

HYBRID MODELLING OF TREE GROWTH AND WOOD FORMATION IN AUSTRALIAN RADIATA PINE

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Precision Forestry, Stellenbosch
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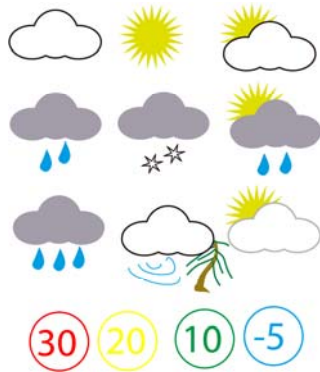
Modelling approach/philosophy



- The eCambium platform incorporating 3PG runs in concert with the xylem development prediction engine (Drew et al. 2010; Drew and Downes 2015)
- Took a philosophical decision with industry partners to test model veracity without “tuning”:
 - Off-the-shelf data sources
 - One parameter set across all study sites and scenarios
 - A range of silvicultural regimes
 - Minimise variation in age: no stands younger than 16 y
- Modelled a large number of “scenarios”: 120 in all
- Calibration (60%) and validation (remaining 40%) set



Scenarios



Weather data



Site/soils



Silviculture

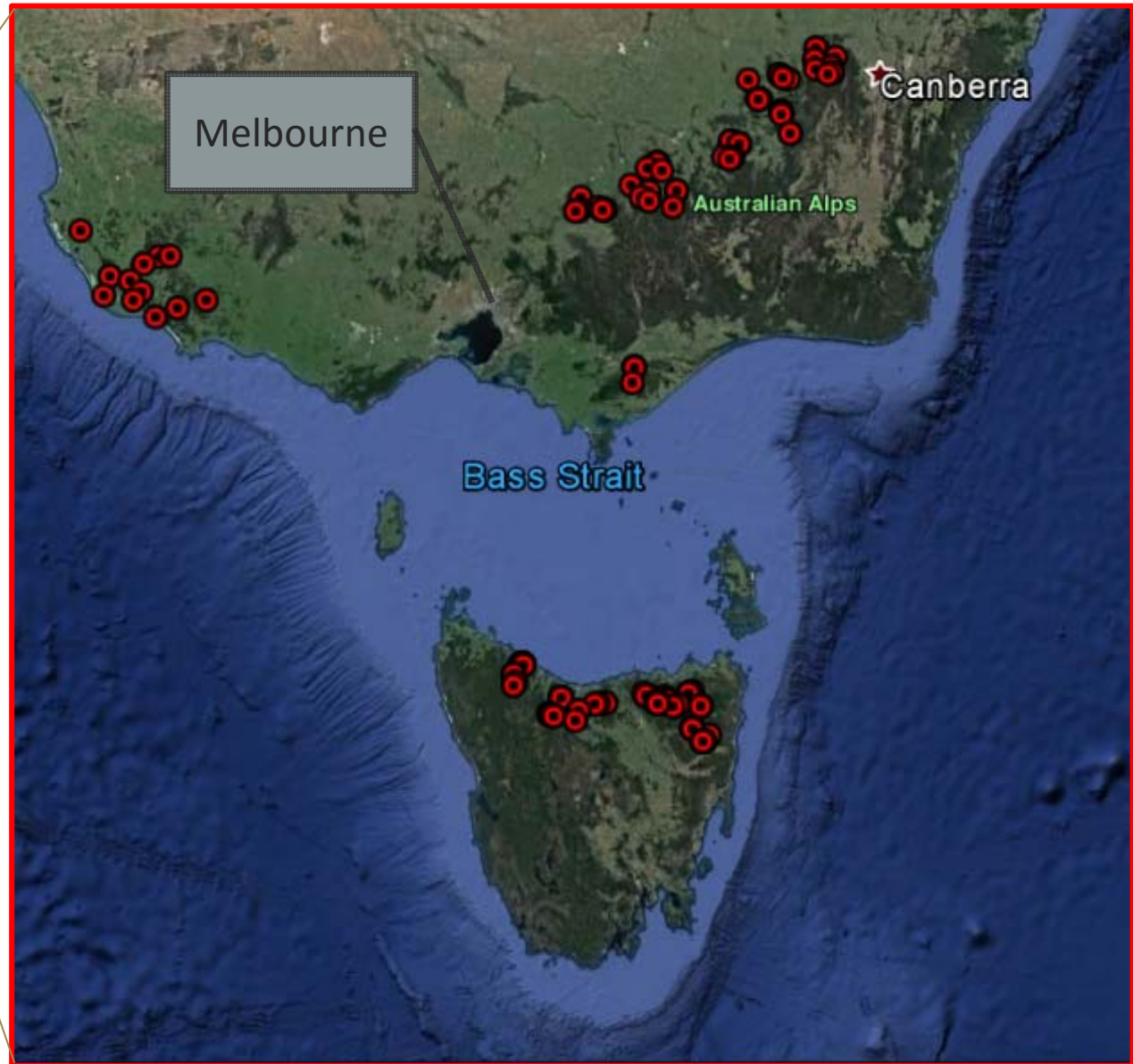


Species/parameter set



Combined in various ways to create a "scenario"





State	Scenarios
SA	12
NSW	22
Vic	27
Tas	52

Site selection: SA, Vic, NSW and Tas



Sites summary



- Ranging from 50 m ASL to nearly 1000 m ASL
- Latitude ranging from 35 – 41 degrees south (NSW – Tas)
- Wide range of soils, from aeolian sand to heavy clay
- Soil depth ranged from about 50 cm to deeper than 3 m
- Annual rainfall ranging from about 800 to 1200 mm
- Annual mean maximum temperature from about 16 to 22°C
- Site index (20 y) from 18 – 34 m



