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Extension note 3

Using natural regeneration to establish shelter on wool properties

Having more shelter trees on a property can contribute to improved profits and a better working environment. Shelterbelts provide many benefits including protection for livestock from harsh weather.

Research commissioned by Land, Water & Wool indicates that natural regeneration is a realistic option on most wool properties in central Victoria. The economics are attractive compared to other forms of tree establishment. Research shows that most wool properties already have at least 6% native tree cover. On average, 40% of the farm area may be capable of supporting natural regeneration, with plenty of choices about where it can be located.

This Information Note is based on the major findings from this research.

Natural regeneration is a cost-effective way of increasing shelter across the property and this Information Note compares the financial benefits of natural regeneration against establishing trees using seedlings or direct seeding. Managing existing healthy and mature trees as potential seed source for natural regeneration, could prove to be a large incentive to Victorian woolgrowers.

Natural regeneration is the process of reintroducing vegetation to a site by naturally allowing seed, suckers or lignotubers to grow. Natural regeneration does not include planting (revegetation) but may require intervention activities such as initial weed control and exclusion of grazing until saplings are established. Using temporary fencing around existing individual or clumps of trees enables natural regeneration of species that are already growing on the farm. Plants established by natural regeneration are suited to individual paddock conditions and will thrive in that location.

“Managing existing healthy and mature trees as potential seed source for natural regeneration, could prove to be a large incentive to Victorian”

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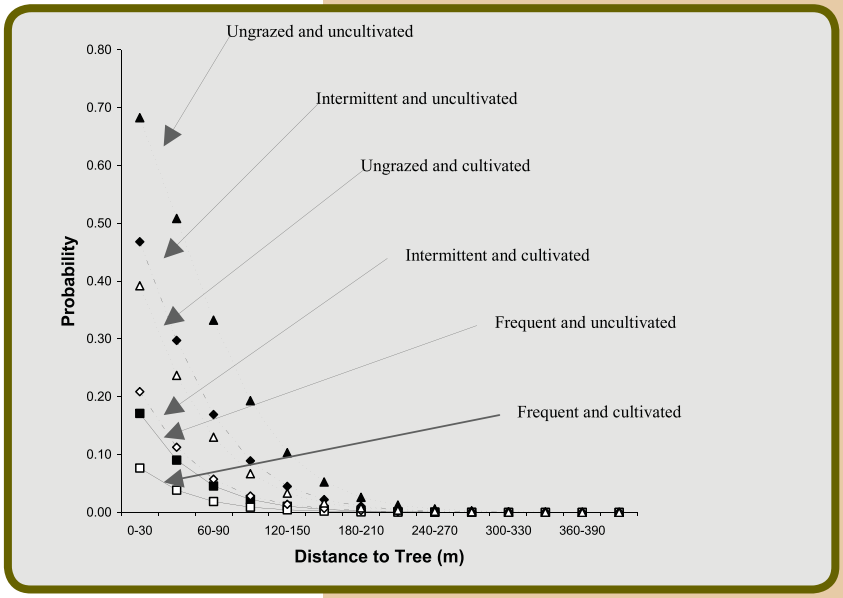
Predicting areas on the farm suitable for regeneration

Natural regeneration needs to be targeted in the right places on the farm for it to be cost effective. Some sites readily suggest themselves for regeneration (e.g. areas that are rocky or inaccessible, erosion prone, unused road reserves, adjacent streams or drainage lines and have remnant trees).



The probability of natural regeneration occurring in response to grazing frequency, cultivation and distance to mature trees.

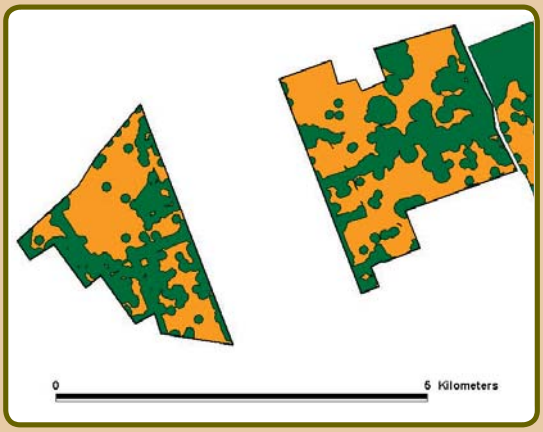
Recent research has found that the distance to mature trees and the frequency of livestock grazing were two of the most significant variables in predicting where natural regeneration will occur. The relative effects of these two variables are shown at right.

