



Trees for our Region

Growing trees in the Manawatū-Whanganui Region for protection, production and pleasure

Third Edition

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Controlling Erosion

The Use of Vegetation to Stabilise Land and Prevent Erosion

Soil conservation and tree planting go hand-in-hand. The planned planting of trees can prevent erosion while providing many other benefits such as shade, shelter, timber, and stock food. Mechanical means can be used to stabilise land but vegetation is generally more economical and more effective in the long term.

Prevention is better than trying to find a cure. When land is cleared, the risk of erosion can be reduced by leaving native forest on fragile areas, such as steep slopes and gullies. Erosion can easily be started by cultivating land.

To reduce the risk of erosion:

- Establish a vegetation cover over cultivated land as soon as possible;
- Cultivate along the contour, not up and down the slope;
- Choose the appropriate time and method of cultivation to avoid compacting the soil.

Trees improve land stability in a number of ways. They:

- Bind the soil together with their roots;
- Protect the ground from the direct impact of rainfall;
- Remove excess moisture from the ground.

The main types of erosion are:

- Gully and streambank erosion;
- Slope instability;
- Tunnel gully erosion;
- Wind erosion.

Gully and Streambank Erosion

Gullies

These should be planted first in any control programme as they often trigger other forms of erosion. If the cause of the gully is treatable, see to that first. Treat the problem, not the symptom.

Willow planting

Salix spp (willows) are well suited to tying up gully systems because they form a fibrous mat of roots. Gully planting must be in pairs (directly opposite each other) to confine the water within

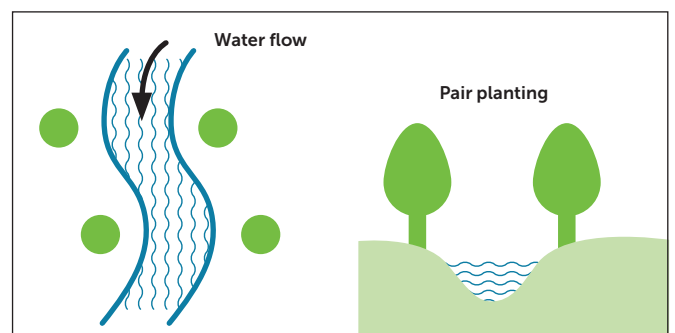
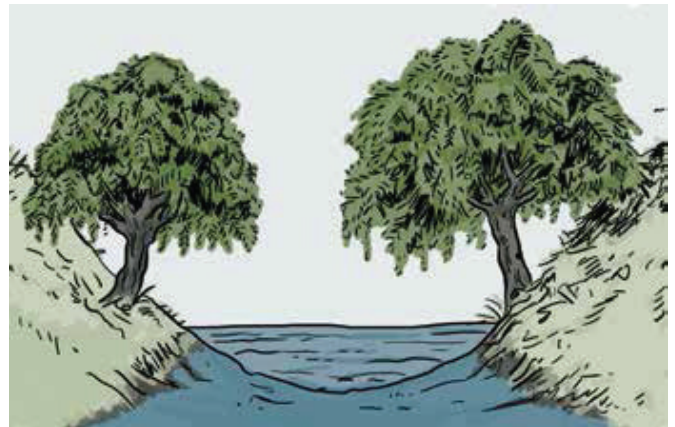


Fig. 1 Gully planting

the channel. Water then flows over the mat of willow roots and does not scour out the bed of the channel.

Tree spacing

Trees should be spaced according to the severity of the problem. For severe problems, tree pairs should be four to five metres apart. For potentially erodable areas, tree pairs need only be 10 to 20 metres apart.

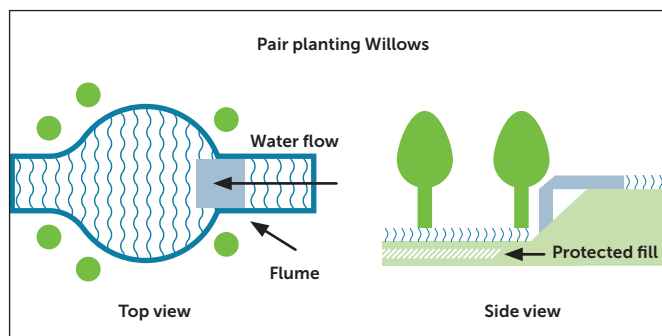


Fig. 2 Gully head

Gully heads

Sometimes a gully develops a 'head' or a pronounced drop as erosion progresses, which works its way upstream. To overcome this problem, a flume, which is a wooden or metal chute, should be built to carry the water over the vulnerable edge of the drop. There are a few key points to note when building a flume:

1. Water must not be allowed to flow around the sides or under the flume;
2. It must be designed to withstand high flows;
3. Rocks, tyres or some non-erodable material is needed at the bottom of the drop to absorb the impact of the falling water and to prevent scouring;
4. Willow planting will be required to further prevent erosion and stop any scouring of the sides and bottom.

Streambank erosion

Willows help to stabilise the toe of eroding streambanks. *Salix purpurea* (shrub willow) is useful on smaller streams. Some form of temporary physical protection may be needed to hold the toe until the trees become established. Further up the sides and top of the bank *Populus spp* (poplars) and *Alnus spp* (alders) may be used. Plant only on the outside of bends so as not to force water onto the opposite bank.

Maintenance is essential to prevent channel blockage and toppling of larger trees into the streambed.

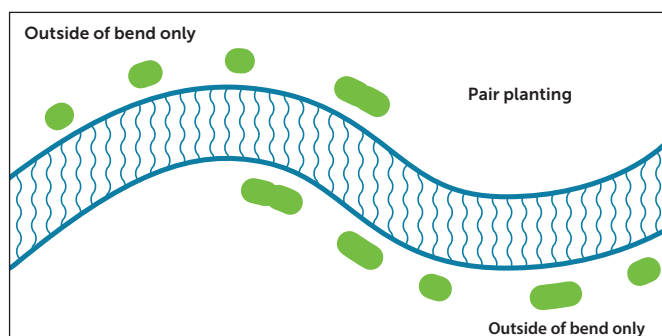


Fig. 3 Streambank planting



Slope Instability

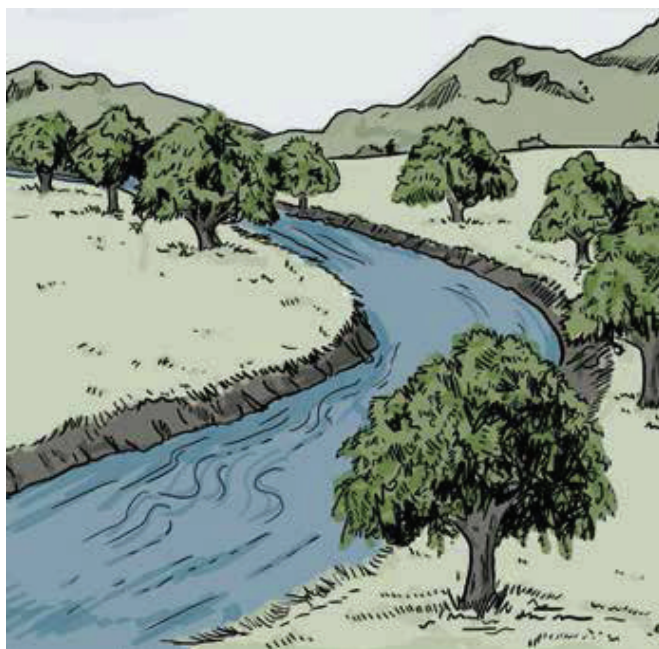
There are various ways of dealing with slips, slumps and earthflows, depending on the severity of the problem. In many cases the movement is accelerated by water:

1. Gully erosion can undermine the slopes above;
2. Water from springs or wet spots on a slope can lubricate a slipping plane below the surface and add weight to the moving soil;
3. Water flowing over an unstable slope can scour channels and remove support, accelerating the movement.

Where possible, deal with any water problems first by:

1. Planting up gullies;
2. Tapping or planting a wet area around a spring;
3. Diverting overland water that is coming from above.

Extra planting will be needed to reinforce any water control works that are carried out.



Planting methods

For less severe problems:

1. Open plant poplar or willow poles at 6-10 metre spacings with the aim of 10-20 metre spacings when the trees are fully grown;
2. Agroforestry plantings at 8-10 metre spacings using *Eucalyptus*, *Pinus*, *Cupressus*, and *Alnus* species will suffice. These trees will initially require fencing from stock.

For more severe problems:

1. Grazing will need to be restricted here until the trees become established. Use close planting with poplar and/or willow stakes. These will require fencing, and planting at 4-6 metre spacings (between trees) at the bottom or toe of the movement and moving up to 6-10 metres further up the slope;
2. Retired from grazing. These areas will require fencing from stock and planting with a combination of *Eucalyptus*, *P. radiata*, *Alnus*, *Acacia melanoxylon* and/ or poplar and willow. Species used will depend on individual site conditions. Spacings usually range from 3 metres between plants at the bottom of the movement to 6-8 metres further up. Future maintenance by thinning will be needed to allow light to penetrate the canopy and encourage understorey vegetation to become established.

Tunnel Gully Erosion

Tunnel gullies are formed when soil conditions allow a tunnel to develop below the land surface. The underground gully eventually collapses the soil surface leaving a hole or series of holes down a slope connected by a tunnel.

