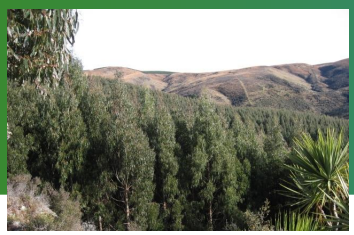

DIVERSIFIED SPECIES THEME UPDATE

Number: 05

Theme Leader: Patrick Milne

Date: March 2011

Meeting held in Rotorua, 22 March 2011

SUMMARY

The underlying goal of the Diversified Forests Theme is just a few steps away. Within a short time we could see at least two new species being planted on the same scale as radiata pine during the boom years.

For cypresses, the only weak link in the growing/processing/marketing chain has been canker; new canker-resistant clones are now being generated, and these will provide benefits (especially wood performance and durability) even greater than those we have come to know and love. For eucalypts, new sawing techniques allow this wonder-genus to challenge radiata pine's profitability on all sites where it performs well – and that's even without its superior carbon payments. And redwood continues to sell at staggering export prices.

This article was written by:
Piers Maclaren, Piers Maclaren & Associates Ltd for FFR Diverse Species Theme Members

Background

Heidi kicked off the meeting by reminding members of the purpose of this Theme (there are always newcomers or those with weak memories). The Theme aims to move away from the 'one size fits all' approach for wood production, and to match species with site and end use. This should produce a wider range of forest products and reduce the risk of single-species dominance from biodiversity and market threats. The landscape variety should appease the public – uneasy as they are with our hillsides of unbroken pine – and enable the forestry sector to retain its 'licence to operate'.

Douglas-fir

For the highlights of the programme, Heidi started with Douglas-fir – which of course is the flagship of the Theme – by announcing that the 500 Index has now been incorporated into Forecaster. Most members of the forestry sector have become very familiar with radiata pine's 300 Index and the huge range of opportunities it offers. The 500 Index for Douglas-fir gives the same capability. We can now ask why a nationwide Douglas-fir 'productivity surface' fails to give a good fit – what really drives growth in this species? Possibly, the poor performance of the surface is because Swiss Needle Cast disease has caused a lot of 'noise'. The ETS carbon plots could be used to bolster the dataset, but we still need PSPs on more extreme sites: working out where – and why – Douglas-fir fails could be as important as knowing where it succeeds.

John Lee reported on the study that looked at using laminated veneer lumber (LVL) from thinnings. The purpose was to discover a profitable use for such thinnings, given that Douglas-fir stands are horrendously expensive to thin to waste (stiff branches and tight stockings make trees 'hang up'). John's conclusions were that, although LVL is successfully made overseas from Douglas-fir, typical thinnings from New Zealand have insufficient piece-size to justify the process. Besides, it was pointed out that an existing export market for such material has just appeared (thus negating the original purpose of the project) – and in any case the Chinese can make LVL cheaper and better than we can. Dave Hilliard argued that Douglas-fir LVL is never used without some cross-bonding or with a mixture of species, so the important research is to identify suitable glues for this purpose. There was also a suggestion that Douglas-fir LVL (stiffer than radiata pine) would be an ideal choice for the proposed rebuild of Christchurch in high-tech multi-storey wooden structures.

Cathy Hargreaves gave an update on her internationally recognised work in tissue culture of Douglas-fir. Things are looking good, with rejuvenation a distinct possibility. In other words, from a superior mature tree (or, better, material from a 'plus' tree clonally tested in a number of locations), we will soon be able to supply growers with

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DIVERSIFIED SPECIES THEME UPDATE

thousands of genetically identical plantlets – in their rejuvenated form. Weyerhaeuser has commissioned Chinese scientists, with considerable success, to research this. Thanks to Cathy's impressive international contacts (and natural charm?) she is readily able to learn about overseas achievements as soon as they occur, and attempt a repeat here in New Zealand – despite operating on a peppercorn budget. Which is not to say she has achieved nothing noteworthy herself?

In question time, Shaf van Ballekom argued that it may be better to plant higher stockings of easily obtainable climbing-select trees – and to achieve selection by thinning – rather than planting fewer but better plants. Mark Dean said the real problem was wildings, to which Cathy replied that the technology is there to turn off flowering – without using foreign organisms and therefore breaching the "GE-free NZ" policy. But Mark replied that growing a seed-orchard full of sterile trees would not be a quick route to riches. Others commented that any vegetative multiplication (whether for SNC-resistance, high stiffness, or sterility) would result in expensive cuttings that would be unprofitable to grow.

Heidi then reported on trips she has made to conferences in Freiburg (Germany) and Orleans (France). One interesting point was the distinct market preference for pruned logs. They can achieve $400/m^3 stumpage, although only with very old trees. In New Zealand, the industry has chosen not to prune, believing there would be no demand for clearwood in a structural species.

