Coast Redwood silviculture trials – installation report

M. Dean

Plantation Management Cooperative

Report No. 97, May 2006
PLANTATION MANAGEMENT COOPERATIVE

EXECUTIVE SUMMARY

COAST REDWOOD SILVICULTURE TRIALS
— INSTALLATION REPORT

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Three replicated final crop stocking trials and a replicated pruning response trial and have been installed across a range of sites to measure the response to silviculture management on the growth and quality of Coast Redwood (*Sequoia sempervirens*).

Where possible trials were installed in young to mid rotation aged stands of sufficient size on a range of site quality. The location of each trial is summarised in the following table.

<table>
<thead>
<tr>
<th>Expt No</th>
<th>Location</th>
<th>Forest Owner</th>
<th>Plant year</th>
<th>Trial purpose</th>
<th>Date Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR 453/9</td>
<td>Waiotapu, CNI</td>
<td>Kaingaroa Timberlands Ltd</td>
<td>1982</td>
<td>Final Crop Stocking</td>
<td>July 2004</td>
</tr>
<tr>
<td>FR 453/6</td>
<td>Otago Coast Otago</td>
<td>Wenita Forest Products</td>
<td>1986</td>
<td>Final Crop Stocking</td>
<td>August 2004</td>
</tr>
<tr>
<td>FR 453/8</td>
<td>Mangatu, East Coast</td>
<td>Ernslaw One Ltd</td>
<td>1978</td>
<td>Final Crop Stocking</td>
<td>April 2004</td>
</tr>
</tbody>
</table>

Final crop stocking treatments of 350, 500 and 650 stems/ha have been applied at all four sites. Each treatment is replicated twice at each site.

At the Tutira site, in conjunction with the New Zealand Redwood company (formally JPS), a pruning trial incorporating three intensities of pruning determined by stem diameter gauge including: unpruned, pruning to 9.0 cm calliper diameter and pruning to a 5.5 cm calliper diameter has been installed. Permanent sample plots have been installed in all treatments and the data stored on the Ensis Forests PSP system.
INTRODUCTION

Californian coastal redwood *Sequoia sempervirens* has proved to grow well in New Zealand when correct siting and establishment practices are attended to. Until recently PSP data was limited to only three plots. However these data show that on good sites site indices are equal to or better than most California sites and mean annual increments’ in excess of 30 m$^3$/ha/year can be routinely achieved.

Although not commonly used in New Zealand, there is a strong traditional demand for Redwood timber in California. This demand is met with the harvest of Redwood from second growth stands that yield significant amounts of clear heart timber. In the Californian market, these clear grades attract a large premium over unpruned ‘tight knot’ grades, which in turn are more valued than timber with bark-encased knots. As access to natural stands in the USA is restricted the potential for an export market to develop for New Zealand plantation grown Redwood is considerable. In order to properly evaluate the economics of growing Redwood in New Zealand a model sensitive to site and silviculture must be fitted to enable managers to create reliable yield tables.

A search for existing Redwood stands has revealed that as at 1992 there was some 400 hectares of coastal redwood growing in New Zealand. Most of this is located on ex New Zealand Forest Service estate. Many stands were in excess of 70 years old and of limited area or planted in mixture with other species, often because of supposed initial failure at establishment of the Redwood. However there are several stands totalling some 70 ha area in the 20 – 30 year old age range. As rotation ages for Redwood plantations are expected to be in the 30 – 40 year range a final crop stocking trial installed in the younger of these will allow measurement of thinning response at a range of final crop stockings.

METHOD

PART 1. FINAL CROP STOCKING TRIALS

In order to establish site differences four trials have been installed across a wide range of geographic locations, soil types, and climatic zones. The four sites selected are listed in table 1.

<table>
<thead>
<tr>
<th>Expt No</th>
<th>Site</th>
<th>Region</th>
<th>Plant year</th>
<th>Cpt No / (area ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR 475</td>
<td>Tutira</td>
<td>Hawkes Bay</td>
<td>1998</td>
<td>1/(3.2)</td>
</tr>
<tr>
<td>FR 453/6</td>
<td>Otago Coast</td>
<td>Otago</td>
<td>1986</td>
<td>44 (2.1)</td>
</tr>
<tr>
<td>FR 453/8</td>
<td>Mangatu</td>
<td>East Coast</td>
<td>1978</td>
<td>98/(58.6)</td>
</tr>
<tr>
<td>FR 453/9</td>
<td>Waiotapu</td>
<td>CNI</td>
<td>1982</td>
<td>3.1/(7.1)</td>
</tr>
</tbody>
</table>

Two replications of three stocking treatments are installed along with an unthinned control. Final crop stockings tested are 650, 500 and 350 stems/ha.