Whilst the Land, Water & Wool project found the highest rates of natural regeneration occurred in ungrazed and uncultivated sites, most woolgrowers will not have many sites like this on their property. However it was also found that regeneration can also occur adjacent to mature paddock trees that are in paddocks that receive periodic rests from grazing.

The Land, Water & Wool project team has developed a scenario model that predicts those parts of the farm likely to support natural regeneration when livestock grazing was:

- removed
- light and intermittent.

The following two maps were developed for a case study farm in Central Victoria to indicate those areas that would best respond to natural regeneration under different grazing regimes.



1. Absence of livestock grazing. An example of a scenario map for one of the case study farms indicating locations that are likely to support natural regeneration (green)

2. The possible impact of light and intermittent grazing on natural regeneration (green)

Why don't we see young, regenerating trees?

Whilst there may be large remnant trees on many wool growing properties there may be very few young ones to take their place. If unchecked, this will eventually lead to a situation where a paddock has no trees or just a representation of old trees in decline (with a reduced ability to provide shelter).

Some of the reasons why this may have happened is because:

- regular stock grazing provides little chance for new trees to establish
- aging and isolation of remnant trees reduces the gene pool and seed viability
- small patches of native vegetation (less the 1 hectare) are subject to weeds (which out competes tree seedlings)
- a high cover of introduced pasture species around paddock trees reduces regeneration potential
- regular cultivation against the base of trees leaves little space for new trees to germinate.

Where does the seed come from?

Most native plant seed is already available on a property. Seed not only comes from the obvious sources such as paddock trees and native remnants, it may also be present in the soil as a 'seedbank' (e.g. some seed such as wattles have hard seed coats that remain viable in the soil for long periods).

Some seed will be blown on the wind (e.g. seed from some native grasses may travel great distances), while heavier seeds like casuarinas and banksias maybe carried no more than a few metres from the parent plant.

Seed from fleshy-fruited plants like tree violet and kangaroo apple may be eaten and deposited on sites away from the original parent plant.

No time to lose

The loss of farm paddock trees reduces the potential for natural regeneration.

In some landscapes, the gradual loss of paddock trees could reduce the potential area of natural regeneration by up to 55% over the next 30 years.

Research suggests that loss of isolated paddock trees may be as high as 1.25% per annum. This equates to a 30% decline in tree cover over a thirty year period on the three study farms.

Of perhaps greater significance is that with the loss of isolated trees and small patches the potential area of natural regeneration is reduced by over 55% (and on some farms by up to 65%).

Summary of major requirements for natural regeneration

Predicting where natural regeneration can occur will greatly assist woolgrowers in making environmental planning decisions on their farms. Research results indicate that natural regeneration best occurs on wool properties with:

- mature trees nearby
- no or intermittent livestock grazing
- no history of cultivation (sowing pasture)
- low phosphorus application
- low proportion of improved/ introduced pastures.

Designing the site

Whole farm planning is a useful tool to help determine the best areas to encourage regeneration. Factors to consider are landscape position, the condition of current native vegetation, soil type and distance to existing trees.

- Large healthy paddock trees will provide a good source of seed. Seed will be more viable if the trees are not too isolated or are growing in a group.
- When deciding on what to fence, bigger areas are better for providing additional shelter, and the shape is relevant (e.g. long thin areas are more vulnerable to wind and invasion by weeds).
- Consider enlarging small remnant patches by extending fences further out. Paddock corners may be fenced out.
- Paddocks next to vegetated roadside reserves may be great natural regeneration sites as they have the advantage of an adjoining seed source.
- If possible choose areas that have native vegetation in good condition. Degraded areas can be expensive and labour intensive to regenerate, as there will be more weeds and introduced grasses to control.
- Trees may not grow exactly where you want them, they won't be in straight lines!
- The seedlings regenerating will be all the same as the parent tree. It may be necessary to undertake additional tube stock planting of different species to increase diversity.
- Areas that have retained a native grass understorey may not need additional tubestock planting.

What else can woolgrowers do to encourage more native fauna in shelter belts?

- Don't remove, or clean up dead trees, fallen logs and litter, as these play a significant role in improving habitat for local species
- Putting up nest boxes will encourage more bird and bat species to nest.
  Hollows take a long time to develop.

