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Case study

Salt-bush hedgerows — trading low productivity for high protection

Farm info.

- **Producer:** Rick and Jenny Robertson (*EverGraze* Supporting Site)
- **Location:** Bengworden, East Gippsland, Victoria
- **Property size:** 1400 ha
- **Mean annual rainfall:** 640 mm
- **Soils:** Vary from clay loam to sand dunes
- **Enterprise:** Self-replacing Merinos.

Merino producer Rick Robertson from Bengworden, Victoria has for many years wondered how best to increase the productivity of certain parts of his East Gippsland property.

Rick runs a breeding flock of 3000 Merino ewes, with wethers turned off at 1.5 years of age (at about 55 kilograms liveweight) and sells his ewes when they reach 5.5 years old.

The property landscape ranges from saline flats on the shores of Lake Victoria to undulating dunes and swales. Most of the property is undulating with light sandy loam soil types.

During 2004, Rick decided to see if a low productivity area of lakeside flats on his property could be successfully sown to saltbush to provide feed and shelter for his lambing Merino flock.

Key points

- **Shrub hedgerows have been successfully used to produce feed and shelter in otherwise unproductive, saline soils.**
- **The hedgerows were established just as successfully from seed as they were from seedlings, at significantly less cost.**
- **Wind chill measurements taken at lambing revealed the hedgerows reduced the number of times the wind chill reached high-risk levels.**
- **While extreme wind chill events are infrequent in East Gippsland, it is worth having hedgerows planted in an 'insurance' paddock, especially for twin-bearing ewes.**

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John Bowman, livestock officer from DPI Leongatha, measuring the height of saltbush planted in 2004. It is still growing well, providing 3–5 grazings each year, with many plants now exceeding 1.5 m in height.

Farm background

Like many other farms in the district, 'Gracemere' was traditionally a high stocking rate and high-input farming system.

"The farm was placed under severe stress during the extended drought, which finally came to an end in 2009-10," Rick said.

"Like other farmers in the district, the ongoing drought placed severe stress on us as a family, in financial, physical and emotional terms.

"But during 2008 we decided to change all that by implementing regenerative and profitable farming practices. We sought advice from other successful producers and consultants, before implementing the changes required to make it all happen.

"Our farming principles now revolve around:

- matching feed availability to animal requirements and maintaining a knowledge of how much feed is available and growing on the farm at any time
- matching stocking rates to rainfall and feed production
- rotationally grazing large mobs for 80% of the year
- establishing more deep-rooted perennial pastures, which use rainfall year round and provide year-round feed
- maintaining ground cover and improving soil health by careful grazing management
- doing as little supplementary feeding as possible.

Existing resources

"Our soils tend towards moderately to strongly acid, and most of our surface-soil horizons have a low nutrient-holding capacity.

"We try to counteract this by increasing the organic matter in these soils, particularly in the sandy dunes. This is also important for maintaining the water-holding capacity of this country.

"We also try to maintain high levels of ground cover using deep-rooted perennial pastures across the entire property and manage grazing to protect the soil from wind erosion.

"This is more difficult on the saline flats, which were cleared along with the rest of the property for grazing purposes. The original vegetation would have consisted of herb-rich woodlands, but now the low-productivity landscape consists mainly of native grasses and tussocks.

"While only a small part of our farm, it was this area we were most keen to transform into a productive area again, by planting hardy, salt-tolerant, perennial forage shrubs".

Establishing saltbush

During spring 2004, a 16 ha trial site was chosen on the lakeside flats, less than 1500 m from the shores of Lake Victoria. This site was split into a 10 ha treatment block and a 6 ha control block.

The control block was covered in mainly native grasses, tussocks and weeds and was left untouched. Rick disced and cross ripped the treatment block, and applied dolomite at one tonne per hectare. He then incorporated the soil ameliorant with a second disc cultivation.

About 6 ha of the treatment site was then sown in rows to old man saltbush (*Atriplex nummularia*), DeKock (*Atriplex nummulria* cv De Kock) and seaberry saltbush (*Rhagodia candolleana*), at a rate of 2700 seedlings per hectare. The different species were sown in separate rows within the treatment site.

This required a total of 16,250 seedlings, costing $1000/ha, planted with a lettuce planter hired from a local vegetable grower.

The remaining 4 ha of the treatment block was sown with old man saltbush seed, at a cost of $150/ha for seed, using a homemade saltbush seed-sowing machine borrowed at no cost from producer near Kerang.

Well established

According to Rick, both the seeds and seedlings established well, and while the seedlings were faster to establish, there was little difference between the two techniques after two years.

"While our main reason for using forage shrubs was to provide a significant grazing alternative for our sheep on previously unproductive land, we also hoped the site could be used as a lambing paddock with the saltbushes providing protection from wind chill," Rick said.

