapes program highlighted the need to keep stock excluded from areas of vegetation and to establish plantings to create an understory.

The biodiversity assessment identified that the current understorey is dominated by native grasses, such as wallaby and spear grass with some annual grasses. Grazing needs to be managed in these areas to reduce the seed set of weed species and reduce the build up of exotic grass dry matter. This will encourage the native grasses and herbs to naturally regenerate through flowering and seed setting.

Understorey establishment and exclusion of stock will increase the biodiversity value of vegetation on farm and encourage natural regeneration of plant species.

"We will try to keep the sheep out of the scrub as we can see the benefit from doing this now," Jim said.



Some of the revegetation the Holman's have undertaken to control salinity.



The Carbon Story

As part of the project the Holman's benchmarked the carbon story for their farm business which identified that they are currently sequestering 75 tonnes carbon dioxide equivalent per year ($\text{tCO}_2\text{e}/\text{year}$). With implementation of future plans to increase areas planted to salt tolerant grasses, re-vegetation around salt seepage areas and understory planting under remnant vegetation, the Holman's annual sequestration is expected to increase to just over 500 $\text{tCO}_2\text{e}/\text{year}$.

"I had heard a lot about carbon and going into this process I was keen to keep an open mind about it," Geoff said. "Since going through the program I am more informed about what it all means and how it may benefit us on our property."

Project Benefits

The Holman family was one of ten farming businesses across Eyre Peninsula who developed a next generation farm plan as part of the "Future Farm Landscapes" project, identifying key areas that need action and

opportunities for the ongoing development and sustainability of the farm business. All participants have a much clearer understanding of the carbon story for their farms including sequestration in their soils and the role soil organic carbon will play in the future with seasonal variability and climate change.

"The Future Farm Landscapes process has shown us that we are doing alright. The things we put in place over the years, such as fencing off vegetation and re-vegetation has all been reaffirmed," said Wendy.

"We knew some areas were a problem on our farm, but we were not really sure what to do." Geoff said, "We are now planning towards addressing these problem areas. We now have the momentum to move forward."

References/Acknowledgements

Acknowledging the work of the landholders Wendy, Geoff and Jim Holman and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Geoff inspecting their salinity mitigation.



Assessing the future impacts of climate change

SITE INFORMATION

Landholder: Jeff and Jodie Jones

Location: Wharminda - near Cleve

Annual Rainfall: 325 mm

Site description

Enterprises

Cropping: 1060 hectares - Wheat/Barley/Rye

Livestock: 500 Self replacing Merinos ewes and 200 Merinos ewes to White Suffolk.

Farm Size: 1860 hectares (across three blocks)

Dominant Soil Type: Light loamy sand with areas of deep non-wetting sand

A number of consecutive dry years up to 2008 and soil exposure to winds saw the top soil from Jeff and Jodie Jones's property at Wharminda cover the adjacent road. It was then, that the Jones' sought to improve several aspects of their management practices. This was made more poignant by predictions that climate change will bring less spring rain and make retaining top soil an even greater management priority.

"Our property can be marginal and, if we get reasonable rains in May, June and July, the soils hold their moisture but if we don't get the finishing rains, then maintaining surface cover is a real issue," said Jodie. "2008 was a real shocker for us and in mid-August we were faced with re-sowing 75% of our crop."

Jeff and Jodie Jones participated in the Future Farm Landscapes program with the aim of increasing their knowledge on the impacts a changing climate may have on their long term sustainability.

Jeff and Jodie undertook an assessment of their productivity by mapping the production zones and identifying the risks to maintaining or increasing production in coming years. As a result they have produced an action plan identifying where they can increase production, and reduce the risks and gaps in knowledge where further research is needed.

Impacts of Climate Change

Already faced with challenging farming conditions, the Future Farm Landscapes program assisted the Jones's to assess the future impacts of climate change. Careful management of the dune swale systems will be important in reducing the risks to production with the predicted changed to rainfall and temperature.

"We have already begun working on some of our lower production areas over the past few years, but we also realise the impact climate change will have on us," said Jodie. "The risk of reduced rainfall, especially in spring makes it is even more important that we work towards building up the carbon store in our soils so that we can make the most out of our soils and the moisture that we receive."

Working with the Challenges

Challenged by a combination of light sandy loam soils, little vegetation cover and variable rainfall, Jeff and Jodie have embarked on a revegetation plan to assist in dune stabilisation and to increase farm biodiversity. Maintaining soil surface cover and improving soil structure is also a management priority.

"We started to look at ways of doing things differently," said Jodie. "One farm only had two trees on the whole property and we knew we had to do something about this. We have also set a target of maintaining at least 50% ground cover throughout the year."

"We are stuck with the soil types that we have, so we just need to manage them better," said Jodie.

As a step in improving their soil properties, the Jones's have shared the cost of building a delver with a syndicate of neighbours. Delving involves bringing or 'delving' the clay from the subsurface and mixing it in with the top soil to reduce the incidence of water repellence in the soil and increase productivity.

"The delved areas will be sown with wheat or barley. The worst sandy rises are sown with cereal rye because sheep don't like rye stubble and this makes these areas, where they seem to like to camp, less attractive" said Jodie, "These sandy rises have veldt grass stands on them from the tree lines to the cropping ground. We use portable electric fencing to manage these areas, which allows a more even grazing of paddocks."

"The biggest decision for us has been, what land we continue to crop and what land we take out of cropping altogether," said Jodie. "The costs of production often outweigh the returns on some of these areas."

Over the past five years, the Jones' have increased the number of hectares planted to medic pastures to increase the amount of nitrogen and carbon in the soil, with good responses.

Re-establishing the Understorey and Increasing Biodiversity

Over the years, the Jones's have made it a business priority to re-establish vegetation cover across the three properties that they own and manage. In 2008, they established shelter belts using oil mallee species with varied success.

"Being involved in the Future Farm Landscapes project has made us realise that we need to put a greater emphasis on re-establishing our understory species in our shelter belts," said Jodie. "When new fences are nearing replacement we run a new fence parallel with the existing fence which allows for three rows of trees and shrubs to be planted. " We will also use electric fencing to keep stock out of native vegetation areas and areas where we are trying to re-establish vegetation."

A property that was recently purchased by the Jones' has very little vegetation cover in the outer paddocks. The Jones' shear in late August, which makes establishing shelter a priority to protect newly shorn sheep. They are conscious of re-establishing vegetation on this property and have recently started planting trees and shrubs.

Maximising Livestock Production

The Jones' have established a feedlot and feed approximately 250 young ewes with lupins, wheat and barley. The feedlot assists in maintaining surface cover by removing stock from vulnerable areas and

addressing the feed gap that occurs at the beginning of autumn by allowing pastures to gain bulk before returning stock to the paddock.

Ewes are pregnancy scanned and drafted into single and multiple bearing mobs. These mobs are smaller in size, with between 120-150 ewes in each mob. Ewe nutrition is a priority; allocating better feed resources to mobs carrying multiple lambs. Since implementing these management strategies, the Jones' have been regularly achieving a lambing percentage of over 120%.

On review

As a result of undertaking a production and risk analysis of their property Jeff and Jodie have developed a five year action plan to reduce the risks and increase production. Actions include establishing more shelter belts on all three properties, increasing the soil organic carbon levels, establishing medic and veldt grass to improve soil ground cover, increasing the area delved and excluding stock from sand dunes and revegetated areas.

"Participating in the Future Farm Landscapes project has confirmed that we are heading in the right direction. It has also allowed us to find out what research has been undertaken out there and what is being trialled," said Jodie. "You have to have an open mind, think outside of the box; and look at other systems and ways of doing things."

References/Acknowledgements

Acknowledging the work of the landholders Jeff and Jodie Jones and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Re-established vegetation.



Livestock - taking the pressure off cropping

SITE INFORMATION

Landholder: Damien and Eileen Lynch

Location: Poochera

Property Size: 1,200 ha

Annual Rainfall: 300 mm

Site Description

The Lynch family has been farming on Eyre Peninsula for three generations. After purchasing neighbouring properties and being involved in the EPNRM / Woolworths "Improving Feed Utilization" program, Damien has been implementing some major changes to improve his business and property.

With predominantly grey loam soils, coupled with a run of dry years in 2005 to 2008 and a subsequent bus trip to Neil Sleep's property at Peterborough in 2008, where he saw 'a different way of doing things', Damien has been inspired to continue improving his business focussing on his livestock.

Working with technical assistance through the Board's "SheepConnect" focus farms program, Damien has implemented strategies to manage risk in his farming enterprise by:

- fencing to land class;
- introduction of Dohnes;
- controlling Wards Weed;
- using fertilisers containing added zinc;
- using electric fencing; and
- improving watering systems.

Aims and Objectives

Uneven grazing, including selective grazing of the pastures allowing weed set, and poorly performing cropping paddocks has led Damien to aim for a more productive and a less risky farming enterprise mix.

Key management issues for regional landholders looking to change to a more intensive livestock system with improved feed utilisation are reducing paddock size and changing watering points.

Damien had always used permanent fencing, however, with capital costs increasing, the need to change from set stocking to rotational grazing and the implementation of smaller paddocks for better feed utilisation; he decided to investigate the suitability of temporary electric fencing.

Approach/Methodology

How and what was done?

Through the Woolworths and SheepConnect project Damien has been trialling and using electric fencing since 2008. Electric fencing is an attractive option as it allows paddocks to be quickly subdivided, enabling stock to be moved regularly on to fresh feed without having to be shifted over long distances. As Damien had no prior experience with electric fencing, this project provided him with an opportunity to trial the technology and to build his confidence.

Paddock subdivision

Damien decided to graze 50 ha of a poorly performing barley and oats crop instead of harvesting it in 2008. The paddock was grazed in six blocks of approximately 8-9 ha each. Damien used temporary electric fencing and erected a single three line fence that was shifted five times to create the six grazing sections. The fence consisted of 1km long runs of two electric wires and one earth wire, supported by steel "tread-ins" that were spaced 15 metres apart. The fence was later changed to only two electric wires and no earth wire without causing any issues for livestock management.

Stock water was provided in a 600 litre poly dish trough, which required cleaning out every two to three days.

Stock were moved onto new feed every eight to ten days and the total area provided 47 days of grazing for 360 crossbred lambs at a stocking pressure of 60 DSE/ha.

Temporary electric fencing made easy

For ease of management in erecting and rolling up electric fencing there are systems available to attach to four wheel motor bikes. Through the EPNRM/ Woolworths project, four Rappa™ systems were purchased and made available for landholders to trial.