It is difficult to predict where these holes will develop, but the roots of trees planted along the suspected line of the gully will help bind the soil. Where a tunnel gully has collapsed and broken the surface, trees (usually poles) need to be planted along it and should be angled out of the reach of stock or cut longer (to 4-5 metres) to avoid browsing. Where there is permanent running water the tunnel gully should be treated as a gully and pair planted with willows.

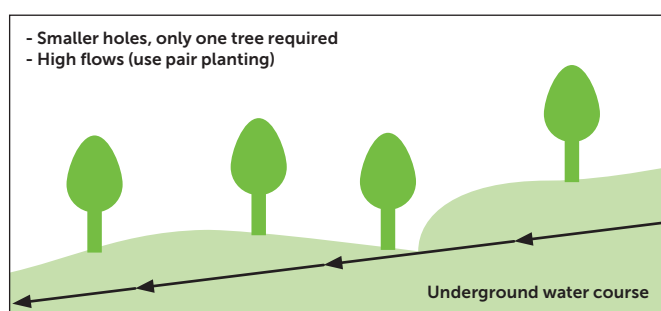


Fig. 4 Tunnel gully planting



Wind Erosion

Wind erosion can be a problem on sandy coastal country and requires the use of special plant species. Specialised technical advice on sand stabilisation and coastal shelter is available from the Land Management team at Horizons Regional Council.

Further inland, shelter planting is the best way to break the wind and deal with wind erosion (see farm shelter section for details).

Points to remember:

- Earthslips and slumps require planting from the bottom up as the majority of control is achieved in the bottom third. Plantings should extend on to solid ground above, below, and to the sides of the movement;
- Do not plant in cracks in the ground, as these will dry out and open up during the summer, causing the tree roots to dry out;
- To prevent death by waterlogging, do not plant any tree except willows in areas that pond water or are likely to do so during the winter. Plant on higher ground that does not pond water to help survival;
- If fencing is required, it must be completed before planting. Goats and horses take no prisoners with trees, and cattle and sheep will cause damage if given the opportunity;
- When planting pole material, use damper depressions and avoid stock tracks. This will greatly assist survival over the first couple of seasons;
- Plant poles deeply (at least 0.75m) and ram well. Repeat several times in the first year if necessary;
- Keep heavy cattle away from the plantings for as long as possible during the first year;
- Ongoing maintenance will be required to promote good tree health and prevent the canopy closing over and creating bare areas through shading.

Timber Production

The world's timber resource is rapidly diminishing. Over 95 per cent of world timber needs come from unmanaged (virgin or regrowth) forests which is unsustainable. Timber is the only market where world demand is increasing and supply decreasing, especially in hardwood timbers.

Logging of our native forests has all but ceased, making native timber difficult to obtain. In the absence of managed native timber, exotic hardwoods or softwoods such as *Pinus radiata* are required to fill the gap. Carbon credits are also an incentive to plant timber crops.

Growing a timber crop in association with farming has many benefits, not only financial. Shade, shelter and erosion control are a few. New Zealand has the land and the climate to produce high quality timber and it is up to us to take advantage of what nature has given us. For many people, the planting of trees for timber conjures up a picture of large, dense blocks of radiata pine. However, the small scale grower may do better by growing fewer trees and managing each one for a greater proportion of high value timber.

Almost every species has some timber value, and trees planted for other reasons such as erosion control or amenity can eventually yield valuable timber or wood for some other use.

Before you put any trees in the ground, do your homework.

Matters To Consider

1. Forest rights legislation

Land ownership changes often and a common statement from potential planters is "why should I plant trees when I may shift? I'll get nothing from them". The Forest Rights Registration Act has been in place since 1953. This Act allows a block of trees and any agreement, for example a joint venture concerning the trees, to be registered against the title of the property involved. This means that if the land is sold, the party or parties who have registered the trees may retain the felling rights to those trees. With this legislation, the forest area can be defined within property boundaries using a mapped aerial photo, thus avoiding high surveying costs.

2. Product types – what do you want to produce?

- Clearwood;
- Pulpwood;
- Framing timber;
- Firewood;
- Farm timber, using durable species for posts and for building.

3. Time – for high returns trees **MUST** be well tended

How much time now, and in future years, will you have for tending your trees?

Can you afford a contractor?

The labour input for planting is approximately 8-12 hours per hectare. For pruning, it increases to 60+ hours per hectare over 2-3 years. Plan your yearly planting to make use of available labour.

4. Land available and species to use

Work out what species you can grow on your land and how far the planting sites are from the road. The further from the road, the larger the forestry area you will need to plant to make it economical to extract those trees when they mature.

5. Water and soil values

Make sure that on the site you choose it will be practical to extract thinnings and/or the final crop without destroying the soil and allowing silt into waterways. Protection strips of vegetation should be left alongside watercourses. Make sure that the area you choose will not erode at harvest time.

Seek advice from Horizons Regional Council before choosing the site if in doubt. Advice is readily available from Horizons Regional Council, the Farm Forestry Association, private consultants, and knowledgeable locals. Make sure that people **advise you on what to do**, not tell you, because it will be **your planting**. Once the advice is given, make your decision.



Spacing Methods

There are many opinions about the best final spacings for clearwood production. These generally range from 50 stems per hectare, to as high as 500, depending on species and whom you talk to. To combine trees with grazing, for example, the final spacings should be less than 150 stems per hectare to encourage grass growth right up to the base of the tree. The trees should be pruned to 6 metres or higher to maintain grass growth.

Initial planting – how many do I plant to achieve the desired final crop?

More trees are planted initially than are needed for the final crop because of the following reasons:

1. Gives a chance to select trees with good form for the final crop;
2. Forces the trees to grow upwards and restricts side branching;
3. Gives options for the final crop use, for example, using thinnings for pulp, framing or fencing timber.

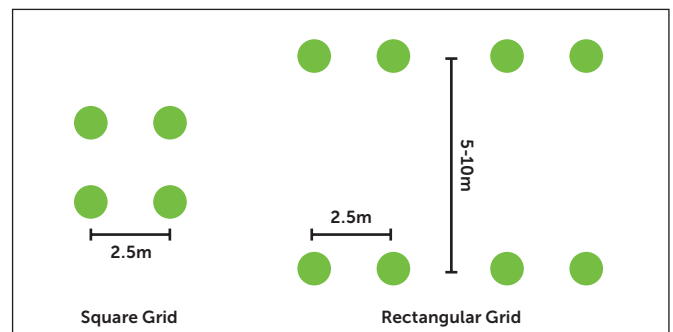


Fig. 5 Grid planting

In the past, when tree quality was lower, spacings were as close as 2.5 x 2.5 metres or 1600 stems per hectare or higher. To get down to a final spacing of 6 x 6 metres (250 stems) involved a lot of thinning and unnecessary pruning. Such a system is economical only if the thinnings can be used for posts or pulp, etc.

With improvement in tree quality and higher labour costs, initial planting densities are generally lower now. If grazing is desired after the trees are well established, it is advisable to plant fewer trees.



Group planting

This system is an alternative where low stocking is desired. In this situation, trees are planted in groups of two or three at their final spacings and at age 2-5 years, one tree of each triangle is selected for the final crop, giving accurate final spacings. This system requires good quality tree stocks. Group planting is also suitable for species like *Acacia melanoxylon* in gaps or lines cut in bush or scrub.

Grid planting

Trees may also be set out in grid patterns. Depending on spacings, pruning may be carried out on as many as three times the final crop number. If there is no production thinning (for posts, pulp, or timber) then money and time have been wasted. Usually, this system is better for higher stocking rates in plantation forestry, where there will be less thinning required, rather than for agroforestry.

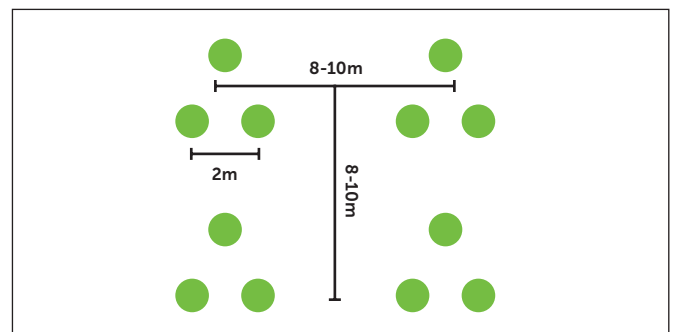


Fig. 6 Group planting

Definitions and Terms

1. Planting systems

- a. **Agroforestry:** Combining stock grazing with wide spaced timber planting. This system maintains grazing underneath for part or all of the life of the tree crop depending on species. This provides a multiple use for the land and often has erosion control, shade and shelter benefits. Even under an intensive forestry regime there is still significant grazing during the first few years. **50 to 200 stems/hectare final spacing.**
- b. **Woodlot:** Concentrating on managing the land for a timber crop only. **200 to 1000 stems/hectare final spacing.**
- c. **Timberline:** Managing a shelterbelt for timber. **30 stems/100 metres.**

2. Clearwood

This is formed as the diameter of the tree grows outwards, laying down new wood with no branches on the outside to cause knots in the timber. Clearwood may be used for furniture, veneer, panelling, and other high value products. Knotty timber does not command such a premium and will normally be used for construction.

3. Defect core

The defect core is all the deformed wood in the centre of the tree that forms as new wood grows around branches. When these are pruned, the healing-over process (occlusion) starts and the new wood laid down immediately over the pruned branch stubs is distorted.