Things to consider when fencing

Fencing may initially be used to manage grazing pressure and manage stock, whilst research also indicates areas with intermittent grazing tend to have a 20% less chance of naturally regenerating. Grazing pressure not only comes from stock but from rabbits, hares, wallabies and kangaroos and the type of fencing used may need to consider controlling these species as well.

Seedlings won't establish immediately under the tree canopy. Any fencing for regeneration sites should be a minimum of two canopy widths from the base of the tree.

Research shows that little regeneration is likely beyond 60 m from a remnant (Dorrough and Moxham 2005).

When fencing a paddock tree or a paddock corner, consider the wind direction and site the fence downwind of the tree. Seed usually falls with hot, dry north or north west winds.

Consider different fencing designs to reduce cost (e.g. designing a circular rather than a square area will mean that there is no need for end assemblies). The cost of temporary fencing is estimated at $1500/km (2005 prices) if using electric fencing.

Creating the right paddock conditions

Creating the right paddock conditions

In some situations natural regeneration will easily occur (provided there is an appropriate seed source) if grazing pressure is removed, but in other areas there may need to for some more positive intervention. Although grazing may be detrimental to tree seedlings and have a negative impact on regeneration success, it can be used to control weeds and create sites for germination.

Trees do not set seed every year, but seed may be present in the soil seed bank.

If natural regeneration isn't occurring consider using some, or a combination of the following techniques to improve the chances for success.

- **Burning**

  Provide a seed bed for regeneration by burning stubble or exotic grass in late summer or early autumn. Fire may help stimulate germination in some species like wattles. Note: take care not to damage parent plants or have the fire too hot.

- **Remove introduced grass species before seed set**
  Assist natural regeneration by crash grazing or slashing annual introduced grasses prior to seed set (particularly appropriate if they are flowering). This will reduce competition and create gaps in the following seasons for native plant seeds to germinate.

- **Cultivation**
  Past cultivation reduces the probability of eucalypt establishment. The nutrient level will have changed if fertilisers have been used and soil structure may have been modified.

  Lightly scarify to initially reduce competition from weeds and encourage germination on sites where weed growth and invasion may be an issue. Note: there may be a likelihood of weed seeds germinating when soil is disturbed.

- **Controlling introduced annual grasses**

  If weeds are dominant then an application of herbicide or crash grazing may be required to control introduced grasses and vegetation. Take care with the selection of the herbicide and seek advice on the most suitable one to use from an agricultural chemical retailer. Before using any herbicide, read the product label carefully and follow the instructions.

  Constantly grazed areas may have annual grasses which are extremely competitive. In these sites control may require a combination of deferred grazing and the use of an herbicide.

Why natural regeneration doesn't always work

You may find that some areas won't support natural regeneration. In these sites it may be necessary to consider undertaking revegetation using tube stock or direct seeding. Reasons for poor or no regeneration maybe due to:

- high soil nutrient levels (nitrogen, phosphorous) in stock camps or adjoining areas
- no mature (i.e. flowering and seeding) native vegetation present in the area
- decline in existing isolated trees
- frequent livestock grazing
- high proportion of introduced pastures, that may need to be sprayed out first.

Ongoing maintenance

It is not recommended that regeneration areas be fenced and permanently left without further management. Where possible include gates so the site can be actively managed for weeds and fire prevention through strategic grazing (see Information Sheet 1, How can managing hill country be more profitable?)

Traditional livestock grazing practices (constant or set stocking) has been identified as a major factor that limits natural regeneration potential. Research and scenario modelling undertaken by Land, Water & Wool projects suggests almost no regeneration is found under traditional farm grazing regimes.

Indications are that stock may need to be excluded from regeneration areas until after saplings are established (usually five years). Fencing may be removed and reused once saplings are established and grazing can continue as normal.

Costs & benefits of natural regeneration

Natural regeneration can be a more cost-effective way to grow more trees than other methods of establishment. There is less money to be invested in natural regeneration, compared to buying and planting tube-stock or seedlings. However, the opportunity cost would be the same for all regeneration options, if grazing land is lost for 5 years while trees establish e.g. if the average paddock stocking rate before tree establishment is 8 DSE/ha., with an average gross margin of $20 /DSE achieved, the lost annual gross margin would be $160 for every hectare of trees established, on top of the initial investment costs.

