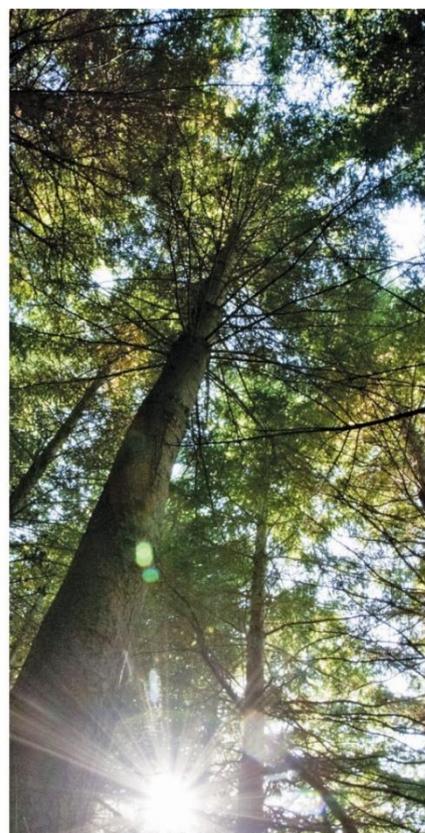
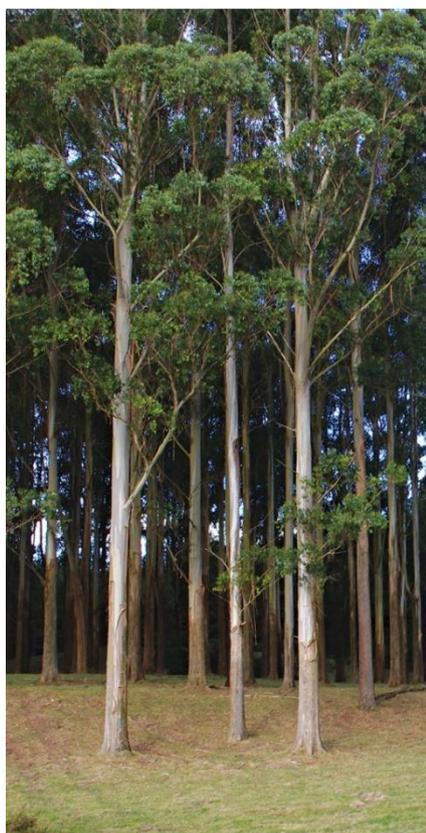


# Decay rate of Cypress stakes after two year's exposure at the Whakarewarewa test site

Authors: Jackie van der Waals, Ian Simpson, and Tripti Singh



**Date:** 11 May 2023

Publication No: SWP-T167

---

# TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	1
INTRODUCTION .....	2
METHODS.....	2
Sample preparation.....	2
Rotoehu <i>C. x ovensii</i> .....	2
Riverhead <i>C. x ovensii</i> .....	2
Leyland Cypress .....	3
Assessment rating scale .....	3
RESULTS .....	3
Assessment results .....	3
REFERENCES .....	4
APPENDICES.....	5
Appendix 1: Individual stake data.....	5
Appendix 2: Description of individual stakes .....	7
Appendix 2 continued: Description of individual stakes .....	9

## Disclaimer

This report has been prepared by New Zealand Forest Research Institute Limited (Scion) for Forest Growers Research Ltd (FGR) subject to the terms and conditions of a research fund agreement dated 1 April 2014.

The opinions and information provided in this report have been provided in good faith and on the basis that every endeavour has been made to be accurate and not misleading and to exercise reasonable care, skill and judgement in providing such opinions and information.

Under the terms of the Services Agreement, Scion's liability to FGR in relation to the services provided to produce this report is limited to the value of those services. Neither Scion nor any of its employees, contractors, agents or other persons acting on its behalf or under its control accept any responsibility to any person or organisation in respect of any information or opinion provided in this report in excess of that amount.

## EXECUTIVE SUMMARY

Stakes of *Cupressus x ovensii* grown in Rotoehu and Riverhead, and ***Cupressus x leylandii*** (Leyland cypress) were installed in the Whakarewarewa outdoor test area in April 2021. Untreated radiata pine and CCA H4 treated radiata pine stakes were also included for comparative purposes.

