Wooden It

Wood processing guidance

Douglas-fir Regional Processing Strategy

Douglas-fir Strategy

Author

Tony Desmond

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Technical Report – SWP-T117

Executive Summary

Wooden It Ltd has been asked by the Specialty Wood Products research initiative (SWP) to prepare a paper on the regional strategic processing options available to growers of Douglas-fir (*Pseudotsuga menziesii*). The project supports SWP's goal of "…. delivering higher value products, providing diversification, and mitigating the risks of growing a single species while supporting regional development."

Douglas-fir (D-fir) is the second most commonly-grown exotic timber species in New Zealand and occupies around 5% of the land used in plantation forestry. For more than 60 years now, D-fir has been in common use in building projects in New Zealand. Its strength, stiffness, weight, and stability characteristics make it an ideal candidate for the light wooden framed building so popular in New Zealand dwellings.

Apart from a general desire to reduce the risk associated monoculture forestry, there is little evidence of a long-term national or regional strategic approach to the planting of D-fir and because of this its distribution, both geographically and temporally, appears to be rather haphazard. Four of the nine recognised forestry regions in the country currently contain 95% of the area planted in D-fir. The major growing regions are now situated in the bottom half of the South Island and the central region of the North Island and this makes a regional approach to processing strategy appropriate.

D-fir is eminently suited to structural building products with some specialty products such as wall panelling also marketable. While D-fir sawmill chips are used in pulp manufacture it is not a prized source of pulp wood, some of its physical characteristics make it difficult to cut in a rotary peeler so it is uncommon to see it in structural plywood or LVL, and difficulty machining it make it unpopular for products requiring a high finish. These factors combine to direct D-fir down a processing path that begins with sawmilling and for this reason this report focuses on sawmill products or engineered derivatives of them.

Structural sawmilling strategies alone did not appear as attractive options for new investment when D-fir products are marketed directly into niches occupied by radiata. However, market niches that suit D-fir's strengths, and/or further processing of D-fir into engineered products can generate more value and support better returns to the grower

Forest management strategies that may assist or support processing investment include –

- allowing harvest age to increase (up to 50 in some regions) to spread spikes in supply and provide longer-term and less erratic supply to those prepared to invest in processing capacity

- co-processing with radiata in existing and/or new mills to help even the log supply

- exporting excess logs to global markets

- a combinations of these.

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Introduction

The Specialty Wood Products research programme (SWP) is a research partnership between MBIE, and Forest Growers Research focused on developing opportunities for minor exotic (non-radiata) species in New Zealand.

SWP describes its vision as,
"……. delivering higher value products, providing diversification, and mitigating the risks of growing a single species while supporting regional development" (SWP Program Description, T043, p.3).

In the context of this vision, Douglas-fir (D-fir) is particularly important as it represents the largest non-radiata exotic planting in New Zealand.

Introduced to New Zealand with p. radiata in 1859, D-fir was planted on a large scale in the 1930s, mostly in the central North Island. Its slower initial growth rate and longer time to commercial harvest size meant it was less attractive to foresters than radiata as a large-scale commercial species (NZ Forestry, May 1994, p28), but it still holds a significant place in New Zealand exotic forest cultivation and timber supply.

Douglas-fir has long been an important source of structural wood in New Zealand. A 1999 ENSIS comparison of in-grade stiffness and strength found Douglas-fir strength is similar to, and stiffness better than radiata – (https://douglasfir.co.nz/_uploads/downloads/douglas-fir_strength_and_stiffness.pdf).

The higher durability of its heartwood means that Douglas-fir can be used in interior framing without chemical treatment.

"Research shows that Douglas-fir resists decay better than untreated radiata pine, but not as well as H1.2 treated timber." (https://www.building.govt.nz/building-code-compliance/b-stability/b2-durability/pink-is-tough/untreated-douglas-fir/)

Its stability and slightly lower density combined made it an attractive material for roof trusses when building with undried framing was common prior to the 1990s.

The Douglas-fir Strategy project is intended to:

- Produce a guide, for existing and future Douglas-fir forest owners and processors, to identify and qualify opportunities for products and processing technologies that will add further value to the resource.
- Support regional development of high value processing facilities focused on Douglas-fir.

- Identify opportunities to optimise Douglas-fir's value chain and deliver best value to its growers.

It consists of three stages of work.

Stage 1: Characterising the resource.

A characterisation of the resource, by location, age class and growing regime is required to understand volumes, timing, and location of availability of logs.

(SWP FN-100 Douglas-fir Resource Characterisation, 2020)

Stage 2: Process Characterisation.

Critical information relevant to each processing option has been collected, from which capital and production costs, market opportunities, product value and scale requirements are derived for each process.

(SWP-T 113 Douglas fir Processing Opportunities: Douglas-fir Strategy, 2020)

Stage 3: Collation and report.

Stage three, this report, matches the outputs of stages one and two to provide indications of which combinations of resources and processing strategies are likely to be successful and, just as importantly, highlight combinations that are unlikely to be successful.

The project focuses on processing strategies for Douglas-fir and investigates and comments on options in the context of the current planted area of Douglas-fir. It assumes replanting rates and regional distribution remain stable.

The Douglas-fir Resource:

The first stage of this study (SWP FN100) characterised the Douglas-fir (D-fir) resource in terms of location, area planted and age classes (Table 1).

