

Theme: Specialty Wood Products (SWP)

WORK PLAN

Work Plan No. SWP-WP081

Milestone Number: 1.1.3.7

**Assessing the wood properties of 20
year old unpruned *Cypress clones***

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This document is confidential to SWP Members

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TABLE OF CONTENTS

BACKGROUND	3
Objectives	4
Personnel	4
Air Drying	5
PARTNER/CO-OPERATORS.....	5
OUTput of study.....	6
PROJECT COSTS.....	7
Milestone 1: Identify Suitable Stand/trees for harvest. Obtain harvest and transport costs	7
Milestone 2: Pre-harvest measures, felling, transport to Raetihi for sawmilling	7
Milestone 3: Saw Logs	7
Milestone 4: Report	7
MILESTONE SUMMARY	8
INTELLECTUAL PROPERTY.....	8
SPECIFIC HEALTH AND SAFETY PLAN	8
REFERENCES	8

BACKGROUND

The last research study into grade recoveries and wood quality for cypress was undertaken in 2005¹. In this pilot study both appearance grade recoveries and structural visual grades were assessed from young pruned trees (21 years old) for a range of cypress species in order to test whether it is viable to harvest young cypress for timber.

The regime was modelled on *radiata*, planted at 3m x 3m with a final stocking of 550 stems per hectare and trees were pruned to between 5m and 8m. Trees selected for processing were greater than 30 cm dbh.

Clearwood recoveries were not determined for the pruned buttlogs because boards were not grade-sawn for clearwood or specific grades. It can be assumed that pruning would have been undertaken to achieve much larger diameters than those milled in this trial and clearly the rotation length was too short for this regime. The conclusion was that "harvesting and milling at this age would be barely viable economically". Subsequent testing of an unpruned regime of this age for the same grades (dressing, merch and framing grades) was not undertaken.

"S" Log diameters were from 323 mm SED down to 186 mm SED, with little variation in sawn recovery according to diameter, suggesting that this log size range may be appropriate for sawing. Sawn recoveries were acceptable, whereas degrade caused low grade-recoveries. Much of the degrade was potentially avoidable had the timber been sawn, dried and processed under improved or optimised parameters. Drying parameters could no doubt be refined, but slow air-drying is good standard practice for producing cypress with low levels of drying degrade.

The trees selected for testing were not from a regime designed for harvest at 20 years of age or from trees of improved selections. The *macrocarpa* logs were badly affected by canker, the *macrocarpa* had more branches than *lusitanica*, the *lusitanica* had large branches and the Leyland cypress trees were small. Buttlog taper was high. All three species had very high branch indices under this regime, much higher than 26-year old *radiata* at 400 stems per hectare¹. Although perhaps indicative of standard practice *radiata* forestry in terms of an immature pruned regime, measuring sawn recoveries from this trial does not help with estimating economic viability of these taxa, especially given that none were improved or selected for growth and form.

Deficiencies in this study included:

- Drying did not mitigate drying defect such as knot checks, surface checks, twist and crook which significantly reduced grade recoveries;
- Whole board lengths (3m) were graded. This means where one defect was present in the board, the whole board length would be degraded to "box". With modern jointing technology available, board length is not as important as grade. Therefore it would be preferable to grade "cuttings" to optimise the trade-off between length and highest grade, for highest value recovery;
- Appearance grades were only assumed based on grading of one face (the outer face) of structural-sized material. Timber should be sawn to size and graded on both faces for appearance properties when measuring trial grade recoveries;
- Wane resulted in significant degrade. This would not be present if appropriate technology were used, such as a precision twin-blade edger used in conjunction with the woodmizer bandsaw;
- Pith was included, reducing appearance and structural properties. Pith should be removed by proper edging for either appearance or structural grades;
- Poor machining performance. This may not have been optimised to the species, resulting in chipping and a reduction in grade recoveries. Slower feed rates or narrower knife angles should overcome this degrade.

Low grade recoveries resulted from wane, knot checks and chipping out during dressing, along with twist and crook, surface checking and also pruned stub holes and excessive knot size all

resulted in reduced grade recoveries. These are all avoidable defects, either from stand management or by processing and docking methods.

