New Zealand Tree Grower

Promoting the wise use of trees for profit, amenity, sustainability and the environment

New Zealand Farm Forestry Association | Oranga Rākau Aotearoa August 2022

Does the unicorn really exist?
Native birds in exotic conifer plantations
Should radiata pine be pruned?
Permanent forests in the Emissions Trading Scheme
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From the President

Graham West

As Covid-19 rages on, all the interactions within the executive and with other associations, officials and politicians, have had to be by video conference or telephone. While everyone has got use to operating this way, it has its consequences and challenges. Those that need to change to a more formal process of requesting to speak in meetings and speaking clearly over a poor internet connection are learning.

It has also affected the willingness of members to attend field days and meetings. One branch meeting reported six people testing positive for covid after the gathering. Some branches have almost closed down because many people chose to simply not got out if there is a significant risk they will catch covid or the flu.

I am in the same situation and will not risk bringing covid back home to infect my family. Also, some of the colds going around are really debilitating. Hopefully this will change soon, and we need to consider remedial actions in the coming summer to support some branches which have lost momentum. In the central North Island we have agreed to collaborate across at least three adjacent branches. The intention is run a regular roster of shared field days or events, perhaps having something every one or two months.

The more successful branches seem to have a continuity of events that keeps members interested. Hawkes Bay branch Tim Forde and his committee seem to have developed a successful formula and are going from strength to strength. I have asked Tim to write out his recipe for success for the national newsletter. Tim is keen to help branches and give advice.

My thanks to all who participated in the Special General Meeting via zoom. This meeting showed we can continue with important organisational matters and make decisions. A full report is made in this issue of *Tree Grower*.

Our collaboration within the Climate Forests Association seems to be paying dividends. Collectively we have a meeting with Ministers Nash and Shaw over the Permanent Carbon Forest issues, and we are working on solutions to find some middle ground to satisfy most parties.

The Climate Forests Association has also commissioned research on some of the missing science, particularly how very old stands of exotic species will behave. Using measurement data we are getting results that confirm earlier reports. While radiata pine drops to low stocking of 100 to 200 stems a hectare by about 60 years, it continues in a steady state past 100 years. Amazingly, it continues to add volume per hectare and accumulates carbon. By 100 years it is holding about 2,000 tonnes per hectare of carbon dioxide equivalent, excluding the native understorey that has developed by then, potentially another 400 tonnes a hectare. If we want climate change to go away, we need to take a lot of carbon dioxide out of the atmosphere and store it somewhere. It is a simple equation.

Recently the executive has completed on your behalf a lengthy submission on the National Policy Statement for Indigenous Biodiversity - Exposure Draft. This will raise some key concerns for land and forest owners. It aims to include plantation forests and anyone who has a Significant Natural Area mapped on their property. I only found I had one when I happened to be viewing some on-line district council maps. There was no consultation or notification. This policy seeks to improve biodiversity as a public good which we support, but it seems the land owner is responsible to maintain it and may wear most of the costs. Great work on this submission is led by Egon Guttke.

The Special General Meeting of 7 July

Howard Moore

This year we had our AGM on-line and did not spend a lot of time on it, which meant we forgot to debate membership subscriptions. We had already decided to rejuvenate the NZFFA, spelled out the work to be done and received offers of support from the branches. What we overlooked was that the work would probably continue beyond 2022/23, that it might not earn enough money to run this organisation at a new, professional level and that the help from the branches would not last forever.

Before the AGM the Executive had compared our subscriptions and services to other organisations. We had debated an increase and who might pay, and in the end we decided the easiest and possibly fairest way was to ask everyone to pay the same increase. Unfortunately, we then forgot to ask you to vote on it, which meant we needed a Special General Meeting.

The resolution put to the meeting on 7 July was –

> That the annual subscription be increased by $40, including GST, for 2023 and subsequent years.

This increase to the head office allocation does not affect branch or action group subscriptions, which are set by the groups themselves.

Good questions

Obviously, any increase in subscriptions brings the cost of membership into sharp focus, and some people ask – Why am I paying this? Where is it going? and What do I get from it? These are good questions.

We cannot answer the first but we did try hard to answer the second and third before the vote. A paper was sent out to branches in February entitled 'Business case for funding projects to be completed by an operations contractor.' This prompted the branch contributions, which gave us confidence that most members had talked about it and reached a general understanding, even if they had not all agreed.

Of course, most members were silent so we do not yet know what they thought, but a few felt strongly enough to email their views. Some were supportive. One or two members threatened to resign. One believed we would be wasting our money because contractors were rubbish, while others were confident that membership would grow and so any fee increase was unnecessary.

Good answers

In response I suggest that if cost is a big issue, you may opt for a 'casual' membership which allows you to receive the *Tree Grower* and occasional newsletter at a reasonable price while still accessing most of the website. For those where doubt is a big concern, you may join the Executive and take part in the debate and decision making. It is a democracy.

At the Special General Meeting a couple of dozen people joined on-line, while 30 or so apologised and nominated a proxy to vote for them. For some reason the NZFFA constitution requires a quorum of 15 councillors, although it is members who vote. Fortunately, there were about 10 councillors on-line and half-a-dozen who had appointed proxies. When the resolution was put to the meeting, the vote was 52 for and six against. That means subscriptions for next year and thereafter will be $40 more than they are at present.

Although we are bound to lose some members in the process, the President noted that we are losing around 100 a year anyway through natural attrition. If we want the NZFFA to thrive and build membership by riding the growing tide of interest in forestry, we need to do more than simply talk among ourselves. We have to raise our profile and become attractive to others. We have to widen the conversation, show off our achievements and offer value to strangers.

Rachel Rose described this well in her article in the May *Tree Grower*, when she talked about reinventing the NZFFA and focussing on the three core areas of education, lobbying and advocacy. We have started in that direction. Our debate over means, costs and priorities is continuing, and the Special General Meeting was a direct result of it.

Those who are concerned about climate change see farm forestry as being on the side of the angels. At the moment there are not many of us on this side. Let us try to attract some more.

Howard Moore is the vice-President of the NZFFA.

Does the unicorn really exist?

Vaughan Kearns

Cupressus unicornii could be the silver bullet for the fledgling cypress industry. I have been turning cypress logs into timber for 30 years. Throughout the whole time, other sawmillers and I have been looking for the perfect log. If we are cutting rectangular dimensional timber, the perfect log would be rectangular or square in cross section, but that is not going to happen. The next best would be a perfect circle with little or no taper, the tree trunk a perfect cylinder.

Of the thousands of logs that I have sawn, I am always on the lookout for cypress logs such as these, but they are extremely rare. Macrocarpa tend to start off fairly round but as they get older can develop fluting in the base of the stem and excessive taper with a much smaller circumference further up the tree.

A 25-year-old *C. unicornii* with a sack to show scale

Neil Barr hybrid

The best cypress tree that we have available, as seeds or cuttings with the attributes that a sawmiller craves is known as the Neil Barr hybrid. Neil was the founder of the NZFFA and as a keen eucalypt enthusiast it is quite surprising that he has discovered such a potentially wonderful cypress tree. The Neil Barr hybrid is expected to be a cross between *C. macrocarpa* and *C. lusitanica*. It looks like one but nobody knows for certain.

This tree was rediscovered by Dean Satchell, another eucalypt enthusiast who took on a project in 2017 to re-evaluate the cypress trials which were established in the 1990s by Scion. Fortunately for us at the NZFFA, one of the Scion staff in the original set of trials is Patrick Milne, the current chair of the Cypress Development Group.

A range of New Zealand sourced seedlings, as well as some from California recently imported, were selected for the trials. It appears, perhaps as an afterthought, that the NZFFA were asked to supply some of their 'best stuff'. The result was one cultivar included in the trials, but it only appeared in two of the 14 sites which were planted and that Dean Satchell evaluated.

The unicorn emerges

From the findings of the 2017 report, there was one clear winner from the trials, although it was only represented by seven individual trees. It was superior to all the rest by quite some margin in its growth and health. Because of its rarity and that it was known nowhere else in recent times, the Neil Barr hybrid has been called the unicorn or *Cupressus unicornii* – the cypress which only exists in imagination.

A recent visit by the Action Groups to Eastland, Te Tai Rawhiti, gave the membership the opportunity to visit the cypress trial in the Wharerata Forest, where


The green crown shows no sign of health problems


The light branching of *C. unicornii* is evident

C. unicornii was on display for all to see. The four stunning specimens are growing on an exposed ridge towards the top of the Wharerata ranges. They towered above the other cypress which formed the rest of the trial and they also exceeded the surrounding radiata pine which was busy battling with, or dying from, red needle cast. The average diameter at breast height of *C. unicornii* was 60 cm and the height was estimated to be 36 metres.

These are 25-year-old trees growing in what are probably quite good cypress conditions. The well informed among us marvelled at these specimens. The discerning looked carefully for faults with the best that could be offered was – those large branches leave a lot to be desired. Considering the trees had out-competed their neighbours in the trial, they were growing in the open, so that criticism has little credence.

Good heartwood

Last year as part of a Specialty Wood Products project, a suite of cypress varieties, or genotypes as scientists like to refer to them, were tested for heartwood content. Measurements were taken from 22-year-old *C. unicornii* growing strongly on the farm of Don Tantrum. Results from the measurements are expressed in percentage terms, with *C. unicornii* coming in at 76 per cent. This put it in the top 30 per cent of all the varieties recorded with regard to heartwood percentages. In overall diameter, the sample tree was in the top 10 per cent.

In many aspects it is looking like a good tree to propagate and deploy in large numbers. We had thought this for some time and have been busy taking cuttings to grow in Southern Cypress nursery to put into stool beds. These are where young trees are kept growing closely together and cropped annually to provide thousands more cuttings to then use to grow into clone trees for forestry deployment. There will be more to come on this exciting genotype as we gather more information about it.

Vaughan Kearns is the unicorn of the Cypress Development Group.

Should radiata pine be pruned or not?

Hamish Levack

There is often disagreement about whether to prune radiata pine or not. For small-scale forest owners, pruning has frequently been a weekend project, or even holiday work for the family. On this basis the only cost is time, and perhaps a few bruises and blisters. However, if you have to pay for pruning, this can be a problem in the early years when there is no income from the trees. This can be overcome if you are able to earn carbon by registering in the Emissions Trading Scheme. The income in the first half of the rotation will more than cover the costs of pruning at current carbon prices.

The extra value of pruned trees over the unpruned ones has to cover all the additional costs. This article attempts to show that the increased value of a pruned tree, combined with the additional flexibility when it comes to selling the logs, means that pruning is generally a good idea.

The table at the bottom of the page of a direct sawlog regime, developed by Bob Fenton and Wink Sutton, was recommended in the early 1970s by the Forest Research Institute. This was designed to achieve a mean knotty core in the tree of 12.5 centimetres.

At the time, based on then current costs and revenues, it appeared to be the most profitable method to follow except on low-yielding, highly erodible forest sites. However, an important question still needed to be answered – would future pruned log prices remain high enough?

The question answered

In 1973 Wink Sutton answered this question in a thesis using the best available data at the time. The international demand was for pine clearwood, timber with few or no knots which was needed for decorative, furnishing and finishing purposes. Most of this clearwood was then coming from old growth ponderosa pine in North America, The only possible way to replace it in significant volume would be from clearwood produced from pruned, fast-growing radiata pine. This forecast was strengthened by projections of expanding world population and wealth, with forests being overcut globally or being locked up for environmental protection.

For about 20 years Wink's argument held sway, but in 1996 it was rejected by Carter Holt Harvey for its large North Island forests. This company, now managed by Handcock, switched to its so-called 'millennium regime', which involved no pruning and focussed on higher volume and lower rotation for trees which produced structural timber. The rationale was that it would soon be more profitable to use new technology to turn knotty, structural wood into engineered wood products. Short clear, knot-free boards could still be sawn from logs, and long finger-jointed boards would substitute for the long, clearwood, board market.

Others join in

About a decade ago, Kaingaroa Timberlands, which manages 175,000 hectares of forest also opted to stop pruning on the basis that the additional value of a pruned log was not enough to justify continued pruning. Jeff Tombleson pointed out that this strategy means that there will be a major drop in pruned log

At tree height	Prune the branches	Stems per hectare to prune	Thinning after final pruning
5 metres	From 0 to 2.5 metres	400	Thin out the remaining stems. Later a final crop stocking of 300 to 400 stems a hectare instead of 200 was recommended.
7.5 metres	From 2.5 to 4.3 metres	300	
10 metres	From 4.3 to 6.0 metres	200	

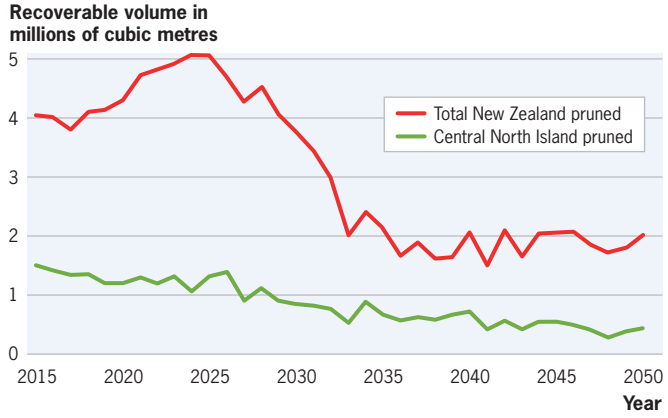
availability, with serious ramifications for the central North Island milling industry. Presumably that industry is making appropriate adjustments.

The decisions being made by these large forest owners, and the fact that the published difference between the average pruned and A-grade logs exported from New Zealand in the first quarter of 2010 was only $27.50 a cubic metre for export, convinced me to leave a block of my forest in the Wairarapa unpruned. However a number of medium-size forest owners were not persuaded. They remained faithful to producing pruned saw logs, although with some modifications. These owners included the Lake Taupo and Lake Rotoaira Forest Trusts, Juken New Zealand, and Forest Enterprises Limited.

