

# Case studies

# eight

## Shade and Shelter

### Sally and Tony Wilding - Okoroire dairy farm

#### What Was Planted

Concerned about the “misery” of stock - particularly in summer, Sally and Tony Wilding have been planting trees over the past twenty years to provide shade and shelter on their Okoroire dairy farm. They have maintained the existing barberry hedges, infilling when plants died, and have also planted a range of specimen trees for shade, including Chinese elms which are semi-deciduous, chestnuts and limes (*Tilia*) which have both been slow growing, Paulownia and Albizia.

They find Italian alders do very well in wetter parts of the farm, but don't recommend *Prunus* species because of insect problems. Willows are used to stop the edge of the track falling away and create a nice shady race. “We don't want the races to get wet and the poplars and willows let air through in winter”. Native trees have been planted around the ponds and in clusters in corners of the farm, and Sally finds that the “colours are lovely”.

Sally grew up in England, which she remembers as a “treed landscape”. “When we got here, the place was so bare. We started with fast-growing trees like planes and learned as we went along - the local nurseryman was a mine of information”. Sally has tried buying small grades (PB1.5) but now sticks to larger (5 or 6 ft) trees because the small ones died - “so they weren't cheap in the end.” She buys a bundle of ten bare-rooted trees for \$40-50, and gets native trees for \$1 each from the Okoroire Stream Care Group nursery.

#### Protecting the Trees

Sally says that they have taken tree protectors away too soon in the past and have lost trees as a result, so says “you can't get away with not fencing”. The fence lines are the easiest place to plant, without needing to put in a wooden fence or underground electric wires to get to the middle of a paddock. “If I've got a corner, I can even do that - put in a few insultrimbers and some electric string tied to the fence. It's simple and works well - it won't last as long as wire but I find I can do that, and get the trees protected until we get around to something more permanent.”

#### Keeping On Top of the Maintenance

Tony began the tree planting 20 years ago, but with is increasing involvement in Dairy Board and Dairy Group activities as well as farm jobs, Sally now does most of the tree planting and maintenance. “I programme the releasing every year to make sure it gets done. Once I finish the calf rearing, I just keep getting up early in the morning for about another week, and spend an hour and a half walking around the farm with my backpack on to spray around the young trees.”



As the trees get up higher, the lower limbs are pruned off with the help of a contractor and farm staff. This lets light in underneath the tree and encourages a better form for shade and “because we like the look of a tall, limbed-up tree in the middle of a paddock”.

#### Other Plans

In the future, Sally would like to plant up some of the rougher gullies, which are home to old willows, blackberry, and bracken fern. “It would be nice to try and plant something. We notice how the bush has crept up on the ranges - there used to be tui here and we don't get them now.”



# Heritage, Timber and Erosion Control

Stewart Gray and son Peter - Tirau dairy grazing property

## Reassessing the Farm Landscape

When the Grays decided to lease out their Tirau farm to a neighbour to graze his dairy cows and heifers, Peter took the opportunity to clearly define areas outside of the grazing lease so they could continue planting.

“It would have been good to have put more time into fencing little areas and planting for shade and protection while I was busy intensively farming. Leasing the farm helped us to focus on those put-aside plans,” says Peter.

Of their 140 hectares of rolling land, there is now a QEII National Trust covenant over 5.78 hectares of native bush, and extensive planting of natives on one steep hillside which is a former pa site. Other steep areas prone to slips are planted in pines, blackwoods and Paulownia for timber and for land stabilisation. While the Paulownia trees were frosted when young and will not have good form for timber, the Grays enjoy their attractive flowers and new leaves in spring.

## Stock Management

Now that cattle are run instead of sheep, Peter finds that the sidings are hard to maintain. “You can see at a certain steepness they don’t hold the soil. But the advantage with cattle is you can put up electric wires”. For sheep, the Grays recommend starting with at least four electric wires and checking regularly that the growth inside doesn’t short out the fence. In addition to stabilising soil, Peter says that “fencing steeper slopes and putting a few trees in made the paddocks easy to manage - stock can’t hide round the other side of the hill”.

## Going for High Value Timber

The blackwoods are form-pruned by taking out competing leaders to discourage a bushy habit. The lower branches are then removed as trees get taller, and half of the trees in the stand will be taken out (the original spacing was 3m x 3m). The Grays have planted and pruned the timber trees themselves, and note that while the blackwoods enjoy a steep, sunny slope, they haven’t done as well in heavier clay soils. Stewart believes that blackwood timber with its lasting qualities “will come into play a bit more in the future”.

## Protecting Local Heritage

At the pa site, the planting has been designed to maintain the silhouette which clearly shows the fortification earthworks. With this in mind, low shrubs and flaxes were planted near the top to keep the outline clear. Hardy native trees like akeake (*Dodonaea karamu* (*Coprosma robusta*), kanuka (*Kunzea ericoides*) and *Pittosporum* species (*eugenioides*, *tenuifolium* and *crassifolium*) were planted below this adjoining the existing remnant bush which has been fenced. Further down the slope, *Cupressus lusitanica* and totara are planted for timber. Five years on, the hardy natives are well established, and larger trees like pigeonwood (*Hedycarya arborea*), titoki (*Alectryon excelsus*), mangeao (*Litsea calicularis*) and lacebark (*Hoheria*) are being inter-planted among them. Podocarps are planted in the lower sites and among the blackwoods to provide an eventual succession. Possum bait is laid every couple of years.





The regeneration of undergrowth in the fenced native trees has been phenomenal. The few ailing old canopy trees which used to be a stock camp have been “totally transformed” in four years, and today you can barely push through the thick understorey of native plants. The neighbours have also been inspired to fence their patches of bush.

### Lessons Learned

When asked if he would have done anything differently, Stewart says: “If I had my time again I wouldn’t have drained all the swamps, because it was all raupo. It’s an amazing sight - the water flattening the raupo in a flood, the insects all floating around in it. In the old days if you had a slope you put it in grass, full-stop. Land is so valuable here, draining swamps is seen as a bit of a challenge. But when you look back on it, the raupo swamps are very attractive. They’re natural, and you don’t see so many around now.”



# Practical Shade on a Dairy and Maize Cropping Farm

John and Jenny Neill - Te Kawa

## The Importance of Shade

"I believe that heat stress in dairy cows is one of the most underestimated issues related to production and animal welfare in the Waikato" says John Neill. John and Jenny run 230 cows on a 94 ha dairy farm at Te Kawa West, near Te Awamutu.

"Eczema is manageable, lack of feed is manageable, but you can't manage shade in five minutes. If cows are hot, they won't produce as much milk. You can have all the water you like. It may take 10 years to get shade trees up, but you've got to start somewhere. I believe it's important to the people we're selling our products to, and from a pure stockmanship point of view I don't like seeing cows heat stressed and panting."

## Other Goals

While the property is exposed to the south and west, that is where their 2 km road frontage runs, and with the power lines there the Neills can't grow tall shelter belts. So they have aimed for a park-like effect with at least two trees in each paddock on their rolling country. A gully which can be seen from the house is now retired and planted for autumn colour. Jenny uses the Mortimers' book *Trees for the New Zealand Countryside* to pick out shade species like Zelkova, Liriodendron, Melia and Golden Elm. She also recommends the Amur cork tree for its appealing form. When planted, the trees are labelled using ear tags and marked on a farm plan. The Neills purchased 34 ha of peat five years ago which is currently bare of trees, so some trial and error will be needed to figure out what will grow well in the peat and the cold. They would also like to create a corridor for birds to travel down from nearby Kakepuku mountain.



