NZDFI NEW ZEALAND DRYLAND FORESTS INITIATIVE

breeding tomorrow's trees today

Eucalypt forests that produce ground durable hardwood: a sustainable land use option for New Zealand drylands

Presentation to

Hawkes Bay Seminar

Havelock North Community Centre

4th November 2015

SUPPORTERS:

NZDFI Partners and Supporters

Founding Partners

- Proseed NZ Ltd
- Vineyard Timbers Ltd
- Marlborough Research Centre Trust
- New Zealand School of Forestry (University of Canterbury)

Supporters/Sponsors

- **Ministry of Primary Industries Sustainable Farming Fund**
- Juken NZ Ltd
- Regional Councils x5: MDC, GWRC, HBRC , BoPRC & Horizons RC.
- 26 landowners in Marlborough , Canterbury, Wairarapa, Hawkes Bay, Horizons, BoP Taupo and Gisborne. (In Hawkes Bay – B. McNeill, R. Alexander, E. Saathof , JNL and HBRC)
- Marlborough Lines and Marlborough Gold Honey
- Neil Barr Farm Forestry Foundation and NZ Farm Forestry Association's Eucalypt Action Group .
- NZ Forest Growers Levy Trust and MBIE/FFR SWP partnership
- AGMARDT

NZDFI established at Marlborough Research Centre on 1st July 2008

- Official launch on 28th January 2009.

- First planting at Lawson's property, Waterfalls road

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Post breakage in Marlborough's and NZ's other wine regions

Posts are broken in vineyards during mechanical harvesting.

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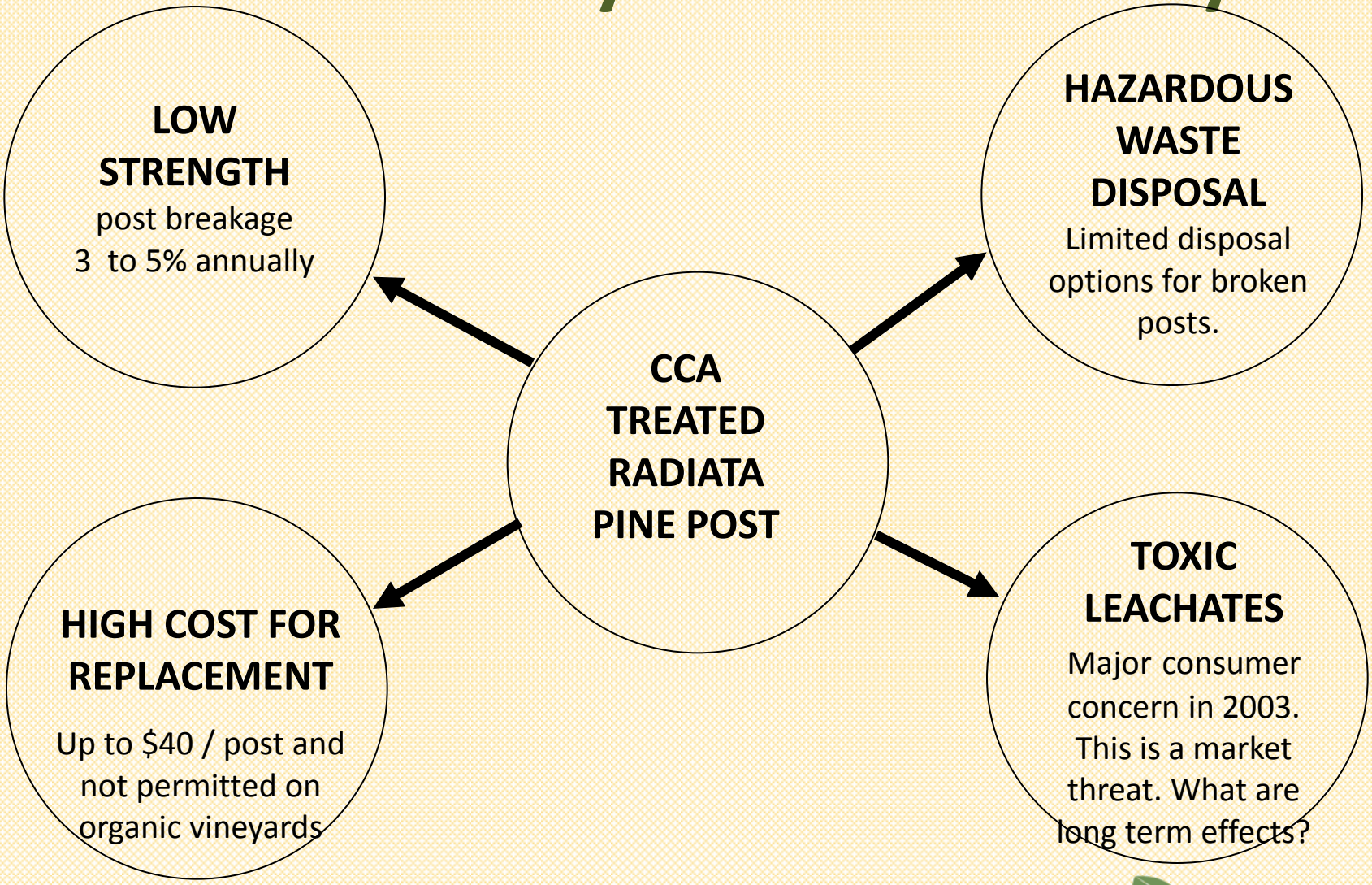
CCA treated pine posts reduce sustainability of wine industry



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Hardwood Solution

HIGH STRENGTH

NATURAL RESIDUES

DURABLE EUCALYPT TIMBER POST

ZERO WASTE
Recycle or use as firewood

NATURAL DURABILITY

No Treatment Costs

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Durable eucalypt sawmilling trial in Marlborough - 2006

- **Rapaura Timber cutting *E. globoidea* VT posts for local vineyard.**

What is the Potential Market for Vineyard Posts in Hawkes Bay?