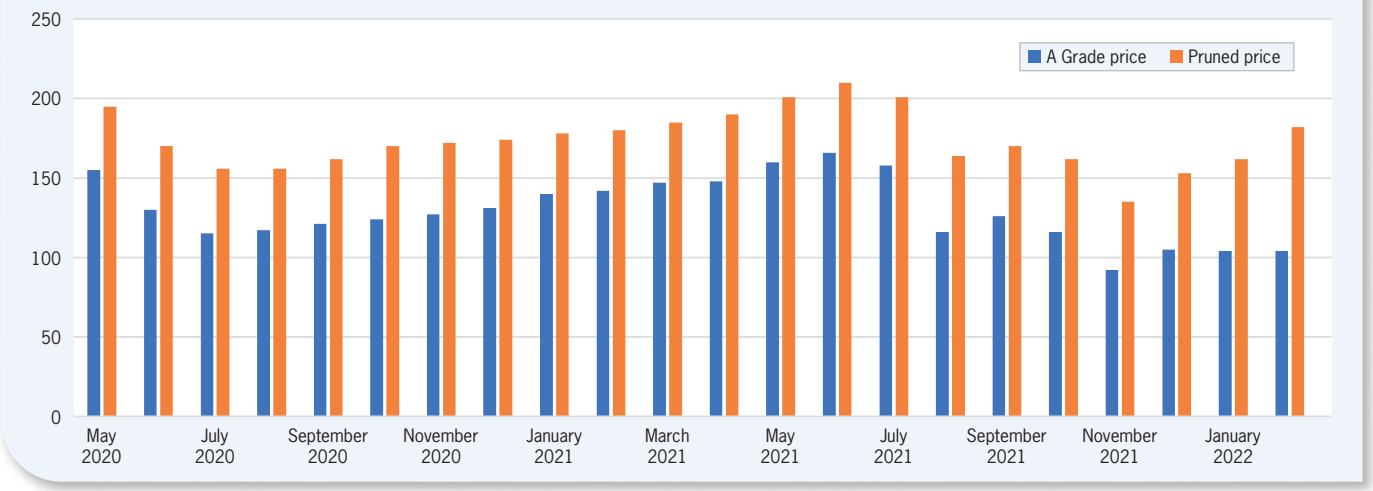
For the reasons outlined below I now agree with these medium size forest owners. I am a born again, intensive-tending disciple for pruned radiata pine.

The prices in the graph below are for export logs at the wharf gate. The table below the graph uses the figures from the graph. It shows that a mean additional premium of about $49 a cubic metre for a pruned log can be expected.

Pruned wood availability forecast for New Zealand and the Central North Island to 2050



Comparison of pruned logs and A grade



Differences between the price of A grade logs and pruned grade logs

Date	A grade price in dollars per cubic metre	Pruned grade price in dollars per cubic metre	Difference in dollars per cubic metre
February 2021	$142	$180	$38
May 2021	$160	$201	$41
August 2021	$116	$164	$48
November2021	$92	$135	$43
February 2022	$104	$180	$76
		Mean:	**$49**

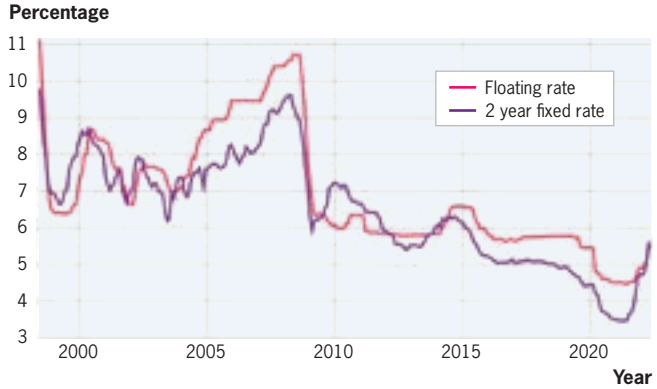
The compounded cost of pruning to age 28 using different interest rates

Operation and timing to prune one tree		Cost per tree from Levack Forest	Years to age 28	Cost per tree at age 28 using 7 per cent interest	Cost per tree at age 28 using 5 per cent interest	Cost per tree at age 28 using 3 per cent interest
Year 5	To 2.2 metres	$1.67	23	$7.92	$5.13	$3.30
Year 7	2.2 to 4.2 metres	$2.10	21	$8.70	$5.85	$3.91
Year 9	4.2 to 6.5 metres	$2.67	19	$9.66	$6.75	$4.68
		Compounded costs of pruning to year 28:		**$26.27**	**$17.73**	**$11.88**

The table above shows that the compounded cost of pruning is now lower than it used to be, because of lower interest rates than in the past. Interest rates at the moment are rising but have yet to reach the highs of 10 or more years ago. The value of a pruned butt log is $49 more than if it had not been pruned. This indicates that pruning is well worth the investment.

The size of the interest rates used to calculate the compounded costs of pruning is a game changer. Interest rates which apply to funds you might raise against the security of your house have been less than seven per cent since the 2008 financial crisis.

Mortgage rates – floating and two year fixed



Future demand

The likelihood of pruned logs maintaining a high enough premium over A grade logs in future needs to be re-assessed, because of changed evidence. A strong future demand, and high prices, for radiata pine clearwood appears very likely as a result of a new acetylation technology, which is owned by the British Accsys Group. The product is known by its trade name Accoya and apparently it is now sold widely in Europe. Uses include canal linings, motorway bridges, decking and exterior joinery.

Accoya is durable for 50 years above the ground, and 25 years below the ground. In many cases it is substituting for tropical hardwoods, and in others it is replacing steel and concrete which both have a high carbon footprint.

A further advantage of Accoya is its stability. It remains stable even when painted black and exposed to full sun. There are plans to increase production, and expand into the United States and other markets. An increased demand is certain, and the only reservation that the company has is its ability to secure enough supply. Serendipitously, radiata pine is regarded as the best timber in the world for the process, and also for the furfuryl alcohol treatment known as Kebony wood. Both processes need clear, knot-free radiata pine. Finger-jointed material is not an acceptable substitute. This means that a high price for pruned, well-grown, radiata pine logs could be expected.

Reducing the cost of pruning

During my first year in the Forest Service in 1963 pruning above 2.2 metres was carried out with a heavy pole attached to a saw blade. This was slow and strenuous work. By 1969 when I returned to Kaingaroa Forest, a ladder and jack saw system had been introduced. Work studies demonstrated that this method had reduced the cost of pruning by between 30 and 40 per cent. Since then, the introduction of improved loppers, better hand saws and lightweight chainsaws have made pruning even more efficient.

Recently the Forest Growers Levy Trust, the Sustainable Food and Fibre Futures Fund and the forest industry have allocated more than $10 million for research into more cost-effective ways of pruning and mechanised thinning. This is part of the seven-year, $25.5 million Precision Silviculture Partnership launched in May this year.

Other pruning advantages

Pruning means better air flow through a stand, which discourages the growth of needle fungi such as *Dothistroma* and *Phytophora pluvialis.* Cutting the lower branches in a stand means that the branches which are most likely to die are removed. This ensures there is no possibility of there being bark encased knots in the mature butt log.

Pruning makes forest access much easier to measure plots, or just having an enjoyable walk-through the stand. In addition, about two years after the final pruning and thinning to waste, the branches and trees on the ground will have rotted making the forest less of a fire risk.

Branch removal and lower stocking allows grazing within the forest if that is a secondary objective. Finally, a well-pruned forest block looks much more attractive than an untended stand.

Conclusion

This article has not made a full comparison of pruning versus not pruning. By not pruning, the structural regime in a forest will have cheaper supervision costs. It will also have a larger number of trees per hectare in the final crop which means that there is less thinning required, with subsequent lower thinning costs. There may also be a greater volume of logs in each hectare.

However, this article indicates that in generally, pruning to at least 4.2 metres above the ground, is wise providing that you can afford it. This gives rise to the query about why the large New Zealand forest corporates have not started to prune again. Is improved value being neglected?

Short-termism may be encouraged by shareholders who want bigger early dividends. This is, of course, easily achieved by cutting out the cost of pruning. Nevertheless, the shareholders of New Zealand's large forest corporates would be wise to closely question the accounting practices of their respective companies. Could it be that the decision not to prune is actually a matter of the company directors fogging the issue, so as to appear more successful than they really are?

Hamish Levack is the immediate past President of the NZFFA.

The NZFFA submission on permanent exotic forests

Howard Moore

Back in the May *Tree Grower* I commented on 'permanent' exotic plantation forests and the arguments for and against. In this issue I review the NZFFA's official submission, which at the time of writing is still being considered by the government, and has yet to decide what it is going to do.

You will remember that the 'permanent' exotic forests category was announced in 2019 to be introduced into the Emissions Trading Scheme in January 2023. Once announced, the idea quickly took hold. Forestry investors looked forward with joy at the potential returns from carbon credits while farming organisations looked forward with horror at potential losses of farms to trees. Emotions ran high, wild claims were made and bill-boards sprang up around the country.

The Ministry for Primary Industries reacted and in March released a consultation document *Managing Exotic Afforestation Incentives* asking for feedback on proposals to restrict exotic forests from being registered in the 'permanent' category, This somewhat placated the farmers but angered Maori land owners who saw at risk their chances of earning $7 billion in carbon credits from planting pines on remote and difficult country.

The distrust continues because the conflict cannot be resolved. The likely political outcome is a compromise that will hurt everyone to a greater or lesser extent, but we have to get used to that. Under climate change, as we all know, things will get tougher, not easier. Fairness is now as unachievable as business as usual.

Egon Guttke led the NZFFA submission with input from others including Graham West, Jeff Tombleson and myself. It is on the website if you want to read it but here are the main points.

We think it is a good idea

Under farm forestry we believe it is unlikely that 'permanent' exotic afforestation will 'displace productive land uses that provide wider economic benefits'. In fact it is likely to supplement farm income, lead to better targeted land use and by replacing pasture, increase indigenous biodiversity. All 'permanent' exotic and indigenous afforestation has significant environmental benefits.

We need the removals

Internationally there has been so little action on climate change that it seems inevitable we will pass 1.5 °C, and probably exceed 2.0 °C of global warming. Those countries which are taking action are already starting to exert trading pressure on those who are not. In New Zealand, many of us believe there will not be any significant near-term reductions in greenhouse gas emissions from agriculture and transport, because of the perceived economic and social costs. Our best option for meeting the country's global obligations is offsetting.

Afforestation with fast growing plantation trees is needed at scale if we are to achieve significant carbon dioxide removal and reduce the country's rising net emissions. Committing to a programme of planting forests to create growing carbon sinks will buy time and international credibility, now and beyond 2050. The 'permanent' exotic forests will involve the least land use change and the most flexibility. Indigenous forests grow slowly, and compared to 'permanent' exotic forests we would need to establish three times the area to achieve the same carbon removals by 2050.

We have the land

Many of our members, and possibly many of the approximately 12,000 other small-scale forest growers in New Zealand, have pockets of land which are not suitable for farming or for radiata production forests. Generally, the land is poor, steep or inaccessible and radiata pine is not sufficiently valuable to cover the costs of roading, harvesting and freight.

Our choices are to let that land become native scrub in the process of succession, with little or no financial return, or to plant it in high value exotic trees which can be managed either under continuous cover forestry, or on long rotation with small coupe harvesting. There is far more incentive to establish such forests under the 'permanent' category of the Emissions Trading Scheme than under 'averaging' accounting,

The land is better in trees

There are several species of plantation trees which produce at least three times the dry matter of pasture,

for each hectare each year annum, on soils of low fertility. That difference in productivity drives the basic economics of land use and helps explain how forestry can financially outperform sheep and beef farms on marginal hill country. Similarly, the productivity of exotic plantation forests out-performs indigenous forests.

In the steep mudstone hill country of the North Island, 1.2 million hectares of pasture is at risk of accelerated erosion from high intensity rainfall. Re-sowing the slip faces is cosmetic and not sustainable. The only solution is afforestation in permanent cover to stabilise the land and reduce flooding and sediment.

It could be left to become native bush, but the increasing frequency and intensity of heavy rainfall suggests that might be too slow to really deal with the problem. Exotic protection forests are the obvious solution and the 'permanent' category offers more long-term incentives for establishing these than the 'averaging' category.

Farming organisations see the competitive advantage of exotic forests as a threat to rural communities, while ignoring the decline of those communities from changing agricultural demand and farm practices. We acknowledge the effect that afforestation would have on social values and patterns of employment, but suggest that the effect of climate change will be significantly greater than the afforestation of four per cent of the country's exotic grassland.

Trees have evolved to cope

Some of the wild claims made by non-foresters about radiata pine are that such forests will die and fall over within 100 years, and will not be replaced by native trees as they will have poisoned the soil and destroyed all indigenous biodiversity. If only that were true we could sell radiata seedlings as biological weapons.

Scientific evidence indicates that for a broad range of tree species there is a maximum stand density level. Left alone, radiata pine forests – like all forests, including indigenous – are self-thinning, and will reduce in numbers as the healthy, dominant trees shade out and kill the weaker ones.

Successive measurements from radiata pine sample plots clearly indicate that 40 years, stocking falls below 400 stems a hectare, and generally by 100 years, stands have reduced to around 100 stems a hectare. There are many examples of radiata pine stands greater than 100 years old which demonstrate this, showing that generally they do not collapse or suffer catastrophic wind damage. There is also evidence that on many sites, indigenous forest species will establish as a significant understory in old exotic forests, and can be managed to become the emergent forest type.

Many NZFFA members have been trialling alternatives to clear-fell for decades, and at many locations emulate natural forest behaviour using continuous cover forestry. That allows selective thinning of the stand while maintaining soil protection and ecosystem services, as in a natural forest. Unfortunately, selective logging is more expensive than clear-fell as it requires good access and specialised equipment. Therefore the 'permanent' exotic forest category offers more scope for this form of management.

Biodiversity likes exotic forests

There is a significant body of scientific evidence that shows exotic forests protect significant numbers of endangered birds, reptiles, bats and insects. This is partly because of the habitat, and partly because the people who manage exotic forests often go to some trouble to control pests and predators. An overview article reports that at least 118 threatened indigenous species have been found in the mix of exotic and native ecosystems which make up New Zealand plantation forests.

Numerous examples have been reported by NZFFA members, who have found bird life to be widespread in some of their plantations. The fact that a rich biodiversity develops in the understory of many exotic forests suggests that 'permanent' exotic forests on most sites will develop similar understories with similar biodiversity. Left alone they will eventually transition to indigenous forests.

Summary of consultation

The NZFFA's preferred results from the consultation were, in order –

- That no action be taken on permanent exotic forests until after the release of the National Emissions Reduction Plan, since released. Alternatively,
- That permanent exotic forests be allowed, provided the regulations include appropriate forest management guidelines – 'appropriate' meaning that such guidelines should be agreed with the forest industry. Failing which,
- That legislation allows for exceptions to be developed, such as for 'permanent' exotic forests to be allowed under some circumstances, for example on Maori land. Or at the least,
- That a category be created under averaging which allows 40-year rotation or greater, suitable for long-lived exotic species.

Howard Moore is vice-President of the NZFFA.

The winter was no deterrent to Eastland Action Groups weekend

Rachel Rose

The alternative species Action Group outing to Gisborne in June was a packed programme which drew members from around the country.

The first morning was spent on properties belonging to the Clarks, a well-known farming family in those parts. The size of the 15-year-old redwood stand on the Ross estate was outstanding. New Zealand often squeezes trees on to the poorest classes of land so it is eye-opening to see the trees which flat, fertile land can grow. This alluvial site had been used for cropping previously but had become too isolated from the main paddocks to be worthwhile.