## Tree Planting and Care

"Everything's got to be fenced, and that's probably the biggest barrier - you can't just go and plant a tree." But Jenny believes they are onto something with the treeguard system they use now. These treeguards are sourced from Auckland<sup>1</sup> and the Neills have one word for them - "brilliant".

<sup>1</sup> The tree guard used by the Neills comes from Auburn Industries, phone 0800TREEGUARD (0800 873 348)



Their son has devised a technique using tie-downs and a handle which allows them to pull together half a dozen guards in an hour. "It's a bit tricky," says John, "but as against posts and wire - it now takes 20 minutes to plant a tree." There are versions available for sheep and cows. The cow guard is 1.55m tall, and comes at a cost of about \$40 plus freight, so the Neills recommend buying a bundle to save on freight. They pin them down using half-inch reinforcing steel, cut to 1m lengths with the top third bent into a staple and put in on an angle - the rough type of steel holds best.

Baling twine is used to brace the tree across the guard. The Neills report that not one has been knocked over or damaged - and the cows won't rub on them because they move. "Posts and rails get broken as the cows rub on them, and they take up a 3x3m square, whereas these take a tenth of that and are easy to go around when we're mowing or topping with the tractor."

Jenny does the pruning until it becomes a chainsaw job. Trees are limbed up "for high shade and to discourage the cows from eating them. It's important for pasture management, otherwise you get a bog underneath and it becomes an obstacle for the tractor".

## Multi-purpose Shelter for a Dairy Herd

Ben and Sylvia Lee - Reporoa



### Value of shelter

Benjamin Lee farms at the top of the Reporoa basin where it meets the Kaingaroa plateau, and he can see the value of shelter for production as well as animal welfare.

"You notice here when the cold southerly is blowing the grass doesn't grow as well. And from my observation, a cow makes milk when she rests - just like a lactating mother, she needs comfortable, quiet, calm rest to produce enough milk. So if she's in a storm up against a fence she's using all her energy to stay warm or she's walking around looking for shelter, - she's not making milk."

### Design is Important

Grazing a herd of 500 cows, Benjamin says it is difficult to get shade and shelter for all cows in all paddocks while maintaining pasture production.

"A dense shelter belt running East-West harbours frost on the south side all day - so you want permeable ones for light and ventilation. With shelter running North-South frost is not such an issue, so orientation is important," says Ben, who now plants T-shaped shelter belts as illustrated above.

"Using a mix of species and the T-shape creates the illusion of a forest even though the trees are in straight lines. It's very cosy, which we appreciate in the milking shed - you don't want the southerly blowing straight down the pit, and your hands freezing up when you're trying to milk."

## A History of Achieving Multiple Objectives with Farm Trees

Benjamin and Sylvia have run the farm on their own account since 1983, taking it over from Ben's parents. Ben's father Alan was a founding member of the Farm Forestry Association, and over the two generations of Lees, 32 of the 187 ha have gone into trees for a range of purposes.

Originally, gullies were retired to control gully erosion which is notorious in this area. The policy is now "anywhere we can't truck on fert is retired and goes into trees". The Lees also saw the scope for timber production and the need for shelter, so they began planting and managing shelter belts.

Now, the Lees focus on "all aspects of tree planting, but because we are on valuable land we look at the economic outcome as well. So the trees are for financial return, and we get other benefits - soil conservation, animal welfare and to some extent native reforestation for birds". (Ben has inter-planted 500 totara trees into existing kanuka).

"There are not many podocarps around here so it's good to get that going for the native birds and animals and for timber as well." Ben has also developed "timber belts" - five or nine rows of pines planted at 600 stems/ha and then thinned to 450 stems/ha. "We can carry a high stocking rate of trees because it's very fertile soil. I have deliberately planted a belt in the path of the water run-off, in the hope that nutrients lost to pasture roots may still be taken up by trees."

A huge range of species have been planted by the Lees. "In choosing species, we look for trees that'll grow well. All trees need management but some trees are easier to manage. We look for good health and good form for timber, and species that are easy to prune. Conifers, like the spruces and firs, do well here in the colder country and free draining soils, and with their branches interspersed rather than in whorls they are structurally very sound." Sometimes evergreen and deciduous trees are combined, as in the 3 km of radiata/ Kawa poplar belts on the farm. Both species are pruned up, providing a multi-purpose belt with "some light, some shelter, some shade, and some timber".

## Edge Effects

Extra thought goes into designing the edges of woodlots. A row of exotic hardwoods was planted in front of the largest timber block to create a visual barrier at harvesting time. Eucalyptus fastigata have been placed between the cypresses and boundary fences, to avoid windblown cypress material causing abortions in cows.



"I wouldn't advise cypress as a shelter belt for that reason - you really need to educate all staff and fence stock 6-7 m out from them during that one rotation while they are at risk." When placed well away from stock, though, Ben sees great potential for the cypresses. He plans to experiment with the Japanese cypress which he says is highly valued in that country.

## On-Farm Use

So far, timber grown on the farm has been milled and used on site, though some Eucalyptus delegatensis was sold for pulp. Coastal redwood was milled at 33 years and used in farm buildings, and macrocarpa is milled as required for farm use. Poplar timber is cut into 100x100mm fence posts and treated in the same way as radiata, at a cost of \$82 per m<sup>3</sup> to treat and \$120 to mill. Including cartage to a local Broadlands treatment plant the total cost is \$220/m<sup>3</sup>.

# Reducing Stress on a Deer Farm

Vic and Margaret Clark - Reporoa

## Trees calm deer

Vic Clark believes that trees have a calming effect on deer and reduce their tendency to run the fences and create erosion.

"Deer are basically fringe dwellers - they live on the forest edges, rest, hide and come out to feed," says Vic. "Recreate that and you get a big change in temperament of the deer - they are calm and a pleasure to work with. With plenty of widespread trees they move there instead of running the fences - they feel more secure. That's good for them and it cuts down on tracking." The evidence can be seen on Vic and Margaret's farm near Reporoa which won the inaugural national deer farming award judged on both production and environment factors.



About half of the Clarks' stock units are deer, farmed for meat. They also rear dairy heifers and a small flock of ewes. Vic says the farm is a marginal size but "profitable because of the focus on quality. Here we have a good fawning rate, up to 95 percent; I believe that is because of reduction in stress."

Deer have mating groups and Vic believes that the visual barrier between groups provided by the trees makes master stags less stressed and more effective during the four-week mating period when they don't eat.

"Deer farming can work, if you're on the ball with good environmental management - that's the way to reduce stress, and it's extremely good business." Vic says the trees made the farm safer for stock, and "defined the land we could use and the land that wasn't worth using. They were just nasty rough places, boggy in the bottom with raw, infertile pumice. That's where lusitanica does well - due to low fertility the limbs stay small. The trees are worth far more than a bit of rough grazing."



### Spaced Poplars for the Deer and the Soil

Vic provides space-planted poplars for the deer, 25m apart. The poplars are pruned up for longer shadows and a timber butt log. Sleeves don't work with deer, so Vic makes tree protectors from sheets of reinforcing mesh (100x100mm grid) cut in half and tied with wire. This works out at about \$13.50 each hoop and the poles cost about \$5. "I can plant 10 poles in an afternoon - it's quite a bit of work but not worth doing if don't do a good job" says Vic. The trees draw stock away from streams, allowing grass to stabilise the banks. "Their roots grow 40m - I've seen it cultivating - so they protect hill slopes."



### Preventing Gully Erosion with a Timber Crop

In addition, 20 hectares of the 170ha farm have been retired altogether and planted under the Paeroa Range soil conservation scheme to control the severe gully erosion which occurs in the pumice soils of this area. Under a 35 percent grant rate, it worked out that Vic prepared the fences and the scheme looked after planting and spraying. The trees will be thinned and pruned so that grass grows underneath to give maximum soil protection. Vic chose the species used on the farm, and decided not to plant pines. "But we didn't go over the top with species. You need a critical mass to make it worthwhile for logging on a commercial basis."

