

## Case study

# Managing hill country pastures — challenges and benefits

### Farm info.



- **Producer:** Mark and Ange McKew (EverGraze Supporting Site)
- **Location:** Warrak, South West Victoria
- **Property size:** 600 ha
- **Mean annual rainfall:** 600 mm
- **Soils:** Shallow loams
- **Enterprise:** Merino ewes and wethers, fine wool, prime lambs and cattle.

A combination of strategic and rotational grazing is proving a successful tactic for boosting native pasture densities and maintaining groundcover in steep hill country.

EverGraze Supporting Site host Mark McKew runs a fine wool operation near Ararat in South West Victoria and has found greater flexibility in managing his livestock is an added advantage of the new grazing strategies.

"The results of our change in grazing management from set stocking to optimised deferred grazing and strategic rotational grazing are encouraging, even though I realise it is a long-term exercise to achieve major change," Mark said.

"I can see the potential for increasing stock productivity and our stock are in better condition throughout the year. They also produce more wool, which is cleaner and stronger along the staple.

### Key points

- Optimised deferred grazing can reduce the seed set of annual species and encourage perennial species in steep hill pastures.
- Rotational grazing is more labour intensive than set stocking, but can improve management skills through better stock and feed allocation.
- The challenge is to have enough stock and big enough mob sizes to effectively use the feed, and the extra investment in water and fencing infrastructure.
- Onion grass can be controlled by chemical and grazing management in native pastures.



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Local graziers see for themselves how production from native pastures increased at the Warrak Supporting Site.

"The grazing systems make sense when we are trying to run low-input native pastures on the steep, hilly country.

"Our country consists of cleared steeper sedimentary hills with grassed gullies and our soils are shallow clay-loams with low water-holding capacities, which become shallower as the country rises, with rocky outcrops on spurs."

According to Mark, there is a diversity of native species on southerly aspects including about 40–50% native grasses — mainly weeping grass (*Microleana stipoides*), common wheat grasses (*Elymus* spp.), wallaby grasses (*Austrodanthonia* spp.) and spear grasses (*Austrostipa* spp.) The other 50% is annuals, mostly silver grass (*Vulpia* spp.) with some onion grass (*Romulea rosea*) and Yorkshire fog (*Holcus lanatus*). The northern aspects have more onion and wallaby grasses.

"Traditionally we set stocked large paddocks, mainly due to limited watering points. This led to under-utilisation of the valleys and slopes and overgrazing of the hill tops," Mark said.

"Continuous grazing pressure reduced the perennial pastures, allowing unwanted species, such as capeweed, silver grass and onion grass to invade."



Wallaby grass  
(*Austrodanthonia* spp.)



Spear grass  
(*Austrostipa* spp.)



Weeping grass  
(*Microleana stipoides*)



Common wheat grass  
(*Elymus* spp.)

### Getting started

With help from site co-ordinator Julie Andrew, the McKews established the Supporting Site during 2007. The aim was to try and increase the density of perennial native species and improve the productivity and utilisation of pastures in their marginal, steep hill landscapes. The McKews also hoped to maintain ground cover at above 80% and increase production.

According to Julie, part of the impetus was to extend the work conducted by the DPI Victoria *Sustainable Grazing Systems for Steep Hills* project carried out in the Ararat Hills. This work showed that optimised deferred and rotational grazing, at critical times of the year, can increase the amount of native perennial grasses in hill country.

"The McKews chose a site across two paddocks, to compare a system of rotational grazing with specific periods of destocking, or deferred grazing, with set stocking," Julie said.

"They fenced a 100 ha paddock into six smaller paddocks, based on land classes and hill aspects, to allow rotational grazing. A poly pipe, holding tank and solar pump system was set up to deliver stock water and two active erosion gullies were fenced out and rehabilitated.

One of the six smaller paddocks was the 'innovation paddock', where the McKews applied optimised deferred grazing together with the rotational grazing practices.