Damien did not have a four wheel motor bike. So he has built a two-wheeled trailer to mount the Rappa system to, along with all the equipment required. He towed this with his farm ute to make the rollout and shifting of these temporary fence lines a lot less time consuming.

It takes two people about one hour to take down and re-erect a 600-700m length of fence. Damien is very happy with the Rappa™ system and even made his own reels to reduce the costs.



Feed utilisation

By using the temporary electric fencing, Damien is now aware of how much feed has been wasted in previous years through stock trampling and selective grazing over his larger paddocks. His sheep now graze to within one metre of the fence lines. Provided there is adequate feed in the paddock, livestock are retained and do not put pressure on the electric fence. However, Damien has had a few issues with kangaroos and emus, occasionally flattening the fences, as two wires can be difficult for them to see.

Damien has now been using electric fencing for four years and has been continually increasing his breeding ewe numbers due to better feed utilisation.

Portable watering system

Using electric fencing to subdivide larger paddocks for better feed utilisation can create issues around watering points. Damien overcame these issues through constructing a mobile system consisting of a 9,000 litre tank mounted on a four wheel trailer. A poly trough is also attached to the rear of the trailer. It is connected via a 50 mm hose providing good flow rates. This system facilitates a cost effective means of shifting watering points between and within different locations within a paddock to influence grazing habits. Damien said that “as these mobile watering tankers worked so well, I now have three of these portable systems, to an extra trailer and an old truck mount, both constructed under the same system”.



Damien's trailer mounted mobile watering system.

Conclusions/Recommendations

What was achieved?

Damien previously cropped about 2,200 hectares; however, after switching his focus to livestock after the Peterborough visit, a decision was made to split the family partnership and the property in 2012 and run his property solely as a livestock enterprise. Currently,

Damien's cropping activities are very small (about 100 ha of oats and barley) dedicated to livestock fodder. This shift to a livestock enterprise running more sheep, together with good livestock prices, has taken the pressure off the farm finances and provides greater flexibility with less risk.

Damien said “Depending on how the season is progressing, I now plan to let these oat/barley crops run up to head and hay freeze the paddock to eliminate any weed seed set in those crop/feed paddocks”

Controlling weeds such as wards weed and turnip has become one of Damien's priorities in his pasture paddocks. Stock will usually only consume these weeds when plants are young and they are often left ungrazed once they hay off. This issue compounds as they then out compete the quality livestock feed such as annual medics.

Damien said “I am now using either Tigrex ® and/or diuron early in the season to target these weeds and it appears to be reducing the weed numbers allowing medics to get away”.

Note: The tolerance of medic varieties to Tigrex ® and diuron can vary (rates are very important) Seek agronomic advice prior to use!

Planting of cereals gives flexibility by allowing either grazing when green and then harvesting, cutting for hay or being grazed as a standing crop, this practice allows maximum grazing days to be achieved.

Simple strategies to provide adequate stock water have aided in increasing pasture utilisation and the ability to graze smaller paddocks that have been subdivided.

“Temporary electric fencing has increased paddock flexibility and provided management flexibility to graze cereals depending on the season,” Damien said.

Damien is also going to construct a permanent feedlot/ confined feeding area, he said “Although this season (2013) looks like we not be requiring one, it will be there for the long term, when it's required either at the break of the season to spell paddocks while they get away, or during the next dry season which is sure to come again particularly in this district”.

References/Acknowledgements

Acknowledging the work of the landholders Damien & Eileen Lynch, and Rural Solutions SA consultants for the technical support to implement this demonstration site.



Managing dunes for productivity

SITE INFORMATION

Landholder: James Pollock

Location: Wudinna

Growing Season Rainfall 2012: 200 mm

Site description

James like many farmers in his area was faced with some serious drift and blow outs over several sand ridges on his property.

The site is located within Paddock #5 on the property he leases in the Pordia district. The paddock consists of 150 ha with approximately 35% covered by very low fertility deep sand dunes.

The management area comprises four of the larger dunes on the paddock (SH1 to SH4) totaling 40 ha

(Figure 1). These dunes are at very high wind erosion risk if not managed well.

Two of these dunes (SH1 and SH4) had large blow outs on them, increasing the complexity of management required on the site.

Aim and Objective

The purpose of the demonstrations

This demonstration paddock has been cropped regularly in the past, however due to poor inherent fertility, crop performance has been poor. From 2008 to 2010 the paddock was not cropped, but left as a grassy pasture. Wind erosion is a major soil management issue in the district and requires careful management to reduce the risk. Heavy grazing has left the site at risk of wind erosion and increased the size of the blow outs on the dunes.

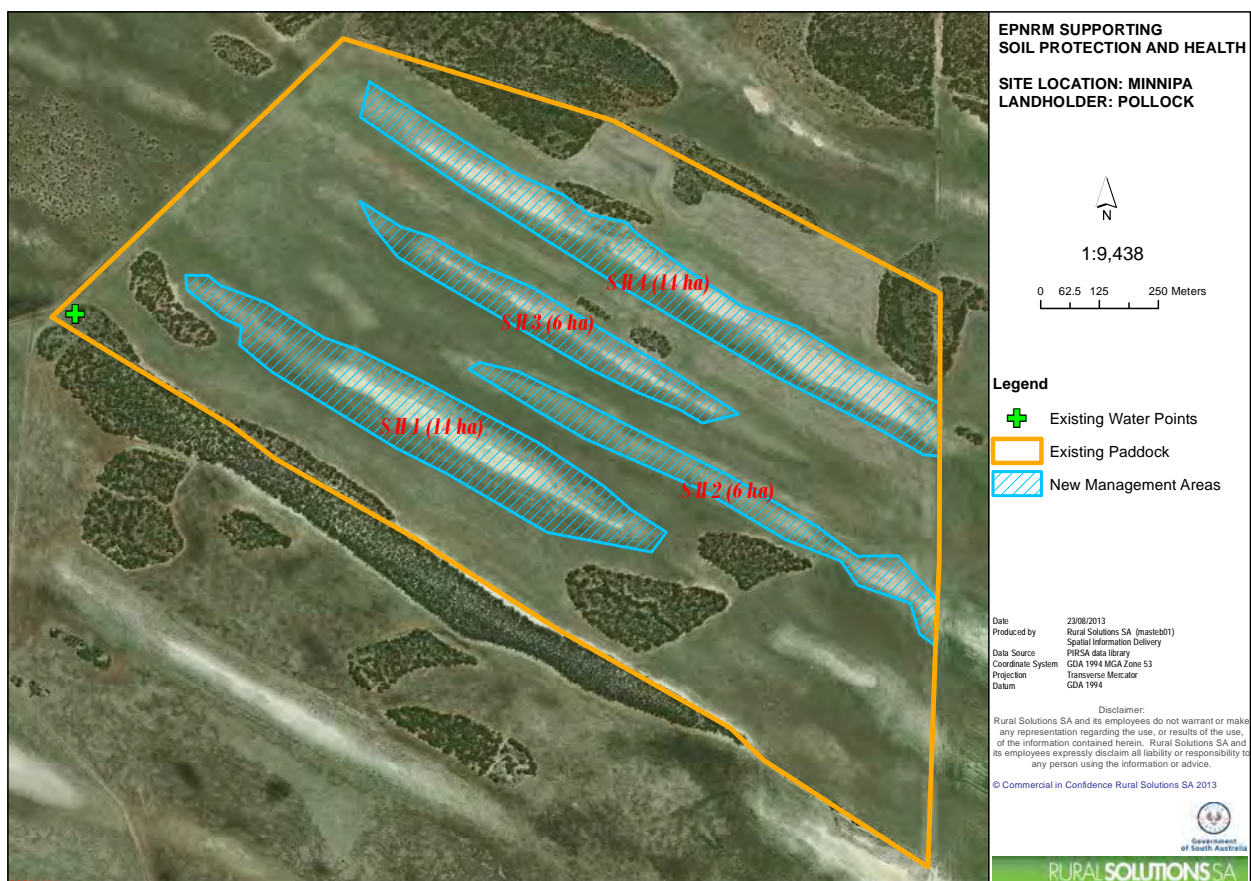


Figure 1. Management areas SH1 to SH4 on Paddock 5



Short and long term benefits

James was concerned that without a change in management the site would continue to erode and become more difficult to manage. This EPNRM Board program enabled James to seek extra assistance and advice. The key outcomes that he was looking to achieve were to; increase surface cover, reduce erosion risk and increase production. He was also looking to increase soil organic carbon levels in the long term.

It was determined that the best way in which these objectives could be achieved was to first fill in the blowouts, reduce tillage, increase nutrition and seed inputs and retain surface cover by carefully managing grazing. James considered that a range of management strategies needed to be implemented including a change in rotations and separately sowing dunes with cereal rye. Using temporary electric fencing to exclude stock and better grazing management, would sustainably increase surface cover on the site and stabilise the dunes.

Approach/Methodology

How and what was done?

Soil testing

Soil samples were taken from the 0-10 cm soil layer at the top of the rise in April 2012 (Table 1).

Analysis of these samples showed that organic carbon figures are low and that phosphorus levels are very low.

Paddock Name	Depth	Organic Carbon %	Cond. EC (1:5) dS/m	pH (CaCl ₂)	pH (H ₂ O)	Calcium Carbonate %	Colwell Pmg/kg	PBI	CDGT mg/L
No 5	0-10	0.69	0.097	6.9	7.5	0.30	7	2	24.6

Table 1. Results of soil analysis April 2012

Site levelling

After a site visit by farming systems consultants, a three year management plan for the site was drawn up. It was recommended that the blow holes in the drifted areas be leveled and the site initially be sown with cereal rye in 2012 to quickly establish adequate surface cover for wind erosion protection.

The blowouts at SH1 and SH4 were filled in by dragging a grader blade along the direction of the dune. This took between 12 and 14 hours to complete. Enough soil was shifted from the higher areas of the dunes to fill in blowholes 0.6 to 1.2 m deep. The whole site was then cultivated to create water harvesting furrows.

Crop Establishment

Following the leveling of these blowouts, the sandhills were subsequently sown to cereal rye into a damp soil profile in mid-June using an airseeder at 15 cm row spacings. James trialed a number of different sowing methods and seeding rates to see which gave the best plant establishment.

The Western end of SH1 was sown to Cereal Rye in a cross hatch pattern (sowing first in one direction and then again across the original direction of sowing) at a total seeding rate of 180 kg/ha. The remainder of this dune and sandhills SH2 – SH4 were sown in a single direction at 85 kg/ha of Cereal Rye and the flats sown to wheat at 85 kg/ha. All areas had 50-60 kg/ha of DAP fertiliser applied at seeding.