There are separate blocks of *Cupressus lusitanica* and *Robinia*, and mixed blocks of eucalypts and blackwoods, and of deciduous Japanese larch and redwood. "Planting larch and redwoods together breaks up the colour and it seems to suit the redwoods." Vic tried twelve varieties of *Robinia* in one block near a stream and he recommends three - Ulloy, Zalai and Vati. "Robinia has a long creamy flower but the frost gets them. They are wonderful for erosion control because moving ground breaks their roots and they sucker. They were called ship-mast locust due to their strong, straight trunk but in New Zealand they don't seem to grow as straight," says Vic.



### Making the Farm More Attractive

For Margaret, the plantings have "made the farm - it's a lovely farm, pretty, you see the seasons come and go." Aesthetics are also important to Vic, who considers how the trees will fit into the landscape. "We tried to preserve remnants of native bush and made the soil conservation areas bigger to take in the existing natives. We have grown flax along the creeks and the bellbirds come down. And we don't keep a cat. It's not really a mix of objectives - it's integrated. There's a place for everything - good environmental management and with that you can have good commercial objectives - we have the farm to make a living but we can also enjoy how it looks - it's a middle line."

# Trees in a Wet Landscape

**Peter and Judi Buckley and son Aaron - Meremere dairy farm**

## **Trees Keep Water Cooling Costs Down**

Cooling water is essential on a dairy farm for food safety reasons. With this in mind Peter and Judi Buckley decided to plant their stream to keep it shady and cool. "The water has to enter the chiller at 18° if it is to get the milk down to 3° over three hours - which is the required rate of cooling," Peter says. "Our summer water temperature is 18° so we couldn't have it getting any hotter. Otherwise, we'd be looking at \$10-12000 to put a bore down for colder water, or else we'd need to install icebanks in the shed. So our plantings are an investment in keeping the water cool through shade. It didn't cost much - a few posts at \$4.75 each, a bit of wire, insulators at 25c each and we bought three bundles of twelve trees at \$100 a bundle."

The 100m stretch of stream has been planted on the north side with Pittosporum, flax, eucalypts, cabbage trees, blackwoods and some specimen trees. The south side has been left for digger access. Peter plans to plant the last 100m to the shed next year.

## **Vegetation for Drain Management**

Managing vegetation on drains is also important to the Buckleys, who have planted kahikatea and flax along them on the south side to minimise shading and retain vegetation cover in the drain itself. Minimum spraying is done and blackberry is kept under control while it is still small.

"We want our drains to be weedy and well overgrown to hold water up before it gets to the flood pumps. Our drains are important for water storage because we pump out onto the other side of the stopbanks and can lose 30 acres to flooding on the other side. The drains are also the outlet for field tiles in other paddocks, and by keeping them weedy they can filter water before it gets pumped out," says Peter.



## **Wetland Habitat - a Feature of the Farm**

Water is pumped out all year on the farm, part of which sits on 30m of peat. The back paddocks are left in swamp vegetation - willows, some native trees and wetland plants. They are home to 3000 pukeko according to the Buckleys' estimates.

"Judi's philosophy is that they were here before us and have as much right as we do to be here. If we have to carry three less cows because of it, we get a lot of pleasure from watching the birds, rather than just cows. So we leave the back paddocks locked up for birds in the winter and do some rat and possum control with the help of Environment Waikato."

## Using an On-Farm Resource

In the past, Peter has bought in compost to put around the trees he plants to get them off to a good start. Now he is making his own compost in partnership with a local machinery operator. They use a digger to mix pond sludge and bark in a 1:2 ratio, and to turn it periodically for aeration. Peter will use his share of compost for further tree planting, while his partner plans to sell his share.

## Shade and Shelter for Production and Animal Welfare

There are also trees planted in paddocks and beside the races and yards for shade and aesthetic appeal.

“Judi’s up on animal welfare. The cows coming in on the race like to stop and rest at each group of trees. They just go crazy for the poplar leaves around the yards, scoff the lot - there must be something good for them in the leaves. We have very high humidity here which is hard for stock. But we get a lot of evaporation and can still get a summer drought. You notice then that more grass grows under the shade - it stays green right up to the shade line. So there are production benefits as well as practical improvements. As we see it, farming can be easy or you can make it hard. You can make it easy and still have everything right. The money we spend on farm improvements makes life easier and more pleasant for Dean (the farm worker) or Judi or me, and the trees are part of that.”

# An Ideal Way to Grow Blackwoods

**Andrew and Marguerite Leadley - Ngapaenga dry stock farm**

## Planting the bush edge

Many people find it hard to get Tasmanian blackwoods to grow straight, unless they spend a great deal of time and attention pruning them. But Andrew and Marguerite Leadley have found that by growing blackwoods in light wells on the fringes of their native bush, they can get a tall straight tree with minimal impact on the surrounding bush.

The Leadleys farm 208 ha of rolling limestone country north of Piopio, at an altitude of 300m. They run sheep and dairy grazers. During the tough times of the 1980s, the Leadleys felled some of their native trees for timber “but we’ve regretted it ever since” says Andrew. The remaining forest is now fenced from stock, and pines and blackwoods have been planted around the margins among the regenerating native trees.

“I guess some people would have a problem with mixing natives and exotic trees like this, but it means we can harvest something from the area while we also protect it. And from a distance, the blackwoods blend in well with the colours of the bush.”





The planted trees will also help to reduce weed growth. "Weeds were a horrendous problem, with blackberry growing 2m high. I squashed it with the tractor and sprayed Roundup and it seems to have knocked it back," says Andrew.

### **The Farm Forestry Connection**

The blackwood seedlings came from a member of the local Waitomo branch of the Farm Forestry Association (FFA), and with the competition for light "they just went straight up". Andrew's father was a founding member of the FFA and did lots of planting on the farm. He grew pines as a shelter belt, pruning every second tree high

for timber and the ones in between in a fan shape so as not to take up too much pasture space. "I tried to talk him out of it at the time, but this is now one of my best lambing paddocks and I guess we will get some timber out of the trees too."

### **Species and Sites**

Andrew has continued planting, and the varied topography of the farm allows many different trees to be grown. The Leadleys find macrocarpa does well on poor clay soils and can grow as quickly as pines. Dawn redwood is a favourite for fertile, sheltered spots with its red foliage in autumn and leafy green colours in spring. While sycamores can become a problem tree in some areas, Andrew finds them useful as a hardy coppicing tree with good properties for timber, firewood and turning, plus stock seem to leave them alone. Marguerite protects other trees in the house paddock from sheep using lengths of chicken wire wrapped around long, pointed battens driven into the ground.

Some of the tomo have been fenced to prevent stock loss and trees were planted over a cave. Andrew notes that the cave has become wetter since replanting, possibly because plants stop rainwater running rapidly to streams - instead it collects behind organic material and seeps into the ground, benefiting the cave.

### **Two-Tiered Shelter Using Flax**

A feature of the farm is a belt of pruned poplars and cherry trees with flax grown underneath as extra shelter for sheep. "Sheep don't bother the flax but cows demolish it. We just run a 2-wire electric fence while the flax establishes, then we can let sheep graze around it. And if the flax gets out of hand, you can get rid of it with a front-end loader and a chain, or just let the cows graze it. It seems to attract tui to the trees," says Andrew.

