LAND MANAGEMENT

SUSTAINABLE LAND MANAGEMENT
Shelter for Hill Country Farms: Part 1 Shelter Design

Introduction

This Environment Topic will assist you to decide where and what type of shelter to plant. Use the second Environment Topic in this series, *Part 2: Shelterbelt Trees*, to decide what species should be planted. The third in this series on *Shelterbelt Establishment and Maintenance* discusses how to plant and manage shelterbelts.

Why have shelter?

Shelter has many uses because it:

- Reduces the risk of wind erosion on cultivated soils.
- Shelters stock and crops.
- Minimises moisture loss from plants and soil.
- Protects buildings and yards and provides shade.
- Provides a source of fodder during droughts.
- Increases biodiversity, food and habitat for birds, bees and insects.
- Enhances the landscape.
- Provides a source of timber and firewood.

Planning

We cannot overstate the importance of planning. Planning is essential to successfully match needs, species and site. It is important to know exactly why a tree is being planted.

Draw up a tree planting plan for the farm before starting any planting. Planning must consider:

- *Shelter objectives* – which wind

An example of effective shelter using the contours of the land and enhancing landscape values. Photo: Jonathon Barren

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direction are you sheltering from. What are alternative uses for the trees e.g. to provide fodder during droughts.

- *Present and future land uses* – what crops and what types of stock will be grazed and what are the fencing requirements.
- *Topography* - the slope angles and land formations effect the wind direction and speed.
- *Soils* - soil structure and nutrient deficiencies effect tree survival and growth.
- *Climate* – the wind direction, rainfall, aspect, sunshine, temperatures and frosts are all important.
- *Water* - wet areas, drainage patterns and stock water access all effect shelter location.
- *Plant and animal pest control* - is essential
- *Views* - into and out of the farm and landscape values are important.
- *Access routes* - vehicles, stock movement, access to drains, power and telephone lines must be considered.
- *Boundaries* - check district and city council requirements for planting along boundaries and next to public roads. Especially consider potential road shading causing wet and icy roads *(see Environment Topic "Tree Planting on Boundaries – a guide")*.

You need to plan when to plant, where to get your plants, plant quality and quantity, and on-going maintenance. To help with planning, also see the other Environment Topics in this series.

Shelter design features

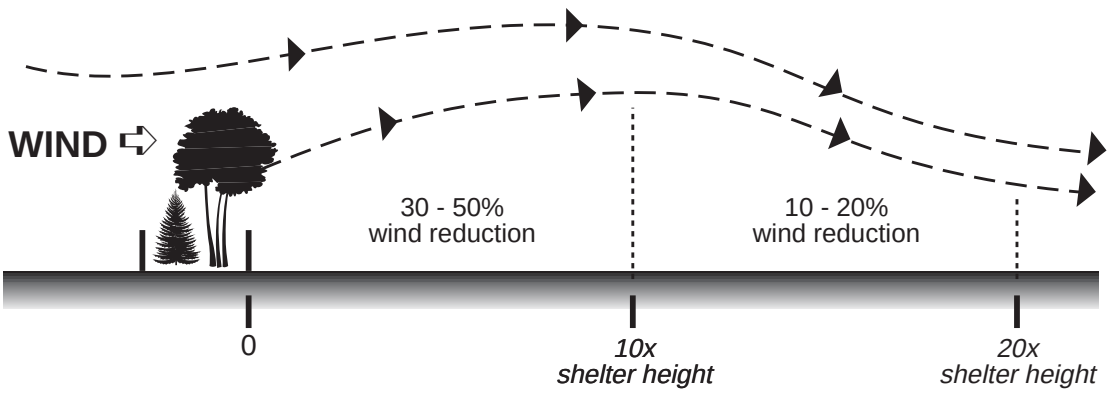
The aim of shelter is to filter the wind and slow it down but not stop it entirely so it's effect is maximised as far downwind as possible. This is achieved by planning for correct density, height, orientation and continuity.

Density

The best sheltering effect is achieved where there is 40-60% permeability through the shelter. An impermeable shelter can accelerate the wind as it whips through gaps and over the top, creating turbulence. The ideal density can be achieved by planting trees which have the apprioriate natural density. E.g. *Pinus radiata* has a dense crown while Eucalyptus and Poplar species have light crowns and are much less dense.

Height

Shelter with 40-60% permeability will reduce wind velocity by 30-50% downwind for a distance of 10-15 times the height of the shelter. Calculate your estimated sheltered zone. For example: 15m high shelter x 15 = the 225m downwind sheltered zone.