Bending tests showed a wide variation in stiffness values both between and within species, along with some variation according to position in tree. The report concluded that for *C. lusitanica*, which had a very wide variation in wood stiffness (between 3.0 - 11.4 GPa), that stiffness varied between inner wood and outer wood and suggested a relationship between stiffness and density. Stiffness also appeared to decline going up the tree. However, testing was on full sized timber that was selected to represent the different radial positions, which does not accurately determine changes in radial strength properties.

The conclusion that "harvesting and milling at this age would be barely viable economically" was justified by the very low grade recoveries from this study. It is proposed that better quality cypress trees from regimes appropriate for the harvest age be processed and grade recoveries determined as a pilot for guiding possible further work on the species. If the results from this previous study can be reversed and economic viability implied, then further work would be justified to explore economic potential for cypress and optimised regimes.

Objectives

1. Determine green grade recoveries from unpruned 20-year-old *Cypress* clones from an appropriately stocked regime, from trees displaying good growth and form characteristics and processed using best practice.
2. Store and air dry all boards for grading (not covered in this WP)
Assumptions are that:
 - a. grade recoveries could be improved by a regime with a lower branch index;
 - b. a conservative air-drying regime can mitigate drying defect;
3. Both appearance and structural grades will be measured. Cypress is primarily an appearance timber and substitute for high-value native softwoods now in short supply. However, regard should also be given for marketing lower grades into structural applications. Cypress heartwood is more durable than Douglas-fir heartwood² and is the only softwood suitable for structural applications without treatment in New Zealand (NZS 3602 draft). Cypress sapwood is more durable than Douglas-fir sapwood² and is therefore suitable for use untreated in buildings of simple design (B2, NZ Building code) as structural timber, a significant market advantage if stiffness deficiencies could be overcome. To capitalise on these advantages along with grower needs in terms of economic viability, both appearance and structural grades should be assessed from young trees (20 years old) from unpruned regimes, such that overall grade recoveries and value are optimised.

The purpose of this study is to quantify grade recoveries for 20-year-old trees with good growth and form, for a low cost unpruned regime at an optimum stocking. It is proposed that 12 trees are harvested from a suitable site (approx. 20 years old). Unpruned trees would be selected for good growth and form and with low branch indices.

The intention is to provide pilot grade recoveries from trees with good genetics, under an optimised regime and where the wood is dried and graded to best practice. Recoveries will be measured as docked lengths of higher value appearance grades where possible, and long length structural grades where appearance grades are not practical.

4. Prepare a report summarising these results.

Personnel

Dean Satchell, Marika Fritzsche, Vaughan Kearns (Ruapehu sawmills)

METHODS

The number of trees tested will be 14 unpruned from FR328/6 at cpt 131 Rotoehu forest. Six trees of clone Owensii and 8 of clone GH5 that have good growth and form with low branch indices) will be selected for this study.

Tree selection will be performed by Scion and Timberlands staff. The 14 trees selected as being representative of the stand. These trees will be marked, DBH and Height measured. From these trees, logs will be cut to 6m long and labelled with tree number, and whether they are the butt log or second/third log. Logs will be freighted to the chosen Ruapehu sawmill.

Prior to sawing, the following measurements will be made on each log:

- Branch index
- Sapwood and heartwood diameters
- Hitman
- Measure log length and large end and small end diameters
- Sweep

A combination of 25mm and 50mm thick boards will be cut from each log, according to best practice sawing for cypress for highest grade recoveries and appropriate products. The final cutting pattern will be decided in consultation with Dean Satchell. Boards will be slabbed with a horizontal bandsaw and then edged with a precision twin blade edger.

Straightening cuts may need to be incorporated into the sawing to give greater control of board dimensions. Sawn boards will be given a unique barcode or colour pattern for identification.

Air Drying

Boards will be fillet stacked in covered packets with side shelter. Air drying will be to below 20%mc.