# Replacing Willows in Gullies with Native Trees

Peter and Gael Levin - Taupiri bull farm

## Replanting with natives

When Peter and Gael Levin bought their 265 ha property near Taupiri to run bulls 15 years ago, Peter “got straight into the gullies. It was for aesthetic reasons and because I was keen to recover some of the native vegetation we’ve lost. I’ve been responsible for that myself - I burnt and felled native bush when I was younger, but attitudes change.” So much so, that the Levins’ farm now has 10,000 trees planted on it and the remnant totara and kahikatea along the Komakorau stream are under a QEII National Trust covenant.

## Dealing with Willows

The farm’s willow-filled gullies were transformed by clearing them, digging ponds, and planting the sides with native trees.

“We’d end up with 50:50 water and plantable ground. We’ve done nine of those and the small black shags come in to feed now. Diversity adds interest and you get more feeling for the farm” says Peter. He has some tips for people dealing with willow gullies.

“Don’t try and do it all at once - go through and fell the willows. Then go back and do your weed control. Leave it to the following year to plant, once everything’s clear. It’s much more relaxing for farmers.” As for clearing willows, Peter suggests felling the trees in dry conditions when the wood will not resprout, and painting the butts within 20 minutes of cutting.

## Re-establishing Native Trees

Hardy pioneering native plants are replanted in the gullies.

“People think natives are slow but the regenerative natives are as quick as anything else. Kanuka grows very vigorously, toetoe is good early on and we use a lot of Coprosma robusta - karamu and flax. Makomako gets up and gives good cover and Pittosporum eugenioides takes off - it’s almost too dominant. All a farmer has to do these days is look at Transit’s plantings to see what to plant”. As the first trees have grown up and now provide some shelter and frost protection, Peter is planting kahikatea, kauri, rimu and titoki.



At planting



■ *Three years after planting*

### **Practical Spin-offs and Environmental Gains**

There are practical reasons for retiring and planting the gullies. “With bulls, greater separation between mobs makes it easier and fencing has improved the paddock - it’s easier to manage”. Peter says it is now farm policy to fence all drains using a single electric wire and “you might as well do it at the top of the gully instead so you don’t get bull activity on the sides. We would get some grazing from those areas but it’s not very intensive grazing so the areas lend themselves to planting”.

Water quality was the main reason to fence and plant drains but Peter says it also reduces drain maintenance.

“If levels of drainage systems are important you must leave access for diggers, but outside those areas we plant beside drains. The farm manager Wayne says that 80percent of water run-off from the farm now has good barriers between stock and the stream. With bulls being so messy, protecting water quality is a priority.”

### **How Much Weed Control?**

After areas are sprayed for planting, no releasing is done. “It’s cheaper to replant than spend the time and the risk of spraying is hitting them accidentally with the wand. We put plenty of trees in to begin with and use a large grade (PB5s), at 1.5m centres. Once the trees are away they’re OK.” They did spot-spray blackberry twice a year for two years but Peter says “it’s not gardening. You can worry about everything too much. What I enjoy is seeing nature take over.”

# Trees on Farms - Market Information

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What prices might you expect to get for the trees you are growing for economic returns? Most trees grown for an economic return will be grown for higher value sawlogs, however, many landowners will prefer to grow trees on a shorter rotation, primarily for pulp. The price that a landowner gets for a tree will depend on many factors including species, market demand, quality of the tree, harvesting and transport costs, etc.

## Species

### Radiata Pine

Radiata pine is the predominant species planted throughout New Zealand. There are many reasons for radiata pine being the species of choice including the relatively low cost of establishment, its ability to grow on a wide range of sites, the versatile nature of the timber, and the ready market established over the last several decades. Information on growing radiata pine is readily available from a number of sources. See Piers Maclaren's excellent Radiata Pine Grower's Manual (Maclaren 1993).

Radiata pine forms the benchmark to evaluate the economics of other species, although there will be certainly be reasons other than strictly economic ones that are key to any decision on what to plant. Current market values for radiata pine can be easily obtained from a number of sources including the NZ Forest Industries journal, which is published 11 times per year.

### Radiata pine log prices as of October 2001

Log Grade	\$/m <sup>3</sup> delivered to mill
P1 (pruned)	188
P2 (pruned)	149
Domestic S (sawlog)	99
Japan A	69
Korean KS	58
Pulp	40

Many growers will choose not to grow radiata pine, often out of personal preference, but also because other species are better suited to their properties or because they speculate that they will receive better financial returns for other species in the future.

New Zealand has invested very heavily in radiata pine and the current harvest of 18 million m<sup>3</sup> is set to double in the next five years. Current processing capacity is unable to handle the existing harvest and export log volumes are predicted to increase as several billions are required for domestic processing to match supply. The increase in harvest and processing will be mainly designated for export markets.

Non-radiata pine plantings offer an attractive investment because supply is generally low. However, if supply is too low it can mean that market demand is also low as there isn't enough of a resource to justify marketing or specialised processing for a particular species. There is considerable logic in growers working together through organisations such as the Farm Forestry Association to build up knowledge and a reasonable resource base of a few select species.

# Other Species

The range of species being planted on farmland in the Waikato and throughout New Zealand is very wide and includes trees for aesthetics as well as trees planted simply for potential log markets. A recent survey of log buyers indicated a wide range of prices for log, mainly dependent on species and quality. This information is summarised in the following table, however, readers are advised that these are indicative figures only and will change with time as market demand varies.

## Indicative log values for non-radiata species grown in the Waikato

General/Species	Log Grade	\$/m <sup>3</sup> delivered to mill	Potential Uses
Eucalypts	Large sawlog	100	Flooring
Eucalypts	Large, pruned log	160	Furniture
Eucalypts	Pulp	50	Fine paper
Acacia melanoxylon	Large sawlog	100	Furniture, flooring
Acacia melanoxylon	Large pruned log	250	Furniture
Oaks	Large sawlog	100	Flooring
Oaks	Large pruned log	300	Furniture
Poplar	Pulp	43	Paper
Other hardwoods	Large sawlog	100	Flooring
Other hardwoods	Large pruned log	150	Furniture
Cypresses	Large sawlog	110	Sarking, beams etc
Cypresses	Large pruned log	300	Sarking, beams etc
Redwoods	Large sawlog	150	Paneling, siding etc

### Explanation:

“Pruned” basically means “clear” or free of knots. Many species are self-pruning and will produce clearwood without being manually pruned.

For all species there seems to be a strong preference for large diameter logs because they are less likely to produce wood with large internal stresses and therefore the lumber processes better. “Large” generally means a small end diameter (SED) greater than 500 mm and most buyers indicated that they would prefer logs greater than 1 m diameter. Some species, such as most eucalypts, can reach a large diameter in less than 30 years, whereas oaks will take closer to 80 years.

Eucalypt species vary considerably in properties but most log buyers indicate that there is a demand for virtually all species at this point in time and prices vary much more by log quality (size and form) than by species. However, they also indicate they have a preference for certain species including: botryoides, fastigata, saligna, regnans, and some of the stringy bark eucalypts (mainly grown on warmer sites)etc.

**Acacias:** Some preliminary information indicates that dealbata could prove to be a valuable timber crop but there is no market information currently available on this species.

**Poplars:** It appears that the current market is mainly for pulp, but the pulp mills prefer eucalypts.

Other hardwoods include: liquid amber, plane trees, ashes, etc. The main problem is that low supply appears to keep prices down as most mills can't be bothered with “odds and sods” and would prefer a larger supply of one species.

Cypresses include macrocarpa, lusitanica, and Lawson. It seems that the rule is “the bigger the better”, but plantation grown are very much preferred to open grown.