Merino wethers, which are well suited to the hill country, grazed this paddock and the McKews monitored changes in pasture composition, recorded ground cover, feed availability and the number of grazing days.

An adjoining 70 ha, which contained wallaby grasses, weeping grass, fog grass, introduced annual grasses and onion grass, was the 'control paddock'. This was set stocked with autumn-lambing Merino ewes and cattle at about 2.6–4 DSE/ha.

### Optimised deferred grazing

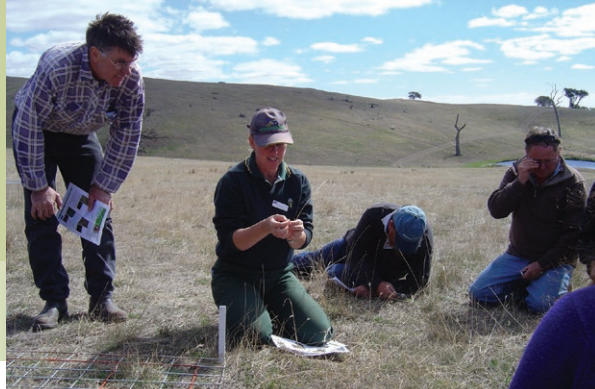
From December 2007, wethers were rotated through the innovation paddock. But in early spring 2008, grazing pressure was increased when annual grass weeds set seed. The McKews de-stocked the paddock as the perennials started to set seed during late spring to mid-January.

This crash grazing, with stocking rates as high as 28 DSE/ha, allowed weeds such as silver grass to be targeted. There was still sufficient ground cover when the sheep were removed, four weeks later.

Stock returned to the paddock for a week during late summer to provide some soil-seed contact. This promoted the germination of the newly-dropped native grass seed.



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Mark McKew watches on as Julie Andrew identifies native grasses at the site.

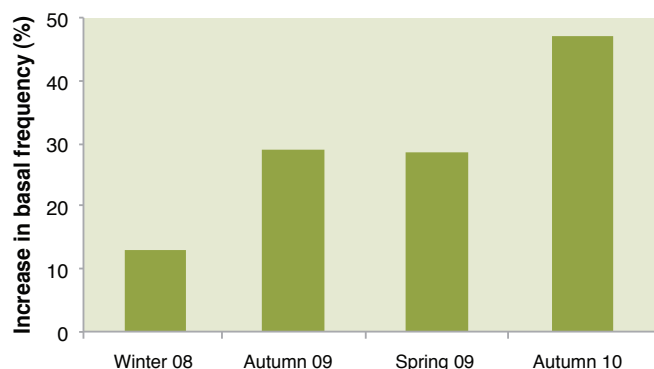
Following the initial optimised deferred grazing during spring 2008, the McKews rotationally grazed the paddock after the autumn break during 2009, with sheep in each paddock for about a 7–10 days and then out for 5–6 weeks.

### Persistence

According to Julie Andrew, the native perennials have persisted well to date in all six paddocks in the rotation.

“Two years of monitoring has shown a marked increase in perennial coverage and more feed compared with the control paddock, as shown in Figure 1,” Julie said.

**FIGURE 1. Increase in basal frequency of native perennials in the innovation paddock**



“The capeweed has all but disappeared, probably as a result of low nutrient levels and rotational grazing, although onion grass is still a problem.”

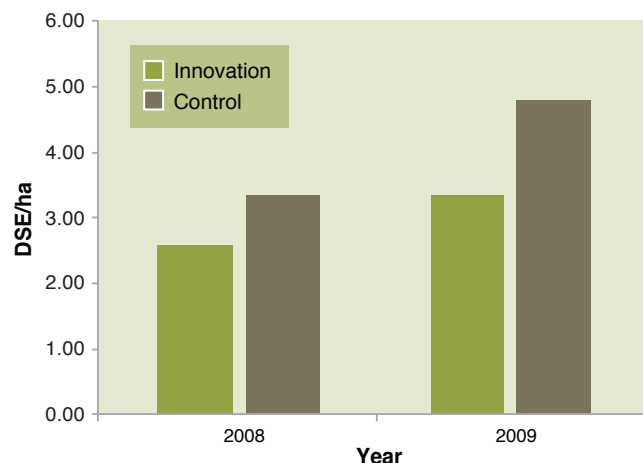
Between June 2008 and 2010 the control paddock had a higher stocking rate than the innovation paddock (see Figure 2), but there was between 50% and 120% more feed in the innovation paddock, showing the potential to increase grazing pressure (see Figure 3).