Sandhill SH1 also received an extra fertiliser application of 30 kg/ha of Sulphate of Ammonia (+ Zinc and Manganese) as a foliar spray in August.

This cross hatch sowing technique resulted in visually, better crop growth compared to the other sown dune.

Very little rainfall was received after August and although the cereal rye grew a large amount of biomass (above the height of the ute bonnet) the paddock only achieved on average a yield of 0.8 t/ha of cereal rye on the dunes and 0.5 t/ha of wheat on the flats. James trialed harvesting the crop at different heights, with and without chaff spreaders to see what impact this would have on protection from wind erosion. SH1 was harvested at 40 cm height using chaff spreaders. SH2 and SH3 were harvested at 20 cm height; however the chaff spreaders were removed on SH3. On SH4 the crop was harvested at 40 cm height with no chaff spreaders.



The tall growth habit of cereal rye provides excellent surface cover for erosion protection in both spring and summer.



Higher harvested stubble.

Grazing Management

Sheep were turned onto the paddock stubbles immediately after harvesting. James opened the gate between paddocks and had up to 800 ewes grazing on 320 ha over summer. The sheep very quickly utilised the wheat stubble on the rest of the paddocks. They then started to explore the rye stubble as a second preference and grazed on a green pick of volunteer rye following summer rainfall events.

When the sheep started to graze in the rye area the high erosion risk land of SH1 was fenced off using electric fencing. The electric fence consisted of corner posts with a three wire (two hot wires and one earth) permanent fence along either side of the dune. The permanent fencing follows his A/B lines being wide enough to allow sowing in between. The electricity for the fence is supplied by a solar electric unit with a 12v battery. James also added a drum of water next to the unit with a slow drip onto soil around the earth stake to provide enough soil moisture to maintain the electrical current in the fence.

With the corner posts and permanent (side) fences in place, an electrical wire can be run between the ends of the fences to manage grazing or cropping operations. At any time stock can be excluded from these types of areas quickly and economically with the use of temporary electric fencing, a simple and effective management tool.

Results

Using the grader blade to fill in the blow holes, then cultivating the site to create water harvesting furrows was effective in controlling the erosion. The area is now level with no sign of the blowouts remaining. The cross hatch sowing proved to be the best method for quickly establishing surface cover. James commented that "there was a marked difference in wind erosion protection between the cross hatched treatments and the other single direction treatments, with a sufficiently dense germination and early crop growth to ensure that the sand hills became quickly stabilised".

James noted that harvesting higher (40cm) resulted in better erosion protection by the rye stubble and the use of chaff spreaders resulted in increased surface cover in the crop rows.

It was observed that prior to the use of the electric fencing the sheep spent a lot of time in the scrub next to the watering point causing some damage to the native vegetation. Electric fencing enabled James to change stock movement patterns and prevent them from walking over the dunes to graze the wheat stubble in the flats. This provided an effective way of allowing the stubble feed in the paddock to be utilised without exposing the high risk soils to erosion.



Challenges and Lessons Learnt.

The first issue that James identified was that when filling in the blowholes he should have worked both along and across the dune rather than just along the dune to ensure that the whole site was level.

He also said that the time of seeding was not ideal as although the seedbed was wet, cooler conditions in late June slowed germination and early crop vigour. He has trialed dry sowing in 2013 to see what difference this will make on early crop establishment.

What would you do differently next time?

2013 management actions

James decided that due to time constraints with the seeding program over the rest of the property he would rather sow the paddock dry than sow it last into a cold seedbed. James also stone rolled the bad areas of stone on the flats before sowing. The paddock was again sown in April 2013 by broadcasting the seed (barley on flats and cereal rye on dune) on the surface at around 120-130 kg/ha. The paddock was then prickled to incorporate the seed into the top soil. Although the prickle chain operation was light enough so that it still left some standing residues James left a 2 ha area on SH4 which he did not prickle chain as a trial site. The aim of this was to see whether he would get good crop germination simply from stock trampling the seed into the ground. This would allow him to reduce soil disturbance at seeding and retain standing stubble at the surface for wind erosion protection.

Due to the increased protection offered by rye stubble compared to wheat stubble James decided to sow cereal rye further down the slope on the dunes outside the electric fencing that he erected in 2012.

In 2014 James will sow the paddock to oats or barley and under sow with medic on the dunes.

Conclusions/Recommendations

What was achieved?

The key take home messages that James has identified from this site are; that planning is the key component of managing these areas effectively. James states that

“You need a vision! Although the plan for this site is a long term proposition (3-5 years), the management actions are broken into manageable chunks”.

When filling in blowholes on sand dunes James encourages landholders to ensure that they take the time required to level the site properly.

James observed reduced crop germination where the seed was not incorporated into the soil using the prickle chain. He considers that in order to establish cover for erosion protection on sandy soils, seed should be sown at a high rate (greater than 100 kg/ha) into a damp seedbed. He also noted the benefits in sowing in a cross hatched pattern. This provided extra erosion protection by increasing the surface cover percentage.

From his observations, James recommends harvesting crops as high as possible to provide better for wind erosion protection over summer. He states that careful stock management is critical to maintaining appropriate levels of surface cover for erosion protection. Management of the high risk dunes needs to begin immediately after harvest and stock should be excluded from grazing these areas using temporary electric fencing. Where stubbles are being grazed, surface cover levels should be monitored and stock removed well before they reach critical levels for erosion protection.

Future potential benefits

In the long term James wants to manage the site according to soil type by fencing off SH4. He would also like to retain as much stubble on these high risk areas as possible. Using minimum tillage methods to sow crops will reduce the amount of soil disturbance and reduce the risk of wind erosion. The increase in organic matter will in time improve soil health.

References/Acknowledgements

Acknowledging the work of the land manager James Pollock, Natural Resources Eyre Peninsula officers, Minnipa Ag Centre and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Addressing water logging issues to increase production

SITE INFORMATION

Landholder: Scott and Evan Siviour

Location: Wangary

Rainfall: 500 mm

Site description

Scott farms with bother Evan and parents Maurice and Lyn Siviour.

Enterprises

Cropping: 2,200 Ha Cropping area with rotations of Wheat/ Canola/Lupins (includes share farmed areas)

Livestock: 500 Merinos and white Suffolk lambs

Soil Type: The soil profile can be generally classified as light sandy clay loam topsoil with a lightly bleached A2 horizon over ironstone gravelly B horizon clay.

Support to Address Areas of Low Production

Waterlogged soils were impacting on cropping yields and increasing the risk of crop failure on the property of Scott and Evan Siviour. The brothers decided to participate in the "Future Farm Landscapes" project to put together a plan to address their waterlogging issues and return these areas back into successful cropping production.

"Our property is surrounded by a range and where the land flattens out the water doesn't run off," Scott said. "We have cropped these low production areas in the past with little success. Wheat crops in other parts of the farm would go 4-5 tonne per hectare yet these poorer areas yielded one tonne. We knew we had to do something, but didn't really know what."

The Future Farm Landscapes program enables producers to map their property based on production zones and the level of risk associated with those defined areas. Producers then develop an action plan for managing any production constraints for these different management zones with support from technical experts.



One of the many areas on Siviour's property where water logging is an issue.

Identifying Low Production Areas

Scott and Evan identified and mapped their property into more than 16 different production areas, identifying those areas with good production to those with particularly poor production. A key production constraint for the property is the potential for waterlogging. A number of areas on the property have poorly structured dispersive clay subsoils which limit drainage, resulting in reduced crop growth.

The south eastern end of the property is a natural discharge zone and combined with other shallow water courses that run through the property production is limited in these areas.

"Initially I didn't think I would get much out of the planning session in Future Farm Landscapes, but I soon realised it was the most important part," Scott said. "Our plan changed quite considerably many times, but it was good to work through various scenarios to see what would best suit our property." This session enabled Scott and Evan to develop a "next generation" plan with short and long term actions and identified gaps where further research and trials were needed.

Finding Solutions

Scott and Evan soon realised that one solution would not fix all of their issues and devised an action plan to address each low production area differently. The brother's identified three main areas of action; wet non cropping areas, returning wet areas back to cropping and creating open drainage.

"I was always thinking of sub surface drainage but after speaking with a few people, I have now ruled it out as it just isn't suitable here," Scott said. "Different areas will need different approaches to bring it back to productive land. Some areas require deep ripping mixed with gypsum, other areas will be planted with trees."

Wet areas that have been identified as no longer suited to cropping will be planted to a permanent pasture mix and fenced with the aim of establishing a cell grazing system for sheep during winter. Scott and Evan currently run 500 Merino ewes, but with the increased area under permanent pasture, they intend to more than triple their stock numbers to over 2000 sheep. This will substantially lift productivity from these areas.

"We did look at a scenario of turning the whole farm to livestock, but completely converting our system from mixed enterprises to just sheep would be too labour intensive," said Scott.

Taking Action

A demonstration site has been established on the Siviour's property to assess if current water logged areas can be ameliorated through deep ripping and incorporation of organic matter and/or gypsum.

Ten tonne per hectare of pea straw was incorporated into the A and B soil horizons to improve soil structure and increase fertility of the soil profile. Dry matter cuts were taken from the site to assess the value of the residual stubble. A Dominator (DMR) deep-ripping plough was used to incorporate the organic matter.

The gypsum treatment areas were also ripped using the DMR plough and the equivalent of five tonne per hectare of gypsum applied. The application of gypsum will aid in improving soil structure through stabilisation of the dispersive clay subsoils.

"If the deep ripping is successful then we will look at other areas on our property that may benefit from ripping," Scott said.

The outcome of the demonstration will determine if Scott and Evan continue to crop these areas, or establish perennial pasture to assist in controlling the waterlogging issues and support a further increase in sheep numbers.

An open drain will be established in the remaining low production area. This area has a slope which would allow it to drain into a natural swampland. It is hoped that this area could be returned to continuous cropping.

"We realise now we need a mix of both sheep and cropping to be financially viable," Scott said. "We also are moving from minimum till to zero till during cropping. This will help us to retain more carbon in the soil which benefits us through improved soil structure, better organic matter and also a healthier soil system."

References/Acknowledgements

Acknowledging the work of the landholders Scott, Evan, Maurice and Lyn Siviour and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Watercourse running through the property.



Utilising feed in large paddocks

SITE INFORMATION

Landholder: Myles and Kylie Tomney

Location: Streaky Bay

Rainfall: 300 mm

Site Description

Myles and Kylie Tomney are partners in a 7,900 ha arable family cropping and grazing farming enterprise located in the Cungea and Chandada districts.

