

Validation of Early Genetic Selection

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School of Biological Sciences

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New Zealand School of Forestry

Who We Are

- Compromised Wood Quality Project

- Collaborative project between NZ School of Forestry and School of Biological Sciences

- Focus on juvenile wood

- “What is good for young trees is not good for the timber industry”

- Improve wood quality at harvest by early selection against trees that will produce poor quality timber

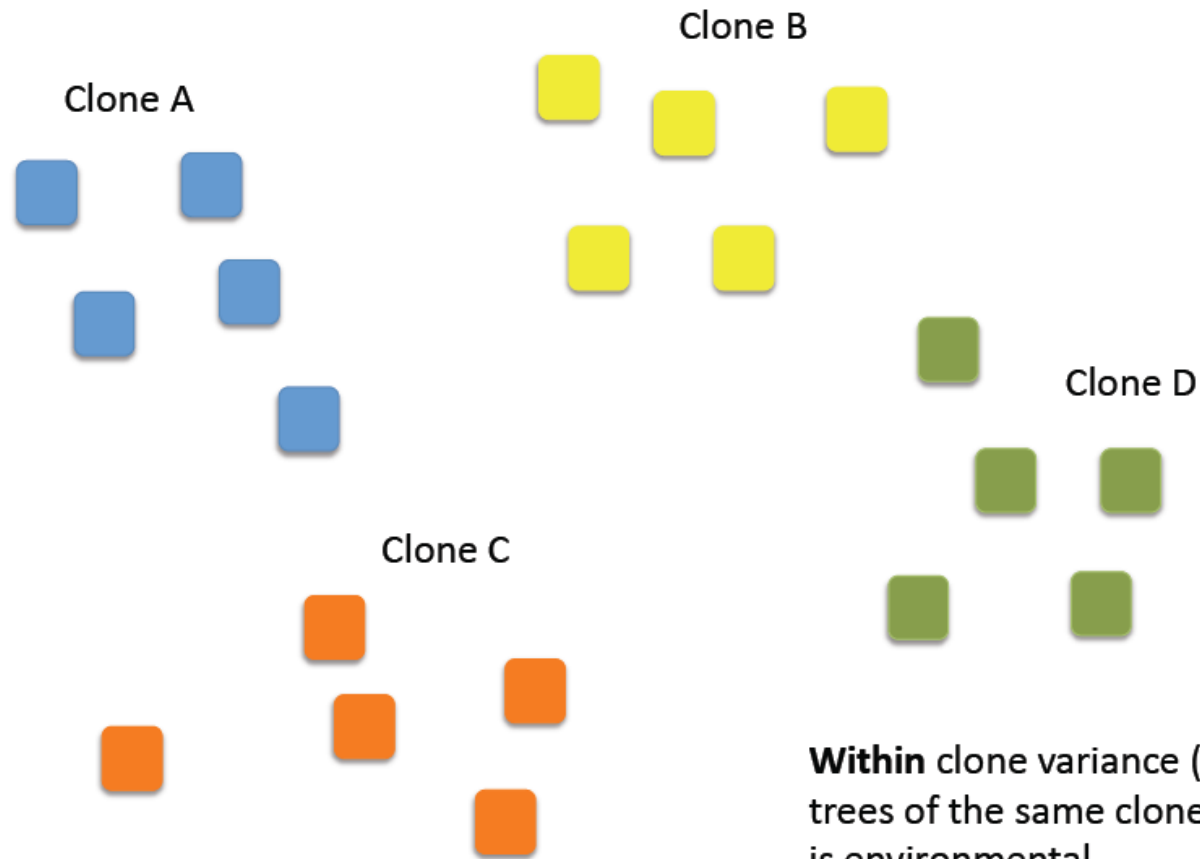


Background

- Phenotype = Genotype + Environment
- Phenotype = Genotype + (Silviculture + Site)

Background

Separating genetic and environmental effects



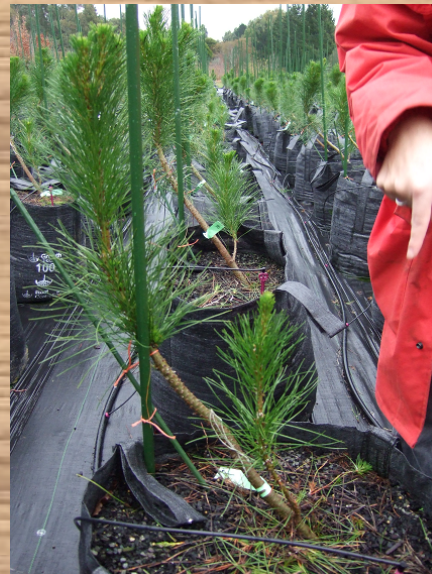
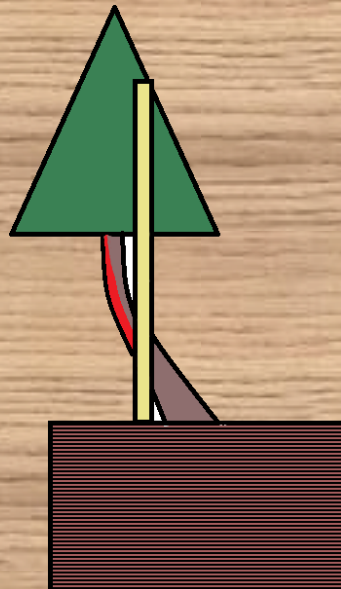
Variance **between** clones includes refers to genetic effects

Within clone variance (between trees of the same clone) is environmental

Background

- Continuation of clonal research established in 2009 by Compromised Wood Quality project
- Nursery trial aimed to remove environment

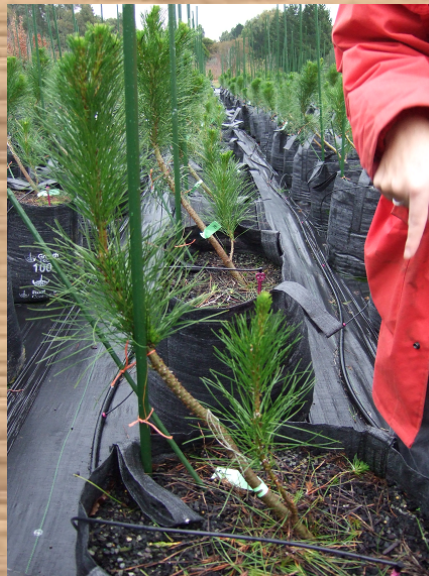
Phenotype = Genotype



Aims

- How do the selected clones perform outside of the nursery?

DOES



=



?

