Profitable wood processing - sawn timber needs

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Abstract

Knowledge and technology have surpassed the commonly used log specifications for the New Zealand sawmilling industry. External log characteristics, while providing important parameters for sawmill conversion rates, provide almost no guarantee of the suitability of that log for the intended end product. This applies particularly to pruned log processing and to mills cutting for the structural markets where mechanical testing of wood stiffness is the entry point.

Researchers, technologists and sawmillers themselves have improved their knowledge of wood properties and characteristics and developed methods of measuring these to enable the development of a more suitable set of guidelines for log grades.

The industry needs to update existing 'broad' quality specifications for logs into a set of standardised National grades more appropriate to current knowledge and to product specifications.

Log Grading

Back in 1986 two prominent foresters of the New Zealand Forest Research Institute presented a set of generic grading rules for radiata pine logs (Whiteside & Manley 1987). These rules were an attempt to reduce the wide variety of log specifications used New Zealand-wide. They included two pruned log grades based on small end diameter (sed), and a further ten sawlog grades based principally on sed and branch size. For simplicity sweep and internode index requirements have been omitted from Table 1, which summarises these twelve grades.

Eighteen years later these grades are still applied as the basis of comparisons in the Agrifax monthly price movement descriptions and this, I think, is because in their simplicity, the grades have been useful as a very basic representation of log type and shape. However attempts to standardise grades nationally for uniform resource descriptions and for log sale purposes have not been as successful. Mark Bloomberg carried out a thesis investigation into domestic sawlog prices back in 2001. In his discussion he wrote

"One reason for the variation in prices, was the diversity of specifications that existed within each of the three nominal log grades (P, S, and L grade). The standard minimum SED limits...were not used in the majority of P and S grade sales... Minimum branch size and sweep specifications were also variable within each of the two unpruned log grades."

These results are largely to be expected. Firstly, individual mill configurations will dictate many of the aspects of size and shape and their relative effect on each mill's ability to profitably create a marketable product. Secondly, availability of raw material will affect specifications and there are a number of examples of this:

- The current low-stocking silvicultural regimes have made the percentage of 6cm branches so low that realistically this spec probably only applies to that corner of the back paddock where the cockie's sons never quite got around to carrying out any thinning in the university holidays.
- The effect of shortening internode lengths, both by the efforts of breeders attempting to improve structural grades, and by growers planting on more fertile 'farm' type sites, has reduced the percentage of logs matching the internode log (I grade in Table 1) to very low numbers. Consequently I question the suitability of NZ timber 'cuttings' grade rules or 'internode index' as relevant in today's industry.
- Bloomberg's study also showed that almost no one was using the P2 spec. With the pruned log specifications 35cm seemed an industry wide minimum sed. When you do the sums this is hardly surprising. If we accept a minimum useable pruned log index (PLI) of 4.0 then

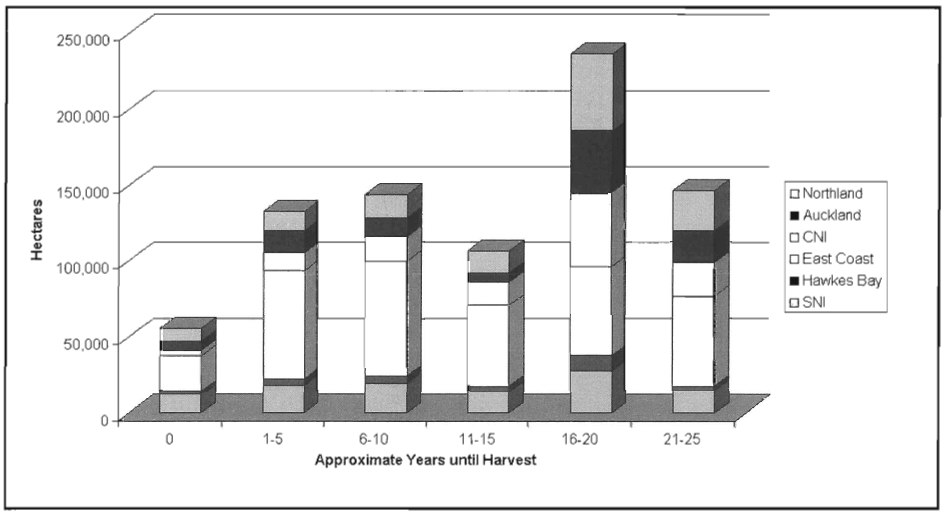
Table 1: FRI log-grade specifications

Grade	Pruned or Unpruned	SED (mm)	Max. Branch (cm)
P1	Pruned	400+	na
P2	Pruned	300-399	na
S1	Unpruned	400+	6
S2	Unpruned	300-399	6
S3	Either	200-299	6
S4	Either	150-199	6
L1	Unpruned	400+	14
L2	Unpruned	300-399	14
L3	Unpruned	200-299	14
L4	Unpruned	150-199	14
I[1]	Unpruned	300+	14
R[2]	Either	100+	na

[1] *Also included an internode requirement.*

[2] *Higher levels of sweep also allowed*

Fig. 1: Pruned harvest profile by area planted (data from MAF)



to obtain that with a sed of 30cm the defect core would have to be about 17cm. That means the DOS (diameter over stubs) at time of pruning would have to be 11cm. To achieve this remarkable result would probably require annual short pruning lifts for a number of years. A more realistic economic schedule is to aim for a DOS of around 16cm. With a 35cm sed you can achieve that minimum specification acceptable to the local sawmill.

