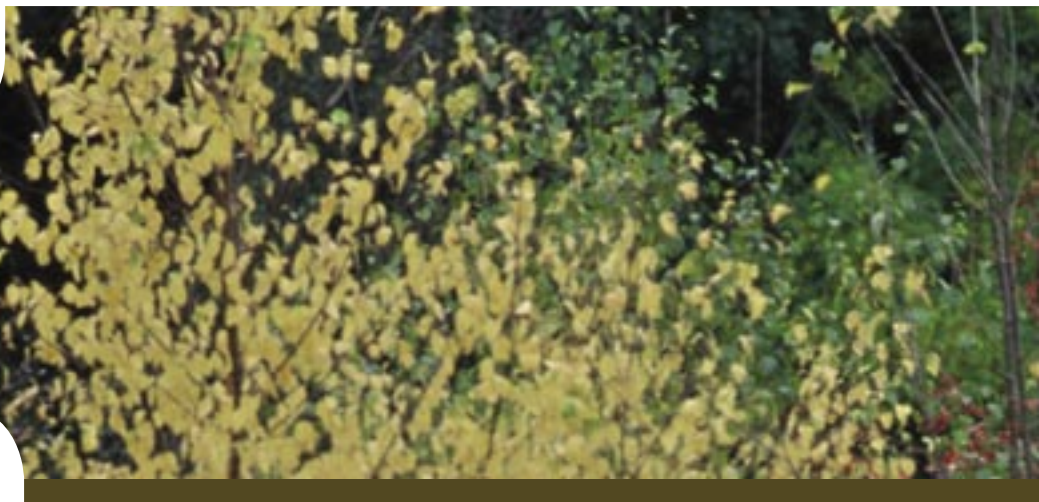


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Introduction

People have always valued trees, whether for visual appeal, shade, shelter, food production or for timber. Some areas of New Zealand are distinctive because of their trees and in Taranaki many attractive plantings enhance our natural landscape. There is always room, however, for more.

This booklet explains the many benefits trees offer to our farms and rural landscape and provides practical advice and information. It is part of the Taranaki Tree Trust's project "Treescaping Taranaki" which encourages rural landholders to adopt a regular tree-planting programme. Even a handful of trees planted each year will enhance a property's beauty, productivity and value.

We are fortunate to live in a region that has a climate and soils in which a huge variety of native and exotic trees can flourish. It is time to take up this project and ensure that the trees we plant now in Taranaki become a legacy appreciated by future generations.

David Walter QSO, JP
Chairman Taranaki Tree Trust and Taranaki Regional Council



Children learn much about themselves and the environment when they plant a tree,



Taranaki Tree Trust

The Taranaki Tree Trust is a registered charitable trust dedicated to the preservation and development of Taranaki's natural ecosystems and landscapes. The Trust works with landholders and agencies to protect forest and wetland remnants, to fence and plant stream and river margins and to purchase valuable forest remnants and wildlife habitats. In order to enhance Taranaki's natural environment the Trust encourages the planting of trees.

The Trust depends on event-type funding; corporate sponsorship of individual projects; public bequests and donations. The Taranaki Regional Council administers the Trust's independent policies at no cost to the Trust. All sponsorship funds and donations therefore go directly to Trust projects. Without all this support, the Trust could not function.

Significant contributions from the TSB Community Trust and the Taranaki Regional Council have supported the publication of this booklet.



Parts of the Taranaki landscape have very few trees remaining since the land was cleared.



A well planted Taranaki landscape.

Why plant trees?

Taranaki was once covered in lowland podocarp forest, much of which has been cleared for pastoral farming leaving less than 5% of the region's indigenous vegetation remaining today.

So why plant trees again? The reasons are many and varied. Some trees are planted mainly for their aesthetic value, others are planted to provide a specific habitat and still others are intended for financial rewards. Enhancing Taranaki's treescape adds much to our lifestyle and quality of life. Trees have so many uses, in fact, that it is difficult to imagine anyone not wanting to plant them.

The secret for successful results is in matching the tree-type to its locality and its desired use, and in managing it correctly. The right trees can be valuable sources of shade for stock in summer, can provide useful shelter from the wind and can be used for stock feed, timber or firewood. They can help improve water quality by shading and cooling the water, by stabilising eroding slopes and river banks and, as part of riparian buffer areas, by filtering sediments and nutrients from run-off.

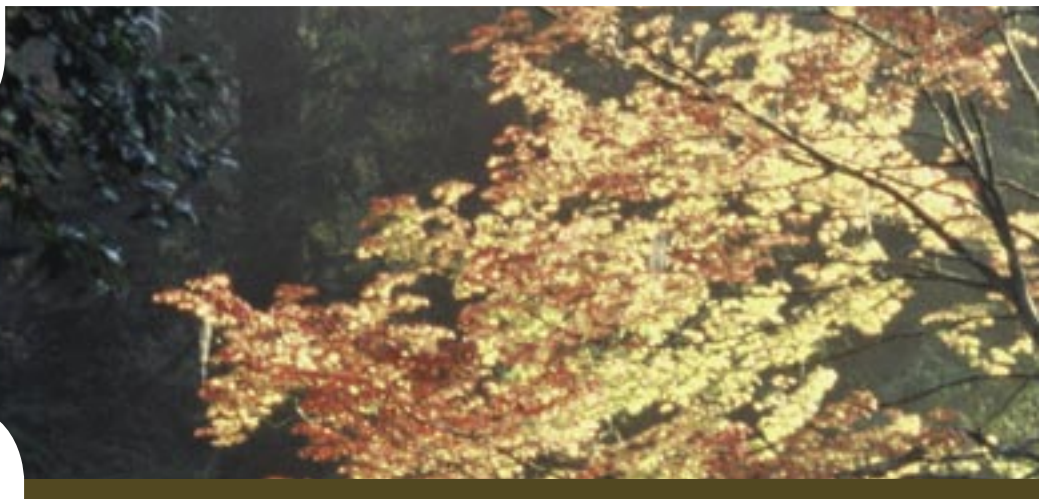
There is money to be made from trees directly through timber, or indirectly through stock health and shelter or through attracting clover pollinating bees. The aesthetic appeal of a well planted property can contribute too to property values and sale-ability.

Treescaping Taranaki is an investment in the region's future. There are immeasurable benefits that extend well beyond individual lifetimes, whether the trees provide millable timber for the next generation, help combat the effects of global warming or ensure an attractive countryside for the generations to come.

Planning

The success of tree planting relies on proper planning. Before you put any tree in the ground, you need to decide what it is you wish to achieve and to consider the site conditions. Bearing this information in mind, you will be able to make an informed decision on the most appropriate tree species to use and will ensure that the plantings will not pose any problems later on.





Stock shading under a large copper beech tree.



A well designed multi-row and multi-species shelterbelt will enhance timber production.

Specific planting goals

Shade

In summer, animals without shade trees are often exposed to hours of direct sunlight and high temperatures with resulting heat stress, sunburn and decline in production. At the same time, shade trees can have their disadvantages by reducing available pasture and encouraging stock camping. It is important to note however, that these effects can be reduced by the careful selection of the species planted. Deciduous trees are best for southern slopes to allow sunlight to reach the base of trees in winter. By providing shade on areas where it is hard to push stock in the summer you can achieve better grazing control. The appropriate location of stock water and high pruning of trees are further management tools to bear in mind. Good pruning may allow trees to be used also for future timber production.