Redwood experts

The redwood experts present were very interested in this stand and are keen to establish permanent sample plots there. Some of the data which follows may differ from what was said on the day. It has been updated by information from Rob Webster, the Sequoia Action Group chair, and Paul Silcock. Paul's measurements show trees between 18 metres and 20 metres in height pruned to just under seven metres. They were planted 4.5 metres apart producing a stocking rate of about 500 stems a hectare.

Three different clones were planted, but two of them are showing excellent form and vigour and cannot be distinguished visually. The third was inclined to wobble and about 20 per cent were producing double leaders or ramicorns. This clone had been dropped from New Zealand catalogues on the basis of these traits.

We continued the discussion we began in the redwood trials on Friday about stocking rates. The gist of it is that recommended stocking rates, at least in stands grown from clones, is increasing. There are still different views about how high it can go. Simon Rapley of the NZ Redwood Company suggested this site could grow more than 420 stems a hectare. Rob Webster put a stake in the ground and declared 500 was good.

Paul Silcock has subsequently suggested to the Clark's forestry manager that they maintain the good clones at their current stocking, but for the stand showing the malformation to production thin, or thin to waste down to 400 stems a hectare. This would also allow for valuable new permanent sample plot data, producing a demonstration stand of final crop stocking at each end of current best practice for clearwood redwood production.

Selective harvesting

There was also discussion about how to thin or selectively harvest these trees so that there was minimal damage to remaining crop trees. Paul considers mechanical harvesting would not be economical for such a small stand. He thinks it is a job for an experienced feller, perhaps aided by a bottle jack to ensure the trees fall in the right place.

The sawmillers present pointed out it was worth pruning higher in order to get better timber from the top logs. It takes five or six years to progress to bark-encased knot, so there was just still time to prune out dead branches.

More sun

Heading uphill, we saw a very different stand of 1997 seedling redwoods on a moderately steep face. They showed considerably slower growth than on the flat, much more variation, a bit more wobble, but also deeper crowns. Gary Fleming attributed this to the terrain as sunlight can penetrate further into the stand on a north-facing slope. Lower-fertility sites are less of a limiting factor for redwoods once the canopy closes. The absence of windthrow was pointed out by Whanganui redwood grower Dougal McIntosh, along with the suitability of redwoods for preventing tunnel gully erosion.

When to prune redwood to minimise epicormic growth was discussed at some length. Paul noted that his company aims not to prune in spring, but no labour is available in winter because everyone is busy planting. Therefore, they prune between November and May.

Stan Braaksma noted that poplar and willow should not be pruned in spring. He suggested starting again around Christmas.

Thinning

We kept climbing, to stands of Leyland cypress and *Eucalyptus fastigata*. These had been thinned but were still overstocked. The perennial discussion was kicked around about thinning to waste the worst trees or production thinning the best ones? Vaughan's view was 300 stems a hectare was about right for the cypress on this steep, windy site with thin soils.

There was talk of the need for technology to efficiently and economically harvest small stands of alternative species. South Island sawmiller George Shallcrass had a contrary view, stating that the Leyland cypress needed nothing more than a man on a chainsaw along with a digger. He said he mills logs with a small end diameter as low as 20 centimetres using his portable mill.

What about the eucalypts? Gary spoke about a useful ratio for eucalypt crown to target diameter at breast height of 15 to one. Usually, past advice has been to thin down to spacing of 10 metres by 10 metres, or about 100 per hectare, which should produce logs between 65 and 70 centimetres. A smaller spacing of nine by nine would produce a final diameter at breast height of 60 centimetres.

The target diameter depends on intended use. There was discussion about the potential of eucalypts for engineered timber products, which does not require large diameter logs. Gary also pointed out that shade-tolerant species such as *E. microcorys* can be grown at higher stocking rates as they will have a deeper green crown and more leaves per hectare.

Cypress siting

Lunch was at the nearby Shanks Block, a site established by David and Libby's son Richard Clark. It was interesting to review younger planting here, of six-year-old Oven's cypress, redwoods and many eucalypts including *E. regnans, E. fastigata, E. quandrangulata, E. globoidea* and *E. bosistoana*. The fate of some Oven's cypress planted in a drain at the edge of a stand illustrated an important point about siting cypress. They will topple in soil which is too wet but survive well in the dry. Otherwise, the uniformity of this clone was notable and they are easy to prune. Japanese cedar *Cryptomeria japonica* on the ridges was not successful due to frost and deer browsing.

Cricketer trial

Toby and Vaughan talked about what the Cypress Development Group now calls the cricketer cypress trial. This started with Scion endeavouring to create the Oven's cross by importing the *nooktatensis* pollen from British Columbia and crossing it with the best lusitanica and macrocarpa in Scion's breeding programme. There have been several subsequent rounds of selection. Trials have been planted of the 12 they picked as best, named after the players and coach of the cricket team which should have won the 2019 one day cricket World Cup The cypress are now down to a favoured four or five selections. The aim is better resistance to canker and more durable timber. The best of the trials are growing 25 per cent faster than the original Oven's clone, which has been around for more than 100 years.

High pruning

In the afternoon we moved on to Kees and Kay Weytmans property where radical high pruning of oaks sparked spirited discussion. There was general astonishment that this agro-forestry planting qualified for carbon under the Emissions Trading Scheme, but as Kees said, he did not make the rules or even bend them.

The income from carbon was a game changer for the property. The small stand of black walnuts on alluvial soils was impressive. Kay created a memorable dinner for us that evening, leaving no doubt why theirs is such a well-regarded, exclusive venue for weddings and other occasions.

Poplar

Sunday began with a quick stop to see a poplar shelterbelt at Glenroy which were remarkable for their form and pruned height. This variety, kawa, is one of the best timber poplars, producing high-density wood with an appealing colour. Stan Braaksma called it an example of good, perceptive pruning, little and often, with swift correction if the form goes wayward.

That morning we got to meet Gisborne branch's latest member Panapa Ehau and hear about his projects. Panapa is an executive director of Hikurangi Enterprises, an entrepreneurial Maori business best known for its medicinal cannabis operation.

Whare Ora is another project he is leading, which is creating multiple opportunities and benefits. Transportable housing, from sleep-outs to small homes with full services, is being manufactured in Gisborne by a team led by Panapa's brother. We drove past their yard on Saturday. The houses are well-built and appealing and better insulated than the building code minimum standards. This iwi-led initiative is about employment and housing for their people, not profit.

Old redwoods

On our way north, we ventured into a grove of some of New Zealand's oldest redwoods, planted around 1920. The trees were noteworthy for their size and girth and also because some of them were dead. The massive hung-up trees made for some nervous joking as we moved through the stand. The story, explained by Gisborne branch stalwart Phil Gaukrodger, was that the river below us had flooded this small block of trees during cyclone Bola. So much sediment was deposited that some trees had died because of extended anaerobic soil conditions.

This wedge of land was returned to local iwi as part of the treaty settlement process. Panapa would like to recover logs and use the timber for external cladding for the Whare Ora builds. It will not be easy to fell these trees safely and there was considerable discussion about different approaches and relative risk. There was mention that Soper Wheeler once went so far as to import American fellers for a similarly challenging harvest. They used a specific technique, mounding earth and building up a nest of slash to minimise shattering when the tree fell.

Milling macrocarpa

On Sunday, we continued on 30 km north of Ruatoria to Ohinewaiapu Marae, what the locals describe as literally the end of the road. We gathered in a paddock with Panapa and his small sawmilling team who had been milling old macrocarpa logs. The boards will be available to local whanau so they can make repairs to their homes. The team had lots of questions about the mechanics of milling and the best use for different species and grades and what treatment was needed. Predictably, the NZFFA members present had lots of advice that the locals were keen to hear.

The benefits of Whare Ora are multiple. People are learning valuable skills and moving into steady employment, trees which are a liability and cannot be harvested under normal commercial terms are being used and families and communities are benefiting from warmer, drier, more secure housing. It is impressive. Several of us with sawmilling interests left our details and invited them to get in touch so we could provide more support. It was a good example of the NZFFA making connections with local communities and offering collective knowledge to people keen to learn from us and with us.

Weather

Monday was when our luck ran out with the weather. The long and muddy walk through Nick Pollock's farm ended with a solid drenching, but the spit-roasted lamb and a roaring fire at the house was excellent. There is a small section below with more reading about previous articles on this and other properties. There is also an associated article about redwood trials and the Barr cypress hybrid on page 18 in this issue.

More reading

These are a few additional items for you to read about other properties we visited on this trip with some shortcuts for your internet browser –

- A 2009 write-up of Kees and Kay Weytmans' property with a lot of good background information which is still valid https://bit.ly/Kees-TG09
- A showcase of Nick and Sheryll Pollock's property after they won the Husqvarna North Island Farm Foresters of the Year 2021 https://bit.ly/Nick-TG21
- A summary of Gisborne's erosion problems and a bit about the Weytmans property https://bit.ly/Gizzy-Feb09
- You can read about the historic Harris oak, on another block owned by the Clarks, by searching for Oaks New Zealand on Facebook.

Rachel Rose, Cypress Development Group secretary and Oaks NZ committee member, with photographs provided by Neil Cullen and Tess Smith.

You just have to be there

Country on the move was eye-opening and very sad to see the effect of the serious storms earlier this year and evidence of continuing major erosion. This was brought home in a very sobering way by the photographs and videos in Graeme Atkins' presentation at Ohinewaiapu marae. It showed the massive scale of erosion in the 100,000-hectare Raukumara Conservation Park and the current and likely future effects on local river systems. You cannot plan or manage forests on country like this without taking serious account of these problems.

I was privileged to share a van with Kees Weytmans and Stan Braaksma. Kees, now a Gisborne local, had lots of stories and background about passing points of interest. Stan is well known to our members as a soil conservator par excellence and a poplar and willow expert. I learned a lot about soils, erosion, how to kill crack willow and what species of poplar I ought to be planting – all in between our stops.

Of course, the dinners, along with the before and after drinks for those inclined, are a superb opportunity as always to catch up with old friends, continue arguments about pet species and projects, or pester new friends with questions. No write-up can cover all the opportunities offered by these trips. Thanks are owed to Vaughan Kearns for organising this mid-winter escapade, Gisborne branch members who fleshed out the programme especially Phil Gaukrodger who racked up the miles putting the East Cape programme together at short notice, and all those who so generously hosted us on their land.

Some of the 100-year old redwoods

Some highlights of Eastland Action Groups weekend


Pruned poplars


All having lunch


Vaughn Kearns and Kees Weytman at Knapdale


Lusitanica at Knapdale pruned to nine metres


The Waiapu river and Mount Hikurangi


Some of David Clark's cypress planted in 1997

Some highlights of Eastland Action Groups weekend


Among 100-year-old redwoods


Eucalyptus fastigata planted in 1996


Listening at Knapdale


Stringybark eucalypts


David and Richard Clark's mixed planting


Redwood planted in 1997

Redwood trials at Lake Tutira and Waerenga-o-Kuri Sequoia Action Group visit

Rob Webster and Paul Silcock

The field weekend visit to Eastland in mid-June provided an opportunity on the Friday for the Sequoia Action Group members to inspect two important trials at Lake Tutira and Wairenga o Kuri.

The Forest Growers' Levy Trust has approved funds to carry out the establishment and re-measurement of various permanent sample plots of alternative species. When the interim redwood growth model was developed in 2005 it was based on measurements from destructive sampling in stands of a suitable age and stocking. This was due to the lack of permanent sample plots in the Scion database.

A number of coast redwood permanent sample plots were established throughout the country during the field work associated with the development of the growth model. However, many of these have not been re-measured for about a decade due to previous lack of funding.

Redwood enthusiasts in the Waerenga-o-Kuri trial

The Lake Tutira trial

This is a final crop stocking and pruning intensity trial. Treatments are shown in the table below. The 21 plots along with an un-thinned circular control plot were established in January 2004 in a stand planted in 1998 at a nominal stocking of 1,300 stems a hectare.

Crop and followers	Final crop	Pruning calliper in centimetres			Repeats
525	350	None	5.5	9.0	2
750	500	None	5.5	9.0	3
975	650	None	5.5	9.0	2

The trial was measured during the winter following establishment, with the intention of being measured bi-annually for 12 years. However, the last recorded measurement was in 2012.

The Tutira trial is hosted by the Guthrie-Smith Arboretum and access is appreciated. The arboretum covers 90 hectares where over 20,000 trees have been planted since 2002. The overall concept is a series of groupings of trees from different countries and geographical regions including New Zealand, Australia, China, Japan, Himalayas, Europe, Mexico, North America and the Mediterranean countries. The trees are all linked by various walkway tracks and well worth a visit.

The Wairenga-o-Kuri trial

This trial was established in 2004 as part of the Lake Tutira trial in a stand established in 1998 at a nominal stocking of 1,200 stems a hectare. The motivation for the trial arose following a visit with Bill Libby to the

UCLA Blodgett Research Station in the Sierra Ranges. Researchers working with giant sequoia had established seasonal pruning trial to determine if the seasonality of pruning affected the development of epicormic shoots. It was considered that it would be useful to establish a similar trial on coast redwood in New Zealand.

The trial consists of four plots, all pruned to 5.5 centimetres and with a stocking of 500 stems a hectare. Of these, two plots with followers giving a total of 750 stems a hectare and two without followers. Followers are trees which have been suppressed by the trees around them and have stopped or slowed in their growth. Each of the plots was split into spring and autumn pruning treatments.

Trial observations

Dean Meason reported on both the trials in 2012 and made the following observations.

The response to thinning was inconclusive at the time of last assessment in 2011. However, how the trees have responded when the final crop densities were to be applied over the following five years would provide the best indication of how redwood responds to thinning at the stand level.

The results of the Waerenga-o-Kuri trial showed that epicormic development was less if trees were pruned in autumn. At the Tutira trial it was found that the 5.5 cm treatment was too severe. For the second pruning, gauges were increased to 12 cm for the light treatment and 9 cm for the severe. The third pruning used a constant pruned height with a minimum percentage crown removal rule.

Between 2004 and 2009 heavy pruning reduced basal area growth by 21 per cent while the light pruning decreased it by 10 per cent. Height growth did not vary between treatments.

The trial indicated that pruning had a short-lived effect on productivity but the trees are able to recover quickly even when a large proportion of the crown is removed. Remeasurement of the Tutira trial will be carried out in August. It will be interesting to see if the trees can recover the increment lost by the pruning and how they have responded to the thinning.

General discussion

The two trials are part of a wider series of final crop stocking trials. These were established to study the effects of alternative final crop stocking of tree development across New Zealand which will be re-measured this year. The additional data will greatly improve the thinning response component of the redwood growth model and give further confidence to growers when making final crop stocking decisions.

Both trials enabled field day attendees to discuss rotation lengths, target final crop stockings and options for production thinning. In addition were the merits of removing suppressed branches in the lower crown in order to avoid the development of bark-encased knots leading to timber quality downgrade. This is compared with thinning to maintain a live crown, but suffering a loss of volume production.