After a review of stocking rates and feed-on-offer (FOO) in the innovation paddock, greater grazing pressure was planned for spring 2010. However the wet conditions made managing spring-feed difficult and the McKews couldn't maintain high enough stocking rates.

“The solar pump and panels were also stolen, so we stopped rotational grazing stopped to allow access to the only dam in the paddock,” Mark said.

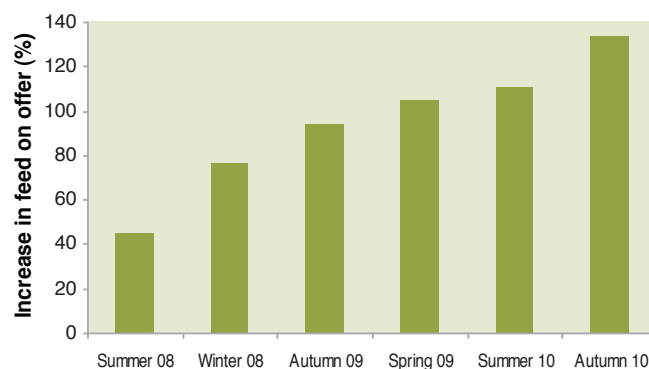
“Despite the challenges, the Supporting Site results have shown we can increase the perennial pasture component and maintain groundcover. It also demonstrated that an increase in FOO offers potential productivity benefits. But we need to weigh up the extra infrastructure costs for fencing and water on the hill country and the cost of additional stock.”

**FIGURE 2. Stocking rate in the control versus innovation paddocks**



Note: 2010 figures are not included due to the impact of the pump theft.

**FIGURE 3. Increase in feed-on-offer in the innovation paddock**



### New strategy fosters a keen eye

“In the past, our sheep often lacked condition at shearing in August,” Mark said. “The new grazing strategy keeps stock in better condition year round and offers greater marketing options.”

“While the regular stock moves are labour intensive, they allow us to closely monitor pasture and animals. I can quickly adjust numbers to improve native pasture content, maintain groundcover and increase pasture utilisation.”

### Crunching the numbers

A cash flow analysis has been used to estimate the time it would take for production increases to ‘payback’ the initial investment in pasture improvements.

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Onion grass was controlled by spraying six weeks after emergence when the old corm was exhausted and the new corm not yet formed.

The cash flow calculations use the income and variable costs associated with the enterprise, the capital and maintenance costs associated with improving the pasture, purchase of extra stock and interest costs to allow for both the borrowing of capital and the opportunity cost of investing.

Using the costs and stocking rate changes outlined previously, the payback period for the innovation paddock at the Warrak Supporting Site is estimated to be 6.5 years, using a gross margin of \$26/DSE.

This is similar to some estimates of payback periods for establishing new pastures. If a gross margin of \$20/DSE for a less profitable enterprise is used, the payback period is pushed out to nine years.

A more detailed economic analysis, including gross margins per hectare and Net Present Values (NPV) per hectare for the control and innovation paddocks at Warrak, can be found in Appendix 1 (see page 6). ■

### Science behind the story

Zhongnan Nie and Julie Andrew, DPI Victoria

Research in the Ararat Hills showed optimised deferred grazing was an effective method to promote native grass growth and alter species composition. After three years of deferred grazing, the tiller density of perennial grasses (predominantly native grasses) increased by up to 88% and annual grass tiller density decreased by up to 58%. Optimised deferred grazing increases the proportion of perennials, while suppressing annual grasses.