These days, shade for animal health is becoming more important. The issue is highlighted in recent quality assurance programmes where stock access to adequate shade has become a condition of supply.

Shelter

Scientific trials have shown that shelter belts will increase dry matter production between 5% and 15% and improve livestock performance through reduced animal stress and enhanced metabolic conversion of feed. Shelter belts can serve other purposes too. They can be planted in a retired riparian margin, used for erosion control, provide habitat and corridors for birds, provide some commercial timber value, and enhance the farm landscape.

The best shelter filters the wind by slowing it down, not by attempting to stop it. In fact, dense shelter can do more harm than good by accelerating the wind and creating turbulence. The best sheltering effect is achieved when there is about 50% permeability through the shelter belt. For maximum protection the plantings should be uniform and at a continuous length of at least 24 times the ultimate height of the shelter belt. The resulting shelter can be felt at a horizontal distance of up to 20 times the height of the trees, but the most benefit occurs between one and five times their height. There can also be some shelter value on the windward side of the belt.

When designing a shelter belt, consideration should be given to the direction of the prevailing wind, any possible effects of shading, when shelter is required, the level of shelter needed, soil conditions, and the opportunities for the shelter belt to be multifunctional. All these factors will determine the choice of tree species, the number of rows, the planting density and the orientation.



Ewes feeding on freshly cut poplar.

Aesthetics

Another important reason for planting can be the visual effects achieved. Will it be pleasing to the eye? Many farmers can take advantage of fenced dams or paddock corners to plant trees that simply look good. With good management, there may well be added benefits too such as the provision of stock fodder, erosion control, timber, or bee and bird food.

Habitat

Humans and their farmed animals are not the only inhabitants of the land to benefit from treescaping. Birds too can take advantage of trees and shrubs planted by rural landholders to create or enhance habitat or even create ecological corridors between several blocks of bush.

Trees for nectar and pollen

Honeybees need protein that they obtain from pollen, and carbohydrates that they obtain from nectar. Pasture flowers often provide bees with most of their requirements, however when these are not in bloom, such as in early spring, bees need other food sources. The planting of nectar and pollen bearing trees is important and often will be complementary to the original planting objective.

Trees for birds

Any tree or shrub will have some value to some bird, but to get the best possible results from trees planted with birds in mind you need to be selective. A year-round supply of food is the most important factor in attracting birds. If this is provided, particularly for fruit and nectar feeders, the same trees in sufficient variety will also meet most other requirements, including food for insect and seed eaters. When selecting tree species, consideration must be given to climate, soil conditions, the time of the year when the feed is required, and the target bird species.

Stock feed

Many tree species are suitable for stock feed for either animal health supplements or drought fodder. AgResearch and Massey University are currently investigating the use of poplars and willows for fodder. Results show that the digestibility of these two species is similar to lucerne hay. Poplar and willow can improve ewe reproduction during times of drought and sometimes result in significant increases in lambing percentages.



A space planted hill side for erosion control.



A well planted riparian margin has many benefits not only for water quality but also animal production.



Trees planted for timber production can assist cash flows when livestock returns are down.

Soil erosion control

There are many types of soil erosion and the success of their control using trees is dependent on the erosion types and their severity. Studies have shown that shallow mass movement erosion can be reduced by up to 65% by space planted trees or up to 95% with closed canopy trees or afforestation.

Ideally plantings for erosion control should be undertaken before erosion occurs. Planning needs to consider the potential area that is likely to be affected, the tree species used and whether or not the planting density is sufficient to control the type and severity of erosion expected in the future. If grazing is to be continuous this will influence the species and the type of planting material used.

Riparian management

Planting up a riparian margin with trees and shrubs has a multitude of benefits. Wildlife habitat can be enhanced, stream bank erosion controlled, flood impact reduced and water quality improved. The water will be improved by the removal of the stock from the watercourse, by filtering surface run-off, removing nutrients, and minimizing water temperature fluctuations.

Timber

The value of timber varies considerably depending on the species planted, the management of the trees, and the potential end uses. To produce quality timber nearly all trees require some training and some form pruning. Often trees planted for timber are grown in wood lots to ensure good form by controlling branch size and forcing the tree to grow upwards. If you are considering establishing a commercial wood lot or forest, give some thought to ease of access, method of harvest, age to maturity, soil conditions, silvicultural requirements, pests and diseases, and estimated costs and revenues over the life of the wood lot itself.



The orange-red mottles in this soil profile indicate poor drainage.



Site conditions

Treescaping can significantly alter a rural landscape and requires careful consideration. View lines on the property are important and need to be taken into account. You need to consider not just the location of the trees you are planting, but the larger landscape as well. There may be views to protect, buildings to screen or natural features of the landform to accentuate. Proximity to overhead and underground cables, tile drains and pipelines needs to be taken into account. Consider slope, sunny or shady aspect, soil depth, texture and drainage, wind exposure, salt wind effects, erosion, frost, humidity and flood risk. On any property, site conditions vary and there is a variety of microclimates that suit different trees. These site conditions can all have a marked effect on tree growth and survival.

The soil conditions are often the hardest to read. Some tree species like free draining soil while others prefer it wet, some need to get their roots down while others will grow in shallow soils, and some like acidic conditions while others prefer alkaline conditions. Digging a hole and looking at the soil profiles, the colour patterns, textural and structural changes, depth to parent material and the depth of the topsoil are the first steps in determining what the soil conditions are like.

Where to plant

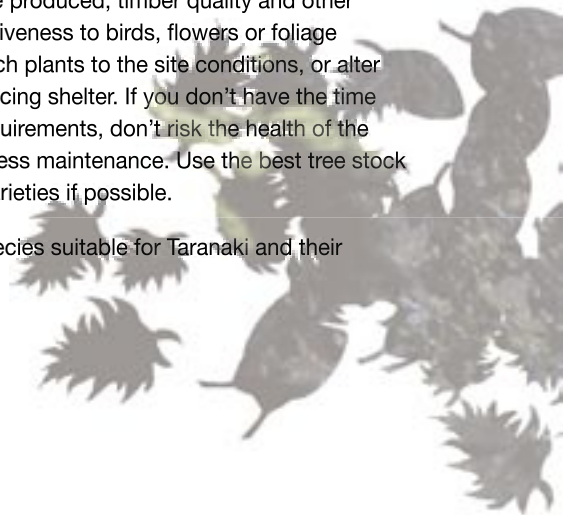
The location of your plantings will vary depending on the requirements of the trees and their purposes. Some trees are hardy and will grow in a variety of conditions: others are more sensitive and will only thrive in specific conditions. Use the best sites to produce the best trees. Sheltered locations with deep, well-drained soil are desirable. Think of the final size of the tree, consider access around the site when fully grown, and determine shading effects on roads and drains. Ease of stock management, ease of fencing, environmental gains (eg from retiring wetlands or eroding sites), access for harvest, visual impact, neighbours' fence lines and views are some of the many aspects that need your attention.