	Age class (years) -ha planted											
Region	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-50	51-60	61-80	Total
Northland	0	0	0	0	0	8	0	0	2	0	0	10
Central NI	427	719	2,201	2,499	2,500	2,688	2,253	1,585	1,481	115	161	16,629
East Coast	181	253	336	519	380	1	1	2	108	382	0	2,163
Hawkes Bay	18	45	2	63	138	25	11	23	56	57	7	445
Southern NI	6	169	12	90	122	17	26	14	38	416	103	1,014
Nelson/ Marlborough	11	240	148	662	2,035	1,199	1,392	967	461	102	32	7,249
West Coast	120	251	303	441	73	8	2	98	108	164	3	1,571
Canterbury	650	1,202	1,431	5,135	4,917	971	819	781	674	48	72	16,699
Otago	781	1,693	1,882	6,238	7,025	2,178	2,213	1,846	1,243	314	107	25,519
Southland	1,561	3,386	3,764	12,476	14,050	4,356	4,425	3,692	2,486	628	214	51,039

Table 1. Hectares of D-fir forest in NZ by region and age class. (*NZEFD April 2019)*

Southland, Otago, Canterbury, Nelson/Marlborough, and Central North Island between them account for 95% of the area planted in D-fir with the remaining 5% distributed over five other regions.

Information from foresters and managers suggests that, north of Canterbury little land currently in D-fir will be replanted in the same species, and in Canterbury itself only 5% is expected to be replanted. In Otago and Southland, the last decade or so has seen a rationalisation of species with lower altitude forests being mostly converted to Pinus radiata, and D-fir replacing radiata at higher altitudes. This process is now largely complete, and we expect that D-fir will be replanted in those blocks where it is better suited to the conditions than radiata.

All foresters can see some benefit in growing D-fir but at present that benefit is outweighed by the cost and challenges of longer rotation, Swiss Needle Cast in northern parts of the country, and the problems and cost of managing the environmental effect of wilding trees in the southern part of the country. These challenges are the most cited reasons for the move away from planting D-fir over the last couple of decades and into the foreseeable future (Fig.1). Both challenges are the subjects of current SWP projects.

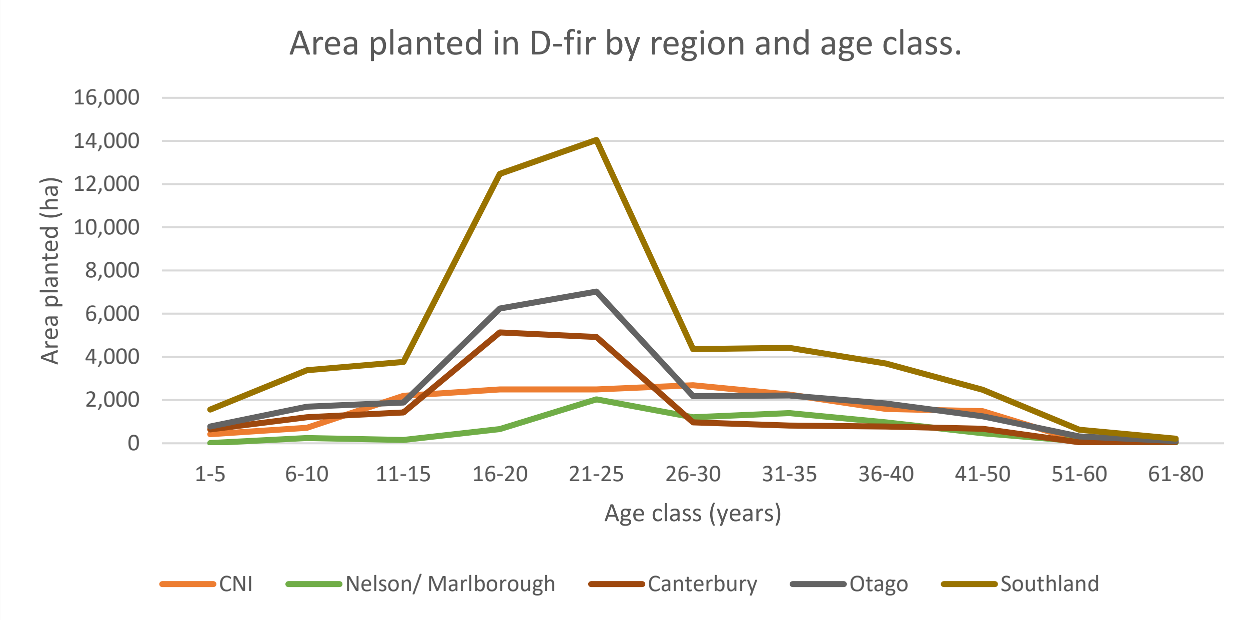

Fig 1. Age class distribution of the top 5 D-fir producing regions. (*From NZEFD April 2019*)

There is an obvious increase in planted area from around 11 years through to about 25 years in the five major regions, with Southland area increasing more than three-fold in this period (Fig. 1).

Supply Variation.