Future work once dry- Scion (subject to funding)

1. Mechanical testing on small clear samples to determine stiffness and strength according to radial and vertical position in the tree.
2. Grade dry boards according to NZS 3631 for the following grades:
 - a. Clears
 - b. Premium
 - c. Dressing
 - d. Modified No. 1 Cuttings
 - e. Modified No. 2 Cuttings
 - f. Box grade
3. Record length of each Clears section and Premium section of face and edge of all boards)
4. Record type of degrade causing Box.

It is anticipated that wood from this study will be used for processing experiments such as thermal modification and/or chemical treatment, finger-jointing, glues and gluelines, and/or processes that improve hardness.

PARTNER/CO-OPERATORS

Timberlands have offered the logs as in-kind contributions. Scion will pay for tree extraction and transport to the sawmill. Ruapehu Sawmills will be contracted to saw the logs, provide facilities for grading and will mill, stack and begin air drying the boards onsite as funding for further work is not yet in place.

- To identify suitable trees to be sampled within stand.
- Arrange harvesting and transport of logs to Ruapehu sawmills.
- Sawing logs under Dean Satchells direction/Cutting plan

OUTPUT OF STUDY

A report outlining tree and log information, methods used for sawing according to diameter or other noteworthy variables, the differences and issues experienced with grade-sawing buttlogs and headlogs, any decay or movement issues, observations on levels of knot degrade in headlogs and issues encountered with sawing very small diameter headlogs.

PROJECT COSTS

Milestone 1: Identify Suitable Stand/trees for harvest. Obtain harvest and transport costs

Cost: \$5,000

Personnel: Marika Fritzsche, Toby Stovold

Completion Date: 30 April 2019

Task Summary: Stand selection, tree selection, labelling. Confirm any in-kind assistance from owners and costs for logging and transport to chosen Sawmill

Output: Trees from a suitable stand identified and harvest and transport costs identified.

Milestone 2: Pre-harvest measures, felling, transport to Sawmill for sawing

Cost: \$14,500

Personnel: Toby Stovold, Marika Fritzsche

Completion Date: 30 May 2019

Task Summary: Pre harvest assessment, mark trees
Select harvest and transport contractors
Harvesting and transport of trees, measurement of logs

Milestone 3: Saw Logs

Cost: \$17,300

Personnel: Dean Satchell, Rosie Sargent, Kane Fleet, Vaughan Kearns

Completion Date: 30 July 2019

Task Summary: Saw Logs

Output: Data file of measurements

Milestone 4: Report

Cost: \$2,000

Personnel: Dean Satchell

Completion Date: 30 October 2019

Task Summary: Report

Output: Report findings

MILESTONE SUMMARY

All costs exclusive of GST

Milestone	Output	Dean Satchell/ Sawmill	Cost	Total \$
1	Identify Suitable Stand/trees for harvest. Obtain harvest and transport costs		\$5,000	\$5,000
2	Pre-harvest measures, Felling, Transport to Sawmill.		\$14,500	\$14,500
3	Sawing and capture Board data	\$7,000	\$10,300	\$17,300
4	Report	\$2,000		\$2,000
Total				\$38,800

INTELLECTUAL PROPERTY

This work plan is governed by the Services Agreement dated 1 January 2016 between FOA and Scion. Any intellectual property made, discovered or developed under this work plan will be owned and managed according to clause 11 of the Services Agreement.

SPECIFIC HEALTH AND SAFETY PLAN

Scion will be provided with an acceptable Health and Safety Plan by Ruapehu sawmills before any activities are undertaken.

REFERENCES

1. Sawn timber and wood properties of 21-year-old *Cupressus lusitanica*, *C. macrocarpa*, and *Chamaecyparis nootkatensis* × *C. macrocarpa* hybrids. Part 1: Sawn timber performance (2006) C. B. Low, H. M. Mckenzie, C. J. A. Shelbourne, and I. D. Gea. Scion.
2. The decay resistance of Douglas-fir, *C. macrocarpa*, Lawson cypress and European larch framing summary of results after 52 weeks exposure. (2005) Mick Hedley. Scion.