Sampling and field work

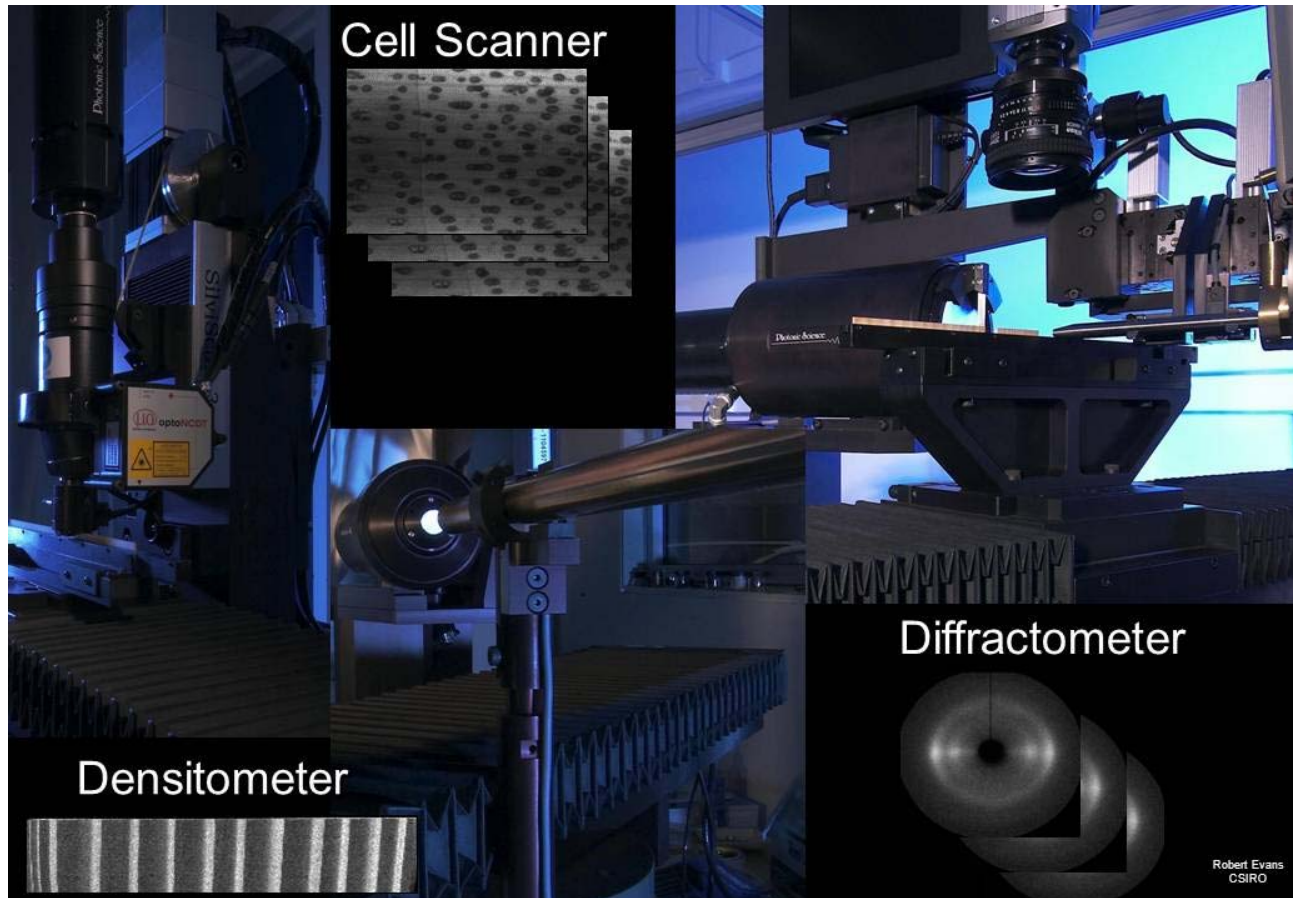


- Varying plots for stand-level estimates
- Sub-sampled trees within plots or separate transects for wood properties sampling



Full cores or outer 5 cm, depending on study: Outer 5 cm used for analyses shown here...

SilviScan: A critical technology



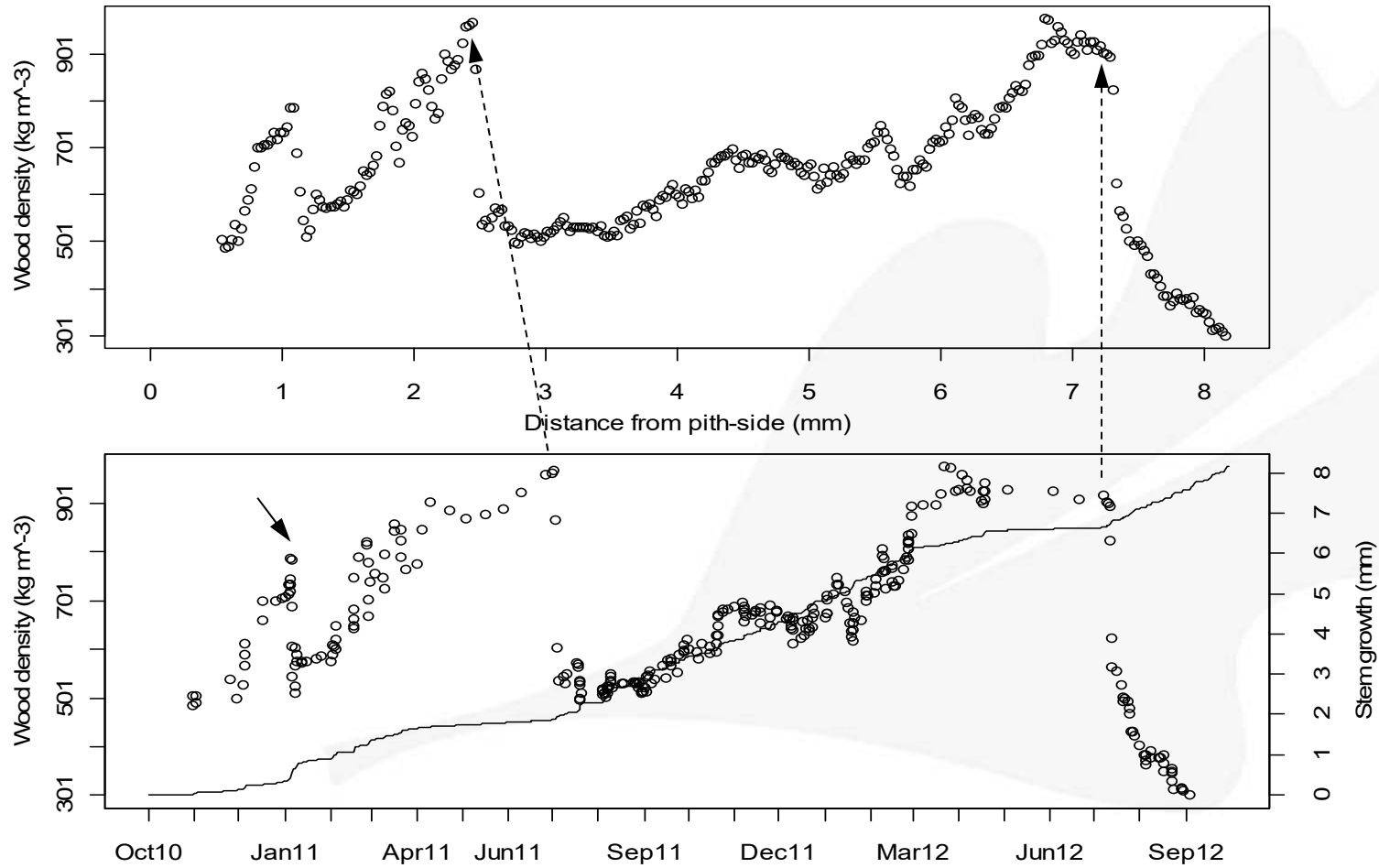
Dr Rob Evans



Dendrometers and cambial sampling



Relating distance to time...



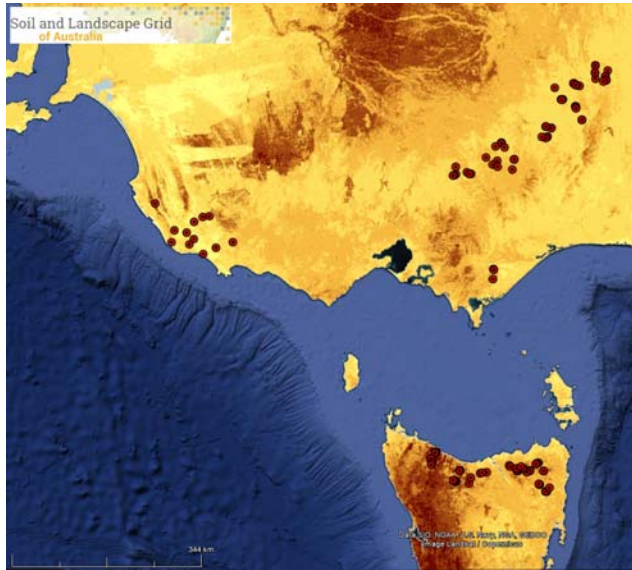
A sad day...