After two years in-ground exposure, the first Rotoehu *Cupressus x ovensii* stake failed giving the group an Index of Condition (I o C) of 7.3. The Riverhead *Cupressus x ovensii* group had an I o C of 7.5 and the *Cupressus x leylandii* group an I o C of 7.7.

In comparison, the CCA H4 treated radiata pine stakes have an I o C of 9.6 and the untreated radiata pine stakes an I o C of 3.0 (three stakes failed at this latest inspection).

This trial should continue and be assessed annually, with the next assessment due in April 2024.

# INTRODUCTION

Natural durability is a key focus for the SWP Eucalypts and cypresses breeding programmes. Natural durability is known to vary by the level of extractives and possibly growth rates which in turn are known to potentially vary by genetics and environmental conditions at growing sites. This implies that to assign accurate durability performance to a species, more than one set of 'replicate' trees need to be assessed.

Trees from *C. x ovensii* which is a clone of the hybrid *C. lusitanica* x *C. nootkatensis* (nootka), are starting to become available as they are now large enough to produce meaningful amounts of processed timber. Leyland cypress is a hybrid with macrocarpa/lusitanica and nootka cypress parentage. Durability is a key feature for cypress timber, so understanding the durability of *C. x ovensii* and Leyland cypress is important for its future utilisation.

A stake trial was established in the Whakarewarewa outdoor test area to determine the in-ground durability of *Cupressus x ovensii* and *Cupressus x leylandii* (Leyland cypress). This report presents the results of the decay assessment after two year's exposure.

## METHODS

### Sample preparation

Stakes (20 x 20 x 500 mm) were prepared as shown in Table 1. Appendix 2 records a description of each stake.

**Table 1:** Stake groups

Group	Source	Number of stakes	Comments
<i>Cupressus x ovensii</i>	Rotoehu	30	Three 22 year old trees
	Riverhead	30	One 24 year old tree
<i>Cupressus x leylandii</i> Leyland cypress	Northland	30	Sawn at Ruapehu sawmill
CCA H4 treated radiata pine	-	10	
Untreated radiata pine sapwood	-	10	

#### Rotoehu *C. x ovensii*

The selection and harvesting of these trees is covered in the file note SWP-FN084 (Stovold, et al., 2019). The trees were 22 years old and were grown as part of a cypress clonal trial. The graveyard stakes were cut from three trees. Stakes were cut at Scion from inner and outer heartwood at three heights up each tree:

- The bottom of the first 6 m log (approx. 0.5 m up the tree)
- The top of the second 6 m log (approx. 11.5 m up the tree)
- The top of the first 6 m log (approx. 5.5 m up the tree). In a few cases suitable samples couldn't be found, so stakes were cut from the bottom of the second log (approx. 7 m up the tree)

#### Riverhead *C. x ovensii*

These trees were grown by Audrey Hayes, Riverhead and were 24 years old at the time of harvest. Details of the trees were published in New Zealand Tree Grower in February 2013, and can be

found on the New Zealand Farm Forestry Association Website (Satchell, 2013). These stakes were supplied to Scion in final dimension and came from the head log of one tree (approx. 8 m up the tree).

## Leyland Cypress

Eighteen lengths of Leyland cypress were supplied to Scion by Ruapehu sawmill as boards for structural testing. Half the boards were 150 x 40 mm and half were 150 x 25 mm. The boards were nominally 4.8 m long, but many boards were longer. The boards came from trees grown in Northland, and no further details are known about the trees. Stakes were cut at Scion from all 18 boards, with between 1 and 3 stakes cut from each board. The board number and the end of the board where the stake was cut was recorded. For five boards, it was possible to cut stakes from either end of the board.

Stakes were installed in the Whakarewarewa graveyard in Rotorua in April 2021. The second assessment was carried out in May 2023. The assessment rating scale is shown below.

