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DRYING LOGS IN THE FOREST

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BACKGROUND

Present logging in New Zealand involves the immediate delimbing of logs prior to extraction and transport to the mill. Approximately half the weight of radiata pine logs cut from trees up to 18 years old (slightly less for older trees) is made up of water. The water content of logs limits the maximum volume of wood which can be carried on trucks. For all uses, except pulpmaking, the moisture must be removed from the wood at some stage in the processing. Transport and drying are expensive phases in producing saleable timber products. If some reduction in log moisture could be obtained, it might represent significant savings to the industry.

Under normal conditions a growing tree loses a large amount of water through its foliage in the process of transpiration. A ten year old radiata pine tree in New Zealand can lose as much as 30 litres per day. When a tree is felled it no longer takes up water from its roots. If its foliage remains attached so that water loss can occur, some of the water in the sapwood may be drawn out, causing drying of the wood while it is still in the forest.

As part of the Forest Research Institute's programme of work on moisture movement in trees, some seven year old radiata pine trees were felled into a clearing. Some of the trees were left with their branches and

needles intact, others were delimbed. Discs were cut, half a metre from the butt of the tree, over a period of weeks after felling. The results showed a dramatic drying out of the trees which had their branches and needles intact.

	Relative Moisture Content	
Days after Felling	Delimbed Tree	Full Tree
0	91 %	93 %
14	94 %	77 %
28	95 %	60 %
47	95 %	36 %

The Relative Moisture Content (RMC) is the percentage of space in the wood which is filled with water. In radiata pine sapwood, such as that found throughout seven year old trees, the RMC is independent of age, position in the tree, or season, and is generally around 90%-95%. It is much less variable than wood density or moisture content and is a good parameter for measuring the drying out of wood.

These results indicate a moisture loss of some 450 kg per cubic metre of wood after 47 days, or a 43% decrease in log weight. This experiment showed the possible significance of weight reduction in harvesting, transport and processing of New Zealand's radiata pine resource.

A meeting of all interested parties was called and it was decided to set up a co-operative experiment. A trial was set up to extend the information obtained from the earlier F.R.I. trials to cover older trees which included sawn timber and to look at the processing aspect of dried logs.

Whaka Forest staff located a stand with suitable trees to carry out the experiment, provided logging and transport facilities as required during the trial, and provided weighbridge facilities for weight and volume measurement. The N.Z. Forest Service computed the weight and volume figures. The Forest Research Institute monitored and measured moisture content changes in felled trees, insect and pathogen status of the felled trees and the moisture content of chips produced from the trees. Waipa Sawmill debarked logs for processing. The Timber Industry Training Centre processed logs through their sawmill and chip mill. LIRA co-ordinated the work in various areas.

THE TRIAL

A suitable stand of 17 year old radiata pine trees from Whaka forest was chosen. Three truck loads were felled on 16.9.80. One truck load was immediately delimbed, extracted and taken to the weighbridge. The remaining trees were left in the forest with foliage intact. The second truck load of the felled trees was delimbed, extracted and taken to the weighbridge after five weeks and the final load after approximately nine weeks.

At the weighbridge the logs were weighed and scaled for volume. A value of weight per cubic metre was obtained. Four logs from each load were then debarked at Waipa sawmill and taken to the Timber Industry Training Centre Sawmill. These logs were sawn into boards and the waste was chipped. The chips were assessed for size and moisture content.

Six trees were chosen for more extensive investigation of the rate of drying of the stems. At periods of 0, 2, 4, 6, 8 and 10 weeks after felling, discs were

cut at various positions in the tree and assessments made of moisture content, density and percent saturation. Cellular activity in the sapwood of the felled trees was studied. Insect and fungal status of the trees and water stress in the needles were monitored.

RESULTS

Log and Chip Drying

The following table summarises the results.

	At time of felling	After 5 weeks	After 9 weeks
Logs % change in weight per unit volume	0	+ 4%	- 8%
Chips % change in moisture content	0	- 8%	- 16%

The rise in weight per unit volume of the logs after five weeks is probably explained by the fact that only a part load of logs was extracted at this time. These logs had a different diameter distribution from those taken in the first and third loads. The overall weight reduction of 8% is not considered particularly significant. The reduction in moisture content of the chips is greater at a total of 16% after 9 weeks. The greater reduction here is because the chips came from sawmill residue which is largely sapwood. Drying occurs in the sapwood rather than in the heartwood.

Drying Pattern from Analysis of Discs

One of a group of six trees was sectioned every second week to determine drying patterns and moisture distribution variation with height and radial position in the tree.