East Gippsland producer Rick Robertson and other local producers inspect seaberry saltbush, one of two species of forage shrubs sown on the trial site to provide feed and shelter for lambing Merinos.

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The shrubs have transformed a previously unproductive paddock, prone to wind erosion, into a stable and productive grazing area.

With this in mind, the forage shrubs were established as hedgerow windbreaks, aligned north to south, with 4.5 metre spacing between the rows.

The plants were left untouched for the first 12 months, with the old man saltbush outperforming the seaberry saltbush in terms of production. The former reached an average height and width of one metre by one metre, and they were dense and multi-stemmed, producing a significant quantity of leaf material. The seaberry saltbush peaked at about 800mm in height.

Grazing benefits

"The shrubs have certainly achieved the aim of bringing a previously unproductive site back into production, providing significantly more grazing days than the neighbouring, unimproved control block," Rick said

Rick kept records for the first few years after establishment of the number of grazing days the forage shrubs provided, which is shown in Table 1. The site was grazed 3–5 times each year, including during summer when available green feed elsewhere on the farm was usually limited.

TABLE 1. Grazing days of saltbush compared with the control block

Grazing days	2005–06	2006–07	2007–08
Forage shrubs	7000	14,000	20,000
Control	**1000**	**Not available**	**Not available**

Source: Rick Robertson

"Improved seasonal conditions during recent years have meant we have not grazed the saltbush as much during summer, due to the quantity and quality of green pasture across the rest of the farm," Rick said.

"We found the adult sheep adapted quickly to saltbush as a feed source and they could maintain their body condition on it during general feed shortages. This reduced the time and money we spent on supplementary feeding."

Lambs are more difficult to introduce onto the saltbush, as they prefer the grasses in the inter-row areas. But Future Farm Industries CRC research is showing this could be made easier by exposing animals to new feeds early in life, such as during pregnancy or soon after weaning.

The overall result is that the 10ha forage shrub area has improved the overall carrying capacity of the farm, adding value to it as an asset.

Additional plantations

The original saltbush trial paddock is still growing well, with many plants more than 1.5 m high. On the back of this success, Rick attempted to establish a second saltbush site during 2008, using wider row spacings, to allow more pasture to grow between the hedgerows. Unfortunately this plantation failed as the site didn't receive the rainfall post-sowing that was needed for successful establishment.

"Then during 2011 we trialled 10 ha of the tropical perennial grass premier digit (*Digitaria eriantha*) on a sandy-loam slope with a north-westerly aspect," Rick said.

"Excellent seasonal conditions have resulted in strong establishment and provided high-quality grazing for the weaners and adult sheep during summer. This summer feed meant we haven't needed the saltbush as much for summer grazing during recent years.

"I now intend to sow more premier digit following the success of this first trial area."

Combating wind chill

In addition to grazing the original saltbush trial block at different times during the year, the Robertson's started using the block during their July–August lambing period, to mitigate the effects of wind chill on new born lambs.

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Anemometers were placed among the saltbush hedgerows on the trial site, to measure and record wind speed at 10-minute intervals.

While high wind-chill periods are uncommon during winter and spring in East Gippsland (unlike areas such as Hamilton), extreme events do occur. According to Rick, these result in heavy stock losses, particularly twin-born lambs and bare-shorn sheep.

"We were pleased to have the saltbush hedgerow trial plot available as an 'insurance' paddock for lambing, and were interested to find out exactly how much protection the hedgerows offered," Rick said.

Lambing observations

"To determine the protective value of our saltbush, we decided to carry out a simple trial using two flocks of lambing ewes.

"During July 2010, we drafted off 50 ewes from the main mob, 40% of which were scanned as bearing single lambs and 60% bearing multiple lambs.

"We locked these 50 ewes in the saltbush paddock for the entire six-week lambing period.

"A second mob of 30 ewes was drafted from the main mob, again with the same proportion of single and multiple-bearing ewes, and we put these into the control paddock.

"When the lambs were marked three weeks after the end of the lambing period, the marking rate for the saltbush paddock mob was 116%. The marking rate for the control mob was a little less, at 110%.

"A similar experiment was run the following year and resulted in very little difference (2%) between the flocks inside and outside of the hedgerows. This difference may have been higher if there had been more adverse weather conditions over long periods."