## Assessment rating scale

### Decay ratings

10	No decay or insect damage.
T	Trace or discolouration, not positively identified as decay.
9	Minor decay, 0 - 3% of the cross section.
8	Lightly established decay, 3 - 10% of the cross section.
7	Well established decay 10 - 30% of the cross section.
6	Extensive and deep decay, 30 – 50% of the cross section.
4	Deep and severe decay, more than 50% of the cross section.
0	Failed.

The Index of Condition is the average of all the stakes in a group.

## RESULTS

### Assessment results

The following table shows a summary of the decay ratings. Appendix 1 lists the individual stake ratings.

**Table 2:** Index of Condition for each group of samples after two year's exposure (30 stakes in each cypress group, 10 stakes in each radiata pine group)

Group	Source	Number of stakes	Index of Condition / Average life <sup>1</sup>
<i>Cupressus ovensii</i>	Rotoehu	30	7.3 (1) <sup>2</sup>
	Riverhead	30	7.5
<i>Cupressus x leylandii</i> Leyland cypress	Northland	30	7.7
CCA H4 treated radiata pine	-	10	9.6
Untreated radiata pine	-	10	3.0 (3)

<sup>1</sup> Index of Condition is the average decay rating for all of the stakes in a group.

<sup>2</sup> Number of stake failures in brackets.

After two year's in-ground exposure, the first stake failure occurred in the Rotoehu *Cupressus ovensii* group, giving this group an I o C of 7.3. Failure was due to white rot. The Riverhead

*Cupressus ovensii* and the Northland *Cupressus x leylandii* groups have similar I o C's of 7.5 vs 7.7. All the remaining *Cupressus sp* stakes have ratings between 9 (minor decay) to 6 (extensive to deep decay).

In comparison, the I o C of the CCA H4 treated radiata pine group is 9.6 with one stake rated 10 (sound), five stakes rated T (Trace or discolouration, not positively identified as decay), and four rated 9 (minor decay). Three stakes in the untreated radiata pine group failed at this latest inspection, giving the group an I o C of 3.0. Failures were due to a mixture of brown and white rots. Remaining stakes in this group have ratings of 6 (extensive and deep decay) or 4 (deep and severe decay).

The *Cupressus ovensii* stakes from Rotoehu were cut from either inner or outer heartwood. Table 3 shows the I o C separately for the stakes cut from inner and outer heartwood.

**Table 3:** Index of Condition for *Cupressus ovensii* inner and outer heartwood samples after one year's exposure

Group	Source	Number of stakes	Index of Condition / Average life <sup>1</sup>
<i>Cupressus ovensii</i> Rotoehu	Inner	15	7.7
	Outer	15	6.9 (1) <sup>2</sup>
	Inner and Outer combined	30	7.3 (1)

<sup>1</sup> Index of Condition is the average decay rating for all of the stakes in a group.

<sup>2</sup> Number of stake failures in brackets.

A difference can be seen between the I o C's of the inner and outer heartwood stake samples (7.7 vs 6.9). This has widened due to the failure of an outer stake at this latest inspection and that three other outer stakes have a rating of 6 (extensive and deep decay). The rest of the inner and outer stakes have ratings between 9 (minor decay) and 7 (well established decay).

## REFERENCES

Australasian Wood Preservation Committee. (2015). *Protocols for assessment of wood preservatives*.

Satchell, D. (2013). Sawmilling Ovensii cypress - A New Zealand first? *New Zealand Tree Grower*.

Stovold, T., Sargent, R., & Satchell, D. (2019). *SWP-FN084 Sawing Cypress Clones - Green recovery. File Note prepared for the Specialty Wood Products Partnership*. Scion, Rotorua.

# APPENDICES

## Appendix 1: Individual stake data

Stake number	Row/Position	Index of Condition
<b><i>Cupressus x ovensii</i> - Rotoehu</b>		
3631	I14	7
3632	Q9	9
3633	B7	8
3634	G10	0
3635	F2	7
3636	T8	6
3637	N14	8
3638	C9	8
3639	D2	7
3640	R14	8
3641	R3	8
3642	G11	8
3643	A7	7
3644	M6	6
3645	C12	6
3646	B16	8
3647	S19	8
3648	Q17	8
3649	J4	8
3650	E15	8
3651	P8	8
3652	I13	7
3653	J20	8
3654	O16	8
3655	G3	7
3656	H17	7
3657	D6	8
3658	Q13	8
3659	A10	8
3660	S4	7
<b>Average</b>		<b>7.3</b>