- Approx 5,000 ha vineyards in Hawkes Bay.
- Vineyards have approx 600 posts / ha.
- Total existing posts = 3 million.
- Potential replacement @ 3% p.a. = 90,000 posts per year.
- Potential replacement @ 5% p.a. = 150,000 posts per year.
- **BUT NO LARGE AEA OF DURABLE HARDWOOD FORESTS IN NZ!**

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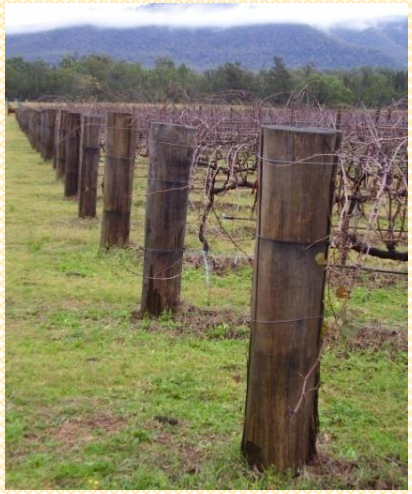
This is not a new idea….Australian hardwood used for vineyard posts!

- **Hunter, Mildura & Clare**



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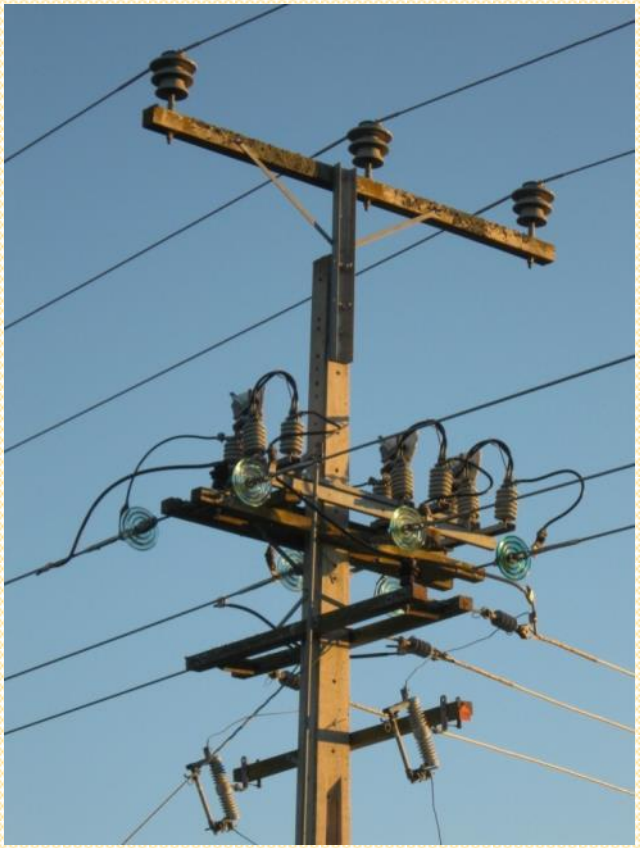
Marlborough Lines identified they needed cross arms.

- **‘Aussie hardwood’s have been the preferred timber for crossarms that are now in short supply and expensive.**



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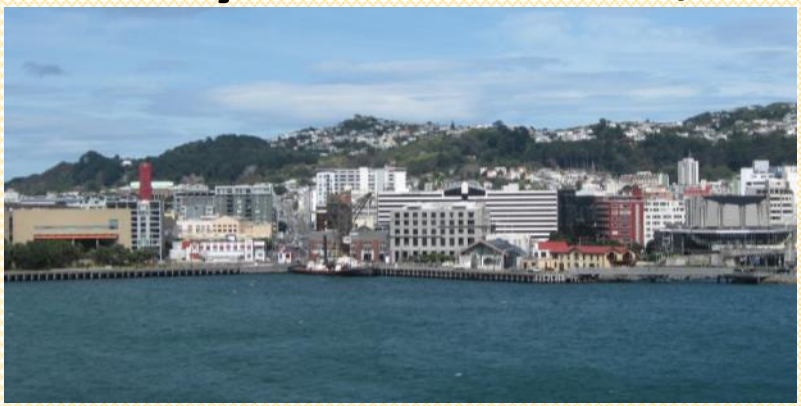
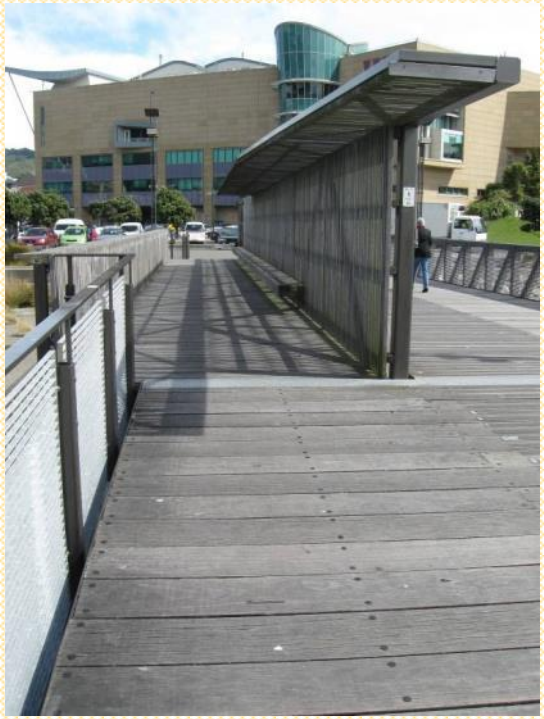
Hardwood decking & beams are used in modern city waterfronts

Imported Australian hardwood on Wellingtons waterfront

- **Karri** - $ **2,666** per cubic metre(1998)
- **Grey Ironbark -** $ **5,333** per cubic metre (1998)





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Hardwood sleepers and poles for KiwiRail!

Radio NZ reports 'Rotting sleepers cause derailments' 2nd August 2012. Cost $7M.

Blenheim Rail Bridge, Taylor River with SH 1 bridge behind.

High strength LVL beams and cross laminated timber panels of eucalypt /pine are possible

New Kaikoura District Council offices under construction

Emerging Asian markets are huge

- 1500 million new middle-class Asians by 2050 with demand for timber forecast to increase 400%.

- Tropical rainforest supplies are decreasing: Asia produced 130M m3 of hardwood sawlogs in 1989, versus 98M m3 in 2010 and is projected to fall to about 55M m3/annum by 2050.

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NZ teak (*E. bosistoana*)

Colour, durability, figure and tradition.