Overview: Materials & Methods

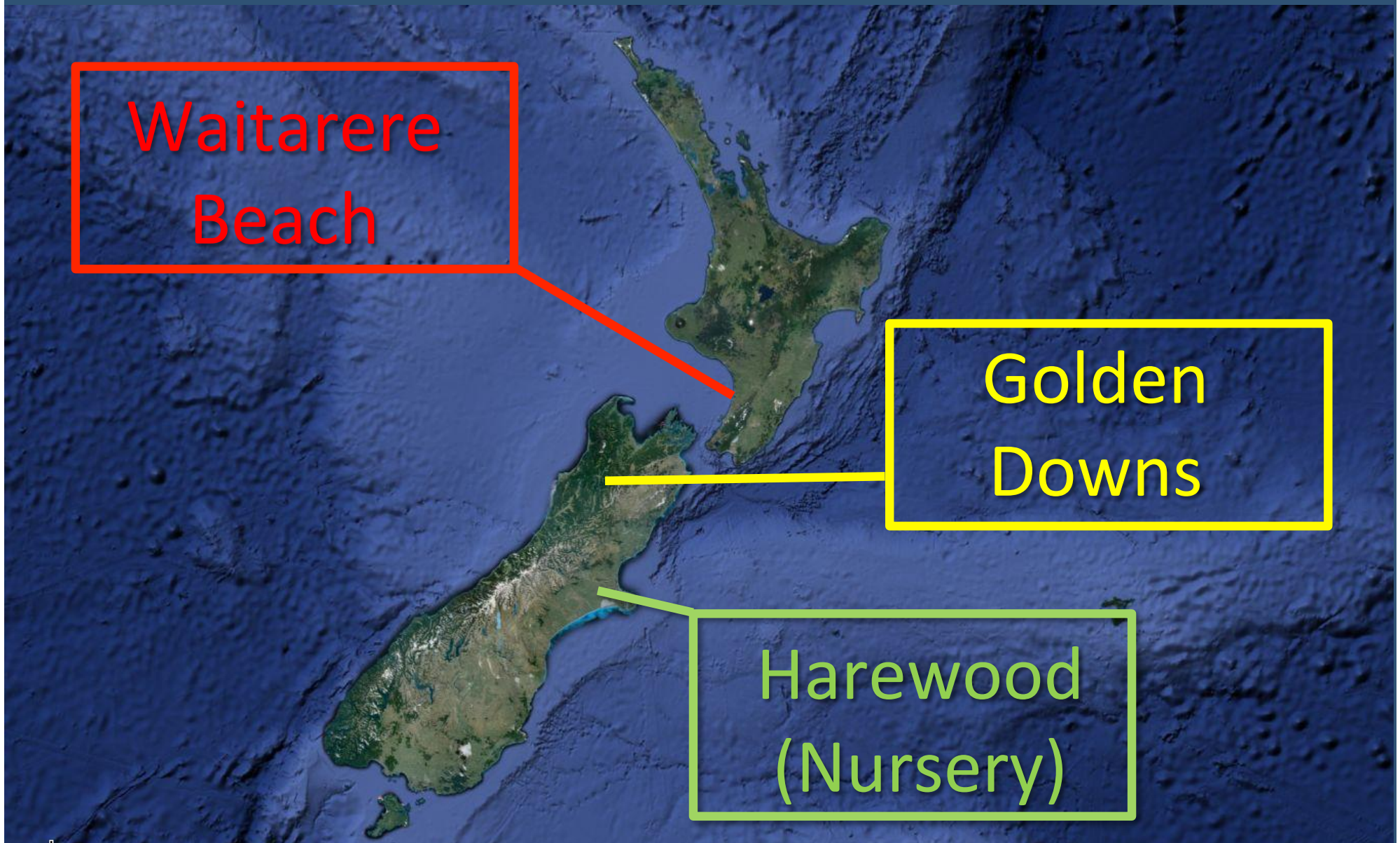
- 12 year old clones on two sites.
- Material matches 2 year old clones at School of Forestry.
- Wood quality assessment of 12 year old and 2 year old clones.

Materials

<u>Site</u>	<u>Age</u>	<u>Clones</u>	<u>(Reps)</u>	<u>Trees</u>
Golden Downs	12	15	(5)	75
Waitarere Beach	12	19	(5)	95
Harewood (Nursery)	2	20	(35)	700

20 Clones in total, 15 common to all three sites, 4 common to two, 1 unique

Site Locations



Waitarere
Beach

Golden
Downs

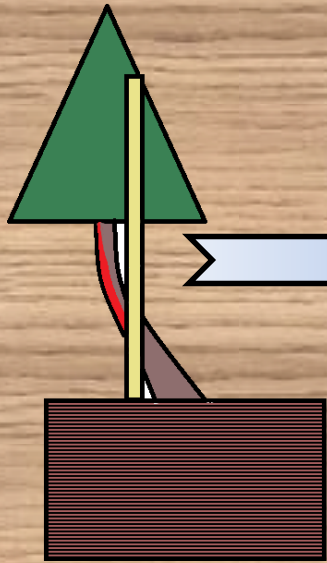
Harewood
(Nursery)

Methods – Nursery Trials

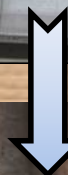
- Very uniform site conditions
- Irrigated and fertilized
- Trees tilted after 4 months