Simon Rapley commented that recent studies showed increasing profitability with increasing rotation lengths due to the increasing volume of high valued clearwood and heart grades of timber. This fits in nicely with the benefits of increased carbon credits. We can only hope that new look-up tables for redwood in the Emissions Trading Scheme reflect the benefits of longer rotation under averaging accounting.

Further work discussed during the day included improvements to the volume and taper equation for coast redwood and development of a heartwood model. Understanding how the sapwood responds to growing space will contribute to a better understanding of how the final crop stocking of a redwood stand influences value per hectare, rather than just volume per hectare. We need to determine if heartwood formation varies with final crop stocking and pruning.

Rob Webster is the Chair of the Sequoia Action Group and Paul Silcock is the Forestry Manager for Kingheim Ltd.

The development of forestry extension services to encourage planting more trees on farms

Hamish Levack and Julian Bateson

We all know that the main aim of the NZFFA is to get more trees planted on more farms – the right trees in the right place. This has been the aim for over 60 years and is inherent in the name the New Zealand Farm Forestry Association.

In recent years trees and forests have become more of a political concern with some farms being bought to be planted with trees as carbon forests, but also being bought as production forests on land where trees are more profitable than sheep and beef. This has been opposed by some farming representatives in areas such as the Wairarapa with meetings and even movements, such as 'Fifty Shades of Green' protesting against trees and afforestation. Signs along the roadside which say 'You cannot eat trees' are examples of the discord.

Perfect storm

There was also a demonstration in Wellington about three years ago when hundreds of farmers marched on parliament with an anti-tree message. At around the same time the government, via Te Uru Rakau, launched the One Billion Trees programme linked to concerns over climate change and an attempt to reverse the deforestation of plantation forest land. Clearly the government is having difficulty keeping the whole rural sector happy.

The anti-forestry lobby has been feeding the Minister of Forestry with several myths disparaging radiata pine. However, they are being debunked, one by one, thanks to the new Climate Forest Action Group, which includes our president.

As mentioned earlier, the NZFFA are in an ideal position to help get more trees on farms. The rise in the price of carbon in the Emissions Trading Scheme has added an extra incentive to plant more trees on farms. Finally, the possibility of He Waka Eke Noa becoming the alternative to the Emissions Trading Scheme for farmers provides an even greater incentive to plant more trees.

It is almost the 'perfect storm' in the NZFFA's favour.

Working together

On the basis that the NZFFA could do more to help, last year we approached Te Uru Rakau – New Zealand Forest Service to ask if they would fund a series of workshops and field days for farmers. Our members know a lot about trees on farms and are very good at field days.

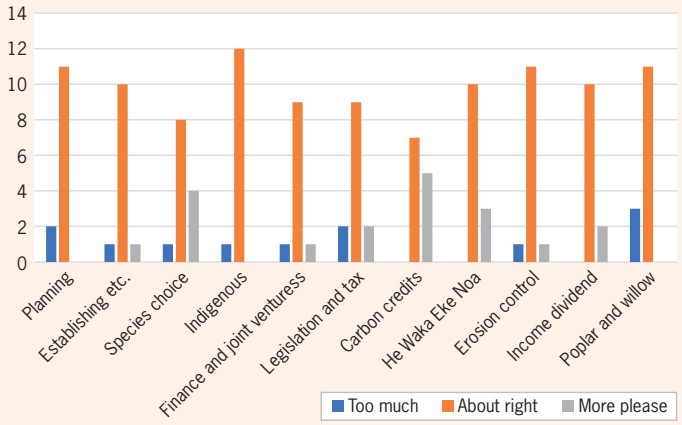
The discussions took quite a while, as these things do, but readers of the *Tree Grower* will remember the article in the May issue. In this it was explained that a pilot project had been funded by Te Uru Rakau – New Zealand Forest Service and the Forest Growers Levy Trust for a series of workshops and field days for farmers.

What was the result

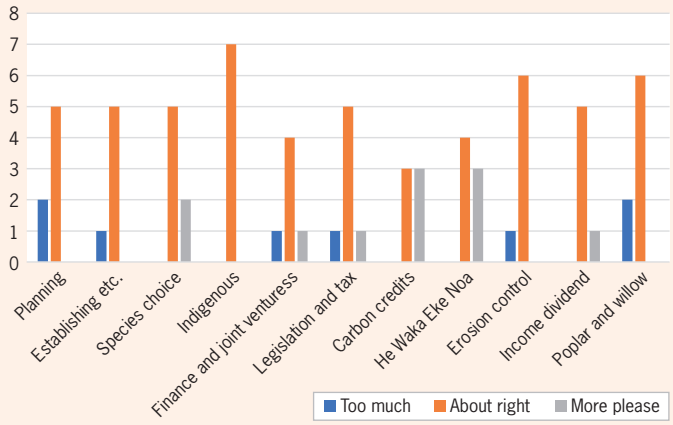
After a lot of hard work, the workshops took place in Hawera, Bulls and Masterton, each with an accompanying field day. The presenters included Howard Moore, Egon Guttke, Tim Forde, Kevin Reardon, Vaughan Kearns, Morris Fisher, Hugh Patterson, Denis Hocking, Johan Bremmers, Stan Braaksma, Bert Hughes and ourselves, the two authors.

The workshops attracted a broad range of attendees. As well as the target group of hill-country farmers, there were industry support organisations, regional council land managers, researchers, representatives of companies associated with the carbon market and the bio-fuel industry and forestry companies. We had over 130 registrations in total and of these 55 were farmers. Some preliminary analysis was carried out although more is still being done.

All participants – Hawera



Farmers – Hawera



The graphs above were produced from the questionnaires filled out by participants at the end of the day. The sample, from Hawera, is used to compare what farmers thought about the presentations with what the others in the audience decided worked best for them. Overall, the view was that it was about right, although farmers certainly wanted more information about He Waka Eke Noa and carbon credits

The comments on content reflect the particular and diverse interests of the people that gave the feedback. Some participants wanted access to the slide packs and additional information, which has now been provided, and that follow-up sessions on specific topics could be welcome. This information is also available on the NZFFA website.

Some comments from farmers

'Very good, some very knowledgeable speakers.'

'A very big overview, but would be good to have follow up publications with more detail.'

'Really good information on everything.'

'Good to hear from such knowledgeable speakers with practical experience.'

Conclusion

Although improvements can be made, Te Uru Rakau – New Zealand Forest Service has acknowledged that the pilot project was successful, and it is likely that similar workshops will be rolled out across other New Zealand regions. In addition, a memorandum of understanding, cementing closer collaboration between Te Uru Rakau – New Zealand Forest Service and the NZFFA is now being discussed.

We have suggested that it would be good to fund the following projects, but it is a very long wish list.

- The publication of booklets, videos and podcasts to support small scale forest afforestation, including updated versions of the Ministry of Forestry's small forest management series of booklets, published in the mid 1990s but which are now out of print, and the development of three, new, complimentary forest management booklets on the Emissions Trading Scheme, He Waka Eke Noa, and health and safety.
- The development of generic contract templates for farmers wanting forest operations carried out.
- The development of an on-line study course on farm forestry, based on the 1980s extramural course run by Forest Service and the NZFFA via the Technical Correspondence Institute.
- Getting Te Uru Rakau – New Zealand Forest Service forest advisory staff to join the NZFFA, and come to conferences, action group weekends, and other functions.
- Combining the skills and knowledge of expert members of the NZFFA with farmer organisations, such as Beef and Lamb, Dairy NZ and Federated Farmers, as well as established farmer discussion groups, all of which have the resources and the remit to get good sustainable land-use information to their farmers.
- Replicating the excellent 250-page book, published in 2005, entitled *Guide to Successful Farm Forestry – A Hawkes Bay Perspective* for other regions in New Zealand. The NZFFA Central District's branch is keen to champion the development of a similar book.
- Arrange workshops for farmers in the use of the 'TreeFarmer' software. This is an on-line mapping system for planning a forest, and for working out how best to harvest it.
- Funding a full time NZFFA administration officer in Wellington to organise such work.

As it says above, this is a long list, although we could always ask for more, and may yet do so. We will keep you all in touch with progress in future *Tree Grower* articles.

Field days and workshops








Self-supporting strategy to improve climate resilience and biodiversity

Richard Thompson

As a former Chair and founding trustee of the NZ Landcare Trust and co-owner of MacBlack Timber, I have been working on the environment for over 30 years. That background, coupled with governance experience, saw me invited to help establish New Zealand Carbon Farming's Regeneration Independent Advisory Group.

Over the last five years, the group has helped guide the multi-million dollar investment in the development of a nationwide regeneration programme. This focuses on using established science and careful management to support the transition of exotic tree nurse crops into biodiverse native forests. The model established will help New Zealand meet its climate targets, provide long-term earnings for forest owners, and support the resilience and biodiversity of the environment.

As we started the year, the UK Meteorological Office highlighted that human activity would see the atmospheric carbon dioxide concentration in 2022 reach a level 50 per cent higher than the pre-industrial age. At over 420 parts per million, carbon dioxide levels are currently the highest in recorded human history. A lot of the land use debate, and even the global approach to climate change, focuses on what will happen in the latter half of this century. However, with carbon dioxide levels already close to 20 per cent above agreed safe levels, it is clear that we have an urgent need to get carbon out of the atmosphere very quickly and do it in the most cost-effective way possible. When New Zealand Carbon Farming approached me in 2017, the opportunity to tackle this urgent problem on a scale that would make a difference is what attracted me.

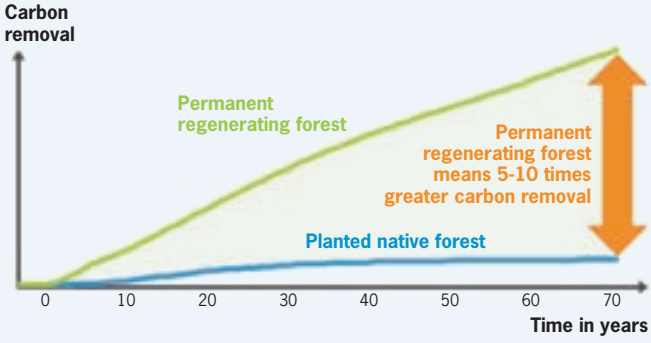
A significant advantage

What made being part of this advisory group extremely attractive was that the proposed regime would produce a 'double whammy' of rapid carbon sequestration and a large biodiversity increase. The concept of establishing a nurse crop to support the regeneration of native species is not new. In New Zealand, dozens of academic papers have been produced on the subject in the last 50 years.

In my own experience, if you want to establish native forests, going out and planting trees in long grass is one of the slowest and most expensive ways to do it. The quickest way is to develop a cover crop and let nature do the work for you. One of the most effective cover crops we have in New Zealand is radiata pine. This means we can draw on significant technology and experience around pine trees, which grow almost anywhere around the country. Radiata pine has incredible properties in terms of sequestration, generating enough revenue to cover the cost of establishment and continuing management.

The ability to be self-funding is significant – especially when native-alone planting projects will cost at least three times as much to establish and potentially use twice or three times the amount of land to achieve the same levels of sequestration. There is also a marked difference in rates of sequestration, particularly over the short-term when carbon must be removed from the atmosphere to help us meet our internationally agreed targets.

Carbon removal over 70 years



Action at scale

When we began our work, the focus for our group of mainly independent scientists and ecologists was to achieve regeneration at a scale not previously attempted in this country.

We identified quite early that pest and weed control were going to be extremely important. But we also recognised that success would hinge on the ability to design the method for each site. That meant tailoring the regime to a particular site, considering the geography and weather as well as how much native forest there was in the neighbouring area to allow seeds to be imported by wind or birds.

We are now providing input into extensive trials across a range of sites to identify the optimum environment for establishing native growth. Along with weed and pest control, one of the main determining factors of success in a transitioning forest is light. Targeted thinning and the creation of light wells at a range of sizes to establish the most productive size, shape and orientation is part of the optimisation process.

Active management

The trick here is to time the intervention, predominately poisoning of selected trees. Too early risks weed and grass suppression of seedlings, too late and it is too dark for establishment. Active management requires monitoring the regeneration progress and tailoring future intervention so that the best microclimate and native forest development takes place.

For owners of permanent regenerating forests, the thinning process could also provide an additional income stream. By undertaking low impact felling, using small machines to minimise disruption to the canopy and undergrowth, wood and fibre created in the thinning process can be recovered from appropriate sites. This can be used to supply the developing local biofuels and existing wood fibre industries, while supporting local employment and supplementing timber supply.

On the other hand, as the non-native plantation trees are progressively removed, there may be a short term reduction in the net quantity of carbon sequestered. This may require the land owner to consider and manage the financial implications. The main fact to remember is that the carbon revenue stream from the early years of rapid exotic tree growth provides enough funds to cover active management of the forest and fluctuations in stored carbon in later years as the forest transitions to native trees.

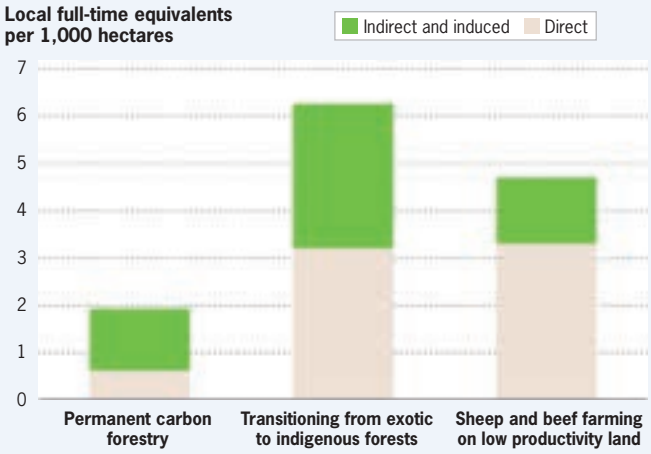
Most of New Zealand Carbon Farming's forest sites are selected for their proximity to native seed sources. As well as a predator control programme to help the bird population, which is vital to seed dispersal, the organisation is also looking at a range of options to introduce more seed sources. This will be with the establishment of native seed islands and supplementary planting.

Economic development

While a lot of the noise from the farming lobby has focused on the potential to reduce jobs in the rural sector, recent updates to Te Uru Rakau research have highlighted the opposite is true. The report *Employment impact of different rural land uses*, produced by PricewaterhouseCoopers Consulting, found that the process of actively managed carbon forestry creates 25 per cent more local jobs than sheep and beef farming on low productivity land.

The report found that of the three land uses considered, transitioning from exotic plantation to indigenous forests creates the most local jobs. An estimated 6.3 local full time equivalent jobs for every 1,000 hectares, compared to 4.7 for sheep and beef farming on low productivity land and two for permanent carbon forestry. The larger number of jobs created by transitioning from exotic to indigenous

Estimated local full time equivalent jobs per 1,000 hectares



New Zealand Carbon Farming

Established and owned by Matt Walsh and Bruce Miller, the business is one of the largest contributors to New Zealand's climate change efforts, sequestering more than 25 million tonnes of carbon dioxide over the last decade.

