



CHAPTER 8 - CYPRESS GROWTH MODEL AND EXAMPLE REGIMES

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INTRODUCTION

Cypress regimes are still evolving, but the regime outlined in Table 5 is currently recommended. This aims to produce a reasonable volume of logs/ha of sufficient diameter for efficient utilisation of clearwood

from butt logs and top logs with a reasonable proportion of green crown. As more experience is gained and further evaluations of regimes are carried out, this regime is likely to be modified in the future.

Table 5: Proposed silvicultural regime for cypress saw logs (initial stocking 1000 stems/ha)

Age (years)	Pruned height (m)	Number pruned (stems/ha)	Thin to (stems/ha)
6	2.5	600	600
8	4.0	400	
10	6.0	300	300

GROWTH MODEL

A preliminary growth model has been developed for New Zealand-grown macrocarpa and lusitanica plantations. Functions that predict mean top height and basal area growth, mortality, thinning, initial basal area, and volume were developed using data collected from permanent sample plots in most regions of New Zealand (Table 6). Maximum MAI was probably underestimated in some regions where young or thinned stands were yet to reach peak MAI. The model is referred to as “preliminary” because most plots were located in young stands, and had not been re-measured many times. The model relies heavily on data from a smaller number of older stands for predictions to later ages. These older stands may or may not adequately represent the types of sites and seedlots being planted more recently.

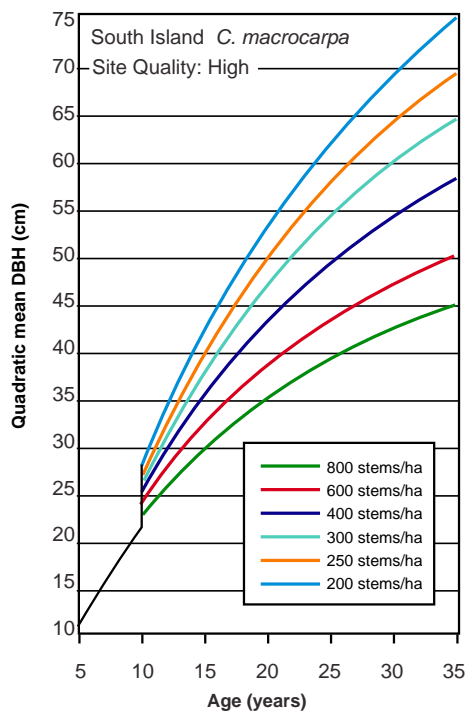
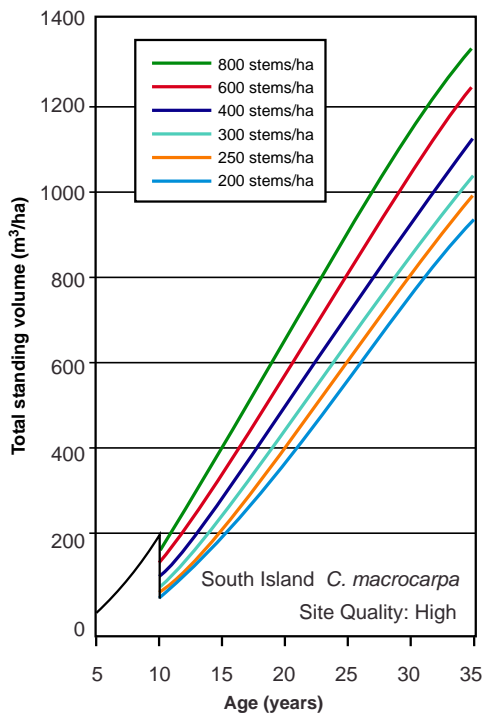
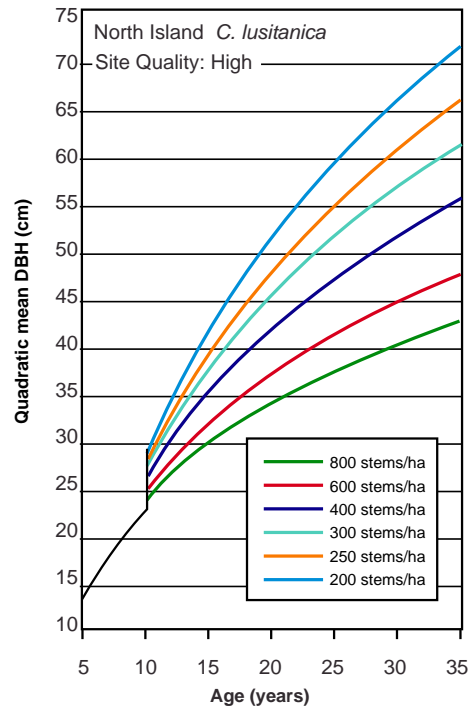
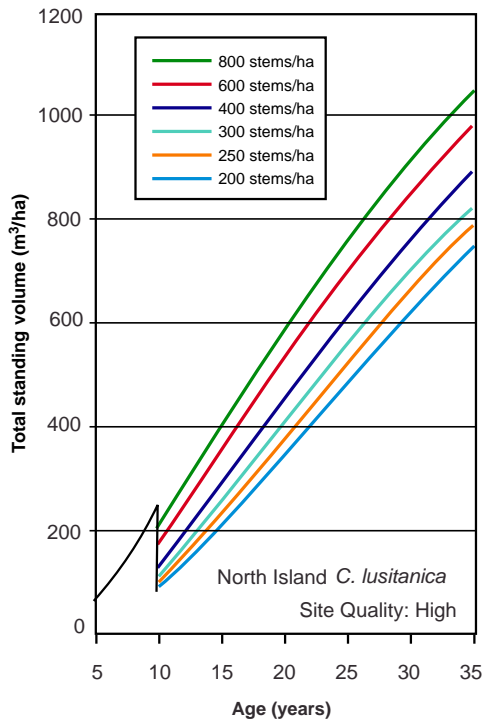