Methods – Nursery Trials



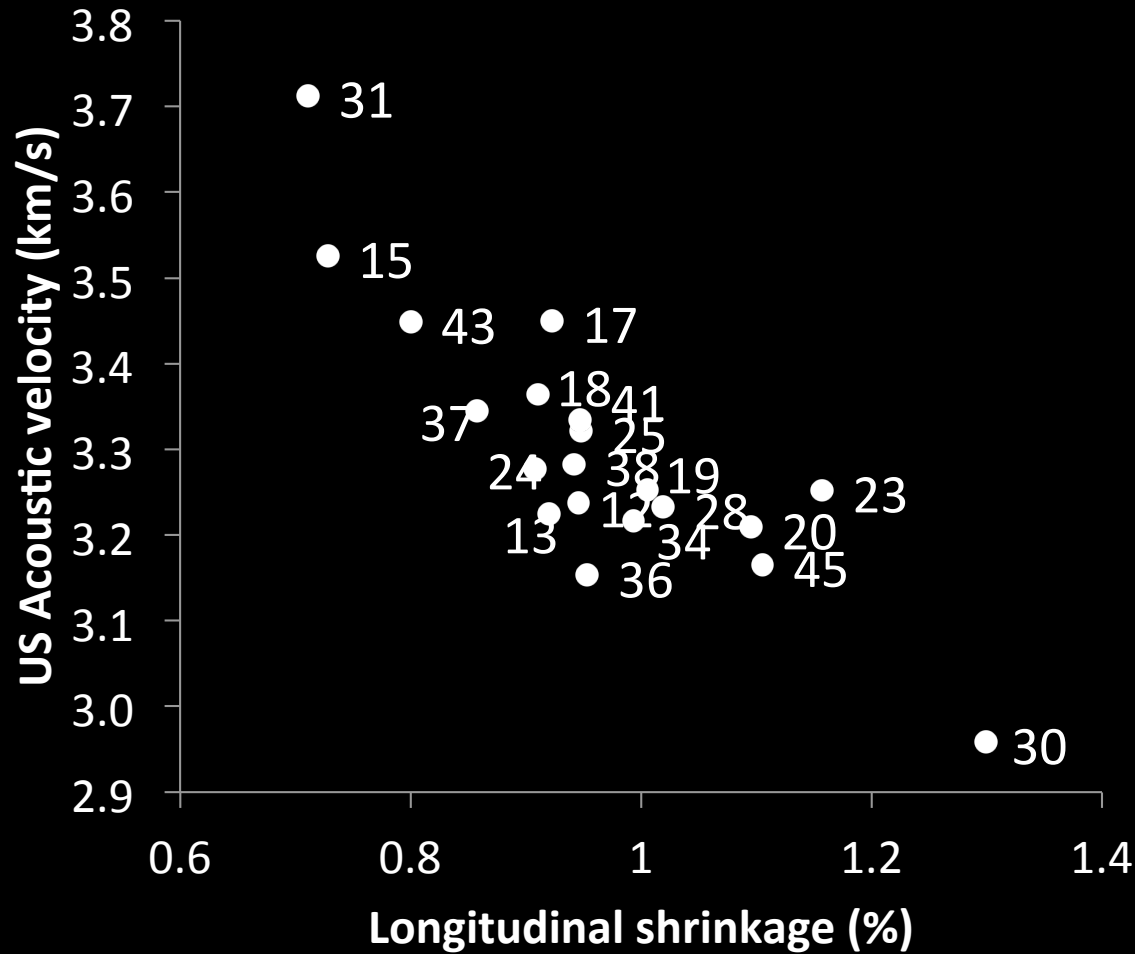
**Longitudinal
Shrinkage**



Acoustic Velocity



Results – Ranking of Nursery Clones



Best

Velocity	MOE _d	LS	BD
31	31	31	18
15	15	15	25
17	17	43	20
43	43	37	24
18	18	24	17
37	25	18	38
41	37		23
25	41	17	31
38	24	38	37
24	38	12	45
19	23	41	36
23	20	25	15
12	12	36	12
28	13	34	13
13	28	19	41
34	19	28	34
20	34	20	43
45	45	45	28
36	36	23	19
30	30	30	30

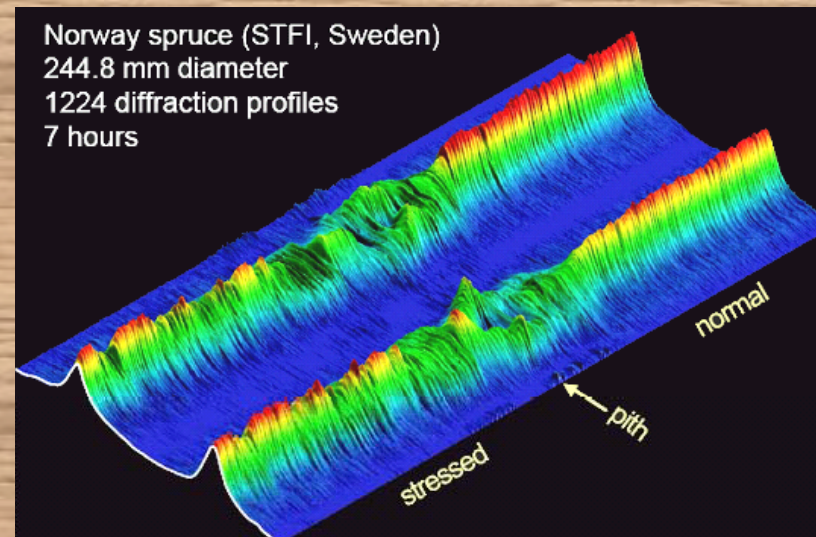
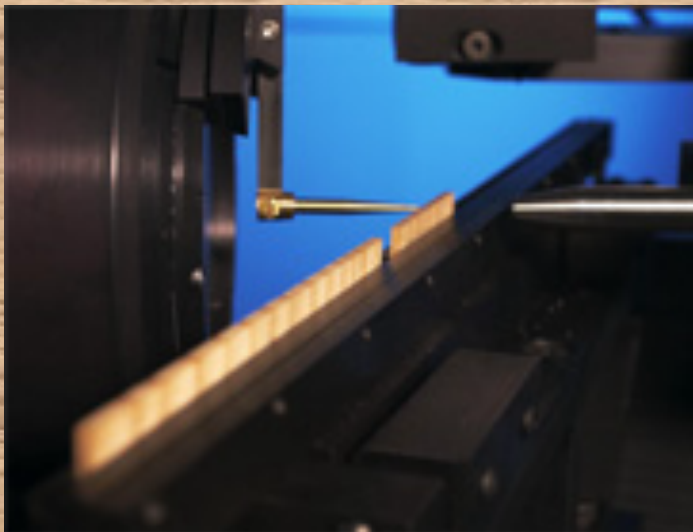
Worst