At the Warrak Supporting Site, Mark and Ange were able to increase the native grass component of their steep hill pastures by more than 50% with the same grazing approach.

The timing of both grazing and rest is critical and depends on the growth stage of the annual grasses in the pasture.



The Innovation paddock at Warrak.

Ideally, grazing starts after annual grass stems elongate, but before seed heads emerge during September to early October. Heavy grazing is undertaken (grazed down to approximately 1000 kg DM/ha) to ensure the growing points of these plants are effectively removed.

Stock are then removed and the pasture is not grazed until late summer and early autumn (February–March) the following year.

To be successful this grazing strategy requires a reasonably high (>20%) level of desirable species and sufficient stock to graze the pasture quickly, at the right time, so annual grass growing points can be largely removed.

Subdividing large paddocks is also important to achieve appropriate grazing pressures.

### Onion grass

Onion grass was a problem at Warrak, resulting in stock selectively grazing the native perennials.

Onion grass is a perennial herb, which produces abundant seed and corms that germinate during autumn and grow during winter, flowering from August to November.

The underground corms can survive through hot, dry summers.

The Ararat Hills research showed deferred grazing did not affect the densities of onion grass, as the plant had almost completed its life cycle when optimised deferred grazing was imposed during spring.

Onion grass is sensitive to heavy grazing (or thrives with lax grazing) and can decline under phosphorus fertiliser applications, through greater competition from nitrogen and phosphorus responsive species.

(Continued page 5)

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Silver grass was significantly reduced in the Ararat Steep Hills trial by heavy grazing in spring followed by a summer rest (Optimised Deferred Grazing).

### Science behind the story

(Continued from page 4)

In low-fertility native pastures, onion grass can be a challenge but chemical control is an option.

To control the onion grass, the 'innovation paddock' was sprayed with a recommended rate of a metsulfuron-methyl herbicide during June 2010. Spraying needs to be done when new corms start developing, around 6-8 weeks after the onion grass has emerged.

There was noticeably less onion grass during autumn–winter 2001, without any noticeable effects on the native grasses.

The control paddock, which started with a higher level of onion grass than the innovation paddock, also had lower levels of onion grass recorded. This may be due to the wet conditions allowing the perennial and annual grasses to better compete with the onion grass.

The greater frequency of low levels of onion grass during 2011 in the innovation paddock showed that spraying was effective in reducing onion grass levels (see Table 1).

■ Zhongan Nie is a senior research agronomist at the Department of Primary Industries Victoria, Hamilton. Zhongan was the project leader of the Sustainable Grazing on Steep Hills project, and the more recent study on onion grass control.

■ Julie Andrew was an environmental management officer at DPI Ararat, and was the coordinator of the Warrak Supporting Site from 2007-2010.

#### Acknowledgements

Funding for the Warrak Supporting Site was provided by Wimmera Catchment Management Authority, Australian Wool Innovation (2007-2010), Caring for Our Country through Central Highlands Agribusiness Forum (2009-2011), and Department of Primary Industries Victoria through the EverGraze project and Future Farm Industries CRC (2007-2011). The Site was coordinated by Julie Andrew (Department of Primary Industries Victoria) and was supported by the Perennial Pasture Systems producer group. The EverGraze project team would like to thank Mark and Ange McKew for their ongoing commitment to the project as hosts.