Stage one of the project also made projections on the D-fir wood available for harvest by region to 2060, (Fig 2)

Combining,

- Stated harvest intentions of those we spoke to,
- National Exotic Forest Description (NZEFD) data from April 2019,
- m^3/ha total-recoverable-volume (TRV) factors for each region (from MPI's wood availability forecast of 2014 (WAF))

we have calculated a wood flow prediction through to 2060 (fig 2) for the five major regions based on the stated harvest ages of:

- 40 years for Southland, Otago, and Canterbury
- 37 years for Nelson/Marlborough
- 35 years for CNI

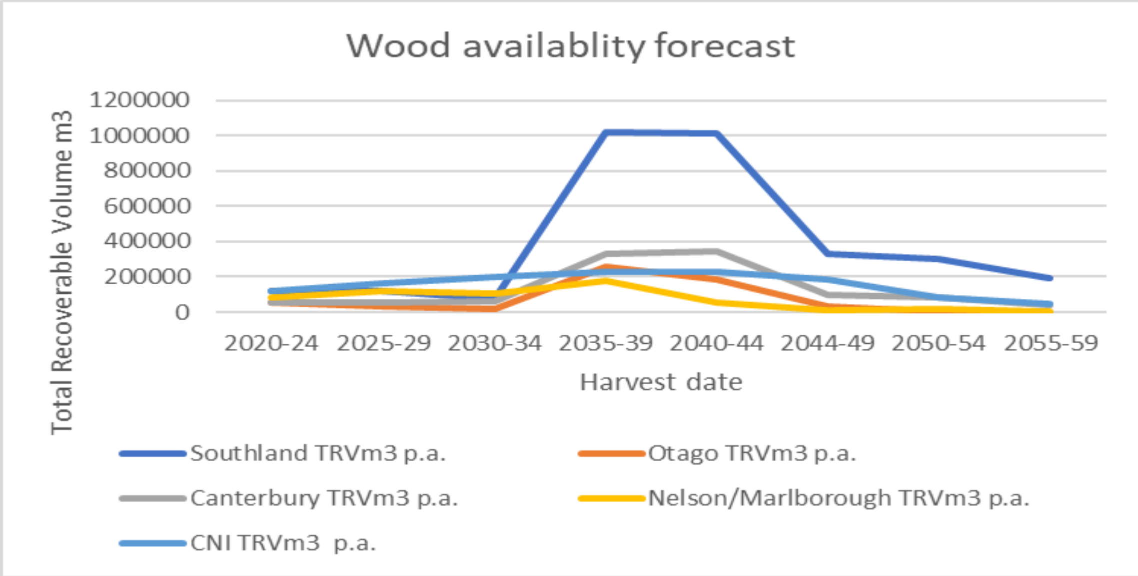

Fig 2. Wood availability prediction. (*Wooden It, using MPI data*)

Consistent with the planted area analysis (Fig. 1), Figure 2 highlights a significant increase in available volume in all major regions from 2035 through to 2045, especially in Southland.

A spike such as this poses challenges to developing a strategic processing plan. New Zealand's wood processing industry has seldom shown enthusiasm for the commissioning of infrastructure and processing capacity in response to short to mid-term increases in supply and is unlikely to do so in this case, especially as that spike drops away just as dramatically after 10-15 years.

So, options to deal with this increase and reduction of D-fir wood availability are considered here.

Strategic approaches to managing supply variation.

Let it Grow

Allow age at harvest to increase through this period, by keeping the harvest volumes consistent or growing incrementally.

This approach has been partially applied to MPI's Wood Availability Forecast (WAF) published in 2014. *The WAF) will be updated in 2021*. The results of this smoothing in Southland are shown below in fig. 3. Such an approach allows more gradual and sustainable build up of harvest, transport and processing capability and sustains the productive use of that infrastructure over a longer period.

Southland will require significant investment in processing, harvest, and transport capacity over this period despite efforts to reduce the spike. According to this model, harvest will increase by 150% between 2028 and 2029, an additional 30% in the next five years and 25% in the following 5 years (fig. 3). This approach allows the average age at harvest to increase from 40 years to 50 years, but still leaves some big increases in available harvest volume.

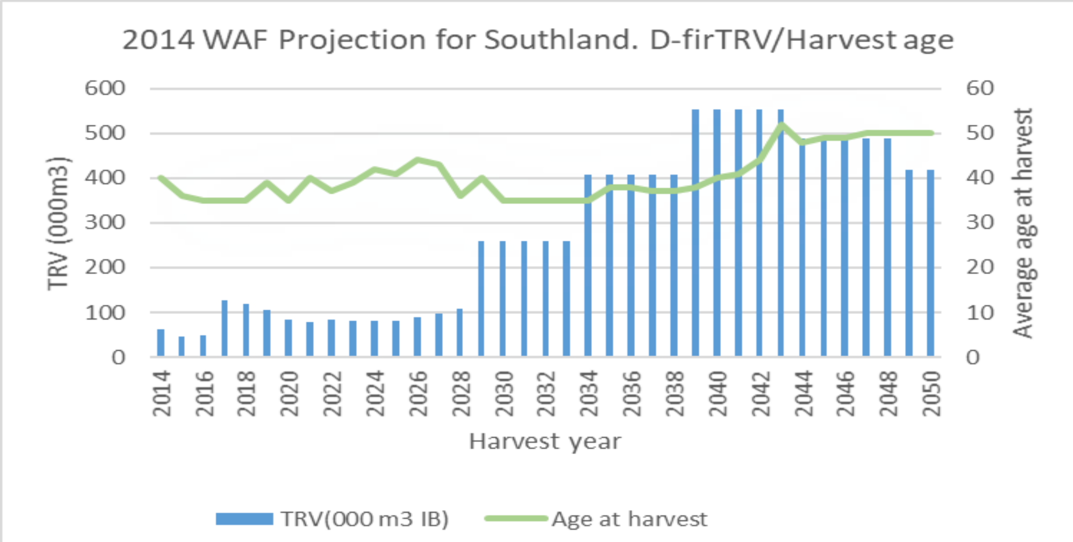

Fig. 3 Reducing wood flow spikes by adjusting harvest age. *(Wooden It, from MPI, WAF data)*