What to plant

For a particular purpose there may be a variety of trees to choose from. Compare the trees in terms of growth rates, final size, resistance to pests and diseases, hardiness, amounts of shade produced, timber quality and other spin-offs like bee nectar/pollen, attractiveness to birds, flowers or foliage colour or just general good looks. Match plants to the site conditions, or alter the conditions, for example, by introducing shelter. If you don't have the time or money to accommodate special requirements, don't risk the health of the trees, instead choose trees that need less maintenance. Use the best tree stock available and choose multi-purpose varieties if possible.

Appendix I and II outline some tree species suitable for Taranaki and their site requirements.



Planting

Proper planning will ensure that seedlings will have the best possible chance to establish and grow to fulfil your initial goals. Planting at the best time, sufficient site preparation, obtaining suitable quality tree stock, providing tree protection from livestock, suitable planting techniques, and adequate and timely maintenance will lead to the successful establishment of your seedlings.





Trees need to be protected from stock to prevent ring barking.



Possums can cause serious damage to young trees.



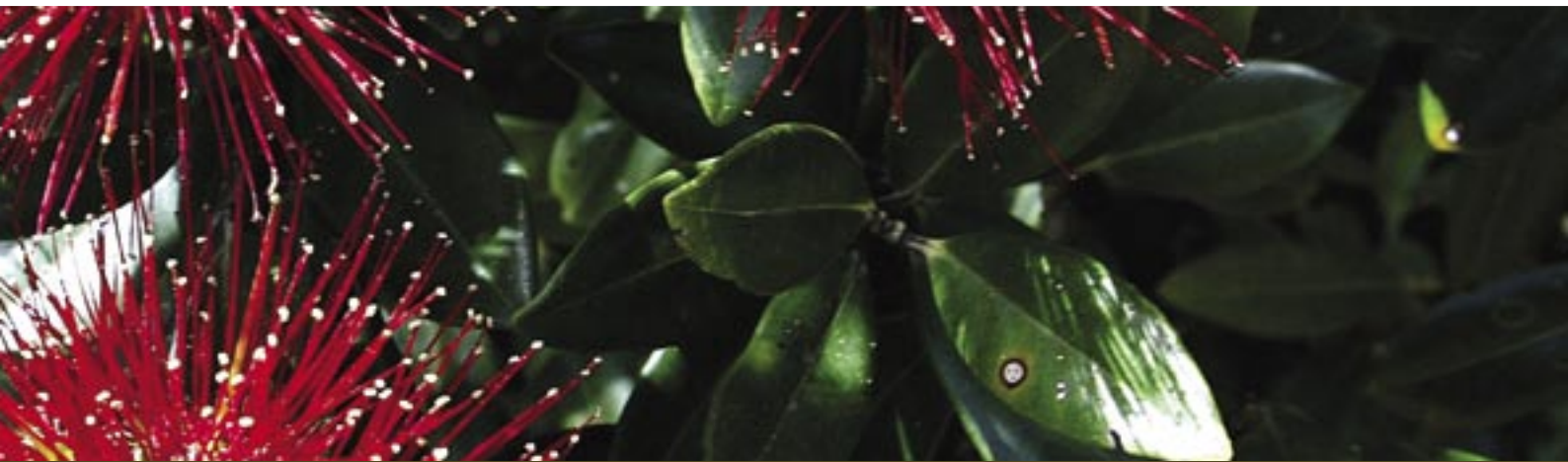
When to plant

For trees to survive without irrigation, the best time to plant is from late May until September, the slowest growth period, especially for deciduous species. Trees will not survive in dry soil, so plant when the ground is moist. In dry winters, planting should be delayed 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. The planting of frost prone seedlings should be delayed until the spring. Some plants require some shelter or a nurse crop to grow amongst and planting cannot occur until these are established. Erosion prone areas should be planted before they slip.

Preparing the site

The following three rules will enhance the successful establishment of seedlings:

1. Protect seedlings from stock browsing or rubbing. This rule applies whether there is one tree or a forest being planted.
2. Eliminate competition from pasture or weeds. This is critical. Pasture and weeds at planting time are often very short in length and do not appear to pose problems. However when the spring growth comes, grass and weeds will out-compete young seedlings and smother them. To reduce the effects from this, 1 to 2 metre diameter spots should be sprayed with Glyphosate and a residual herbicide a couple of weeks prior to planting. A release spray in the spring-summer period may be required to keep pasture grasses and weeds low. When using a residual chemical, check the label to make sure that it is safe for the tree species you are planting. Removing the competition from grasses and weeds will also ensure that seedlings will handle summer droughts better because there is no battle for moisture.
3. Control animal pests prior to planting. Rabbits, hares and possums will all damage newly planted seedlings. Rabbits and possums can be poisoned with Pindone, 1080, etc, however hares will generally require shooting. Long pasture prior to planting can reduce the effects of these animal pests, as they generally do not like getting their bellies wet from the long grass. Animal stock need to have had their last grazing a couple of weeks prior to planting rather than the morning of planting.



Selection of tree stocks

Tree stock selection too is critical. If tree quality is poor then survival and subsequent tree growth will also be inferior regardless of other techniques used.

There are several factors that should be checked when buying plants.

First check the above ground characteristics including height, diameter, foliage colour, damage by insects and fungi and degree of hardiness.

Then inspect the root conditions. It is also important to look at the overall size of the plant. Large plants can be blown around in the wind: large seedlings in small containers can have serious root distortion, often resulting in instability.

The choice of whether to use bare-rooted or container grown plants will depend on personal preference. Bare-rooted plants are usually cheaper than container grown plants, usually easier to handle and are often more vigorous. Bare-rooted plants need to be put in the ground within 24 to 48 hours of being wrenched and the roots or foliage must not be allowed to dry out. Container grown seedlings are popular because they extend the planting season. The size of the seedling will reflect the container size.

When growing native trees the tree stock should be grown from seeds from local sources where possible. This will ensure that the indigenous genetic variability is retained for a particular area.

When transporting seedlings it is essential they arrive at the planting site in the best condition possible. Seedlings must be covered on vehicles, as wind will dry them out. Bundles of seedlings stacked high can crush the ones on the bottom and the stacks themselves can heat up and cause further damage.

Order wisely. Bulk ordering of plants from a nursery will usually attract discounted rates.



There are many ways to protect trees from animal stock.

Tree protection

There are many forms of tree protection with many uses. Choosing an appropriate type will depend on the tree species, the type of animal the tree is being protected from, how many trees are being protected, and the purpose for planting the tree. The photos (left) show just a few ways to protect trees.

Planting

While the planting of various types of trees differs in detail, all trees eventually end up in a hole. Not any old hole, however, will do.

The most common mistake made when planting a tree is digging a hole that is both too deep and too narrow. If the hole is too deep, the roots don't have access to sufficient oxygen to ensure proper growth. If it is too narrow, the root structure can't expand sufficiently to nourish and properly anchor the plant.

As a general rule, trees should be transplanted no deeper than the depth of soil in which they were originally grown. The width of the hole should be at least three times the diameter of the root ball or container or spread of the roots in the case of bare-rooted trees. This will provide the tree with enough worked soil in which to establish its root structure.