NZ rosewood (here, *E. camaldulensis*)

NZDFI Vision

Our vision is for New Zealand to be a world-leader in breeding ground-durable eucalypts,

and to be home to a valuable sustainable hardwood industry based on 1000,000 hectares of eucalypt forests, by 2050.

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Eucalypt forests that produce durable hardwood are a sustainable land use option

- Smaller scale processing possible with no chemical treatment & minimal RMA issues.
- Lower transport and processing costs (and carbon emissions) than pine & can deliver higher carbon sequestration rates.
- Reduced erosion risk in cutover and resilient to fire due to coppicing (stumps regrow).
- Future regional development in processing high value wood products.

Eucalypts support honey bees and native bio diversity

- Some durable eucalypts produce abundant nectar and pollen at various flowering times throughout the year for different species.

NZDFI's ingredients for success!

A market

Valuable products; competitively priced; environmentally friendly; sustainable

Trees that adapted to grow productively in NZ conditions

Fast; straight; disease, drought, frost resistant…

Growth and yield models / siting

and produce high quality hardwood

Consistent properties; natural durability, low growth strain; high heartwood percentage; no collapse; high stiffness…

Interested growers / wood processors / end-users

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Since 2003 NZDFI has invested $2.6M on R&D

1. DURABLE EUCALYPT SEED COLLECTION. 2003 - 2006	→	2. ESTABLISH TRIALS TO TEST SPECIES 2003 - 2006	→	3. SELECT SPECIES for BREEDING & COMPLETE SINGLE TREE COLLECTIONS started 2007	→	4. PLANT BREEDING POPULATIONS & EXTENSION TO OTHER REGIONS Started 2008

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Species Selection Criteria

Selection criteria for growing elite timbers:

- High natural durability
- Fast growth, straight stems
- Rich diversity of colour
- Early heartwood formation
- Drought & frost tolerance
- Coppice vigorously
- Nectar/pollen for native biodiversity and beekeeping

Selected 5 species from 25 candidates

Natural durability classification of timber

- Australian Standard No 5604, Timber – Natural Durability Ratings, 2003

Class	Probable in-ground life expectancy (years)
1	Greater than 25
2	15 to 25
3	5 to 15
4	0 to 5

Durable *Eucalyptus* species selected for NZDFI breeding populations

- *E. bosistoana* (coastal grey box)
- *E. argopholia* (western white gum)
- *E. quadrangulata* (white topped box)
- *E. tricarpa* (red ironbark)
- *E. globoidea* (white stringy bark)
- Red highlighted species have no record of breeding for plantation use.

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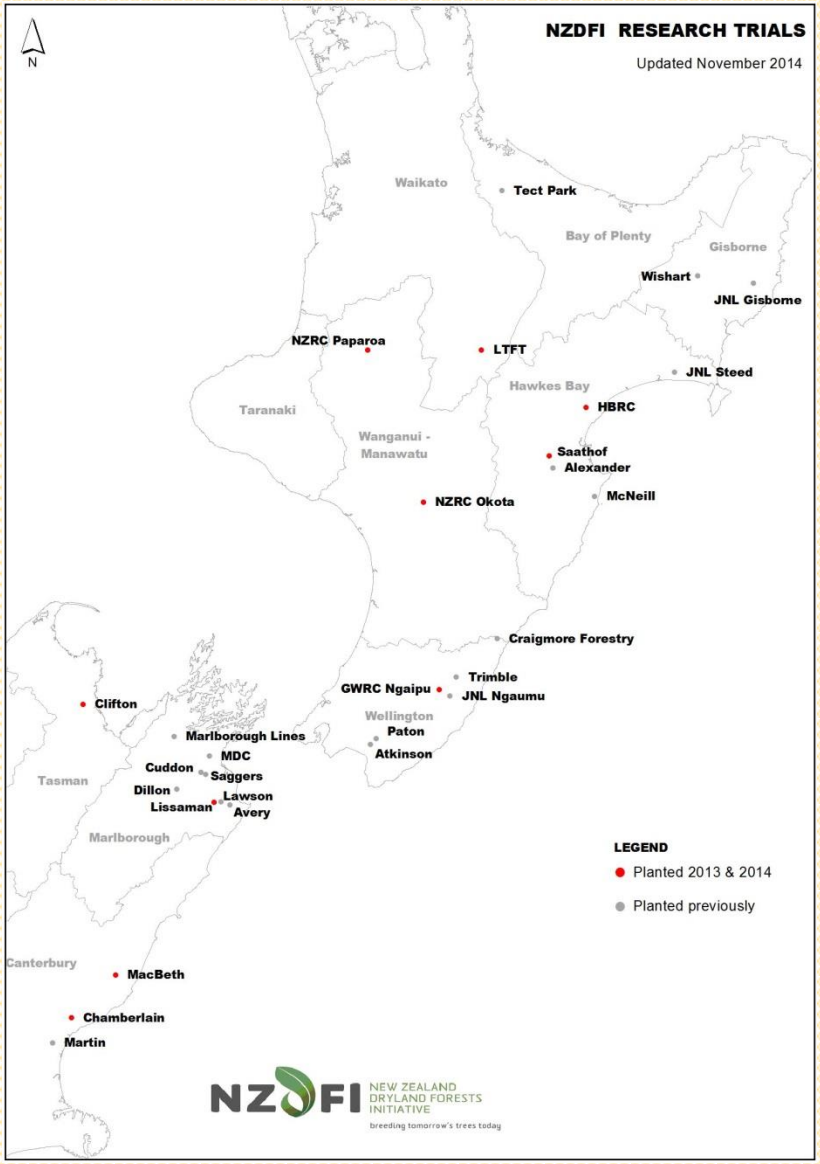
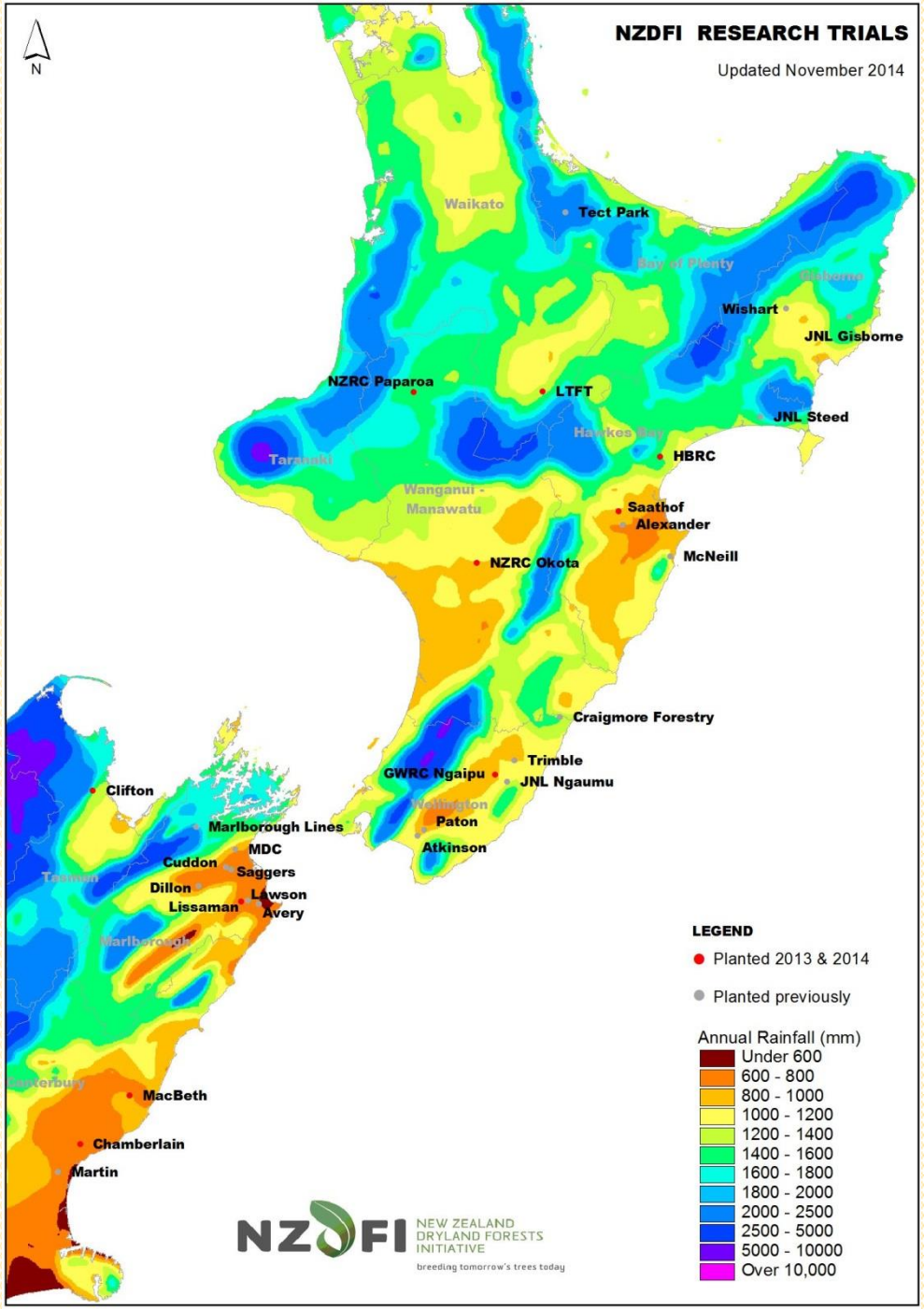
NZDFI research trial sites