The strategy of allowing harvest age to increase requires resolving the conflicting priorities of

- Maximising short-term return on investment
- Maintaining a long-term sustainable position for all members of the supply chain.

Co-processing

Using this strategy, growers could align themselves with sawmillers and wood processors who have adapted to running both D-fir and radiata through their processes and into their markets.

These processing operations and their markets need to be flexible enough to substitute radiata and D-fir for each other as supply levels change. Although there are a number of processors that do this successfully, in practice it is difficult to do outside a narrow range of variation and, on its own is unlikely to be sufficient response to the spikes illustrated in figure 3. Market preferences and the different uses for residues of each species are both challenges to high levels of species flexibility in processing operations.

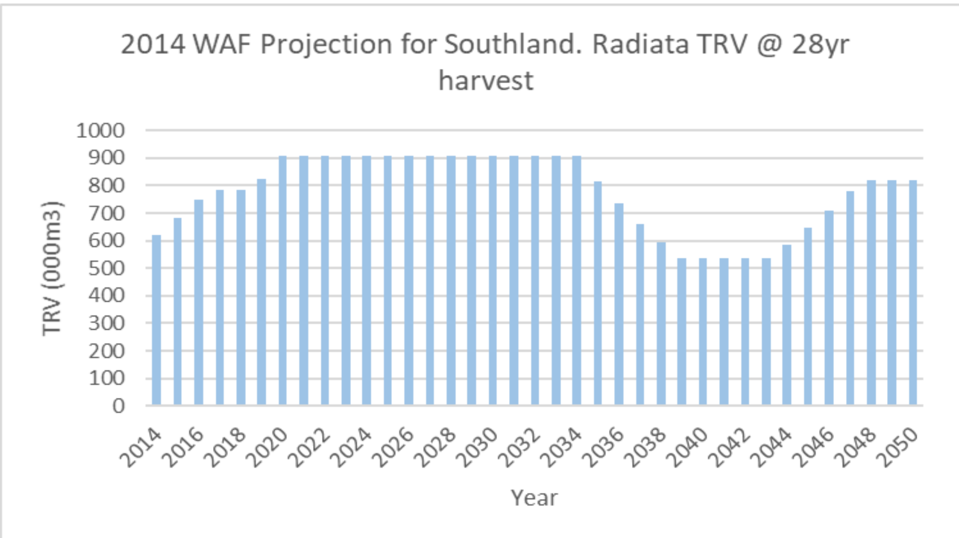

Fig. 4. Southland radiata wood availability *(From MPI, WAF data)*

Southland shows a reduction in radiata harvest that roughly coincides with the spike in D-fir supply (Fig 4). Aggregating the harvest from these two species (Fig 5) looks more manageable than when each species variation is viewed separately. Figure five shows the wood flow effect in Southland of combining radiata - harvest at age 28 years - and allowing D-fir harvest age to increase to 50 years, in line with WAF modelling.

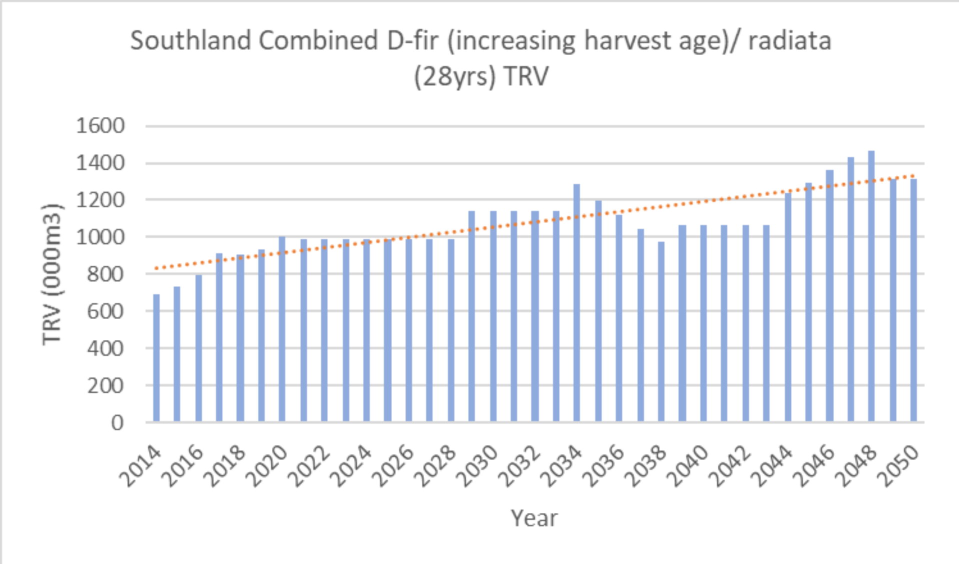

Fig. 5. Southland combined radiata/ D-fir wood availability. *(From MPI, WAF data)*

