NZDFI NEW ZEALAND DRYLAND FORESTS INNOVATION

Breeding durable hardwood | Whakatipu taikākā mauroa

NZDFI aims to produce superior genetic material for the establishment of a significant new hardwood supply chain in New Zealand for a diversity of products and markets.

Pole wood, Sawlogs, Veneers

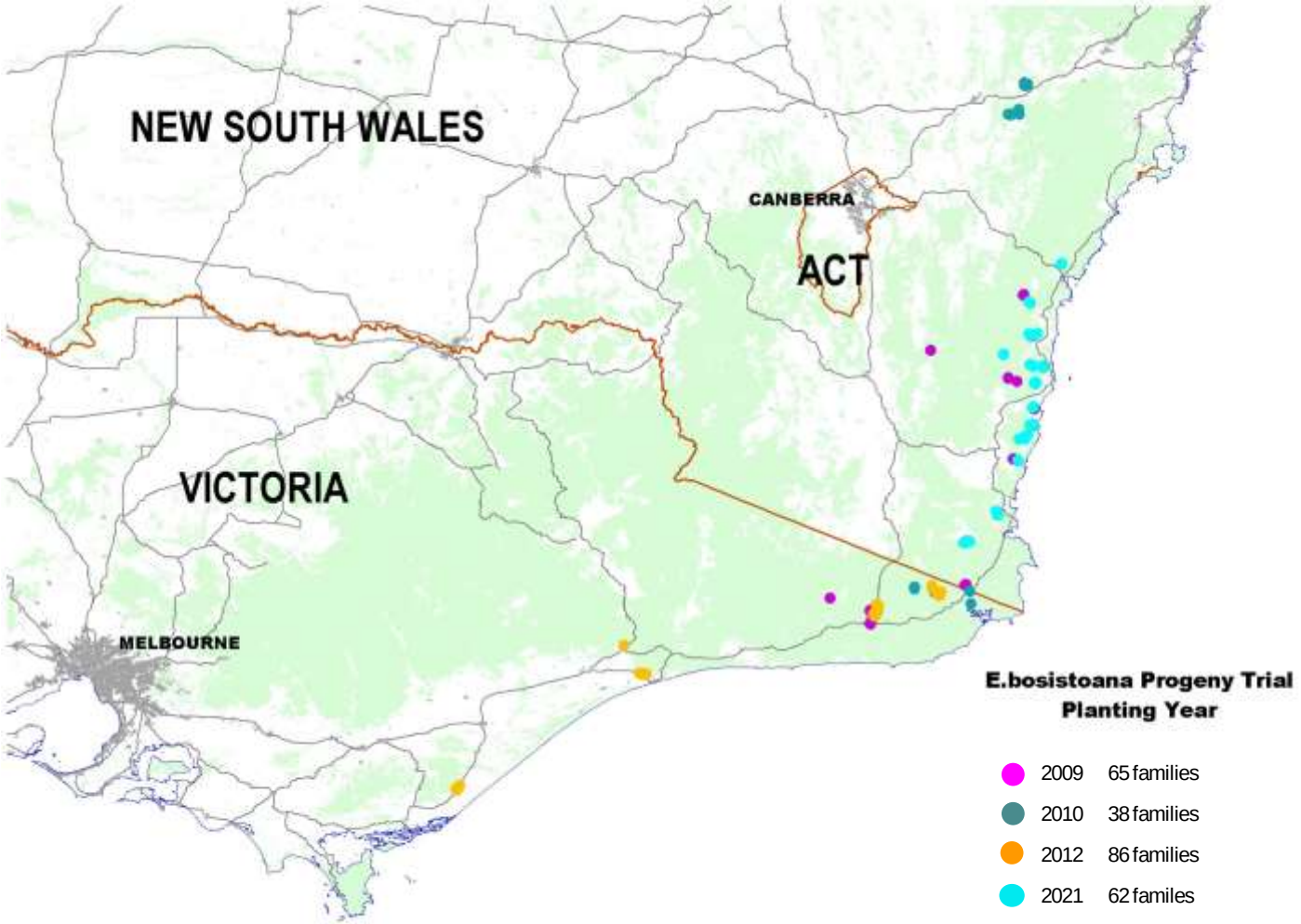
Challenges faced when domesticating a new eucalypt species and undertaking a breeding programme.