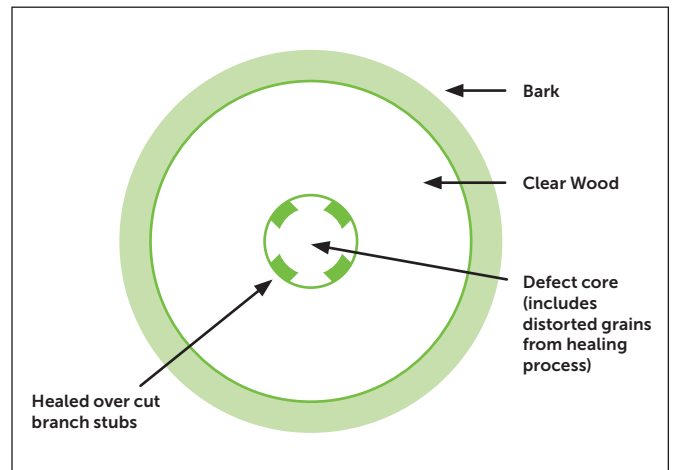


Fig. 7 Clearwood and Defect core

4. Diameter over stubs (DOS)

This is measured after pruning, over the top of the pruning wound. A good DOS to aim for is 130 to 190 millimetre. This will give a defect core of between 190 to 250 millimetre. The difference between these measurements is the wood laid down over the pruning wound.

5. Diameter at breast height (DBH)

This refers to the measured diameter at around 1.35 metre off the ground, taken from the uphill side of the tree.

6. Stems per hectare (SPH)

The number of trees per hectare.

7. Final crop

The number of trees intended for harvest once all thinning has been carried out.

Notes

Sequence for Planting

As early as possible	Order the trees. Some varieties may be sold out up to two years ahead, so the sooner they're ordered the better.
March–May	Control possums, hares or rabbits and complete fencing.
April–May	Spray spots with weed killer where you intend to plant individual trees and/or graze the area hard with stock to reduce weed competition.
June–August	Plant when the ground is moist, fertilise at planting if required.
September onwards	Plant the frost susceptible species once it's safe.
October	Release trees by clearing the grass from around them using mechanical, or if necessary, chemical means.
March	Check for survival. Release again if necessary, then start again for next year.

Suitable Timber Species

<i>Alnus rubra</i>	Red alder
<i>Acacia melanoxylon</i>	Australian/Tasmanian blackwood
<i>Cupressus lusitanica</i>	Mexican cypress
<i>Cupressus macrocarpa</i>	Monterey cypress
<i>Cupressocyparis leylandii</i>	Leyland cypress
<i>Cupressocyparis ovensii</i>	Ovens cypress
<i>Dacrydium cupressinum</i>	Rimu
<i>Eucalyptus delegatensis</i>	Alpine ash
<i>E. fastigata</i>	Brown barrel
<i>E. fraxinoides</i>	White mountain ash
<i>E. globoidea</i>	White stringybark
<i>E. muellerana</i>	Yellow stringybark
<i>E. nitens</i>	Shining gum
<i>E. pilularis</i>	Blackbutt
<i>E. regnans</i>	Mountain ash
<i>E. saligna</i>	Sydney blue gum
<i>Juglans nigra</i>	Black walnut
<i>Pinus radiata</i>	Radiata pine
<i>Podocarpus totara</i>	Tōtara
<i>Populus spp</i>	Poplar
<i>Quercus robur</i>	English oak
<i>Sequoia sempervirens</i>	California/Coast redwood

Notes

Farm Shelter

Throughout the year, whether the wind is warm and drying or cold and wet, shelter is essential to improve conditions for stock, pasture, and people alike. As there are many different types of shelter belts, this guide will cover only the main types and the principles of shelter planting. Requirements will differ greatly with individual sites.

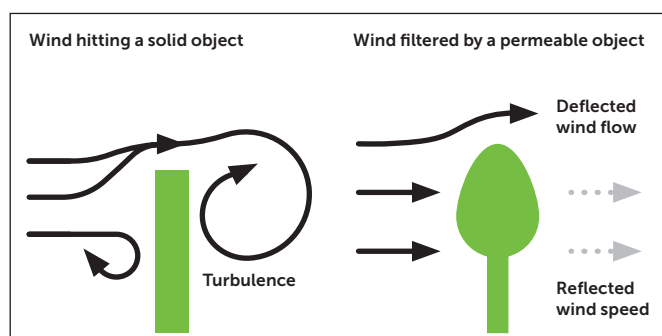


Fig. 8 Wind flows

Principles

1. The aim of a shelterbelt is to filter the wind and slow it down, not stop it entirely. A solid obstruction or a very dense shelter belt tends to create turbulence on both sides and accelerates wind speed on the downwind side which defeats the purpose of a shelter belt.
2. Planning is essential. It is best to work with a farm map and, where possible, use existing fence lines. Design the shelter, work out what results it will deliver, and decide on a priority order of planting.
3. To achieve a good even shelter belt, care needs to be taken with grass and weed control, tree health and species selection. A shelter belt must be managed to give good results. Some species such as *C. macrocarpa* require pruning or trimming to stop them becoming too dense.
4. Shelter can be multi-purpose. Trees can be managed for timber, bee and stock fodder, and amenity values.
5. Fencing MUST be stock proof and a 2-3 metre gap is required between the outside trees and fence line. Fences must be erected and made stock proof before planting.
6. When using evergreen species, remember that if the row runs east-west, there will be a problem with shading on the southern side. A less dense eucalyptus species teamed with a denser and shorter understorey may solve this problem.

Types of Shelter Belts

Single row

- May be deciduous or evergreen;
- The trees need to be closely spaced (2-3 metres apart) to prevent gaps and draughts underneath;
- A single deciduous row is useful in breaking up westerly winds, and may be used as a secondary internal shelter belt.

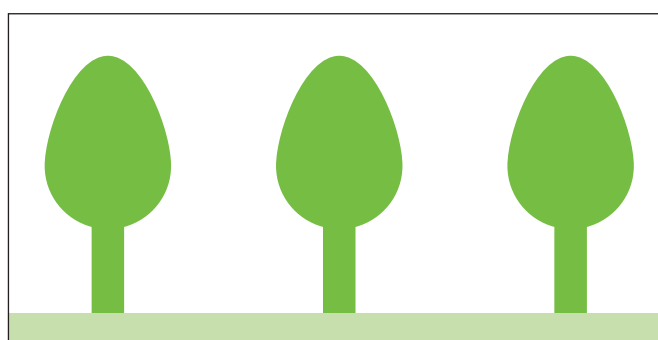


Fig. 9 Single row shelter belt





Double row

There can be many combinations of species but generally one species provides high shelter with the other giving lower and denser shelter. Often the trees are offset in double rows to provide the understorey, and spacings range from 2-3 metres within and between rows.

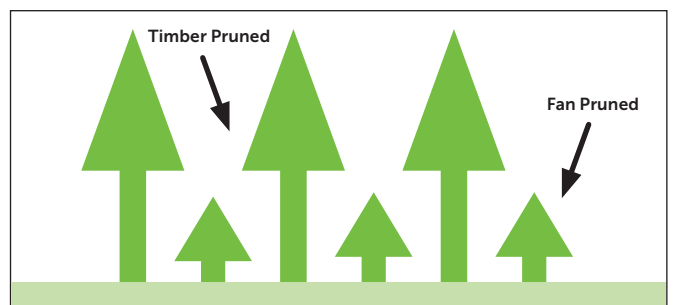


Fig. 10 Double row shelter belts



Triple row

Shelter belts often used in very exposed or coastal situations.

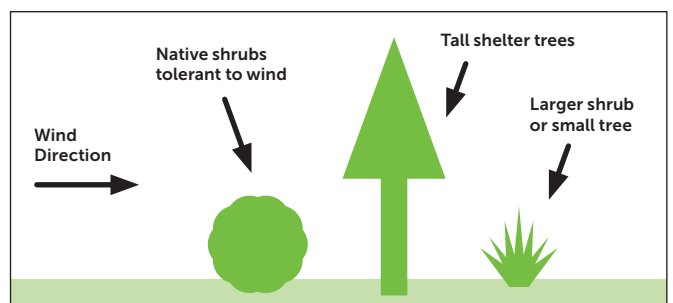
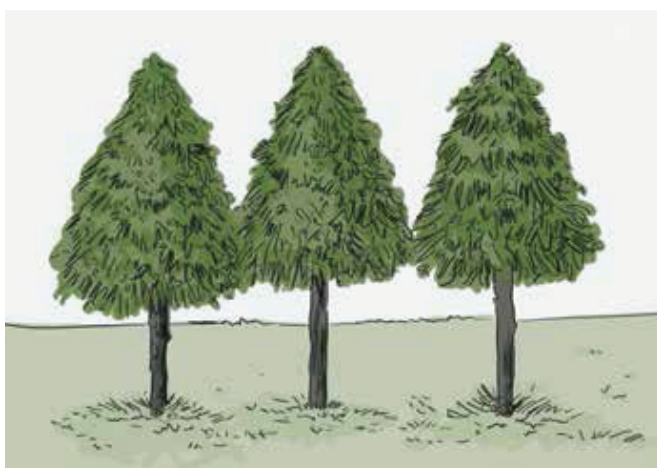


Fig. 11 Triple row shelter belts



Timberline

Alternate trees are fan pruned and clear pruned, providing both timber and shelter.