Applying the same co-processing strategy in Otago and allowing D-fir harvest age to increase to 50 years produces a similar smoothing effect in supply with a slightly sharper initial dip, Fig 6

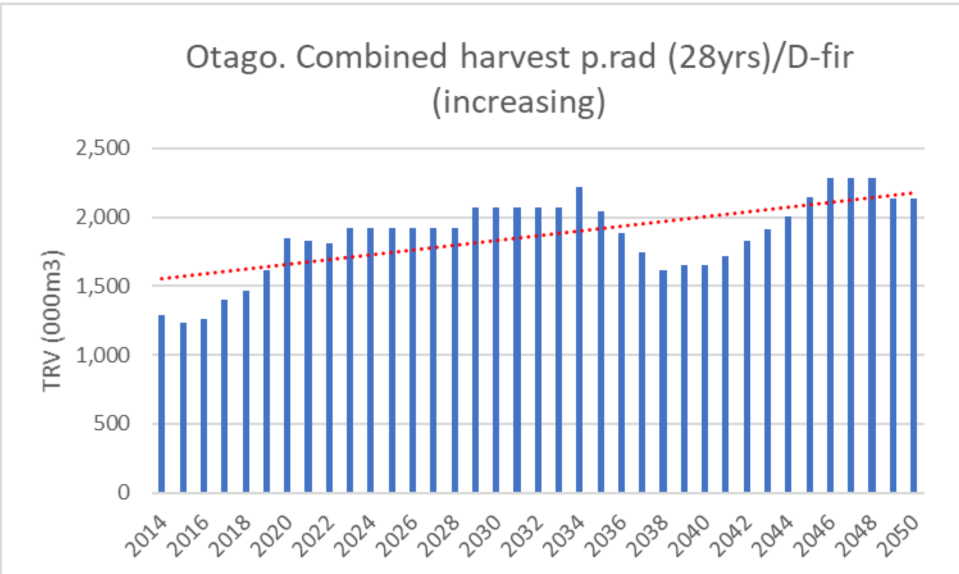

Fig. 6. Otago combined radiata/ D-fir wood availability. *(From MPI, WAF data)*

In Canterbury (Fig 7) and the Central North Island (Fig. 8) regions the harvest age for D-fir can remain at 40 years and achieve the same result following an initial dip.

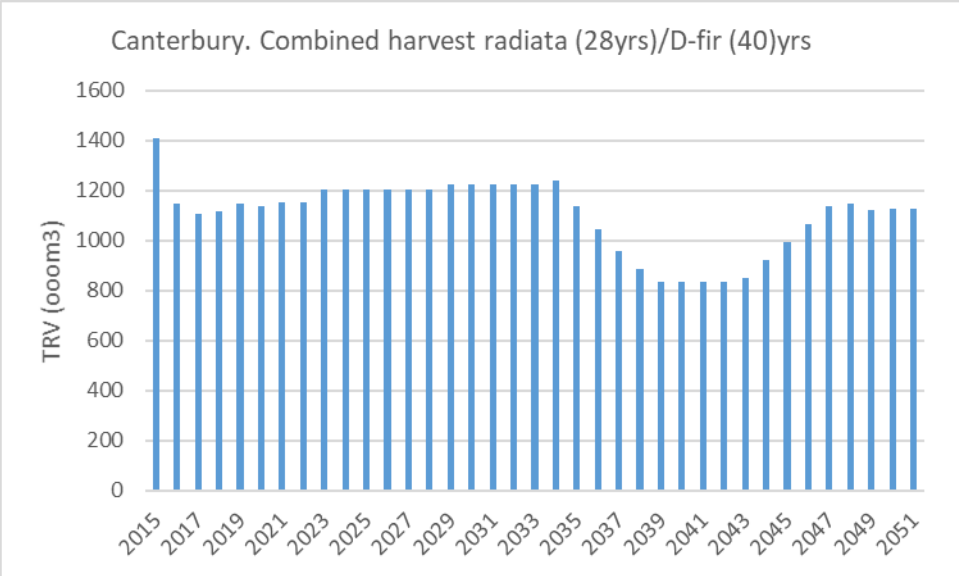

Fig. 7. Canterbury combined radiata/ D-fir wood availability. *(From MPI, WAF data)*