The key soil types on this property are grey calcareous soils (highly calcareous gradational sand to sandy loam) and calcareous mallee loams (calcareous sandy loam on clay). The high levels of carbonate in these soils result in very low nutrient availability, particularly phosphorus and trace elements.

The management area consists of two separate sites. The first site (S1) is an area of 141 ha, consisting of two adjoining paddocks: The south-western Paddock 53 (87 ha) is mostly lighter textured whilst the north western Paddock 49 (54 ha) contains a mixture of the two soil types. Paddock 49 also contains a rocky outcrop with some remnant vegetation in the north east corner.

The second management area (S2) is a separate large paddock totaling 283 ha. It encompasses a range of soil landscape units and contains two watering points.

Aim and objective

The purpose of the demonstration

The sites have previously been cropped on a two year rotation, with oats being sown for grazing in the alternate year. However, it has been difficult to manage grazing on such a large area and across different soil types to get the best feed utilisation and protect soils from wind erosion.

Myles was concerned that with such large paddocks he was not able to effectively utilise the feed on offer. Stock can waste a lot of feed walking back and forth to a water point. He was also concerned that some parts of the paddock which were grazed unevenly were on lighter textured soils, therefore prone to wind erosion. Myles wanted to demonstrate that by fencing to soil

types, using temporary electric fencing and installing an extra watering point, the cropping and grazing activities on the two paddocks could be managed more appropriately. He also recognised that the different soil types in the paddocks require different management to increase productivity and sustainability. Consequently he separated the two soil types into different management units to allow them to be managed more appropriately.

Approach/Methodology

How and what was done?

In 2011 paddocks 49 and 53 consisted of a sown oat crop originally to be harvested for grain. Myles grazed Merino weaner lambs on the paddock during winter and then took them out in spring to let the crop set seed. Paddock 53 was harvested in December whilst Paddock 49 was grazed as a standing crop by 200 wether lambs. During autumn these were sold and dressed at an average of 21 kg.

In 2012 Myles removed the northern fence between paddock 49 and a paddock sown to wheat. A temporary electric fence was initially used to contain the sheep until he put up a new fence. Myles encountered issues with some lambs testing the fence and getting out, but they soon learnt to stay on the right side of the fence.

Good rains in April 2012 enabled good crop germination. However, there was little rain in May and although June received 50 mm of rain, July and August rainfall totals were below average. The winter was also cold with frequent frosts so the growth was slow.

Paddock 53 and 49 were continually stocked with between 250 and 560 cross bred lambs or wether lambs through winter and spring. Myles used three feeders in the paddock feeding a ration of oats and barley. Due to the slow growth of the volunteer oats Myles did not use the temporary electric fence to subdivide this paddock. However, he utilised the electric fencing following harvest on Site 2 (a 283 ha failed oat crop). This paddock had been sown with Potaroo oats at 55 kg/ha with 40 kg/ha DAP. However, due to a very dry winter and spring, the crop was too short to reap and crop yields would have been less than 0.5 t/ha.

Myles used a solar powered electric fencing unit to split the paddock into four smaller 70 ha areas. The sheep were watered with a portable trough which was filled



from a tanker. A 50mm hose with a camlock fitting was used to allow the trough to fill in one minute.

Myles moved 900 spring drop merino lambs onto the first 70 ha section on the 5th January 2013 and grazed them for three weeks at a stocking rate of 13 DSE/ha. At the end of January the first fence was moved and another 300 lambs added.

In February the lambs were grazing on 140 ha and the watering point was moved into the un-grazed oats on a stone ridge.

Lambs were giving the electric fence a hard time walking straight through. Due to the dry ground and poor earthing of the energizer, the electric fence was not strong enough shock though the lamb's wool and was insulating the zap.

In late February the temporary fence was removed giving the sheep access to the entire paddock. The water trough and tanker were moved at this time to the un-grazed section of the paddock in order to encourage even grazing. During this time no supplementary feeding was needed.

Following 25 mm rainfall the sheep were removed on 12th March 2013. The lambs had started scouring from eating onion weed and lost condition quickly. The paddock still had over 30 grains of oats per square metre. In early May the paddock was split into two and Myles re-introduced the ewes and lambs back into the paddock as the early rain had resulted in an increased germination of self-sown oats. Myles intends to rotate the mob between the two paddocks over the winter and spring.



By moving the water trough and tanker into the un-grazed zone Myles was able to improve feed utilisation.

Results/Successes

Myles found that the use of temporary electric fencing on this site provided him with a cost effective and flexible tool which allowed him to manage grazing on the paddocks to utilise the feed on offer and to manage uneven grazing. By subdividing the large paddock into four smaller paddocks he was able to utilise the entire failed crop through grazing. Myles did not have to supplementary feed 1200 merino lambs from January through to March, saving him a great deal of time and money. He stated that using this tool gave him an extra month of feed for his stock.

Myles recognised the importance of good watering points to enable adequate feed utilisation and to reduce the potential for wind erosion by reducing the amount of stock tracking over high risk soils. By moving the water trough and tanker into the un-grazed zone Myles was able to improve feed utilisation. It also gave the sheep access to the water that they require to return to grazing without baring the area around the water trough out.

Challenges and Lessons Learnt

What problems were encountered?

As this was the first time Myles had grazed a large mob in a cell grazing situation over summer, he came across a few challenges.

Firstly he needed to recognise that the onion weed that lambs were grazing on was causing them to scour; and so he removed them from the paddock. He considers that it is vital to monitor stock condition so they can be moved when conditions change (particularly lambs). In future he would add additional water points in the paddock. Myles also encountered some problems with a lack of current in the electric fencing system. He discovered that without a high enough current the sheep did not respect the electric fence to remain in the defined area. Current flows from the energizer (source) through the fence then through an animal and through the ground. Where the soil is too dry the earth often cannot conduct enough current to deliver an effective shock. Myles spent some time trouble shooting to solve the problem, which he realised was due to a lack of moisture around the earth stake and the fact that the lambs were woolly and therefore, insulated from the shock.

When the watering points are shifted the whole mob of lambs need to be driven to the new trough position to ensure that they know that they do not have to track back to the original water point.



What would you do differently next time?

In order to address the low electrical current Myles needs to ensure that the soil around the earth stake remains moist to overcome the poor earthing issue. One way of doing this may be to set up a water drum with a slow dripper to deliver water to the soil near the stake. In future he would train the lambs to get used to the electric fences prior to putting them in the paddock. Myles also considered that he would ideally have additional water points in the paddock to encourage even grazing and reduce stock traffic across high erosion risk areas.

In order to encourage good early development of volunteer cereals and improve production in paddocks, Myles considers that he would in future apply a low rate of fertilizer (up to 10 kg/ha of urea) to these paddocks.

Conclusions/ Recommendations

The key benefit of this trial was using electric fencing to divide larger areas into grazing cells allowing growers to achieve more even grazing on the paddock and utilising more of the feed on offer. As well as the improved feed utilisation, this system of grazing can be used to manage feed reserves over summer and protect soils that are at risk from wind erosion by excluding stock.

Myles considers that adequate fertiliser is vital to ensuring that grazing cereals get a good start and continue to produce through the season.

The temporary electric fence system is run by a solar system. Selecting the right energizer for the system is very important as the energizer is the heart of the operation. When choosing an energizer take into account not only the length of fencing but the type of vegetation expected to contact the fence, number of internal wires, and types of animals to be contained. Investing in a larger system will give more flexibility and allow for future planning and expansion.

Myles would also encourage growers to train stock that are going to be put into an area contained by electric fencing. He says that "if you get them used to the electric fencing and show them where the watering points are you have a better chance of them staying where they are supposed to be and utilising the feed properly".

Take time and effort to build a decent earthing system for the fence as it will work much better as a result. Earth stakes must be as conductive as possible for the fence to give the animal an effective shock. Consider using an earth return system when farming in dry conditions, sandy and dry soil need more earth stakes to improve the earthing ability of the fence. Use galvanized earth stakes as rusty or corroded stakes will not work. It may be necessary to water the earthing system particularly with low sub soil moisture.

Good water flow is vital to ensure that sheep do not camp around troughs. Place of troughs in stony areas to reduce erosion potential. As the trough was being moved as each cell was opened up there was less risk of baring out the paddock.

Future potential benefits.

Realigning the fences on Paddock 49 and 53 to soil types will enable Myles to make better management decisions related to the productivity and limitations of each soil type.

References/Acknowledgements

Acknowledging the work of the land manager Myles and Kylie Tomney, Natural Resources Eyre Peninsula officers, Minnipa Ag Centre and Rural Solutions SA consultants in producing and implementing a management plan for the site.



Managing land classes for better feed utilisation

SITE INFORMATION

Landholder: Rob Walsh

Location: Cowell

Rainfall: 280 mm

Site Description

This site is an 830 ha (724 ha arable) paddock located on Robert Walsh's property at Midgee, north of Cowell.

The site consists of round granite hills with heavy red soils (light sandy clay loams over dispersive red clays) intersected by parallel siliceous sand ridges. The sandy soils have low inherent fertility, are water repellent at the surface and are highly susceptible to wind erosion. The remaining 106 ha consists of mallee vegetation on granite outcrops.

Aim and Objective

The purpose of the demonstration

Rob's heavier soils tend to be hard setting and can become compacted with heavy stocking rates and the light textured rises have a very high erosion risk. This means that the Rob has only been able to graze this area for short periods of time before the heavier soils become bared off and the sandier soils are exposed to a risk of wind erosion. The paddock currently contains two watering points.

Rob wanted to increase soil cover for erosion protection on the site by fencing off the sandy rises to help manage grazing and establishing an appropriate perennial pasture. He considered that the best way in which to do this would be to fence off 220 ha of the deep sand dune system, and establish a new water point. Due to the high risk of unfavorable conditions for pasture establishment on this site, Rob decided to establish perennial veldt grass over a two year period.

The paddock had been planted to wheat in 2010 and was left as a ley pasture paddock with summer weeds dominating during 2011. Rob would like to intensify his grazing on the site (he runs 2000 sheep).

Approach/Methodology

What was done?

Following rain in March 2012, Rob used a Kelly chain to pull out the woody summer weeds, he also applied glyphosate at 1 L/ha to control herbaceous summer weeds to prepare the paddock for seeding.