Methods – Mature Field Trials

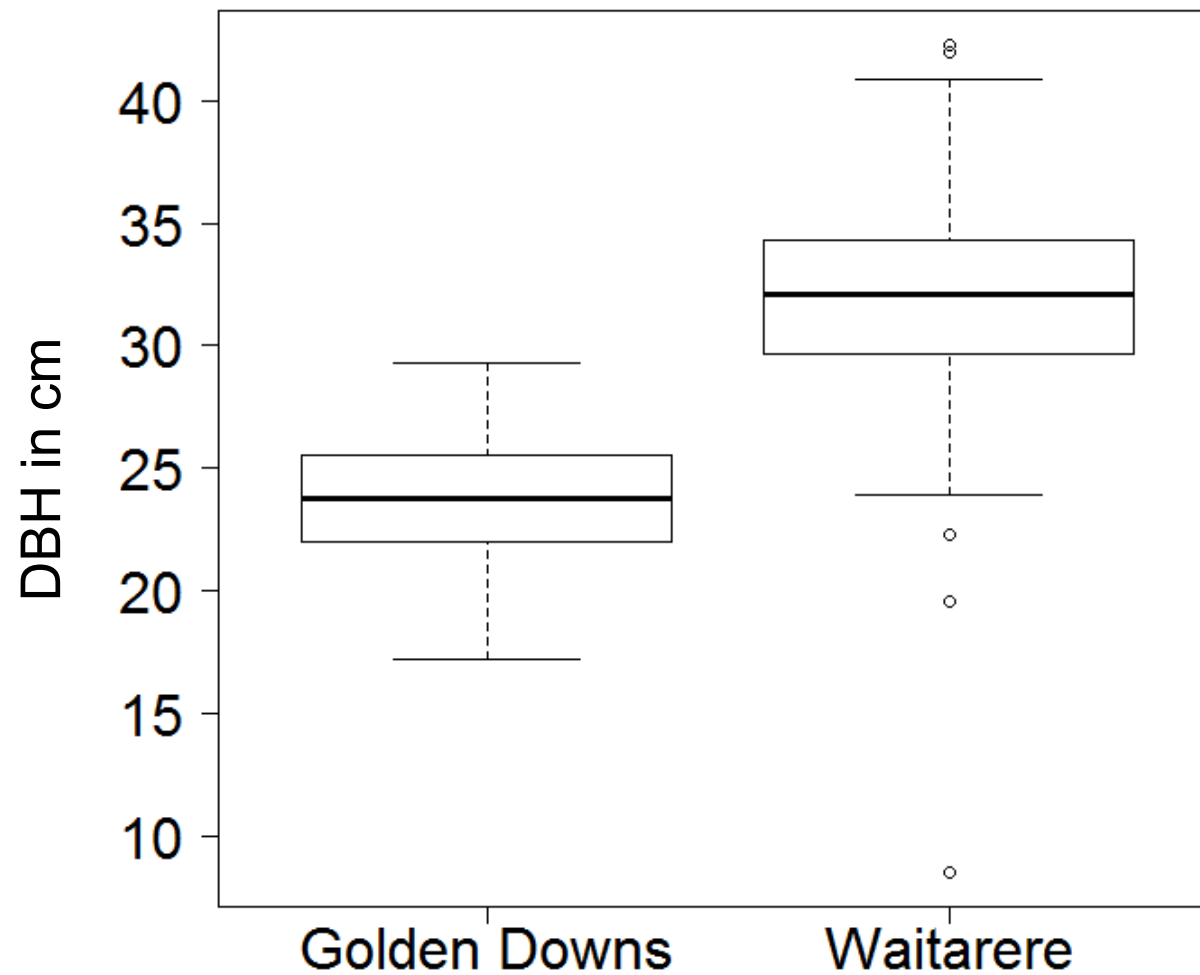
- Core sample trees (Autumn Winter 2011)



- Silviscan Analysis – Derived MOE (Dec 2011)



