

# Improving hardwood of durable eucalypts

Yanjie Li

Gayatri Mishra

Clemens Altaner

University of Canterbury

NZ School of Forestry

# High quality products



- Posts (agricultural industries)
- Poles / cross-arms (power companies)
- Wharf timbers
- Decking / outdoor furniture
- Flooring ...



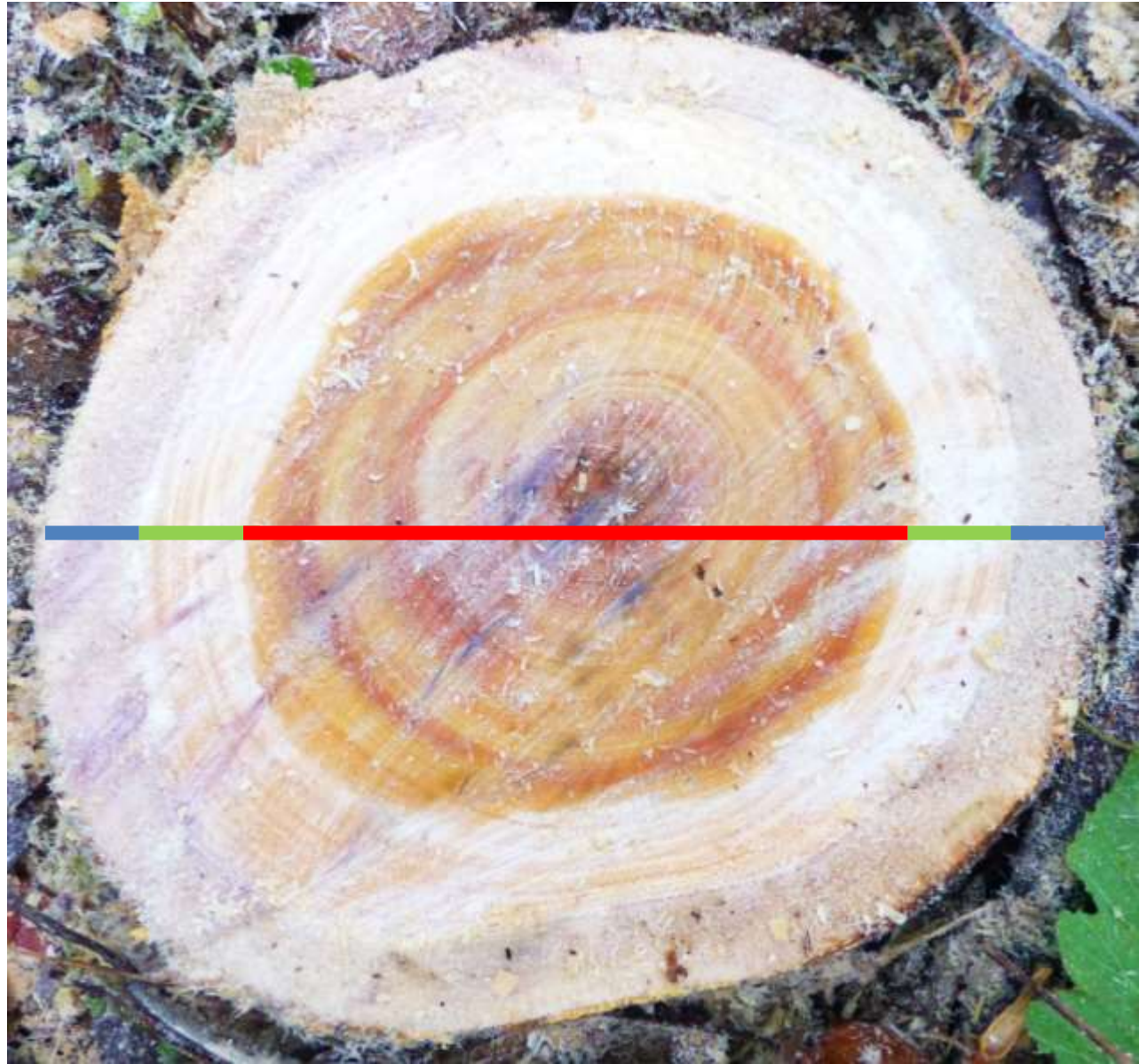
**Only heartwood is durable and has colour**

# Heartwood

Bark

Sapwood

Heartwood



8-year old *E. bosistoana*

# Variability

**Large trees are not necessarily the most valuable**



- **Screen for heartwood quantity**

# Heartwood quality

## Quality

- Durability
- Colour

Highly variable



Table 2. Performance of stakes cut from 5 trees, after 14 years in the ground.