When digging in poorly drained clay soils, it is important to avoid 'glazing'. Glazing occurs when the sides and bottom of the hole become smoothed thereby forming a barrier, through which water has difficulty passing. To break up the glaze, use a fork to work the bottom and drag the prongs along the sides of the completed hole. Raising the centre bottom of the hole slightly above the surrounding area allows water to disperse and avoids pooling of water in the planting zone.



Planting container trees

Once you have carefully removed the tree from its container, check the roots. If they are tightly compressed or 'pot bound', with your fingers or a blunt instrument (to minimise root tearing) carefully tease the fine roots away from the tight mass and then spread the roots prior to planting. In the case of extremely woody compacted roots, it may be necessary to use a spade to open up the bottom half of the root system. Then pull the root system apart or 'butterfly' it prior to planting. Loosening the root structure in this way is extremely important for container plants. If you don't loosen the roots they may grow around in a ball or 'girdle' rather than rooting outwards, and kill the tree. At the very least, the roots will have difficulty expanding beyond the dimensions of the original container. To assist the tree's growth, lightly break up the soil outside the planting zone. This allows roots that quickly move out of the planting zone to be more resilient as they anchor into existing surrounding soil conditions.

Once the tree is seated in the hole, back fill the original soil into the hole to the soil level of the container. The back filled soil should not be over compressed but firm enough so that when the stem of the plant is gently pulled the tree remains fast in the ground.

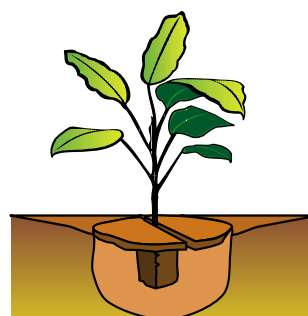
Planting container trees

A. Planting sites that have been cleared of vegetation or prepared with knockdown herbicide.

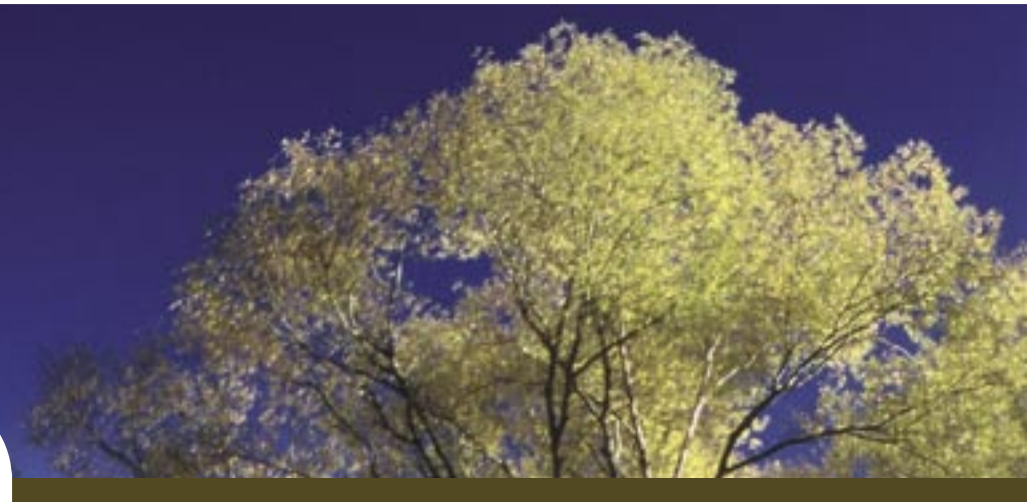
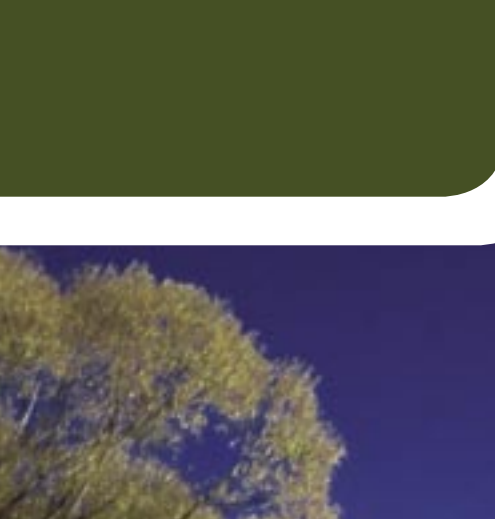


Make the planting hole at least twice the size of the container, and plant in the same way as for bare-rooted stock. The top of the root ball should be no more than 3cm below the soil.

B. Planting sites that have been prepared with a soil residual herbicide.



Make sure that any treated turf you remove is replaced the right way up.



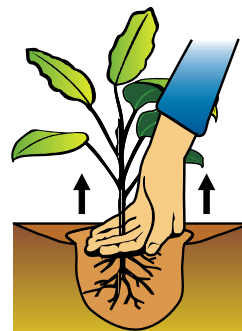
Planting bare-rooted trees

Planting bare-rooted trees is a little different, as there is no soil surrounding the roots. In this case, the time between purchase and planting is extremely important. Plant as soon as possible. When purchasing bare-rooted trees, inspect the roots to ensure that they are moist and have numerous lengths of fine root hairs, indicating good health. Make sure that the roots are kept moist in the period between purchase and planting. Prune broken or damaged roots but save as much of the root structure as you can.

Planting bare-rooted trees



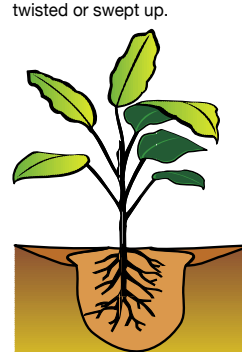
1. Place the seedling in the slot about 10cm deeper than the final position you want.



2. Replace the soil around the roots and pull the seedling up about 10cm. This will straighten any roots that are twisted or swept up.



3. Only now do you firm the soil around the seedling using the soles of your boots, never your heels. If you use your heels you are more than likely to over-compress the soil and damage the seedling.



4. Leave a small depression when you firm the soil around the seedling to help retain any water you add and any rainwater.



Open rooted trees often need staking following planting.

Fertilizer

Excessive feeding at planting time can be dangerous and is unnecessary. Encouraging accelerated growth at planting time with fertilizers often means that the roots below ground will not be able to support the excessive growth above ground during periods of strong winds or drought. Natural fertilizers such as blood and bone can be incorporated into the soil before planting, however it is best to scatter a couple of handfuls on to the surface after planting. By the time it reaches the roots it will be in soluble form and readily available.

Staking

Young trees should be able to support their own weight, but when they are transplanted, they often need time and assistance to re-establish. Many nurseries plant their trees very close together to maximize use of space, and stake them to promote height growth at the expense of trunk strength. When shopping for trees, look for trees with branches all along the trunk – not just at the top.

Once a tree is planted, it will concentrate its energy on standing upright. If it is unable to do so, try thinning out the upper branches to reduce wind resistance. If that is not enough and you find you have to stake a tree, remember the following:

1. Only stake the tree long enough for it to be able to stand on its own.
2. Stakes should not be too tight – there should be room for the tree to sway in the wind.
3. Stakes should not be too loose – the tree should not rub against the stakes.
4. Stakes should be buried at least 50 cm under the ground to provide ample support.