Shelter reduces the wind speed over a distance that is proportional to the shelters height. Diagram: Environment Waikato

Orientation

Shelter should be planted at right angles to the prevailing wind but usually some compromise is needed to fit with existing fencelines. Wind velocities can actually be made worse if shelter is angled greater than 40^{o} from the prevailing wind direction as wind is concentrated.

North-South orientated shelter:
Protects against strong, desiccating, westerlies. Tall growing species maximise the effectiveness of the shelter. As shading is not a problem, evergreens can be used.

East-West orientated shelter:
Protects against cold, biting southerlies. Shading on the south side of shelter is a problem with this orientation. They can also cause cold air dams in frosty weather on flat land and valley floors. Low growing, or deciduous species are generally best in this orientation. Closely planted deciduous trees will give shelter even when bare.

On hill country wind may come from a different direction to the prevailing winds, i.e. it can funnel up gullies:

- *Ridges* – do not plant on top of a ridge as this sharpens the ridge increasing the turbulence. It also affects landscape values. Instead, plant shelter below the crest on the leeward or windward side.
- *Valleys* – plant across, not down, valleys to reduce the funnelling effect of the wind.
- *Buildings* – planting shelter upwind of stockyards and buildings provides effective shelter. However, plant to minimise shade (or to maximise it) and ensure falling trees will not damage structures.

Continuity

The lack of continuity is one of the major faults with shelter. Wind accelerates through gaps, around the ends of shelterbelts and over dense barriers.

Individual shelter lengths should be at least 12 times, and preferably 24 times, the height of the shelter trees.

To increase the shelter planting length “tie-in” your shelter with other plantings such as woodlots and native bush and use the shape of the land to increase the effective length of the shelterbelt.

Maintain shelter down to ground level to avoid wind funnelling. Trimming encourages foliage growth to ground level in some species. Alternatively, grow low growing species on the windward side of a taller species (but ensure permeability is maintained).

Shelter design

Shelter can be planted as a single or multiple row shelterbelt or it can be a well-placed stand of trees. The design selected will depend on the objective of the shelter and it’s location:

A double row, north-south orientated shelterbelt of Eucalyptus delegantensis and Cedrus deodara. Photo: Jonathon Barren

- *Groups of trees* – the clever placement of a group of trees, rather than a row, can be just as effective. However, understand the wind patterns before contemplating this type of shelter.
- *Single row* – closely spaced at 2-3m to prevent draughts at ground level and gaps. This design is used where conditions are not extreme.
- *Double row* – used often where wind is strongest (primary shelter), soils are light and maximum shelter is needed. Plant one row of slow growing and one row of faster growing species, or plant two rows of the same species. The row of slow growing windward species will provide added stability.

  Low or slow growing evergreen species, providing low winter shelter for stock, can be combined with tall deciduous trees that provide high permeable shelter during the growing season.

  Tree spacing for double rows is 2-3m between and within rows with the rows offset to each other.
- *Triple row* – suited for very exposed conditions. Use tough, wind resistent species in all rows.
- *Timberbelt* – generally shelterbelts do not produce good timber, while trees pruned for timber do not make good shelter. Options are a single row of trees where alternate trees are fan pruned to provide low shelter and the others are clear pruned for timber. A timberbelt is usually only successful in low wind situations.

Establishment and maintenance

Careful establishment will promote good, even, growth rates and avoid losses leading to gaps. Trimming will enhance the effectiveness of the shelter and prolong its life.

For further information see the Environment Topic in this series on *Shelter for Hill Country Farms: Part 3 Shelterbelt Establishment and Maintenance.*

Recently trimmed single-row Leyland cypress Leighton Green shelterbelt. Photo: Simon Stokes.

References

Trees on Farms. A guide with local experience of growing trees in the Waikato Region. Environment Waikato in association with MAF Sustainable Farming Fund, NZ Farm Forestry Association and Federated Farmers. Hamilton. 2002.

Guide To Successful Farm Forestry: *A Hawke's Bay Perspective* Kevin Thomsen, Simon Stokes, Alec Olsen & Susan Mackintosh, Napier. To be published 2005.

Plant materials handbook for soil conservation. Volume 1: principles and practices. Water and Soil Miscellaneous Publication No. 93. Soil Conservation Centre, Aokautere, 1986.

For further information

For further information see the other Environment Topics in this series *Shelter for Hill Country Farms: Part 2 Shelterbelt Trees* and *Part 3 Shelterbelt Establishment and Maintenance.*

For further information

For information on Sustainable Land Management ask for other titles in this series or contact Land Management Officers at Hawke's Bay Regional Council.

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