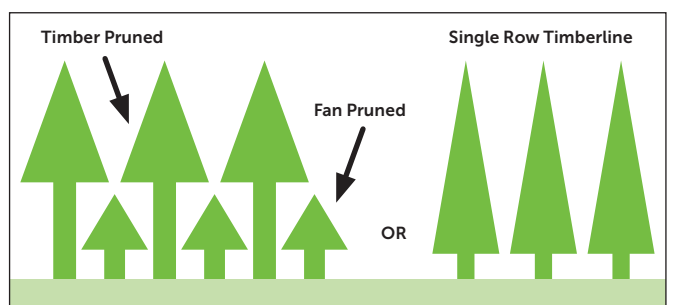


Fig. 12 Timberline

Inland Shelter Species

Tall (20+ metres)

<i>Alnus cordata</i>	Italian alder
<i>A. rubra</i>	Red alder
<i>Cryptomeria japonica</i>	Japanese cedar
<i>Cupressus macrocarpa</i>	Monterey cypress
<i>Cupressocyparis leylandii</i>	Leyland cypress
<i>Eucalyptus fraxinoides</i>	White mountain ash
<i>E. nitens</i>	Shining gum
<i>E. ovata</i>	Swamp gum
<i>Podocarpus totara</i>	Tōtara
<i>Pinus radiata</i>	Radiata pine

Medium (up to 20 metres)

<i>Alnus incana</i>	Grey alder
<i>Kunzea robusta</i> (prev. <i>ericoides</i>)	Kānuka
<i>Pittosporum eugenioides</i>	Lemonwood
<i>P. tenuifolium</i>	Kōhūhū
<i>Plagianthus regius</i>	Ribbonwood, Mānatu

Small (up to 8 metres)

<i>Coprosma crassifolia</i>	Coprosma crassifolia
<i>C. propinqua</i>	Mingimingi
<i>Corokia x virgata</i>	Geenty's green
<i>Leptospermum scoparium</i>	Mānuka
<i>Olearia albida</i>	Tanguru
<i>O. lineata</i>	Small leaved tree daisy
<i>O. solandri</i>	Coastal shrub daisy
<i>O. virgata</i>	Twiggy tree daisy
<i>Phormium tenax</i>	Flax, Harakeke
<i>Veronica stricta</i>	Koromiko, Hebe

Coastal Situations

The coast is prone to strong, salt-laden winds and only certain trees will thrive under these conditions. Most of these trees will grow in inland situations too.

The most severe forms of wind erosion are seen on coastal land, especially on loose unconsolidated dune sands. Wind can be damaging in other ways. Cold, wet winds will lower animal body temperatures and raise feed requirements, while warm westerly winds dry out pastures and crops.

Coastal Shelter Species

Tall (20+ metres)

<i>Araucaria heterophylla</i>	Norfolk Island pine
<i>Cryptomeria japonica</i>	Japanese cedar
<i>Cupressus macrocarpa</i>	Monterey cypress
<i>Cupressocyparis leylandii</i>	Leyland cypress
<i>Eucalyptus fraxinoides</i>	White mountain ash
<i>E. johnstonii</i>	Tasmanian alpine yellow gum
<i>E. nitens</i>	Shining gum
<i>Pinus radiata</i>	Radiata pine

Medium (up to 20 metres)

<i>Banksia integrifolia</i>	Coast Banksia
<i>Casuarina glauca</i>	Swamp she oak
<i>Chamaecytisus palmensis</i>	Tree lucerne
<i>Kunzea robusta</i> (prev. <i>ericoides</i>)	Kānuka

Small (up to 8 metres)

<i>Austroderia toetoe</i>	Toetoe
<i>Coprosma repens</i>	Taupata
<i>Dodonaea viscosa</i>	Akeake
<i>Dysoxylum spectabile</i>	Kohekohe
<i>Olearia solandri</i>	Coastal shrub daisy
<i>Olearia traversiorum</i>	Chatham Island akeake
<i>Phormium tenax</i>	Flax, Harakeke

Shade

In summer, animals are often exposed to hours of direct sunlight and high temperatures. These conditions cause heat stress and production declines. Many European animal breeds also suffer from skin cancers, and constant exposure to sunlight does not help recovery.

It makes sense to use trees to provide valuable shade. To reduce pasture loss and discourage stock from camping, it is preferable to high prune the trees, allowing the leaf shadow to move around the tree. Pruning will also ensure future timber production from the tree. Deciduous trees are best on southern slopes to allow sunlight to reach the base of the tree in winter.

For sensitive species such as deer, shade and/or shelter is essential to keep stress to a minimum. However, the trees must be protected from animal browsing.

Shade around buildings and yards helps make life easier for both stock and stockmen. Because the leaves of trees are cooled by transpiration, they provide cool shade. Shade trees will provide shelter, beautification, soil stability, and perhaps timber. Stock will be happier and less stressed, as should be the stockmen.

The Following Trees are Good for Shade

(Either planted in the open or in groups in paddock corners)

<i>Alnus cordata</i>	Italian alder
<i>A. rubra</i>	Red alder
<i>Casuarina cunninghamiana</i>	Common river oak
<i>Castanea sativa</i>	Sweet chestnut
<i>Eucalyptus spp</i>	Eucalypts
<i>Fraxinus oxycarpa var Raywoodii</i>	Claret ash
<i>Liquidambar styraciflua</i>	Liquidambar
<i>Liriodendron tulipifera</i>	Tulip tree
<i>Magnolia grandiflora</i>	Magnolia
<i>Paulownia tomentosa</i>	Paulownia
<i>Platanus spp</i>	Plane trees
<i>Podocarpus totara</i>	Tōtara
<i>Populus spp</i>	Poplars
<i>Plagianthus regius</i>	Ribbonwood, Mānatu
<i>Quercus spp</i>	Oaks
<i>Salix spp</i>	Willows – (cultivars only, some species are weedy)
<i>Schinus molle</i>	Pepper tree
<i>Ulmus glabra 'lutescens'</i>	Golden elm

Trees for Stock Food

With the risk of summer droughts, it is useful to plant trees that can be used as stock food.

Different parts of trees may be used.

Types of Stock Food

1. Poplar and willow branches are the preferred choice that can be cut off the tree and left below for stock to eat. Poplar leaf has the same nutritive value as lucerne hay.
2. A small fenced block with low growing poplar or willow that can be opened up for browsing.
3. Trees may be planted in the open or paddock corners to provide fruit or seed pods that drop to the ground. It is a good idea when buying these types of trees to make sure that they have been bred for their fruit/seed production, as some cultivars are better than others.

Suitable Trees and What They Produce

<i>Castanea sativa</i>	Sweet chestnut	Seeds
<i>Chamaecytisus palmensis</i>	Tree lucerne	Pods and leaf
<i>Morus alba</i>	Mulberry	Fruit
<i>Populus spp</i>	Poplar	Leaf
<i>Quercus spp</i>	Oaks	Seeds (mainly pigs), leaf (ducks and livestock)
<i>Salix spp</i>	Willows	Leaf

Notes

Amenity Values

An important reason for planting can be the visual effect. Many farmers are able to take advantage of fenced dams or paddock corners to plant trees that look good. There may well be added benefits such as stock fodder, flower display, and bee and bird food.

Trees for Autumn Colour

<i>Fraxinus oxycarpa</i> var <i>Raywoodii</i>	Claret ash
<i>Ginkgo biloba</i>	Ginkgo
<i>Juglans nigra</i>	Black walnut
<i>Liquidambar styraciflua</i>	Liquidambar
<i>Metasequoia glyptostroboides</i>	Dawn redwood
<i>Nyssa sylvatica</i>	Tupelo
<i>Paulownia</i> spp	Paulownia
<i>Platanus</i> spp	Plane trees
<i>Populus</i> spp	Poplars
<i>Quercus coccinea</i>	Scarlet oak
<i>Quercus palustris</i>	Pin oak
<i>Quercus rubra</i>	Red oak
<i>Taxodium distichum</i>	Swamp cypress
<i>Ulmus glabra</i> 'lutescens'	Golden elm

Flowers

<i>Cordyline australis</i>	Cabbage tree, Ti kōuka
<i>Corymbia ficifolia</i>	Red flowering gum
<i>Eucalyptus leucoxylon</i> var 'rosea'	Tasmanian yellow gum
<i>Hoheria sexstylosa</i>	Lacebark, Houhere
<i>Liriodendron tulipifera</i>	Tulip tree
<i>Magnolia grandiflora</i>	Magnolia
<i>Paulownia tomentosa</i>	Paulownia
<i>Sophora</i> spp	Kōwhai (area dependent)
<i>Veronica stricta</i>	Koromiko, Hebe

Notes

Planting Information

1. When to plant?

For trees to survive without irrigation, the best time to plant is from late May until September. This is the slowest growth period, especially for deciduous species. Contact your nursery beforehand to check for availability of your desired plants.

Trees will not survive in dry soil, so plant when the ground is moist. In dry winters, planting should not take place until enough rain has fallen to make the ground easy to dig. Planting before May and after September is a gamble. In some years, and with some species, you may get away with it, but the odds are not in your favour.

2. Order a realistic number of trees

How many trees can I expect to plant in a day?

There is of course, no substitute for experience, but a reasonably fit person planting into spot sprayed pasture using a sharp planting spade, on not too steep country, should be able to plant 400-450 pines a day. For other species (which will require more cultivation), or if your planting situation is more difficult, reduce this number. It is better to plant all your trees and have some time left over, than to order too many and watch some die before you can get them in the ground. Err on the side of caution until you know your capabilities!