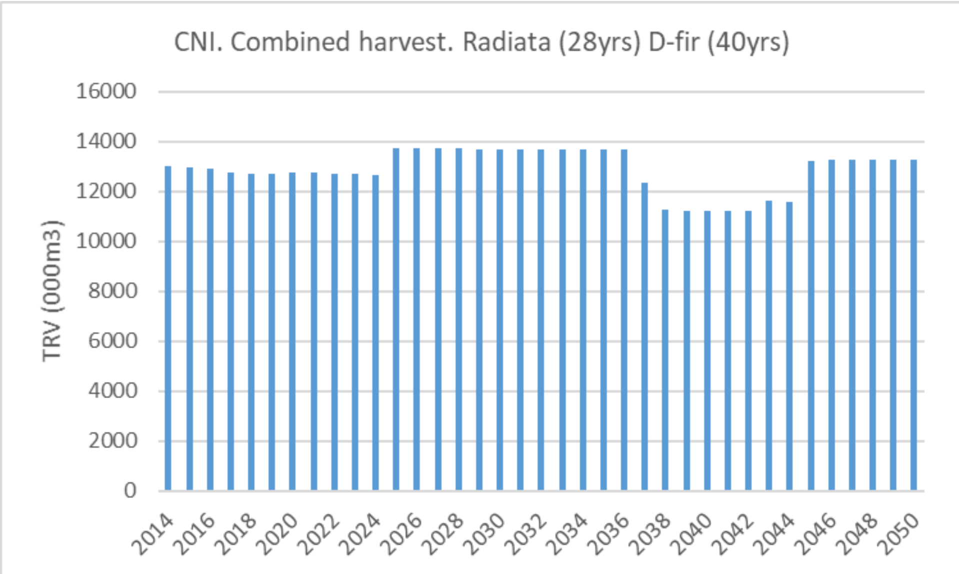

Fig. 8. Central N.I. combined radiata/ D-fir wood availability. *(From MPI, WAF data)*

Raw log sales

Sell excess logs into overseas markets.

Overseas markets are of such a scale that even Southland's spike will have little effect on supply dynamics and price in market. This solution has the advantage of turning extra supply into cash quickly and efficiently, requiring extra capital investment only in harvesting and transport. Harvesting and transport capital plant is much more portable than processing plant, so can readily be re-deployed once regional spikes have been dealt with.

This approach does little to support the long-term sustainability and growth of a local D-fir processing capability.

Combination

The final, and most likely option is a combination of some or all the approaches above. The weighting of each option in a mixed strategy will be driven by

- appetite for investment,
- prevailing market opportunities and conditions,
- capacity to add infrastructure at each stage of the harvest – transport - processing supply chain.
- sufficient developing supply of other species to replace D-fir as the spike is consumed.

For example, willingness to invest in harvesting and transport but not processing will weight a strategy towards export of raw logs.

Processing options.

D-fir physical Characteristics.

The physical properties of any wood are a good guide to potentially valuable end uses and the processing options that are most likely to add value.

The physical properties of D-fir make it a great candidate for use in structural applications. The qualities that differentiate it from other structural timbers include its consistency from bark to pith, its density to strength ratio, its generally higher stiffness, its stability in use, and some natural durability. These qualities are covered in detail in SWP T113.

D-fir has a high difference in density between early-wood and late-wood within the same growth ring, this leads to some splitting or breakage in nailing and rotary peeling, and difficulty achieving high quality planed finishes. These two factors combine to make it less attractive for some uses.

The processes considered in this project tend towards structural uses because of these qualities and include products such as solid wood structural members and various engineered products including glue laminated beams (GLT), cross laminated timber (CLT) and optimised engineered lumber (OEL). All these processes take advantage of D-fir's strengths and are not adversely affected by its short comings. Also considered is the option of not processing and simply supplying logs to export markets.

LVL and plywood options were not considered because the early-wood late-wood density difference make rotary peeling of D-fir difficult.

Regional considerations:

Radiata is currently preferred for replanting in most regions because of shorter rotation times, the negative effect of Swiss needle cast fungus on D-fir growth rates in warmer regions and, the perception of D-fir as a significant contributor to wilding pine problems in the South Island.

The only regions currently replanting harvested areas with D-fir are Otago and Southland and there is no indication that new plantings will resume any time soon in any region. For this reason, many regions are unlikely to attract significant investment in processing based on D-fir supply, especially those 5 regions making up the last 5% of planted area.

Discussion on processing options investigated.

Processing Option	Capital cost	Economic Scale	Post delivery Production costs	Market size/ Profitability	D-Fir advantages
Raw log sales	0	100 m^3 plus	Marshalling /Loading	Unlimited? Price 10-15% above radiata.	Demand consistent even in slow markets
Sawmill, Large scale	$100 mill	400k-500k m^3 p.a.	$40/$m^3$	GM -3%	Stiffness Durability Stability
Sawmill small scale	$15 mill	40,000 m^3 p.a.	$90/$m^3$	GM -15%	Consistent through log
GLT mass product	$1mill-$5mill *	10,000m^3 p.a. 50,000m3 p.a.	Processing, labour, glue	Post and beams. Competitive market	High stiffness
GLT bespoke products	$1mill-$5mill *		Design, process, labour, glue	Cost plus	Low density
CLT	$3.5 mill*	15,000m^3 p.a.	$470/$m^3$	Significant growth locally and globally. Largely cost plus.	Engineer to take advantage of superior stiffness
CLT High volume	$40 mill*	100,000m^3 p.a.	$320/$m^3$	Significant unsatisfied demand locally and globally. Largely cost plus.	Engineer to take advantage of superior stiffness
OEL	Unknown	Unknown	Unknown	Unknown	Use of cheaper D-fir thinnings and small logs

Table 2: Summary of key factors for the processing options investigated in SWP-T113.
(* includes only glue application, assembly, and pressing plant)

As far as possible we identified, capital cost, scale, production cost, market size and profitability for each processing option (Table 2). These numbers have been used to draw comparisons between different options and should in no way be used to guide processing investment decisions. The variables and complexities involved in each process require anyone investigating investment to engage early in the process with equipment suppliers, technical experts and market analysts and do their own thorough due diligence.