Investment cost comparison

	Natural Regeneration (fenced)	Tubestock (no fencing)	Hiko seedlings (no fencing)
	$/ha	$/ha	$/ha
Electric fencing costs @ $80.00 / ha.	$ 80.00	$ -	$ -
	$/tree	$/tree	$/tree
Purchase cost of tree	$ -	$ 1.00	$ 0.40
tree guards	$ -	$ 0.26	$ 0.26
planting labour	$ -	$ 0.10	$ 0.35
$/tree	**$ -**	**$ 1.36**	**$ 1.01**
@ 500 trees/ha ($/ha)	$ -	$ 680.00	$ 505.00
TOTAL $/ha	$ 80.00	$ 680.00	$ 505.00

Temporary fencing can be removed and reused, whilst grazing can be resumed five years after tree establishment.

Shelter benefits can be in the order of an extra $0.93 /DSE gross margin. This figure comprises benefits from reduced mortality as well as feed savings in cold weather, from research conducted in Western Victoria (Bird, R. [1981]).

Having more trees can also improve the visual appearance of the farm.

Natural corridors provided by additional trees encourages the movement of native birds and animals across the landscape as well as providing good habitat for native flora and fauna species. The presence of native plants and animals on farms usually fits in with farm family goals and their long-term objectives.

Shelter Benefits

# lambs (DSE)	**2500**			
# sheep (DSE)	**11000**			
Gross margin /DSE	**$ 20**			
Reduced Mortality		**# DSE**		**Extra $**
lamb mortality	5%	125		$2,500
off-shears mortality	0.5%	55		$1,100
Feed savings in cold weather				
10% inc in GM to 30% of stock	10%	3,300		$6,600
	Total Extra $			**$10,200**
	Extra $/DSE			**$0.93**

Assumptions used in the financial analysis of the Land, Water & Wool project

- Shelter benefits are a 5% reduction in lamb mortality and 0.5% reduction in shorn sheep mortality, fully achieved after 14 years.
- Fencing costs of $80 per ha. Based on an average figure derived from the study of costs involved in fencing remnants in case study properties in Central Victoria (standard fencing costs for electric fences were $1500 / km).
- 15% of the total farm area is established to trees through natural regeneration.
- There is a 10% increase in pasture growth and feed savings on double the area established to trees i.e. 30% of the farm area fully achieved after 14 years, valued by increase in gross margin per DSE.
- Temporary fencing is carried out to prevent stock access to tree areas using electric fencing at a cost of $1,500 / km.

Major stock husbandry benefits from increased shelter

- When comparing sheep in sheltered areas to those with no shelter a 31% increase in wool production and 21% increase (6 kg) in live-weight (5 year trial) may be expected. Lynch, J.J., and Donnelly, J.B., (1980). Changes in Pasture and Animal Production Resulting from the Use of Windbreaks. Australian Journal of Agriculture, 31:967-979.
- Research indicates that winter lamb mortality from birth to 48 hours would be greater in an exposed group of single lambs (14%), than a sheltered group (4%). Likewise, mortality rates of twins could be 9% in shelter and 28% when exposed (Western Victoria). Squires, V.R., (1983), 'The value of trees as shelter for livestock, crops and pastures: a review', in F.J. van der Sommen, R. Boardman, V. Squires, Trees in the Rural Environment: towards a greenprint for South Australia, Roseworthy Agricultural College, Roseworthy, South Australia.
- Research found that reducing heat load on ewes at joining and lambing results in 10-16% more lambs present at marking. Wakefield. S., (1989). Designing windbreaks on farms. Forestry Commission of NSW, NSW Agriculture and Fisheries, Soil Conservation Service of NSW, Sydney.
- When comparing sheep in sheltered areas to those with no shelter there is a 50% reduction in lambing losses (average losses without shelter were 36% for twins and 16% for single births (South-west Victoria, Eastern Highlands). Bird, R., (1981). Benefits of Tree Planting in South West Victoria. Trees and Victoria's Resources, 23: 2-6.
- Heat stress reduces wool growth by reducing feed intake. Anderson, G., (1986). The Effects of Trees on Crop and Animal Production. Trees and Natural Resources, Vol 28. No 4.
- Sheltered off-shears wethers only required about one third the amount of supplementary feed to maintain body weight as unsheltered off shears wethers (results obtained during a period of poor weather). Kingham L., (1996). 'Winning battles but losing the war?' in Proceedings of Remnant Vegetation in the Central West. Orange.