1. Selecting the right species from a long list of candidates and matching to the right site
2. Collecting and testing germplasm with a broad genetic base
3. Species identification and diversity
4. Measuring the important traits to maximise product quality
5. Early multiplication and deployment of best genetics

1. Selecting the right species from a long list of candidates.

E. bosistoana, coast grey box, was selected by NZDFI for genetic improvement as it has proven adaptability in many NZ regions and produces class 1 durable timber (expected in-ground service life of 25-plus years) with excellent strength properties.

2. Collecting and testing germplasm with a broad genetic base.



The *E. bosistoana* family seedlots were sourced from trees growing across the natural range of the species from northern New South Wales south to coastal southeastern Victoria.

Progeny tests are used to calculate breeding values of individual families to identify the best genetics for further development and deployment.

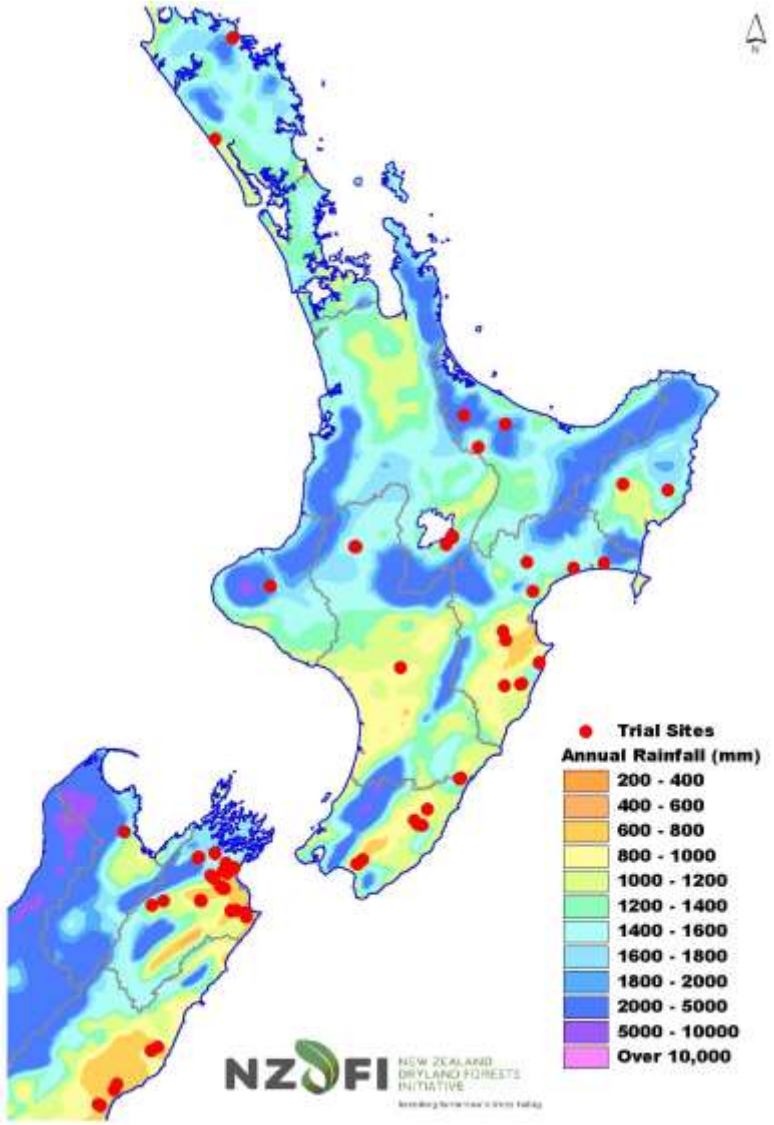
A network of progeny trials was planted between 2009 and 2021 to establish a 1st generation breeding population.

A large number of trees planted per family (40 – 75) to maximise gains derived from within-family selection.

Planted at multiple locations to test different environments.

NZDFI recognised the need for a sustainable land use resilient to the effects of climate change and the increase in prolonged droughts.

Trials were located predominantly in dry regions where annual rainfall is 500 to 1,000 mm/year.



3. Species identification and diversity.

Eucalypts have a propensity to hybridise and distinguishing species is often a challenge even for the most skilled botanist.

Seed collections were made from remnant native stands of mixed eucalypt species.


2010 *E. bosistoana* narrow-leafed form

Seedlings of families planted in 2010 trials displayed a mix of narrow and rounded leaf forms.