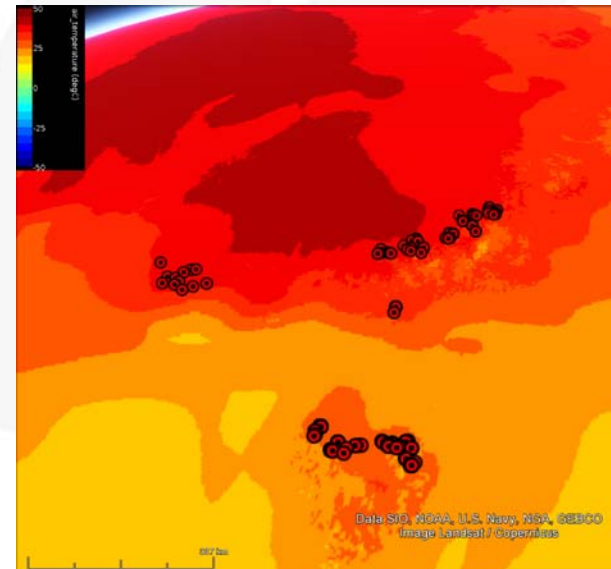
Fire, caused by a discarded cigarette butt, at our “Reedy Creek” study site caused the loss of over R70,000 worth of equipment...



Primary data from two sources



AusCover/Australian Bureau of Meteorology (BOM) Australian Water Availability Project (AWAP) and/or Scientific Information for Land Owners (SILO) interpolated daily weather datasets



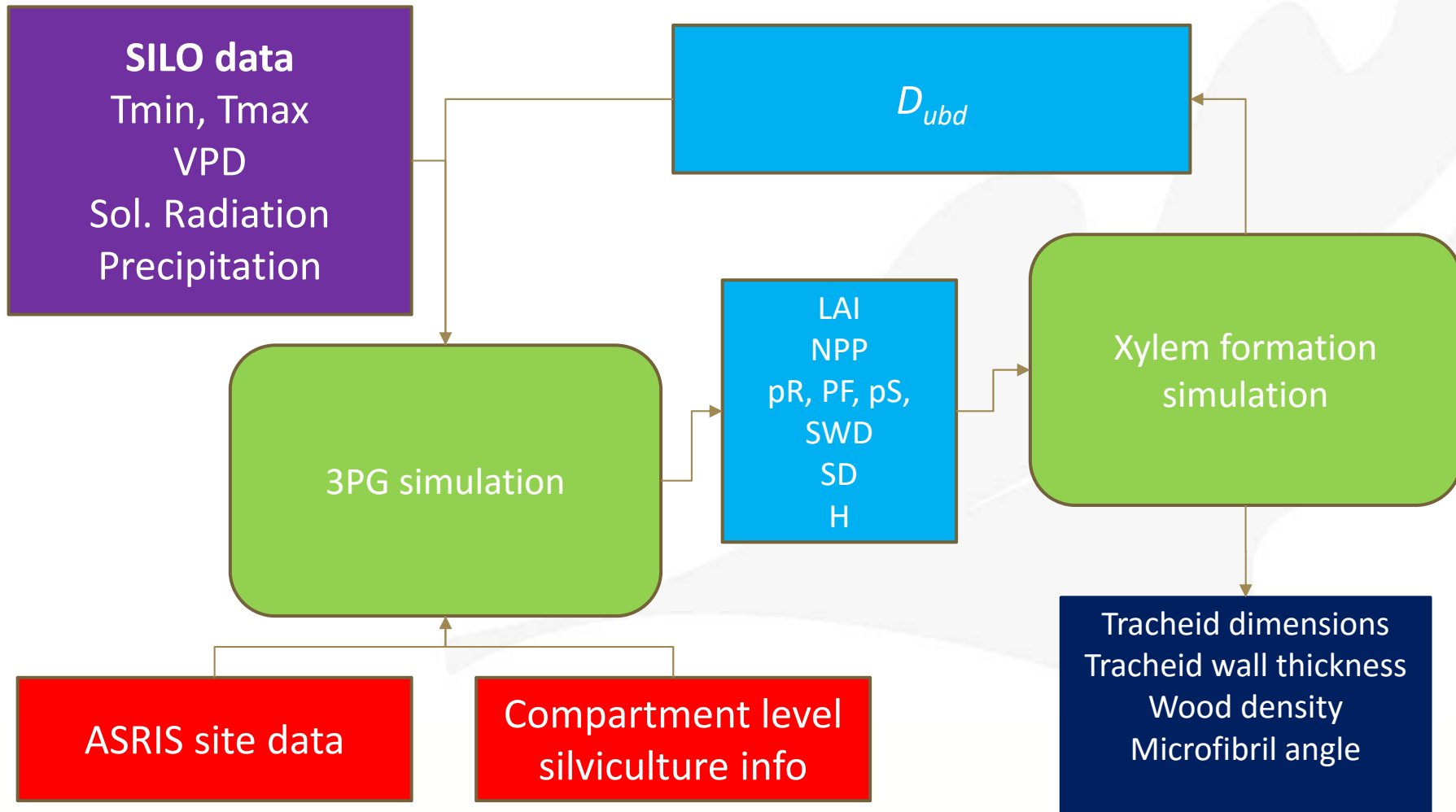
AusCover Australian Soil Resource Information System (ASRIS) interpolated soils data surfaces:

- Soil texture
- Soil depth
- (Fertility as $f\{N,P\}$)