Bare-rooted or not bare-rooted?

Bare-rooted trees (i.e. not in pots or containers) are vulnerable to sun, wind, and frost. They should be planted within 48 hours of lifting from the nursery. If you leave them any longer they will need to be heeled into cultivated ground or kept at low temperatures. Plants in root trainers or pots can be kept until they grow out of their containers, thus planting is more flexible (but beware, it is easier to keep putting it off!).

3. Take care of the trees before they go in the ground

To get the most growth from your trees, they need to be well treated before planting, especially the roots, and put into the ground with the least amount of stress.

4. Five star treatment for seedlings – some dos and don'ts

Never order more bare-rooted seedlings than you can comfortably plant in two days. Always keep boxes of seedlings out of the sun to protect plant roots.

Do

- Trim the roots if they are longer than 10 centimetres, otherwise they will become misshapen;
- Check for seedling quality before you leave the nursery. Make sure the roots are moist, and that there are plenty of fine fibrous roots for water uptake, with several thicker anchoring roots;
- Cover seedlings with a damp sack and put them in the shade, out of the wind.

Don't

- Take the seedling out of the bag/pot until immediately before putting it in the ground;
- Expose seedling roots to the air more than necessary before planting;
- Stand the sacks on end or the roots can be crushed. Transport them on their sides;
- Leave the sacks in the sun or heat while waiting to plant (trees will sweat and overheat).

5. Crunch time – planting technique

The best way to learn how to plant trees properly is to see it done and then have a go. All of the local branches of the Farm Forestry Association in this Region have annual field days to give people this opportunity, usually in April or May. A good planting spade is essential – there are specialised ones available.

When planting

- Bury the spade to its 25 centimetres depth on each cut;
- On the last cut, make sure to break through any soil pan below.

The main objectives when the tree is planted are to make sure the roots are

- Pointing downwards;
- Not bent or crooked;
- Have no air pockets around them.

How?

1. Trim any roots which are longer than 10 centimetres.
2. Make sure the soil around the tree is well cultivated, to approximately 300x150 millimetres wide and 250 millimetres deep.
3. The tree must be planted straight (within 20° of vertical).
4. Make sure to compact the soil around the tree; use the toe of your boot, not the heel. The tree needs to be firm enough to resist a steady upward pull.
5. A container seedling should not be any deeper in the ground than it was in the container. A bare-rooted seedling can be buried with up to 1/3 of the greenery in the ground.

This helps to keep the tree stable and stops socketing (wind blowing the tree around and creating a hole around the stem). In very wet, heavy soils, no more than 4-5 centimetres of the stem should be buried to prevent stem rot.



Tree Protection

Given all the things which can go wrong as a tree grows from a seed to a 30 metre monster, it is incredible so many survive. However, survival and healthy growth are not necessarily the same things, and there are quite a few actions to take in order to stack the odds in the trees' favour. Trees are most vulnerable during the first few seasons, so putting in effort early will pay dividends at harvest time.

Some of the things your trees may need protecting against are:

- Wind;
- Frost;
- Wild animals; possums, hares, rabbits, goats, deer;
- Farmed animals; sheep, cattle, goats, deer, horses;
- Weed competition;
- Insect pests and disease.

The best way to avoid many of these problems is to plan ahead.

Before Planting

1. Match the right tree to the right site

Look at your site and list the limitations it may have. In frost-prone areas, poor soil, swampy, dry or very sandy soil, a tree may survive, but be stressed and vulnerable to disease. For example, willows or alders planted close to the coast and constantly in salt spray may live, but not for very long, or very well. Choose varieties resistant to any problems your site may have. This will save you time and money later on.

2. Prepare the area to be planted

The most important actions you can take are:

- **Fencing out stock** – this is absolutely essential
- **Reducing competition from other plants by:**
 - Taking out problem plants in the general area because you are not likely to be able to control them once the seedlings are planted;
 - Spot spraying with herbicide where each tree is to be planted, approximately six weeks before planting;
 - Grazing the area very hard before spraying (if spraying) and immediately before planting to give the seedlings a head start on competing grasses.

- **Controlling pest numbers:**

To do this you will first need to estimate what pests are already present. This can be done through your own observations, or talking to neighbours and the Horizons' pest management team to gauge the extent of any problem. Once you have an idea of the scope of the problem, Horizons' pest management team will be able to help with advice and perhaps an initial control programme. Be sure to give them at least two months notice before you are intending to plant.

- **Planting initial shelter** – if needed.

- **Ripping the ground to be planted** – if needed.

Spot spraying grass in exposed sites:

Seedlings, especially bare-rooted or those subject to salt winds, can be better off when protected by grass while they get established. Having some protection in grass also stops plants from being twisted around if the ground becomes wet.

During Planting

- **Treat the seedling well;**
- **If pests are still a problem**, treat your seedlings with a pest repellent;
- **Mulch around the plants**, if not intending to use other controls on weeds.



After Planting

- **Exclude all heavy stock** for as long as it takes to get the seedlings established, depending on the species and growth rates. In some cases it may be as little as two years (poplar poles). Closely monitor any sheep grazing to prevent damage.
- **Keep up the pest control.** How much you will have to do will depend on your situation. Don't waste all that early work only to have rabbits, possums or goats kill or damage your young trees.
- Release your trees (clear any competing weeds/grass from around them). This may be either by chemical or mechanical means and generally needs to be done in the first (and sometimes the second) year, starting from October after planting and until the trees are well above surrounding weeds.
- **Chemical**
Special herbicide sprays are available which will not damage young trees if they are used strictly according to directions.

- **Mechanical**

Use a scrub cutter with a nylon attachment, or any other device that will cut potentially smothering weeds. You have to be careful not to damage the stem of the seedling, but the advantage of this method is that the cut weeds can be used as a mulch, and help stop any drying and cracking of the soil over the summer. You can also handrelease by pulling the grass/weeds away by hand which is a safer approach, but labour intensive.

Protection from Insect Pests and Diseases, and Nutritional Deficiencies

Nutritional deficiencies, weed competition or water shortages place a tree under stress and can reduce its ability to withstand pests and diseases. Knowledge of your soil properties will help you to apply the right fertiliser when the trees are young. You can search books and online for additional information, but if your trees do not look healthy and you are not sure why, get expert advice from a consultant.

Self Help Information

If you are considering investing in tree planting, it is important to get advice.

Advice and Other Considerations

1. Horizons Regional Council – 0508 800 800
www.horizons.govt.nz

Advice on:

- Land management;
- Erosion control;
- Flood protection and drainage;
- Land use capability;
- Shelter and shade;
- Weed and pest control.

2. Farm Forestry Association

A national organisation providing local field days, information (both national and local), and sources of local knowledge. There are many branches of the Farm Forestry Association, which you can check here – www.nzffa.org.nz/branches. The three that cover the Horizons Region are:

- Middle Districts Branch
- Ruapehu Branch
- Tararua Branch

3. Books

Bought or borrowed from public libraries. Some good books are listed in the tables at the back of this publication.

4. Internet

A wealth of information is available online. Regional council websites are a good source of information, and have publications to print. There are many other websites, such as for nurseries, that have good information available.

Consents may be required from:

- Your local district council – for changing a land use;
- Horizons Regional Council – for activities (including logging) which involve land clearance and/or land and water disturbance. The need for a consent will depend on the scale and location of your operation. Contact Horizons for further information.

Notes

Brief Tree Descriptions

Acacia melanoxylon **(Australian/Tasmanian blackwood)**

This is an important timber species used for furniture, turning, veneer, and panelling. Blackwood is very hardy and will grow in most sites but to produce a good timber tree, it requires shelter and tending. Grown in the open it spreads outward and its form is difficult to control, even with extensive pruning. There are varieties now available that keep their form with manual pruning.

***Agathis australis* (Kauri)**

In a situation that is sheltered and fertile, kauri will grow up to 50 centimetres per year. Kauri has excellent timber and shape with a minimum rotation time of approximately 80 years.

***Alectryon excelsus* (Titoki)**

Normally found in coastal and lowland forests, titoki thrives along rivers. Frost tender when young, it needs shelter and prefers a heavy soil. It has beautiful, graceful foliage.

ALNUS (Alders)

***Alnus cordata* (Italian alder), *A. incana* (Grey alder), *A. rubra* (Red alder).**

Alders are a versatile species with Italian and red alder having commercially useful timber. Grey alder will grow to 15 metres and is a useful shelter tree. They will grow in very disturbed and infertile sites. They improve soil conditions by fixing nitrogen and their leaf drop builds up soil structure. Their timbers are ground durable and good for furniture and firewood.

***Araucaria heterophylla* (Norfolk pine)**

Norfolk pines are very resistant to salt winds. This tree grows best in sandy soils, and is useful as coastal shelter. Young trees are frost tender.

***Banksia integrifolia* (Banksia)**

Tolerant to dry, exposed and salt laden conditions, the banksia is excellent for low coastal shelter. It has upright brush-type flowers which attract bees during the summer months.

***Casuarina glauca* (Swamp she oak)**

Casuarina has beautiful timber, useful for cabinet making, turning, and furniture. This tree tolerates strong and salty winds and will survive both damp and dry conditions. Excellent coastal shelter. A good alternative to cypress when stock have access.

***Chamaecytisus palmensis* (Tree lucerne)**

A nitrogen fixing shrub, tree lucerne is adapted to drought prone sites provided drainage is good. It withstands salt winds but has a limited life in these conditions. Normally it will last 10-20 years. As it is a soil improver, it can be used on a dry site to give early shelter to slower growing natives.