Plots will be re-measured in the winter immediately following plot installation and then biannually for 12 years after which remeasurement frequency maybe reviewed. All data will be entered and stored on the Ensis Forests Permanent Sample Plot (PSP) System.

The unthinned control plot is a 0.0400 ha circular bounded plot, whilst the 650, 500 and 350 stems/ha treatments have 0.0500 ha circular plots.

Details of individual trial sites follow.
FR 475  Tutira

**Trial location**  
(NZMG):  
Near Lake Tutira, Northern Hawkes Bay  
2845615 m East, 6211081 m North

**Owner**  
Mr Richard Doust  
Email: rdoust_tf@comcast.net

**Manager**  
Roger Dickie (NZ) Ltd

**Contact person**  
Steve Bell  
Ph 025 433 889  
Email: grl.napier@clear.net.nz

**Soil type**  
Taupo ash over marine sediments

**Geology:**  
Rich fossiliferous sands, silts, limestone and conglomerate

**Rainfall:**

**Stand details**  
Planted 1998  
Initial stocking:  1300 stems/ha  
Seedlings ex Puha nursery  
Trial installed:  January 2004.

**Trial description**  
Ex pasture site located adjacent to a gravel pit 700m. Some scattered manuka scrub reversion.  
Some blackberry present which may become a significant hindrance in the future. Tree form is good, but growth is variable reducing as you move up slope.

**Figure 1. FR 475 trial location map**
Figure 2. FR 475 plot layout map

FR 475 Tutira Forest Redwood Pruning trial

Willow Tree

Willow Tree

Fence

Gravel pit/parking area
FR 453/6 Otago Coast

**Trial location**
Cpt 47, Otago Coast Forest
(NZMG): 2293931 m East, 5469463 m North

**Owner**
Wenita Forest Products Ltd

**Contact person**
James McEwan
Ph (03) 489 3234
Email: james.mcewan@dn.wenita.co.nz

**Soil type**
23 dH medium fertility Henly hill soils

**Geology**
Strongly foliated quartzo-feldspathic schist

**Annual Rainfall**
677.8 mm

**Stand details**
Planted 1986
Initial stocking: 1667 stems/ha
Trial installed: August 2004.

**Site description**
Ex pasture site located on a gentle slope on the north bank of a small creek. The lower elevation plots are well sheltered but there is some evidence of top damage to trees in plots 6/50 and 7/65.

Figure 3. FR 453/6 - trial location map
Figure 4. FR 45/6 - plot layout map
FR 453/8 Mangatu

**Trial location**

Cpt 98 Mangatu Forest
(NZMG): 2940641 m East, 6324553 m North

**Owner:**

Ernslaw One Limited

**Contact person**

Dave Grogan
Ph (06) 8680089
Email: dave.grogan@erslaw.co.nz

**Soil type**

Ruakumara Yellow brown earth and Urewera Yellow brown pumice

**Geology:**

**Annual Rainfall:** 1300 mm

**Stand details**

Planted: 1978
Planted stocking: 1200 (est)
Trial installed April 2004

**Trial description:**

This is high altitude (600m a.s.l.) exposed site located at the back of Mangatu forest on the Wairangi boundary. The trial itself is moderately sheltered from the north west by a predominant ridge. Access is gained via Wairangi forest and Fern Island road. The site is considered to be ex pasture but the understorey, where present is dominated by pig fern indicating a fairly run out status before being afforested. Because of the variable topography the plots are scattered through the compartment in reasonably homogenous micro sites. This trial was installed by Harry Saunders and Simon Stuckey of NZ Forestry Ltd.