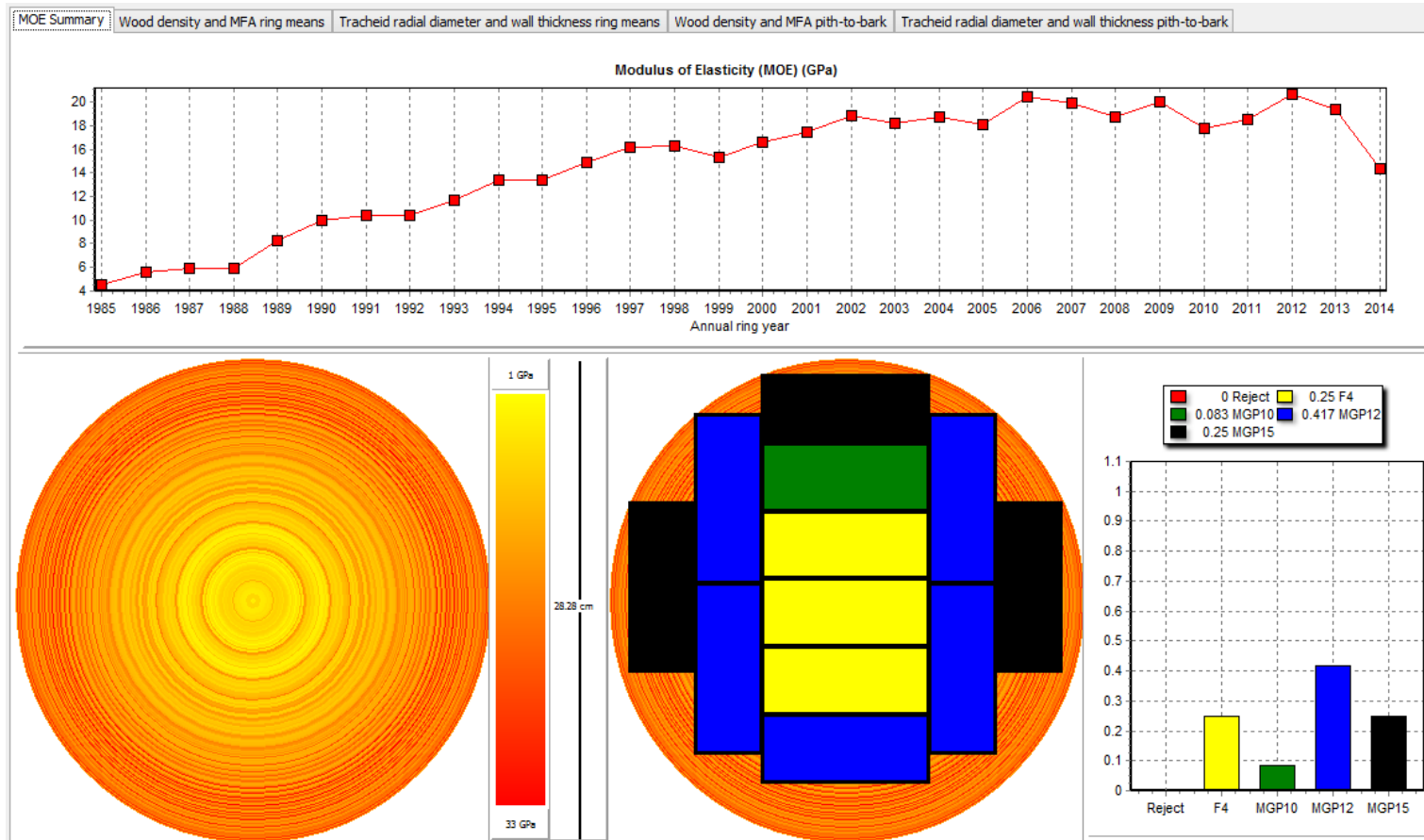


See www.auscover.org.au or www.tern.org.au for more info!

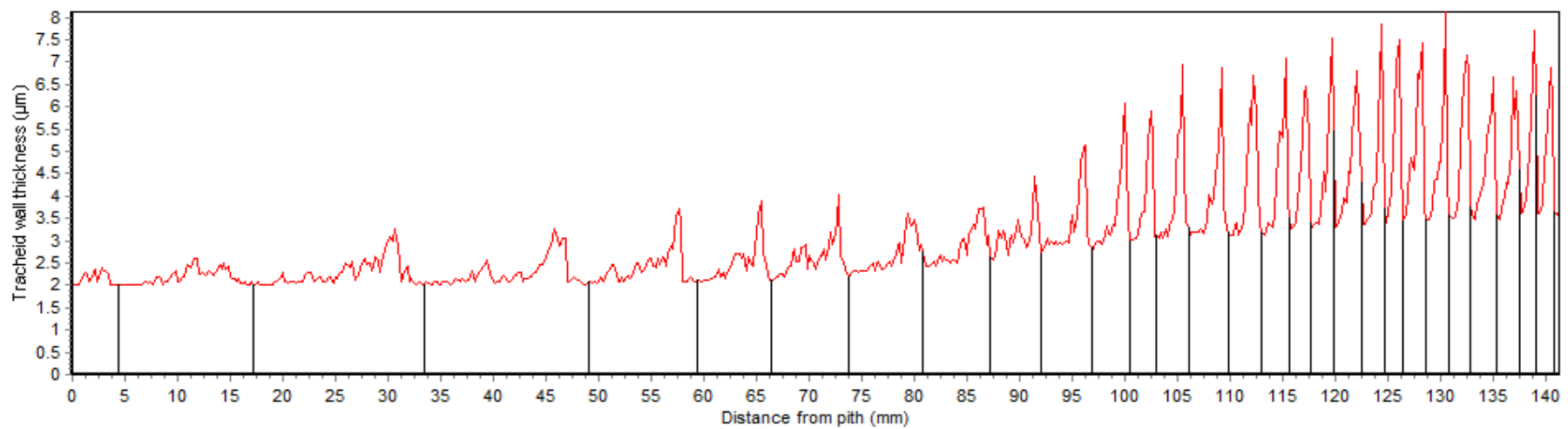
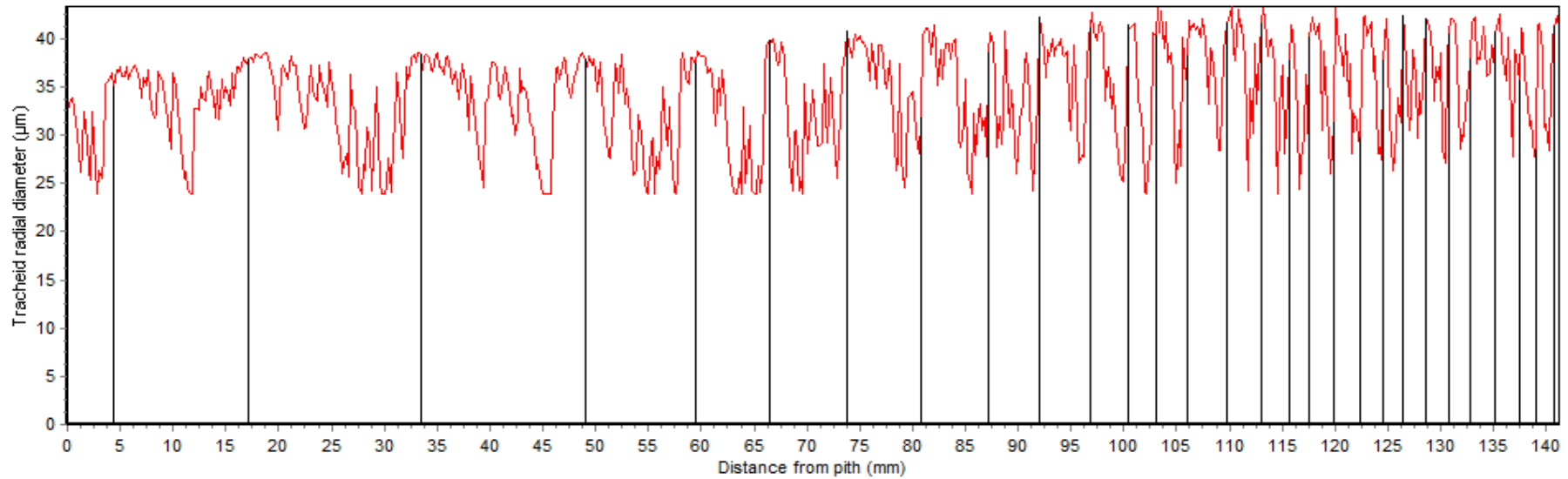
Data flows: daily time-step