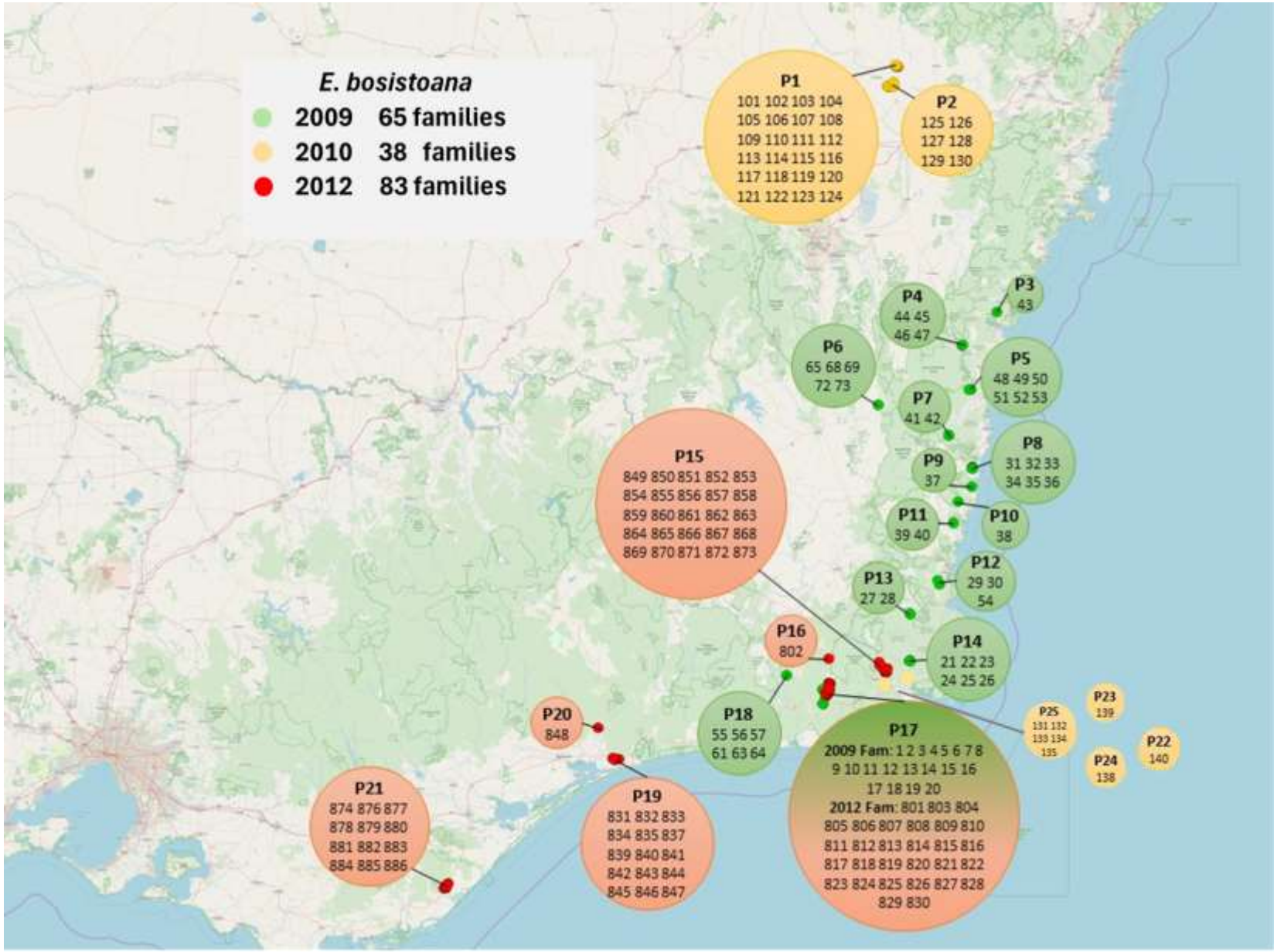
Early assessment results showed poorer growth, form and heartwood content among the families with narrow leaf form.

Possibility of a hybrid or incorrect species.


2010 *E. bosistoana* round-leafed form

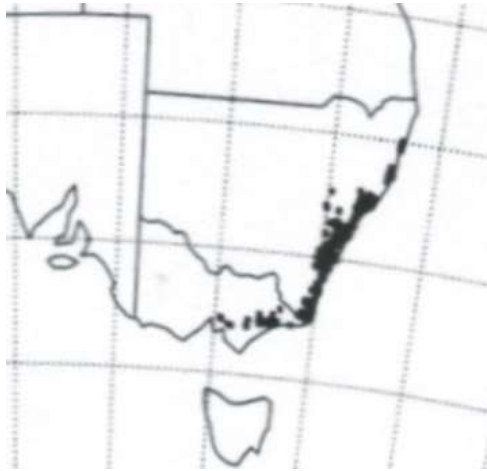
A tree from the Northern NSW inland population shows

the leaf narrow leaf form and slower growth.



