

Timberbelts

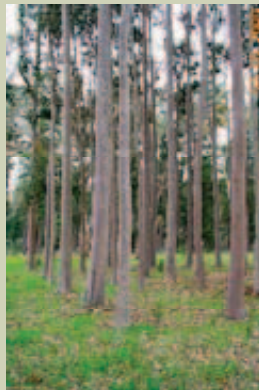
Farm Forestry in the Adelaide Hills / Fleurieu Peninsula - Farm Forestry Note 5/05

This Farm Forestry Note provides a guide to growing trees on farms in the Adelaide Hills and Fleurieu Peninsula to provide shelter for existing farming activities as well as commercial timber production.

It looks at a number of design and management aspects for timberbelts that you will need to consider, including:

- location in the landscape
- orientation
- permeability
- thinning practices
- pruning requirements
- likely returns
- advantages and disadvantages of timberbelts

Timberbelts can provide shelter for your existing farm activities together with timber production. They are generally long, narrow plantings from a single row up to 10 rows wide (approximately 30m), and can be permanently or temporarily fenced.



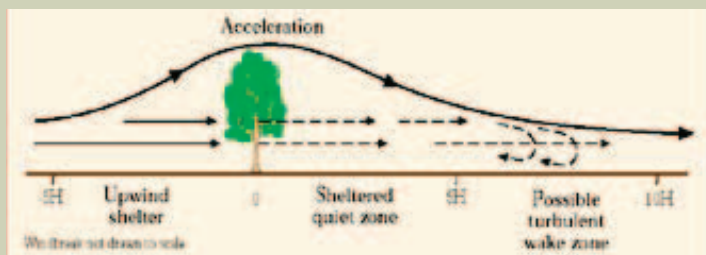
Timberbelts have the advantage over other planting designs of removing minimal land from farm production. They are well suited to highly productive grazing or horticultural land where shelter is an important requirement.

Timberbelts provide for exhibity

Rather than confining plantings to existing artificial lines along fencelines, timberbelts can be located to enhance the aesthetics of your property by picking up natural lines within the landscape such as watercourses, ridgelines and changes in soil types and landform.

Design Principles

The degree of shelter that can be achieved with a timberbelt depends on a number of key design factors. Such factors include its orientation, position in the landscape, height and the porosity of the timberbelt.



Permeability

Timberbelts work by taking the energy out of the wind and slowing it down. This is best achieved by making the wind 'push and shove' to pass through the belt and slowing the wind in doing so. As this 'slowed air' moves across the paddock it prevents the fast moving air from dropping onto the paddock.

Type of shelter

The first consideration must be the degree of shelter that is required. Do you require intense shelter for a short distance, suitable for lambing havens and off-shears protection, or more general shelter across a whole paddock.

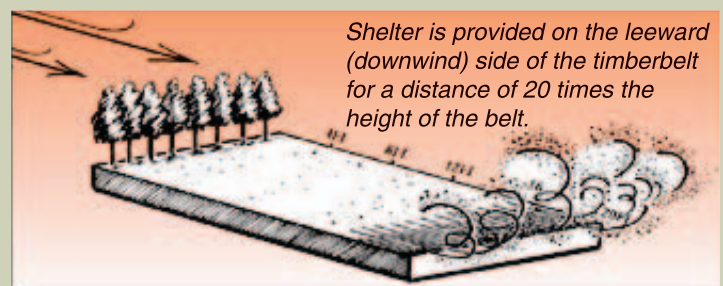
A dense shelterbelt (low permeability) will provide very intense shelter close to the belt, suitable for lambing havens and off-shears protection. Dense timberbelts will not allow the wind to pass through, but causes it to tumble over the top and back to ground level with little reduction in velocity within a short distance.

A more permeable shelterbelt will provide less intense shelter over a much greater distance. Thus it is more effective in providing general all of paddock shelter. Maximum protection distance is obtained from timberbelts with a porosity of 30-50%.

Height

The height of the timberbelt is the major determinant of the total area to be sheltered as the sheltered area is proportional to the height of the belt. Therefore maximum shelter is achieved by using tall fast growing species.

Shelter is provided on the leeward (downwind) side of the timberbelt for a distance of 20 times the height of the belt.