The main eCambium GUI

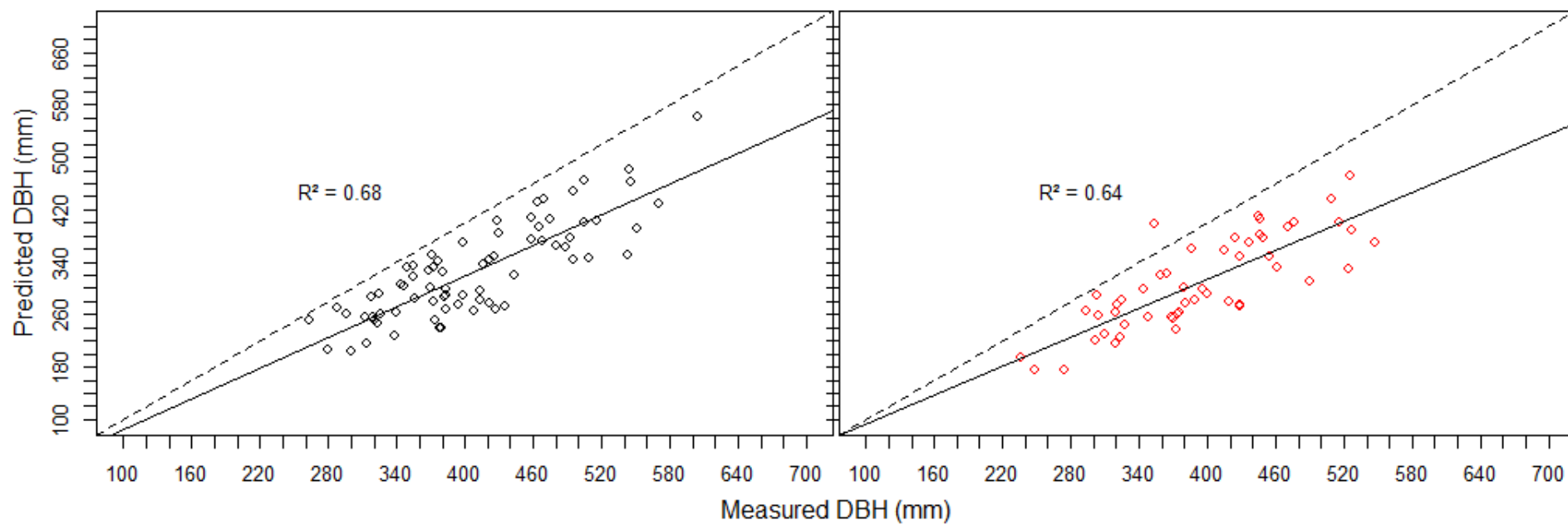
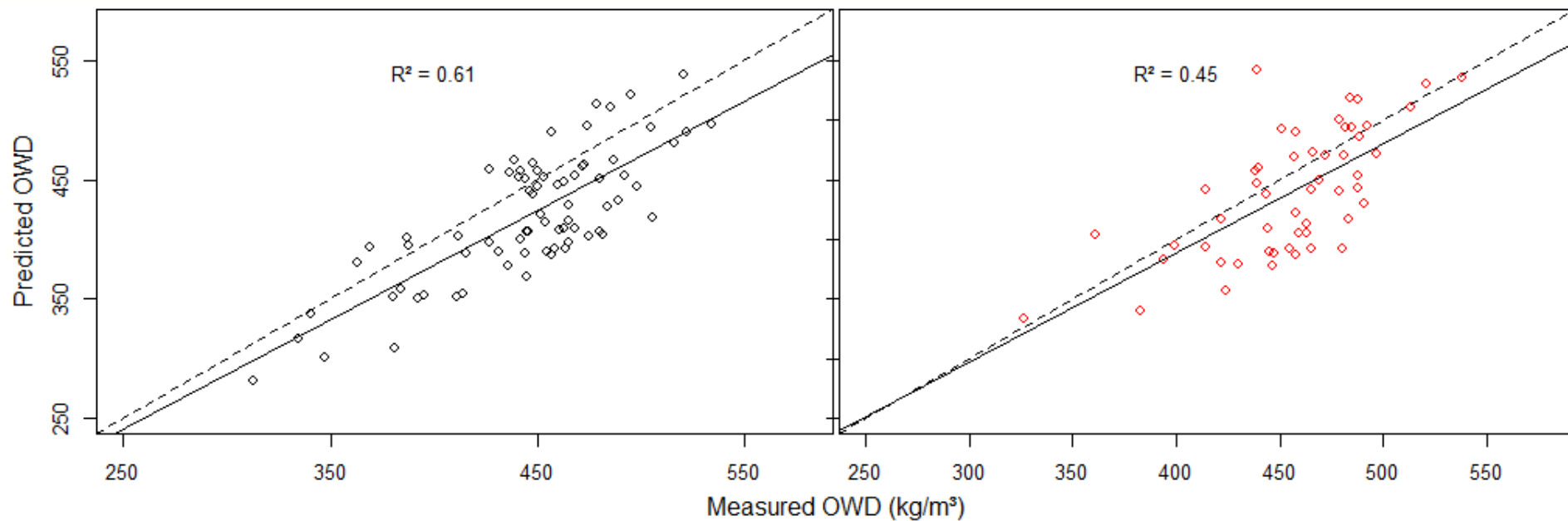