To put that into context, according to the Ministry for the Environment, the government's five highest-performing projects in its newly released Emissions Reductions Plan will reduce emissions by between four and nine million tonnes of carbon dioxide over the next three years, at a cost of over $1 billion. Over the same period, 90,000 hectares of New Zealand Carbon Farming owned and leased forest land will sequester 7.5 million tonnes of carbon dioxide – at no cost to the taxpayer.

The organisation targets only marginal land, with 95 per cent of the property it owns in land use class 6, 7 and 8. The company will subdivide off any better land from the marginal block, re-selling productive farmland and buildings back to the local community.

The company runs the largest private pest control programme in the country, which has removed more than 30,000 pest animals over the last two years at a cost of more than $1 million each year.

forests was as a result of the additional management activities required to achieve the regeneration.

The report updates employment analysis prepared in 2020, using more up-to-date information and focusing on the specific set of land uses considered, as well as local employment rather than that created elsewhere. In addition to focusing on local employment, not carried out in the 2020 report, the report also provides a 'like-for-like' comparison of the relative effects for a given piece of land. This means sheep and beef farming is only considered on low productivity land, compared to the 2020 report which used an average over all farming land 'because that is the type of farming land which would typically be converted into permanent forests both permanent carbon forests and transitioning from exotic to indigenous forests.' According to the July 2021 Baker Ag report, over 90 per cent of land purchased for carbon farming since 2017 was within these land use classes.

The opportunity to create a complementary income stream on otherwise marginal land is also one that should be attractive to farmers and forest owners. There is plenty of research highlighting that such land can be a drain on farm finances. Introducing a well-managed transitional forest in areas which are steep, erosion prone or hard to access can turn them into a net positive by providing carbon credits and additional income. There is also a long-term benefit of establishing a native forest as an intergenerational legacy that will continue to generate a carbon income over the longer term.

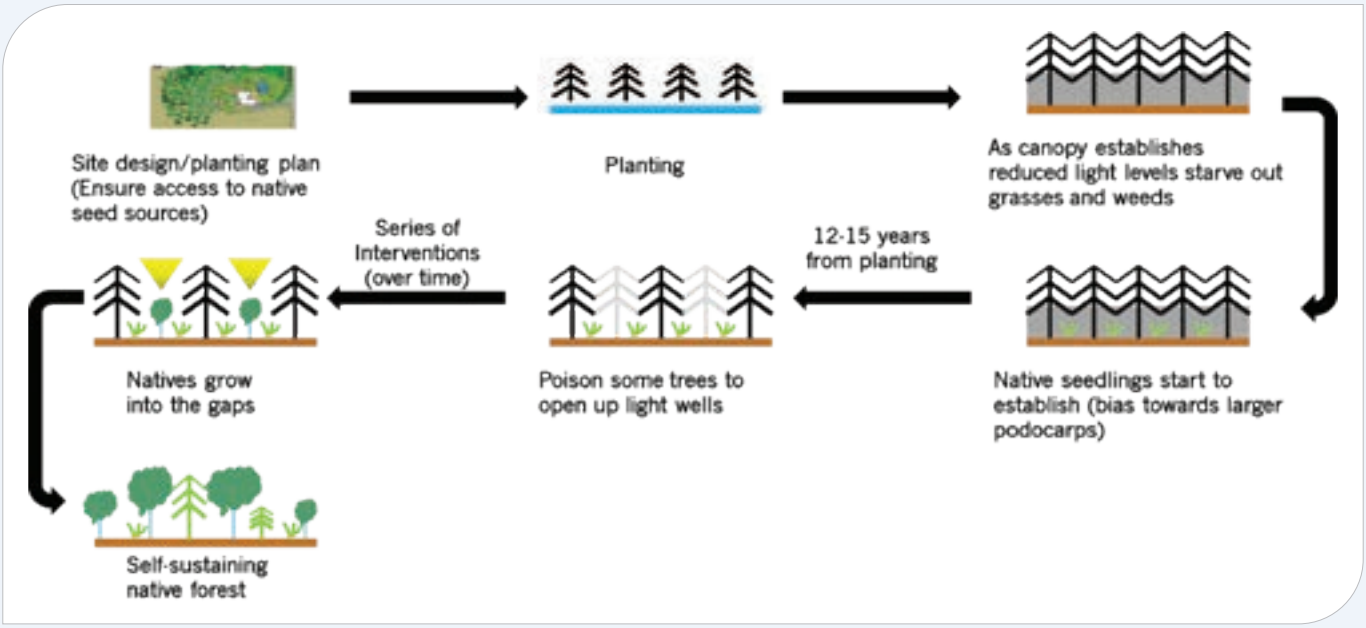
The climate emergency

I am convinced this process has myriad benefits for the environment and the rural economy, but what has become obscured in the heated debate about land use is climate change. There can be little doubt that the rural community is on the front line of climate change. Effects such as drought, flooding and extreme weather already cost rural New Zealand significantly. Anyone who owns vulnerable hill country needs to think about what the future looks like and find ways to improve the resilience of their land while also improving the financial resilience of their business. The farming community has also been on short notice that if they do not act now, they are going to have a carbon price imposed on them.

This makes what we are promoting incredibly important. By establishing a model to sequester carbon and build biodiversity which is essentially self-funding, at the scale required to make a material difference to the problem, the investment required is covered for the long-term. The alternative is a large cost to the taxpayer where billions of dollars could be spent offshore to make up the shortfall in our local carbon targets.

Viable alternative

When there is a clear alternative which relies on established local science and the abundance of marginal land we have available, it makes much more sense to make that investment here and fund it with private



investment rather than the taxpayer. I have spent 30 years working in the environment movement, looking at hill country in particular. I have seen more of our hillsides falling away and very little done to prevent it.

Much of my time has been spent working with regional councils and other organisations to identify ways of turning this round. In all that time, the process of actively managing the transition of exotic trees to native is by far the most viable and successful way of solving some of the urgent problems we are facing.

The transition process

Some of the basic steps to establish and transition an exotic forest to native trees.

- Survey and understand the site. This includes soil, orientation, moisture, existing ground cover, presence of native vegetation, proximity to seed sources and presence of pests. It is especially important to identify and protect native plants of all ages.
- Develop a canopy planting plan. This will be mainly the nurse crop selected for cost of establishment, growth rates, ability to create a canopy and carbon sequestration characteristics. The plan should include stocking rate and set-backs for riparian areas and native vegetation. Stocking rate should be fairly high to quickly establish the light-eliminating canopy.
- Maximise access to seed sources by creating corridors and using gullies and riparian zones.
- Consider the need for enrichment planting which will depend on what is there or nearby. Enrichment planting should have a bias towards podocarps.
- Develop and rigorously implement a pest management plan.
- Create a microclimate to enable regeneration. Carry out a series of thinning intervention to progressively open up light wells. Timing of these is dependent on conditions at the site.
- Commit to continuing management and monitoring of the forest.

Some branch and special interest group reports you may have missed

Howard Moore

Because it is now August, this article is offered as something of a tribute, rather than a news item. We usually celebrate the work members have done around the country at the AGM, but this year's was on-line and for brevity everyone asked that their reports be taken as read. We finished on time but nobody read anything, so unless you were involved in the reports or hunted them down on the website, you may not know what they contained. I planned to summarise them in May but it took a while to gather them up. Now that I have most of them, and apologies for those I have missed, here is a quick overview.

Southland

On behalf of the branch Heather and Graham Milligan received the trophy for the Branch of the Year at the 2021 Conference. Graham wryly suggested that the main reason receiving it was all the work the branch had put into the 2020 Conference before it was cancelled. That had drained the branch's energy and consequently there was little activity over the rest of the year. He thanked the branch committee and members for their work and support, and looked forward to an influx of new members from the rising interest in small-scale forestry.

South Otago

Scott McKenzie thanked the branch committee, and reflected on the pressures small forest owners experienced over the year. Happily, domestic log demand was stable, chip prices were rising and the carbon price was high. However, local farms being converted to forestry made it harder to find seedlings and planting crews. Several planned events were cancelled because of Covid, but George and Shirley Pearce had won the Peter and Pearl Moffat Award and hosted a brilliant field day. Scott also congratulated Barry Gray for winning the Landcare Trust Award.

Mid-Otago

Peter Thomson confirmed that the branch is growing its membership, and managed two main events over the year. One was a visit to the Sinclair Wetlands to see the riparian areas and hear an overview of their planting regime and future plans. The other was a visit to the Otago log handling facilities in Dunedin managed by the C3 company, where members saw world- class log measuring and calculating processes, and learned the logistics of unloading trucks and loading ships at Port Chalmers. It was a real insight. Peter thanked the committee and branch newsletter editor, and invited more to step up to join them.

West Coast

Michael Orchard reviewed the activities of the West Coast branch and the West Coast Regional Plan that aims to combine the environmental management of four local bodies. The Grey District Council had successfully completed its Significant Natural Area process when he worked with them 12 years ago, and he felt there were lessons to be learned.

The branch held two field days, one to see Redwoods and a 30-year-old pine stand being selection harvested for local supply, one to Noel Hardie's in the Grey Valley and then on to Omoto Forests to view an area being rehabilitated after mining.

Nelson

The Nelson branch attracted new members and Russel Brown was pleased to report a busy year. One field trip was to see tethered harvesting operations at Michael and Jan Higgins property in the Gowan, followed by a visit to Terry and Claire Gavin's property. Tasman Pine Forestry hosted a visit to the Pigeon Valley Restoration Project. James Mathison invited the branch to his property in Tadmor, and Tony Dick showed the group their family logging operation. Russel thanked his committee, and on behalf of the Nelson branch wished head office good luck in their plans.

Wairarapa

Ian Dewes reported an excellent visit to Stephen de Jong's property in Gladstone. Stephen grows radiata, lusitanica, poplars, eucalypts and acacias together with some specialty trees, and plans to build a new house with some of the timber he has cut. A Scion workshop described the Forest Flows research project, which is aiming to increase understanding of how trees and water interact. At Rewanui on a fine day a few stalwarts planted 500 native trees near one of the main walking tracks. Ian thanked the committee and the hardy faithful for their work over the year.

Middle Districts

Rick McAslan reported that the branch had run six field days before Covid made it too difficult. Kieran and Shonda Devane in Taihape were managing the natural regrowth of totara, and growing cypress, redwoods, eucalypts and Douglas-fir. The Browns north of Whanganui had similarly planted a wide range of species. Gisela and Natalie Ahlborn at Aokautere were developing a sheep milking venture, and logging a 20-hectare radiata pine block. A working bee was held at the magnificent McKean Pinetum at Rangiwahia. Denis Hocking hosted a milling day, with portable sawmills on show cutting a variety of eucalypts. Ian McKelvie, the National Party's spokesperson on forestry, joined the branch for a mid-winter dinner. It had been a busy schedule and Rick thanked the team for all their work.

Gisborne East Coast

Nick Seymour also reported a busy year with six field days. One was to Knapdale, where Kees Weytmans was managing native succession. He had planted a small area to attract birds and act as a seed source for a wider forest, then worked hard cutting out wilding pines, gorse and blackberry to allow the emerging seedlings a chance. At Ahititi, Bill Savage managed a honey business based on plantation manuka raised from seed in Gisborne. At the Te Arai Bush Waterworks Reserve, pines that were planted after cyclone Bola are being harvested and the council is trialling native forest on the cutover. Nick and Sheryl Pollock were awarded the Husqvarna North Island Farm Forester of the Year award and were congratulated on their hard work, and Nick thanked other branch members and the committee.

Taupo and Districts

Allan Coyle reported a quiet year with no field trips, largely due to Covid. Their AGM at the Ploughman's Restaurant in Taupo was the last gathering for the year, but 2022 would be busier. Allan noted the activity of the Executive, the optimism around revitalising the NZFFA, and the planned conference in Timaru, now April 2023. Branch membership was steady and he thanked the group for its work.

Waikato

Covid meant that 2021 was one of the quietest years in the branch's history. A field day was held with the AGM in March, when members of the Hawke's Bay branch were hosted for a weekend and an afternoon was spent at Graham and Tess Smith's farm, famous for its paulownia. Later a few members represented the NZFFA with the Ministry for Primary Industries at Mystery Creek. It was not an ideal site but 2022 promises to be better. The chairman thanked the branch committee and gave plug for their newsletters, which he felt were 'starting to achieve cult status.'

Northland

Peter Davis-Colley advised that the Northland branch celebrated an excellent two-day field trip around the far north together with a team led by Vaughan Kerns, who bravely drove through the Auckland lockdown to share the event, fully reported in the *Tree Grower* of February 2022. A field day at Glenbervie looked at innovative logging technology, and a tree was planted at the Gravatt property in memory of Bev. There is a growing realisation of the need to plant more trees in Northland to reduce sediment flows, and perhaps the Emissions Trading Scheme will provide the necessary incentives.

Sequoia Action Group

Rob Webster confirmed that the group had asked Te Uru Rakau for a separate redwood look-up table for carbon credits, and this was being considered. Research priorities were agreed with Scion, including

re-measurement of permanent sample plots, updating the redwood growth model, establishment of Neldar Spacing trials and investigating the condition of stumps and roots between rotations for modelling early second-rotation carbon sequestration. Membership had increased, and although there had been few field trips the group was in good shape.

Indigenous Forest Section

Julian Bateson reported that the group met during the 2021 Conference, had a lively debate and AGM, and went on the field trip to Kaitoke where Jeremy Collins gave a run-down on the old native forest which is used as a water supply catchment for Wellington and the Hutt Valley. The group successfully applied to the Forest Growers Levy Trust for funds to monitor the survival of native planting and improve its effectiveness, as it can be enormously variable. Work will start in 2022 and if another application is accepted, will continue through 2023.

Forest Investors Action Group

This group met often and Hamish Levack produced a comprehensive report. Members helped write submissions, successfully applied for project grants from the Forest Growers Levy Trust, negotiated a substantial contract with Te Uru Rakau and acted as an editorial committee for the *Tree Grower*. When others were not available, members wrote many of the articles including ones on alternative species, land rights, safety, forest management and climate change.

Howard Moore is vice-President of the NZFFA.

WorkSafe notifications and a disturbing trend

Julian Bateson

Trees coming down? Make sure you give WorkSafe a heads-up. You need to notify WorkSafe before starting any tree felling or logging operations where money changes hands. By law, WorkSafe must be notified as commercial tree felling operations are classified as hazardous work. Failing to notify WorkSafe could put you at risk a fine of up to $50,000. If you have any problems or questions, contact WorkSafe on 0800 030 040.