Costs quoted only consider the process under consideration e.g., sawmilling costs only include the costs involved in converting logs into green rough-sawn lumber. Down stream costs such as drying, planning etc. are expected to be no different from those for radiata.

Direct log export

Infrastructure, procedures, and markets for raw logs are all well established, meaning there is almost no extra cost to exporting logs rather than selling to a local processor. In fact, the export market is so dominant that major species log prices to onshore processors are routinely derived from the return a grower can achieve at the wharf gate.

Douglas-fir does, and has for a long time, command a premium over radiata in export log markets, primarily because it is supplied alongside North American grown D-fir. Demand seems to hold up even in soft markets.

There is plenty of scope in this market to take smaller logs than domestic processors prefer, so logs from thinning operations are often directed through this channel. This market provides a good safety valve/ buffer for times of over or under-supply and can give a good return on logs that domestic processors do not find attractive.

In regions with low and/or erratic supply of D-fir logs and reasonable export-port access such as Northland, East Coast NI, Hawkes Bay, and the lower North Island, exporting raw logs can be an important contributor to forest profitability.

Sawmilling – Large scale

The processing costs and gross margin figures for both large, and small, scale sawmills are based on numbers generated by SCION's WoodScape model as reported in SWP report T-037. These numbers were used because the same model included the log prices used in gross margin calculations and account for all processing costs. We have not done a survey of current market prices in New Zealand, but anecdotally understand that 2020 has seen all prices increase. U.S. lumber market publication Random Lengths on October 2nd, 2020 had green D-fir price at $US857/mbf compared to a year before when it was $435/mbf. In the context of 2020's volatility it seems safest to make strategic decisions on data from a more stable time, such as the prices used in SWP T-037.

Even in this large scale, low-cost sawmill configuration (400,000m^3 p.a.), using the WoodScape predictions on market price and log cost, it is difficult to find economic encouragement for a strategy of sawing D-fir into common structural components and selling these in the same market as radiata. We did not find anybody currently cutting D-fir using only the structural approach. There are companies doing this, but they are also putting products into added value processes, or higher value market niches.

Sawmilling – Small/Medium scale.

Medium scale sawmilling offers greater flexibility and more responsiveness to market conditions than larger scale operations can easily accommodate. Lower capital cost reduces the overhead burden somewhat, but smaller scale operations cannot achieve the very low production costs available to high volume mills so look to find ways to improve the value of their cut. The most successful structural mills in New Zealand and Australia cutting any species are large-scale low-cost mills using hi-tech gear to enhance their efficiency. Those smaller mills that cannot match this efficiency and low cost tend to focus on extracting maximum value from the fibre in logs they buy. Nobody buys pruned logs to cut structural components. Sawmilling is a dis-assembly operation similar to butchering meat, the better a mill or butcher is at segregating the value components of a log or beast the more value they can recover, but this strategy is difficult to implement in a solely cost focused operation

The biggest assets of D-fir lumber are its strength and stiffness properties, its log uniformity and low proportion of industrial grade core wood. All these properties make it a preferred species for cutting structural components and suited to the high volume-low-cost mills discussed above.

The opportunities to successfully mill D-fir in smaller mills exist by choosing higher value products or supplying wood into added value uses in which the wood cost is not so critical. For example, specialty glue laminated designs can often be more about form than about function and, as such, carry a value that is not solely dependent on the load bearing capability of the wood used (Fig. 9).

D-fir readily lends itself to use in large solid wood beams because of its relatively low moisture content off the saw and its stability on drying, and it also commands higher prices in specialty products such as wall panelling. Its inherent durability can make it an attractive option for those seeking building solutions that do not contain chemical preservative. Products to support all these end uses are much better suited to flexible operations and can command higher prices if marketed well.

Glue Lamination.

Fig 9. Beach-side bar from glue laminated wood. Phu Quoc, Vietnam. Tran Duc.

Capital costs to set up glue laminating operations can vary from a few hundred thousand dollars for a basic line using manual operation of low-tech glue application and pressing of full length lamella, to many millions of dollars for highly automated lines including defecting, finger-jointing, planning, gluing, pressing, curing, and final machining operations integrated into a single process.

The process of preparing wood and glue lamination requires

- the removal of unsuitable defects,
- finger jointing to desired length,
- machine to an even, fresh surface
- application of glue
- assembly and packing into press
- pressing and curing
- unloading and trimming
- planning to final finish and dimension

all of which have so many variables that it would be misleading to supply a cost estimate.

Automated lines are well suited to straight square products such as laminated verandah posts, common beams and lintels, or Japanese house components which can be manufactured in large quantities to a single design and specification.

More complex components like the laminated elements in Fig. 6 require adaptable plant set up and are unlikely to be able to use accelerated curing technology such as radio frequency, as a result these are likely to have more cost. They will also include a significant design component in the cost and so occupy a special part of the market that will accept cost plus as a basis for pricing.

Cross Laminated Timber

Cross laminated timber (CLT) was introduced to New Zealand by Xlam who opened a commercial plant in Nelson in 2012. It has proven to be highly successful technology for the construction of multi-level mass timber structures and is leading the increasing use of timber in multilevel construction. Xlam have since moved their manufacturing to Australia but Red Stag are currently installing a plant in Rotorua with about twice the capacity.