Species	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Total stakes remaining per species
<i>E. vitularis</i>	5	0 (av. life 7 yr)	3	0 (av. life 5.7 yr)	2	10
<i>E. muelleriana</i>	2	1	2	1	0 (av. life 8 yr)	6
<i>E. globosa</i>	4	6	2	0 (av. life 4 yr)	1	13

# Ensure quality

## Reduce variability in a breeding programme

- Large sample numbers



## Extractives

- Key factor for durability and colour
  - Proxy measurement of heartwood quality
- Variable
  - 4-yr *E. bosistoana*: 1.4 - 15.0 (wt%)

# Sampling – Tree corer

## **Battery powered**

- Fire safety

## **Light-weight**

- Less fatigue

## **Quick**

- <60s per tree

**14 mm core with  
'small' wound**



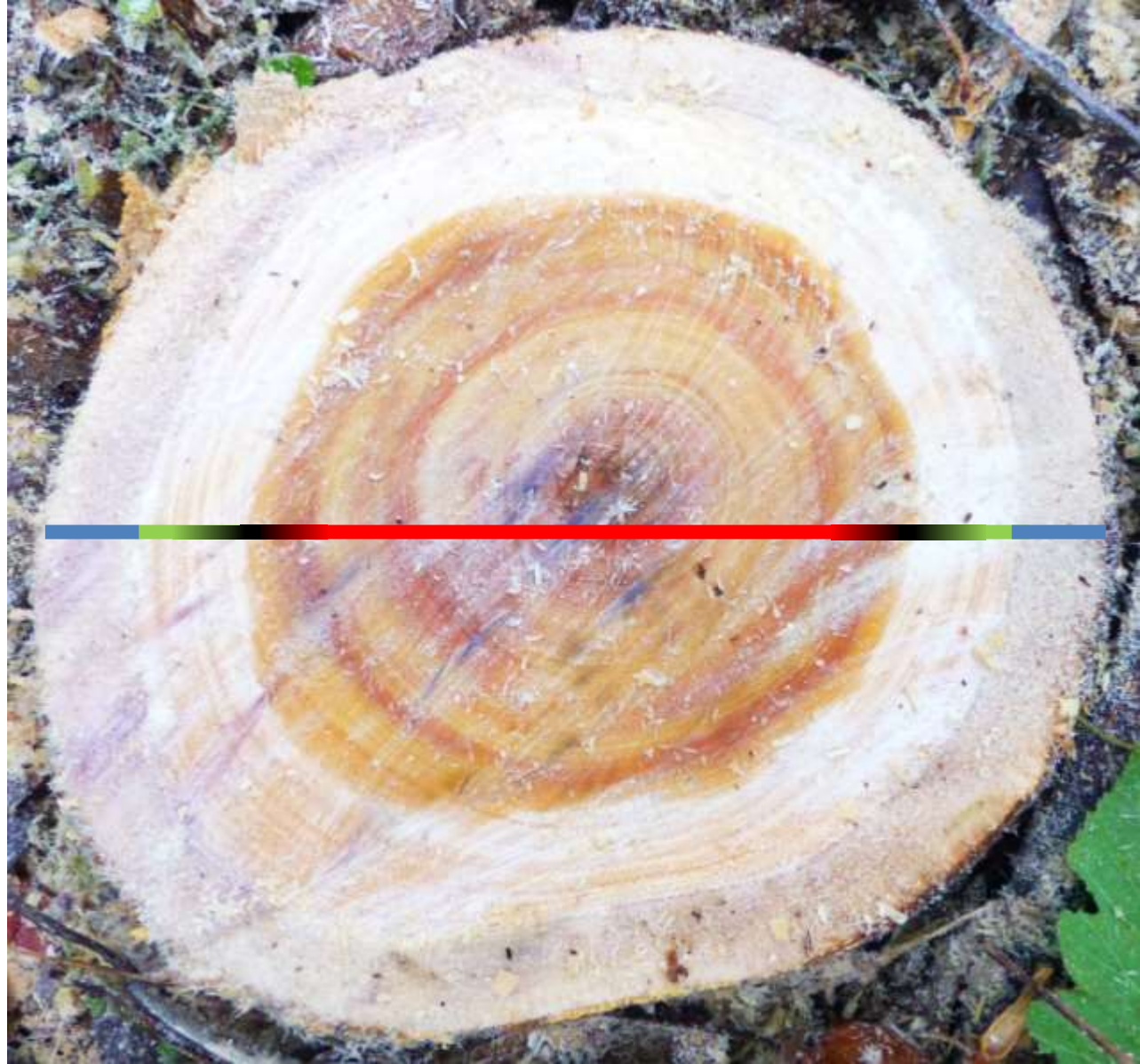
# Heartwood

Bark

Sapwood

Heartwood

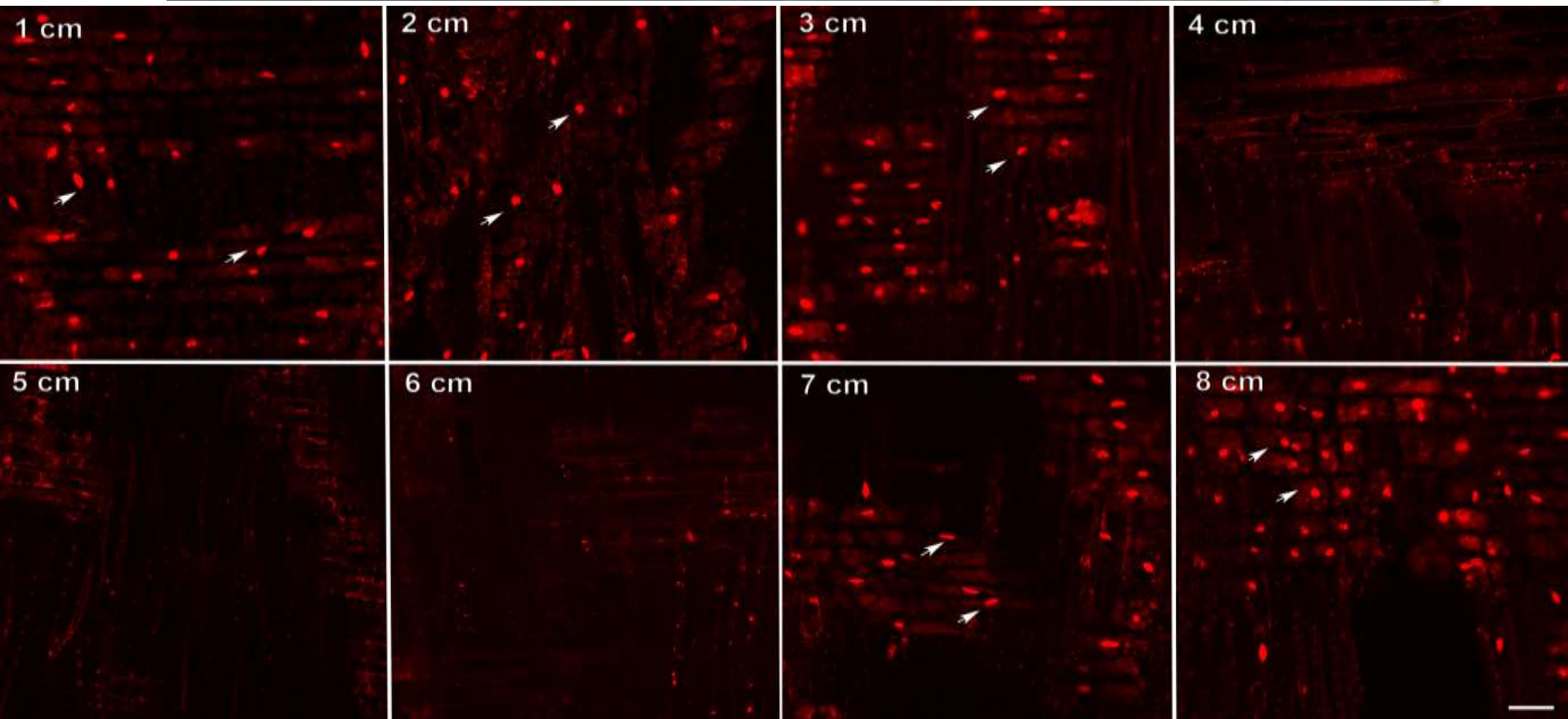
Transition zone





# Cell nuclei – bark to bark

6-year old *E. bosistoana*