Table 6: Lusitanica and macrocarpa sample plot count, maximum age and mean annual volume increment (MAI) by geographic region of New Zealand.

Region		Lusitanica			Macrocarpa		
		No. plots	Max. age	Max. MAI (m ³ /ha)	No. plots	Max. age	Max. MAI (m ³ /ha)
North Island	Northland	34	41	19.3	4	42	17.2
	Auckland	6	8	11.0	-	-	-
	Bay of Plenty	47	41	24.6	20	39	15.6
	Waikato	33	67	19.8	23	61	22.6
	Gisborne	20	31	20.3	3	4	6.3
	Hawkes Bay	10	28	26.0	-	-	-
	Taranaki	1	32	19.6	1	33	29.0
	Wanganui/Manawatu	3	31	17.5	10	34	20.0
	Wellington	3	13	18.5	6	51	22.9
All regions		157	67	26.0	67	61	29.0
South Island	Nelson	1	13	11.4	8	36	4.7
	West Coast	8	14	9.2	7	16	18.9
	Canterbury	-	-	-	21	55	16.9
	Otago	-	-	-	53	72	36.1
	Southland	-	-	-	7	18	16.4
All regions		9	14	11.4	96	72	36.1

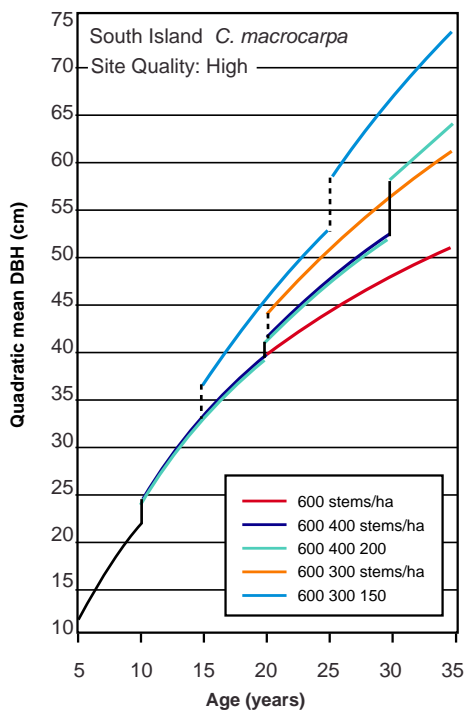
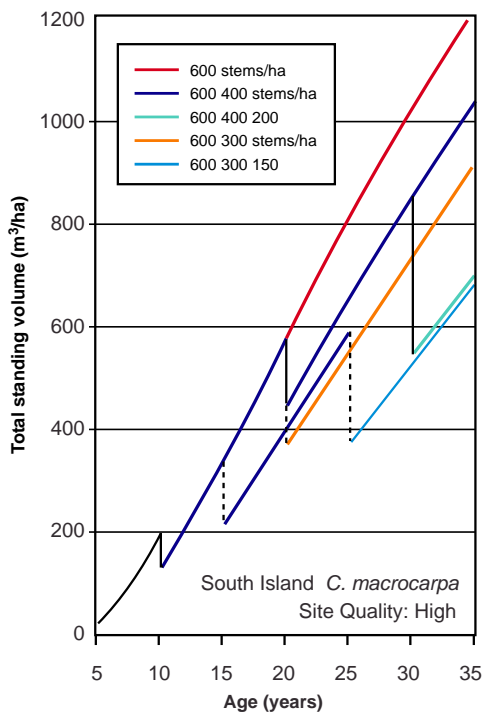
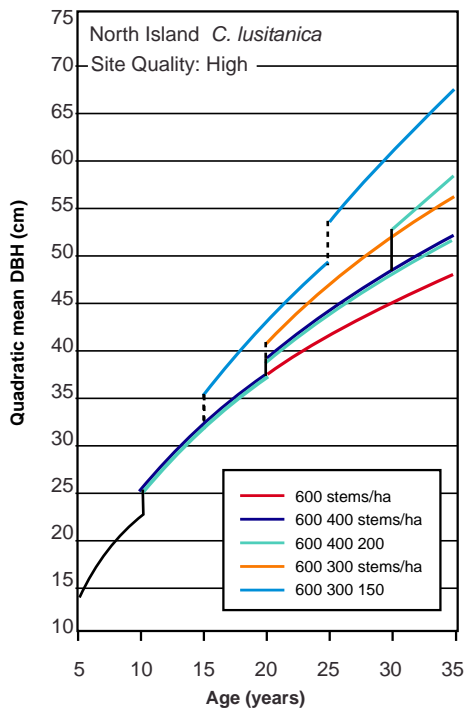
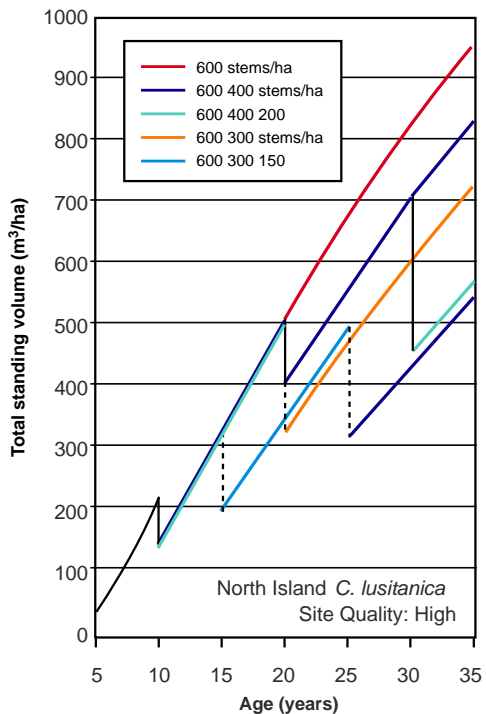
The model can be started with default or user-defined values for tree height, diameter, age and stocking. The model user can schedule thinning, and “grow” the trees forward in time, observing the influence of stocking and site quality on average tree diameter and total standing volume. The model can be used to find the rotation length needed to achieve a target average tree diameter for any given stocking, or to find the stocking needed to produce a target average tree diameter over a set rotation length.

The following graphs show various simulated model runs designed to demonstrate the influence of final crop stocking, multiple thinnings and site quality on cypress growth and yield for North Island lusitanica (top) and South Island macrocarpa (bottom). In the following examples, starting values for 1100 stems/ha planted on a high-quality site (90th percentile of all NZ data) were grown to age 10, and thinned to a range of final crop stockings demonstrating the influence of stocking on volume and tree size.