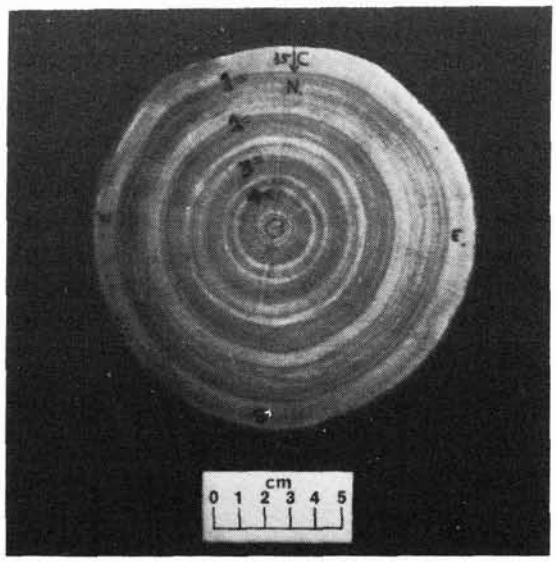

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Figure 1 - Seven year old radiata pine after 4 weeks of drying. Dry concentric rings have formed in the earlywood of each annual ring. Latewood rings are marked 1 to 4.

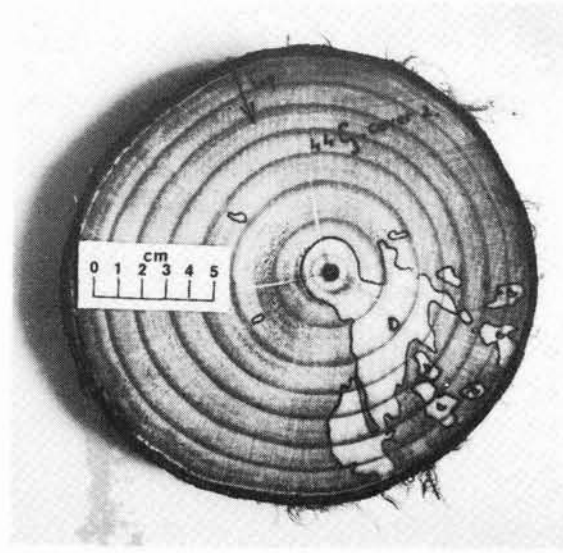

Figure 2 - Drying pattern of 17 year old radiata pine after 10 weeks. Dry and light coloured areas have formed, marked with the letter D.

The drying pattern of internodal sections in the 17 year old trees differed markedly from the pattern perviously observed in seven year old trees. These differences are shown in figs 1 and 2. The drying pattern of seven year old radiata pine is shown in figure 1, where the latewood rings are numbered 1 to 4 from the bark. In the earlywood of each annual ring one or more dry light-coloured concentric rings formed, while the moisture content of the adjacent earlywood remained unchanged. For the 17 year old trees such concentric rings did not constitute the main drying pattern, however. Where substantial drying out took place it occurred in patches, as shown in figure 2, where most dry patches are marked with a D in the centre and all are markedly lighter in colour than normal green wood. Dry areas were first observed in the upper crown after four weeks of drying. As drying time increased the size and frequency of dry areas in the upper crown region increased, and many also occurred in the lower crown region. However, even after 10 weeks of drying only a few small dry areas had developed in the stem regions below the crown. Hence it appears that crown suction is not capable of removing moisture from the stem region below the crown. This was confirmed by moisture content and relative moisture content measurements of the sapwood. As most of the commercial log volume of a tree occurs below the crown, this explains the small amount of drying that was reported above for complete logs after 9 weeks of drying.

Insect and Fungal Attack

The felled trees were examined for the presence of insect and fungal attack every two weeks for ten weeks after felling.

After four weeks, two of the six trees had light bark borer attack confined to the butt area. On subsequent inspections, the attack was found to have moved up the tree, but it remained at a light intensity. After ten weeks, one tree had a light attack of pit weavil where it was in ground contact. No sapstain fungus was observed.

Insect and fungal attack did not become important during the period of observation, unless the logs had been destined for export. However, their presence is very season-dependent, and related to areas of recently felled forest.

CONCLUSIONS

The results from this trial do not indicate any economic significance for drying radiata pine of this age in the forest. Drying occurred only in the young trees and where the green crown extends well down towards the base of the tree. At this stage it is not considered worth evaluating management implications of tree drying in the forest. While 17 year old trees did not show any significant drying, trials with earlier pulpwood thinnings may give results similar to those found with the trial in seven year old trees. If any N.Z. logging organisation wishes to pursue this possibility, LIRA and F.R.I. would be willing to assist.

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