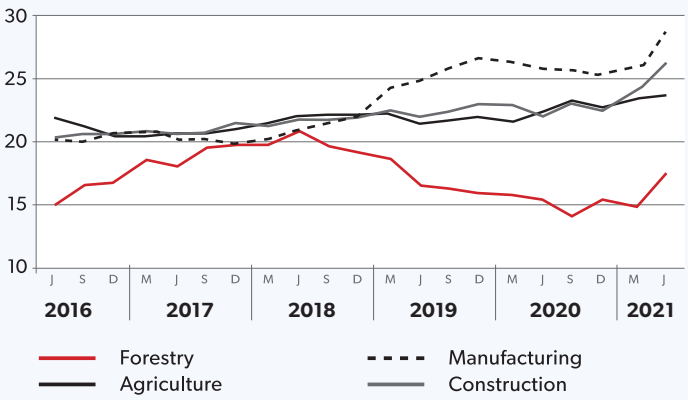
A disturbing trend

I regularly receive the quarterly reports on accidents and time off work due to injury from forestry and often let you know via *Tree Grower* how it is all going. For a while the serious injury rate has been on a downward trend, although still not as low as six years ago. However, if you look at the graph you will see a dramatic upward spike in the middle of last year. The figures are from almost a year ago as they need to be for accuracy.

The spike is significant for three of the four industries, slightly less so for agriculture, although agriculture still has almost 30 per cent more serious injuries per 1,000 workers than forestry. Why the spike in serious injuries? I have no idea and I hope it is merely a blip, but everyone should still be taking more care.

HOW DO WE COMPARE

RATE OF INJURIES RESULTING IN MORE THAN A WEEK OFF WORK



Rolling average last four quarters per 1000 workers

supported by forestgrowers commodity levy

Advances in cypress research
A summary of the activities of Specialty Wood Products

Marco Lausberg and Harriet Palmer

The Specialty Wood Products research programme draws to close in 2022. Species included are Douglas-fir, cypress along with durable and non-durable eucalypts. This article is about the results of the cypress research.

Two of the main objectives of the Specialty Wood Products programme can be summarised as being to –

- Develop new processing and product options to make the most of existing specialty species growing in New Zealand
- Make breeding gains to encourage new planting of specialty species to ensure a sustainable supply in future.

Total investment in cypress research in this programme from 2015 to 2022 is over $960,000. The research is in five main areas, shown in the table.

Project	Approximate percentage expenditure
Breeding	50 per cent
Processing	6 per cent
Durability	7 per cent
Site species mapping	22 per cent
Regional strategy development	15 per cent

Expenditure on breeding research is supported because of the continuing demand in New Zealand for quality timber used in indoor and outdoor joinery along with other high-value applications. Processing and durability work is justified to make the most of the approximately 10,000 hectares of cypress growing in New Zealand. The existing cypress processing industry has been based on old macrocarpa trees, the supply of which is now almost exhausted. New processing and product options are needed for what is predominantly a young, growing resource.

Cypress breeding

Almost half the spend on cypress over the past seven years has been in breeding research. Scion has led the breeding work, with a big input from Toby Stovold and colleagues. The NZFFA's Cypress Development Group has also become heavily involved. The work has built on earlier work by the Forest Research Institute which left a legacy of a large nationwide trial network with over 500 permanent sample plots still surviving in cypress stands.

The decline in the popularity of macrocarpa from the perspective of New Zealand forest growers, is understood and well-documented. New Zealand tree breeders have long been looking for canker-resistant macrocarpa, as well as testing closely related alternatives to macrocarpa – predominantly various *C. lusitanica* Mexican cypress, including the now relatively popular Ovens cypress *Cupressocyparis cv ovensii*, a hybrid of *C. lusitanica* and *Chamaecyparis nootkatensis*.

The Specialty Wood Products research programme, a seven-year partnership between Forest Growers Research, the Ministry for Business, Innovation and Employment, research providers and industry partners, draws to close in 2022. The August 2021 *Tree Grower* provided an overview of Specialty Wood Products objectives and activities. An important recent product is *Cypress Industry Strategy 2022-2042*, produced by the NZFFA's Cypress Development Group.

The investment in cypress breeding is leaving its own legacy, having completed all or part the following –

- *C. lusitanica* progeny trials were evaluated for growth and health, with new selections made to include seed orchards, bringing new seeds to industry over five to seven years.
- The third generation of *C. lusitanica* trials established in 2017. Two are new trial series established in the past three years with large-scale trials to test new *C. macrocarpa* genotypes identified as potentially canker tolerant and a series of small-scale trials to test 12 *Ch. nootkatensis* hybrids, managed by the Cypress Development Group and planted across a range of properties in 2021 and 2022. Trials will continue to be established with promising varieties promoted.

The Cypress Development Group has worked closely with Scion to establish hybrid trials over the past few years. They have also identified several strains of *C. torulosa* Himalayan cypress, which are being trialled with a view to producing the next generation of planting material. *Ch nootkatensis* and *C. torulosa* both appear to be canker resistant, with growth and form of some trial trees looking promising.

Growers are already benefitting from the new seedlings and clones being made commercially available, with more to come. The estimates are that there will be 100,000 plants for the 2023 planting season. The Cypress Development Group has also been experimenting with using tissue culture to propagate planting material, which in theory could lead to mass production, should there be sufficient demand.

Processing and durability

Much of the cypress research on processing and durability has been led by Scion wood scientist Rosie Sargent. Practical processing research has included the work to investigate the timber potential of young, unpruned and un-thinned cypress. Specimens of two cypress clones, one *C. lusitanica* and one *C. ovensii,* growing in a 22-year-old trial, were harvested and taken to Ruapehu Sawmills for milling. Volume recoveries were high with 51 per cent of logs harvested converted into graded timber. Over 90 per cent of the boards reached the top appearance grade.

If this timber can be made durable using thermal modification, as now seems possible, then it will open up multiple market opportunities. This provides encouragement to advocates of relatively short rotation, low-cost cypress regimes.

Two projects associated with this sawing study have also been completed. One is the construction of economic models of *C. ovensii* clonal regimes grown on short rotation no-prune, no-thin cypress regimes. The Cypress Calculator was used to analyse permanent sample plot data from a range of sites supplied by industry. Some options appeared to be profitable depending on site productivity, log prices and starting land values.

The other project used sawn *C. ovensii* timber from the grade recovery trial which was tested for bending strength and stiffness by Scion. In terms of bending stiffness, the *C. ovensii* achieved SG 6 structural grade. In terms of bending strength, it achieved SG10 structural grade, resulting in an overall grade of SG 6. A full suite of structural grade tests will need more timber, but these tests were a useful starting point to understand the potential applications. High-value joinery is considered the preferred potential end use, rather than framing or other load-bearing applications where structural grade is critical.

Durability research has focused on thermal modification of *C. lusitanica*. This involves heating timber to 220 °C and then testing the effect of this on durability and other properties.

Short duration and long-duration tests are used to determine durability. The interim 12-month fungus cellar results for *C. lusitanica* are very promising with modified heartwood and sapwood both showing increased durability over unmodified heartwood. They show similar durability to H3.2 treated radiata pine. Outdoor tests are under way.

Work on the dimensional stability of species, including cypresses, has also been completed. Dimensional stability is critical in terms of how wood performs in service.

Woodscape models

As part of the broader programme, Scion's Woodscape model has been used to assess the technical and economic potential of processing specialty species under a range of options.

Three analyses have been completed and provide early guidance on how future investment in processing could be made viable. The reports are recommended reading for anyone with an interest in developing specialty species supply chains.

The first report *Identifying processing opportunities for key specialty tree species – resource analysis* uses National Exotic Forest Description data for cypress, eucalypts and Douglas-fir to model regional wood flows up to the 2060s. This information is an essential precursor to running the Woodscape model as the economics of different processing options depend on the location and long-term stability of the wood supply.

Reports

The information outlined above was an important part of detailed regional technical and economic analysis of probable small-scale processing and drying options for Douglas-fir, *E. nitens, C. macrocarpa* and *C. lusitanica*. The best performing options were a small-scale cypress sawmilling option, around 5,000 cubic metres a year using solar kilns, and a similar *E. nitens* option but which was more sensitive to log prices.

A third report based around Woodscape was an analysis of producing thermally modified wood products from specialty species *Techno-economic analysis of producing engineered and thermally modified products from specialty wood species*. This concluded that a medium-scale processing operation with an intake of around 9,200 cubic metres a year, could produce thermally modified cypress cladding and generate a return on capital of 30 per cent and an internal rate of return of 16 per cent. This compares favourably with a range of other processing options for Douglas-fir and *E. nitens*. The cypress operation would require an estimated 75 hectares of forest to be harvested annually, meaning a total area of around 3,000 hectares of mixed-age forest to supply the operation.

An associated Woodscape report was produced for Hawke's Bay Regional Council. This used Wairoa as a case-study of a potential location for a specialty species processing operation.

Together these reports have under-pinned the concept of growing the specialty species industry in New Zealand via a network of planned regional wood supply catchments. In these, new planting and investment in processing would be encouraged with support from regional authorities and forest growers. A small-to-medium scale wood processing operation or hub would be located at the centre, each requiring 3,000 to 5,000 hectares of forest to be planted over approximately 30 years.

Up to 40 catchments spread throughout New Zealand could be established, each central hub having good transport links and a nearby population centre from where labour could be obtained. This concept may well form the basis of a future research and development programme.

The cypress strategy 2022 to 2042

The Specialty Wood Products original objectives included developing a series of business cases. In the case of cypresses, a business strategy has been produced, led by the Cypress Development Group. *New Zealand Cypress Strategy 2022-2042: Whakamahere Cypress* is available on the Forest Growers Research website.

Producing the strategy involved a number of stages. The first two involved consultation with large-scale growers, processors and the marketing sector, followed by a workshop which brought together large and small-scale growers, harvesting and marketing professionals, processors and retailers. The workshop identified the industry's strengths and weaknesses. Six main themes for future research and development work on cypress were agreed –

- Implementing a cypress forestry research plan
- Modelling forest productivity and economic feasibility
- Educating growers on cypress forest management
- Identifying markets for cypress timbers of all types
- Working regionally to encourage new cypress forests
- Building industry partnerships to enhance support and capability.

The strategy identifies immediate, five-year and 10-year research and development priorities under the headings of – cypress breeding, site productivity and growth models, silvicultural practices, erosion mitigation, carbon sequestration, market access and wood quality. The Cypress Development Group plans to lead this work.

Summary of cypress research reports	
SWP T141	*Techno-economic analysis of producing engineered and thermally modified products from specialty wood species*
SWP T138	*New Zealand Cypress Strategy 2022-2042: Whakamahere Cypress*
SWP T129	*Cupressus x ovensii bending strength and stiffness*
SWP T116	*Grade recoveries from sawing 22-year-old unpruned cypress clones*
SWP T115	*Economic modelling of C. ovensii clonal regimes for a range of growth rates*
SWP T112	*Cypress Forestry Strategy Stage 2 – workshop summary and next steps*
SWP T107	*Summary of SWP activity 2015-2022*
SWP T099	*Cypress Forestry Strategy Stage 1 – 2019-2020*
SWP T090	*Dimensional stability of specialty species*
SWP T086	*Thermal modification of specialty species: results of Scion's SSIF experiments*
SWP T073	*Identifying processing opportunities for key specialty tree species – processing options analysis using the Woodscape model*
SWP T068	*Identifying processing opportunities for key specialty tree species – resource analysis*

Overall summary

Development of all parts of the supply chain will be critical for the survival and growth of the cypress industry. Cypress have the advantage of already being an accepted and sought-after timber. For the cypress industry to succeed, a sustainable supply of good quality timber is needed. If this is to happen, growers need to be confident of a competitive return on their investment, which in turn should motivate them to plant more.

The gains made in cypress breeding by the programme over the past seven years will increasingly contribute to providing growers with planting material they can have confidence in. The Specialty Wood Products' processing and durability research has filled gaps in the knowledge of the suitability of cypress timbers for traditional and new markets. The Woodscape modelling work provides a much greater understanding of wood flows, processing capacity and the magnitude of investment in processing required for a sustainable specialty species industry to develop. Finally, the work that went into developing the cypress strategy provides a clear way forward and identifies priorities for the cypress industry.

Cypress-related technical reports

All the technical reports referred to in this article are freely available on the Forest Growers Research website. They contain a wealth of further information.

Marco Lausberg is Programme Manager of the Specialty Woods Products Research Partnership. Harriet Palmer is an independent forestry communications specialist.

Permanent forests in the Emissions Trading Scheme Why we need to set the record straight

Mathilde and Ollie Batelier-Belton

This article is the fourth of a series about the Emissions Trading Scheme. The discussions, articles and commentaries on the topic of permanent forestry have been overflowing lately.

It can be difficult to navigate what it all means, especially for land owners who are interested in permanent carbon forestry and want to understand the benefits and risks of getting involved.

As part of our series on the Emissions Trading Scheme, we have been focusing on the changes coming up in 2023. In this context, we think it is important to write about the role of permanent forests, what we can expect in the future and what it means for you.

The current situation

We are currently in a policy vacuum regarding registering permanent forests in New Zealand. Until 2019, it was possible to register any type of forest with the Permanent Forest Sink Initiative. This is the forefather of the Emissions Trading Scheme and was designed to protect carbon sequestration for long-lived forests and reward land owners growing them.

The Permanent Forest Sink Initiative will be discontinued in 2024. A new permanent scheme will be introduced in 2023 and is aptly named 'permanent post-1989 forest'. Since 2019 the only option available to forest owners who want to register their forest as permanent is to register with the intention to switch them to the permanent post-1989 forest in 2023.

The permanent post-1989 Emissions Trading Scheme activity has further restrictions compared to usual –

- You are not allowed to clear fell the forest for at least 50 years. Clear fell is defined as anything which involves harvesting more than 70 per cent of canopy cover within a hectare. If you breach this limit, you will have penalties in addition to repaying the units. This is a watered-down rule from the Permanent Forest Sink Initiative which only allowed limited harvesting on a continuous canopy basis.
- Permanent forests in the new scheme will only be based on carbon stock change accounting. This means they will keep earning carbon credits as the forest grows and you have to repay them if they decide to harvest after the 50-year period.
- You can leave after 50 years by signing in to averaging accounting or leaving the scheme but you will have to repay units in both cases, or sign in for another 25 years and keep earning units.

You should be aware that you do not need to opt a registered forest into the new permanent scheme to manage it as a permanent carbon forest. Forests already registered can continue to use the stock change carbon accounting method which we explained in detail in previous articles. Under stock change accounting, if you decide not to harvest your forest you will continue to earn carbon credits. The only difference is that you will not be able to sell your units at a premium in the voluntary market, in other words, to sell offsets to a polluter who would like to claim carbon neutrality.

The consultation and what it stirred

The government's consultation on *Managing Exotic Afforestation Incentives* released in April has been motivated by a fear that permanent pine forests will blanket the whole of New Zealand. We have released an official response to this consultation, but here are a few points we think are important to bring forward when it comes to this problem.

