High Growth & Productivity of New Zealand Grown Coast Redwood

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Overview

• The New Zealand (NZ) forestry sector
• History of coast redwood (*Sequoia sempervirens*) in NZ
• Major research successes in the last 10 years
• Summary and where to next?
Plantation forestry in New Zealand

National Exotic Forest Description 2012. MPI, Wellington, NZ
The New Zealand forest industry

- New Zealand’s third largest export earner: $4.8 billion (2014).
- Approximately 1.7 million ha in plantation forest
  - 90% *Pinus radiata*
- Volume of wood harvested from planted forests has potential to increase from 26 to 35 million m³ per year by 2023.
- Coast redwood ~8,000 ha
Coast redwood in NZ – what could of have been

• One of the first exotic forestry species introduced to replace dwindling indigenous resource

• Large scale failures due to:
  – Sensitivity to frost
  – Intense competition with weeds at establishment
  – Failure with aerial seed sowing
  – Absence in soil of appropriate mycorrhizae
  – Poor genetics

• Despite localised successes, deemed to be too sensitive for NZ
Coast redwood resurgence – early 2000’s

• Lobbying by Dr Bill Libby and others lead to renew interest in NZ
• Found that coast redwood can be readily established with right practices
• Better selection of sites
• Good genetics, and good nursery & establishment practices greatly increased seedling survivability
• Active collaboration with:
  – NZ Farm Forestry Association Sequoia Action Group
  – NZ Forestry Limited
  – NZ Redwood Company
Coast redwood resurgence – early 2000’s

However, many questions remain about NZ grown redwood:
- Where to grow it?
- What provenances & genotypes would do the best in NZ?
- Can NZ produce high value timber grades?
- How best to manage it?
- Is the wood naturally durable?
Coast redwood resurgence – early 2000’s

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  – Where to grow it?
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  – Is the wood naturally durable?
Where to grow coast redwood?

• Concentration of plots in central North Island
  • Not suitable due to frost

• Smattering of plots throughout the rest of NZ
  • Older NZ Forest Service plantings
  • Young, better sited, plantings
  • Plots not fully representing sites suitable for coast redwood

• How to predict site productivity from limited number of sites?
Where to grow coast redwood?

Empirical modelling – climate/growth extrapolation approach

400 Index: 40 yr. rotation with final stocking of 400 SPH

What provenances would do the best in NZ?

Kuser Provenance Origin Locations

NZ Locations of Kuser Provenance Trials

Assessed Age 10

Thompson

Awaho

What provenances would do the best in NZ?

*Within site genetic correlations at Awaho (purple boxes) and Thompson (aqua boxes) and genetic correlation between sites (grey boxes)*

<table>
<thead>
<tr>
<th>Trait</th>
<th>DBH</th>
<th>DEN</th>
<th>HWAP</th>
<th>EPI</th>
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<tbody>
<tr>
<td>DBH</td>
<td>0.89 (0.04)**</td>
<td>-0.52 (0.07)**</td>
<td>0.60 (0.08)**</td>
<td>0.44 (0.12)**</td>
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<tr>
<td>DEN</td>
<td>-0.58 (0.08)**</td>
<td>0.98 (0.07)**</td>
<td>-0.37 (0.10)**</td>
<td>-0.18 (0.14) n.s.</td>
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<tr>
<td>HWAP</td>
<td>0.73 (0.05)**</td>
<td>-0.30 (0.11)***</td>
<td>0.92 (0.07)**</td>
<td>0.38 (0.15)***</td>
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<tr>
<td>EPI</td>
<td>0.36 (0.08)**</td>
<td>-0.22 (0.11)***</td>
<td>0.38 (0.09)***</td>
<td>0.70 (0.11)***</td>
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DBH = diameter at breast height; Den = tree wood density at DBH; HWAP = heartwood percentage; EPI = epicormic shoots

What provenances would do the best in NZ?

Kuser provenance performance in NZ summary

- High across-site genetic controls for stem diameter, wood density, and percentage heartwood
- No strong provenance trends with growth performance between these two site

Can NZ produce high value timber grades?

Mangatu Sawing Study

- 38-year old stand
- Unknown genetic origin
- Pruned 4 times & thinned twice
- At harvest:
  - Stand basal area 107.6 m²
  - 398 stems per hectare
- 13 trees harvested
  - Cut into 50 logs
  - 13 logs were from pruned trees

Cown et al. 2013. NZ Journal of Forestry Science 43:8
Can NZ produce high value timber grades?

Log grade recovery by pruning prescription

Pruned: 64%

Unpruned: 28%

Cown et al. 2013. NZ Journal of Forestry Science 43:8
Can NZ produce high value timber grades?

Yes we can!

- 38-year old redwood can produce large % heartwood: 44% - 66%
- Low overall shrinkage
- Wood density comparable to other sites
- Large variation in wood density between trees
  - Genetic variation?

Cown et al. 2013. NZJFS 43:8
Summary

- Coast redwood has great potential as a large scale commercial species in NZ
  - After a false start, its potential is now recognised
  - And no it doesn’t need fog to be productive
- NZ grown redwood can produce similar high quality timber as secondary growth USA grown redwood
  - High value timber grades
  - Comparable wood density and stability
- Provenance performance and Genetics * Environment interaction in NZ increasingly understood
Where to next? NZ coast redwood priorities

- Quantifying the impact of silvicultural regimes on productivity
- Comparison of productivity between NZ and USA
- Quantifying the performance of the Kuser provenance collection over a range of NZ environments
- Process-based modelling of redwood productivity
- Quantifying natural durability of NZ grown redwood
  - Next talk in this session
Questions?