NORTHLAND TOTARA WORKING GROUP

NEWSLETTER 2013

Michael Bergin directs measurements of trees within a Permanent Sample Plot (PSP).

RE-MESUREMENT OF THE THINNED FARM-GROWN TOTARA IN NORTHLAND

Paul Quinlan, Northland Totara Working Group

Thin those totara trees!

Growth-rates of individual trees and overall stand productivity can be significantly boosted by thinning. This is indicated by the recent re-measurement of our silvicultural trials established five years ago in naturally regenerating totara-dominant pole stands in Northland. Analysis of these results has also led to the development of preliminary guidelines for thinning totara. This will help landowners to assess how much to thin natural pole-stands or plantations of farm-grown totara.

Many farms have stands of naturally regenerated totara that could be managed for future timber production. Promoting the sustainable commercial use of farm-totara is seen as an effective incentive to further develop this resource on private farmland that will also lead to many environmental and landscape benefits.

The silvicultural-trials

In 2007, 38 permanent sample plots (PSPs) were established in natural totara stands, across 10 farms in Northland. Sample plots are in pairs; one plot was thinned and pruned, the other plot was kept as a "control plot", and received no silvicultural treatments at all. The results below reflect the growth of all the PSPs five years since their establishment and demonstrate the effect of pruning and thinning on the growth-rates of naturally regenerated stands of totara on farms in Northland.

Paul Quinlan further (second) thins a Permanent Sample Plot (PSP) to a lower stocking rate.

Ministry for Primary Industries
Manatū Ahu Matua

Tane's Tree Trust
Native Trees for the Future

NZ LANDCARE TRUST

Increased diameter growth-rates

At all sites mean diameter growth-rates in the thinned plots are faster than in the un-thinned control plots. However there are significant differences in growth-rates between different sites. This is reflected in the range of just over 2mm, to just over 7mm, for the average periodic annual increment for tree diameters (DBH) in the thinned plots.

For the largest 800 trees per hectare, DBH periodic annual increment in thinned plots averaged 4.5 mm per year compared with 2.8 mm per year in un-thinned plots (Figure 1). This shows that diameter growth rates of individual trees in thinned stands are significantly boosted by the reduced competition. A practical implication is that, thinning poorly formed trees within a stand may boost the growth-rate of the remaining potential crop-trees.

Increased volume increment

Particularly interesting is the effect on overall stand productivity. The annual increase in volume per hectare of the live trees in 2012 was significantly higher in the thinned plots compared with the un-thinned plots (Figure 2). Thinned plots showed significantly lower mortality. Therefore the combined effects of greater growth and lower mortality meant that the average net volume annual increment in thinned plots at 7.7 m3/ha/yr was more than double that of un-thinned plots at only 3.1 m3/ha/yr.

A sample disc from a totara tree within one of the plots thinned 5 years before. Note the dramatic increase in the size of the last four growth-rings compared to those before that.

This plot was thinned in 2007 and has now been further thinned in 2012.

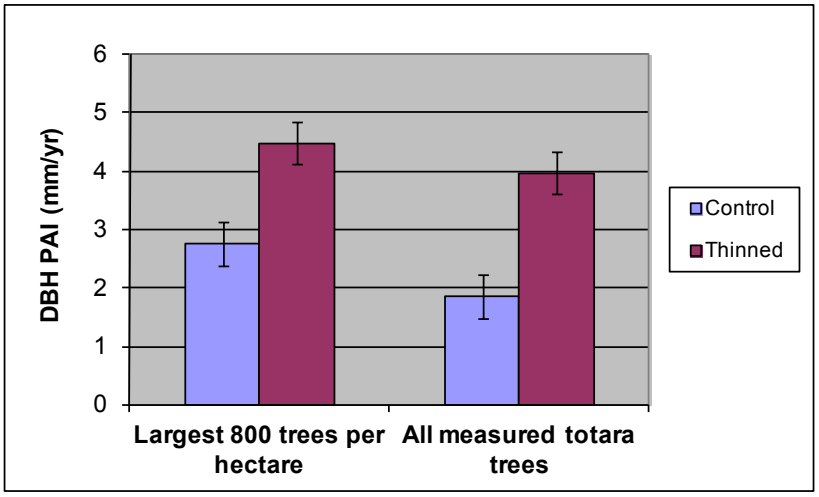


Figure 1: DBH periodic annual increment averaged across all sites for thinned and un-thinned plots over the five-year period 2007-2012 since thinning. Means are shown for the largest 800 diameter trees per hectare, and for all measured totara trees. Error bars show standard errors.