Protection is also provided on the windward side of the belt, but only to 4 times the height.



RURAL SOLUTIONS SA

Length

Wind will eddy around the ends of a timberbelt therefore a minimum length of 12 times the expected height is commonly recommended to reduce this affect.

Width

The width of a timberbelt is always a compromise between loss of agricultural production, the costs of establishment and the benefits gained from shelter, including the potential value of timber production and habitat. Your decision should consider all of these factors before a decision is settled upon.

Width will determine the permeability of the shelter planting. A wide timberbelt will be less permeable, reducing the sheltered area.

Profile

Gone are the days of the aerodynamic sloping profile windbreaks, where each row is composed of single height plants, with increasing height away from the wind. The



Mixed height shelterbelt, ideal for lambing shelter

aerodynamic design provides an impermeable face which tends to lift the wind over the belt rather than slowing and filtering wind through the planting.

Studies have shown that a permeable vertical face with a mix of plant and tree heights across rows is more effective. In very

exposed situations where a tall tree will suffer adverse exposure and not grow satisfactorily it may be appropriate to protect the taller species with a row of shrubby species.

Orientation

To maximise shelter timberbelts should be planted at right angles to the prevailing winds. Locally the most significant winds are from the north through the west to the south.

Planting at right angles to all of these is difficult. When planning for shelter it soon becomes obvious that it is not possible to provide protection from all directions therefore it is important that you consider where your most effective shelter is required and how it can be provided.

North-South belts are generally favoured as they provide:

- good protection from the south-west, west and north-west



Timberbelts reducing windflow from ridge area as well as gully area

- provide less shading of pasture and crops than occurs on the southern side of east-west belts.
- the aerodynamic drag of wind parallel to the belt from the north and south will help reduce the effect of northerlies and southerlies.

Location in the landscape (illustrate)

The position a timberbelt is located in the landscape will effect the distance that protection is provided. A timberbelt on a ridge provides a greater distance of shelter than a belt on flat land, which in turn provides a greater distance of shelter than a timberbelt at the base of a slope. To maximise shelter it then makes sense to locate timberbelts as high in the landscape as possible.

Understorey

Understorey shrubs can be incorporated into multi-row belts to enhance low shelter or as corridors of wildlife habitat. Where planted the belt must be permanently fenced to keep stock out and prevent gaps forming. An easy and cheap way of establishing understorey species is to direct seed between the rows of trees. This can be done by hand or with a seeding machine depending on the site and layout of the timberbelt.

Gaps

Gaps, whether from missing trees or stock grazing the lower branches, will result in accelerated wind speeds. In wide belts the gap factor becomes less of an issue as the depth of the belt compensates, however in narrow belts preventing gaps is important. This is best achieved by retaining permanent fencing and replanting missing trees.



An example of a gap with a direct seeded belt

While a browsing gap may increase windspeeds near the belt it may still be effective in reducing wind speed further away in the paddock. Again you need to consider the type of shelter you require.

Tree and fence spacing

Generally tree rows should be no closer than 1.5-2m from fences. Rows are generally no closer than 2m apart. Typically row spacings of 2.5-3m is utilised. Wide spaced multi-row belts may consist of rows up to 4m apart.

Trees should be 2.5-4m apart within the row and shrubs 1.5-3m. Tree spacing must also consider the type of timber product to be grown. A closer "woodlot" style of planting is suited to growing firewood where as a more open agroforest with high pruning is suited to sawlog production.



Need for Permanent Fencing

Narrow belts (2-3 rows) and belts with shrub species require permanent fencing to remove stock damage and prevent gaps and maintain sound shelter. Wider belts can be temporarily fenced until trees are beyond grazing damage and then the fences removed to provide in paddock shade for stock.

Rotation lengths

Will vary depending on the product grown. Firewood can be grown in 10-12 years while sawlog can be grown in 20-30 years. Obviously both these time frames are dependent on the growing capacity of the site and adoption of good establishment and management techniques.

Pruning and thinning regime

Pruning requirements

The open canopy and high proportion of edge trees in a timberbelt will result in heavy branch development. A pruning regime must be adopted to produce sawlog quality timber from timberbelts. A further benefit of pruning is that it will minimise shading and competition of adjacent pasture.