NZDFI RESEARCH TRIALS
Updated November 2014
N
Waikato
Tect Park
Bay of Plenty
Gisborne
Wishart
JNL Gisborne
NZRC Paparoa
LTFT
JNL Steed
Hawkes Bay
Taranaki
HBRC
Wanganui - Manawatu
Saathof
Alexander
McNeill
NZRC Okota
Craigmore Forestry
Trimble
GWRC Ngaipu
JNL Ngaumu
Wellington
Paton
Atkinson
Clifton
Marlborough Lines
MDC
Cuddon
Saggers
Tasman
Dillon
Lawson
Lissaman
Avery
Marlborough
Canterbury
MacBeth
Chamberlain
Martin
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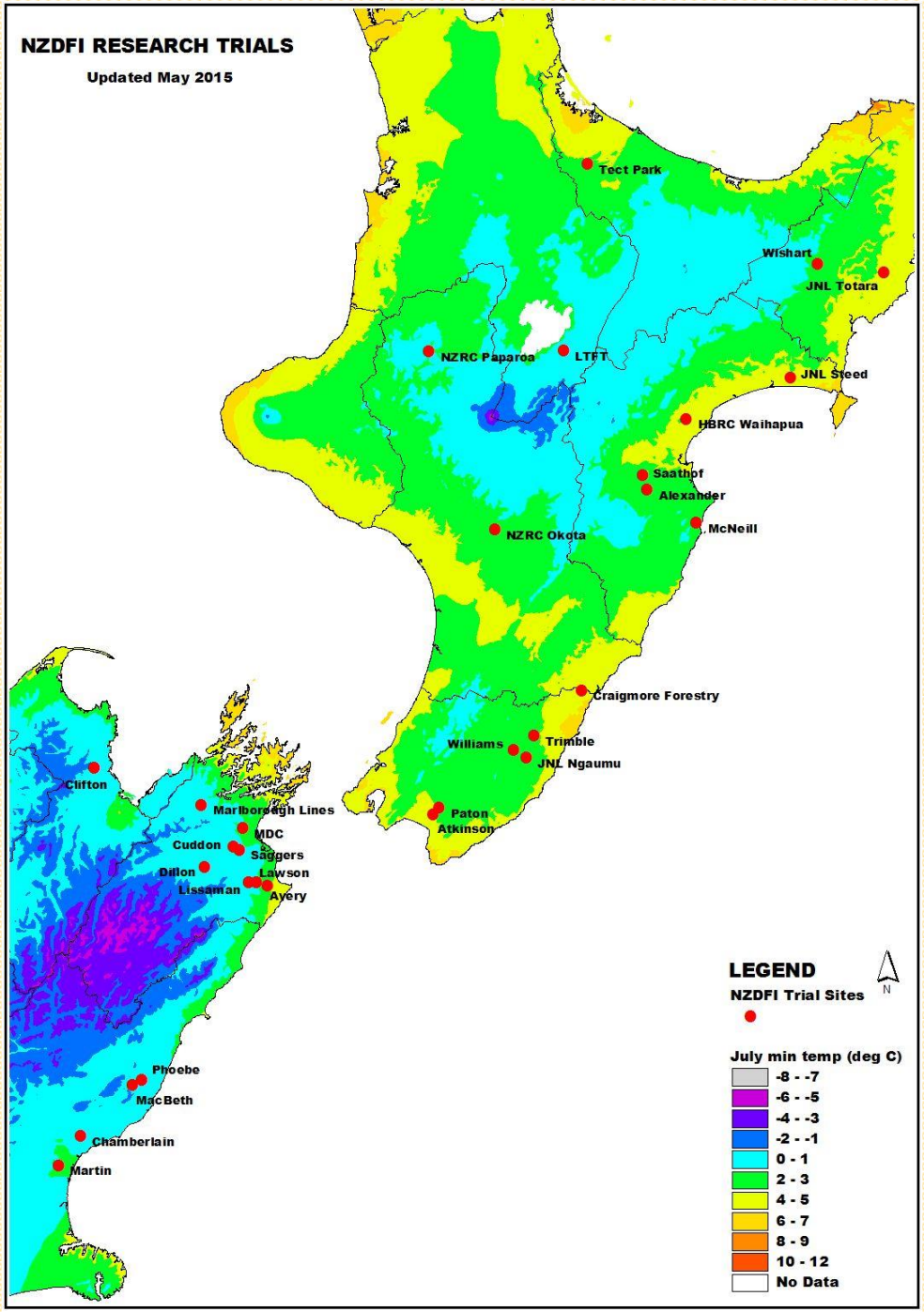
LEGEND
Planted 2013 & 2014
Planted previously
Annual Rainfall (mm)
Under 600
600 - 800
800 - 1000
1000 - 1200
1200 - 1400
1400 - 1600
1600 - 1800
1800 - 2000
2000 - 2500
2500 - 5000
5000 - 10000
Over 10,000