Stake number	Row/Position	Index of Condition
<b><i>Cupressus x ovensii</i> - Riverhead</b>		
3691	K9	8
3692	Q15	8
3693	D18	8
3694	F5	8
3695	L7	7
3696	R2	7
3697	G16	7
3698	N18	8
3699	R12	8
3700	A15	8
3701	M12	8
3702	K12	8
3703	F11	7
3704	B5	8
3705	L5	7
3706	H20	7
3707	S18	7
3708	F13	7
3709	E19	8
3710	J19	8
3711	M20	7
3712	T14	7
3713	L6	7
3714	S2	7
3715	E3	8
3716	N3	6
3717	O11	7
3718	K17	8
3719	S13	7
3720	D10	8
<b>Average</b>		<b>7.5</b>

## Appendix 1 continued: Individual stake data

Stake number	Row/ Position	Index of Condition
<b><i>Cupressus x leylandii</i> (Leyland cypress) - Northland</b>		
3661	P16	8
3662	M19	7
3663	K14	8
3664	S9	8
3665	A12	9
3666	N6	6
3667	E14	7
3668	J5	7
3669	N10	8
3670	I12	8
3671	O6	8
3672	R17	8
3673	H11	8
3674	B9	8
3675	C16	8
3676	O15	8
3677	P20	7
3678	P3	8
3679	M8	8
3680	L20	8
3681	O9	8
3682	S14	8
3683	T10	7
3684	E7	7
3685	L11	7
3686	D9	7
3687	Q11	8
3688	M2	8
3689	G6	8
3690	S4	7
<b>Average</b>		<b>7.7</b>

Stake number	Row/ Position	Index of Condition
<b>CCA H4 treated radiata pine</b>		
2118	A18	9
2742	Q4	9
2743	I15	T
2744	L14	T
2745	P7	T
2746	M13	9
2747	D20	T
2748	S12	10
2749	J10	T
2750	T3	9
<b>Average</b>		<b>9.6</b>

<b>Untreated radiata pine</b>		
2941	F17	4
2942	Q19	4
2943	J13	4
2944	M5	0
2945	R6	4
2946	C20	4
2947	B18	6
2948	O17	4
2949	L4	0
2950	A19	0
<b>Average</b>		<b>3.0</b>

## Appendix 2: Description of individual stakes

### *Cupressus x ovenii* stakes from Rotoehu

Stake no.	Plot position		Stake code <sup>1</sup>	Bar code <sup>2</sup>	I / O <sup>3</sup>	Comments
3631	I14	1	17-1-L-O	42993	O	
3632	Q9	2	17-1-L-O	43005	O	
3633	B7	3	17-1-L-O		O	
3634	G10	4	17-1-S-O	43006	O	
3635	F2	5	17-7-S-O	43050	O	
3636	T8	6	19-1-S-O	25063	O	
3637	N14	7	19-1-L-O	42908	O	
3638	C9	8	19-7-S-O	43038	O	
3639	D2	9	19-7-L-O	43041	O	
3640	R14	10	19-7-S-O	43058	O	Rough sawn patch one side
3641	R3	11	27-1-L-O	42967	O	
3642	G11	12	27-1-L-O	42967	O	
3643	A7	13	27-1-S-O	24994	O	
3644	M6	14	27-1-S-O	24994	O	Staple holes below top punched numbers
3645	C12	15	27-7-S-O	25174	O	Knot 1/4 from one end
3646	B16	16	17-1-L-I	43005	I	Knot 1/2 from end of stake
3647	S19	17	17-1-S-I	43006	I	
3648	Q17	18	17-7-S-I	43050	I	
3649	J4	19	17-7-L-I	43066	I	
3650	E15	20	19-1-S-I	25063	I	
3651	P8	21	19-1-S-I	25063	I	
3652	I13	22	19-1-S-I	25063	I	
3653	J20	23	19-1-L-I	42908	I	
3654	O16	24	19-1-L-I	42908	I	
3655	G3	25	19-7-S-I	43058	I	
3656	H17	26	27-7-L-I	25174	I	
3657	D6	27	27-7-L-I	25174	I	
3658	Q13	28	27-1-L-I	42967	I	
3659	A10	29	27-1-L-I	42967	I	Knot at one end
3660	S4	30	27-1-S-I	42969	I	

<sup>1</sup> Stake code indicates tree number, height (m) of the lower end of the board, small or large end of board where stake was cut, inner or outer heartwood <sup>3</sup>.