Douglas-fir clearwood- $400m^3 at mill door

Heidi described how the trees, to appease public sentiment, were grown in small patches rather than large stands – but there was still hostility towards any introduced species. Lastly, she unveiled a model for predicting within-tree density and MOE distributions. This was obtained from 20 trees on three sites in the Pacific Northwest and needs to be validated in New Zealand.

Douglas-fir harvested from small patches

Cypresses

The technical meeting yielded only one presentation on cypresses but the field day (more later) provided more information. Trevor Jones reported on the durability of cypress heartwood using near-infrared spectroscopy. It is important to use such techniques because only quick and large-scale screening of trees and boards will enable us to understand and document the great natural variation in durability that occurs.

To refresh the memory (this study has previously been reported), two cypress species (*C. lusitanica* and *C. macrocarpa*) and several clones of Leyland and Oven's cypress were grown in both Hawke's Bay and Southland. The variations in diameter at breast height, heartwood content, and weight loss were compared. Diameter differences were confounded by canker and dissimilar stockings; fungal decay resistance was similar for all material; Southland may produce less durable wood than Hawke's Bay, but the comparisons are not sufficiently robust to be certain. Some results, however, were more definitive: *macrocarpa* had more heartwood than *lusitanica*; inner heartwood – as was to be expected from studies of other species – is significantly less durable and more variable in its durability than outer heartwood; some *lusitanica* is considerably less durable than the average – particularly if inner heartwood is used.

Why is inner heartwood less durable? Trevor said that it was because fewer extractives were produced by younger trees, and in addition the older material (ie the inner heartwood) might have suffered some leaching loss. A member questioned whether cuttings of aged material would produce more of the key extractive – tropolone – but the answer is not clear.

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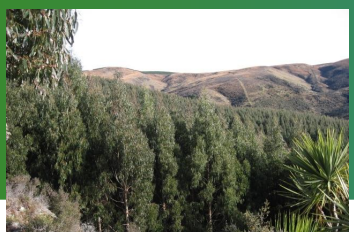

DIVERSIFIED SPECIES THEME UPDATE

From overseas studies with Western Red Cedar, there seems to be a reasonably tidy relationship between tropolone content and measured weight loss, indicating that spectroscopy to quantify this chemical could give us an indicator of likely durability. But, because the original study had many samples with very low tropolone levels but still with high durability, there must also be other factors (or chemicals) at work. This may explain why NIR calibration models gave poor prediction of decay resistance, except to segregate out material that was markedly less durable.

Trevor then fielded questions about the implications of durability with tree height (it varies with height); possible synergism of canker resistance and rot resistance (don't know); and the durability scale used (cypresses are equivalent to the upper end of Class III, ie moderately durable in ground contact).

The Field Day took us to an entire Kaingaroa compartment planted in Oven's cypress – interspersed with a cypress clonal trial. This was most interesting: rather than testing the material that nature has fortuitously provided on English country estates, these parents were carefully selected from superior trees. These were from the well-known antecedents: *Cupressus lusitanica*, *Cupressus macrocarpa* and *Chamaecyparis nootkatensis*, and also from the experimental *Cupressus guadalupensis*. The last mentioned appears to be totally canker resistant [CHECK] and so could contribute useful genes despite any other possible negative qualities.

Charlie Low discussing Kaingaroa hybrid cypress trial

The purpose of the trial is obviously to compare growth rates of these new crosses, but also to furnish a reasonably sized block (100 trees if sufficient plants available) of each cross to allow for initial vegetative reproduction. As a benchmark, specific crosses will be created each breeding generation and compared with material produced from the 'hybrid swarm' resulting from random pollination throughout the trial. Good selections will be transferred to seed orchards as soon as they become available. This means that you, the grower, could access superior canker-resistant material within a few years. If that doesn't herald a new dawn for forestry in New Zealand, what does?

Eucalypts

In all the myriad of insects and diseases that attack eucalypts, Tortoise Beetle (*Paropsis charybdis*) is one of the most spectacular defoliators. In particular, *E.nitens* – a miracle tree that makes radiata pine appear sluggish – has frequently been devastated by it. You can control the pest with Dominex (broad spectrum alpha-cypermethrin) but the Forest Stewardship Council has banned that particular chemical, and there is a need to find alternatives. One such is *Success*, which meets most environmental criteria. The huge fly (or perhaps we should say beetle) in the ointment is that it costs $165/ha merely for the active ingredient, which must be re-applied every few months.

Forestry is an extensive form of land use, unlike horticulture. Worldwide, very few chemicals have been shown to be profitable for disease or insect control (copper oxychloride for *Dothistroma* is a notable exception). So, doomed at the start to economic failure, one might question the purpose of this research. Nevertheless, it would be hugely beneficial if a way could be discovered to free this arboreal *nitens* giant from its insect shackles.