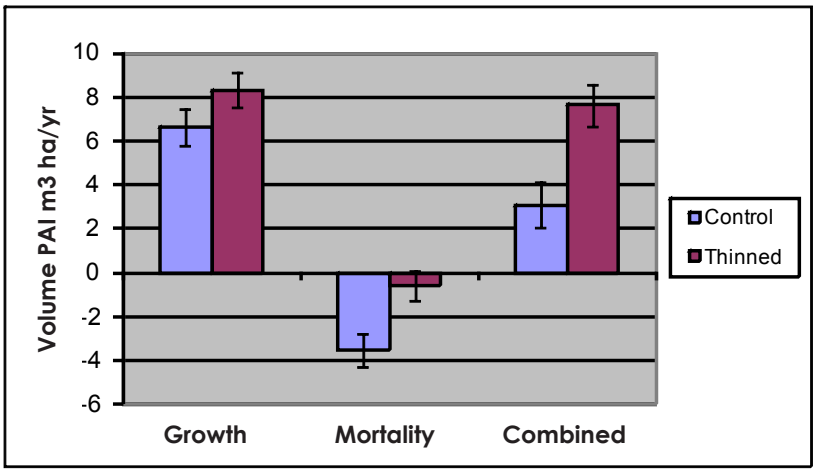


Figure 2: Periodic gross annual volume increment per hectare, mortality, and net volume increment, for control and thinned plots across all sites over the 5-year period 2007-12. Error bars show standard errors.

Implications for management

These are encouraging results that demonstrate a clear growth-response to management (thinning) of natural stands. Reducing competition through the removal of suppressed and malformed trees, can improve the growth-rates of the remaining trees, and also reduce the mortality. Also of particular note is that no significant loss to wind-throw was observed in the thinned stands. Furthermore, analysis of the data indicates that the thinning done within many of the trial plots was generally too conservative. It is therefore likely that a more aggressive thinning would further boost the growth of residual trees in thinned stands.

THINNING GUIDELINE

Scion biometrician Mark Kimberley has compared the growth data from the NTWG totara stands in terms of a Maximum Stand Density Index (SDI) analysis often used in North American studies of naturally regenerating northern hemisphere conifers. These overseas studies indicate that inter-tree competition typically begins at around 25% of SDI and becomes severe at 55% of SDI. Assuming this model can also be applied to totara in New Zealand, a preliminary thinning schedule for totara pole-stands as listed in Table 1 based on average stem diameters of target stands has been developed. The stocking rate at 25% of SDI is the suggested target for thinning. Application of this thinning schedule and ongoing monitoring of treated stands will be required to confirm whether optimum growth responses of treated totara stands is being achieved.

Table 1: Recommended thinning schedule for young naturally regenerating totara dominant pole stands.

Mean DBH* (cm)	Stocking at 55% SDI (stems/ha)	Stocking at 25% SDI (stems/ha)
5	30,655	13,934
6	21,640	9,837
7	16,121	7,328
8	12,492	5,678
9	9,975	4,534
10	8,157	3,708
11	6,799	3,091
12	5,758	2,617
13	4,942	2,246
14	4,290	1,950
15	3,760	1,709
16	3,324	1,511
17	2,961	1,346
18	2,654	1,207
19	2,394	1,088
20	2,171	987
21	1,977	899
22	1,809	822
23	1,662	755
24	1,532	696
25	1,417	644
26	1,315	598
27	1,224	556
28	1,141	519
29	1,067	485
30	1,001	455

* The quadratic mean DBH is obtained by measuring all stems greater than 50 mm DBH, and then calculating the square root of the average of the squared DBH. This varies slightly from the commonly used arithmetic mean to give greater emphasis to the larger and more dominant stems.

One of the thinned and pruned permanent sample plots.