Maintenance and other considerations



Planted seedlings following chemical releasing.



Seedling showing chemical released spot.

Pruning

Use restraint when pruning your newly planted trees and prune only to remove damaged or broken branches. Do not prune the top of the tree as this may alter the structure of the tree excessively and may hamper growth.

Post plant releasing

Good weed control is essential to guarantee seedling survival and good growth. Grasses and weeds are generally much more vigorous than tree seedlings and can quickly smother them, and during dry periods will compete for soil moisture and nutrients.

Grasses and weeds can be removed by either non-chemical or chemical methods. The main non-chemical method is hand releasing and involves slashing, pulling or crushing weeds nearby. Hand tools such as slashers are useful, but considerable care is needed to avoid unintentionally decapitating the tree. Hand releasing is labour intensive and is an expensive alternative to chemical releasing.

Chemical releasing is the simplest method. However if it is not undertaken with care the results can be devastating. Before chemical release spraying, always seek expert advice on what chemical to use, check on the rates required, follow the manufacturer's instructions, use the appropriate safety equipment, and avoid spray drift.

Timeline for successful establishment.

Operation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Order tree stocks	✓	✓							✓	✓	✓	
Fencing				✓	✓							
Pre-plant spray				✓	✓	✓						
Planting						✓	✓	✓				
Releasing			✓*						✓	✓		
Mortality count	✓*											
Blanking (replacing dead seedlings)							✓*					

(* Following year)

Self-help information



Advice

- Taranaki Farm Shelter and Forestry Association. Contact Bill Davies, Phone (06) 762 8619, RD 24 Stratford; Toon Welvaert (06) 752 3313; Tim Rose (06) 764 5060.
- Taranaki Regional Council for advice on erosion control, shade and shelter, weed and pest control, the supply of native plants from the plants scheme. Cloten Road, Stratford. Phone (06) 765 7127, email info@trc.govt.nz

Taranaki Regional Council Information Sheets

The Taranaki Regional Council has produced numerous information sheets on sustainable land management, pest animal management, and pest plant management. These are listed in Appendix IV and can be obtained from the Taranaki Regional Council by visiting their website www.trc.govt.nz, emailing info@trc.govt.nz, or by phoning (06) 765 7127.

New Zealand Farm Forestry Association (NZFFA)

Tree Grower magazine – excellent information provider for farm foresters. Also a number of research or interest groups including Indigenous forest, Acacia melanoxylon interest group, Cypress action group, Eucalyptus action group, Sequoia action group. www.nzffa.org.nz for contacts.

Tree fodder research group

Ongoing research into trees for fodder for drought proofing farms, animal health opportunities, and enhancing animal production opportunities. Visit www.hortresearch.co.nz/projects/fodder/ or contact project leader Dr Grant Douglas at AgResearch Palmerston North grant.douglas@agresearch.co.nz.

Books

- Mortimer J&B. 1990: *Trees for the New Zealand Countryside – A Planters Guide*, Silverfish, Auckland.
- Evans B. 1983: *Re-vegetation Manual*, Queen Elizabeth II National Trust, Wellington
- Salmon, J.T. 1980: *The Native Trees of New Zealand*, A.H. & A.W. Reed, Wellington.

Nursery suppliers

Check out the yellow pages in the phone book or on www.yellowpages.co.nz for local nurseries and members of the New Zealand Nursery Association.



Websites

The Taranaki herbarium – a specific plant website for Taranaki includes information on native plants, enhancement planting, production planting, weeds, and useful links.

www.taranakiplants.net.nz

NZ Farm Forestry Association – local contacts, market information, useful links.
www.nzffa.org.nz

New Zealand Tree Crops Association Inc – local contacts, publications, articles
www.treecrops.org.nz

Taranaki Regional Council – information on land management, pest plants and pest animals, plant scheme etc.
www.trc.govt.nz

HortResearch – information on poplars and willows, varieties and their characteristics, growing advice.
www.hortresearch.co.nz/productions/poplars

Landcare Research – the native plant species selector, the green toolbox land management support package.
www.landcareresearch.co.nz/research/biodiversity/greentoolbox/gtbweb/default.asp

New Zealand Ecological Restoration Network
– some planting tips including a planter guide.
www.bush.org.nz/home/index.html

QEI National Trust – preservation of indigenous bush, Open Space magazine, limited funding for bush protection.
www.nationaltrust.org.nz

Extensive information on native plants including lists for various uses such as timber, shelter, wetlands, attracting birds and book list.
www.tauponativeplant.co.nz

Fish & Game New Zealand – information on wetlands, game bird habitat enhancement, and game bird habitat trust board.
www.fishandgame.org.nz

Appendices



Appendix I

Exotic tree species and site requirements



Key

1. Habit

a. **Foliage:** D = deciduous

E = evergreen

b. **Form:** N = narrow crown

S = spreading crown

N/S = intermediate

NS = narrow when young, becoming spreading with age

c. **Growth rate:** height growth rate estimations are for the annual average over the five years after planting out on moderately favourable sites. Slower growing species may not attain optimal growth rates until full canopy development at over 20 years of age.

S = slow: 0.1 to 0.5 m/yr.

M = moderate: 0.5 to 1.0 m/yr.

F = fast: 1.0 to 1.5 m/yr.

VF = very fast: more than 1.5 m/yr.

d. **Height:** the top end of the height range estimations applies to mature trees growing on favourable sites. Isolated trees and those in single row shelter can normally expect to attain heights towards the middle and lower end of the range.

2. Site/climate/soil conditions

e. Climate zone:

C = coastal: within approximately 3 km of coast

M = mid ring plain: from 3 km of the coast to 200m above sea level

U = upper ring plain: between 200 and 400m above sea level

E = eastern hill country

f. **Wind, salt wind, drought:** species with known tolerance to these factors are rated:

0 = no tolerance

1 = a limited degree of tolerance

2 = good tolerance

3 = very good tolerance

Species that are not rated are known to have no tolerance or no recorded tolerance.

g. **Frost:** The species are rated up to 3 for the lowest mid-winter temperature they are likely to tolerate without substantial damage. The species will certainly be much less tolerant to unseasonal frosts. Seedlings will be much less tolerant than adult plants. The approximate relationship between rating and degrees of frost is:

1 = -2°C to -6°C

2 = -6°C to -10°C

3 = lower than -10°C

Plants that are not rated do not usually withstand more than 2°C frosts.

h. **Waterlogging:** tolerance of a species to soils that are seasonally waterlogged for periods of 3 to 4 months at a time. Rated as for wind etc.

i. **Soil fertility:** tolerance of a species to infertile soils rated on the same basis as for wind etc.

Table a. Environmental requirements of some exotic tree species.