Root pruning may be required to reduce pasture competition from tree roots. A deep rip along the drip line of the tree canopy will reduce competition for a number of years.

A mix of pruned and unpruned trees can be used to maintain shelterbelt effectiveness. However high pruned trees without any low shelter have also proven to be effective for all of paddock shelter in wide belts.

In narrow belts, 1 or 2 rows, every tree must be retained as a final crop tree to prevent creation of gaps and funnelling of wind which may exacerbate wind speed. (See Farm Forestry FactSheet 6/98 Pruning Guidelines for Farm Forestry, for specific details on pruning techniques and strategies.)

Thinning requirements

Thinning of timberbelts should be restricted to multi-row plantings with an emphasis on sawlog production. In narrow belts thinning will adversely affect the quality of the shelterbelt. Establishment of another belt adjacent to the one to be thinned can help to maintain shelter.

In contrast multi-row belts can be treated in a similar way to woodlots and wide-spaced agroforests where poor trees are removed to concentrate wood growth on selected final crop trees. It is imperative that thinning does not create gaps that will adversely affect the shelter performance of the planting. A thinning regime within a timberbelt will be less severe than thinning a woodlot and may require that some trees are retained solely for their shelter value. Where the timber objective is firewood all trees should be retained to maximise volume production.

Designs - Species and Number of Rows

Single Row

Layout	Species	Management
1 row of single species	Radiata pine Cypress pine	Prune all trees to 6m, no trees thinned everyone has to be made a winner with form pruning; requires use of best genetic stock available.
1 row with alternate species	River oak Eucalypt species	OR every second tree pruned to 6m and every other tree fan pruned result will produce less wood but higher degree of shelter. Permanently fence to exclude stock and reduce damage and risk of gaps

Two row variations

Layout	Species	Management
A row of each, or alternated within rows, or two rows of the one species	Radiata pine Cypress pine	Leave one row unpruned and prune the other to 6m OR Alternate within each row unpruned with prune to 6m OR With Cypress pine fan prune one row, or alternate plants, for low shelter and high prune the other species Permanently fence to exclude stock and reduce damage and risk of gaps
1 Row shrub + 1 Row taller tree species	Ti-Tree and Sydney blue gum or Sheoak and radiata pine	Provides for height and is high pruned for timber while the other fills in the lower gap OR other tall timber species and shrub species can be used if suitable Permanently fence to exclude stock and reduce damage and risk of gaps
1 Row slow growing timber species + 1 Row fast growing timber species	Blackwood and Radiata pine or Spotted gum or Sydney blue gum	Alternate the species in each row Increase the number of rows and alternate species in each row Permanently fence to exclude stock and reduce damage and risk of gaps



Three Row Variations

Layout	Species	Management
Outside 2 rows fast growing species + inner row slow growing species	Fast growers Radiata pine Slower growers Blackwood	Prune all rows to 6m OR prune one outside row and the inside row to 6m leaving the other outside row for lower protection OR alternate pruning to 6m with no pruning in both outside rows, prune inside row Permanently fence to exclude stock and reduce damage and risk of gaps
3 Rows of single timber species	Sydney blue gum Tasmanian blue gum Sugar gum Spotted gum Radiata pine	Thin and prune all rows to 6m OR prune one outside row and the inside row to 6m leaving the other outside row for lower protection OR alternate pruning to 6m with no pruning in all rows Permanently fence to exclude stock and reduce damage and risk of gaps
3 Rows of single timber species with local understorey direct seeded between	Sydney blue gum Tasmanian blue gum Sugar gum Spotted gum Radiata pine	Thin and prune all rows for sawlog (prune to 6m) Permanently fence to exclude stock and reduce damage and risk of gaps
2 Rows timber species + 1 row of shrub species	Timber species Sydney blue gum Tasmanian blue gum Sugar gum Spotted gum Radiata pine Shrubs Melaleuca Callistemon	Thin and prune timber species rows for sawlog (prune to 6m) Permanently fence to exclude stock and reduce damage and risk of gaps