Finally, a word for the 'wave of opportunity'. In Fig. 1 I have manipulated the areas of pruned stands by age as provided by the Ministry of Agriculture & Forestry (see www.maf.govt.nz/statistics) for the North Island into 5-year groupings of availability, assuming current rotation lengths are maintained. These data, which are based on 2002 figures, show that areas of mature pruned radiata will more than double in the next 5 years. Even if the recent talk of reducing harvests by 20% eventuates this wood will still have to be harvested and unless export markets change considerably will be available to the limited local market.

I am assuming that this will create an over supply and as a log purchaser I can tell you categorically that with these volumes of wood around I won't be interested in purchasing raw material simply based on some generic log shape. First preference will go to those who can prove that what is inside the logs will suit my processing plant, and then we will set a price balance between that known quality and what my mill can afford to pay. Logs of unknown internal quality will still sell but at a reduced price and probably only after some serious testing. Logs of high quality will receive a premium. This situation already exists today. In the recent past, pruned log prices have varied by as much as $80 to $100 per m³ at any one time simply based on internal quality. In today's more subdued market this is now around $40 to $50 per m³. These differences have very little to do with size. They are based on PLI, occurrence of resinous defects and incidence of intra-ring checking.

Log Grade Segregation.

There are many tools available today which would enable resource description or log segregation to be applied. In terms of producing structural material, there has been a decreasing overall quality of radiata pine logs as raw material. This is due to a combination of changes in silvicultural regimes (principally lower stocking); shorter rotation lengths; a trend towards more highly fertile sites; and to increasing harvests of the lower density '850' breed. Those producing for machine stress grade structural markets have been particularly active in looking at ways to segregate the resource. Both Carter Holt Harvey and Tenon (when it was Fletcher Challenge Forests) produced tools based on sonic time-of-flight technology (e.g. Carter & Lausberg 2001, Treloar 2001) and both have processing plants that rely on these tools for log segregation. The tools don't rely on a measure of wood density, and/or microfibril angle, and/or fibre length, and/or knot size to predict stiffness. In one rapid measure they determine stiffness incorporating all these and more. Now the technology has been advanced to produce a sonic tool suitable for standing tree measurement. This is the newly announced Director ST300 and comes from the innovative folk at CHH's FibreGen group. I anticipate that this will be used in routine pre-harvest inventory and will enable benchmarking of structural value for stumpage sales. Surely these tools provide potential to standardise a log specification to actually predict suitability in use.

The current S grade logs were designed for structural suitability but with the '850' breed becoming a larger proportion of the NZ wide harvest, and with rotation lengths around 26-28 years, then probably as little as 25-30% of the total resource could be profitably sawn for that market.

One recent advance in segregation of pruned logs is a simple little booklet published by Wood Quality Focus Ltd and the Forest & Farm Plantation Management Cooperative. This field

guide written by Don McConchie of Wood Quality Focus Ltd details measurement standards for quantifying external resinous defects on the bark of standing trees. It also provides a summary of one test case showing that the value of lumber between the best trees and the worst trees segregated using this technique was just under 30%. The data have been validated in a number of other studies from around New Zealand.

There are already tools available to assess pruned log quality and these begin with the determination of likely knot-free clearwood recovery. The Pruned Log Index or PLI (Park 1989) is the industry standard. Determination of PLI begins with accurate stand records, probably includes some validation via a model such as Forest Research's STANDPAK, but can be simply determined using stand measurements and spreadsheet type tools such as Jim Park's PLI Estimator or Christine Todoroki's PLI Calculator. Obviously the most accurate for all concerned is a proper PLI survey which will also provide details of resinous defects and of intra-ring checking.

Assessment of intra-ring checking is still reliant on the methodology of destructive sampling and oven-drying discs (McConchie & McConchie 2001). This technique does give good repeatable results but I doubt that these data are accessible enough to be appropriate for a new log spec.

I don't have the answers as to what the new log specifications should be. I know that the current ones are not appropriate in the current market. I know that sawmillers are already becoming interested in even more complicated wood properties such as spiral grain and its effects on twist; compression wood and resulting distortion and loss of strength; heartwood content and effects of drying accuracy and colour acceptability.

As an industry group we haven't even made one step in moving to log grades that reflect suitability for use since those original grades were outlined in 1986. As an industry we need to move together to develop a new set of standard grades and measurements. Input should be from both suppliers and users; growers and processors, harvesting contractors and log traders. The grades should be layered so that 'no-brainer' quality parameters such as stiffness or PLI can be incorporated in New Zealand wide comparisons of price or quality. They should also allow for 'extra' data (like resin or checking) to be added to a localised tender or stumpage sale. We might have P4, P5 or P6 grades being nationally compared while local sales may be P5 (R1.2;IC0.3) to designate levels of PLI, resinous defect scores and intra-ring checking. Structural grades could be appended with a similar stiffness rating score SI250; SI300 etc representing a speed of sound sonic index or similar.

I'm up for an industry working group!

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