GLOSSARY

Native vegetation – any indigenous plant community (includes trees, shrubs, herbs, grasses, mosses, lichens and soil crust) that are naturally occurring within a region or locality. It excludes plantations or vegetation established for commercial purposes.

Remnants – patches of native vegetation. They are usually surrounded by land that has been modified for another use such as grazing or cropping. These patches also vary in their.

Remnants – generally small to medium patches of native vegetation. They are usually surrounded by land that has been modified for another use such as grazing or cropping. These patches also vary in their condition and how they connect to other patches.

Regeneration – naturally allowing seed, suckers or lignotubers to grow. Regeneration may result from human intervention but excludes planting.

Revegetation – the process of reintroducing vegetation to a site through planting.

Native grasses – grasses (e.g. wallaby grass, weeping grass, kangaroo grass, spear grass) that occurred in Australia before European settlement.

Native pastures – pastures that are predominantly composed of perennial native grasses with a variable number of native herbs.

Annual vegetation – plants that complete their life cycles in one year. They regenerate from seed each year and need to set seed to regenerate. (e.g. brome grasses, barley grass and cape weed).

Perennial vegetation – plants that live from year to year. (e.g. wallaby grass, phalaris or woody species).

Exotic vegetation – vegetation that has been introduced from overseas. (e.g. phalaris, perennial rye and brome grasses), but may also refer species not native to the region.

Habitat – the place or type of site where an organism naturally occurs. The environment, in which a community or species of plant or animals live, grows and reproduces including the physical and biological components of the location.

Direct seeding – using mechanical or hand methods to directly sow seed into a prepared site where they are to grow.

Planting – nursery grown tube stock or cell grown plants planted into a prepared site.

Intermittent grazing – grazed for short periods and at regular or sporadic intervals.

Ungrazed – grazing is excluded except for rare events like drought.

Economics of a case study example

The case study is based on an "average" wool growing property operating on hill country in central Victoria. Data used in this economic example is based on farms involved in the Land Water & Wool research project, which identified a case study farm as:

- 1400 ha. (includes 800 ha. of hill country)
- 12 DSE/ha. average stocking rate on flatter parts, with 8 DSE/ha. on hill country.

Required Investment	$/ha	Shelter	
		ha	$
Fencing for natural regeneration	$ 80	210	$16,800
(Based on $1500 /km for electric fencing)			

To establish native shelter requires investment in extra fencing across the property, which will cost $80/ha., on average if electric fencing is used (includes fencing materials and labour costs). This would be equivalent to $16,800 for 210 ha (15% area) of the case study farm. Government grants could possibly be accessed for fencing costs.

Profit analysis

If establishing native shelter through natural regeneration was carried out across a typical central Victorian wool property, it is expected that benefits to stock arising from the shelter can be valued.

Shelter is assumed to reduce lamb mortality by 5% per year, and provide a 10% increase in pasture growth. Department of Primary Industries research has also shown that sheep require 10% less pasture to maintain body heat in cold conditions. The combined effect of these benefits is expected to generate on average an extra $0.93 /DSE per year, which is equivalent to $10,230.

Establishing native shelter requires those parts of the property targeted for regeneration be de-stocked for 5 years, i.e. until trees are established. Sheep are then allowed back in to graze as normal, so the long-term carrying capacity is not reduced.

It is expected that shelter benefits of $0.93 /DSE will not be fully realised for about 15 years. At this stage, this will generate an extra operating profit of $6.53 /ha. over the whole farm.

Extra annual profit, once shelter benefits are fully realised			
EXTRA annual income	GM/DSE	# DSE	$
from inc. in GM/DSE	$ 0.93	11000	$10,230
EXTRA annual costs			
fence repairs/maintenance			$1,095
		EXTRA annual profit	**$9,135**
		EXTRA annual profit/ha	**$6.53**