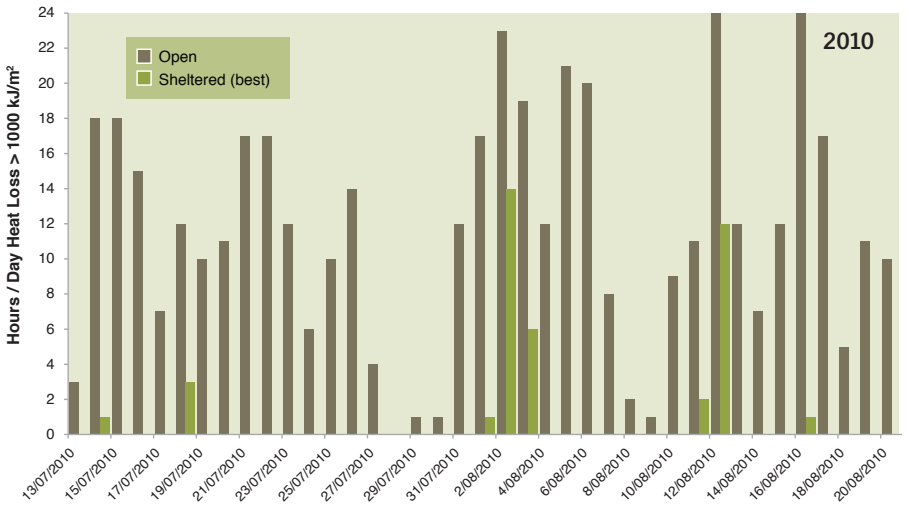
Measuring up

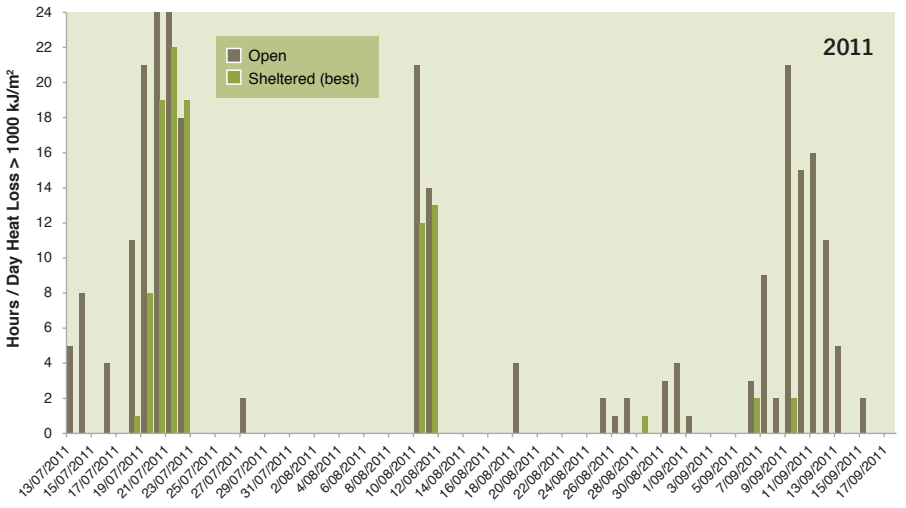
During 2010 and 2011, Darren Hickey, Department of Primary Industries Victoria, set up wind speed measuring equipment on the treatment block. Three anemometers were placed among the saltbush hedgerows, 400 mm above the ground and 200 mm from the saltbush. One anemometer was also placed out in the open to measure wind speed in an unsheltered area.

"The equipment allowed us to measure the differences in wind chill between the hedgerows and the unsheltered areas during the winter lambing period," Darren said.

"As with previous *EverGraze*/DPI Victoria research at Hamilton into the value of hedgerows for lambing protection, we calculated wind chill using wind speed, temperature and rainfall. These results are shown in Figures 1 and 2."

FIGURES 1 and 2. Hours per day that heat loss exceeded the threshold of 1000kJ/m²/hour for the open site and best of the sheltered site in the saltbush hedgerows during the lambing season (July–August).





Source: Darren Hickey, DPI Victoria

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More than 30% increase in lamb survival was achieved from perennial grass hedgerows at Hamilton *EverGraze* research site where there were a high number of chill days throughout lambing.

Chilly times

"Wind chill is the rate of heat loss, expressed as kilojoules per square metre of surface area of the animal, per hour," Darren said.

"Previous *EverGraze* research reported that the threshold rate of heat loss that puts newborn merino lambs at greatest risk of mortality from hypothermia is 1000kJ/m²/hour. Each incidence of wind chill exceeding the 1000kJ/m²/hour threshold is known as a 'wind chill event'.

"Newborn lambs are at most risk from dying of exposure and hypothermia when a wind chill event lasts for 60 consecutive minutes or more. If this happened during the experiment, it became known as a 'chill day', even if the conditions only lasted for a single hour.

"We then compared how often chill days occurred in the sheltered area compared to the open, control paddock, and for how many hours each day these conditions lasted."

Encouraging results

"When we just looked at the number of wind chill events, where the heat loss exceeded 1000kJ/m²/hour in any 10-minute recording period, we found the forage shrub hedgerows reduced the occurrence of these events by 90% in 2010 and 60% in 2011, compared with the open paddocks, as shown in Table 2.