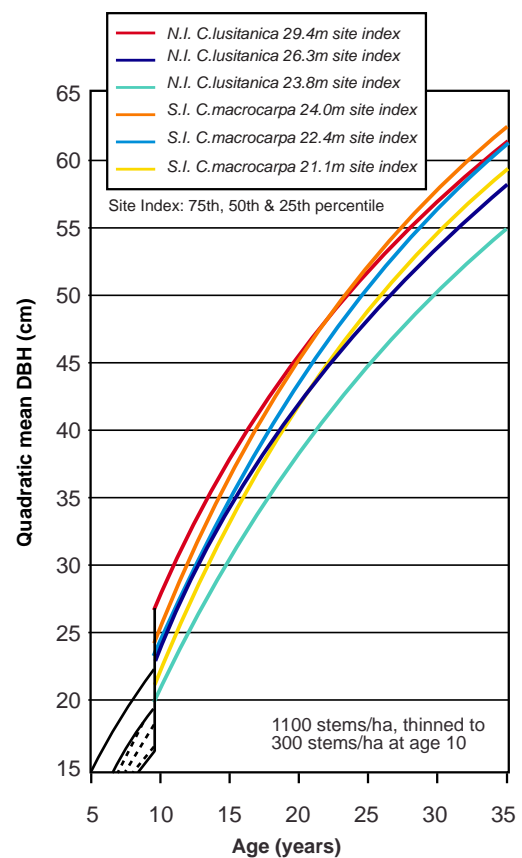
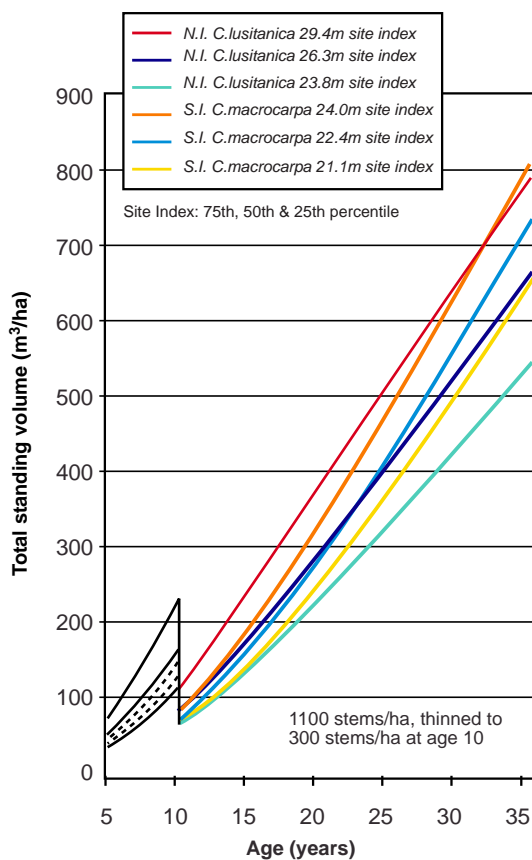
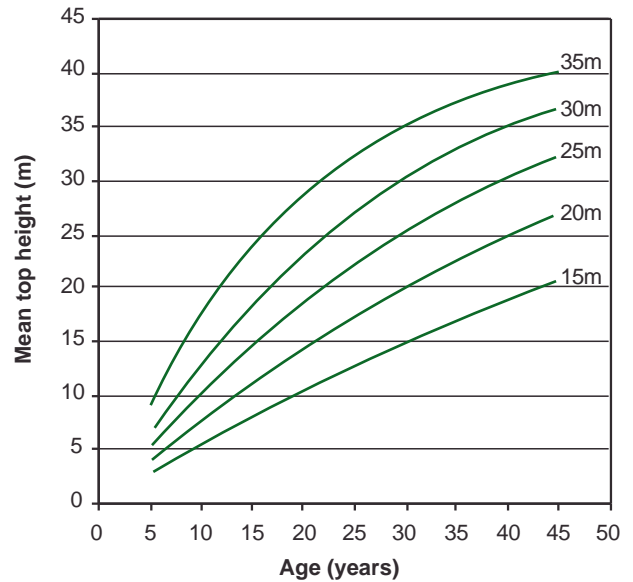
Thinning is modelled “from below” where smaller trees are removed. The following graphs show 1100 stems/ha thinned to 600 stems/ha at age 10, and various later thinnings again for

lusitanica (top) and macrocarpa (bottom). Total standing volume is reduced, but average tree diameter increases as a result of thinning:

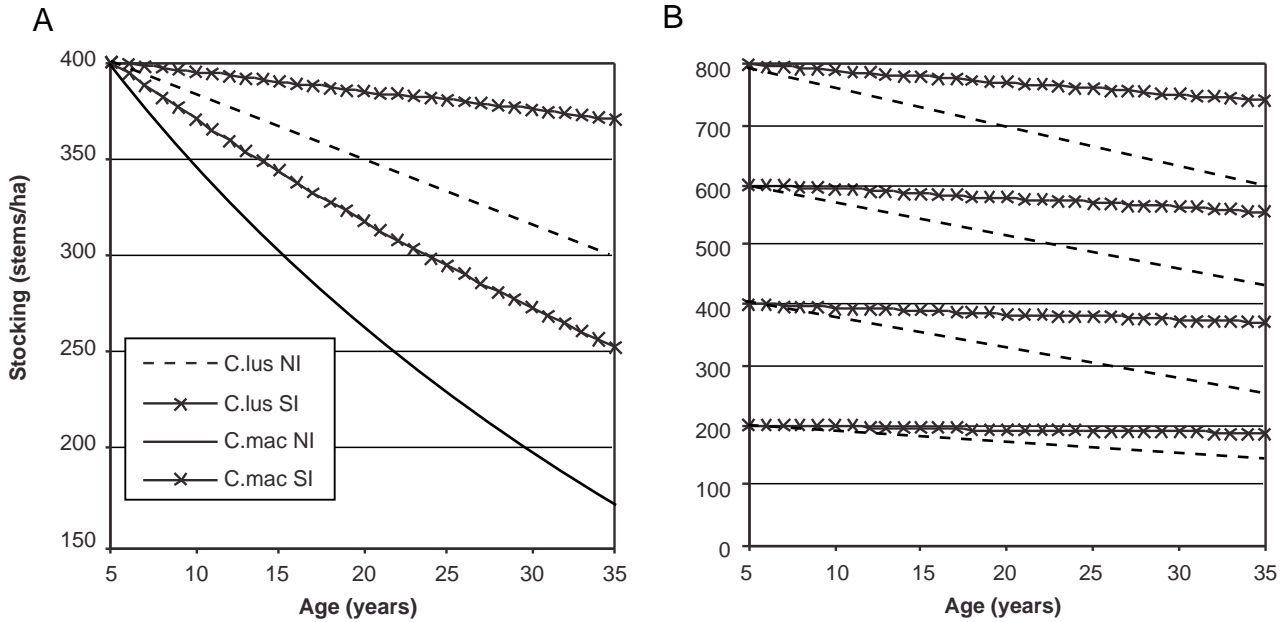


The graph on the right shows site index curves that approximately encompass the range of cypress mean top height and age data around New Zealand. Site Index is the expected height at a given age (30 years for cypresses). Mean top height is the average height of the 100 largest-diameter stems/ha.

Cypress growers should set up sample plots to monitor tree growth and obtain starting values for growth model projections. Tree growth data from your own land, or possibly neighbouring land, probably give better starting values than the model defaults. Height and age data give site index (defined as mean top height at base age 30 years), while stocking and average diameter give basal area (m^2/ha) starting values. In the graphs below, the 75th, 50th and 25th percentile of NZ data show the important influence of site quality on growth rate i.e., 300 stems/ha of lusitanica on the poorer site reach 50 cm average diameter 6 years later than 300 stems/ha on the better site:



The data used to develop the cypress growth model showed that cypress mortality varies widely between species and sites. The following graphs show mortality model predictions for 400 stems/ha at age 5 (A), and North Island lusitanica and South Island macrocarpa stands with 200, 400, 600 and 800 stems/ha at age 5 (B):



The cypress growth model does not consider the effect of pruning intensity on tree growth. The model considers pruning effects implicitly (by default) because data used to develop the model came mostly from pruned stands, but prediction errors may result if starting values are obtained from young stands where severe early pruning has temporarily slowed diameter growth.

For example, annual pruning to leave 1 m of green crown length has temporarily slowed the diameter growth of these age-4 lusitanica trees planted on an ex-pasture site near Gisborne.

Lusitanica pruned annually to 1 m green crown length, resulting in reduced diameter growth.



The preliminary model predictions of cypress growth and yield presented in this chapter may be quite different from growth on your land, but should help with decisions such as management regime design by demonstrating the important influence of stocking and site quality on tree and stand growth. Model users

are reminded that total standing volume includes non-recoverable waste volume such as defects, breakage, tops and cutting waste that can account for a significant portion of total standing volume. Further research is needed to identify and quantify the influence of various factors affecting cypress log grade recovery.

Key Points

- Current regimes suggest final crop stocking of 300 stems/ha, pruned to 6 m.
- The cypress growth model can be used to design regimes that match the owner's objectives, such as finding the optimal stocking for a given rotation length and target tree size.
- Final crop stocking has a major influence on volume production and average tree diameter development.
- Site quality also has a major influence on volume production and average tree diameter development.

Suggested reading:

Berrill, 2004.

Somerville, 1993.

Hay *et al.* 2005.