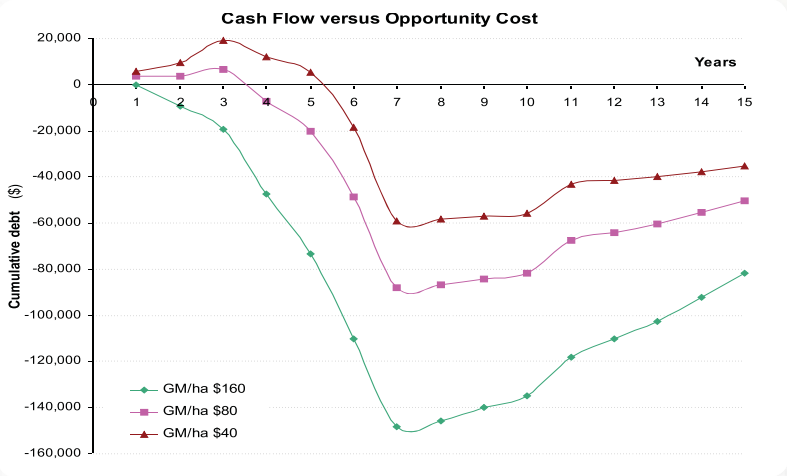
Cash flow

Establishing shelter using natural regeneration is a long - term strategy. The capital cost of fencing is not the reason why this strategy takes a long time to break even, rather the opportunity cost from lost grazing area while trees establish has a larger impact.

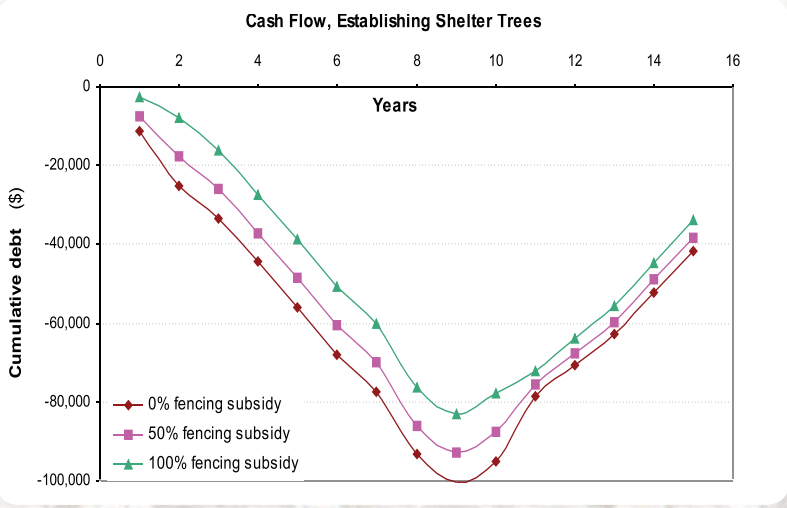
Even if 100% of the fencing costs could be covered with a grant or incentive, the break-even time is still well over 15 years.

Break-even time could be decreased by:

- re-introducing stock to treed areas earlier
- regeneration areas chosen are the lowest stocking rate areas on the farm
- reducing the size of the area allowed to regenerate
- allowing occasional grazing of these areas.



If the opportunity cost was decreased, due to lower stocking rates, or lower gross margin per DSE, the peak debt reduces considerably, however break-even times are still greater than 15 years.



Suggested reading

Ainsworth, N. (2004), **Weed Management in Riparian Zones – a guide for grazing properties in SW Victoria - Module 4**, Department of Primaries Industries, Ellinbank. www.dpi.vic.gov.au

Baxter, N. and Williamson, J. (2000), **Land classing kit for farmers**, Department of Natural Resources and Environment, Melbourne.

Dixon, P. (1996), **Property Management Planning manual**, Conservation and Natural Resources and Department of Agriculture, Melbourne.

Dorrough, J. and Moxham, C. (2005), **Eucalypt establishment in agricultural landscapes and implications for landscape-scale restoration**, Biological Conservation 123:55-66

Dorrough, J., Moxham, C., Crosthwaite, J. and Moll, J. (2005), **Vegetation management in temperate Livestock Production Landscapes**, Department of Sustainability and Environment, Melbourne.

McFarlane, G. and Trewick, K. (2002), **Environmental Best Management Practice on farms: Workbook 1 - Farm Self Assessment Sheets**, Department of Natural Resources and Environment, Melbourne.

Moll, J. and Dorrough, J. (2005), I**nvestment Analysis of proposed management options to increase native vegetation and wool profits**, Department of Sustainability and Environment, Melbourne.

Moll, J., Dorrough, J., Crosthwaite, J. and Straker, A. (2005), **Improving native biodiversity management on wool properties in central Victoria ? investment analysis of four strategies**. A paper presented to a Resource Economics Workshop 'Identifying production and environmental trade-offs at the farm level'. Organised by the AGSIP project AG13 in partnership with the Australian Agricultural and Resource Economics Society. 28 October 2005, Rockhampton.