Precise predictions



Calibration set

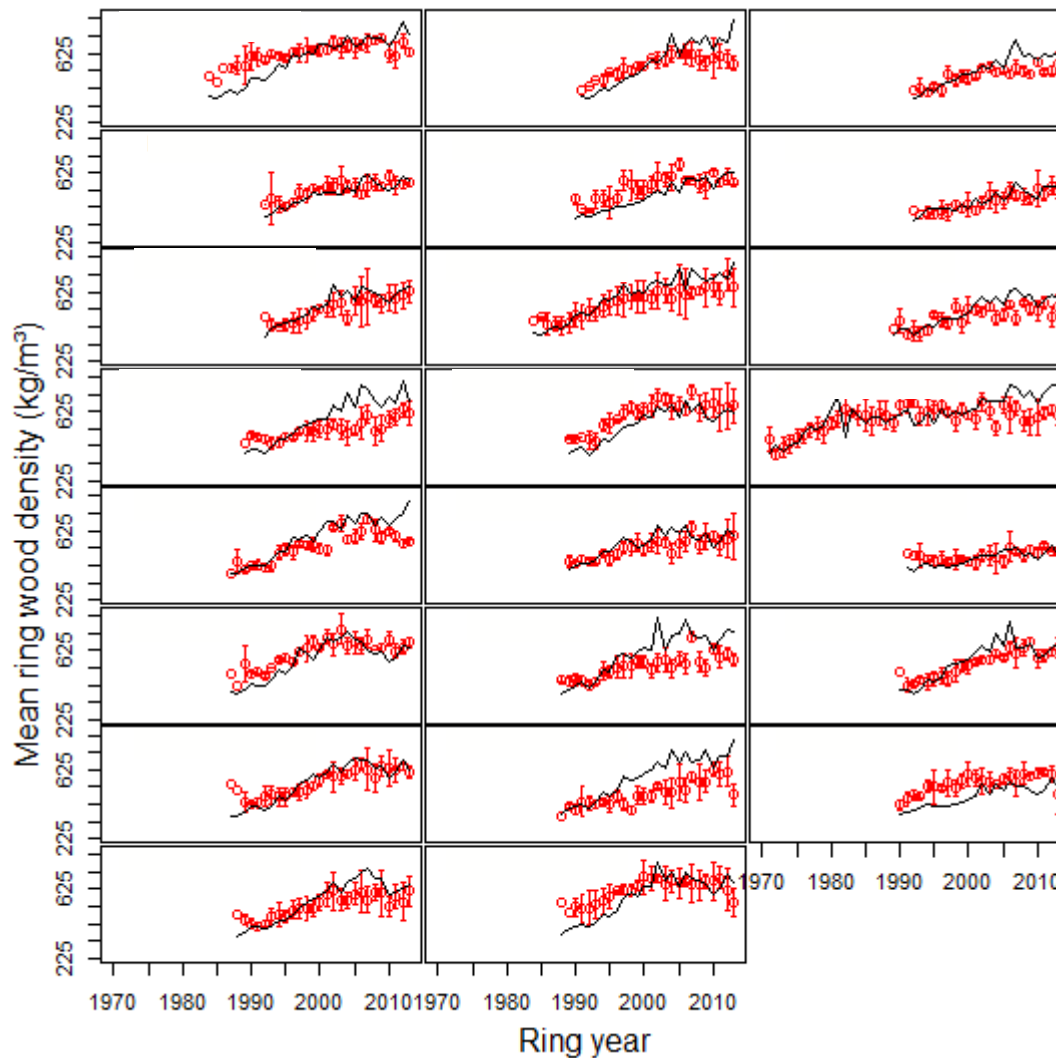
Validation set



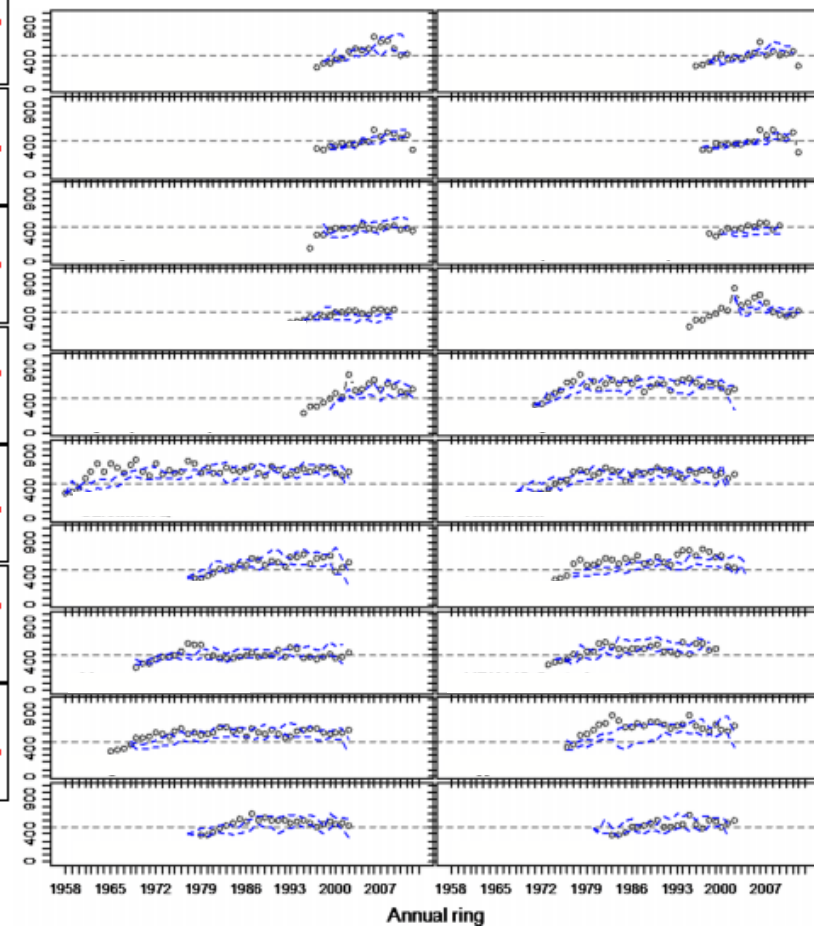
Capturing fine-scale variability



Northern Victoria and NSW



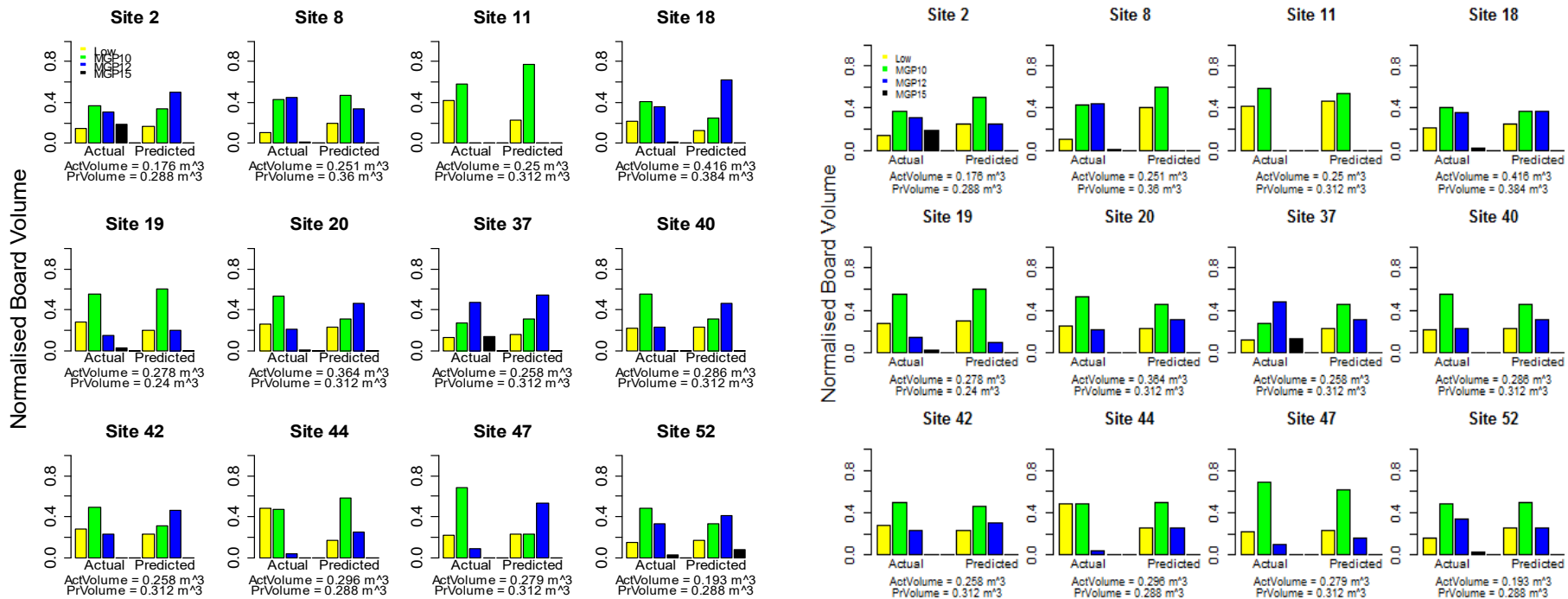
Southern Victoria and South Australia



Board predictions



Prediction success = F{P to B simulations + thresholding}



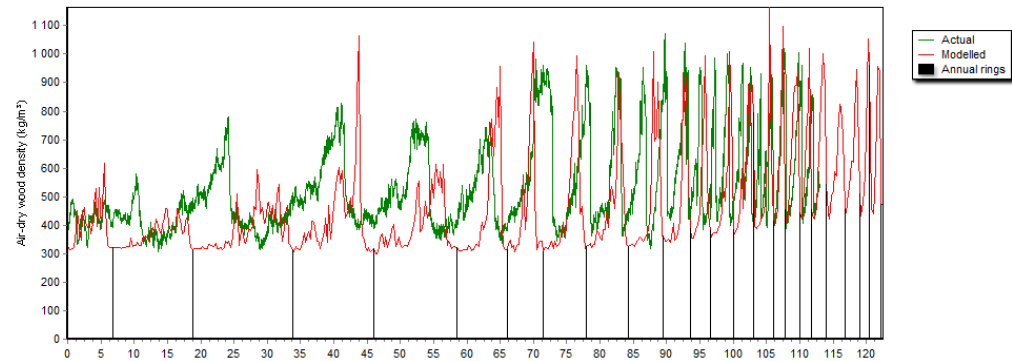
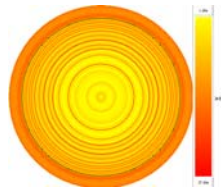