# Market Demand

## Future trends

All indications are that radiata pine will be in large supply in the future and large, high quality hardwood logs will be in short supply. There are very large areas of hardwood plantations (mainly eucalypts and acacias) being planted throughout the world, but these are being grown primarily for pulp and paper. Meuranti has been the traditional large tropical hardwood log supplying most markets, but recent information indicates that the supply of large logs has dwindled and the quality is declining.

Hardwood log buyers in New Zealand generally expect increasing demand for good hardwood logs as world supply of large logs decreases. They also highly recommend that growers focus on creating a sizeable resource of a few species that will enable a processing industry and market to establish.

The Farm Forestry Association provides an excellent mechanism to exchange ideas and to create a sizeable resource of a few selected species.

## Tree Quality

Current market demand is for large, clean, round logs that will enable a high recovery rate during sawing and will produce lumber that is stable as well as knot free. Plantation grown trees will generally be superior to open grown trees, provided that correct silvicultural regimes are used. This is mainly good planting stock, correct spacing/thinning, and in some case pruning. Many trees are self-pruning when grown in stand conditions.

## Harvesting and Transport Costs

Harvesting and transport costs must be factored in to any economic expectations as the unwary grower can be in for a rude surprise at the end of a 30 or 40-year rotation. In general harvesting costs go up as terrain becomes steeper and more difficult and transportation costs increase with increasing distance from mill or port. However, some of these costs will be balanced by the size of the resource as economies of scale will kick in where large areas are harvested as opposed to small woodlots.

Most forestry consultants recommend that especially on steeper slopes, where more expensive harvesting techniques are required, that landowners plant at least 4 ha of any one age class. Harvesting is much less expensive on flatter land where ground-based harvesting systems can be used and planting a large area is not as critical. However, even on flatter land, larger harvested volumes will lead to lower costs/m<sup>3</sup>.

### e.g., for a 10 ha block in the Waipa sub-catchment

- Radiata pine @ \$850/ha to establish
- ha block requires \$23,950 fencing
- Expensive harvesting - \$41/m<sup>3</sup> (in 2026)
- Poor access - roading \$7/m<sup>3</sup>
- 50 km to processing point - transport \$16/m<sup>3</sup>
- Market about the same as today
- 6 percent discount rate
- NPV = \$112,000 (IRR = 13 percent) assuming market same as today

# ten Annotated bibliography

## General

**Mortimer, J., Mortimer, B. 1999. Trees for the New Zealand Countryside. A Planter's Guide. Taitua Books, Hamilton, New Zealand.**

A comprehensive publication of over 270 pages covering many aspects of trees on farms in depth. Topics include planting design, privately owned indigenous forests, site conditions, shade, shelter, trees for birds, nectar and pollen, handling and planting, exotic and indigenous species, wood properties and tree selection.

## Shade

**Managing Hot Cows in Australia  
Davison, T et al. 1996 The Department of Primary Industries, Queensland. Brisbane.**

This publication summarises the scientific evidence for heat stress and reduced production in dairy cows. The studies (mostly Australian) show that high heat loads lead to depressed feed intake, decreased milk yield, milk fat percentage and protein percentage, elevated somatic cell counts, increased weight loss of cows and reduced reproduction. Both temperature and humidity have an effect, and higher producing cows suffer a greater decline in yield.

Availability of this publication is unknown but the postal address given for the DPI Queensland is GPO Box 46, Brisbane, Queensland 4001.

## Exotic Timber

**Bier, H. 1999 (revised) Strength properties of small clear specimens of New Zealand grown timbers. Forest Research Institute Bulletin 41.**

In the 15 years since this Bulletin was first published, continued testing of small clear specimens of timber has resulted in new timber property data from 17 species of New Zealand-grown timber that had not previously been tested.

**Burdon, R., Miller, J.T. 1992. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 12 Radiata pine - Pinus radiata D Don. Forest Research Institute Bulletin 124/12**

This booklet, the 12th in the Bulletin 124 series, provides an account of *Pinus radiata* in New Zealand. Its natural distribution and ecology, its introduction into New Zealand and establishment in plantations, its genetic variability, the plasticity of its behaviour according to site, and the significance of pests, diseases, climatic hazards and fire are briefly reviewed.

**Burdon, R., Miller, J.T., Knowles, F.B. 1991. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 10 Ponderosa and Jeffrey pines: Pinus ponderosa, P. Lawson et Lawson, Pinus jeffreyi Grev. et Balf. - Forest Research Institute Bulletin 124/10**

This booklet, the tenth in the Bulletin 124 series, provides an account of the *Pinus ponderosa* and *Pinus jeffreyi* in New Zealand.

**Burdon, R., Miller, J.T., Knowles, F.B. 1992. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 9 The Cypressess - Cupressus spp., Chamaecyparis spp. Forest Research Institute Bulletin 124/09**

This booklet, the ninth in the Bulletin 124 series, provides a general account of the cypressess in New Zealand, principally *Cupressus macrocarpa*, *Cupressus lusitanica* and *Chamaecyparis lawsoniana*.

**Chapman, S. 1998 Field Guide to common pests, diseases & other disorders of radiata pine in NZ - Forest Research Institute Bulletin 207**

This guide describes the common disorders of radiata pine plantations which, unless otherwise stated, occur throughout the whole of New Zealand. It is concerned primarily with damage caused by pests, diseases, and environmental factors, and the key features which aid their identification.

**Cown, D.J. 1999. New Zealand Pine and Douglas Fir: Suitability for processing - Forest Research Institute Bulletin 216**

A comprehensive guide to wood properties and processing characteristics of New Zealand-grown plantation radiata pine (New Zealand pine) and Douglas-fir, this bulletin provides a useful overview of the major part of the New Zealand wood resource and its potential. It includes comparisons between New Zealand pine and other commercial species. First published as Forest Research Institute Bulletin 168 (now out of print), this new edition has been extensively revised and updated.

**Cown, D.G., Love, J.G., McConchie, D.L., Colbert, C. 1984. Wood properties of radiata pine in some forests of the B.O.P/Taupo region - Forest Research Institute Bulletin 81.**

Following on from a national survey of wood properties of radiata pine (Cown & McConchie 1983), a more intensive study was carried out in a major forest region of the North Island. The objectives were to obtain detailed information on the variability of important wood properties and to assess the implications for local industry.

**Cown, D.J., McConchie, D.L. Young, G.D. 1991 Radiata pine wood properties survey (revised edition) - Forest Research Institute Bulletin 50.**

A survey of radiata pine (*Pinus radiata*) grown throughout New Zealand showed that wood properties are highly dependent on tree age and site. Core samples were taken from 7500 trees growing on 250 sites throughout the country for determination of basic wood density, tracheid length, and heartwood characteristics at breast height.

**Fraser, T., Horgan, G.P., Watt, G.R. 1985. Valuing forests and forest land in New Zealand: Practice and principles - Forest Research Institute Bulletin 99.**

The market provides a valid starting point for valuing land; however, data on markets for immature forests are generally insufficient to allow market-based systems to be used to value trees.

**Haslett, A.N. 1984. Utilisation properties of New Zealand grown European oak *Quercus robur* - Forest Research Institute Bulletin 58.**

This summary of the properties of European oak (*Quercus robur*) grown in New Zealand is based on the evaluation of a single sample of seven trees. The test trees were over 100 years of age and grown in a woodlot in the Cheviot Hills Domain, North Canterbury.

**Haslett, A.N. 1986. Properties and uses of exotic speciality timbers grown in New Zealand: Part 1 Notes on timber properties and test methods - Forest Research Institute Bulletin 119/01**

This explanatory booklet leads a series of booklets which detail the wood properties and utilisation of exotic, speciality species grown in New Zealand.