New Zealand is known for its poor record on climate action over the past three decades. Yet this consultation underlined that the country wants to ban one of the main solutions available, if well managed, to address the urgent climate crisis, without having to purchase millions of credits offshore to meet our climate

targets. The Emissions Trading Scheme is branded by the government as being the main policy to reduce greenhouse gas emissions. But half of New Zealand emissions are not yet covered by the scheme while, at the same time, the government wants to ban exotic forests from being permanent. This does not make sense to us.

More than pine

Overall, the consultation and wider debates have proved to show a lack of thoroughness in defining what the problem could be. This has led to a lack of nuance and a failure to properly consider the complexities related to forestry in the Emissions Trading Scheme. This is by proposing a simple and binary solution – banning exotic forests from being permanent, which is ill-adapted to be beneficial from environmental, social and economic perspectives.

In addition, the debate around exotic forests keeps conflating the term exotic forest with radiata pine. However, these concepts are different and should therefore be treated differently.

There is a significant number of varied and diverse exotic forest types which include many tree species which have a very long lifespan and proven environmental benefits. The focus must be on planting and appropriately managing exotic and indigenous species that have a comfortable life expectancy of at least 100 years.

Forest management

The whole debate around permanent forests in the Emissions Trading Scheme falls short of reflections around the importance of forest diversity – diversity in planting, diversity in the management of registered forests and diversity of ways to tackle the climate and biodiversity crises we face. This all-or-nothing approach goes against the scientific consensus and advice which show that tackling climate change and our biodiversity crisis will be by adapting our responses locally, through and within national frameworks. Any planted monoculture can be harmful and damaging for the environment, whether they are exotic or indigenous.

We believe that the solution is around forest management plans and making them mandatory, rather than attacking a specific kind of tree species. Any forest species which aims to be registered as permanent should have a thorough management plan, detailing the steps to protect the forest from pests, and the benefits it will produce for the local community. A forest can only contribute to the surrounding community, economically by providing jobs, environmentally by increasing biodiversity and providing other environmental benefits such as erosion control, socially and in terms of natural capital by being well managed.

What is coming next?

Rumours from Wellington indicate the government were surprised at the fierce backlash on the proposed exotic tree ban from Maori, farmers and foresters in general. We are hopeful that reason will prevail and the politicians will choose the middle path. In other words provide a scheme which permits any tree species to be registered as permanent, but requiring a clear management plan to achieve long term environmental, economic, and socially positive results.

We expect a decision to be announced before the end of the year. Regardless of the current uncertainty or the result of the consultation, we would remind those planning new projects that forestry, especially permanent forestry, involves playing a very long game. One thing we can be certain of is that ministers and Emissions Trading Scheme policy will change many times throughout a forests life. If you have a vision and passion for long lived forests, it is best to not get too bogged down on what is happening in Wellington and plant those trees.

Ollie Batelier-Belton is the Managing Director of Carbon Forest Services an expert consultancy specializing in carbon forestry. Mathilde Batelier-Belton is a Director and General Manager at Carbon Forest Services.

Native birds in exotic conifer plantations

Nick Ledgard

I worked as a forestry researcher for all my professional career, but I have been a keen amateur birdman for longer than that. I still have the bird box from my school days which has drawers of fragmented birds' eggs and the collapsing skulls of storm-killed seabirds collected from many dozens of days spent combing the beaches of western Auckland. Further inland, I was part of surveys for forest birds such as kokako in Pureora forest, and in Waikaremoana National Park I joined a Wildlife Service team which searched unsuccessfully for the piopio or native thrush. More recently, down in the South Island, I have been the chair of two volunteer groups with the mission of promoting the well-being of shore birds which breed in braided rivers.

I relate this background in order to cement my credibility for writing about birds and exotic forestry, as the topic can attract statements from ill-informed commentators, often claiming extreme examples to be the norm. In a 2019 *Farmers Weekly* article a '50 Shades of Green' farmer describes plantations as 'a bloody great green desert of pine trees'. We have all read or heard similar statements elsewhere.

On the other hand, I have heard pine forest advocates stating that plantations are 'alive with the song of native birds'. Both claims have elements of truth, but in reality the variability is rife and the true situation rests in between.

Survival is number one

The prime motivation of all wildlife is survival, and essential to that is successful feeding and breeding. In the case of native birds, if suitable habitat is offered by exotic plants, they will make use of that.

Outside the window in front of me right now I can hear two bellbirds calling. I know that at this time of the year, autumn, they are here for three main food sources – flowering eucalypts and grevilleas and the juice or flesh of maturing apple and pears. As a result, I do get annoyed when I am told or read the oft-stated and illogical claim that in order to attract native birds, you must have native plants.

Plantation management

There have been a number of studies about what introduced conifer plantations need to maintain a native bird population. A good summary is in a 2018 Landcare Research report titled *Conserving indigenous fauna within plantation forestry landscapes* written by Paul Peterson and Ella Hayman. The authors highlight that a key to success is maintaining a variety of tree ages and plant communities.

Young plantation stands are structurally simple and homogeneous, but from an early age can support insectivorous birds such as fantails and grey warblers. As stands age and structural complexity develops, more site sensitive insectivorous hole-nesters such as rifleman can start to colonise. Finally, if left unharvested, a range of other forest species, including nectivores such as bellbirds, kaka and tui, and frugivores such as kereru and kokako, may also arrive especially if there is a well-developed native understory.

Therefore, if plantation managers want increased bird life, they should retain a mosaic of pine stand ages including stand edges, clear-fell areas, young planting and stands over 20 years old. If conservation of indigenous forest dwelling bird species is a core management aim, then older stands must be well represented throughout, as well as retaining any native forest or shrub remnants, however small.

A few case studies

In order to reinforce confidence in native bird existence within pine plantations, it is worth considering some case studies.

Kaingaroa forest

Not very long ago Kiangaroa was the world's largest conifer plantation. In his 1992 book *A living NZ forest*, Robert Brockie wrote

> 'Tall forest on Little Barrier Island carried 532 to 680 pairs of natives [birds] per 100 hectare …… pine forests at Kaingaroa also supported high numbers of native birds. It was found that mature radiata pine forest supported up to 652 pairs of native species/100 hectares – more than any native forest on the mainland. If introduced birds are included, the mature radiata forests at Kaingaroa supported 1203 breeding pairs/100 hectares – the densest forest bird populations recorded in NZ so far – except for the 71 bellbirds/hectare on one of the Poor Knights islands.'

In the 1960s I worked as a forestry trainee in Kaingaroa forest and well remember the dense and healthy native plant understory beneath old growth pine remnants. In fact, if not for the needle litter and wide-spaced large stems, you would think you were in a native forest.

I realise now that it was this mix of understory vegetation and canopy pines which was so attractive for birds.

Silver Peak forest east Otago

This has long been known as an isolated hotspot for the South Island robin. The forest of 100 hectares is mostly Douglas-fir with a little radiata pine. Apart from the native Silverstream forest of 120 hectares which is 11 kilometres away and has a similar population of robins, the next nearest populations are in native forest much further inland.

Studies at Silver Peak and Silverstream have shown that there was no significant difference in the number of robins found in the Douglas-fir compared with the native forest. Robins were attracted to conifer stands because they prefer structurally simple, monospecific forest with dense and even canopies and extensive areas of ground covered by leaf litter. Robins were found in radiata pine forest, but there were significantly more in the Douglas-fir, which they obviously preferred.

Plantations with kiwi, kakapo and kokako

The birds kiwi, kakapo and kokako are arguably our best known endangered native birds.

Kiwi

There are many reports of kiwi living in plantations, but the most memorable involves Waitangi Forest, which was probably the first to be recognised as a kiwi haven. Integral to that is the variable nature of the forest, which contains many native forest patches and gullies. In the early 1980s it was estimated to have 800 to 1,000 kiwi living as an apparently stable population within a commercial pine forest.

Unfortunately, that was to change dramatically in a very short period of time due to the arrival of a single German shepherd dog. Within a few months in 1987, it is estimated that that dog killed as many as 500 kiwi. This was calculated because it just so happened that kiwi with transmitters were being studied at the time and 13 of the 23 study birds, more than half, were killed by the dog. The killing stopped once the dog was shot.

Kakapo

Nine kakapo were released on to Maud Island in the Marlborough Sounds between 1974 and 1981. Among them was Richard Henry, the only living Fiordland-caught bird, and probably the best-known of all kakapo. He had not bred for 20 years when he was put onto Maud Island. However, soon after arrival he mated with Flossie and they raised three chicks.

This surprised everyone, but as Alison Ballance in her book *Kakapo* wrote

> 'The second surprise was where (they) chose to nest – in a pine plantation! (Flossie) continued to confound observers – when it came time to feed her three chicks, she chose to feed them on an exclusively pine diet: buds, young cones and even needles. The chicks piled on weight, tracking well above average on standard kakapo chick growth charts.'

Subsequent to this discovery, young radiata cones became an accepted part of artificially feeding kakapo chicks. Simon Rapley, currently of the NZ Redwood Company, but at the time the Canterbury Forest Manager for Carter Holt Harvey forests, was asked by Don Merton of the Department of Conservation to collect young radiata cones for transport to Codfish Island for including in foods fed to kakapo. Simon did that for three years.

Kokako

Reports of kokako in pine plantations reached the Forest Research Institute in 1983. The reports came from three forests in the central North Island, and in all examples the birds were in mature pine stands planted adjacent to known native forest kokako habitat. Unpruned pines have regular branches and foliage structure which is well suited to the bounding movements of kokako. Pines also offer good overhead cover, giving some protection from aerial predators such as the Australasian harrier and New Zealand falcon.

The kokako visit pine stands to sing and feed on insects and other invertebrates. Older stands, around 12 years and older are preferred, but nests are nearly always in native forest. One bird lived exclusively in pine forest for over four years. A 1991 report suggested that the fast growth and easy tending of pine forests could be a valuable method for rapidly establishing connections between isolated native forests containing kokako.

Conclusion

There is a definite role for conifer plantations as habitat for native birds. The best examples are forests with a variety of tree ages, along with patches of unharvested mature stands and remnants of native woody vegetation. Needless to say, achieving this requires some rethinking of traditional plantation management, especially as complete clear fell harvesting of forests every 30 years will not encourage representative, specialist, indigenous forest animals to develop.

Nick Ledgard is a keen amateur birdman.

A guide to one of the native trees
Red beech – Tawhairaunui – *Nothofagus fusca*

NZFFA

You should now be aware of the species guides prepared for helping new growers understand which tree species would probably do well on which sites. The NZFFA have produced nearly 30 of these guides, all available on the website. They cover most common timber trees including some natives. Little by little they are being featured here in *Tree Grower*.

Tawhai is the Maori generic name for the beeches. Raunui refers to the large leaf, so the literal translation of tawhairaunui is large-leaved beech.

Red beech produces a strong, durable native hardwood timber and is found naturally in cooler areas from the Bay of Plenty to Southland. It is a reasonably fast-growing tree compared with other native species reaching 30 metres in height and up to two metres in diameter. It lives for over 500 years, tolerates cold and drought and will grow on land up to 1,000 metres above sea level.

Red beech encourages insects which generate honeydew. This is a food source for bees and many native birds, but also unfortunately by wasps.

Site preparation and planting

Red beech regenerates well in natural forests and establishes easily from seed. It has a relatively fast growth rate and is a suitable choice for native timber plantations in cooler climates. The seedlings are susceptible to drought and hard frost and establish best if planted in partial shade and shelter, such as within canopy gaps. Survival in the open may be enhanced by using short shelters or a nurse species such as manuka established a few years earlier.

Prepare grass sites by clearing a one metre circle for each planting site using spray or a spade. If you use glyphosate herbicide a few days before planting this will not leave chemical residue in the soil. Prepare spots using straight lines and measure spacing between the spots so that young trees can be easily found later. Cut down woody weeds and flatten these on the ground so they decay and do not support weed growth.

Planting

Trees are generally available from commercial nurseries as container grown stock. Price per tree should range from $2.50 to $5.00 for contract-grown forestry stock. Plant as soon as possible after you receive the plants. Make sure the root plugs are moist and plant the trees with a slow-release fertiliser tablet or put a trowel of high nitrogen fertiliser in a spade slit above the seedling.

Dig a hole twice the size of the plant container, leaving some soft soil at the bottom. Tease out then straighten and trim the roots, place the tree in the hole before firming the soil ensuring there are no air cavities, then gently pull the seedling up to ensure the roots are straight and pointing down.

Red beech is a reasonably shade-tolerant hardy pioneer species but is frost tender on very cold sites when young and can also succumb to drought. On colder sites plant in early spring, in warmer areas with no hard frosts plant from autumn. It will establish on open sites, but if some side shelter is provided, will be taller and less bushy with improved timber properties such as fewer, smaller knots. A nurse species which grows quickly but not too tall, such as manuka or kanuka, can be planted to provide side shelter. The nurse crop should be planted a few years before so that shelter is well established before planting the beech.

Spacing for planting beech as timber species in an open site is 2,000 a hectare – two metres by two-and-a-half metres apart. The higher the number of trees planted, the greater the selection ratio for retaining only the biggest straightest crop trees.

Establishment and maintenance

Remember to prevent weeds from competing with the red beech seedlings for at least three years after planting. You also need to provide protection from browsing by stock and other animals such as rabbits and deer.

Ensure the newly planted tree gets enough light, moisture and nutrients to establish unimpeded. Maintain young trees by clearing weeds around them for at least two years or until they are well established and growing. Native trees are slower growing than non-native plantation trees and may require weed control for several years so that they do not become smothered by early weed competition.

Overhead shade slows down growth. For good growth rates make sure that some direct sunlight always reaches the top of the tree. Climbing plants and dense woody weeds can overtop young native trees and may require manually cutting back to provide a light-well for the young tree to grow up through. Where red beech regenerates with manuka and gorse it will overtop these species within two or three decades, sooner if there is sufficient light.

Grazing and browsing

Beech is susceptible to browsing by stock, goats and deer so fence the area to keep them out. A single hotwire electric fence will deter most cattle, but it is better to construct a full post and wire fence. Beech is not a preferred food of possums but is palatable to rabbits and hares. They will slice off trees near ground level at a 45-degree angle.

Pests and diseases

A native pinhole borer attacks stressed or damaged red beech trees and moist harvested logs, drilling pinholes in the wood. Healthy trees will survive an attack but the pinholes can allow fungi into the sapwood, which can damage the timber and sometimes kill the tree. In the North Island, trees can also be attacked by the larvae of the puriri moth, which bore relatively large holes and also let in fungal pathogens. The kanuka long-horned beetle attacks saplings in both islands.

Many native leaf-eating insects feed on beech canopies. Red beech also attracts scale insects which feed on sap and produce honeydew, resulting in a black sooty mould growing on the excess nectar. The trees have evolved sufficient hardiness to survive most of these attacks.