NZDFI RESEARCH TRIALS
Updated May 2015
Tect Park
Wishart
JNL Totara
NZRC Paparoa
LTFT
JNL Steed
HBRC Waihapua
Saathof
Alexander
McNeill
NZRC Okota
Craigmore Forestry
Williams
Trimble
JNL Ngaumu
Paton
Atkinson
Clifton
Marlborough Lines
MDC
Cuddon
Saggers
Dillon
Lawson
Lissaman
Avery
Phoebe
MacBeth
Chamberlain
Martin
LEGEND
NZDFI Trial Sites
N
July min temp (deg C)
-8 - -7
-6 - -5
-4 - -3
-2 - -1
0 - 1
2 - 3
4 - 5
6 - 7
8 - 9
10 - 12
No Data

Next 7 years NZDFI research under MBIE partnership to include:

- Selection and outcrossing to improve growth; form; wood quality; pest resistance.

- Matching species and sites for optimal productivity.

- Modelling , management and silviculture systems.

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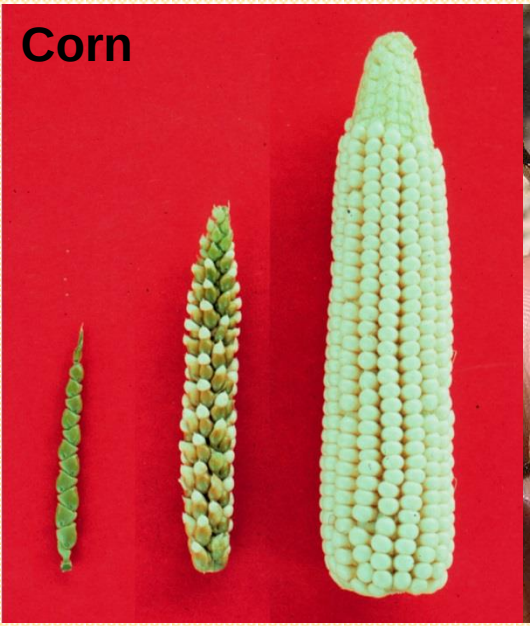
Tree breeding

Large gains can be achieved by improving genetics; i.e. selecting superior trees

Common in agriculture - **Less** common in forestry - **UNCOMMON** for wood properties



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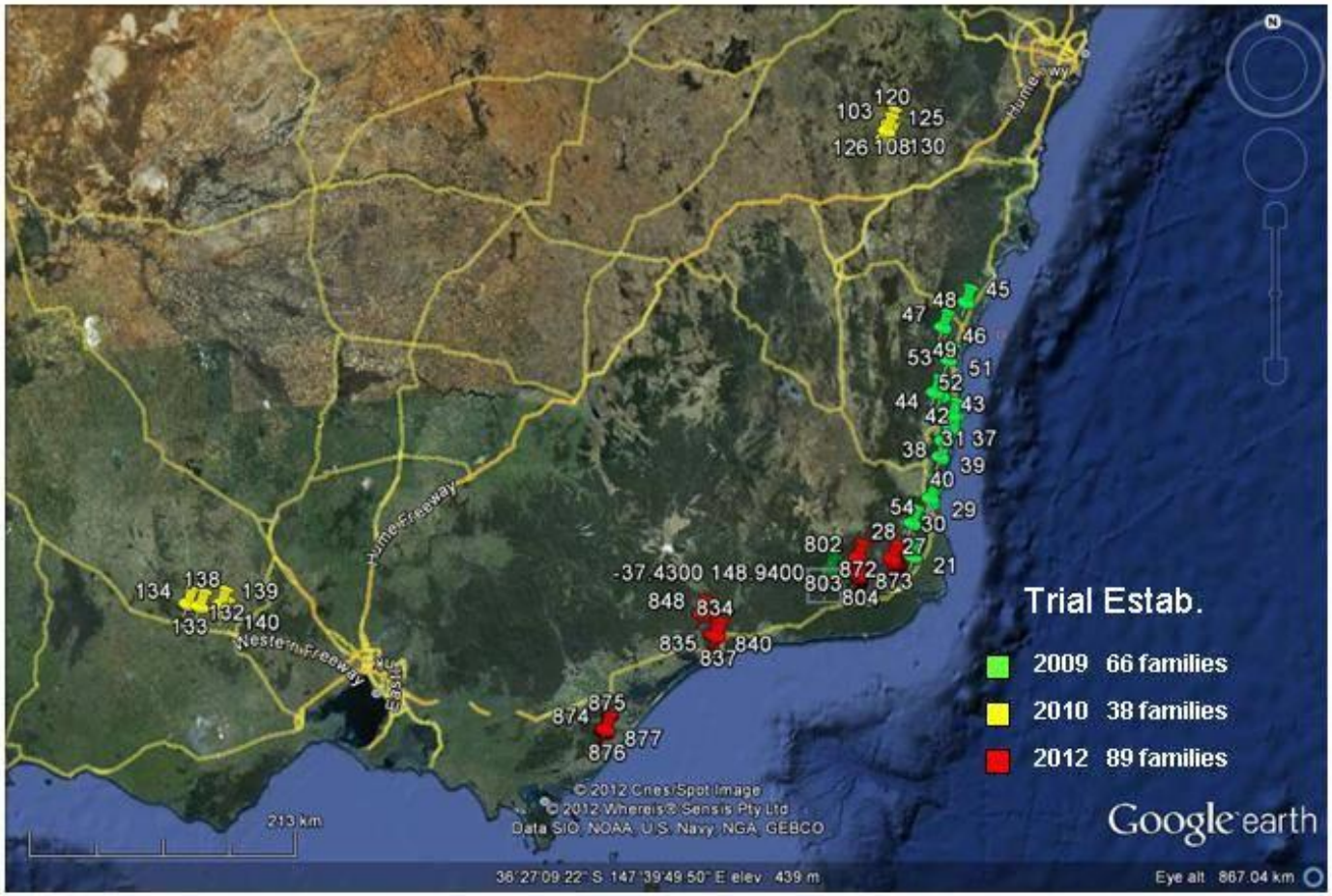
“Uncut Diamonds”