***Coprosma repens* (Taupata), *C. robusta* (Karamū)**

Taupata will withstand extreme coastal winds and dry conditions. It will hedge well and provide a good understorey, to about 1.5 metres. Will grow up to 5 metres in inland sites. Karamū will not tolerate salt winds well, but makes an attractive understorey tolerating most soil conditions.

***Cordyline australis* (Cabbage tree/Ti kōuka)**

The cabbage tree has a multi-branched head and produces perfumed flowers in late spring. As it is very hardy, it will grow in both wet and dry conditions.

***Cryptomeria japonica* (Japanese cedar)**

Grown mainly for shelter, the Japanese cedar has excellent timber, although it is very slow growing. The cedar is relatively tolerant of salt winds and will grow in dry clays but has no tolerance of poor drainage. It is a very valuable timber tree in Japan and well worth growing as a long-term timber/shelter species.

CUPRESSUS (Cypresses)

***C. lusitanica* (Mexican cypress), *C. macrocarpa* (Monterey cypress)**

Both have excellent timber which is used in place of kauri for boat building, furniture making, and turning. *C. macrocarpa* will withstand dry conditions, salt winds, and exposed sites. Excellent shelter when tended. *C. lusitanica* requires more sheltered and fertile sites and will not tolerate salt winds. Of the two, *C. lusitanica* is not susceptible to cypress canker and fluting of the stem which both occur in humid conditions.

***Cupressocyparis leylandii* (Leyland cypress)**

The sterile cross between *C. macrocarpa* and *Chamaecyparis nootkatensis* is an excellent shelter and timber tree. It is very hardy, and will withstand salt winds and dry conditions, but will not tolerate poor drainage. As all trees are grown from cuttings they make a very even shelterbelt.

***Dacrycarpus dacrydioides* (Kahikatea)**

Kahikatea is a beautiful, tall, straight tree growing to 60 metres. It prefers swampy, poorly drained land but is hardy and will tolerate most sites. The timber is straight and easily worked, and the female trees bear a prolific berry crop, edible to humans, birds, and possums.

***Dodonaea viscosa* (Akeake)**

A small tree growing to 6 metres, akeake is hardy, withstands salt winds, and will cope with clay and dry soils. It is excellent as an understorey shelter species in dry and/ or coastal situations. Frost tender when young, it dislikes poorly drained soils. Two varieties are available, with either a green or purple leaf.

EUCALYPTUS GROUP

The eucalypts have several varieties that are well suited for timber production, soil conservation, shelter and amenity.

***E. delegatensis* (Alpine ash)**

Similar to *E. regnans*, but is slower growing and therefore should only be planted where it is too cold for the former species. It is not damaged by snow and is very frost tolerant (temperatures to -12°C). Alpine ash can succumb to various fungal diseases in areas with hot summers and high humidity.

***E. fastigata* (Brown barrel)**

A large tree that will develop heavy branching if not kept at tight spacings. The timber is very pale brown and straightgrained and is suitable for turning, furniture, and veneers. It has the best timber of the ash eucalypts, being easiest to process.

***E. fraxinoides* (White ash)**

A large, attractive tree which prefers moist, free-draining, fertile sites. Early growth is fast, and it makes an excellent shelter belt tree. The timber is pale and straight-grained and can be used wherever *E. regnans* or *E. delegatensis* are suitable.

***E. globoidea* (White stringybark)**

White stringybark is a medium sized timber tree that is easier to mill than most Eucalyptus. It prefers a well drained site and tolerates infertile soils. White stringybark is ground-durable, has cream and pink timber, and is suitable for posts and high-quality uses. White flowers bloom from April-June on this evergreen species. *E. globoidea* tolerates light frosts.

***E. muelleriana* (Yellow stringybark)**

Yellow stringybark is also a hard, strong, durable timber, and is excellent for both farm and exterior uses. This tree does not tolerate poor drainage or hard frosts, but will withstand clay or sandy soils.

***E. nitens* (Shining gum)**

This tree is capable of exceptionally fast early growth. It tolerates damp and heavy soils, severe frosts and wind, and makes a good shelter belt tree. The timber is difficult to dry without surface checking, but makes excellent firewood and good veneers.

***E. obliqua* (Messmate)**

Messmate tolerates seasonally dry conditions and clay soils but is highly variable in form and vigour. It has a pale brown timber of moderate hardness, strength and durability; however, its milling qualities depend on the individual tree form.

***E. ovata* (Swamp gum)**

E. ovata tolerates extremes, such as water-logging and droughts, cold, and coastal sites. It is suitable for shelter belts and produces good firewood. Swamp gum is very ground durable, and reliable for coppicing. White flowers bloom from March-June that attract tuis and bellbirds. The swamp gum is evergreen, frost tolerant, but not suited to ridge tops or drier areas.

***E. pilularis* (Blackbutt)**

This variety has very hard and strong, durable timber. This tree will withstand poor clay soils and drought conditions and is probably the best milling eucalypt species planted in New Zealand. However, it is frost tender and palatable to possums when young.

***E. regnans* (Mountain ash)**

Mountain ash is a very tall, elegant tree which prefers free-draining, fertile sites. The timber is pale brown, opentextured, straight-grained and resembles oak. It is easy to work, dresses well, and is suitable for cabinet work, veneers, joinery, and general construction.

***E. saligna* (Sydney blue gum)**

This species is not suited to windy sites, especially saline winds. It is a good furniture, veneer and building timber if milled properly, and is most suited to sites that are wetter than those recommended for *E. nitens*. Sydney blue gum will tolerate clay soils, and is considered good for firewood purposes. However, it is currently affected by pests and diseases.

***Fraxinus oxycarpa* var '*Raywoodii*' (Claret ash)**

This tree is noted for its claret (deep purplish-red) coloured foliage. It is an attractive shade tree which grows well in dry clay soils and tolerates winds. The timber is scarcely used in New Zealand, but is valued in Europe and America.

***Ginkgo biloba* (Ginkgo)**

The main feature of this slow growing tree is its brilliant gold autumn colouring. A well-shaped tree, it will grow close to salt water, in moist soils, and tolerates wind. The female trees produce edible nuts.

***Grevillea robusta* (Australian silky oak)**

This graceful tree variety has a good display of orange flowers in January. The timber is valuable and easily worked, however, branches tend to be brittle and shelter is required for good shape and timber production.

***Griselinia littoralis* (Broadleaf, Kāpuka)**

The broadleaf grows to 12 metres, is hardy and will withstand coastal winds. It will hedge well and the wood is durable, dense and strong.

***Veronica stricta* (Koromiko, Hebe)**

As koromiko can tolerate dry coastal areas and clays, it is a good low coastal shelter. Self-seeding, it will also revegetate bare areas over time. White or purple flowers attract bees and are present through summer and autumn.

***Hoheria sextylosa* (Lacebark, Houhere)**

An attractive tree which bears white flowers in late summer. It is hardy and will grow in most situations. When pruned it grows to a medium height for a windbreak.

***Knightia excelsa* (Rewarewa, New Zealand honeysuckle)**

Preferring plenty of light, the rewarewa is a striking, narrow tree growing to over 30 metres. The timber is attractive, strong and used for interior decorative work. It is hardy, and will grow in most free-draining soils. Dark red flowers which appear from spring to early summer attract bees and birds, especially the tui and bellbird.

***Leptospermum scoparium* (Mānuka)**

Mānuka will grow in almost any soil and climatic conditions as it is a primary native coloniser. The wood makes excellent firewood and the tree flowers during late spring/summer. Various coloured pink/red forms are available for amenity planting, and a range of cultivars has been developed for Mānuka honey production.

***Liquidambar styraciflua* (Liquidambar)**

This tree is deciduous, with excellent autumn colour. It is hardy and will tolerate both wet and dry soils, and wind. Colours range from orange through to red and are especially effective next to water.

***Liriodendron tulipifera* (Tulip tree)**

The tulip tree requires good soils and a sheltered site. It is a graceful tree with beautiful flowers and foliage. It does not flower for 10-20 years, but the leaves have buttery yellow autumn colour.

***Magnolia grandiflora* (Evergreen magnolia)**

Tolerant of wind and dry clays, the magnolia is hardy and makes a good shade or specimen tree. White, fragrant flowers are profuse and spectacular from early summer right until autumn. The timber is useful for furniture and does not warp.

***Melicytus ramiflorus* (Māhoe)**

A small tree growing to about 8 metres. Māhoe will withstand most soil conditions but does not grow very well in very exposed sites. It is useful as an understorey shelter tree. The leaves are very palatable to stock.

***Morus alba*, *M. nigra* (Mulberry, white/black)**

The mulberry bears fruit which is suitable for both birds and humans. They are small hardy trees, tolerating most soil conditions. They are useful for shade and attracting wild fowl around dams.

***Nyssa sylvatica* (Black tupelo)**

Tolerating wet and poorly drained conditions the tupelo, although slow growing, has brilliant red autumn colours. It will grow better with shelter from wind.

***Olearia traversii* (Chatham Island akeake)**

The Chatham Island akeake is a tough, fast-growing coastal tree excellent for hedging/shelter on dry, exposed sites. It is very intolerant of wet sites. It is a fast growing evergreen and bears profuse numbers of small, white flowers in spring, however will only tolerate light frosts.