Multi-row Variations

Layout	Species	Management
4 or more rows close planted for timber species	Sydney blue gum Tasmanian blue gum Sugar gum	Unpruned and unthinned for firewood OR thinned and pruned for sawlog Temporarily fenced for establishment, then remove fence to allow stock to shelter
4 or more rows wide planted for timber species	Spotted gum Radiata pine	Thinned and pruned for sawlog Temporarily fenced for establishment, then remove fence to allow stock to shelter
2 inside rows close planted for timber and outside 2 rows direct seeded with local understorey		Thinned and pruned for sawlog Permanently fence to exclude stock and reduce damage and the risk of gaps
8 Rows close planted for timber		Thinned for sawlog but only edge rows pruned Temporarily fenced for establishment, then remove fence to allow stock to shelter



Species and stocking rates

The species to be used in a timberbelt will be dependent on the timber production sought from the timberbelt and the site suitability for particular species. Whether local understorey is to be used, or a shrub layer is included for lower shelter, or if the belt consists of purely trees will depend on these factors.

Whatever style of timberbelt you decide upon it is important to select species suitable to your site. It is also important to select appropriate species for the job such as selecting species for producing high quality sawlog if this is the desired outcome.

Other objectives – aesthetics

Selecting planting material with a guarantee of good form is important particularly in narrow belts where there is little opportunity to cull poor trees. For radiata pine this may include use of genetically improved planting material.

A feature to keep in mind for eucalypts is their tendency for outside trees to grow outwards with bent trunks. This is particularly important where sawlog production is required from narrow belts.

Returns - yields

Returns and yields of timber from timberbelts will vary greatly depending on the design and style of timberbelt used. Factors affecting this are species used, improved production from crop and livestock protection, fencing costs and associated management costs (pruning for example). It is important to weigh up all of these aspects before considering returns.

Typical silviculture and returns for a 1 kilometre length of 3 row timberbelts

Species	Typical spacing (metres)	Trees/km (stocking)	Rotation length (years)	Pruning requirement (6m high prune)	Final stocking (trees/km)	Average volume/tree (m ³ /tree)	Average \$/m ³	Total Returns (\$/km)	Annuity (\$/km/year)
Radiata pine	3 x 2.5	1200	25	high	600	0.75	40	18 000	720
Spotted gum	3 x 3	1000	25	moderate	500	0.5	30	7500	300
Sydney blue gum	3 x 3	1000	25	moderate	500	0.7	30	10 500	420
Tasmanian blue gum	3 x 3	1000	20	moderate	500	0.7	30	10 500	525
River oak	3 x 3	1000	30	moderate	500	0.5	40	10 000	330
Blackwood	2.5 x 2.5	1200	30	high	600	0.3	60	10 800	360
Cypress pine	3 x 3	1000	50	high	500	0.7	40	14 000	280

Returns are indicative only and are subject to site interpretation and assessment. Projected returns have not been discounted to net present values.

Indicative establishment costs for a Timberbelt

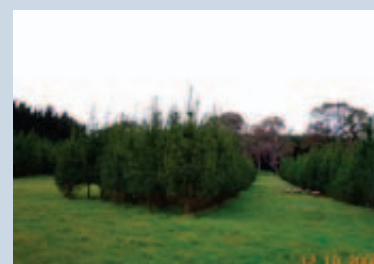
Site preparation	Ripping and mounding	200 \$/ha
Pre-planting weed control	Knockdown	30-40 \$/ha
Seedlings	Depends on species	180-400 \$/ha
Planting	Depends on site conditions, area, quality of site preparation	Do it yourself or 80-250 \$/ha
Post-plant weed control	Soil residual	30-40 \$/ha