In June, he sowed half of the paddock with a mixture of Bevy Cereal Rye (20 kg/ha) and veldt grass (2 kg/ha) at 22.5 cm row spacings with 40 kg/ha of 18:20 fertiliser using a disc air-seeder and press wheels. The remainder of the paddock was sown to 60 kg/ha wheat with 55 kg/ha of 18:20. Winter rainfall only totaled 150 mm prior to August and there was no rain received in a six weeks period from August. Despite the low rainfall the cereal rye and wheat grew very well. However there was a very poor germination of veldt grass and the lack of rain combined with moisture competition from the cereal rye, resulted in poor growth.

At harvest the wheat yield averaged 1.1 t/ha, and despite the low cereal rye seeding rate, it yielded around 0.6 t/ha (64 t of which Rob was able to sell for \$282/t). Rob hoped that summer rains would result in a secondary germination of veldt grass; however, this did not occur.

In October 2012, Rob fenced the site into two paddocks (north and south paddocks) and excluded the remnant vegetation using nine kilometres of five line cyclone fence. The native vegetation on Rob's property includes native pine and provides important habitat for malleefowl, acting as corridors between the larger patches of native vegetation.



One of the holding tanks required for a new trough.



Results/Successes

Using a Kelly chain to pull out the woody summer weeds was effective in preparing the site for pasture establishment. As the soil was moist at the time of cultivation with the Kelly chain, it did not result in an excessive risk for wind erosion. The glyphosate knockdown spray prior to seeding also gave excellent weed control and enabled Rob to sow into a clean moist seedbed.

Sowing the site with a disc seeder further minimised soil disturbance, reducing the risk of wind erosion, and the use of press wheel firmed the seedbed and created moisture harvesting furrows.

Despite competition for moisture from the cereal rye Rob was surprised at just how much veldt grass had survived. However, this was mostly in the areas that only had a low density of cereal rye. The plants that were present were only very small and had suffered obvious moisture stress.

The following rain in autumn 2013 produced an excellent germination of clover across the paddock as well as some wild turnip, brome grass and a low density of volunteer cereals. Rob grazed the paddock lightly in June 2013 with 500 sheep. He was considering spraying the paddock with a light rate of glyphosate to reduce the level of competition by the annual weeds for light and moisture and to assist any surviving veldt grass.

Challenges and Lessons Learnt

What problems were encountered?

The main problem that Rob had with the site was getting a good establishment of perennial veldt grass. Although the cereal rye provided good protection for the soil against wind erosion, it was highly competitive and Rob noticed that where the cereal rye was the thickest, there was little or no veldt grass. Dry conditions from August until the end of summer also impacted upon the establishment of the veldt grass pasture, accentuated by the moisture competition from the cereal cover crop.

Rob stated that "Sowing the paddock with a low rate of cereal rye made the crop easy to harvest with less harvester blockages than I have previously experienced when growing cereal rye". However, he said that "trying to find a market for the rye grain was difficult and takes a lot of time, and eventually found a market in Sydney".

Another problem encountered was the need to use a larger pressure pump to pump water eight kilometres to supply the tank and trough with the recommended flow rate of 1-1.5 L/second. The cost associated with lost water from burst pipes and replacing pipe with a higher pressure rating would have been better spent on header tanks and/or additional pumps near the troughs.

What will you do differently?

Rob recognised that actively growing cereal rye competed vigorously with the veldt grass for moisture. In future Rob would look to sow veldt grass into standing stubble, or if there is no stubble on the paddock, only sow the cover crop with a very light seeding rate (10 kg/ha) so the paddock is protected from wind erosion without the competition for moisture during the veldt grass establishment.

Although it was difficult for Rob to find a market for the rye grain he said that there are few other sowing options available on the deep sands. He wonders if wheat would provide the same protection from wind erosion without the same level of competition with the veldt grass for moisture.

As the paddock has a reasonable fall, Rob considers that in future to minimise the need for high pressure pipes he would place a 20,000 litre header tank in the paddock at the top of a rise. This could be filled using a lower pressure pump and then gravity feed (6 m fall) into the trough. If this system did not supply an adequate flow rate, Rob would supplement the gravity feed with a low pressure solar pump attached at the tank. He considers that such a system would fulfill his requirements for less than the cost of replacing pipes.



Before and after Cereal Rye providing excellent ground cover for protecting wind erosion prone sites.

Conclusions/Recommendations

The key recommendation that Rob wanted to make from this site, was for growers to be aware of the amount that cover crops can compete with available moisture when establishing perennial pastures. Perennial pastures are very slow to establish compared to annual cereal crops. By sowing perennial pastures into standing crop residues, growers can ensure that the paddock is adequately protected from wind erosion while eliminating the competition for moisture from the cover crop.

Rob states that “perennial veldt grass seed is cheap and readily available.” He suggests “shopping around to get the best price you can on seed”.

The other key recommendation is to plan the watering point setup appropriate for your site. The recommended 1-1.5 L/seconds flow rate for water troughs in rotational grazing systems may be able to be achieved using gravity fed header tanks.

Future potential benefits

By fencing the large paddock into smaller management zones and establishing new watering points within each paddock, Rob has an opportunity to better manage grazing for increased feed utilisation and to protect soil against wind erosion. If he can get a good establishment of perennial veldt grass on the site, it will provide good surface cover for wind erosion protection over summer and establish the paddock as a productive permanent pasture.

References/Acknowledgements

Acknowledging the work of the land manager Rob Walsh, Natural Resources Eyre Peninsula officers and Rural Solutions SA consultants in producing and implementing a management plan for the site.





Enrich - Shrub-based grazing systems for low-medium rainfall zones

SITE INFORMATION

Landholder: Scott Williams

Location: Elbow Hill

Rainfall: 300 mm

Property Size: 2024 ha

Site Description

Surface cover has always been an issue in the more marginal areas of Eyre Peninsula and particularly at Elbow Hill. The aim of this project was to increase the productivity of areas that were continually suffering during the dry years and affecting the escalation of salt induced magnesia soils where little will grow.

Surface cover is vital to reduce the impact of magnesia soils which are caused through the evaporation of moisture from the soil, creating a wicking effect and bringing the salts to the surface. These areas become more noticeable and wider spread in the drier years. They can be minimised through increasing ground cover and shading to keep the soil cooler during the summer period.

Aims and Objectives

Farming properties in these marginal cropping areas are in need of good quality stock fodder reserves that can sustain surface cover during the crucial summer period.

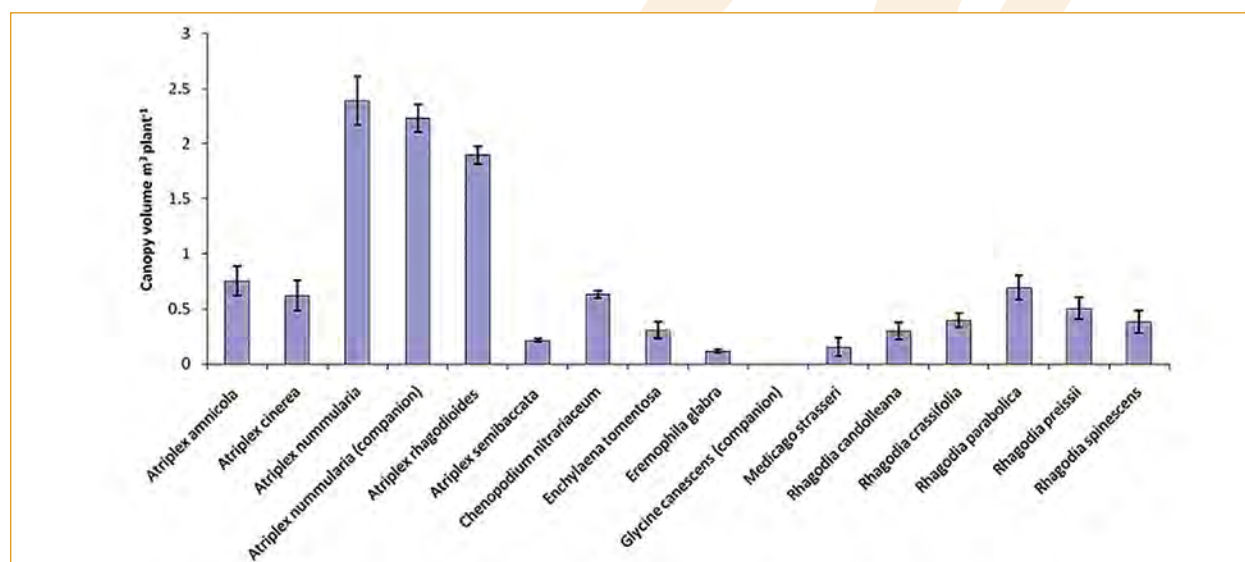
Woody perennial grazing systems are an alternative option to fill the feed gap on these more marginal soil types. They also offer the potential to move sheep into smaller areas of perennial shrub systems at high stocking rates, thus resting paddocks during the break of the season and allowing valuable paddock feed to establish and maintain surface cover.

Approach/Methodology

What was it done

In 2008 the Future Farm Industries CRC (FFICRC) and Eyre Peninsula Natural Resources Management Board (EPNRM) established a trial site of native shrubs; these were selected from a potential of 50 being trialled at Monarto SA. From these trials, Jason Emms, SARDI research officer for FFICRC, selected 15 mainly native perennial shrubs. These were established on a 1 hectare site, divided into four replicated plots of 15 species x 36 plants each at Elbow Hill south of Cowell.

The shrubs' biomass, grazing preference and recovery have been monitored during autumn and spring each year since establishment.



Average production (expressed as canopy volume) of the perennial forage species at Elbow Hill in April 2011.



From the research and observations of the initial small trial plot, four of the better performing varieties were selected and established in 2010 into a larger trial site of four hectares.

Whilst the Eastern Eyre Peninsula has had significantly below average rainfall since establishment of the shrubs in 2008, there has been good survival (up to 80%) and significant inter-row ground cover establishment due to the timing and extent of grazing pressure. Shrub growth has varied, with species ranging from over a 1m in height to stunted 20 mm plants, as indicated by canopy volume. Grazing of the shrubs at high a stocking pressure of 80-120 DSE/ha has occurred each autumn since 2009 until the majority of leaf material was consumed. During this period, grazing habits and shrub survival were monitored.



Trial site being grazed.

Conclusions/Recommendations

What was achieved?

Whilst some of the saltbush varieties were left until last in the first grazed plot 1, by the time they entered plot 4, the shrubs were grazed more evenly, indicating that the sheep had become more accustomed to the each variety over time.

The larger trial site was split in two areas (2 ha each) and grazed over a 10 week period as per the small plots at a grazing pressure of 40 DSE/ha.