<sup>2</sup> Bar code is a unique identifier attached to each board.

## Appendix 2 continued: Description of individual stakes

### *Cupressus x ovensii* stakes from Riverhead <sup>1</sup>

Stake no	Plot position		Comments
3691	K9	61	Small knot 5 cm from stake top
3692	Q15	62	
3693	D18	63	
3694	F5	64	
3695	L7	65	
3696	R2	66	
3697	G16	67	
3698	N18	68	
3699	R12	69	Small knot 2 sides 1/3 from stake top
3700	A15	70	
3701	M12	71	
3702	K12	72	Small knot middle
3703	F11	73	
3704	B5	74	
3705	L5	75	
3706	H20	76	
3707	S18	77	
3708	F13	78	
3709	E19	79	
3710	J19	80	Knot 5 cm from top of stake
3711	M20	81	
3712	T14	82	
3713	L6	83	
3714	S2	84	
3715	E3	85	
3716	N3	86	
3717	O11	87	
3718	K17	88	
3719	S13	89	
3720	D10	90	Knot at top

<sup>1</sup> These samples were supplied by Dean Satchell, cut to the stake dimensions.

## Appendix 2 continued: Description of individual stakes

### *Cupressus x leylandii* (Leyland cypress) from Northland

Stake no.	Plot position		Stake code <sup>1</sup>	Comments
3661	P16	31	LE 2A 1	
3662	M19	32	LE 2A 2	
3663	K14	33	LE 2A 2	
3664	S9	34	LE 3A 1	
3665	A12	35	LE 3A 2	
3666	N6	36	LE 4A 1	
3667	E14	37	LE 5A 1	
3668	J5	38	LE 6A 2	
3669	N10	39	LE 6A 2	
3670	I12	40	LE 10 1	
3671	O6	41	LE 16A 2	
3672	R17	42	LE 17A 1	
3673	H11	43	LE 17A 1	
3674	B9	44	LE 18A 1	
3675	C16	45	LE 20A 2	
3676	O15	46	LE 22A 2	
3677	P20	47	LE 24B 1	Small knot middle of stake
3678	P3	48	LE 24B 2	
3679	M8	49	LE 24B 2	
3680	L20	50	LE 25B 1	
3681	O9	51	LE 25B 2	Small knot one end
3682	S14	52	LE 26B 1	
3683	T10	53	LE 26B 2	
3684	E7	54	LE 26B 2	
3685	L11	55	LE 28B 1	
3686	D9	56	LE 29B 2	Small knot one end
3687	Q11	57	LE 33B 2	
3688	M2	58	LE 33B 2	
3689	G6	59	LE 35B 1	
3690	E12	60	LE 35B 1	

<sup>1</sup> A or B = thickness of board stake was cut from. Boards were either 150 x 40 mm or 150 x 25 mm.

1 or 2 = position in board length where sample was cut.

## Appendix 2 continued: Description of individual stakes

### CCA H4 treated radiata pine

Stake no.	Plot position		Comments
2118	A18	91	
2742	Q4	92	
2743	I15	93	
2744	L14	94	
2745	P7	95	
2746	M13	96	
2747	D20	97	Rough sawn patch one side
2748	S12	98	Rough sawn patch one side
2749	J10	99	Rough sawn patch one side
2750	T3	100	Resin pocket near top of stake

### Untreated radiata pine

Stake no.	Plot position	
2941	F17	101
2942	Q19	102
2943	J13	103
2944	M5	104
2945	R6	105
2946	C20	106
2947	B18	107
2948	O17	108
2949	L4	109
2950	A19	110