Botanical name	Common name	Habit				Environmental Tolerances						
		Foliage	Form	Growth rate	Height (m)	Climatic zone	Wind	Salt wind	Drought	Frost	Water Logging	Fertility
<i>Acacia mearnsii</i>	Black wattle	E	S	F	5-15	M	1	1	3	2	0	2
<i>Acacia melanoxylon</i>	Tasmanian blackwood	E	S	F	15-30	M U E	2	-	2	2	1	1
<i>Albizia julibrissin</i>	Silk tree	D	S	M	10	M U E						
<i>Alnus cordata</i>	Italian alder	D	S	M	30	M U E	2	-	2	2	1	2
<i>Alnus glutinosa</i>	Black alder	D	S	M	30	C M U E	2	1	1	3	3	2
<i>Alnus rubra</i>	Red alder	D	S	M	15-25	M U E	2		1	1	1	1
<i>Araucaria heterophylla</i>	Norfolk Island pine	E	N/S	S	20-35	C	3	3	1	1	-	2-3
<i>Banksia integrifolia</i>	Coastal banksia	E	N-S	M	5-15	C	2	3	1	1	-	2
<i>Castanea sativa</i>	Chestnut	D	S	M	30-40	M U E	0		2	1	0	1-2
<i>Casuarina cunninghamiana</i>	Casuarina (River She-oak)	E	S	M	15-20	C M U E	2	1	2	1	-	Low pH
<i>Chamaecyparis lawsoniana</i>	Lawsoniana	E	N	S	15-25	C M U E	3	1	1	3	0	1
<i>Chamaecytisus palmensis</i>	Tree lucerne	E	S	M	4-6	C M U E	2	2	2	1	1	2
<i>Cryptomeria japonica</i>	Japanese cedar	E	N/S	S	15-30	M U E	2	2	2	3	0	1
<i>Cupressocyparis leylandii</i>	Leighton green	E	S	M	20-30	C M U E	3	3	2	3		1
<i>Cupressus lusitanica</i>	Lusitanica	E	S	M	20-30	M U E	3	1	2	1	1	1
<i>Cupressus macrocarpa</i>	Macrocarpa	E	S	M	20-30	C M U E	3	3	2	2	0	1
<i>Erythrina sykesii</i>	Coral tree	D	S	M	8-12	C M U E	1	3	2		1	2L
<i>Eucalyptus delegatensis</i>	Alpine ash	E	N-S	M	25-40	M U E	3		1	3		
<i>Eucalyptus fastigata</i>	Brown barrel	E	S	F	30-40	M U E	2	0	2	2		2
<i>Eucalyptus ficifolia</i>	Scarlet flowering gum	E	S	F	8-12	M U E			1			2
<i>Eucalyptus fraxinoides</i>	White ash	E	S	F	20-35	M U E	3	2	1	2		2
<i>Eucalyptus leucoxylon</i>	Yellow gum	E	S	M	15-25	M U E	2		2	2		
<i>Eucalyptus nitens</i>	Shining gum	E	S	VF	25-45	M U E	3		2	2		
<i>Eucalyptus obliqua</i>	Messmate	E	S	F	25-45	M U E	3		3	2	1	
<i>Eucalyptus ovata</i>	Swamp gum	E	S	F	18-25	M U E	3		2	3	3	
<i>Eucalyptus regnans</i>	Mountain ash	E	N-S	vF	30-50	M U E			2	2		
<i>Fagus sylvatica</i> var <i>purpurea</i>	Copper beech	D	S	M	25-30	M U E	2	0	1	2		2
<i>Fraxinus angustifolia</i>	Caucasian (or Claret) ash	D	S	M	25	M U E	1				1	
<i>Ginkgo biloba</i>	Ginkgo	D	S	S	15-25	M U E		1				
<i>Gleditsia triacanthos</i>	Honey locust	D	S	M	10-20	M U E	1		1	2	4	
<i>Grevillea robusta</i>	Silky oak	E	N/S	F	25-30	M U E			1		1	
<i>Juglans nigra</i>	Black walnut	D	S	M	20-30	M U E	1	0	1	1	0	0
<i>Liquidambar styraciflua</i>	Liquidambar	D	S	M	20-30	M U E	1	0		2	2	
<i>Liriodendron tulipifera</i>	Tulip tree	D	S	F	25-35	M U E			1			
<i>Magnolia grandiflora</i>	Magnolia	D	S	M	20-25	M U E				1		
<i>Melia azedarach</i>	Bead tree / Indian lilac	D	S	M	20-25	M U E						
<i>Lagunaria patersonii</i>	Norfolk Island hibiscus	E	S	M	5-10	C M	3	3	2	1	0	2
<i>Olearia traversii</i>	Chatham Island akeake	E	NS	M	5-10	C M U E	2	3	1	2	0	1
<i>Paulownia tomentosa</i>	Paulownia	D	S	VF	15-20	M U E	1	1	1	1	1	1
<i>Pinus radiata</i>	Pine	E	S	F	25-40	C M U E	3	3	2	3	0	2
<i>Platanus acerifolia</i>	Plane	D	S	M	20-30	M U E	2		2	3	2	2
<i>Populus deltoides</i> x <i>maximowiczii</i>	Eridano poplar	D	S	VF	20-30	M U E	1	1	1	3	2	1
<i>Populus deltoides</i> x <i>yunnanensis</i>	Kawa poplar	D	S	VF	20-30	M U E	1		1	2	2	1
<i>Populus deltoides</i> x <i>nigra</i>	Argyle poplar	D	S	VF	20-30	M U E	1		2	3	1	1
<i>Populus deltoides</i> x <i>nigra</i> ("Italia")	Tasman poplar	D	N/S	VF	20-30	M U E	2	1	1	3	2	1
<i>Populus deltoides</i> x <i>nigra</i>	Veronese poplar	D	N/S	VF	20-30	M U E	2		2	3	1	1
<i>Populus euramericana</i> x <i>yunnanensis</i>	Toa poplar	D	S	VF	20-30	M U E	2		1	2	2	1
<i>Pseudotsuga menziesii</i>	Douglas fir	D	S	M	20-40	U E	2	0	0	3	1	1
<i>Quercus coccinea</i>	Scarlet oak	D	S	S	15-25	M U E	2		1	2	2	1
<i>Quercus palustris</i>	Pin oak	D	S	M	15-20	M U E	2		1	2	2	1
<i>Quercus robur</i>	English oak	D	S	S	15-25	M U E	1	0	1	2-3	2	1
<i>Robinia pseudoacacia</i>	Black locust	D	S	F	15-20	M U E	1	1	2	3		L fert.
<i>Salix matsudana</i>	Matsudana willow	D	N-S	F	15-20	M U E	2	1	0	3	3	1
<i>Sequoia sempervirens</i>	Redwood	E	N/S	M	25-45	M U E	1	0	1	2	0	1
<i>Taxodium distichum</i>	Swamp cypress	D/E	S	S	25-35	M U E	1				3	3
<i>Thuja plicata</i>	Western red cedar	E	N/S	M	20-30	M U E	2		1	2		H
<i>Ulmus procera</i>	Elm	D	S	M	30-40	M U E	2	0			1	1

Appendix II

Indigenous tree species and site requirements



Key

Environmental tolerances often vary within a species and with time of the year. Tolerances also depend on the growth stage and adaption or acclimatization to a particular environment.