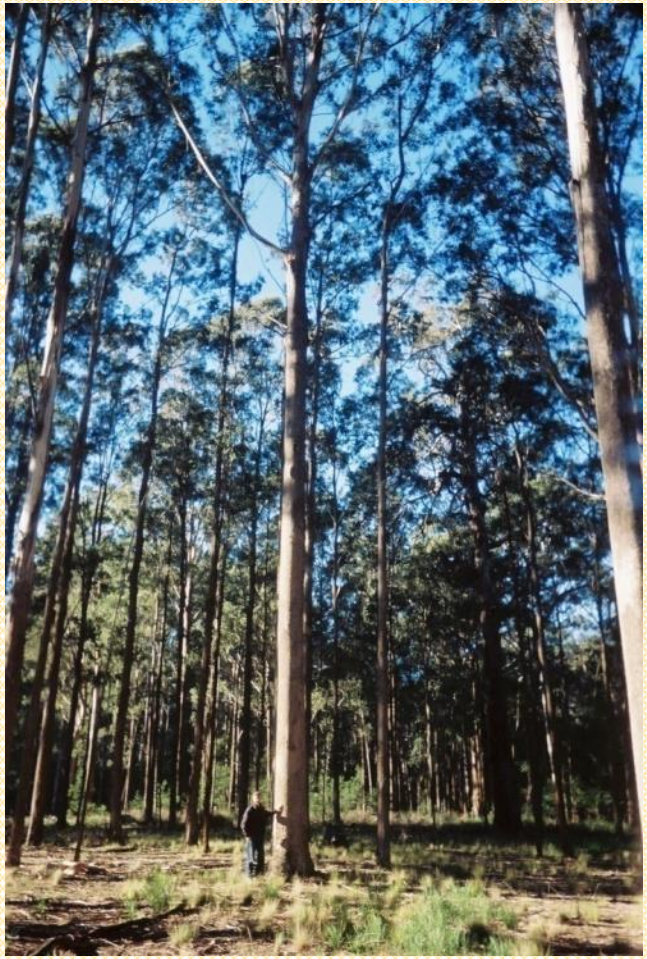
..the natural genetic resources of the eucalypts are still
“A SACK OF UNCUT DIAMONDS” Eldridge (1996)

E.bosistoana Australian Seed Collection



Diamond durable eucalypt seed collection

NZDFI's collected seed from individual trees throughout their whole natural range.



Issues

- Some candidate species survive today in fragmented remnant stands. Most are "unrecognized" in Australia.

- Poor flowering following droughts, good seed years are infrequent.

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Resource of uncut diamonds now in NZ

Five year old *E. bosistoana* at Cravens Road in Marlborough

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More uncut diamonds

4.5 m tall *E. globoidea* @ 20 months and flowering in less than 3 years at Atkinsons in Wairarapa.

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Wood quality

Clemens Altaner,
Nick Davies (PhD), Jackley Li (PhD), Gayatri Mishra (PhD)

Only heartwood is naturally durable and has colour

Variation of heartwood in 4-yr *E. bosistoana*:

0-75 (mean 13) (D%)

Quick assessment with methyl bromide staining (pH indicator)

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Heartwood assessments

Require a **core** sample of trees with heartwood.

Development of new coring tool with Callaghan Innovation underway.

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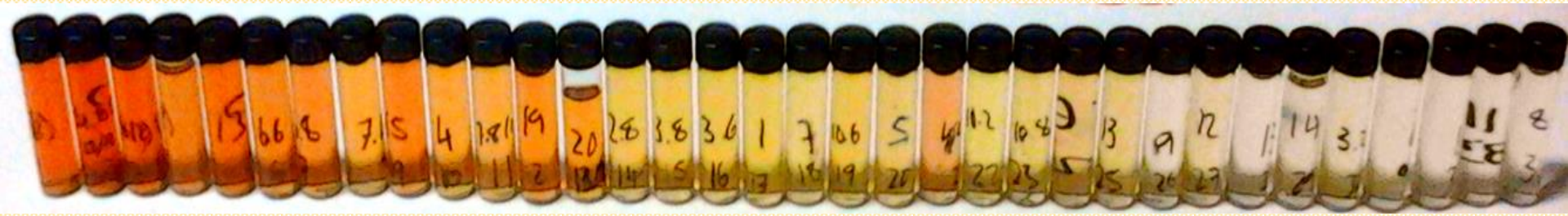
Natural durability



Variation of ethanol solubles in 4-yr *E. bosistoana*:

1.4-15.0 (mean 8.6) (wt%)

- Durability difficult to measure directly
- Primarily caused by extractives
- NIR spectroscopy being investigated

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Growth-strain

Restricts large scale plantation grown eucalypts being sawn for solid timber.