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**TABLE 1. Impact of spraying on onion grass in control vs innovation paddocks at Warrak**

Paddock	28 April 2010 (before spray)			17 September 2010 (10 weeks after spray)			6 April 2011 (year after spray)		
	L	M	H	L	M	H	L	M	H
Frequency scores (L = low, M = medium, H = high)									
Control paddock			9		2	7	4	3	1
Innovation paddock	1	4	4	2	3	4	9		

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#### For further information:

Nie (2003) Sustainable Grazing for Steep Hills, Department of Primary Industries Victoria [http://vro.dpi.vic.gov.au/dpi/vro/glenreg.nsf/pages/glenelg\\_lwm\\_sustainable\\_farm](http://vro.dpi.vic.gov.au/dpi/vro/glenreg.nsf/pages/glenelg_lwm_sustainable_farm)

DPI Agnote – Onion Grass (*Romulea rosea*) Management in Pastures <http://www.dpi.vic.gov.au/agriculture/dairy/pastures-management/ag1389-onion-grass-romulea-rosea>



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### Appendix 1:

## Is investing in fencing to improve grazing management affordable and a good investment?

■ Jane Court (Sheep Industry Project Officer) and  
Tony Berrisford (Senior Economist, DPI Victoria)

Grazing management can be a cost-effective option to rejuvenate existing pastures, improve animal production and ground cover management.

But the capital cost to fence and supply water and to buy the extra stock can be very expensive. The lift in carrying potential that can be achieved, the profitability of the enterprise plus any increase in animal production (as per head production) will effect both the time to recover costs and the return on investment.

Cumulative net cash flows can provide a guide to affordability and payback times of the investment. An estimate of return on capital (as Internal Rate of Return) gives a guide as to whether the investment is worthwhile.

### Calculating cash flow

A cumulative net cash flow shows the annual cash flow associated with the investment, in this case the costs to fence and provide stock water, and the returns from the enterprise for the years in the future in which they occur.

A cash flow includes the capital and maintenance costs associated with improving the pasture, purchase of extra stock and the net income from extra stock purchased and/or improved production. Interest costs to allow for the borrowing of capital and the opportunity cost of investing are also included. Adding the cumulative costs and income associated with the improvement provides a guide as to the time it may take to cover the initial investment costs. It is a measure of the financial affordability of the investment, and on its own does not tell if it is a good investment.

### Enterprise returns

A long-term average gross margin for a wool sheep was used across the *EverGraze* Supporting Site at Warrak, to account for annual variability due to season and price. The 41-year average wool sheep production gross margins from the *Livestock Monitor Project* (2010–11 Report) for the south-west region of Victoria is \$26/DSE (real price, adjusted for inflation).

But as an average wether enterprise is likely to generate lower returns, a lower gross margin of \$20/DSE has also been used to calculate cash flows and return on investment.

A third and feasible option is to include both an increase in stocking rate as well as an improvement in animal performance due to the improvement. Mark noted that after the grazing management was changed, stock were in better condition all year which could lead to better wool cuts, less feed and animal health costs. Therefore the third option considered was to increase the stocking rate and to increase the gross margin from \$20/DSE to \$26/DSE, after the improvement.

### Calculating costs

Actual costs, at contractor rates, have been included for fencing and improvements, even though the work at Warrak was partially funded by the Wimmera Catchment Management Authority.

In this case, the fencing and water charges are shown in Table 1 based on the costs to subdivide 108 ha into six small paddocks with ringlock, lay pipe and build water troughs, and purchase a solar pump.

Purchase of wethers are costed at \$110/wether (\$85/DSE), as in the *Livestock Farm Monitor* report.

**TABLE 1. Costs for Warrak Supporting Site**

	Items	Total cost (\$)	Cost/ha (\$)
	Water trough and tank	5056.00	46.81
	Solar pump	6389.00	59.18
	Pipe laying plus labour	462.50 400.00	4.28 3.70
	Fencing (86 ha)* 2800m at \$9.50/m	26,600.00	246.30
<b>Total infrastructure</b>		<b>38,907.00</b>	<b>360.25/ha</b>
Pasture costs 2010	Onion grass spray		36.00/ha

\*Excludes existing fencing

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An interest rate was set at 8% and inflation at 3%.

The pump and tank costs have been split on a per hectare basis to compare the net returns from fencing and managing 108 ha of hill country to other options such as establishing 108 ha of new pasture.