Low: 7.9
MGP10: 16.25
MGP12: 17.05

Low: 9.2
MGP10: 15.5
MGP12: 17.2

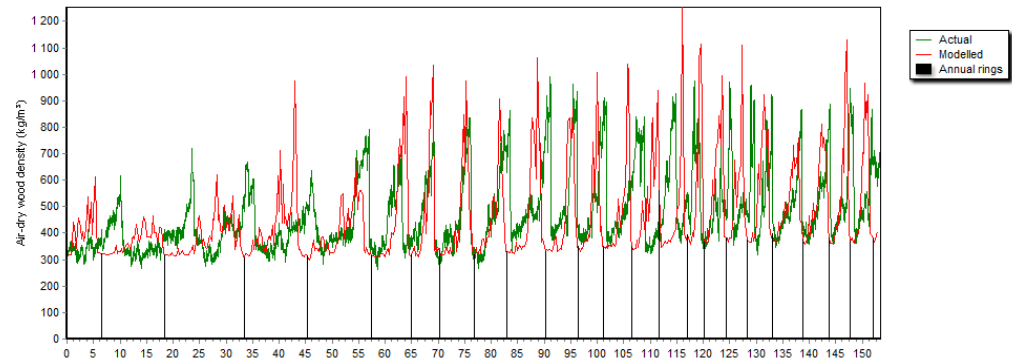
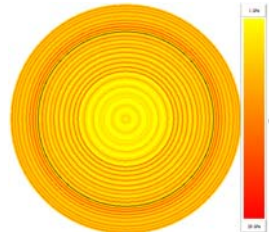
Changed silviculture: HVP thinning trial



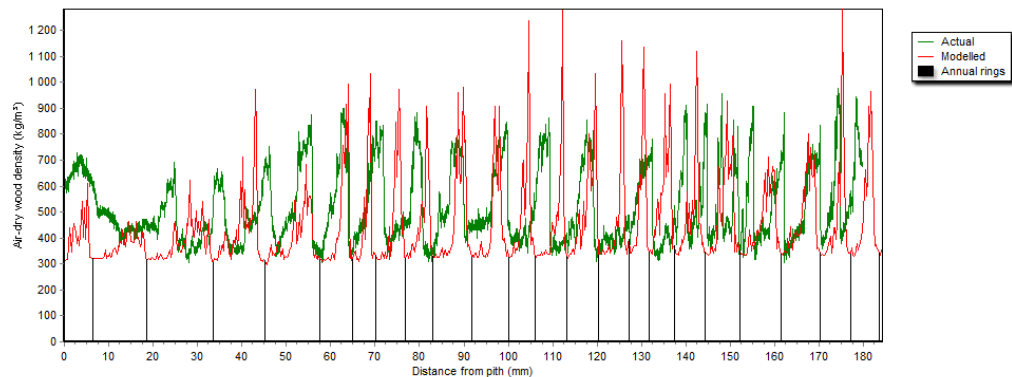
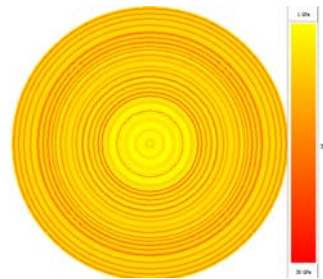
Planted 1989: 1300 SPH
Cut 2014



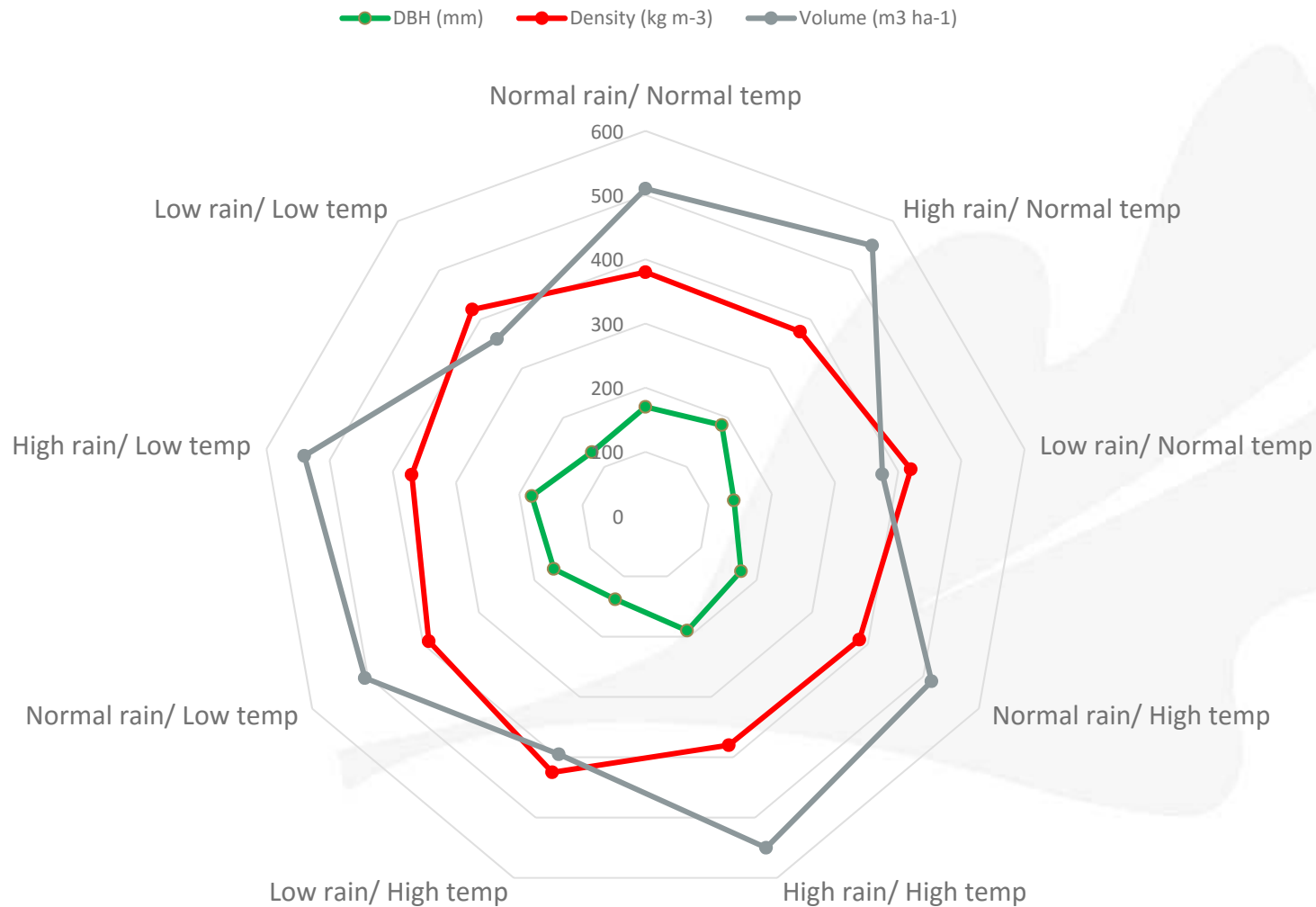
Planted 1989: 1300 SPH
Thinned 11y: 330 SPH
Thinned 19y: 160 SPH
Cut 2014