Platt, S. (2002), **How to plan wildlife landscapes. A guide for community organisations**, Department of Natural Resources and Environment, Melbourne, www.dse.vic.gov.au →Conservation and Environment → Living Systems.

Ridley, A., Paramore, T., Froelich, V., Beverly, C. and Seymour, E. (2002), **Riverina EMS package**. Department of Natural Resources and Environment, Rutherglen.

Sargeant, K. and McLarty, G. (2003), **Grazing management for productive hill country pastures 1998-2002**, Department of Primary Industries, Seymour.

State of Victoria. (2002), **Victoria's native vegetation management: A framework for action**. Department of Natural Resources and Environment, Melbourne, www.dse.vic.gov.au. →land management →land →native vegetation.

Straker, A. and Lowe, K. (2005), **Environmental management in agriculture – Native biodiversity resource kit**, Department of Sustainability and Environment, Melbourne, www.dse.vic.gov.au →Conservation and Environment.

Websites

Birds Australia
Birds on Farms – ecological management for agricultural sustainability. 10 simple guidelines for attracting birds back to farms.

www.birdsaustralia.com.au/remnants/index

Catchment Management Authorities (CMA's) - Native Vegetation Plans / Regional Catchment Strategies **www.dse.vic.gov.au**

Department of Environment and Heritage
Revegetation and Wildlife: A Guide to enhancing revegetation habitats for wildlife conservation in rural environments
www.deh.gov.au/land/publications/revegwild/

Department of Sustainability and Environment
www.dse.vic.gov.au

→ Interactive Maps - information on biodiversity mapping

Follow links from www.dse.vic.gov.au to 'Conservation & Environment for

→ Biodiversity Action Planning

→ Local Area Plans

→ Living Systems (also 'How to plan Wildlife Friendly Landscapes)

→ Environmental Management in Agriculture

→ Management System for Victorian Agriculture

→ Ecological Vegetation Classes

→ Victoria's Biodiversity Strategy.

→ Bats in Paddock Trees www.dse.vic.gov.au/ari

→ publications & downloads → brochures.

Department of Primary Industries
Note information series (in particular Land for Wildlife , trees and native vegetation and weeds)
www.dpi.vic.gov.au

Use the search engine from www.dpi.vic.gov.au and type in Broadford Grazing Management

Greening Australia
www.greeningaustralia.org.au → Victoria →Tips and Tools → Revegetation Techniques Guide

Meat and Livestock Australia
Sustainable Grazing Systems Fact Sheet series (addresses biodiversity, birds, earth worms).
www.mla.com.au

River Landscapes
Riparian Management Fact Sheets
www.rivers.gov.au/publicat/factsheets

The project

Two projects have supported the development of this extension note.

The Victorian-based **Farm businesses, wool production and biodiversity** project has identified productive, practical solutions for native vegetation management, incorporating the commercial aspects of wool growing and sheep breeding. The project is funded by Land Water & Wool, which is a joint investment between Australian Wool Innovation Limited, the wool industry's peak research and development body, and Land & Water Australia.

The **Managing landscapes to meet public biodiversity and farm business goals** project, funded by Land & Water Australia.

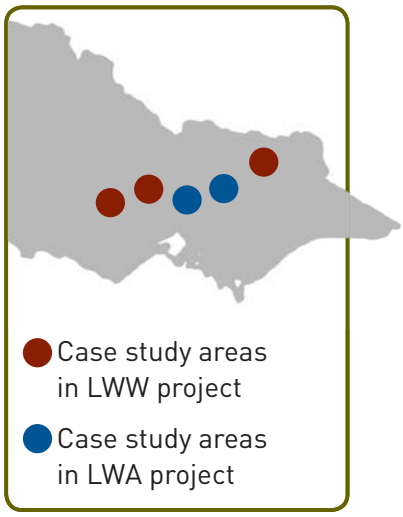
Guiding principles of these projects are that landowners will want to:

→ pass the farm on to future generations in a better condition

→ manage their farming systems to achieve financial, environmental and other family goals

→ be confident in knowing that farm business will not be limited by better management of biodiversity.