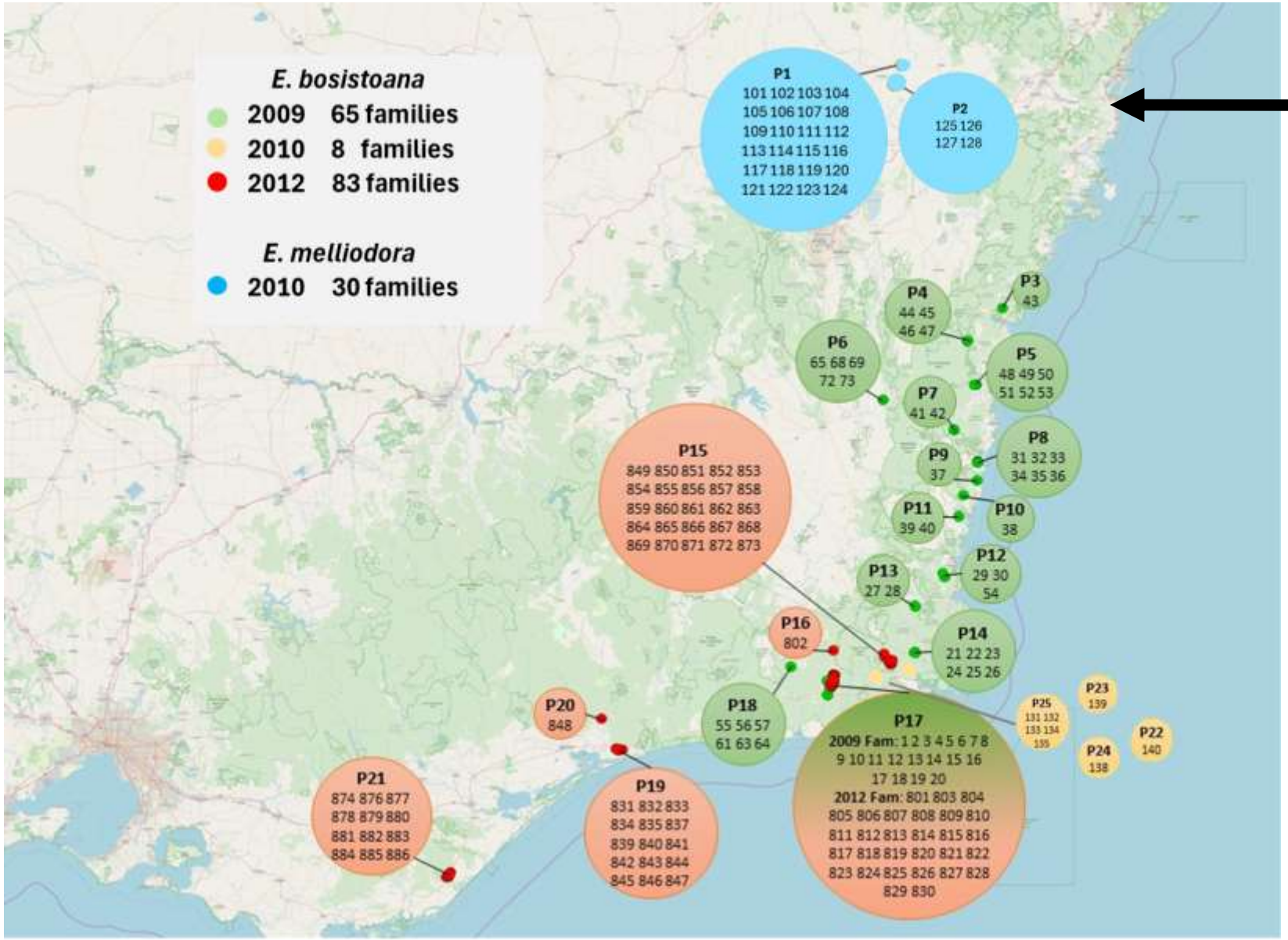
‘Genetic structure and diversity in NZDFI’s *Eucalyptus bosistoana* families.’

Seol Jong Kim, UC PhD genomics graduate 2023



Families were divided into discrete populations based on the location of the mother trees.

Map of the natural distribution for *E. bosistoana*.