***Olearia solandri* (Coastal shrub daisy)**

The coastal shrub daisy is a good fast-growing shelter and hedging plant for dry, exposed sites. It produces abundant small white flowers in late summer which are vanilla-scented. The leaves are small and green/yellow. *O. solandri* will tolerate coastal conditions and is hardy.

***Paulownia tomentosa* (Paulownia)**

A quick growing, attractive tree bearing large purple flowers in spring. The timber is light and very soft. However, the tree requires deep, moist soils over summer and its large leaf is not tolerant of wind.

***Phormium tenax* (Flax, Harakeke)**

Flax is tough, hardy and will tolerate very wet, very dry, and coastal conditions. It is excellent for revegetation, gully planting and low shelter. Tui are attracted to the flower stalks which emerge in late spring–summer.

***Pinus radiata* (Radiata pine)**

This is New Zealand's most important commercial timber tree. Radiata will tolerate a very wide range of soils and climatic conditions. The timber is soft, easily worked, and though not durable, takes treatment very well. It tolerates both coastal situations and windbreak trimming.

***Pittosporum eugenioides* (Lemonwood, Tarata), *P. tenuifolium* (Kōhūhū)**

Both of these species are fast growing and hardy, withstand trimming, and are good for hedging. Lemonwood has attractive foliage and is a good understorey shelter away from the coast. Kōhūhū will tolerate shady conditions.

***Platanus acerifolia* (London plane)**

The London plane is a large, spreading tree, good for shade and timber, which often grows to 30 metres or more. The timber is tough and valuable. The leaves are shed in autumn and have an orange/brown colour.

***Podocarpus tōtara* (Tōtara)**

A very hardy tree, the Tōtara will withstand wet, dry, clay and windy conditions. The timber is ground durable, easily worked, and suitable for outside uses and decorative work.

Notes



POPULUS (Poplars)

Poplars are widespread throughout the Region and most will tolerate clay soils and wind. They are extensively used for erosion control and shelter. Their timber is light, strong, and non-resinous, good for furniture and veneers. In summer the leaves can provide stock food and spring pollen is useful for bees. Poplars are easily propagated from cuttings and poles, and often have a good yellow autumn colour.

The most common poplar varieties planted are **Veronese**, **Kawa** and **Toa**. These reach 20-25 metres in height and have a narrow to open crown. They require reasonable moisture throughout the year but can survive one-off extreme droughts once established.

The **Veronese** poplar is a narrow crowned tree suitable for dry, windy sites.

Kawa and **Toa** varieties are best suited to sheltered areas where possum numbers are high, as possums find their leaves unpalatable. **Kawa** also has good timber potential with a slightly lower density than radiata pine, and a white, odourless timber which is lightweight, but relatively strong. Uses include veneers and plywood, furniture, truck decking, stockyards and pulp and paper.

SALIX (Willows)

Willows are ideal for gully, stream and river erosion control. Where debris, dams and other gully structures or riverbank works have been carried out, willows can reinforce protection. They can also be planted to protect bridges, crossings and tracks.

The **Tangoio** willow is highly adaptable to most sites. Its high wind tolerance and good retention of lower branches make it suitable for planting as a windbreak. It does better on drier sites than other willow species but is palatable to possums.

The **Matsudana** willow is similar to the tangoio willow, but is less suited to dry sites and more suitable for coastal situations.

Osier willows, also known as shrub willows are low growing at 6-8 metres tall. They have good rooting systems and are used for a variety of reasons in stream and riverbank works.

The **Booth Willow** clone is unpalatable to possums and has flexible branches which are resistant to breakage. It will tolerate most soils, particularly alluvial, and is suited to wet valleys and river margins for bank protection and stabilisation. It is best to plant this species on upper river margin away from average flood flows.

Examples of which varieties are suitable for particular situations are as follows:

- **Drier sites:** Crowsnest and Veronese poplar.
- **Lower slopes:** Veronese and Shinsei poplar, Tangoio willow.
- **Moist areas:** Kawa, Shinsei and Toa poplar, Tangoio willow.
- **Possum resistance:** Kawa, Shinsei and Toa poplar.
- **Windy exposed sites:** Crowsnest, Shinsei and Veronese poplar, Tangoio willow.
- **Wet, sheltered valley systems:** Kawa, Toa, Trichocarpa and Yunnanensis poplar.
- **Eroding gullies and streams:** Tangoio willow (situation specific, advice needed), Booth willow.
- **Timber:** Kawa poplar.
- **Shelter:** Veronese, Crowsnest and Tasman poplar.

NOTE: Crack, grey, and golden willow are weedy and should not be used. Do not cut your own poles from existing willows unless you are sure of what species they are.

QUERCUS (Oaks)

Oaks are renowned for their timber, and the following varieties will grow well, giving reliable colour.

***Q. coccinea* (Scarlet oak)**

Prefers dry, sandy soils, and provides a good autumn colour.

***Q. palustris* (Pin oak)**

Prefers wet, poorly drained areas, and also provides a good red/orange colour.

***Q. robur* (English oak)**

Excellent timber with a yellow/orange autumn colour.

***Sequoia sempervirens* (Californian redwood)**

Timber from the redwood is durable, easy to work and resists insects. It grows best on more fertile areas, where the soil is deeper.

Sophora tetraptera/microphylla/godleyi
(Kōwhai)

There are eight species of kōwhai in New Zealand, however not all species are suited to all areas. Kōwhai is a beautiful deciduous tree which flowers in spring and has delicate foliage. It grows well along river margins and close to the coast and will tolerate most soils. The timber is tough, hard and durable with beautiful colour and grain.

***Taxodium distichum* (Swamp cypress)**

One of the few deciduous conifers. Swamp cypress thrives in damp soils and the best shape is achieved in sheltered areas. Rich orange foliage in autumn is followed by delicate green new growth in spring.

***Ulmus glabra* 'lutescens' (Golden elm)**

Tolerant of wind, golden elm has yellow foliage throughout the summer, turning golden in autumn as its leaves drop. It is an excellent shade tree, which will tolerate most soil conditions and provide hard, tough, heavy wood.

Notes

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<i>Acacia mearnsii</i>	Black wattle	•			••	•	2	firewood	•	leaf		N, good roots	yellow	evergreen		fast	20m
<i>Acacia melanoxylon</i>	Tasmanian blackwood	•		•	•	•	2	••	•			N, v. good	yellow	evergreen		fast	30m
<i>Alnus cordata</i>	Italian alder	•	•	•	•	•	1	durable			•	N, tap root		deciduous	•	fast	25m
<i>Araucaria heterophylla</i>	Norfolk pine		salt		•	tender	1	•			coastal	•		evergreen		slow	40m
<i>Banksia integrifolia</i>	Coast banksia		salt		•	•	1				coastal	sand dune	yellow	evergreen		fast	10m
<i>Casuarina glauca</i>	Swamp she-oak	•	•	salty	•	tender	2		•		•			evergreen		med	15m
<i>Chamaecytisus palmensis</i>	Tree lucerne		salt		•	tender	3			••	low	N, ••	Jun – White	evergreen		fast	7m
<i>X Cupressocyparis leylandii</i>	Leyland cypress	•	salt		•	•	1	••	•	••	••	•		evergreen		fast	30m
<i>Cupressus lusitanica</i>	Mexican cypress		•		•	•	1	••	•			•		evergreen		med	30m
<i>Cupressus macrocarpa</i>	Monterey cypress	•	salt	•	•	•	1	••	•		•	•		evergreen		med	30m
<i>Eucalyptus delegatensis</i>	Alpine ash		•	•		••	2	••	•		•	•		evergreen		med	35m
<i>E. fastigata</i>	Brown barrel		•			•	2	••	••		•	•		evergreen		fast	10m
<i>E. ficifolia</i>			salt		•	tender	2		•				Jan-Feb	evergreen		med	30m
<i>E. fraxinoides</i>	White ash		•	•		•	2	•	••		•	•		evergreen		fast	15m
<i>E. leucoxydon</i> var 'Rosea'			•		•	•	2	durable	•		•		Jun-Aug	evergreen		fast	30m
<i>E. nitens</i>	Shining gum	•	•	•		•	2	•	••		•	•		evergreen		fast	30m
<i>E. obliqua</i>	Messmate	•	•	•	•	•	2	•	••		•	•		evergreen		med	20m
<i>E. ovata</i>	Swamp gum	•	•	••	•	••	2	firewood	••		•	•		evergreen		med	50m
<i>E. regnans</i>	Mountain ash		•	•		•	2	••	••		•	•		evergreen		fast	30m
<i>Fraxinus oxycarpa</i> var 'Raywoodii'	Claret ash	•	•				2		••					deciduous	•••	med	30m
<i>Ginkgo biloba</i>	Ginkgo/ Maidenhair tree				•		1	•	••					deciduous	•••	slow	30m
<i>Juglans nigra</i>	Black walnut						2	•••	•					deciduous	•••	med	30m
<i>Liquidambar styraciflua</i>	Liquidambar	•	•	•		•	2	•	••			•		deciduous	•••	med	30m

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2. Native Trees of New Zealand - J.T. Salmon
3. New Zealand's Native Trees - John Dawson & Rob Lucas (2012)