NZFFA

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Woodville field test trial

February 2015

~200 families

E. bosistoana

E. argophloia

~50 replicates

→11,000+ trees

Will be assessed at age 1-2 for:

- Growth strain
- Stiffness
- Collapse
- Early growth
- Early form

Scale only manageable and affordable by early selection!

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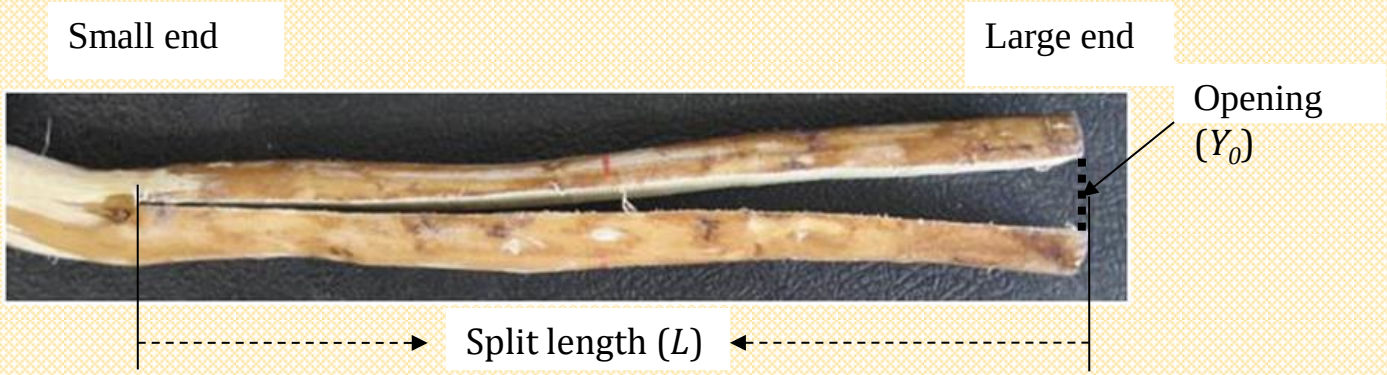
Growth-strain assessment



Growth-strain ε

$$\varepsilon = Y * R / (0.87 * L^2)$$

Assessment takes 1-2 minutes

→ large numbers can be screened

→ early screening at age 1-2

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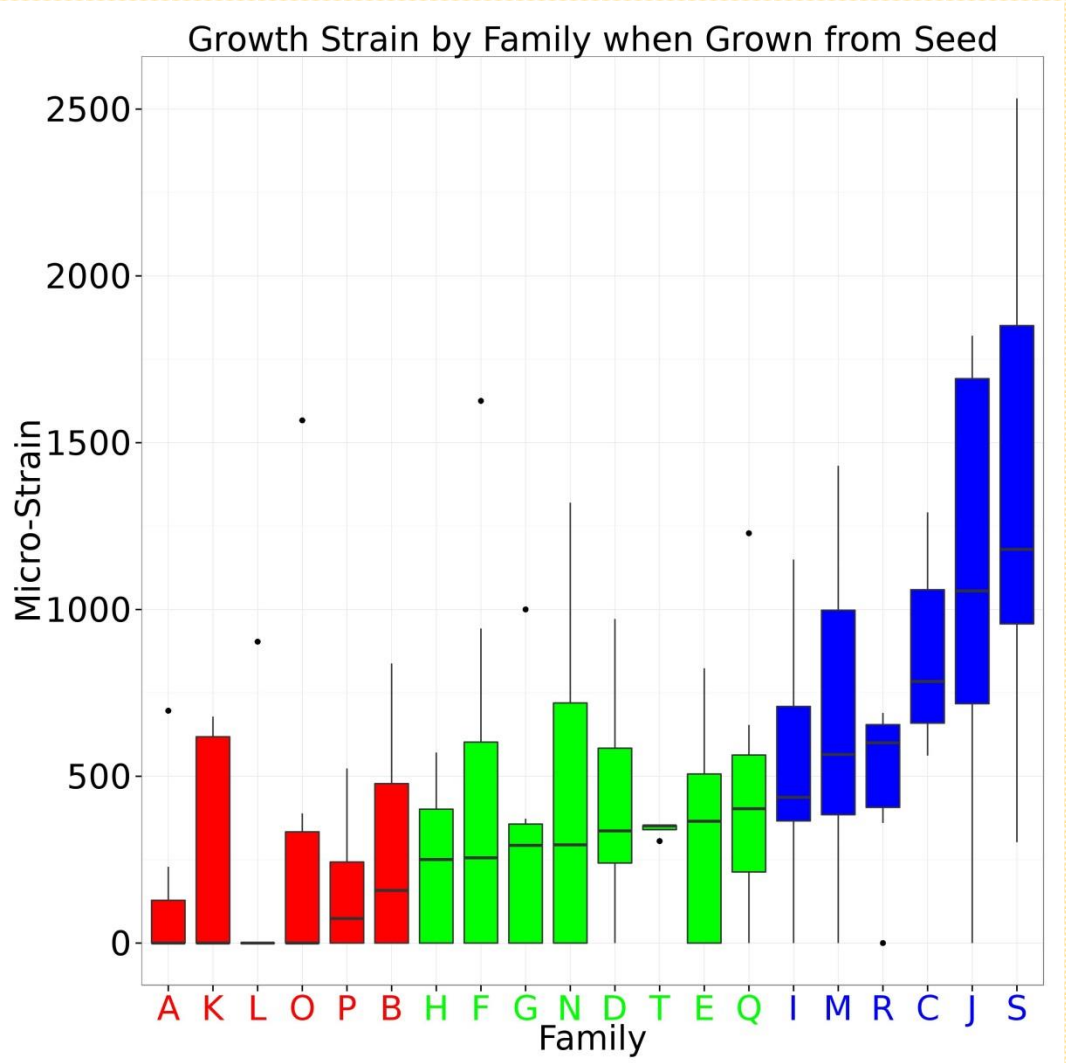
Growth-strain variability



E. bosistoana age 2

Difference between families

→ **Heritable**

Growth strain can be cured by breeding

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Disease resistance

Tara Murray / Huimin Lin (PhD)

Insect herbivores

- Continue to arrive from Australia
- All present in NZDFI sites, occasional severe outbreaks possible

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Insect herbivores research

Tolerance – management

- Eucalypts can naturally cope with insect herbivores
- How much productivity / time do we lose due to different levels of defoliation
- When is it economic to manage insects herbivores – i.e. when do we spray?