Pine timberbelt located on hillcrest



Mixed species shelterbelt with pruned spotted gums in the middle



Wide spread pines with grazing in between



RURAL SOLUTIONS SA



Summary of Timberbelt Characteristics

Situation	Timberbelts
<i>Establishment cost</i>	<i>low, only establish as many trees as needed</i>
<i>Reliance on genetically superior material</i>	<i>high, every tree needs to be a winner, genetically superior material increases the quality of timber produced from fewer initial seedlings (only if sawlog or narrow)</i>
<i>Reliance on small diameter low value log markets for thinnings</i>	<i>nil, thinnings are minimal to maintain the shelter quality of the timberbelt</i>
<i>Rotation length</i>	<i>moderate, 20-25 years for sawlog, 10-12 years for firewood</i>
<i>Area required</i>	<i>low, narrow belts which can be worked in along existing fencelines (if appropriate) or along natural lines in the landscape (such as ridges, land class boundaries)</i>
<i>Pruning requirement</i>	<i>very high, for sawlog only, being relatively open allows trees to develop large branches, pruning removes branches on the trunk and allows the development of knot free timber</i>
<i>Suited to steep land (18°-30°)</i>	<i>yes,</i>
<i>Grazing</i>	<i>yes, little land is taken out of farm production and shelter is provided for grazing, cropping and horticulture on the adjacent paddocks</i>
<i>Total wood volume</i>	<i>moderate, less wood volume than a woodlot but higher quality timber produced</i>
<i>2nd, 3rd log potential</i>	<i>moderate,</i>
<i>Labour inputs</i>	<i>high, initially more labour into pruning, after pruned to 6m little labour input</i>
<i>Commercial thinning requirement</i>	<i>none, still has a selective thinning requirement</i>
<i>Logging costs</i>	<i>low, cutting fewer but higher quality logs than woodlot, harvest with chainsaw</i>
<i>Firewood</i>	<i>low, none or very little thinning required</i>
<i>High quality sawlog</i>	<i>yes, only if pruned</i>
<i>Fire hazard</i>	<i>low,</i>
<i>Paddock shelter</i>	<i>high, depending on location in the landscape and design</i>
<i>Fencing cost</i>	<i>low, if incorporated along existing fencelines, where suitably located for timberbelt planting</i>



For Further Information

FFN 1/98 Introduction to Farm Forestry in the Adelaide Hills and Fleurieu Peninsula

FFN 2/98 Farm Forestry: Frequent Questions and Common Myths

FFN 3/98 Farm forestry: Establishment Guidelines

FFN 4/98 Woodlots and Wide-spaced Agroforestry for the Adelaide Hills and Fleurieu Peninsula

FFN 6/98 Pruning guidelines for farm forestry

FFN 7/98 Firewood Growing in the Adelaide Hills and Fleurieu Peninsula

FFN 8/01 Farm Forestry Species for the Adelaide Hills and Fleurieu Peninsula

FFN 9/98 Protecting your forest plantation from fire

Enquire as to more recent publications

Agroforestry trees for productive farming, edited by Digby Race, published Agmedia 1993

Farm Forestry, Harvesting and Marketing- Guidelines for pine plantations in the Adelaide Hills and Fleurieu Peninsula, David Hanna, Forestry SA 1998

Farmtree\$ for the Mount Lofty Ranges: A regional Agroforestry Handbook by Peter Bulman, Primary Industries and Resources SA 1995

Forest Trees of Australia, D.J. Boland et al, CSIRO, 1994

Land Capability in the Mount Lofty Ranges, Fact Sheet, Central Hills Soil Conservation Board

All available from the Roseworthy Information Centre (8303 7626), Mount Lofty Ranges Catchment Resource Centre (Mount Barker 83917500), Pasadena Natural Resource Centre (8372 0182).

Guidelines for establishing and managing Commercial Forest Plantations in South Australia, ForestrySA, and Guidelines Working Group, 1997.

Mt Lofty Ranges Farm Forestry Industry Plan, Mt Lofty Ranges Farm Forestry Industry Development Group, 1997.

Developed by Rural Solutions SA - Private Forestry

For further information, contact the Mount Lofty Ranges Farm Forestry Program

at the Mount Lofty Ranges Catchment Centre, Upper Level, Cnr Mann & Walker Sts, Mt Barker, 5251

Phone : 8391 7500

Disclaimer

Use of the information/advice in this booklet is at your own risk. Rural Solutions SA and its employees do not warrant or make any representation regarding the use or results of the use of the information contained herein as regards to its correctness, accuracy, reliability, currency or otherwise. The entire risk as to the results from the implementation of the information/advice which has been given to you is assumed by you. All liability or responsibility to any person using the information/advice is expressly disclaimed by Rural Solutions SA and its employees.



RURAL SOLUTIONS SA