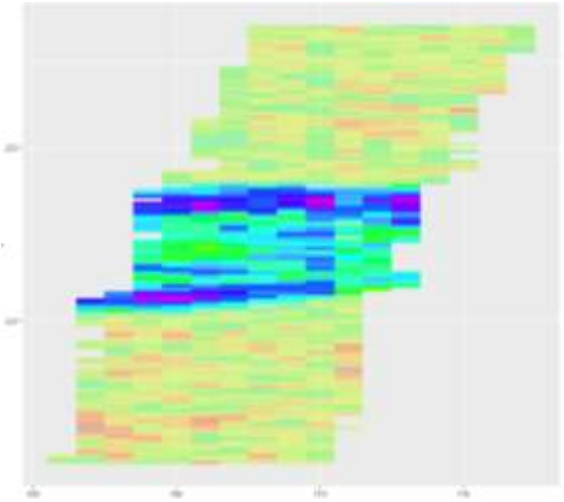


30 families collected from northern NSW with a narrow leaf form were identified as ***E. melliodora.***

Number of families in the 2010 trials reduced to 8.

4. Measuring the important traits to maximise product quality.

- Tree diameter (mm) and height (m)
- Stem straightness and form acceptability (1 = acceptable, 0 = unacceptable)
- Early age heartwood formation (mm)
- Extractive content (%)



The characterization of wood properties required the development of new tools and techniques.

Milwaukee MP18CPD cordless drill mounted with coring tool to take 14mm core samples.

Efficient method for the collection a large core and large number of samples.

Staining reveals the heartwood zone in pink in the bark to bark core.

Sanded face for NIR scanning to evaluate extractive content.

Selection and deployment of elite *E. bosistoana* for short rotation hardwood forestry

MPI Technical Paper: 03

Prepared for the Ministry of Primary Industries

Ruth McConnochie, Paul Millen, Monika Sharma,
Frederick Anthonio and Clemens Altaner.

September 2025

Two progeny trials planted in 2012 at Dillon, Marlborough and McNeill, Hawkes Bay were assessed at age 12 years old and breeding values calculated.

Genetic gain % estimates from between-family selection.

Trait	Site	Top 24 families	Top 10 families
DBH	Dillon	17%	14%
	McNeill	19%	19%
Stem acceptability - straightness & form	Dillon	43%	43%
	McNeill	43%	53%
Heartwood diameter	Dillon	13%	21%
	McNeill	14%	20%
Predicted extractive content	Dillon	11%	12%
	McNeill	14%	16%

Significant gains have been made by screening for growth and form and wood quality traits; heartwood development and extractive content.

Breeding values for 2012 *E. bosistoana* trials at the Dillon and McNeill sites were highly correlated. Family performance is not influenced by site.

Trait	Site correlation
DBH	0.74
Height	0.74
Stem acceptability - straightness & form	0.70
Heartwood diameter	0.82
Predicted extractive content	0.66

Site name	July Min (^oC)	Feb Max (^oC)	Annual Rainfall (mm)	Base Geology
Dillon	0	23	692	Alluvial Gravel
McNeill	2	22	1061	Limestone

5. Early multiplication and deployment of best genetics

Success of the breeding programme is realised by the propagation and delivery of improved germplasm for planting forest stands.

Elite selections from the 2009 progeny trials have been successfully propagated by Proseed and established in a clonal seed orchard (CSO).

Best individual in the top 24 families from 2012 *E. bosistoana* families will be grafted by Proseed in December 2025 to expand the CSO.

Review of the elite tree selections from 2009/2010 trials to rogue CSO and make further selections.