In 2012 sheep condition/bodyweight were monitored at intervals during the trial grazing period and compared to a control paddock mob. Sheep initially gained weight in each of the 2 ha and small trial plots. This was mainly due to consumption of the inter-row before progressing onto the shrubs. Sheep in the shrub trials were subjected to long periods of grazing pressure on shrubs only, which most likely led to a decline in weight compared to the control mob out in the paddock. However, most of the stock at least maintained their initial weight by the end of the 10 week trial even though at times some weight loss was evident during the trial period.

Forage shrubs do provide an option for the non-productive cropping soils in Eyre Peninsula's mixed farming systems, however, identifying the best mix of shrubs that suit differing soil types along with inter-row species requires further investigation. By selective grazing, and using inter-row species such as native and annual grasses and medics, these trials at Elbow Hill have demonstrated that soil cover is able to be maintained on these dry saline magnesias soils.

Challenges and Lessons Learnt

Scott said "I have been encouraged by the growth of the perennial shrubs and the ground cover now in the trial sites, changing the management of these sites through fencing these areas off and locking up for a long time has encouraged the ground cover to return on these often bare dry saline magnesias soils."

Scott also indicated that the direction of the prevailing winds needs to be considered to overcome wind erosion when there is little inter-row ground cover.

While dry saline magnesias sites affected soil within paddocks is often only a portion of the whole paddock area, livestock always camp on these areas, baring them out and escalating the issue. Therefore, managing these sites is a challenge. Scott is still trying work out the practicalities of these forage shrubs and how he will adapt these shrubs into his whole farming system. He has also noticed an increase in water consumption when livestock are grazing these systems and that plenty of good quality water is essential for optimum utilization of these fodder shrubs that are high in salt.

With the development of this and further sites across Eyre Peninsula, future research into direct seeding (a more cost effective option), inter-row species and block/alley shrub designs; may overcome some of the challenges.

While shrubs are not the complete answer and livestock require a balanced diet; the outcomes from this demonstration site along with other "best practice" land management has the potential to increase productivity and soil cover on some of EP's more vulnerable soils.

References/Acknowledgements

Acknowledging the work of the landholder Scott and Greg Williams, Natural Resources Eyre Peninsula officers and SARDI for their contribution with technical support to this site.



Grazing barley an option for early livestock feed

SITE INFORMATION

Landholder: Dion and Bert Woolford

Location: Kimba

Rainfall: 300 mm

Site description

Through the Eyre Peninsula Grain and Graze project and Sheep Connect SA, six sheep groups have been established on Eyre Peninsula to discuss and improve sheep enterprises, as part of mixed farming businesses. The sheep groups meet three to four times per year, with an initial session to discuss the group's main focus. This is followed by a benchmarking session to discuss the previous year's results and opportunities for improvement. They also run additional sessions, either in the field or as a workshop, to discuss practical aspects of managing sheep in a mixed farming business.



Father and son Bert and Dion Woolford are active members of the Buckleboo Sheep Group on upper Eyre Peninsula. Dion is the fourth generation on their mixed cropping and livestock family farm. Dion and his parents Barb and Bert are assisted with their farming enterprise by three skilled workmen (one full time and two part time).

Location:	Two blocks:
	"Karawatha" Buckleboo, 40 km NW of Kimba
	"The Soaks" 25 km S of Kimba
Annual Rainfall (mm):	300 mm @ Karawatha, 350 mm @ The Soaks
Growing season rainfall (mm):	200 mm @ Karawatha, 250 mm @ The Soaks
Soil type:	Karawatha: From heavy red flats to loam on the rising ground
	The Soaks: Everything else
Livestock enterprise:	Karawatha Park Merino and Poll Merino Stud
	2,000 ewe self-replacing flock
Crops:	3-3,500 ha wheat and barley
Pastures:	Barley and vetch at Karawatha and lucerne (on white sand) at The Soaks.

Approach/Methodology

How and what was done?

Dion returned to the family farm in 2009, following three consecutive years of drought. As a consequence of this extended drought, their pasture was compromised as very little medic seed set occurred. Like many others in the district to overcome this feed shortage, they planted a couple of paddocks to barley to maintain ground cover and produce early valuable livestock feed.

"Almost every year we need to hand-feed sheep, so lessening this autumn feed gap was a priority," he said.

Attending the Buckleboo Sheep Group Benchmarking meetings really highlighted a positive correlation between the highest performing producers, high returns per DSE winter grazed hectares and how much feed was sown. This workshop demonstrated that a couple of producers were out-performing the rest because they were regularly sowing early feed. Therefore, the Woolford's decided to plant cereals for early fodder production to benefit livestock productivity.

Dion said “it was as simple as filling both boxes up on the air seeder cart and going for it! We already had the machinery and 40 kg/ha of barley goes a long way.” “We now regularly plant approximately 300 ha of barley solely for grazing.”

The costs for this practice were; labour, fuel (3-5 L/ha depending on soil type), 40 kg/ha of barley and depreciation, however, these costs are minimal compared to the potential returns per head of livestock. Dion also has the option in the wetter years and/or when they have ample fodder reserves, to lock those paddocks up and harvest the grain. Often the grain yields from this process aren’t massive but well and truly worth the effort and expense.

They now use this early seeding as a warm up exercise to identify any issues prior to seeding, and to make sure machinery is working as it should be. Dion said “an added benefit was that some of the machinery cost was offset against the livestock enterprise instead of allocating it all against the cropping side of the business”. This in turn, reduces the input cost of machinery per hectare of crop.

Dion has indicated that it was still too early to say if they have improved with regard to kg/DSE as this is largely dependent on the season; however, they are able to turn the sheep earlier onto higher value green feed after the break of the season. Before this practice, the main feed was mainly sparse barley grass, which took forever to produce enough bulk.

“This practice of sowing early feed basically means we can stop handfeeding sooner,” said Dion.

It has made life easier for both the Woolford’s and their sheep. The livestock can spend more time on these sown feed paddocks at higher stocking rates, allowing other medic pasture paddocks that have been grass freed, time to get away and bulk up before grazing.

In the future, Dion and Bert’s plan is to apply 20 kg/ha of DAP fertiliser with the barley to promote a healthier plant that has the ability to bulk up a bit quicker. This will be an extra cost but the extra dry matter that will be available will cover those costs, with the added benefit of finishing hand feeding even sooner. Plans are also to start using Scope barley (a Clearfield variety), giving them another option with grass control.

Where a history of low protein has been identified, Dion has added to his pasture program one to two paddocks sown to vetch each year. This also helps them to control grasses, protect the medic and is an excellent feed source after desiccation at flowering. Vetch also gives the Woolford’s an option of something that they can plant dry and early in the season which is also very convenient.

Future plans are also to start using Scope Barley (a Clearfield variety) and the new Bozo Barley, when it becomes available. The new “Bozo” variety has the ability to be sprayed with Targa (a group A grass selective herbicide) which might provide alternative options for barley grass control.

Where a history of low protein in crops has been identified, Dion has added to his pasture program one to two paddocks sown to vetch each year. This also helps them to control grasses, protect the medic and is an excellent feed source after desiccation at flowering. Vetch also gives the Woolford’s an option of something that they can plant dry, early in the season which is also very convenient.



Sheep grazing early sown barley.

References/Acknowledgements

Thanks to Dion and the Woolford family for providing information. Thanks to GRDC and Caring for our Country for EP Grain and Graze 2 funds and thanks to AWI and the Natural Resources Eyre Peninsulas Management Board for Sheep Connect SA funds. Thanks to Mary Crawford, Rural Solutions SA for facilitating the Sheep Groups and providing technical support.

Find out more

For more information about the Eyre Peninsula Grain and Graze project, contact Naomi Scholz

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www.minnipaagriculturalcentre.com.au



Technical Information

Understanding your soils and their constraints

Where crop yield is significantly less than the potential yield, the “reasons why” need to be investigated and understood. The PIRSA SoilSmart project funded by Caring for our Country and delivered by Rural Solutions SA works with landholder groups through soil pit field days, workshops and press releases to help landholders better understand their soils, investigate soil constraints and improve production.

Soil sampling and analysis

Excavating soil pits or taking soil cores, combined with simple on-site soil tests and observations can provide useful information about soil characteristics. Laboratory analysis can support these field observations and identify productivity constraints including; effectiveness of phosphorus applications (PBI), inherent fertility and nutrient availability (Organic Carbon, Soil pH and Cation Exchange Capacity) and potential toxicities (Salinity). Soil analysis also provides the current nutrient status of the soil allowing you to calculate the nutrient application required for crop growth.

However different laboratories use different methods for testing nutrient concentrations and can use different units for expressing soil analysis results. Landholders should be aware of the tests that are appropriate for their area and know what the expected range and critical values should be.

Soil samples (at least 15 soil cores from the 0-10 cm layer) should be collected within selected soil types or precision agriculture management zones, avoiding areas that are not representative (including headlands, firebreaks, sheep camps, and old fence lines). These samples should be thoroughly mixed with 300 to 400g of this mixed sample sent for laboratory analysis. If a subsoil constraint is suspected, samples should also be taken from the 10-20 and 20-40 cm layers of the soil profile.

Key Physical Properties of Soils

Texture

Soil texture refers to the percentage of sand, silt and clay particles in the soil. This can be estimated by forming a ball of damp soil in your hand and pressing this between your thumb and finger into a ribbon of soil (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/164615/soil-texture.pdf) (Figure 1).

The higher the clay percentage the longer the ribbon that can be formed, providing a guide to the soil texture class. Sandy soils will not easily form a bolus. Soil texture classes range from sand to heavy clay.

Sandy Soils

Sandy soils hold little water; however the water in this profile is easily accessible by plants. Common issues on sandy soils are poor fertility, water repellence and a high wind erosion risk. Water repellence occurs where waxy residues of broken down plant material coat sand particles resulting in uneven soil wetting. This impacts on crop germination and emergence, which results in reduced yields and increased wind erosion risk. Water repellence is usually found in the top five centimetres of sandy soils. The soil erosion risk can be reduced by maintaining surface cover and reducing soil disturbance (tillage).

Clay Soils

Clay soils have higher nutrient and water storage properties, however heavy clays tend to hold water so tightly that it is difficult for plants to access it. These soils can also be more difficult to work. They can have structural problems that restrict drainage leading to water logging, or can increase the risk of water erosion.

Structure

Soil structure refers to the way soil particles are arranged together. Well-structured soils enable better infiltration of rainfall, drainage and root growth. Poor soil structure can be caused by a lack of organic matter (slaking soils), clay dispersion (sodicity e.g. http://vro.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/sodic_soils) or compaction. Poorly structured soils can be subject to waterlogging, erosion and compaction.