**Haslett, A.N. 1986. Properties and uses of exotic speciality timbers grown in New Zealand: Part 2 Australian blackwood - *acacia melanoxylon* - Forest Research Institute Bulletin 119/02**

This booklet summarises the properties and recommended utilisation procedures for New Zealand-grown blackwood. Blackwood timber is easy to process. The wood is similar to that of Australian-grown material, with its attractive colour, and medium density and texture making it suitable for a range of high quality uses including furniture, cabinets, veneers, and others.

**Haslett, A.N. 1986. Properties and uses of exotic speciality timbers grown in New Zealand: Part 3 Cypresses - Forest Research Institute Bulletin 119/03**

This booklet summarises the properties and recommended utilisation procedures for the major cypress species grown in New Zealand. It includes information on *macrocarpa*, *lusitanica*, Lawson cypress, and Leyland cypress.

**Haslett, A.N. 1986. Properties and uses of exotic speciality timbers grown in New Zealand: Part 4 Black walnut - *Juglans nigra* L. - Forest Research Institute Bulletin 119/04**

This booklet summarises the properties and recommended uses for New Zealand-grown black walnut. The wood has very similar properties to that of black walnut grown in America, thereby making it suitable for a range of high-quality uses including veneer, furniture, gun stocks, and turnery.

**Haslett, A.N. 1988. Properties and uses of exotic speciality timbers grown in New Zealand: Part 5 Ash eucalypts and *Eucalyptus nitens* - Forest Research Institute Bulletin 119/05**

This booklet summarises the properties and recommended processing procedures for our major ash eucalypts and for *Eucalyptus nitens*. All these species have similar wood properties and they require the same specialised processing techniques, so it is likely that in the future they will be marketed collectively as ash eucalypts.

**Haslett, A.N. 1988. A guide to handling and grade-sawing plantation - grown eucalyptus - Forest Research Institute Bulletin 142**

Because eucalypts and other hardwoods can contain considerable growth stresses, they require specialised sawing techniques. Incorrect handling of hardwoods can cause end-splitting of logs, end-splitting and distortion of sawn timber, and low sawn timber recoveries.

**Haslett, A.N. 1990. Properties and uses of exotic speciality timbers grown in New Zealand: Part 6 Eastern blue gums and stringy barks - Forest Research Institute Bulletin 119/06**

This booklet summarises the wood properties and recommended processing procedures for *Eucalyptus botryoides* Sm., *E. saligna* Sm., *E. globoidea* Blakey, *E. muellerana* Howitt, and *E. pilularis* Sm. - the major eastern blue gum and stringy bark eucalypt species grown in New Zealand. Although New Zealand material has slightly lower density and strength than Australian material, it is still suitable for structural uses, including framing, cross arms, and decking.

**Hillis, W.E., Brown, A.G. 1984. Eucalypts for Wood Production. CSIRO, Academic Press, Australia, 434 p.**

This is one of the authoritative texts on eucalypts, and although written to encourage the planting of more eucalypts in Australia, it is also relevant to the New Zealand tree grower. The book contains chapters on stand establishment, protection and management and several chapters on the utilisation of eucalypts.

**Hunter, I.R., Rogers, B.E., Dunningham, A., Prince, J.M., Thorn, A.J. 1991 An atlas of radiata pine nutrition in New Zealand - Forest Research Institute Bulletin 165**

TerraSoft, a Geographic Information System, has been used to link data relating to radiata pine foliar nutrient concentrations with New Zealand Soil Bureau soil maps. The data on foliar concentrations were extracted from a computerised nutritional database (maintained by Forest Research) containing 200 000 nutrient analyses on 40 000 plant samples.

**Knowles, F.B., Miller, J.T., 1986. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 13 The redwoods: *Sequoia sempervirens* (D. Don) Endl. - Coast redwood, *Sequoiadendron giganteum* (Lindley) J. Buchholz - Giant sequoia, and the related ornamental genera *Taxodium* and *Metasequoia* - Forest Research Institute Bulletin 124/13**

This booklet, the thirteenth in the Bulletin 124 series, provides an account of the redwoods and related species in New Zealand. It deals mainly with coast redwood (*Sequoia sempervirens*) and giant sequoia (*Sequoiadendron giganteum*), and more briefly with dawn redwood (*Metasequoia glyptostroboides*) and swamp cypresses (*Taxodium* spp.).

**Maclaren, P. 1993. Radiata Pine Growers' Manual - Forest Research Institute Bulletin 184**

This manual is written primarily for the small-scale forest grower, and the emphasis is on profitability. All aspects of tree-growing are covered, and suggestions for further reading are made at the end of each section.

**Maclaren P. 2000. How Much Wood Has Your Woodlot Got? - Forest Research Institute Bulletin 217**

This book has been written to show non-specialist tree growers how to estimate the volume and value of wood in a stand of trees. In keeping with this aim, the information in this "recipe" book is presented in as non-technical a way as possible.

**McKenzie, H., Hay, E., 1996. Performance of Eucalyptus saligna in New Zealand - Forest Research Institute Bulletin 195**

Eucalyptus saligna (commonly known as Sydney blue gum) occurs naturally on the east coast of Australia, with a range from southern New South Wales to southern Queensland.

**Miller, J.T., Cannon, P., Ecroyd, C.E. 1992. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 11 Eucalyptus nitens - (Deane et Maiden) Maiden Forest Research Institute Bulletin 124/11**

This booklet, the eleventh in the Bulletin 124 series, provides a general account of the Eucalyptus nitens in New Zealand.

**Miller, J.T., Ecroyd, C.E. 1987. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 2 Pinus contorta Loudon - contorta pine - Forest Research Institute Bulletin 124/02**

This booklet, the second in the Bulletin 124 series, provides an account of Pinus contorta in New Zealand, referring to its introduction, history, and role as an exotic forest species, its recognition in the field, and the location and quality of current local seed sources.

**Miller, J.T., Ecroyd, C.E. 1988. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 4 Pinus mugo Turra - dwarf mountain pine, Pinus uncinata Mirbel - mountain pine - Forest Research Institute Bulletin 124/04**

This booklet, the fourth in the Bulletin 124 series, provides an account of Pinus mugo and P. uncinata in New Zealand, referring to their introduction, history, and role as introduced forest species, their recognition in the field, and the location and quality of current local seed sources.

**Miller, J.T., Hay, A.E., Ecroyd, C.E. 2000. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 18 Ash Eucalypts - Forest Research Institute Bulletin 124/18**

This bulletin, the eighteenth in the Bulletin 124 series, provides an account of the ash eucalypts in New Zealand, with emphasis on Eucalyptus fastigata, E. regnans, E. obliqua and E. delegatensis.

**Miller, J.T., Knowles, F.B. 1986. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 1 Pinus nigra Arn. - European black pine - Forest Research Institute Bulletin 124/01**

This booklet in a bulletin series provides a brief account of Pinus nigra Arn. In New Zealand, referring to its introduction, history, and role as an exotic forest species, its recognition in the field, and the location and quality of current local seed sources.

**Miller, J.T., Knowles, F.B. 1988. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 3 The larches, Larix deciduas Miller, Larix kempferi (Lambert) Carr, Larix eurolepis A. Henry - Forest Research Institute Bulletin 124/03**

This booklet, the third in the Bulletin 124 series, provides an account of the larches, Larix decidua, L. X eurolepis in New Zealand, referring to their introduction, history, and role as exotic forest species, their recognition in the field, and the location and quality of current local seed sources.