1. Habit

a. Foliage:

- D = deciduous
- E = evergreen

b. Growth form:

- S = shrub
- T = tree, forms a distinct trunk although sometimes short
- ST = shrub or small tree
- s = spreading or forming wide canopy
- d = divaricating, often only in juvenile stage

c. Height: the top end of the height range estimations applies to mature trees growing on favourable sites. Isolated trees and those in single row shelter can normally expect to attain heights towards the middle and lower end of the range.

2. Site/climate/soil conditions

d. Climate zone:

- C = coastal: within approximately 3 km of coast
- M = mid ring plain: from 3 km of the coast to 200m above sea level
- U = upper ring plain: between 200m and 400m above sea level
- E = eastern hill country

e. Wind, salt wind, drought: species with known tolerance to these factors are rated:

- L = low tolerance
- M = moderate tolerance
- H = good tolerance

Species that are not rated are known to have no tolerance or no recorded tolerance.

f. Frost: The species are rated up to 3 for the lowest mid-winter temperature they are likely to tolerate without substantial damage. The species will certainly be much less tolerant to unseasonal frosts. Seedlings will be much less tolerant than adult plants. The approximate relationship between rating and degrees of frost is:

- L = generally frost tender and will be damaged by cold winds or frost of -2°C or -3°C
 - M = will tolerate frosts -3°C to -6°C
 - H = generally considered as frost hardy and will tolerate frost of -7°C or lower
- Plants that are not rated do not usually withstand more than 2°C frosts.

g. Waterlogging: tolerance of a species to soils that are seasonally waterlogged for periods of 3 to 4 months at a time. Rated as for wind etc.

Table b. Environmental requirements for some indigenous tree species.

Botanical name	Common name	Habitat			Environmental tolerances					
		Foliage	Form	Height	Climatic zone	Wind	Salt wind	Drought	Frost	Water logging
Agathis australis	Kauri	E	T	30-50	M U	M	M	M	L	M
Alectryon excelsus	Titoki	S	sT	10	C M U	M	M	M	M	M
Aristotelia serrata	Wineberry / makomako	(D)	ST	9	M U E	M	L	L	H	M
Beilschmiedia tawa	Tawa	E	T	25	C M U	M	L	M	M	M
Brachyglottis repandra	Rangiora	E	sST	7	C M U E	M	M	M	M	L
Brachyglottis rotundifolia var. elaeagnifolia	Leatherwood	E	S	6	C M	M	M	M	M	L
Carmichaelia spp.	Native broom	E	S	2	M	L-H	L	M-H	(H)	L
Carpodetus serratus	Putaputaweta	E	S	5	M U	L	M	M	M	L
Cassinia leptophylla	Cottonwood, tauhinu	E	S	2	C	M	M	M-H	M-H	L
Cassinia vauvilliersii	Mountain cottonwood		S	2	C M U E	M	M	M-H	M-H	L
Coprosma repens	Taupata	E	ST	8	C	H	H	M	M	L
Coprosma robusta	Karamu	E	ST	6	C M U E	M	M	M	M	M
Coprosma tenuifolia	wavy leaved coprosma	E	ST	5	C M U E	M	M	M	M	M
Cordyline australis	Cabbage tree	E	T	5-13	C M E	H	M	M	H	H
Cordyline indivisa	Mountain cabbage tree	E	T	8	M U E	L	L	L	H	H
Corokia macrocarpa	Corokia	E	S	6	C	H	H	H	L	L
Cortaderia fulvida	Toetoe	E	S	3	C M U E	H	M	H	H	M
Corynocarpus laevigatus	Karaka	E	T	16	C	H	H	M	L	L
Dacrycarpus dactyloides	Kahikatea	E	T	25-50	C M E	M	L	L	M	H
Dacrydium cupressinum	Rimu	E	T	20-35	M E	M	M	L	M	M
Dodonaea viscosa	Akeake	E	sST	7	C M E	H	H	H	M	L
Dracophyllum longifolium	Inaka	E	T	12	C M					
Dysoxylum spectabile	Kohekohe	E	sT	15	C M	M	M	M	L	L
Elaeocarpus dentatus	Hinau	E	sT	18	C M					
Elaeocarpus hookerianus	Pokaka	E	sT	12	C M U E					
Entelea arborescens	Whau	E	S	6	C M	M	H	M	L	M
Fuchsia excorticata	Kotukutuku	E	sT	12	C M	M	L	L	M	M
Griselinia littoralis	Broadleaf	E	sT	10-15	C M E	H	H	M	M	M
Hebe macrocarpa var. (H corriganii)	Hebe macrocarpa var. (H corriganii)	E	sS	7		M-H	L-M	L-M	M-H	L-M
Hebe odora	Hebe odora	E	sS	1-2		H	L	L	H	M
Hebe speciosa		E	S	1-2	C	H	H	H	H	L
Hebe stricta var. egmontiana	Hebe stricta var. egmontiana	E	sS			M-H	L-M	L-M	M-H	L-M
Hebe stricta var. macroura	Hebe	E	sS	4	C	M	M	M	M	L
Hebe venustula	Hebe venustula	E	sS			M-H	L-M	L-M	M-H	L-M
Hedycarya arborea	Pigeonwood	E	T	12	C M U	M	M	L	M	M
Hoheria sexstylosa	Lacebark	E	ST	8	C M	M	L	L-M	M	M
Knightia excelsa	Rewarewa	E	T	20-30	C M U E	M	L	M	M	L
Leptospermum(Kunzea) ericoides	Kanuka	E	ST	15	C M E	M	L	H	H	M
Laurelia novae-zelandiae	Pukatea	E	T	36	C M U E	M	M	L	M	H
Leptospermum scoparium	Manuka	E	S	5		M	M	(H)	H	(H)
Libocedrus bidwillii	Kaikawaka	E	T	20	M U E	M	M	L	M	M
Libocedrus plumosa	Kawaka	E	T	20	M U E	M	M	L	M	M
Lophomyrtus bullata	Ramarama	E	S	6	C M					
Macropiper excelsa	Kawakawa	E	S	6	M	L	L	M	L	M
Melicope ternata	Wharangi	E	S	7	C M	M	H	M	L	L
Melicytus ramiflorus	Mahoe	E	sT	10	M	M	L	M	M	M
Metrosideros excelsa	Pohutukawa	E	sT	10-20	C	H	H	M	L	L
Metrosideros robusta	Rata	E	sT	15-25	M U E	M	L	M	M	L
Myoporum laetum	Ngaio	E	ST	10	C	H	H	M	M	L
Myrsine australis	Mapou	E	ST	6	C M					
Myrsine salicina	Toro	E	T	8	C M					
Nothofagus sp.	Silver Beech	E	T	25-30	M	M	L	M	H	M
Olearia ilicifolia	Hakeke	E	ST	5	C M U E	M	H	M	H	L
Olearia paniculata	Akiraho	E	ST	7	C M	M	H	M	H	L
Olearia rani	Heketara	E	S	7	C M	M	H	M	H	L
Phormium tenax	Flax	E	S	3	C M U E	H	H	L	H	H
Phyllocladus trichomanoides	Tanekaha	E	T	20	M E	M	L	M	L	M
Pittosporum crassifolium	Karo	E	ST	9	C M	H	H	M	M	L
Pittosporum eugenoides	Lemonwood	E	ST	12	C M U E	M	L	M	M	M
Pittosporum tenuifolium	Kohuhu	E	ST	10	M E	M	L	M	H	L
Plagianthus divaricatus	salt marsh ribbonwood	E	S	2	C	H	H	M	(M)	H
Plagianthus regius	Ribbonwood	E	sT	15	C M	M-H	L-H	M	M	M-H
Podocarpus totara	Totara	E	T	10-30	M U E	M	L	M	H	M
Pomaderris apetala	Tainui	E	ST	5	C	M	M	M	M	L
Prumnopitys ferruginea	Miro	E	T	25	M U E	M	L	M	H	M
Prumnopitys taxifolia	Matai	E	T	15	M E	M	L	H	H	M
Pseudopanax arboreus	Five finger / puahou	E	ST	8	M E	M	L	M	M	L
Pseudopanax colensoi		E	ST	5	M E	M	L	M	M	L
Pseudopanax crassifolius	Lancewood	E	T	15	M E	M	L	M	M	L
Pseudopanax simplex	Haumakaroa	E	sT	8	C M E	M	M	M	M	L
Pseudowintera axillaris / colorata	Horopito	E	sT	10	C M U E	H	M	M	M	M
Schefflera digitata	Pate	E	sS	8	M E	L	L	L	M	M
Sophora microphylla	Kowhai	E	dT	10	M U E	M	L	M	H	M
Vitex lucens	Puriri	E	ST	20	C M	M	M	M	L	M
Weinmannia racemosa	Kamahi	E	sT	25	M	M	L	M	M	M