Tolerance – species selection

- Field assessment of natural variation in levels of defoliation sustained by genetically distinct species and families

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Propagation by Proseed at Amberley

NZDFIP
NEW ZEALAND DRYLAND FORESTS IP LTD
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XyloGene®
Nature's Green Diamond

XyloGene is a trade mark to certify NZDFIP green diamond genetically improved durable eucalypt seed/germplasm to add value to future hardwood forests and timber products.

A royalty will be collected on sale of improved seed or plants to pay for ongoing research.

Information on how to grow durable eucalypts

- Check out NZDFI's web site www.nzdfi.org.nz
- NZ Farm Forestry Association's Eucalypt Action Group – a network of eucalypt growers.
- Check out the web site www.nzffa.org.nz
- Buy Neil Barr's book 'Grow eucalypts for milling on NZ farms'.

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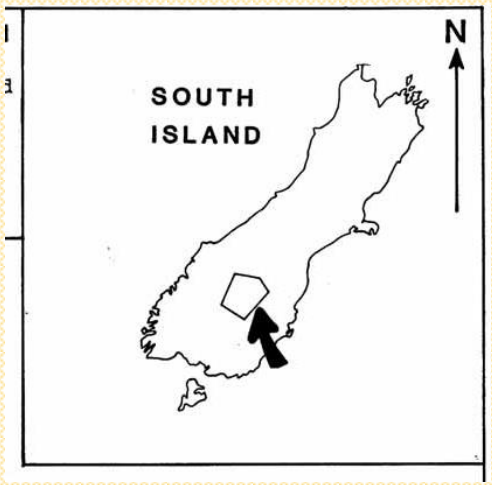
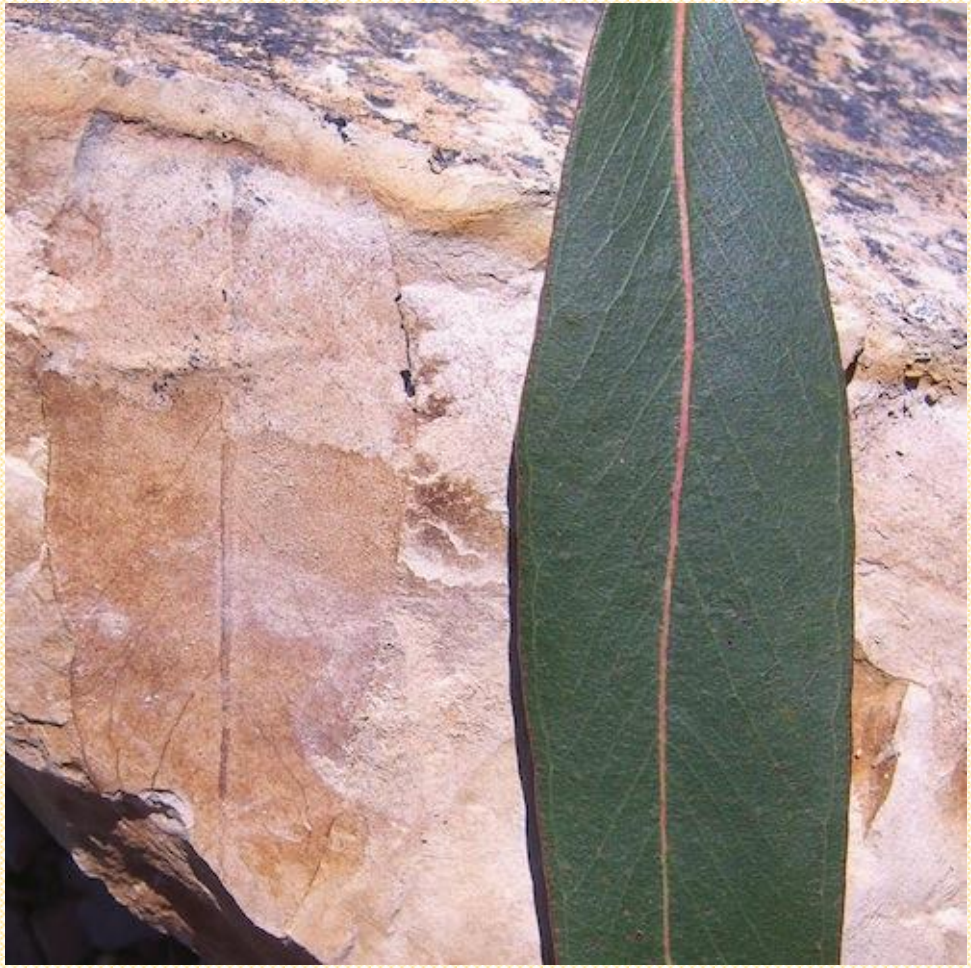
Eucalyptus grew in Central Otago during Miocene 14 to 19 million years ago





Fossils found in Lake Manuherikia are part of growing evidence that the distinctive Australian biota is due not to evolution in isolation i.e. endemic, rather it is relictual – eucalypts have become extinct everywhere else.

And thanks to an excellent team of dedicated people

Shaf van Ballekom, Chairman NZDFI (Proseed NZ Ltd, Amberley)

Gerald Hope, Finance Manager **(**Marlborough Research Centre Trust, Blenheim)

Professor Bruce Manly, Dean (School of Forestry, UoC)

Professor John Walker, Wood research (School of Forestry, UoC)

Dr. Luis Apiolaza, Tree Genetics (School of Forestry, UoC)

Professor Euan Mason, Physiology & modelling (School of Forestry, UoC)

Dr. Clemens Altaner, Wood science (School of Forestry, UoC)

Dr. Tara Murray, Forest entomology (School of Forestry, UoC)

Ruth McConnochie, Consultant tree breeder (under contract to NZDFI)

Harriet Palmer, Communications consultant (under contract to NZDFI)

Roger May, Forestry GIS mapping specialist (under contract to NZDFI)

Ash Millen, Forestry technician (under contract to NZDFI)

Kevan Buck and Maree Way, Administration (MRC Trust, Blenheim)

5 UC PhD students; 26 landowners and 7 NZDFI Extension Team members

Check out www.nzdfi.org.nz for more information