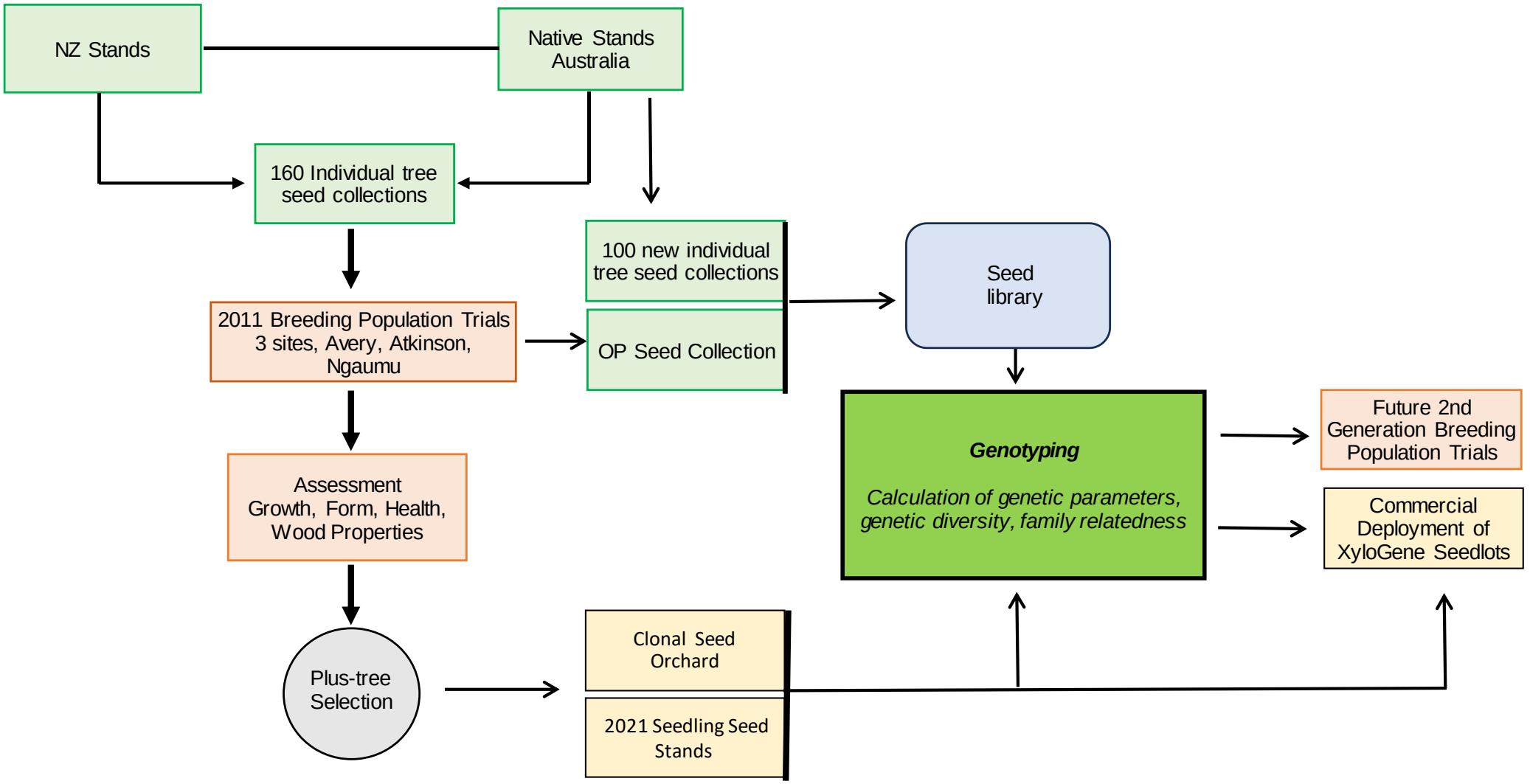
Proseed clonal seed orchard, CSO, Amberley

Management of the clonal seed orchard

- Open – pollination, insect pollinated.
- Flowering needs to be widespread across families and occurring at the same time to ensure outcrossing.
- Application of paclobutrazol to enhance flowering.

E. globoidea, White stringybark, grows well across a range of sites, and produces Class 2 durable timber which is heavy, versatile and attractive. *E. globoidea* has good natural form and self-pruning ability.

NZ Dryland Forests Innovation, Breeding and Deployment Plan - *E. globoidea*



Improved seed is produced and supplied by Proseed NZ

High-quality XyloGene® seed ensures eucalypt growers can plant the best genetics available and scale-up planting a durable hardwood forest resource.

XyloGene-branded E*. bosistoana, E. globoidea, E. cladocalyx, E. macrorhyncha and E. quadrangulata* seed and seedlings produced by NZDFI's breeding programme are available for growers to purchase.

Licensed nurseries to supply tree stocks. The royalty on seedling sales contributes to ongoing research.

Many thanks to

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- Frederick Anthonio, PhD Student, School of Forestry
- Monika Sharma, School of Forestry, UoC
- Other UoC staff and students
- Ash Millen, Forestry Technician
- Buck Forestry
- Harriet Palmer, Communications consultant
- Roger May, Forestry GIS mapping specialist

2012 *E. bosistoana* trial landowners: Susan Dillon, The Throne, Marlborough
Ben McNeill, Waimarama, Hawkes Bay.
Juken NZ Ltd, Wairarapa.

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