**True heartwood 4 - 6 cm: parenchyma cells dead (no nuclei)**

# True heartwood



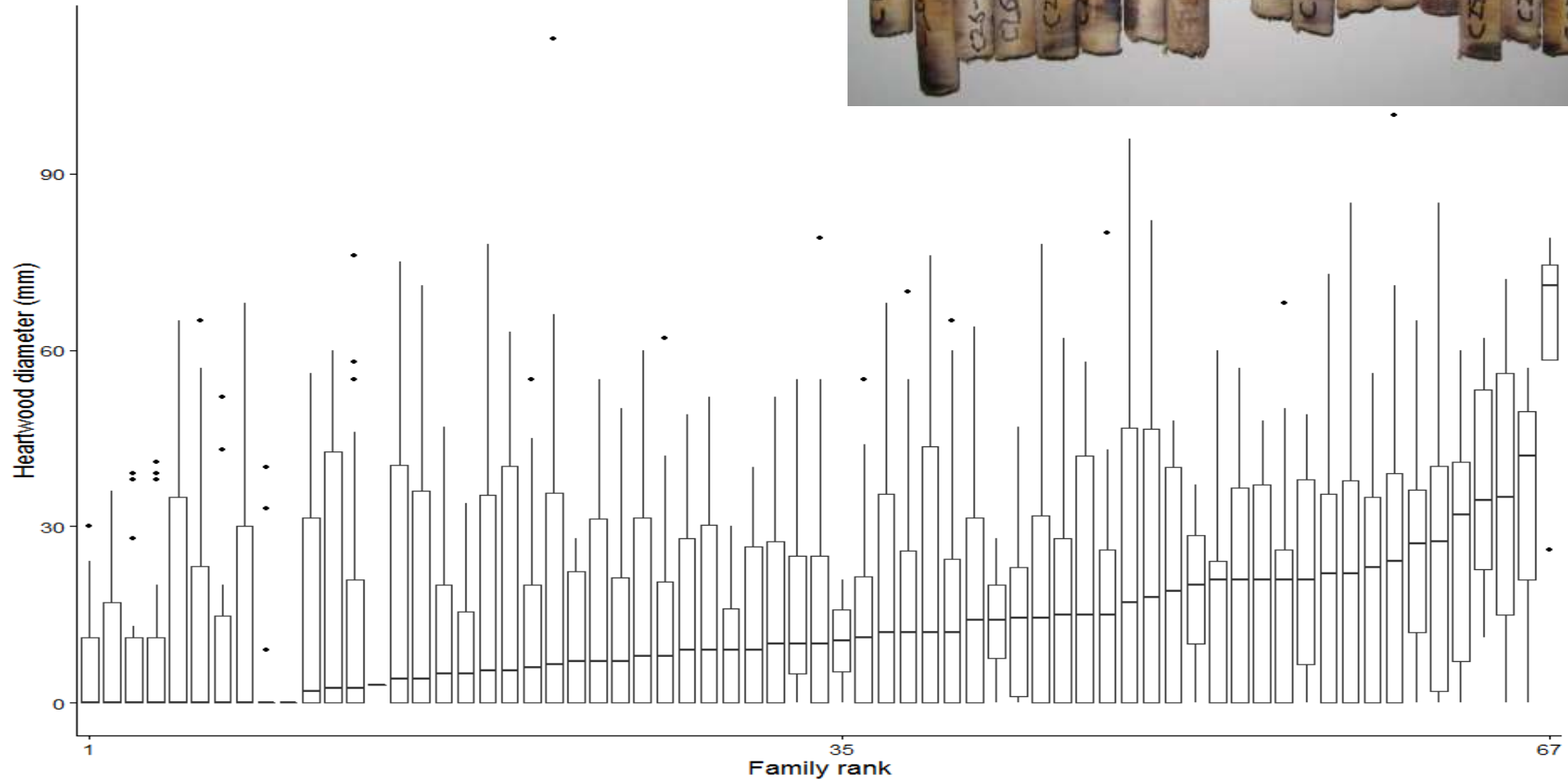
Position	1 cm	2 cm	3 cm	4 cm	5 cm	6 cm	7 cm	8 cm
Starch (KI stain)	Yes	Yes	Yes (some)	No	No	No	Yes (some)	Yes
Nuclei (histone labelling)	Yes	Yes	Yes	No	No	No	Yes	Yes
Tyloses	No	No	Yes (forming)	Yes	Yes	Yes	Yes (forming)	No
Tissue type	Sap wood	Sap wood	Transition zone	Heart wood	Heart wood	Heart wood	Transition zone	Sap Wood