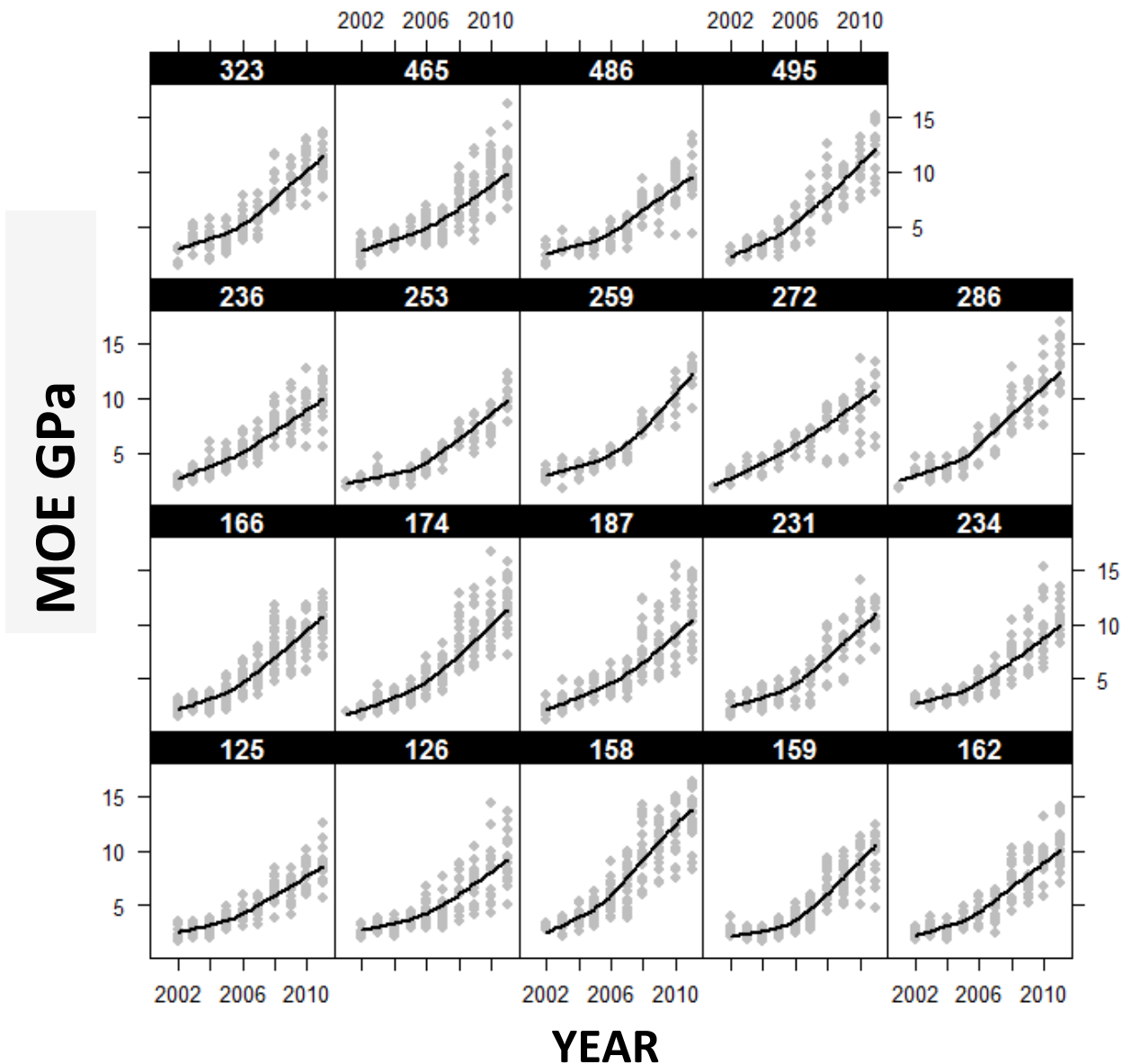
Results - Tree Growth



Corewood & Outerwood Stiffness

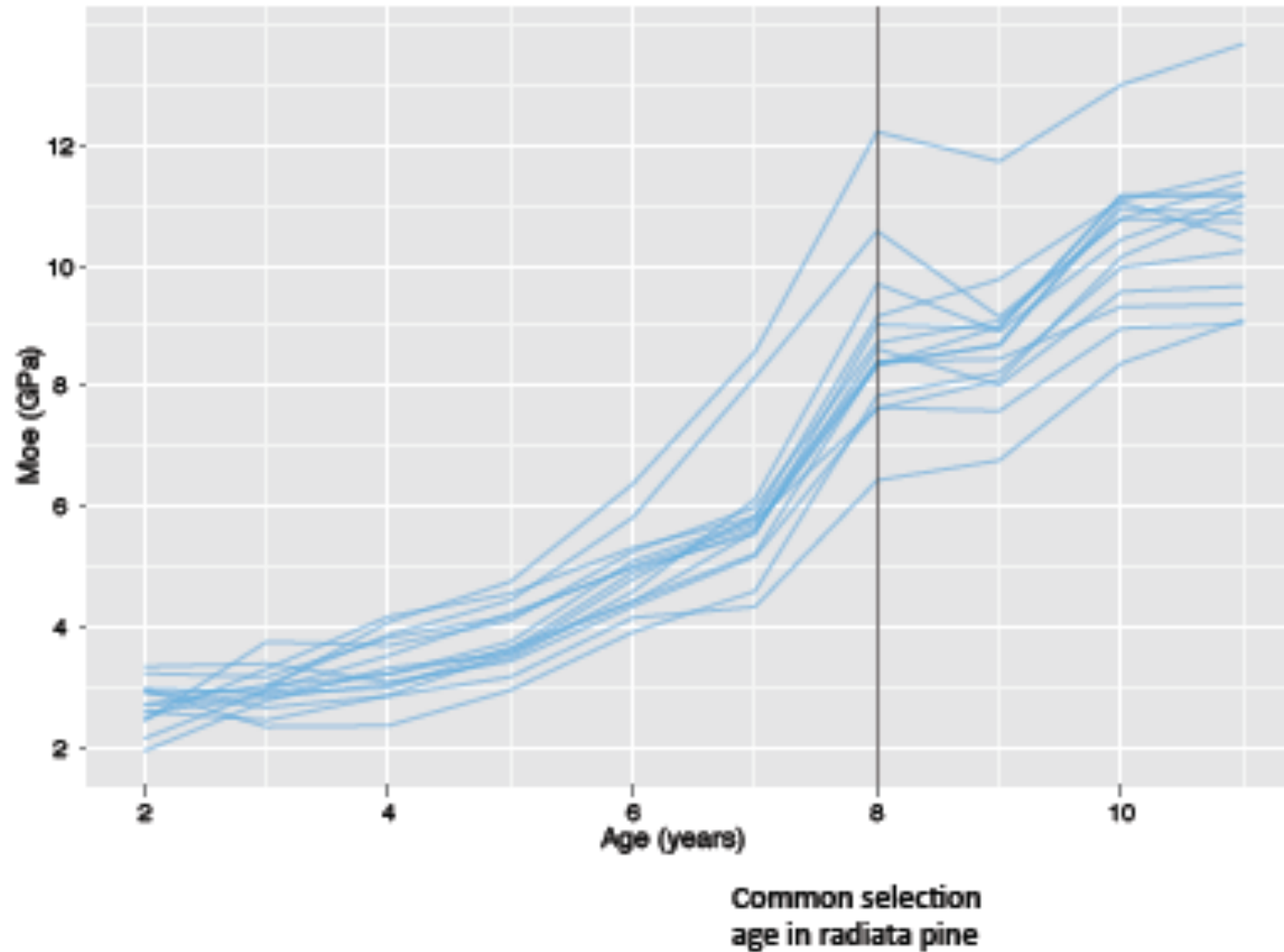


Radial Stiffness Variation



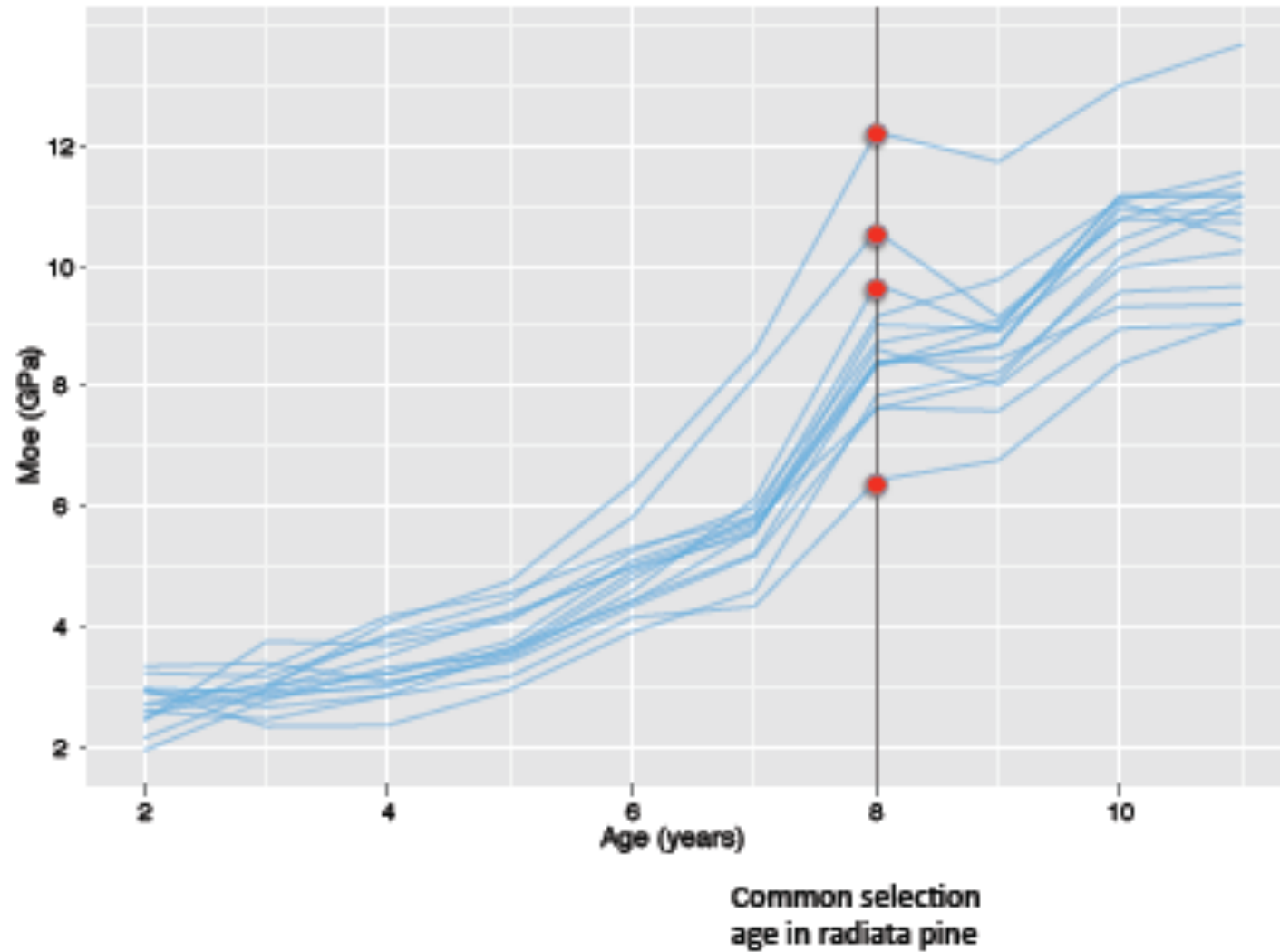