Clay soils with high levels of exchangeable sodium (>6% of exchangeable cations) are structurally unstable and can readily disperse when wet. This can impact paddock workability and seedling emergence and increase the risk of water erosion. To test for dispersion and slaking, place a large crumb of clay distilled water or clean rainwater (not tap water which may contain chemical which may prevent dispersion) without shaking or stirring the sample. Slaking clay will slump and fall apart in the water, forming a small blob of mud on the saucer, but the water will remain clear (Figure 2). Dispersion will result in a milky layer forming around the soil crumb after 30 minutes.



Figure 1. Hand texturing soil samples in the field



Figure 2. Field dispersion of a number of clay samples

Applying gypsum addresses sodicity by replacing sodium ions with calcium ions that hold the clay structure together. However slaking soils often do not respond to gypsum applications, requiring reduced soil disturbance and increased soil organic carbon to improve soil structure. The application of gypsum to saline soils is not recommended as the sodium is unlikely to be displaced under saline conditions.

Soil Colour

Soils which are dark in colour usually contain high organic carbon levels and are often more fertile. Sandy soils can often have a lighter coloured (bleached) layer below the darker organic surface layer, which can indicate leaching of organic matter and nutrients through the profile. Soils with bright colours (particularly red) indicate good aeration and moderately good drainage whilst grey coloured clay soils (sometimes with orange/yellow mottles) indicate poor drainage. Lighter (pale) red or off-white colours down the profile may be related to the presence of soil carbonates (lime) which can reduce the availability of nutrients.

Key Chemical Properties of Soils

Soil pH and Carbonates

Soil pH (the acidity/alkalinity of soil) can provide an indication of nutrient availability and affect the way in which agricultural products react in the soil. Soil pH can be quickly estimated using a field soil pH test kit but a more accurate figure can be acquired by sending a sample for laboratory analysis. When sending samples for laboratory analysis results may come back with two values for soil pH. These are $\text{pH}(\text{H}_2\text{O})$ measured in a 1:5 soil:water solution and $\text{pH}(\text{CaCl}_2)$, where a small amount of calcium chloride has been added to the soil:water solution prior to testing. The addition of calcium chloride to the solution is to reduce the influence of seasonal soil moisture variations on soil pH. As such $\text{pH}(\text{CaCl}_2)$ is a more accurate indication of the "true" pH of the soil and is usually 0.5 to 1.0 unit lower than the $\text{pH}(\text{H}_2\text{O})$ value.

Acidic soils, with pH less than 5.5 (CaCl_2), may have low available levels of magnesium, copper and zinc and may be high in toxic elements such as aluminium. Low soil pH can be addressed through the application of lime (calcium carbonate) to the soil.

Alkaline soils, with pH above 8 (CaCl_2), may indicate the presence of high amounts of calcium carbonate which can reduce the availability of phosphorous, zinc, manganese and copper. Carbonates can be tested for in the field by observing the reaction (fizz) from the application of a weak solution (1:10 dilution of hydrochloric acid) to the soil sample. Highly alkaline soils (pH levels greater than 8.5) indicate the presence of toxic substances such as sodium bicarbonate. Sodium is often associated with boron in soils. Clays with a very high pH can be high in lime, salinity and boron.

Organic Carbon (%)

Organic carbon is an indicator of plant production. It also supports increased production as it provides the food source for soil biology, and aids in improving soil structure, water holding capacity and nutrient retention. High organic carbon levels are generally good, however, can also indicate low levels of biological activity due to acidity or water logging.

Cation Exchange Capacity (CEC)

Cation exchange capacity is a measure of the soils ability to attract, hold and exchange nutrients (usually in the form of positively charged particles called cations). It is associated with the amount and type of clay and organic carbon and to a lesser extent soil pH. Generally, the higher the CEC the higher the potential fertility of the soils and the reduced leaching of nutrients. Very low CEC values ($<5\text{meq}^+/100\text{g}$) are an indication of low inherent fertility and are commonly a characteristic of sandy soils and some acidic soils. However, the presence of salts, gypsum or carbonate (lime) can lead to over estimation of exchangeable cations resulting in CEC values that are higher than in other soils in the same texture class.

Macro and Micronutrients (Major nutrients and Trace Elements)

Plants require 19 chemical elements for adequate plant growth, these are referred to as plant nutrients. Macro nutrients (Nitrogen, Phosphorus, Potassium and Sulphur) are required in higher quantities than micro nutrients (also referred to as trace elements and including Iron, Copper, Zinc, Manganese, Molybdenum). Despite the different quantities of each nutrient required for plant growth, crops will only perform to the potential of their most limiting nutrient.

Soil tests provide information on the levels of each of these elements available in the soil and enable management of fertiliser application to address deficiencies. But, the status of some nutrients is highly variable depending on soil moisture and temperature. Results must be interpreted in relation with other soil data including texture, pH, CEC and the levels of other nutrients as well as paddock history and knowledge of



the production capacity of particular paddocks. If the potential of your soil is limiting due to factors other than nutrition, no amount of fertiliser will lift the yield beyond that potential.

It is strongly recommended that soil test results should be discussed with your agronomic consultant or fertiliser supplier when making decisions based on test results.

Phosphorus

Phosphorus requirements will be based on crop yield, stocking rate, production targets as well as soil phosphorus status. When applied as a granular fertiliser phosphorus dissolves rapidly and is then subject to a range of processes in the soil. These include combining with other soil elements (such as iron and aluminium), adsorption to clay and organic carbon particles and leaching. The Phosphorus Buffering Index (PBI) analysis can support soil phosphorus analyses by providing an indicator of phosphorus "tie up" and leaching potential. Higher PBI levels (greater than 150-200 PBI units) indicate potential for a significant proportion of phosphorus applied to be unavailable to plants, while very low PBI values (below 40 PBI units) indicate that there may be potential for phosphorus to leach (these soils generally have low soil phosphorus levels as well).

Nitrogen

Soil nitrogen figures should be used as a guide only as these can change quickly with changes in soil temperatures and moisture. Nitrate levels less than 5 mg/kg are considered low, however nitrogen applications should be determined by yield expectations, crop type, soil type, rainfall, past and present management factors etc. Deep soil nitrate testing is the preferred testing as nitrate is highly soluble and can be leached deeper into profiles.

Micro Nutrients (Trace Elements)

Soil test interpretation for trace element deficiencies is difficult as critical concentrations vary between soil types and plants. Availability also varies through the season. Provided the growth status of the plant is not significantly constrained by other factors (e.g. low rainfall) plant tissue analysis can be useful in determining trace element deficiencies. Availability of trace elements will vary depending on a range of factors including; carbonate levels, soil texture, and soil moisture.

Soil Toxicities

There are a number of chemical properties that can be detrimental to plant growth. The impact of Dryland Salinity results from salts in rising ground water tables ending up in the soil. This type of soil salinity often results from the clearance of deep rooted perennial vegetation. It can be managed by either using the water in the topsoil

before it reaches the water table (through revegetation or high water use perennial pastures) or lowering the ground water table at the discharge point through improved drainage. Areas which are not influenced by shallow water tables but that have high levels of salt present in the soil profile from historical deposition/regolith weathering are referred to as Dry Saline Land (or "Magnesia patch"). These salts move up and down in the soil profile depending on the level of seasonal rainfall (leaching) and evaporation (capillary rise or "wicking").

Soil salinity can be measured using a salinity meter and a soil-water mixture of 1 part soil to 5 parts water. The electrical conductivity (EC) of the 1:5 soil/water suspensions is measured (dS/m). The reading is then multiplied by a texture based conversion factor to give an estimate of electrical conductivity (ECe). Where ECe is less than 4 dS/m yields will be impacted only on sensitive crops. ECe values above 4 dS/m will affect the yield of many crop species.

Boron

Boron toxicity can occur in dryland cereals where boron levels exceed 15 mg/kg (ppm) and in sensitive crops when exceeding 5 mg/kg. High boron levels are often present at the same depth in the soil profile as elevated levels of carbonates and salinity. This gives an indication of the historic rainfall and depth to which these salts were leached in the soil profile.

Aluminium

High levels of extractable aluminium in soil tests are closely related to soil pH, with low pH (less than 5.0 CaCl₂) releasing aluminium in an active form into the soil. Soil test values greater than 4 mg/kg can damage developing plant roots. Increasing the pH of acid soils through the application of lime will make aluminium unavailable for uptake by plant roots.

Reference/Acknowledgements

Modified from: Masters, B., Davenport, D. and Crawford, M. (2013) "SoilSMART: Understanding Your Soils" Field Day Handout, Rural Solutions SA.





Surface Cover for Erosion protection

Maintaining adequate soil surface cover on paddocks, as well as reducing soil disturbance are the two most important factors in protecting soils from wind and water erosion. Surface cover includes any material covering the soil surface including; live plants (e.g. crop, pasture, weeds), dead plants (e.g. crop/pasture residues, leaves) and rocks.

Soil surface cover:

- cushions soils from damaging impact of rain drops and hoofs
- prevents wind from picking up soil particles
- slows run-off, allowing it more time to infiltrate the soil and reduce the risk of carrying soil particles away
- minimises germination of and competition from annual grasses and broadleaf weeds in perennial grassy systems
- binds soil particles into stable aggregates in the roots
- provides a food source for soil microbes
- traps seed and other loose material, and provides better conditions for seed germination.

On soils prone to water erosion, maximising the percentage of the soil surface covered is the most important factor in managing the risk of erosion.

On soils prone to wind erosion, well anchored plants or plant residues offer more protection than a surface mulch that can be blown away. Taller plants or plant residues deflect wind away from the soil surface further than shorter ones.

How much surface cover is enough?

Maintaining adequate cover on erosion prone areas can be challenging. These case studies highlight some strategies for improving surface cover levels on these areas including managing grazing to minimise the risk of erosion. If adequate surface cover levels cannot be kept to protect soils from wind erosion then stock should be removed from them well before minimum surface cover levels are reached.

If there are no other paddocks on the property with adequate feed and surface cover, options are:

- Selling stock before there is a shortage of cover and while the stock are in good condition
- Agistment
- Confinement feeding of stock - keep and feed stock in a small paddock.

Reference/Acknowledgements

Young M.A. (Sept 2013) Soil and land management consultant, Rural Solutions SA.

Minimum cover levels regarded as adequate to protect soils from erosion under “average” climatic conditions.

Wind erosion prone soils	Water erosion prone soils
<ul style="list-style-type: none"> • Minimum of 2cms height of relatively even but thin plant growth or residues • Butt density of established grasses or cereals around 100 per square metre. • Most residues well anchored 	<ul style="list-style-type: none"> • Minimum of 50% surface cover on flat - gently sloping land • Minimum of 75% surface cover on moderate - steeply sloping land.