Management and silviculture

Red beech is among the faster growing of native species and is one of the more promising for plantation timber. Natural beech forests also provide watershed protection. Although the trees tend to have shallow roots, the roots of closely spaced trees will interlock, making them wind-stable and suitable for exposed, eroding hill country. Red beech does not coppice and the stump dies when the tree is felled.

If grown under full light conditions red beech will become heavily-branched with multiple leaders or shoots unless carefully form pruned. Close spacing provides better height growth and small branches but with a reduced diameter growth rate. Even at high stocking rates red beech may require pruning to help it to grow a straight trunk.

If grown for timber, prune at regular intervals to encourage a single dominant leader, and prune the trees every two years to prevent the lower branches from getting too big. Pruning can begin once the trees are well-established and above the height of any competing weed vegetation'

Clearwood pruning

The aim of clearwood pruning is to reduce the diameter of the defect core and produce wood free of knots. Pruning must be regular and undertaken at a frequency which minimises branch size and diameter over stubs. Ideally, only final crop trees would be clear-pruned. The smaller more horizontal branches on lower stems of red beech established within a highly-stocked stand around 1,600 per hectare will generally self-prune when they are shaded out. Larger, upward pointing branches should be removed as soon as possible as they will reduce

height growth and increase defect core diameter.

Pruning should be completed a year or two before thinning to reduce the likelihood of shoots forming on the pruned stem, these are called epicormics. The pruned tree often attracts deer wanting to rub velvet from their antlers, resulting in ringbarking of the trees. Deer control is necessary to prevent this.

Thinning

Close spacing provides better height growth and small branches but with a reduced diameter growth rate. Thinning is required to reduce the number of trees per hectare and encourage diameter growth in the remaining crop trees. Red beech trees are relatively light-demanding and require light to grow well. However, if open grown, red beech will tend to be heavily-branched.

Thin as soon as the canopy has closed and before the trees get too tall, at around eight to nine metres in height. Stocking should initially be reduced to around 1,100 to 800 stems a hectare, around three or four metres apart, by removing poorer quality trees. Thin again once the canopy closes a second time, about six years later, to a density of around 500 to 600 a hectare approximately four to five metres apart. The trees could be left at this density, or later given a third thin to as low as 200 a hectare or around seven metres apart.

When to harvest

A survey of beech plantations on a range of sites shows that mean diameters of 50 to 60 centimetres can be achieved within 100 years of planting. The owners of the Woodside property in Oxford, North Canterbury, have produced 45 cm diameter black beech sawlogs over rotations averaging 50 to 55 years. A 60-year rotation is suggested as a minimum for red beech and a continuous cover regime with selective harvesting is recommended.

Timber use

Red beech is a durable medium density hardwood with fine, straight grained and even textured wood, sometimes with attractive figuring. It is difficult to dry because it shrinks when drying and may warp and split. However, once dry it is strong and stable, machines well, is resistant to borer and can be used for flooring, joinery and furniture. The heartwood is ground-durable and was historically used for pilings, sleepers and fence posts, while the sapwood was used extensively for building.

Red beech heartwood is compliant in the building code for durability in internal structural applications, flooring, exterior decking and weatherboards. Harvested beech logs are quickly attacked by pinhole beetles and tend to split unless milled soon after felling.

South Island sawmills trade red beech. Harvesting red beech is controlled by the Forests Act and must be undertaken sustainably. Planted red beech may be harvested for timber without controls if the owner has obtained a certificate from the Ministry for Primary Industries.

Growth and economics

Annual growth rates of planted red beech usually range from 30 to 60 cm in height, although can be as high as a metre on good sites, and can be more than a centimetre in diameter. A survey of stands gave average heights of 16 to 17 metres 40 years after planting and 18 to 20 metres after 60 years. Samples averaged 30 to 40 centimetres in diameter at breast height after 40 years and 50 centimetres after 70 years.

No published calculations show return on investment for growing red beech for commercial purposes. However, a simple calculation based on a carbon price of $30 a unit suggests earnings from carbon credits might overtake the costs of establishment after 20 years. The assumptions used were –

- Establishing 400 a hectare at $5 per tree or $2,000 a hectare
- Cost of capital at five per cent
- The price of carbon $30 for a New Zealand Unit
- Excluding the costs of land, rates, management and compliance.

Since this calculation was made the carbon price has risen significantly and is currently around $70 a unit.

If the land is registered under the Emissions Trading Scheme and the trees are planted to comply – at least one hectare, with tree crown cover of more than 30 per cent in each hectare and an average width of tree crown cover of at least 30 metres – then they should earn carbon credits. The relevant tables for determining how quickly they store carbon and earn credits, and guides to how to use the tables, may be seen on the Ministry for Primary Industries website. Red beech stores carbon over its first 30 years at a rate of approximately one third as fast as radiata pine.

supported by forestgrowers commodity levy

Predicting the shape and volume of *Eucalyptus globoidea* heartwood

Daniel Boczniewicz and Euan Mason

What do eucalypts have in common with sauvignon blanc? Why will durable eucalypt posts be a critical part of New Zealand's vineyard landscape in future and how do taper and volume equations help tree growers to produce them? Researchers at the University of Canterbury School of Forestry have produced a new model which accurately predicts the volume of durable heartwood in the stems of one durable eucalypt species *Eucalyptus globoidea*.

This story starts in Marlborough, New Zealand's largest wine region. To protect vineyard wood posts against decay when in contact with soil, most are given a copper chrome arsenate treatment. This is a toxic substance and disposal after breakage can be difficult because wood treated with copper chrome arsenate is hazardous waste.

Many wine drinkers would prefer to purchase wine from grapes grown in vineyards that used posts which do not require such treatment. The same treatment is routinely applied to pine fence posts and poles. If a naturally durable alternative was available many other growers currently using treated pine, such as farmers, apple and kiwifruit growers, will prefer it for their fencing and trellis structures.

Predictions

The research focuses on durable eucalypts from which timber provides a naturally durable alternative. After studying New Zealand-grown *Eucalyptus globoidea* taper and volume, we have created a model which predicts the shape and size of the heartwood, which is the part of the stem suitable for durable posts. The research also provides crucial information about monitoring and maximising heartwood production.

Individual tree taper and volume equations are essential for forest management. They provide estimates of volume, using diameter at breast height and tree height. This data is incorporated into volume equations and also into growth and yield models to estimate volume per hectare in forest crops.

Taper models show the shapes of tree stems by predicting diameter at any given height. Compatible taper and volume equations mean that the same individual tree volume can be estimated from the tree volume equation. When logs are cut from a modelled stem in a stand simulator, the taper equation can be used to provide estimates of shape and volume of individual logs. This type of analysis allows growers to estimate value of their forests at harvest more accurately than if they simply had estimates of overall stem volume.

Equations

Durable eucalypt species such as *E. globoidea* have especially valuable heartwood. Therefore, managers require estimates of the volume and shape of heartwood zones within trees. Simple overall wood taper and volume equations would be inadequate.

In our study, 74 *E. globoidea* trees were destructively sampled in eight different trial plots throughout New Zealand. Tree ages were between seven and 29 years old, the diameter at breast height was between 11 cm and 67 cm and the height, seven to 35 metres. All trees were felled, with length and taper diameter outside the bark measured. To measure taper diameter of heartwood and sapwood, discs were cut at intervals along the stems. Heartwood and sapwood were identified by applying methyl orange dye and the quantity calculated using image analysis on a computer.

Taper and volume equations usually estimate all wood in a stem, but we wanted additional equations that would provide estimates of heartwood, sapwood, bark, and all of the stem including the bark. For convenience, people want simple, overall stem-wood volume


The authors confer during an initial assessment


After the trees were felled, they were carefully measured and location of sample discs marked


Heartwood is clearly visible in the disc

Staining the heartwood makes it easier to measure

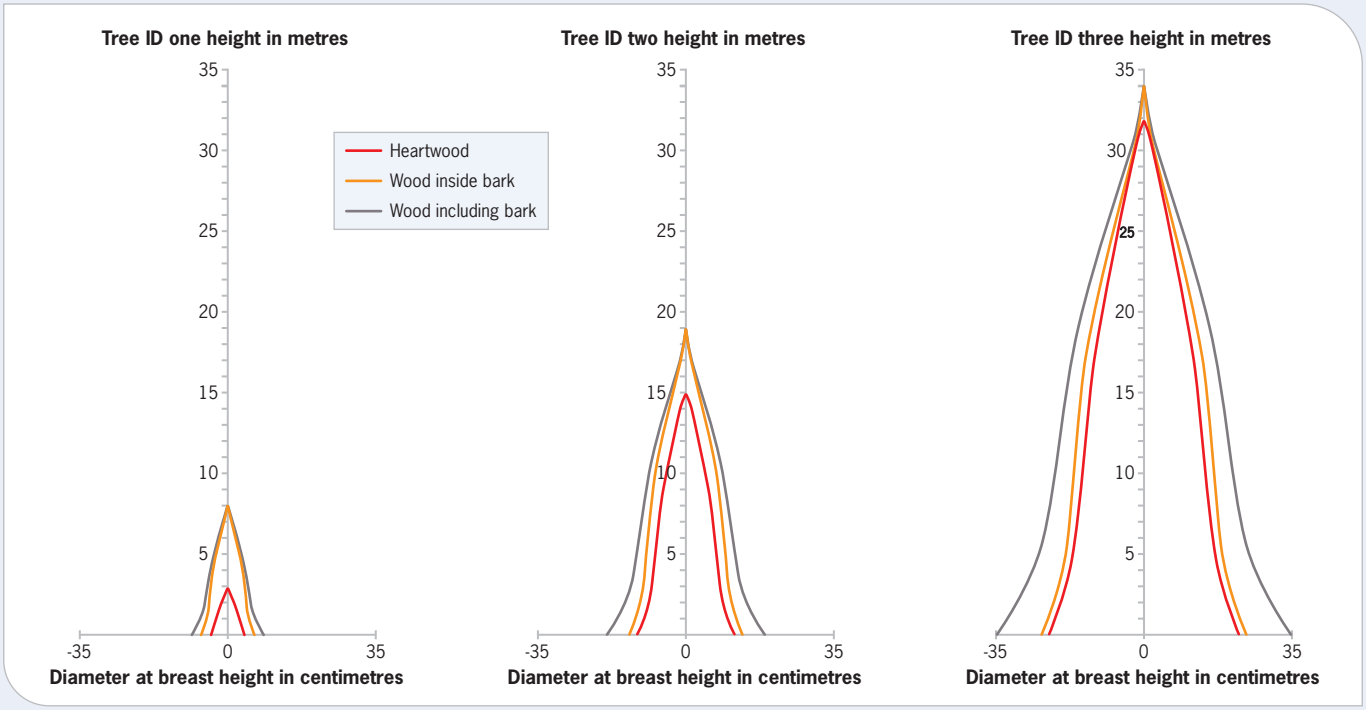
equations as well as volume equations for different wood types. If estimates of all the component parts of a tree stem did not add up to the estimate in total stem volume it would be inconsistent.

Inconsistensies

To solve the problem, we used statistical methods which allowed us to make all the volume equations simultaneously, ensuring that there were no such inconsistencies. In addition, volume can be estimated either by a volume equation or by integrating a taper equation. In this way we ensured that all taper equations were consistent with the more easily used volume equations.

This means that a forest grower can use the simple volume equations to estimate the volume of total stem, total wood, heartwood, sapwood and bark. If they use taper equations to estimate shape and volume of logs cut from the stem, the volume of wood types estimated within all logs will add up to total stem volume provided by the simple equations

Results from taper and volume were combined and used to create a spreadsheet which can produce tree shapes including three components of heartwood, wood inside bark and wood including bark. The user inputs the tree diameter at breast height and the overall height. If they are within the model range then the spreadsheet will show 'OK'. If they are beyond the range of the model then the word extrapolated will appear. The height of the heartwood is predicted along with shape of different wood zones and plot predictions in graphs.



The graph above shows that as trees increase in size the proportion of heartwood increases. A further result from the model suggests that trees grown at wider spacing, and which have a larger diameter at breast height for any given height, will have a higher proportion of heartwood. This has been corroborated by studies in eucalypts in Australia.

New to forestry

The techniques we have developed to create these models are new in forestry and we see potential to develop similar ones for other species such as totara, *Robinia,* a range of durable eucalypts and those which have valuable heartwood. We have made a preliminary model for *E. bosistoana* from a small sample of trees that suggests the two species may differ markedly in their capacity to grow heartwood.

Further steps in this research are to make the models sensitive to tree-core estimates of sapwood depth for those who wish to sample using tree cores. They will also extend them to create whole stem and heartwood models which work alongside growth and yield models so that heartwood yields from whole woodlots can be estimated when trees are measured and when they may be harvested.

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Daniel Boczniewicz is a PhD student and part of New Zealand Dryland Forests Initiative's research team at the School of Forestry, University of Canterbury and Euan Mason is Professor at the School of Forestry.

Branch and special interest group contacts

All the branches and special interest groups now fall into the same category in the NZFFA rules. This should not make a lot of difference but it does make it easier to set up new special interest groups. All the contact names listed below for branches and groups are the relevant secretaries.

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Are you a member of the NZFFA?

The New Zealand Farm Forestry Association has been around for over 50 years and has around 2000 members. There are 32 active branches and special interest groups.

If you are reading this issue of the *Tree Grower* you are probably already a member, but could well just be a casual reader or subscriber. If you are a member of the NZFAA, you could make a gift membership to a friend or relative.

The cost of joining starts at $90 a year. You are welcome to join even if you have no trees.

Why join the NZFFA?

Tree Grower

You will get four copies a year of the *Tree Grower*, the best source of information about growing trees in New Zealand.

Field days

Your branch will hold regular field days where you can see what other farm foresters have grown, where they may have made mistakes, and what trees grow well. This is an opportunity to mix with other like-minded tree growers.

Action groups

If you want to know more about cypress, eucalypts, redwood, blackwood or indigenous trees, then you can have the opportunity to join one or more of these groups. Many are involved in field trials that you can join and help with.

Annual conference

This is held in a different region every year. The conference is mainly field days and gives attendees the chance to visit farm forestry properties, QE II Trust covenanted areas, logging sites or other places of interest. It is also an opportunity to attend the AGM, meet up with up to 200 other members of the NZFFA and have a good time.

How to join

Joining is very simple.

Copy the form below, complete the details and send it to: NZFFA, PO Box 10 349, The Terrace, Wellington.

You will get some free back issues of *Tree Grower* and all your membership privileges. If you have have no trees or have up to 10 hectares of trees the membership cost is only $90. For 10 to 40 hectares the cost is $145 a year. For over 40 hectares of trees the cost is $220 a year.

I would like to join the NZFFA ❑ $90 a year ❑ $145 a year ❑ $220 a year

Please debit my credit card: ❑ Visa ❑ Mastercard

Number: ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ Expiry date: ☐☐ / ☐☐

Name on card: _____ Signature: _____

Address: _____

Email: _____ Phone: _____ Postcode: _____