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<i>Liriodendron tulipifera</i>	Tulip tree		x			•	2	•	••				Oct – White	deciduous	•••	slow	40m
<i>Magnolia grandiflora</i>	Magnolia	•	•		•	•	1	•	••				Dec- Mar			med	20m
<i>Morus alba/nigra</i>	Mulberry white/black	•	•	•			3		•	fruit				deciduous		med	10m
<i>Nyssa sylvatica</i>	Black Tupelo	•		••		•	1	•	•					deciduous	•••	slow	20m
<i>Paulownia tomentosa</i>	Princess tree		x		•	•	2		••			•	Oct – Purple	deciduous	•	fast	15m
<i>Pinus radiata</i>	Radiata pine	•	salt		•	•	1	••	•		coastal	•		evergreen		fast	30m
<i>Platanus acerifolia</i>	London plane tree	•	•			•	2	••	••		•	••		deciduous	••	med	30m
<i>P. deltooides x yunnanensis</i>	Poplar 'Kawa'	•	•	•		•	1	•	••	leaf	•	•		deciduous	•	fast	30m
<i>P. euramericana x yunnanensis</i>	Poplar 'Toa'	•	•	•		•	1	•	••	leaf		•		deciduous	•	fast	30m
<i>P. euramericana</i>	Poplar 'Veronese'	•	•	•		•	2	•	••	leaf	•	•		deciduous	•	fast	30m
<i>P. yunnanensis</i>	Chinese poplar	•	•	•		•	1		••	leaf	••	••		deciduous		fast	30m
<i>Quercus coccinea</i>	Scarlet oak	•	•		•	•	3	•	••	leaf		•		deciduous	•••	med	25m
<i>Quercus palustris</i>	Pin oak	•	•	•		•	3	•	••	leaf		•		deciduous	•••	slow	20m
<i>Quercus robur</i>	English oak	•	•			•	3	••	••	leaf		•		deciduous	•••	med	25m
<i>Salix matsudana</i>	Tree willow	•	•	•	•	•	3		••	leaf	•	gully	Sept – yellow	deciduous	•	fast	25m
<i>Salix purpurea</i>	Shrub willow	•	•	•		•	1					gully	Sept – yellow	deciduous	•	med	8m
<i>Sequoia sempervirens</i>	Coast redwood		•			•	1	•	•		•	•		deciduous		med	50m
<i>Taxodium distichum</i>	Swamp Cypress	•	•	•••		•	1	•	•					deciduous	•••	slow	30m
<i>Ulmus procera</i>	Golden elm	•	•			•	2	•	••					deciduous	•••	med	20m

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<i>Agathis australis</i>	Kauri	•		•		•	1	• • •						evergreen	med	40m
<i>Alectryon excelsus</i>	Titoki	•		•		tender	2	•	•	•			Oct-Dec	evergreen	med	12m
<i>Aristotelia serrata</i>	Wineberry/ Makomako	•	•	•	•	•	2		•	•		revegetation	Sept-Dec	deciduous	fast	8m
<i>Austroderia toetoe</i>	Toetoe	•	•	•	• •	•	1		•	•	low	coastal	Dec-Feb	evergreen	fast	2m
<i>Beilschmiedia tawa</i>	Tawa	•		•		•	2	• • •	•	• •		•	Dec	evergreen	med	20m
<i>Brachyglottis rapanda</i>	Rangiora	•	salt	•	•	•	1					revegetation	Sep	evergreen	med	7m
<i>Carpodetus serratus</i>	Putaputaweta	•	•		•	•	2		•	•		revegetation	Oct-Dec	evergreen	med	8m
<i>Coprosma repens</i>	Taupata	•	salt		•	•	2			•	coastal	sand dune	Sept-Oct	evergreen	med	6m
<i>Coprosma robusta</i>	Karamu	•	•	•	•	•	2			•	low	•	Sept-Oct	evergreen	med	5m
<i>Cordylone australis</i>	Cabbage tree/ Tī kouka	•	•	•	•	•	1			•	coastal	revegetation	Nov – White	evergreen	med	10m
<i>Corokia cotoneaster</i>	Korokia	•	•		•	•	2		•	• •	coastal		Aug-Mar	evergreen	med	6m
<i>Dacrycarpus dacrydioides</i>	Kahikatea	•		• • •		•	2	• •	•	•			Sept-Oct	evergreen	slow	50m
<i>Dacrydium cupressinum</i>	Rimu	•		•		•	1	• • •	•	• •			Nov-Jan	evergreen	slow	40m
<i>Dodonaea viscosa</i>	Akeake	•	salt		•	•	1			•	low	revegetation	Oct	evergreen	fast	7m
<i>Dysoxylum spectabile</i>	Kohekohe		salt	•	• •	•	3	durable	• •	•		revegetation	May-Aug	evergreen	med	10m
<i>Elaeocarpus dentatus</i>	Hinau	•		•		•	1	•	•	• •			Oct-Dec	evergreen	slow	18m
<i>Elaeocarpus hookerianus</i>	Pokaka	•		•		•	1	•	•	•		revegetation	Oct-Jan	evergreen	med	15m
<i>Entelea arborescens</i>	Whau	•	salt		•	tender	1	light				revegetation	Oct-Nov	evergreen	fast	6m
<i>Fuchsia excorticata</i>	Kotukutuku		•	• •		tender	3	• •	•	•	•	•	Oct-Dec	deciduous	med	10m
<i>Griselinia littoralis</i>	Broadleaf	•	salt	•	•	•	2	durable	•	•	low	coastal	Nov-Jan	evergreen	med	12m
<i>Hedycarya arborea</i>	Pigeonwood	•		•		•	1		•	• • •		revegetation	Oct-Dec	evergreen	med	12m
<i>Hoheria sextylosa</i>	Lacebark	•	•		•	•	2		•			gully	Feb-Apr	evergreen	med	10m
<i>Knightia excelsa</i>	Rewarewa	•	•		•	•	1	•	•		•	revegetation	Oct-Nov	evergreen	med	30m
<i>Kunzea robusta</i>	Kānuka	•	•	•	• •	•	1	•	•		•	revegetation	Nov-Feb	evergreen	med	10m
<i>Veronica stricta</i>	Koromiko	•	salt		•	•	2			•	low	sand dune	Jan – Purple	evergreen	med	3m

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<i>Laurelia novae-zelandiae</i>	Pukatea	•		••		•	1	•	•			gully	Oct-Dec	evergreen	slow	35m
<i>Leptospermum scoparium</i>	Mānuka	•	•	••	••	•	1	•				revegetation	Nov-Feb	evergreen	fast	6m
<i>Libocedrus plumosa</i>	Kawaka	•	•	•	•	•	1	•			•	revegetation	Aug-Oct	evergreen	slow	20m
<i>Lophomyrtus bullata</i>	Ramarama	•	•		•	•	1						Jan	evergreen	med	5m
<i>Melicytus ramiflorus</i>	Mahoe	•	•	•	•	•	2				•	revegetation	Twice	evergreen	med	10m
<i>Metrosideros robusta</i>	Rata	•	•	•	•		3	••	•			•	Dec – Red	evergreen	med	20m
<i>Myoporum laetum</i>	Ngaio	•	salt		•		1		•			coastal	Nov-Dec	evergreen	fast	10m
<i>Myrsine australis</i>	Mapou/Red matipo	•	•	•	•		1			low	•	•	Dec-Jan	evergreen	med	5m
<i>Olearia paniculata</i>	Akiraho	•	•		•		1				••	•	Feb-Mar	evergreen	fast	5m
<i>Olearia rani</i>	Heketara	•	•	•	•	•	1			•		revegetation	Sep-Nov	evergreen	slow	7m
<i>Phormium tenax</i>	Flax/harakeke	•	salt	••	•	•	1				low	revegetation	Nov-Dec	evergreen	med	3m
<i>Phyllocladus trichomanoides</i>	Tanekaha	•	•	•	•	•	1	•			•	revegetation	Oct-Jan	evergreen	med	25m
<i>Piper excelsum</i>	Kawakawa	•		•		tender	1					revegetation	All year	evergreen	fast	6m
<i>Pittosporum eugenioides</i>	Tarata/ Lemonwood	•	•			•	2			•	••	•	Oct-Dec	evergreen	med	9m
<i>Pittosporum tenuifolium</i>	Kōhūhū	•	•	•	•	•	2		•		••	•	Nov	evergreen	fast	12m
<i>Plagianthus regius</i>	Ribbonwood/ Manatu	•	•	•		•	1		•			streambanks	Oct-Jan	deciduous	med	15m
<i>Podocarpus totara</i>	Tōtara	•	•	•	•	•	1	durable	•		•	•	Sep-Oct	evergreen	med	30m
<i>Prumnopitys ferruginea</i>	Miro	•				•	1	••		•••		revegetation	Sep-Oct	evergreen	slow	25m
<i>Prumnopitys taxifolia</i>	Matai	•				•	1	•••		•		revegetation	Oct-Nov	evergreen	slow	25m
<i>Pseudowintera axillaris/colorata</i>	Horopito/Pepper tree		••	••		•	2			•	•	•	Sep-Nov	evergreen	med	8m
<i>Pseudopanax arboreus</i>	Five finger/Puahou	•	•		•	•	3		•			revegetation	Jun-Sep	evergreen	med	8m
<i>Pseudopanax crassifolius</i>	Lancewood/ Horoeka	•	•	•	•	•	1	•		•		revegetation	Jan-April	evergreen	med	15m
<i>Sophora microphylla/tetraptera</i>	Kōwhai	•	•	•	•	•	1	durable	•			riparian	Sep-Oct	deciduous	med	9m
<i>Weinmannia racemosa</i>	Kamahi	•	•	•		•	3	•	•	••		•	Nov-Mar	evergreen	med	20m

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