Appendix III

Trees for specific uses



The following lists contain the genus names only. For the final tree selection you should consult with your local nursery to ensure that what you buy will match your particular site conditions.

Deciduous trees for autumn colour

Acer, Ailanthus, Betula, Carya, Diospyros, Fagus, Fraxinus, Ginkgo, Gleditsia, Glyptostrobus, Juglans, Larix, Liquidambar, Liriodendron, Metasequoia, Nothofagus, Nyssa, Populus, Quercus, Sorbus, Taxodium, Tilia, Ulmus, Zelkova.

Trees with fragrant flowers and foliage

Flowers

Acacia, Aesculus, Fruit trees, Magnolia, Malus, Pittosporum, Plagianthus, Robinia, Tilia.

Foliage

Calocedrus, Cedrus, Cinnamomum, Cupressus, Eucalyptus, Juglans, Pinus, Populus.

Trees for dry sites

Acacia, Acer, Ailanthus, Albizia, Brachychiton, Casuarina, Corynocarpus, Cupressus, Dodonaea, Eucalyptus, Gleditsia, Juniperus, Lagunaria, Maclura, Metrosideros, Olearia, Pinus, Pittosporum, Podocarpus, Quercus, Robinia, Schinus, Tamarix.

Trees for damp sites

Acacia, Acer, Alnus, Betula, Carya, Casuarina, Catalpa, Chamaecyparis, Cordyline, Cupressus, Cydonia, Dacrycarpus, Eucalyptus, Fraxinus, Glyptostrobus, Hoheria, Larix, Laurelia, Liquidambar, Liriodendron, Metasequoia, Nyssa, Picea, Populus, Pyrus, Quercus, Salix, Sequoia, Taxodium.

Trees for exposed coastal sites

Araucaria, Coprosma, Cordyline, Corokia, Corynocarpus, Cupressus, Griselinia, Lagunaria, Metrosideros, Olearia, Pinus, Pittosporum, Tamarix.

Trees for sheltered coastal sites

Acacia, Alnus, Carpinus, Castanea, Casuarina, Cinnamomum, Cupressocyparis, Dodonaea, Eucalyptus, Grevillea, Hoheria, Jacaranda, Knightia, Leptospermum, Liquidambar, Melia, Nothofagus, Paulownia, Phebalium, Populus, Pseudopanax, Pseudotsuga, Quercus, Salix, Sequoia, Sophora, Sorbus, Syncarpia, Thuja, Ulmus, Vitex, Weinmannia.

Appendix IV

Information sheets



The following information sheets are available from the Taranaki Regional Council free of charge:

Information sheets on sustainable land management

- 3. Blackwoods
- 5. Forestry joint ventures and cutting rights
- 6. Radiata pine
- 8. Douglas fir
- 11. Indigenous forestry
- 13. Eucalyptus
- 14. Eucalyptus species for Taranaki
- 16. Shelter and timber belt design
- 20. Poplars and willows for fodder
- 23. General principles and practices of riparian management
- 24. Riparian fencing options and costs
- 25. Plants for riparian margins
- 26. Establishing riparian vegetation
- 27. Maintaining riparian vegetation
- 29. Spraying for weed control in riparian margins
- 30. Trapping and poisoning for pest control in riparian margins
- 31. Poles – why plant them
- 32. Pole planting – what are the benefits?
- 33. Pole planting – general principles and practices
- 34. Pole planting – maintenance
- 35. Poplar and willow varieties available from Taranaki Regional Council
- 36. Poplars for timber production
- 42. Establishing a radiata pine woodlot
- 43. Managing trees in a radiata woodlot
- 44. Harvesting a radiata pine woodlot
- 45. Worksheet for estimating costs and returns for a farm wood lot
- 50. Native riparian plants
- 51. Canopy weeds in the riparian margins
- 53. Control of willow weeds
- 55. Ground cover weeds in the riparian margins
- 56. Shrubby weeds in the riparian margins
- 57. Tree weeds in the riparian margins

Appendix IV

(cont)



Information sheets on pest animal management

1. Use of repellents
17. 1080 (detail)
20. Cyanide
21. Feracol
22. Feratox (detail)
24. Pestoff ferret paste
25. Phosphorus
26. Pindone rabbit pellets
27. Shooting
28. Trapping
29. Live traps
30. Fenn kill traps
31. Timms kill traps
33. Leg-hold traps
34. Possible restrictions on the application of pesticides
35. Obtaining a license to use controlled pesticides
36. Control methods - poisoning or fumigation
38. Hares(detail)
39. Rabbits - poisoning
44. Cyanide (detail)
45. Feracol (detail)
46. Phosphorus (detail)

Information sheets on pest plant management

1. Pest plant management strategy for Taranaki
2. Old man's beard (*Clematis vitalba*)
3. Chilean rhubarb (*Gunnera tinctoria*)
4. Darwin's barberry (*Berberis darwinii*)
5. Gorse (*Ulex europeaus*)
8. Senegal tea (*Gymnocoronis spilanthoides*)
9. Australian sedge (*Carex longibrachiata*)
10. Mignonette vine (*Anredera cordifolia*)
11. Climbing spindleberry (*Celastrus orbiculatus*)
13. Wild broom (*Cytisus scoparius*)
14. Spanish heath (*Erica lusitanica*)
15. Brush wattle (*Paraserianthes lophantha*)
18. Japanese walnut (*Juglans ailantifolia*)

Information sheets available from Fish & Game Taranaki

- Creating and enhancing wetlands
- Wetland life
- Wonderful wetlands
- Creating wetlands
- Wetland planning