- ~1 cm transition zone
- True heartwood in 6-year old *E. bosistoana*
- Allows to assess heartwood at this age

# Heartwood quantity

7-year old *E. bosistoana*

3 sites, >1000 trees



# Measuring extractive content (EC)

## Extraction

- Slow
- Labour intensive

## NIR

- Measures sample chemistry
- Used in agriculture (e.g. protein content of grains)
- Quick (seconds)
- No sample preparation (solid wood – cores)
- Needs calibration



# Calibration of NIR for extractive content (EC)

*E. bosistoana*

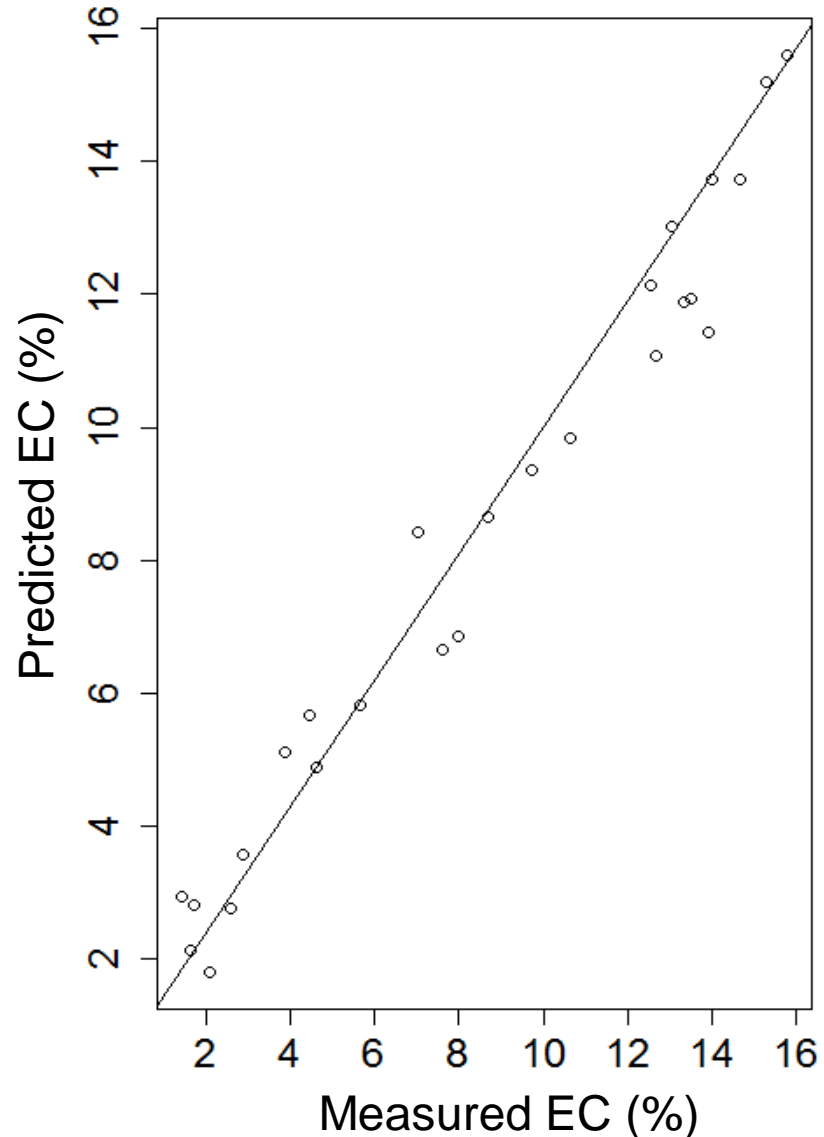
*E. argophloia*