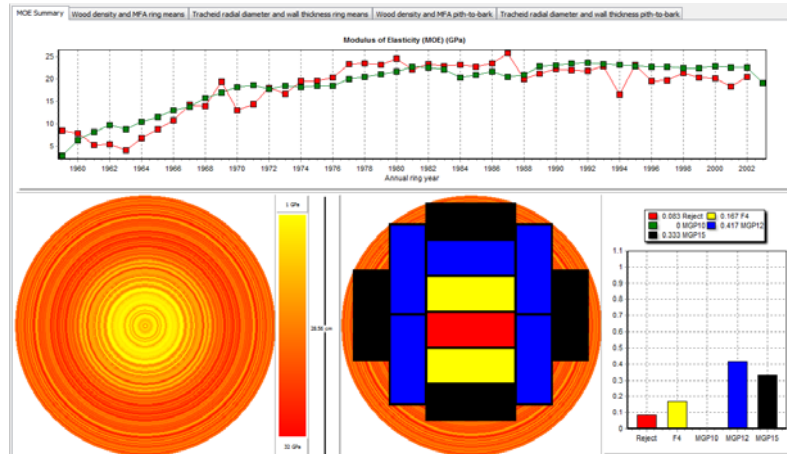
Planted 1989: 1300 SPH
Thinned 11y: 600 SPH
Thinned 19y: 450 SPH
Thinned 24y: 300 SPH
Cut 2014



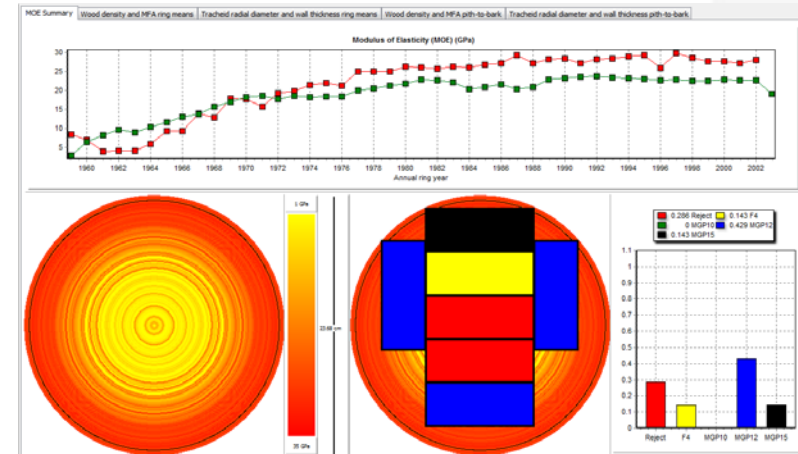
Exploring scenarios: Rain + temp



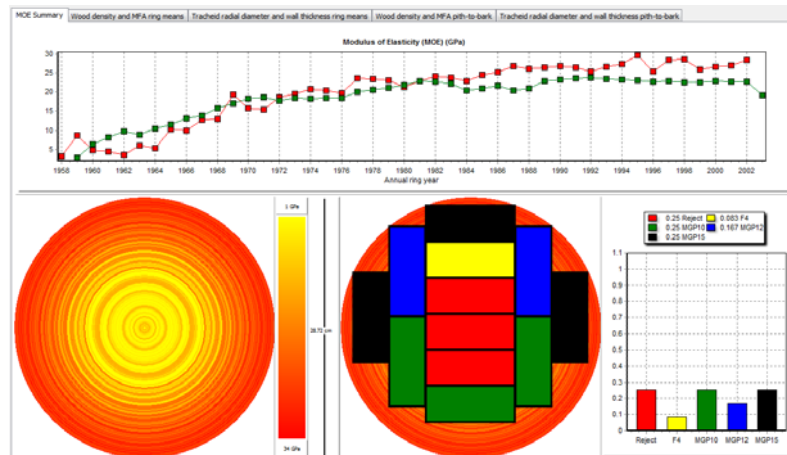
Scenarios: adjusted silviculture



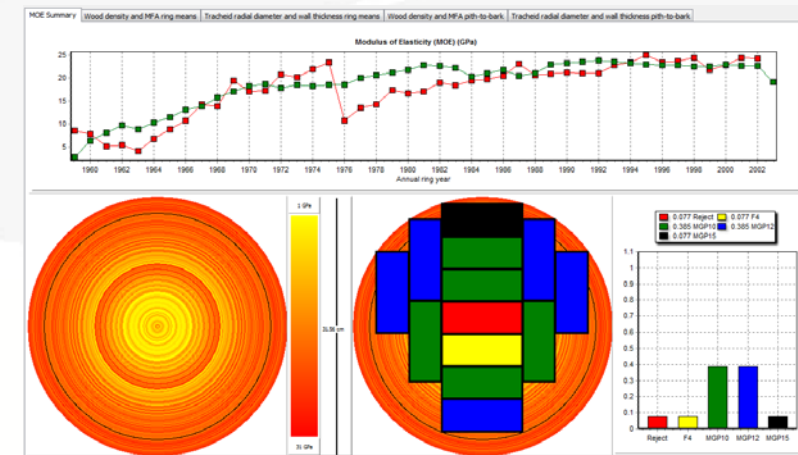
Standard silviculture: 1736 SPH + 4 thinnings



1736 SPH + no thinnings



555 SPH + no thinnings



1736 SPH + single heavy thinning

Acknowledgements



**Forest & Wood
Products Australia**



**HVP
plantations**



**Forestry
Corporation**



**TIMBERLANDS
Pacific**



ForestrySA