In the early days of New Zealand based CLT production D-fir was used regularly along with p. radiata for the feed-stock without any significant changes to the process and was found to perform at least as well. Laboratory testing of D-fir CLT behaviour under rolling shear stresses, and how the commonly used dowelled fixing systems performed in D-fir panels, showed that "…D-fir CLT specimens demonstrated good RS (rolling shear) and embedment properties and the dowelled connections also showed reliable behaviour with high strength and stiffness and superior ductility" (Li et al 2018).

There is no reason that D-fir cannot be used for the manufacture of CLT and, although this has not been exploited yet, D-fir's superior stiffness performance has the potential to make it a preferred feed stock material. Its lack of treatability restricts its use in large commercial buildings because of current requirements to use H1.2 and H3.2 treated wood in such buildings.

The capital costs for glue application, assembly and pressing equipment only come to about $3.5 million for a mechanical pressing operation similar to that used by Xlam, and capable of producing about 15,000m^3 per year. CLT has all the preparation operations associated with glue lamination and so requires further capital for these. The process also has higher post-gluing costs for CNC profiling of completed panels.

In addition, this process introduces a wood-loss component after manufacture that is unavoidable. Poorly managed, this can be very costly because all the processing costs are embedded in the panel as well as the cost of wood that is discarded. The other significant contributors to operating cost are labour and glue.

Market demand for mass timber products is strong and interest in building with this technology remains high. Some respondents report fielding enquiries for thousands of cubic meters of mass wood products every few weeks. A 2016 model of CLT demand in the Pacific Northwest of the USA, for use in 4-7 storey multi-dwelling and office buildings, predicted that by 2020 demand would reach 45,000m^3 and double every 5 years after that (Beyreuther et. al. 2016).

Laminated veneer lumber and plywood.

Neither of these technologies were considered because of the difficulties identified in rotary peeling of D-fir.

Optimised Engineered Lumber

Optimised engineered lumber (OEL™) is a process that uses low grade/low value logs and cuts them in to short, small components (50x10x1000), stress grades these then sorts based on stress grade, finger joints and laminates them to produce MGP 8 and better structural products.

The process is owned by Wood Engineering Technology Ltd who operate a pilot plant in Gisborne developing the product and the manufacturing process. The product and plant are still in their development phase so there is no cost information available either in terms of capital outlay or operating expenses that is likely to be representative of full commercial operation costs.

SWP has however, conducted a trial (SWP-T007) to establish the suitability of using wood cut from D-fir thinnings as an input to this process. The trial struck some processing issues that left recoverable volume in some doubt, but which was technically successful, producing a useful product of good grade. WET's own analysis of the trial and its calculations based on expected recovery suggest that D-fir thinnings could be a successful source of feedstock for the manufacture of OEL.

Conclusions

Regions with low, erratic, and diminishing volumes of D-fir have fewer strategic options available to them and are unlikely to attract investment in D-fir focused processing capacity. These include Northland, East Coast NI, Hawke's Bay, Southern NI, the West Coast South Island, and quite likely, Nelson/Marlborough. The options available for the D-fir that is already planted in these regions consist of export of the logs, co-processing in a mill processing p. radiata, shipping logs out of the region for processing, or firewood sales. There is simply insufficient stable supply to sustain any other processing options.

The other four growing regions - Southland, Otago, Canterbury, and Central North Island - have sufficient volume to encourage investment in processing capacity. All of these have a rapid increase in available volume in about 10 years from now and should be looking for processing options for that supply now. The fact that this increase is not sustained after 15 years presents some challenges that need to be overcome. The options to do this are outlined above in the section on managing supply variation and include

> -allowing harvest age to increase to spread the spike in supply and provide a longer-term supply to those prepared to invest in processing capacity
>
> - co-processing with radiata in existing and/or new mills
>
> - exporting excess logs to global markets
>
> - combinations of these.

D-fir is a particularly important structural timber that has some superior qualities such as high stiffness, better stability, natural durability, less variation from bark to pith. These superior qualities are not always taken advantage of in the market. In many cases D-fir is sold alongside radiata as equivalent to H1.2 MSG8. The higher-stiffness wood is not always segregated into higher value uses, the opportunities for untreated wood are not always pursued. Some more focus on these areas in future would help increase market opportunities for D-fir.

D-fir logs, like all others available to New Zealand sawmillers, have their price determined by the prevailing export log price. In the case of D-fir this is usually a few dollars more than radiata so the processor must get some extra value from their logs through higher recovery of valuable grades, adding value through other processes, or supplying into specialty markets.

Included in these value adding processes are

- glue laminated (GLT) beams, posts and lintels and specialty laminations
- cross laminated timber (CLT) panels

both of which can extract extra value from D-fir by making good use of its stiffness characteristics and stability.

References

Note to references:

This report is the collation and discussion of information from two previous reports, namely, *SWP FN-100 Douglas-fir Resource Characterisation, 2020* and *SWP-T 113 Douglas fir Processing Opportunities: Douglas-fir Strategy, 2020* . It draws on the information contained in both of those reports and as such all references included in those reports are acknowledged here whether they have been directly cited in this report or not.

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