Reframing Selection Process

Apiolaza (2009) Annals of Forest Science 66(6): 1-10



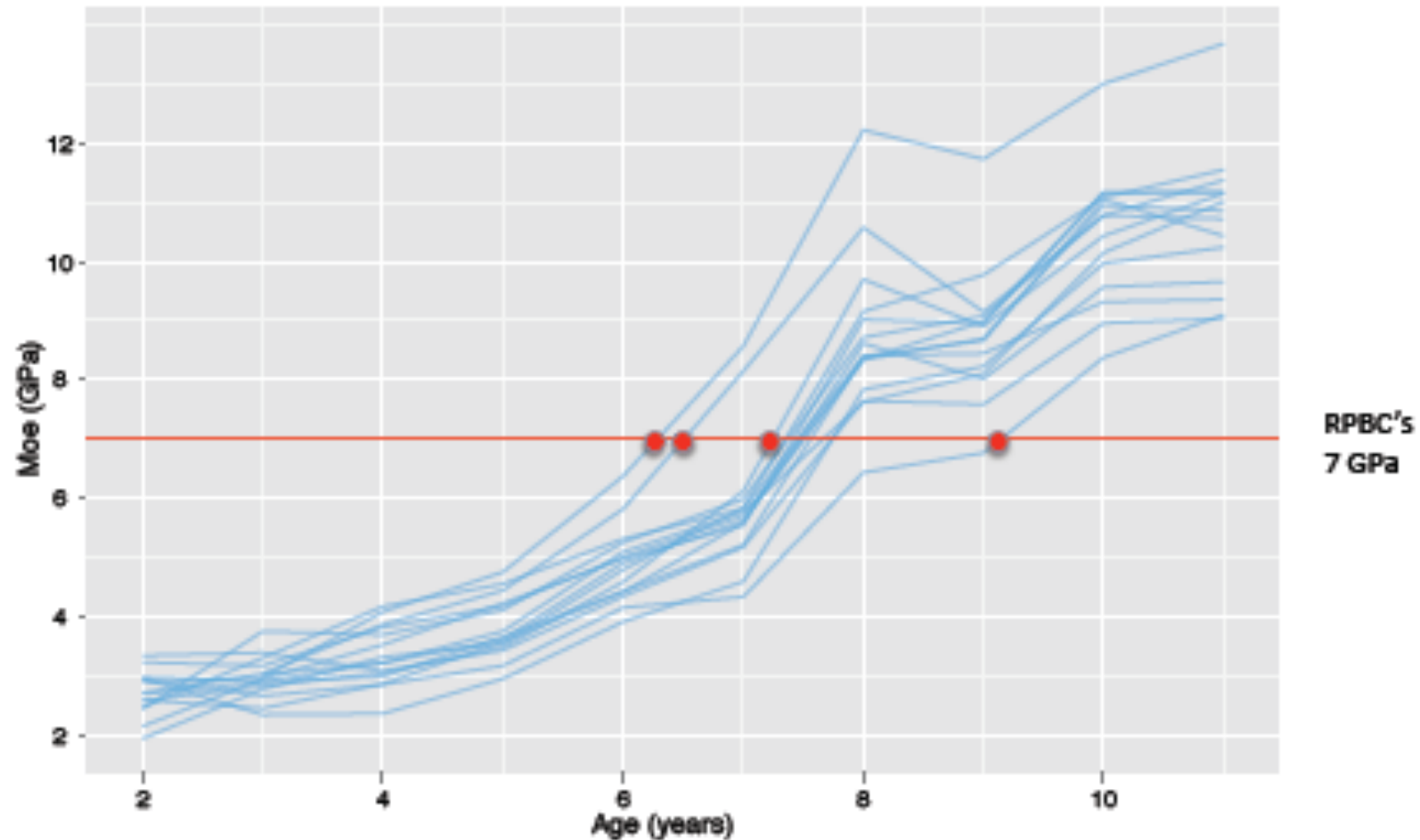
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Reframing Selection Process