TABLE 2. The number of wind chill events from the sheltered and open sites

Number of wind chill events (where heat loss exceeded 1000kJ/m²/hour)	2010	2011
Sheltered, hedgerow site (best across sites)	330	640
Open, unprotected site	3292	1615
Percentage reduction	**90%**	**60%**

Source: Darren Hickey, DPI Victoria

"The 2010 dataset contained about 5500 measurements, while the 2011 dataset was nearly double at 9400 measurements, because we extended the measurement period into September – illustrating that the risk of chill days extends into early spring in this region."

"We then looked at the number of chill days in the recording period, where there was at least one instance of a chill event that lasted for 60 minutes or more in a 24 hour period," Darren said.

"The results for the saltbush hedgerows were again encouraging, with significant reductions in the number of chill days in the hedgerow paddock compared with the open paddocks each year, as shown in Table 3."

TABLE 3. The number of chill days from the sheltered and open sites

Number of chill days in the recording periods	2010	2011
Sheltered, hedgerow site (best across sites)	8 (20%)*	10 (15%)
Open, unprotected site	38 (97%)	27(40%)
Percentage reduction	**79%**	**63%**

* The percentage in brackets indicates the proportion of days in the recording period.

Source: Darren Hickey, DPI Victoria

"When we compared the results from 2010 and 2011, they showed us that hedgerows are undoubtedly effective in reducing the number of wind chill events and chill days during the lambing period in each year.

"From the 2011 data, we found there were far fewer chill days measured in the open, unprotected area compared with the 2010 data.

"However, during some chill days in 2011, the anemometers placed within the hedgerows did not measure a reduction in wind chill by the same amount as was seen in 2010. This is because of the position of the anemometers and the direction of the prevailing weather."

The anemometers were best at detecting reductions in wind speed when the adverse weather conditions were from the east or west because the hedgerows are aligned north/south. ■

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Photo courtesy Hayley Norman, CSIRO

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The benefit from shelter varies depending on the environment. A 0-10% increase twin lamb survival was achieved using shrubs in the milder conditions at Wagga Wagga *EverGraze* research site.

Science behind the story

Darren Hickey and Malcolm McCaskill

It is well understood that profitability in sheep enterprises can be improved significantly by increasing lamb survival and weaning rates. Newborn lambs are most at risk of dying up to 3–4 days after birth. There are many factors that influence lamb survival at this critical stage of life, such as nutrition, mob size, genetics and predation. Weather is also a major factor, with losses attributed to cold stress costing the industry millions of dollars every year.

Because of the potential of significant financial loss associated with weather-related deaths in sheep enterprises, a great deal of published research has been carried out on the influence of cold-stress on survival in sheep. Much of this work has investigated the causes of deaths shortly after birth and cost-effective risk management strategies.

Some of the most recent work was carried out by *EverGraze* researchers at DPI Hamilton. The objective of this research was to investigate the effectiveness of perennial grass shelterbelts in reducing lamb deaths, particularly in multiple births. A similar experiment was carried out in Wagga Wagga NSW, where fast-growing shrubs were established to provide shelter and improve the survival of twin lambs.

At DPI Hamilton, where Merino and Coopworth ewes were used in the experiment, there was a 42% reduction in deaths in the Merinos from having shelter available, while there was a benefit of 23% in the Coopworths. The overall benefit to lamb survival of providing shelter for all birth types for both breeds of sheep (at the average birth weight of 5.9 kg) in this experiment was 31% (90% survival in sheltered areas and 69% survival in the open). The benefit from shelter at Wagga was only up to 10% due to the lower number of chill days experienced in that region.

At both Wagga and Hamilton, access to a shelterbelt during cold stress inducing weather events resulted in a noticeable benefit in mothering behaviour. Ewes spent more time with their newborn lambs during the critical first few days of life. This reduces losses caused by mismothering, starvation and exposure. The availability of high-quality feed within that 'safety zone' was also important to that behaviour.

The dollar benefit to the provision of shelter was also measured for the work at Hamilton. In 2009, the benefit for ewes carrying twin lambs was calculated at approximately $5 per ewe with a breakeven period of three years on the cost of the establishment of the hedgerows.

A key spin-off benefit to this research has been the introduction of a new online tool for sheep producers to help predict more accurately the wind chill involved with cold, rainy and windy weather events. Wind chill (measured in terms of heat loss per hour) can be a big risk to the survival of newborn lambs and sheep off-shears so knowing this information well in advance (up to seven days) allows producers to ensure stock most at risk are adequately protected. These forecasts are currently available for Victorian producers at **www.dpi.vic.gov.au/vro/ibaw**

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For further information:

Related case studies and lamb survival outcomes from the Hamilton Proof Site can be found at **www.evergraze.com.au**

Information on forage shrubs can be found at **www.futurefarmonline.com.au > Research > Future Livestock Production > Enrich**

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