Figure 5. FR 453/8 - trial location map
FR 453/9 Waiotapu

**Trial location**
Cpt 3/01 Kaingaroa forest
2804751 m East, 6312211 m North

**Owner**
Kaingaroa Timberlands Management Limited

**Contact person**
James Bullen
Ph (07)343 1070
Email: james.bullen@ktml.co.nz

**Soil type**
Taupo yellow brown pumice

**Geology:**
Siltstone, sandstone conglomerates and pumice breccias

**Annual Rainfall**
1300 mm

**Stand details**
Planted: 1982
Planted stocking: 1200 stems/ha

**Trial description**
Located in Waiotapu thermal area. Some parts of this stand failed because of geothermal activity. The stocking was variable at the time of trial installation so plots were blocked and thinning designed to normalise standing basal area.

Figure 7. FR 453/9 - trial location map
FR 453/9 - Waiotapu Redwood Final Crop Stocking Trial

Cpt 3.1 planted 1978

Figure 8. FR 453/9 - plot layout map
PART 2. PRUNING TRIALS

Introduction

Although there is considerable interest in growing and intensively managing Coast Redwood (*Sequoia sempervirens*) in New Zealand little is understood of how it responds to the intensive silviculture commonly practiced with radiata pine in this country.

In 2004 a replicated randomised block design pruning trial for Coast Redwood was installed at Tutira in Hawkes Bay. A step out trial to investigate the effect of the season of pruning was installed in the same year at Te Wairengaokuri near Gisborne.

The details of treatments applied at each site follow below.

FR 475 – Tutira

In addition to the final crop stocking treatments described in section one, silviculture treatments covering a range of three pruning intensities have been applied. The treatments are summarised in Table 2.

Table 2: Stocking and Pruning Treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final crop stocking (Stems/ha)</td>
<td>350 (525)*</td>
</tr>
<tr>
<td>Stem calliper diameter (cm)</td>
<td>No prune</td>
</tr>
<tr>
<td>Replicates</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

* Total stocking including unpruned followers in brackets.

Each pruning treatment at the 350 and 650 stems/ha stocking is replicated twice and three times for the 500 stems/ha final crop stocking. Because of the severe early pruning each treatment is thinned to 1.5 times the prescribed final crop stocking. The followers will not be removed following until well after the final pruning lift.

The pruning treatments were applied using a stem calliper in January 2004.

**Figure 9. 5.5cm stem gauge pruning treatment applied at 975 stems/ha. Photo taken June 2004**
Figure 10. 5.5cm stem gauge pruning treatment applied at 975 stems/ha. Photo taken Nov 2005.
FR 453/3 – Te Wairengaokuri

**Trial location**
Gentle Annie State highway 36, near Gisborne
(NZMG): 2930105 m East, 6270377 m North

**Owner**
Gisborne District Council

**Manager**
PF Olsen &Co Ltd

**Contact person**
Nick Bunting
Ph (06) 868 5427
Email:

**Soil type**
Taupo ash over marine sediments

**Geology**

**Annual Rainfall**
1200mm

**Stand details**
Planted 1998
Initial stocking: 1200 stems/ha
Two year old bare rooted seedlings ex Puha nursery
Trial installed: January 2004.

**Trial description**
Ex pasture site located adjacent to a Eucalyptus and Poplar species trial in the Gentle Annie soil conservation area.
Some blackberry present which may become a significant hindrance in the future. Tree form is good.
At this site treatments include four split plots at the central 500 stem/ha final crop stocking to investigate the effect of season of pruning (Spring vs autumn) with and without followers (250 stems/ha)
Treatments imposed are summarised in Table 3.

**Table 3: Stocking and Pruning Treatments – Waerengokuri**

<table>
<thead>
<tr>
<th></th>
<th>No trts</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocking (Stems/ha @P1/ Stems/ha FCS)</td>
<td>2</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750/500</td>
</tr>
<tr>
<td>Stem calliper diameter (cm)</td>
<td>1</td>
<td>5.5 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5 cm</td>
</tr>
<tr>
<td>Replicates</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Season of pruning</td>
<td>2</td>
<td>Spring/autumn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spring/autumn</td>
</tr>
<tr>
<td>Total plots</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
Figure 11. FR 453/3 - trial location map

Figure 12. FR 453/3 - plot layout map

FR 453/3 Wairengaokuri trial map

Gully

State Hwy 36

House

30m 30m

Plot # 30m 30m

4 500/5.5

1 500/5.5

2 750/5.5

3 750/5.5