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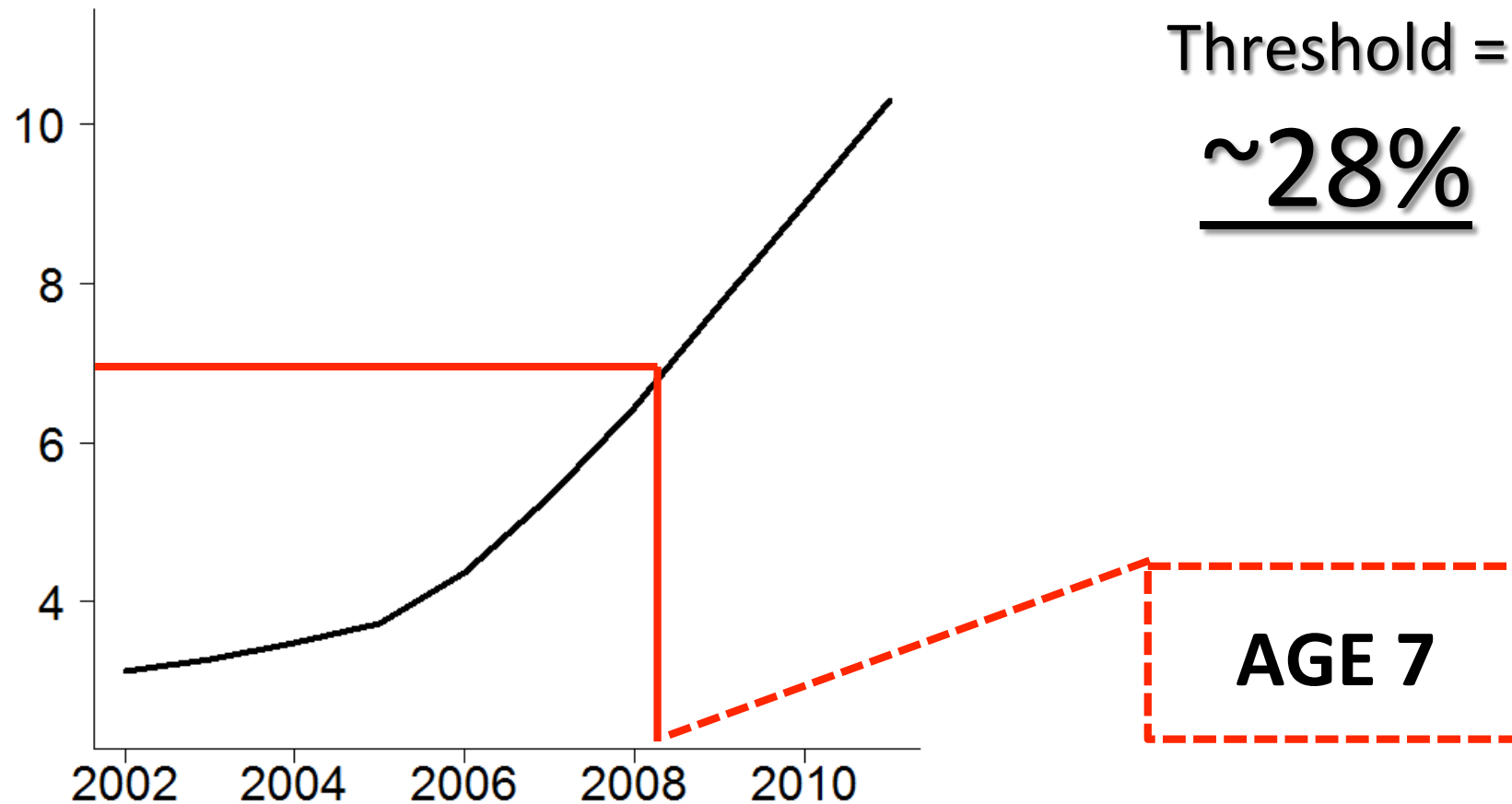