The research project involved seventeen case study farms throughout Victoria, including the Springhurst, Upper Goulburn, Mid Goulburn, Maryborough/Lexton, and the Ararat Hills districts. The study area is characterised as being foothill country consisting of hills, low hills and some flat country. The soil types are generally fragile or light and the substantial land clearing in the past has contributed to some large areas of soil erosion and low productivity. Native pastures and vegetation occur in much of the hill country.



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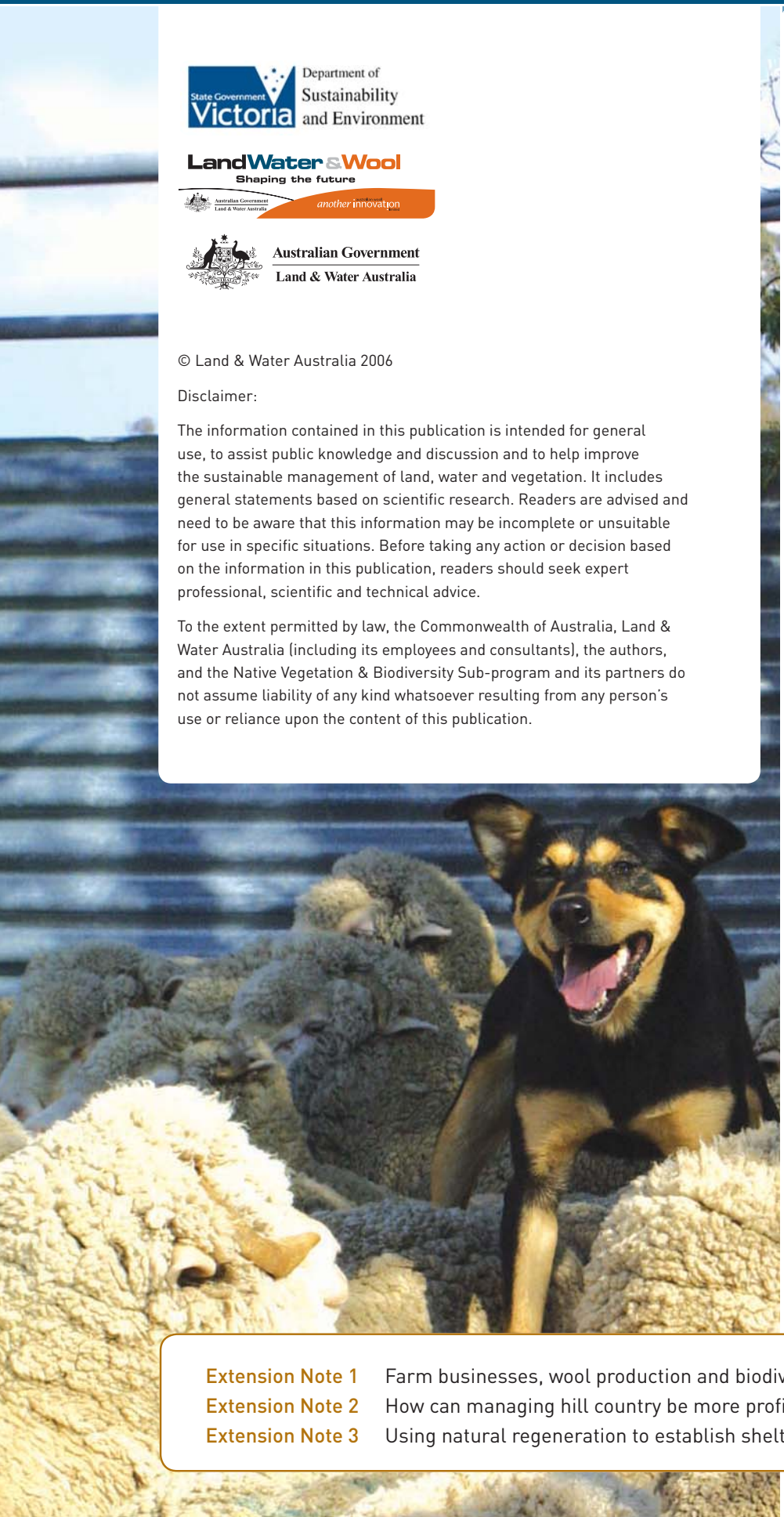

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The Native Vegetation and Biodiversity sub-program of *Land, Water & Wool* has five major regional projects across eastern Australia that are bringing woolgrowers and researchers together.

For more information on these projects contact **Land, Water & Wool - Native Vegetation and Biodiversity National Coordinator,**

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