In this case study the estimated cost per hectare to fence and supply water to six paddocks, compared to one 108 ha paddock was \$306/ha. Other sites that renovated or established new pastures estimated costs around \$400–\$500/ha.

### Stocking rate and returns

The control paddock at the Warrak Supporting Site represents 'business as usual'. This paddock was run at 2.6 DSE/ha.

In comparison, the innovation paddock reached 5 DSE/ha by the fourth year, but was underutilised due to lack of water.

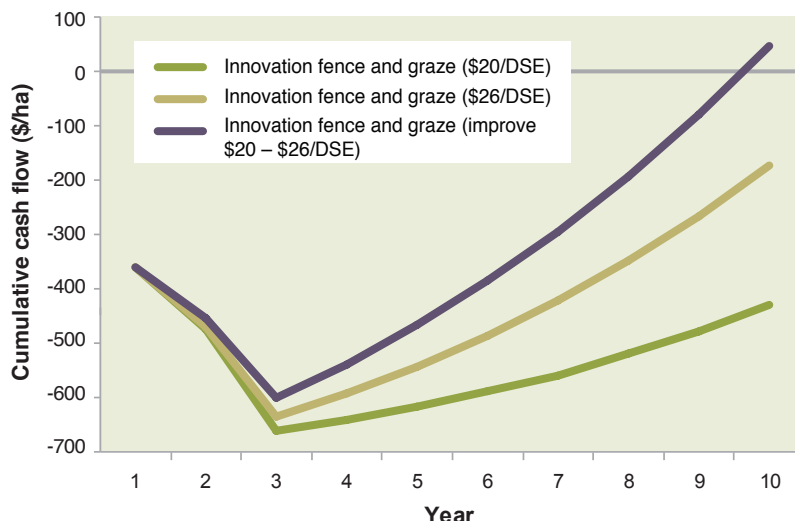
The 2010 and 2011 years were exceptional, especially in comparison with the previous eight years, so it is difficult to get an indication of the long-term carrying capacity of the country.

Seven years of annual cash flow, costs and income and the calculations for cumulative net cash flow (for the innovation paddock) with an enterprise gross margin of \$26/DSE is outlined in Table 2.

### Returns from stock

The example in Table 2, shows that if the sheep enterprise has a gross margin of \$26/DSE and the stocking rate is increased from 2.6 DSE/ha to 5 DSE/ha, then the cash flow for the investment will still be in the negative in the seventh year. The purchase of the extra stock (\$64/ha in the second year and \$221/ha in the third year) contribute significantly. In this example, it would take until

**FIGURE 1. Cumulative net cash flow for investing in infrastructure for better grazing management to increase stocking rate**



the 11th year for the costs to be recovered or for the investment to have paid for itself.

If the enterprise had a gross margin of \$20/DSE rather than \$26/DSE, the payback would be pushed out to 13 years.

If the extra stock were run and they improved in production per head (as observed in the demonstration) from \$20/DSE to \$26/DSE, payback occurs in the 9th year, which is more consistent with other pasture improvement options.

### In a picture

Figure 1 shows the cumulative net cash flow of investing in fencing to improve stocking rate with a gross margin of \$20/DSE, \$26/DSE and the third option of increasing stocking rate and per head production from \$20 to \$26/DSE.

**TABLE 2. Estimating cumulative cash flow and NPV for fencing and managing hill country to lift stocking rates**

Year	Cost of improvements (\$/ha)	Purchase extra stock (\$/ha)	Annual maintenance costs (\$/ha)	Extra stocking rate (DSE/ha)	Inflation (3%)	Extra gross margin (\$/ha)	Net cash flow (\$/ha)	Cumulative net cash flow (\$/ha)	Interest paid or earned on cash flow at 8% (\$/ha)
1	360.00			0.0	1.00	19.55	-360.00	-360.00	-29.00
2		64.00	36.00	0.73	1.03	91.85	-80.36	-469.00	-38.00
3		221.00		3.33	1.06	94.61	-129.15	-636.00	-51.00
4				3.33	1.09	97.45	94.61	-592.00	-47.00
5				3.33	1.13	100.37	97.45	-542.00	-43.00
6				3.33	1.16	100.38	100.37	-485.00	-39.00
7				3.33	1.19	106.48	103.38	-421.00	-34.00