SST - Structural Stiffness Threshold

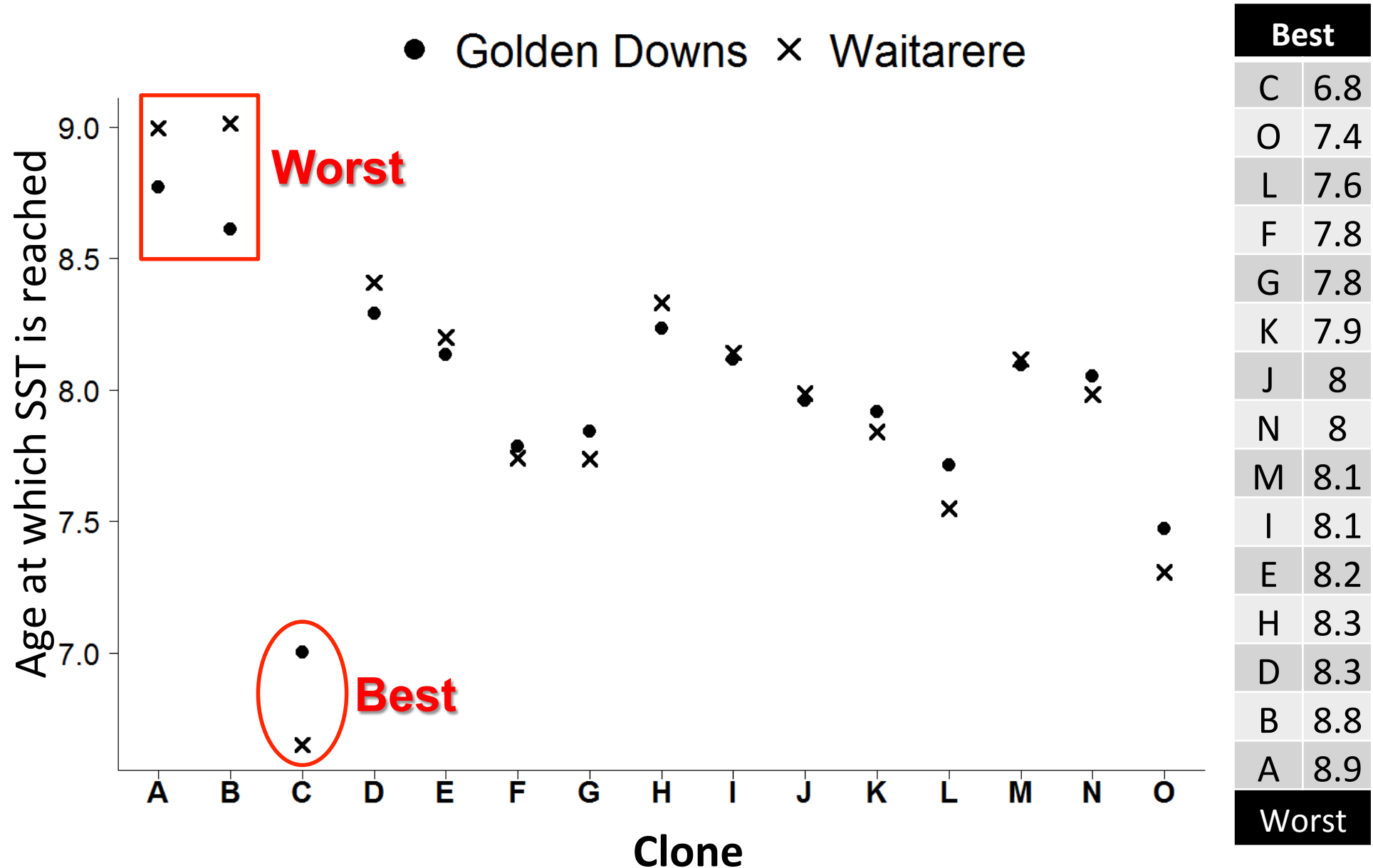
Genetic Control of

Threshold =

~28%

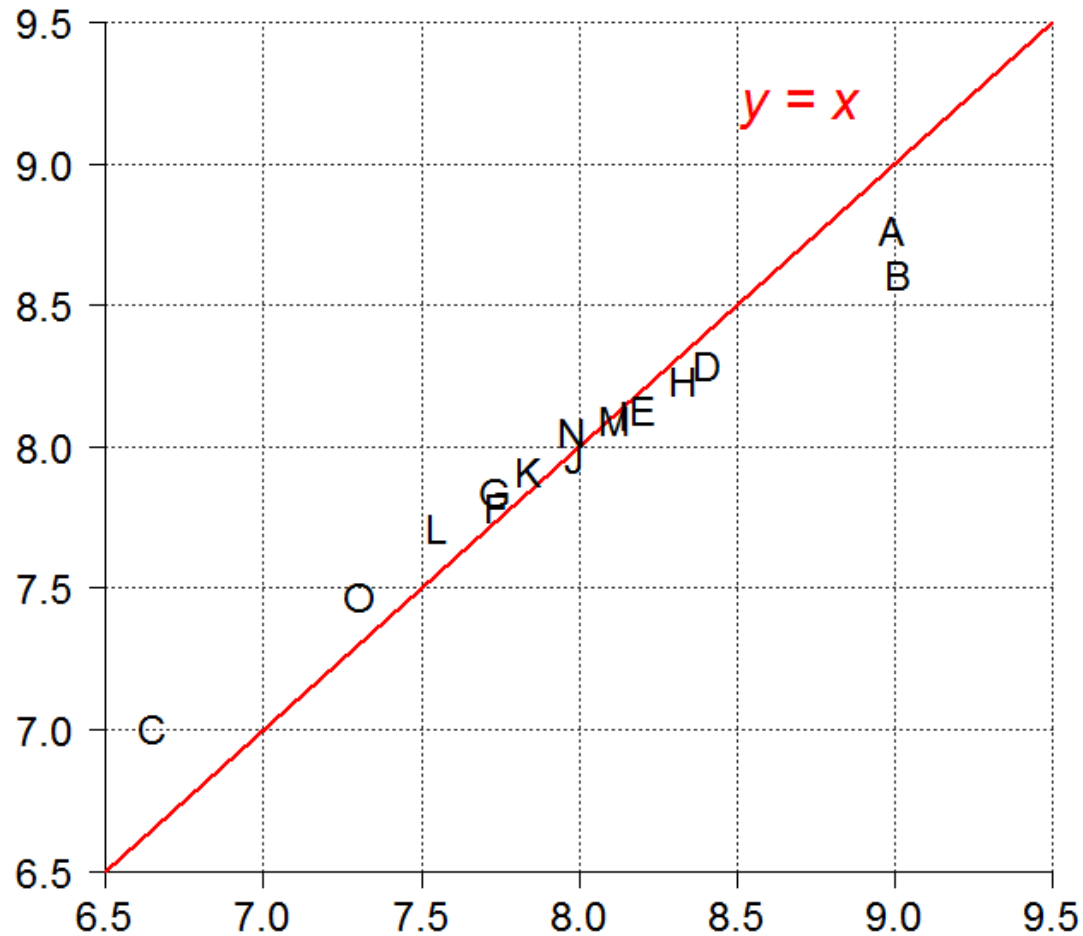


Differences Between Clones



Differences Between Sites

Age to reach SST at Golden Downs

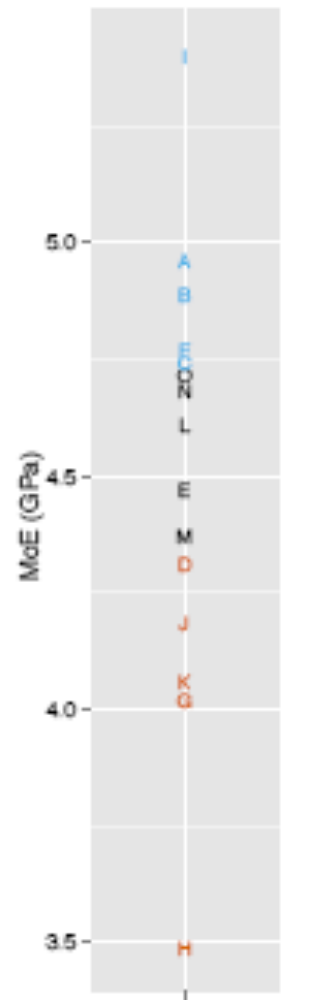


Age to reach SST at Waitarere

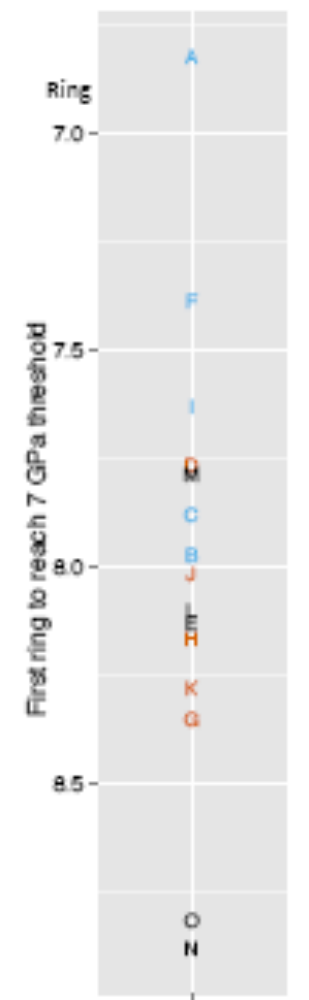
Best	
C	6.8
O	7.4
L	7.6
F	7.8
G	7.8
K	7.9
J	8
N	8
M	8.1
I	8.1
E	8.2
H	8.3
D	8.3
B	8.8
A	8.9
Worst	

Comparison to Nursery

Some results



Harewood, age 2



Clonal Trials, age 11

Comparison to Nursery

Age: 2 years

Harewood: genetic control
for dry MoE

$$H^2 = 0.49$$

Age: 11, 12 years

Clonal trials: genetic control
for 7 GPa threshold

$$H^2 = 0.21 \sim 0.23$$

Clonal trials: across-site genetic
correlation for 7 GPa threshold

$$r = 0.98$$

Spearman's rank correlation between trials:

-0.53 including all clones

Prospects and Conclusions

- We can rank clones based on age for stiffness threshold to reduce corewood percentage
- Compare to acoustic assessments on standing trees
- Compare to core scanner

Acknowledgements

- CWQ colleagues
- FRST
- Forest Genetics
- Scion
- Nelson Forests
- Rayonnier
- FPRI - Edinburgh



Questions



Materials

Waitarere Beach
(North Island)

Golden Downs
(South Island)

15 Clones
5 Reps

Both sites
&
Nursery

15 Clones
5 Reps

4 Clones
5 Reps

This site and
nursery only