**Miller, J.T., Knowles, F.B. 1988. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 5 Pinus attenuata Lemmon - knobcone pine - Forest Research Institute Bulletin 124/05**

This booklet, the fifth in the Bulletin 124 series, provides an account of Pinus attenuata, knobcone pine, covering its introduction, history, and role as exotic forest species, its recognition in the field, the location and quality of current local seed source, and the species' hybridisation with P. radiata, radiata pine, in New Zealand.

**Miller, J.T., Knowles, F.B. 1989. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 6 The Spruces - Picea sitchensis (Bong.) Carrière - Sitka spruce, Picea abies (L.) Karsten - Norway spruce, Ornamental spruces Forest Research Institute Bulletin 124/06**

This booklet, the sixth in the Bulletin 124 series, provides an account of spruces in New Zealand, principally of Picea sitchensis and P. abies, describing their history, and role as exotic forest species, their recognition in the field, and the location and quality of current local seed sources.

**Miller, J.T., Knowles, F.B. 1989. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 7 The silver firs - *Abies* spp. - Forest Research Institute Bulletin 124/07**

This booklet, the seventh in the Bulletin 124 series, provides an account of the silver firs (*Abies*) in New Zealand, referring to: their introduction, history, and role as exotic forest species; their recognition in the field; and the location and quality of current local seed sources.

**Miller, J.T., Knowles, F.B. 1989. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 8 *Pinus pinaster* Aiton - maritime pine - Forest Research Institute Bulletin 124/08**

This booklet, the eighth in the Bulletin 124 series, provides an account of the pinaster (maritime pine in New Zealand, covering its introduction, history, and role as exotic forest species, their recognition in the field, and the location and quality of current local seed sources.

**Miller, J.T., Knowles, F.B. 1994. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 14 Douglas-fir - *Pseudotsuga menziesii* (Mirbel) Franco Forest Research Institute Bulletin 124/14**

This booklet, the fourteenth in the Bulletin 124 series, provides a general account of Douglas-fir, *Pseudotsuga menziesii*, in New Zealand. Topics covered include its natural distribution, its introduction and history in New Zealand, its role as an introduced, recognition in the field, the significance of pests and diseases, and information on local seed sources.

**Miller, J.T., Knowles, F.B. 1997. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 16 *Cryptomeria*, *Thuja* & *Tsuga* - Forest Research Institute Bulletin 124/16**

This booklet, the sixteenth in the Bulletin 124 series, provides a general account of *Cryptomeria japonica*, *Thuja plicata* and *Tsuga heterophylla* in New Zealand. It covers their introduction and history, variation recognition, performance and role as introduced forest species and the location of seed sources.

**Nicholas, I., Gifford, H., Kimberley, M. 1997 Siting Black Walnut - Forest Research Institute Bulletin 188**

Black walnut trees are native to eastern North America, and produce a timber that is internationally renowned for the manufacture of high quality furniture. Interest in black walnut as a potential plantation species for New Zealand arose in the 1970s and 1980s, resulting in the establishment of some small private plantations and a series of research trial throughout the country.

**Shelbourne, C.J.A., Low, C.B., Smale, P.J. 2000. Eucalypts for Northland: 7 to 11-year results from trials of nine species at four sites. *New Zealand Journal of Forestry Science* 30(3): 366-383.**

This journal publication describes the results of species and provenance trials of eucalypts planted in Northland between 1988 and 1993. It includes several provenances of *E. fastigata*, *E. regnans*, *E. saligna*, *E. botryoides*, *E. grandis*, *E. nitens*, *E. globulus*, and *E. maidenii*. *E. fastigata* showed best growth and health of all species. *E. regnans* also performed well.

**Shelbourne, C.J.A., Low, C.B., McConnochie, R.M., Hay, A.E. 2000. Stringybark eucalypts for New Zealand: 6-year results from a provenance/family trial of *Eucalyptus muelleriana* in Northland. *New Zealand Journal of Forestry Science* 30(3): 384-400.**

*E. muelleriana* was evaluated in a provenance-family trial at two sites - Omataroa (near Whakatane) and Parakao (west of Whangarei). The Omataroa trial was abandoned after heavy frost damage the first winter.

The stringybark eucalypts may deserve a significant future role in New Zealand forestry on the basis of their freedom from growth stresses in sawing; on the stability, strength, stiffness, and durability of their timber, and on their relatively rapid growth and freedom from pests and diseases.

**Shelbourne, C.J.A., Bulloch, B.T., Cameron, R.L., Low, C.B. 2000. Results of provenance testing of *Acacia dealbata*, *A. mearnsii*, and other acacias at ages 7 and 5 years in New Zealand. *New Zealand Journal of Forestry Science* 30(3): 401-421**

In trial plantings at a range of sites across the North Island of New Zealand, *A. dealbata* and *A. mearnsii* greatly outgrew other acacia species tested - *decurrens*, *melanoxyloides*, *falciformis*, *filicifolia*, and *silvestris*, and were of much better form.

**Shula, R.G., Hay, A.E., Tarlton, G.L. 1989. The firewood venture - planning, execution, evaluation - Forest Research Institute Bulletin 137**

The intent of this bulletin is to provide professional advice simply yet clearly and accurately regarding purpose-grown firewood ventures - set out to be a foundation upon which to build as researchers and entrepreneurs benefit from hindsight.

**Van Kraayenoord, C., Slui, B., Knowles, F.B. 1995. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 15 The Willows *Salix* spp - Forest Research Institute Bulletin 24/15**

This booklet, the fifteenth in the Bulletin 124 series, provides a general account of willows in New Zealand, principally *Salix alba* var. *vitellina*, *S. babylonica*, *S. fragillis*, *S. matsudana*, *S. x sepulcralis* 'Chrysocoma', *S. x rubens*, *S. matsudana* x *S. alba*, *S. viminalis*, *S. purpurea*, *S. elaeagnos*, *S. daphnoides*, *S. x reichardtii*, *S. cinerea* and *S. x calodendron*.

**Vincent, T.G. 1997. Production of forest tree seed for plantation use - Forest Research Institute Bulletin 191**

Methods of seed production range from opportunistic collections of unimproved seed, to the production (in specially designed control-pollinated orchards) of seed with specific trait combinations desired by tree growers and wood processors.

**Wilcox, M.C.; Miller, J.T., Williams, I.M., Gould, D.W. 1985 Eucalyptus species trials in Longwood Forest, Southland - Forest Research Institute Bulletin 41.**

Seventeen species of Eucalyptus were planted in trials in Compartment 30, Longwood Forest, Southland, in 1977 and 1978.

**Wilkinson, A.G. 2000. Introduced forest trees in New Zealand: Recognition, role and seed source: Part 17 The Poplars; *Populus* spp. - Forest Research Institute Bulletin 124/17**

This booklet, the seventeenth in the Bulletin 124 series, provides a general account of poplars in New Zealand, principally *Populus alba*, *P. deltoides*, *P. trichocarpa*, *P. yunnanensis*, and their hybrids and cultivars. It covers their introduction and history in New Zealand and gives a brief account of the natural distribution and ecology of the important species.

**Will, G.M. 1985. Nutrient deficiencies and fertiliser use in New Zealand - Forest Research Institute Bulletin 97.**

This bulletin has been prepared as a practical guide to the identification and correction of nutrient deficiencies: primarily for radiata pine although some information is provided on eucalypts. The publication brings together under one cover a summary of current information.

**Will, G.M. 1986 Field guide to nutrient deficiencies in radiata pine - Forest Research Institute Bulletin 97s.**

Deficiencies of at least seven mineral nutrients have been identified in New Zealand's pine plantations. Bulletin 097 gives full details of symptoms, where the deficiencies commonly occur, and corrective fertiliser applications.