working on *E. globoidea*

**RMSE ~1%**

**independent of**

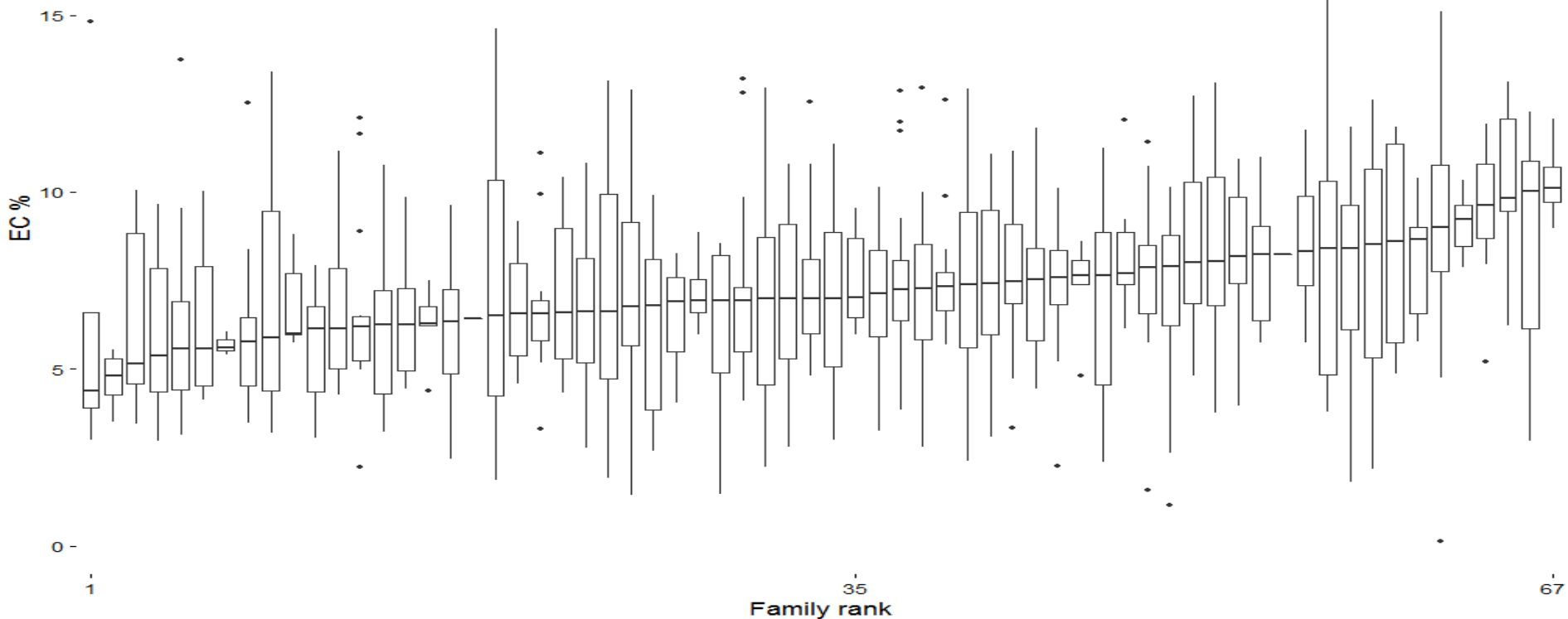
- grain
- particle size
- (air dry) MC



# Extractive content in heartwood

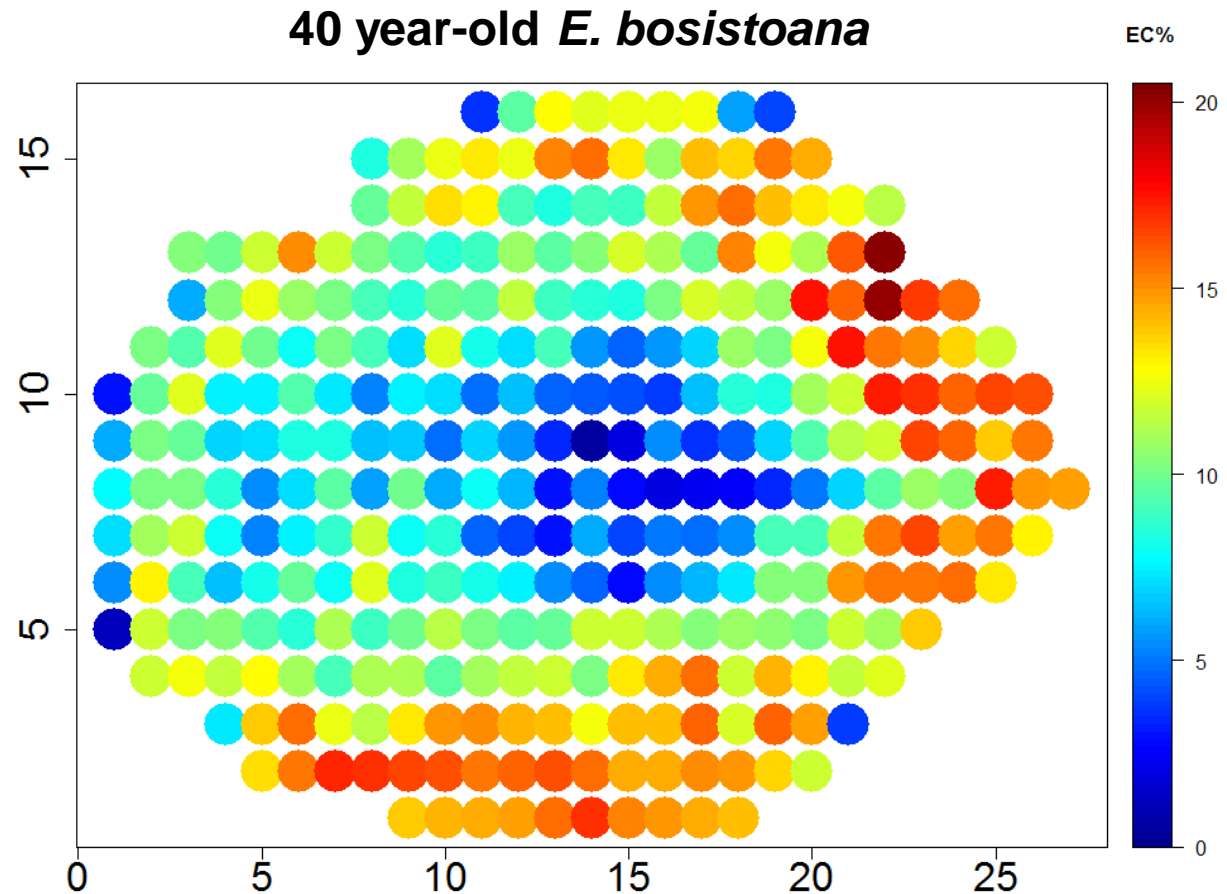
7-year old *E. bosistoana*

3 sites, >1000 trees



# Typical heartwood gradient

- Radial extractive content gradient
- Reinforcing possibility to improve wood quality early



# Environment and heartwood formation

Most heartwood Biggest trees

	Lawson's East	Lawson's North	Craven's Road
Heartwood diameter (mm)	5	32	16
Sapwood diameter (mm)	64	60	81
Core diameter (mm)	76	91	104

**Need to include heartwood into site-species and growth & yield models**



# Durability

## **Selections for high extractive content**

- Allows incorporation of heartwood quality into breeding programme (assess large number of samples)
- Early assessment (smaller samples)
- Increases probability of quality (durable) heartwood in selected trees

## **Need to certify durability of selection**

- Manageable number of samples
- Better outcome
- Independent laboratory
- According to (export market) standards
- Larger samples needed (older trees)