Well anchored stubble residues greater than 2 cm in height.



75% surface cover.



Temporary electric fencing

Recommended Equipment

Energiser

A 2.5 to 3 joule solar energiser is the minimum required for sheep and most strip grazing situations. Note - this sized unit may seem excessive, but provides plenty of power to shock the sheep and allows for any faults in the system such as grass touching wires.

Wire

Braided wire is used in preference to tape which flaps in the wind. Use the high quality braided wire with 9 strands of wire. It is more expensive but will last longer and provides 6-7000 volts after 1km compared to 5-600 volts with the cheap braided wire.

Posts

Steel tread-ins are the most robust and sturdy and therefore recommended. Plastic tread-ins can break and re-use is limited. Steel post (droppers) can be used with insulators. They are sturdy in sand but are hard to shift if the fence is moved regularly. Posts can be made on farm from steel rod with the use of insulators.

Reels

Reel stands can be constructed on farm. Large reels are available which hold 1km of wire. Make sure reels are geared to reduce time required to wind wire up.

Battery

Deep cycle

Lightening diverter

Should be used if you want warranty.

Rappa™ system

- Costs approximately \$3,300 plus reels
- Erects and pulls down 1km of fence in 1 hour
- Requires special reels which only fit 500m of braided wire.

Electric Fencing Tips

Setup

- Face solar panel north
- Put battery in an old esky to avoid temperature fluctuations and increase battery life
- Avoid grass touching wires and shorting out the system
- Use a tester to test fence for power

Earthing system

- Use galvanised earth stakes
- It is very important to set up correctly (seek advice)

Wire height

- Spacings on steel tread-ins are adequate. However they can be shifted as required (refer to images on page 44)

Number of wires

- 2-3 live wires are adequate in winter
- An earth wire is required when there is no moisture in the soil.

Wire tension

- Do not tension tight as it will stretch the braided wire

Post spacings

- 15-20m is adequate depending on the level of the ground

Joining wires

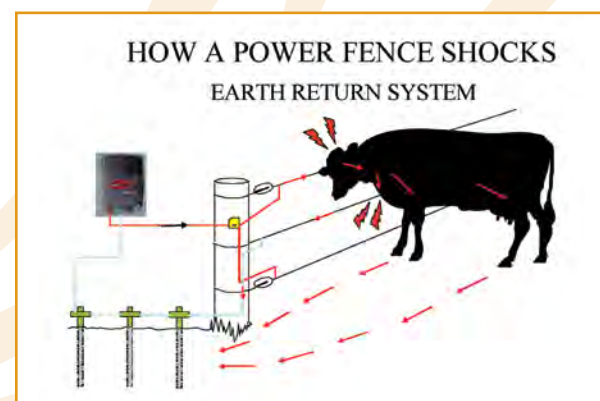
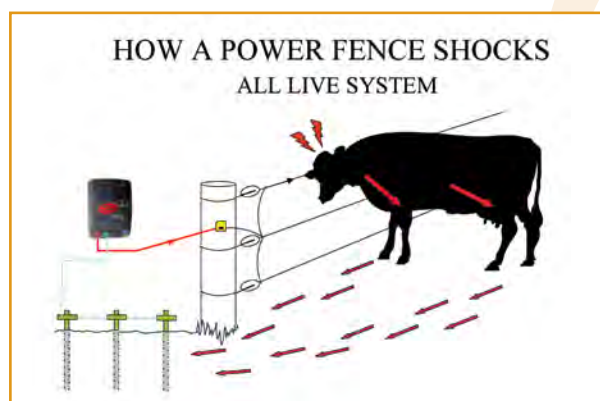
- Braided wire can be tied together
- Use insulated wire and clamps for other joining eg. earth and power source

Stock movement

- Lift up the fence using a steel peg, move stock under wire
- Move reel stand, or use end of fence as a gate

Management

- For ease of management subdivide paddock at the start of the season and leave fences up where possible so stock can be rotated e.g. A simple 4 paddock rotation
- If moving fence along a paddock have a single wire power source down one side of the paddock.

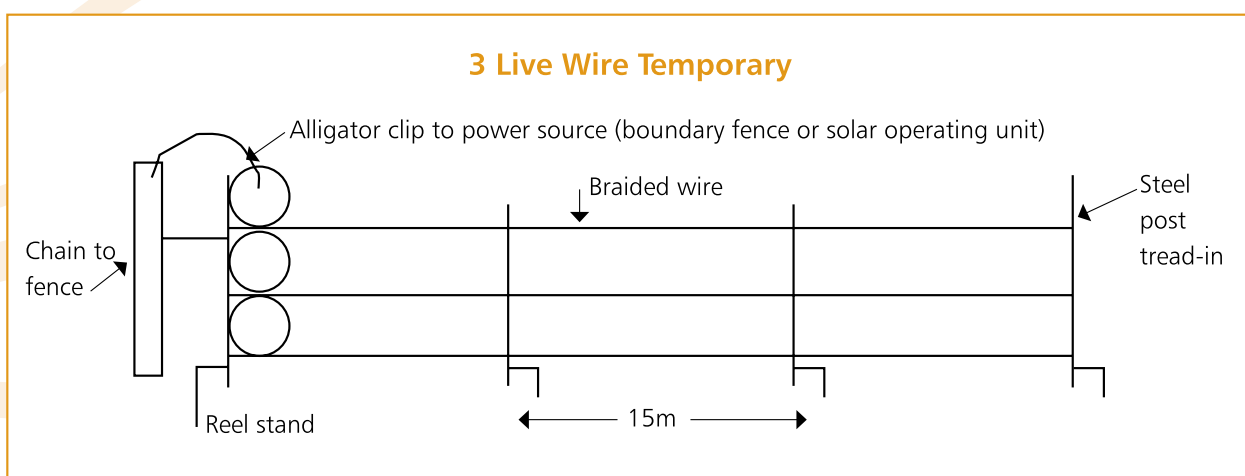




Rappa™ system



Top left, above and bottom right: Fence setups



Electric fencing acknowledgement - Gallagher Livestock Information Systems.





Livestock watering tips

Develop a water plan and reticulation scheme even if it takes 5 years to put in place.

Daily water requirements

Daily water requirements for different classes of livestock are outlined in table 2. When estimating how much water should be allowed the following factors must be considered:

- Salinity of water
- Size of stock
- Species of stock
- Time of year
- Feed type
- Lactating animal
- Walking distance

Water budgeting

When determining total water requirements, consider spillage, evaporation, cleaning, and seepage from dams in addition to stock requirements.

Water troughs

Location is important for pasture utilisation. A central location in the paddock is ideal. Long troughs are not needed, provided flow rate is good. Troughs of 2.4m - 3.6m in length are recommended. Use portable troughs that can be shifted with stock to reduce costs.

Flow rate into the trough - *This is the key*

Livestock should be able to come in and get a drink without waiting for water. Flow rates are outlined in table 3.

Animal	Litres per day
SHEEP	
Weaner	2-4
Adult dry sheep - grassland - saltbush	2-7 4-14
Ewes with lambs	4-10
CATTLE	
Weaners	25-50
Dry stock	35-80
Lactating cow - grassland - saltbush	40-100 70-140

Table 2: Livestock daily consumption

Mob size (DSE)	Suggested flow rate L per second
1000-2000	1-1.5
2000-3000	1.5-2
3000-5000	2-3
Greater than 5000	3

Table 3: Required flow rates

DSE ratings for various classes of livestock

DSE stands for 'dry sheep equivalent' and is a standard unit used to compare the feed requirements of classes of livestock and to assess the carrying capacity of a farm or paddock.

The standard DSE is the amount of feed required by a 50 kg Merino sheep (wether or nonlactating, non-pregnant ewe) to maintain its weight at fat score 2.5.

Expressed in metabolisable energy or mega- joules/day) one DSE is equivalent to 7.6 MJ/day. DSE ratings for stock types are shown in the table

Mature ewes		Pregnant (last month)		Lactating		Average for year
	Dry	Single	Twin	Single	Twin	
40kg	0.9	1.2	1.4	2.6	3.7	1.5
50kg	1.0	1.4	1.6	2.7	3.9	1.6
60kg	1.2	1.6	1.9	2.9	4.4	1.8
Growing Lambs						
Growth (g/day)	50	100	150			
20kg	0.6	0.8	1.0			
30kg	0.9	1.1	1.3			
40kg	1.0	1.3	1.5			
Wethers						
50kg	1.0					
60kg	1.2					
70kg	1.4					

Further reading and references

"Pasture Options for Eyre Peninsula" (2010) Grain & Graze Eyre Peninsula.

"Improving Feed Utilisation – Producer case stories" (2009) Eyre Peninsula Natural Resources Management Board.

"Use of salt bush and other perennials on Eyre Peninsula" (2009) Eyre Peninsula Natural Resources Management Board.

"Livestock water quality and consumption" (2009) Rural Solutions SA - Brian Ashton.

Useful Websites

Eyre Peninsula Natural Resources Management Board

Website: <http://www.epnrm.sa.gov.au/>

South Australian Research and Development Institute

Website: www.sardi.sa.gov.au

Future Farm Industries CRC

Website: www.futurefarmonline.com.au/

Australian Wool Innovation Limited

Website: <http://www.wool.com/en/on-farm-research-and-development>

Meat & Livestock Australia

Website: www.mla.com.au

Department of Environment, Water and Natural Resources - Sustainable soil & land management

Website: <http://www.environment.sa.gov.au>

SheepConnect SA

Website: <http://www.sheepconnectsa.com.au/>

For further detail on Feed on offer and ground cover see <http://www.feedonofferlibrary.com/>

Thank you

The organisers of the "Changing land management to increase surface cover" program, sincerely thank the following land managers for their time and commitment to show case their properties and stories to the community.

Emie Borthwick and Andrew Cabot, Tumby Bay

Jason Brace, Poochera

Isaac and Lisa Gill, Mangalo

Mark and Andrea Hannemann, Cleve

Neville Hoffrichter, Ceduna

Jim, Geoff and Wendy Holman, Cockaleeche

Jeff and Jodie Jones, Wharminda

Damien and Eileen Lynch, Poochera

James Pollock, Wudinna

Scott, Evan, Maurice and Lyn Siviour, Wangary

Myles and Kylie Tomney, Streaky Bay

Rob Walsh, Cowell

Scott Williams, Elbow Hill

Dion and Bert Woolford, Kimba



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