**Williams, D., Simpson, I, Bier, H. 1986. Properties of New Zealand grown poplar - Forest Research Institute Bulletin 112.**

Utilisation of poplar was studied at all levels, from sawing, drying, machining, and preservative treatment to pulp and paper, and ethanol production.

# A Guide to Tree Species

## A simple guide to some exotic tree species for planting in the Waikato Region

Scientific name	Common name	Uses/amenity										Tolerances					Other			Comments		
		Timber	Pulp	Firewood	Shade	Wind shelter	Erosion control	Bank stability	Autumn colour	Wet tolerant	Dry tolerant	Wind intolerant	Shade intolerant	Salt wind tolerant	Frost tolerant	Disease or insect prone	Susceptible to stock browsing	Fast growing	Prone to weediness		Poisonous to stock	Provides food for birds
<i>Acacia melanoxylon</i>	Blackwood	•	•	•	•	•	•							•	•	•	•					Form problems
<i>Acer</i>	Maples				•	•	•								•							Several species
<i>Alnus glutinosa</i>	Black alder	•	•	•	•	•	•		•				•					•				Nitrogen fixer
<i>Castanea sativa</i>	Chestnut	•			•																	Edible nuts
<i>Cedrus</i> spp.	Cedars					•								•								Ornamental
<i>Chamaecytisus palmensis</i>	Tree lucerne			•		•	•											•	•		•	Small tree nitrogen fixer
<i>Cryptomeria japonica</i>	Japanese cedar	•			•	•	•															
<i>C. japonica 'elegans'</i>	'Elegans'					•	•		•													
<i>Cupressus macrocarpa</i>	Macrocarpa	•		•	•	•	•							•	•						•	Canker problems
<i>Cupressus lusitanica</i>	Mexican cypress	•		•	•	•	•							•	•						•	Good timber
<i>Cupressus leylandii</i>	Leyland cypress	•		•	•	•	•							•	•							Shelter and wood
<i>Embothrium coccineum</i>	Chilean flame tree				•																•	
<i>Eucalyptus botryoides</i>	Southern mahogany	•	•	•		•								•	•	•						Pest problems
<i>E. delegatensis</i>	White topped stringy bark	•	•	•	•	•	•							•							•	Veneer
<i>E. nitens</i>	Shining gum	•	•	•	•	•	•							•	•	*					•	Strong veneers
<i>E. regnans</i>	Mountain ash	•	•	•	•	•	•							•	•						•	Timber value
<i>E. saligna</i>	Sydney blue gum	•	•	•		•									•	•	•					Warmer sites
<i>Ginkgo biloba</i>	Ginkgo				•				•													
<i>Juglans nigra</i>	Black walnut	•			•																	Very site specific
<i>Liquidambar styraciflua</i>	Sweetgum		•	•	•				•						•							
<i>Metasequoia glyptostroboides</i>	Dawn redwood				•				•						•							Deciduous
<i>Paulownia</i>	Princess tree	•																				Fortunei best
<i>Pinus radiata</i>	Radiata pine	•	•	•	•	•	•							•	•	•	•	•	•			Established market
<i>Platanus acerifolia</i>	London plane tree	•		•	•	•	•								•							Hybrids
<i>Populus</i>	Poplars	•	•	•	•	•			•	•												Many species and clones
<i>P. yunnanensis</i>	Chinese poplar	•	•	•		•				•				•								Possum proof
<i>Pseudotsuga menziesii</i>	Douglas-fir	•		•	•	•	•								•							Ensure a good seed source
<i>Quercus</i>	Oaks	•		•	•				•						•							Duck food
<i>Salix babylonica</i>	Weeping willow				•				•													
<i>Sequoia sempervirens</i>	Coast redwood	•			•	•	•								•							Coppice. Large tree
<i>Taxodium distichum</i>	Swamp cypress	•			•		•	•	•													Deciduous
<i>Thuja plicata</i>	Western red cedar	•			•	•	•			•											•	Site specific

■ \* Depends on site

# A simple guide to some native species for planting in the Waikato Region

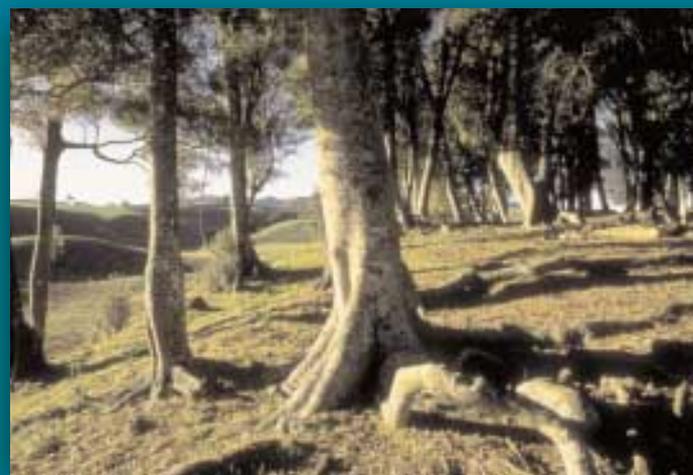
Scientific name	Common name	Uses					Tolerances					Other					Comments
		Timber	Shade	Wind shelter	Erosion control	Bank stability	Wet tolerant	Dry tolerant	Wind intolerant	Shade intolerant	Salt wind tolerant	Frost tolerant *	Disease or insect prone	Susceptible to stock browsing	Fast growing	Prone to weediness	
Agathis australis	Kauri	•					•		•								Warm northern areas
Aristotelia serrata	Wineberry/Makomako					•							•			•	Shrub
Coprosma repens	Taupata			•	•	•			•	•			•	•		•	Shrub, coastal
Coprosma robusta	Karamu			•	•	•			•				•	•		•	Shrub
Cordyline australis	Cabbage tree/Ti kouka				•	•	•		•		•	•	•	•		•	
Corynocarpus laevigatus	Karaka		•	•						•						•	Coastal
Dacrydium cupressinum	Rimu	•	•				•		•								
Dacrycarpus dacrydioides	Kahikatea	•	•		•	•	•		•	•	•					•	Fast growth on some sites
Fuchsia excorticata	Tree fuschia/Kotukutuku				•	•			•	•			•			•	Small tree/shrub
Hebe stricta	Koromiko				•	•		•		•			•	•			
Knightia excelsa	Rewarewa	•	•	•													
Kunzea ericoides	Kanuka				•	•		•		•	•						Larger than manuka
Leptospermum scoparium	Manuka				•	•	•	•		•	•			•	•		Shrubby - honey
Litsea calicaris	Mangao	•	•		•								•				
Nothofagus solandri	Black beech/ Tawhairauriki	•			•	•			•		•				•		Cool southern areas
Olearia spp.	Olearia			•	•												Shrub
Pittosporum crassifolium	Karo			•	•	•			•	•			•	•			Small tree coastal
Pittosporum eugenioides	Lemonwood/ Tarata			•	•	•			•		•		•	•		•	Small tree
Pittosporum tenuifolium	Kohuhu			•	•	•			•		•		•	•		•	Small tree
Prumnopitys ferruginea	Matai	•	•						•							•	
Prumnopitys taxifolia	Miro	•	•				•		•							•	
Podocarpus totara	Totara	•	•	•	•	•		•	•		•					•	
Pseudopanax arboreus	Five finger				•				•		•		•	•		•	
Sophora tetraptera	Kowhai					•					•			•		•	Semi-deciduous. Nitrogen fixer
Vitex lucens	Puriri	•	•									•	•	•		•	Warmer sites

• \* Many species don't have high frost tolerance when young but do so when older.



**Disclaimer:**

*The mention of products and companies in workshop results is a record of participant's comments and is not an endorsement of these products or companies by Environment Waikato.*



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