In another talk, Dean Satchell had a stunning story to tell. Indeed, if validated by other studies it could be the most important discovery in the entire history of the Diversified Forests Theme. Dean has found a way to saw eucalypts – even young, small-diameter ash eucalypts – to generate highly valuable boards with few end-splits. The boards are dead straight (the problematic tension having been released) and the only defects are the knots – which can persist, for example, in *E.nitens*.

Dean's sawing method involves ripping the log down the middle, and then using a bandsaw to cut 28 mm (or narrower) boards at right angles to the main rip. At each end, tension-stresses force these boards away from the centre. The boards will also bow at the middle. Dean's innovation is to edge the boards to remove the crook, and then counteract the bow by careful stacking and drying. Other sawmillers have avoided this expedient on the grounds that it is

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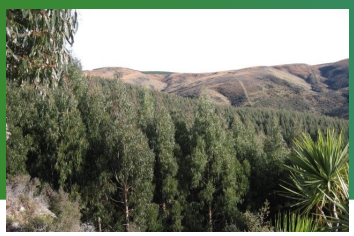

DIVERSIFIED SPECIES THEME UPDATE

wasteful of wood, but Dean claims a 50% recovery into boards – and we are talking about small logs!

Novel sawing method for eucalypts

It is well known that, in eucalypts, the recovery of sawn timber declines with small-end diameter. The milling costs also increase, and there is a lower proportion of the more valuable grades. So it would seem evident that it does not pay to saw such material, despite the obvious advantages of a fast return on the investment from shorter rotation trees. Dean was using 18-year old *E. regnans*, so we are looking at a rotation even shorter than radiata pine. But the study, done together with the economist James Turner, used actual sawn outturn and realistic prices on the Australian market. It is hard to argue with such solid evidence.

Very good recovery of sawn timber

What are the results? Using a pre-tax discount rate of 8%, the NPV was $10,292/ha. The IRR was 16.8%.

These results should awaken the dead. But Dean gave his presentation in such a low-key style that members of the audience barely opened an eye. If these astonishing results are confirmed by other studies, and if the sawing technology can be scaled up to industrial levels, and if the market infrastructure is developed, then why would we want to grow pine on sites that could support a crop of eucalypts? Clearly, this line of research needs to be vigorously pursued.

Dean went on to describe ways in which the eucalypt resource could be developed: into laminated beams or panels, into attractive flooring by fuming with ammonia to darken the wood, or by thermal modification to improve durability and stability. We are not talking about a small niche market here; we are talking about a genuine large-scale alternative to pine.

Redwoods

Dean Meason reported on his investigation of silvicultural regimes for redwood. There are five current thinning trials (three in the North Island and one down in Otago Coast) and two pruning trials. There are also four PSPs with planting dates stretching back to 1901, but unfortunately these don't generally have a record of the early mortality or the thinning operations.

There are simple equations that describe stand basal area growth against tree age, but they don't seem to be sensitive to stocking. Similarly, there doesn't seem to be a thinning response: growth after thinning appears unrelated to the severity of thinning. The reason could well be that redwood is an extremely shade-tolerant tree; therefore you would need a very high stocking before there is a detectable level of mutual suppression. To deal with this problem, Dean used alternative ways of assessing the thinning response. He tried graphing initial tree DBH against DBH increment, but that didn't seem to work, so he tried comparing the individual growing space of each tree with its DBH increment and – bingo! – he did discover a relationship.

With regard to pruning, he found that pruning does slow down DBH growth somewhat but – at high stockings – this was not significant. At low stockings, however, and in particular with low stockings at early ages, heavy pruning reduced growth significantly more than moderate or light pruning. Yet even if you hit redwood hard with pruning, it seems to bounce back given time.

What is the purpose of all this work? It is important to develop the relationships between stocking, thinning and pruning in order to build a useful redwood model. This would be available to FFR members (probably through Forecaster) and then licensed to MAF for their carbon work. We know that redwood can achieve extremely high levels of basal area and stocking, but we still don't know the upper limits. There is insufficient

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DIVERSIFIED SPECIES THEME UPDATE

data to develop good thinning functions or to make a model that would lead to definitive silvicultural recommendations.

Trevor Jones examined the natural durability of coast redwood, because it is quite variable. Current methods of decay testing are slow and require many samples, so he used near-infrared spectroscopy to look at the effect of different sites and ages. He used three differently aged stands (Mangatu, Putaruru and Rotoehu) for his study. At Rotoehu, there were trees from nine different provenances. All yielded similar DBH's at age 20, and statistically indistinguishable wood densities. Heartwood content, however, seemed to be greater for the Año Nuevo provenance and there was considerable variation in colour. So how does the durability compare? We'll know about the fungal decay testing of redwood blocks in early April 2011 and the NIR predictions by 30 June. Watch this space.

Coast Redwood

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