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### Return on investment

Cash flows alone do not tell us whether an investment is a good one. The common measure that is used to help decide whether an investment is worthwhile, is return to the marginal capital invested, called the Internal rate of Return (IRR).

The IRR is a measure of the economic efficiency of the investment over a set period of time. It can be compared with returns from alternative investments of the same capital, with a similar life and that are similarly risky.

The IRR accounts for all the income generated over the period, less the costs of the improvements. It also includes a salvage or depreciated value of the capital investments (such as livestock, fencing and pasture improvement) at the end of the time period. Ten years is common for pasture improvement programs.

Table 3 shows the gross margins per hectare (when potential stocking rates are achieved) and Return on Capital for the three scenarios with a discount rate of 10%, compared to business as usual. A 30 year lifespan is assumed on the fencing and troughs etc. The average gross margins per hectare for the innovation paddock have increased significantly compared to business as usual, when both the gross margins of \$20/DSE and \$26/DSE are used.

Whilst the payback period for the investment, with a \$20/DSE enterprise, is long (greater than 10 years), the investment may be considered worthwhile if the capital can't be invested elsewhere to give a return better than 9%. Having a more profitable enterprise with a gross margin of \$26/DSE gives a return (IRR) of 13% in this example. If the improvement leads to the same increase in stocking rate but also a lift in per head production from \$20/DSE to \$26/DSE, the IRR is further raised to 16%.

Whilst an estimation of IRR can show a good return on the investment, the net cash flow may show that it is not affordable (due to the length of negative cash flow). Conversely, an

investment with a long payback period may still lead to a more profitable and viable enterprise and a good investment, in the long term. The investment maybe worthwhile if either a more profitable enterprise is used (to take advantage of better feed) or production per head is improved, raising the GM per DSE to \$26. Therefore investing in infrastructure to improve grazing management and productivity in native grass hill country, may be worthwhile without the need for a grant, depending on the profitability of the enterprise.

This analysis cannot easily measure some of the more intangible production and environmental benefits that come with better management of hill country, such as improved ground cover and native perennial grass density, and reduced soil loss.

Gross margins are useful for estimating enterprise profitability and cash flows at a paddock level, but they do not represent a measure of whole farm profitability. Gross margins do not take into account owner-labour (only contract labour is included), overheads or interest and lease costs, (apart from the interest on the capital to make the improvements). They do not take into account the whole farm as a system and how land class and pasture species are integrated to make the best value of each. Improving productivity and hence stocking rates may have the potential to turn an enterprise that barely covers farm costs to a more viable enterprise, depending on the increase in operating costs (and overheads) caused by running more stock. ■

### Resources:

Do your own sums and try the Pasture Improvement Calculator — <http://www.evergraze.com.au/library-content/pasture-improvement-calculator>

Investing in pasture improvement — <http://www.evergraze.com.au/library-content/investing-in-pasture-improvement>

**TABLE 3. Estimated average gross margins per hectare and Return on Capital (IRR) for a 10-year period**

Paddock	'Business as usual' control paddock	Innovation paddock	Innovation paddock
Average gross margin/DSE	\$20/DSE	\$20/DSE	\$26/DSE
Stocking rate achieved	2.6 DSE/ha	5 DSE/ha	5 DSE/ha
GM/ha (average)	\$52/ha	\$100/ha	\$130/ha
Value of investment (compared to 'business as usual')			
Return on capital (IRR)			
When 'business as usual' is at \$20/DSE		9%	16%
When 'business as usual' is at \$26/DSE			13%