Putting thinning into practice

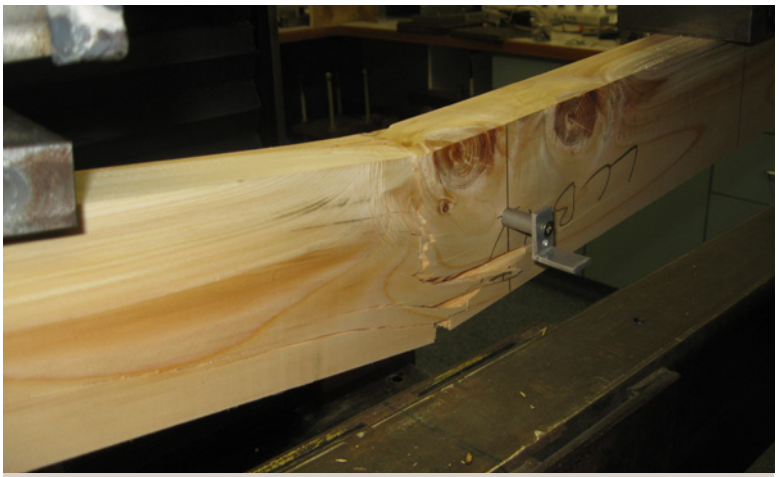
Naturally regenerated totara stands are highly variable in their characteristics. However, where pole-stands of young totara exist, Table 1 may provide a useful guide to landowners wanting to manage their resource and boost growth-rates (i.e. thin to 25% SDI – right-hand column in Table: 1).

Practical methods for determining the mean diameter (DBH) and stocking-rate (stems/ha) of totara stands are set out in a 2009 Scion unpublished report Assessing Regenerating Totara on the Farm, by David Bergin or in other publications such as FRI Bulletin No. 186 Field guide for sample plots in New Zealand forests by J.C. Ellis & J.D. Hayes (available from Scion at www.scionresearch.com).

Further research

These results highlight some areas for further research. In particular, the potential to further increase growth-rates by more aggressive thinning treatments should be tested. To this end, some additional thinning has been undertaken within some of the previously thinned plots.

The significant variance in growth-rates between sites suggests that other factors such as soil type and fertility are of considerable influence. And finally, these trials need to be extended across the full age/size range of the farm-totara resource present in many parts of Northland.



Destructive testing of timber

Totara Timber Strength Test Results

The Northland Totara Working Group in collaboration with Tane's Tree Trust and Farm Forestry Timbers, has contracted Scion to test the bending, strength and stiffness values of a sample of farm-totara timber. This found the totara timber to be quite strong, but not particularly stiff (Table 2). However, the real importance of this data is that it enables architects and engineer's to correctly specify farm-totara timber for structural purposes and be able to demonstrate Building Code compliance. The test results relate to visually graded timber and have assigned Stress-Grade (SG) values for characteristic stresses, such as bending, strength and stiffness.

Table 2: Characteristic Bending, Strength & Stiffness Properties of Totara

Bending Stiffness MoEj (GPa)	7.39	Stress Grade 6
Bending Strength MoEj (GPa)	20.50	Stress Grade 10
Tension Strength (MPa)	10.63	Stress Grade 10
Shear Strength (MPa)	4.43	Stress Grade 10
Compression Strength (MPa)	30.19	Stress Grade 10

Totara is one of five alternative-species timbers to be tested as part of a project initiated by NZ Farm-forestry Association branch Farm Forestry Timbers. AGMARDT have provided funding support along with industry players and co-funding for the totara testing by Tanes Tree Trust. Many thanks also to Dean Satchell, Geff Cookson, Li Legler (Diverse Tree Species), Arty Bergman (Northland Kauri Timbers) and others who generously donated time, materials and labour etc to make this project possible.

The full results are posted on the NZFFA website: http://www.nzffa.org.nz/specialty-timber-market/brand-grades/structural-grading/

An important complement to these structural strength test results will now be to demonstrate compliance with durability standards of the Building Code.

Profiling totara at the NZ Farm Forestry Association 57th Annual Conference Orewa, 20-23 April 2013

Michael Bergin

From the 20th to the 23rd of April the Northland Totara Working Group (NTWG) shared a display stand with Tane's Tree Trust (TTT) at the latest NZ Farm Forestry Association's annual national conference held in Orewa, North Auckland. Michael Bergin was in attendance for the three days as a representative of the NTWG and TTT with a large display that included several project posters, NTWG and TTT publications, samples of totara discs from the thinned plots and a milled slab of totara from Jeff Cookson's farm-grown totara milling trial. The stand proved extremely popular with the attendees many of whom were very impressed with initial growth response from the totara thinning trials. Several were keen to return to their own properties to initiate thinning on their own stands of naturally regenerating farm-grown totara.

The NTWG and TTT information stand at the NZFFA Orewa Conference registered considerable interest in managing native trees on farms.

Acknowledgements

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