



FWPA Project: PNC196-1011: Predicting wood quality to improve sawlog value in radiata pine

David Drew

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CSIRO ECOSYSTEM SCIENCES
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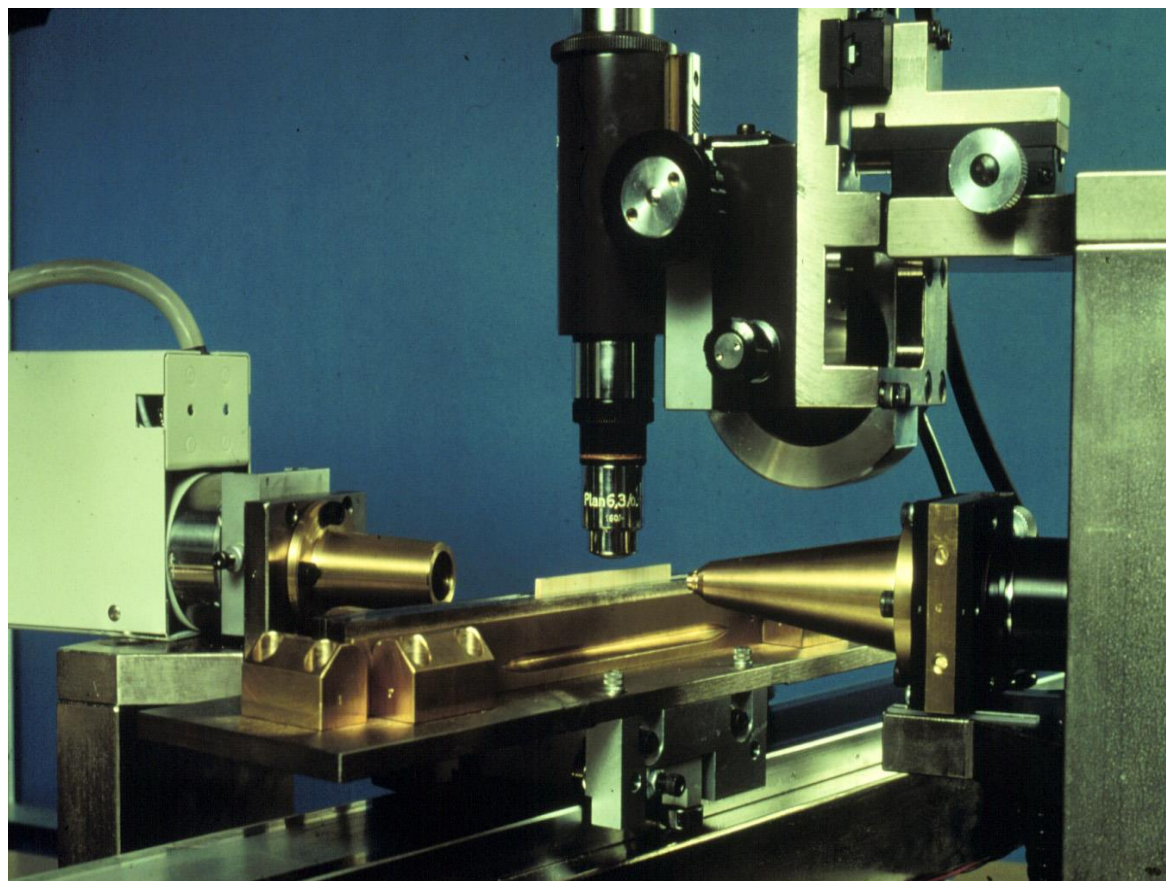


Project objectives and deliverables

- Develop and validate a software tool to predict variation in commercially important wood properties of *Pinus radiata* as a function of variation in growing conditions and management.
- Deliverable 1: Softwood e-Cambium Prototype
- Deliverable 2: Industry testable version of e-Cambium

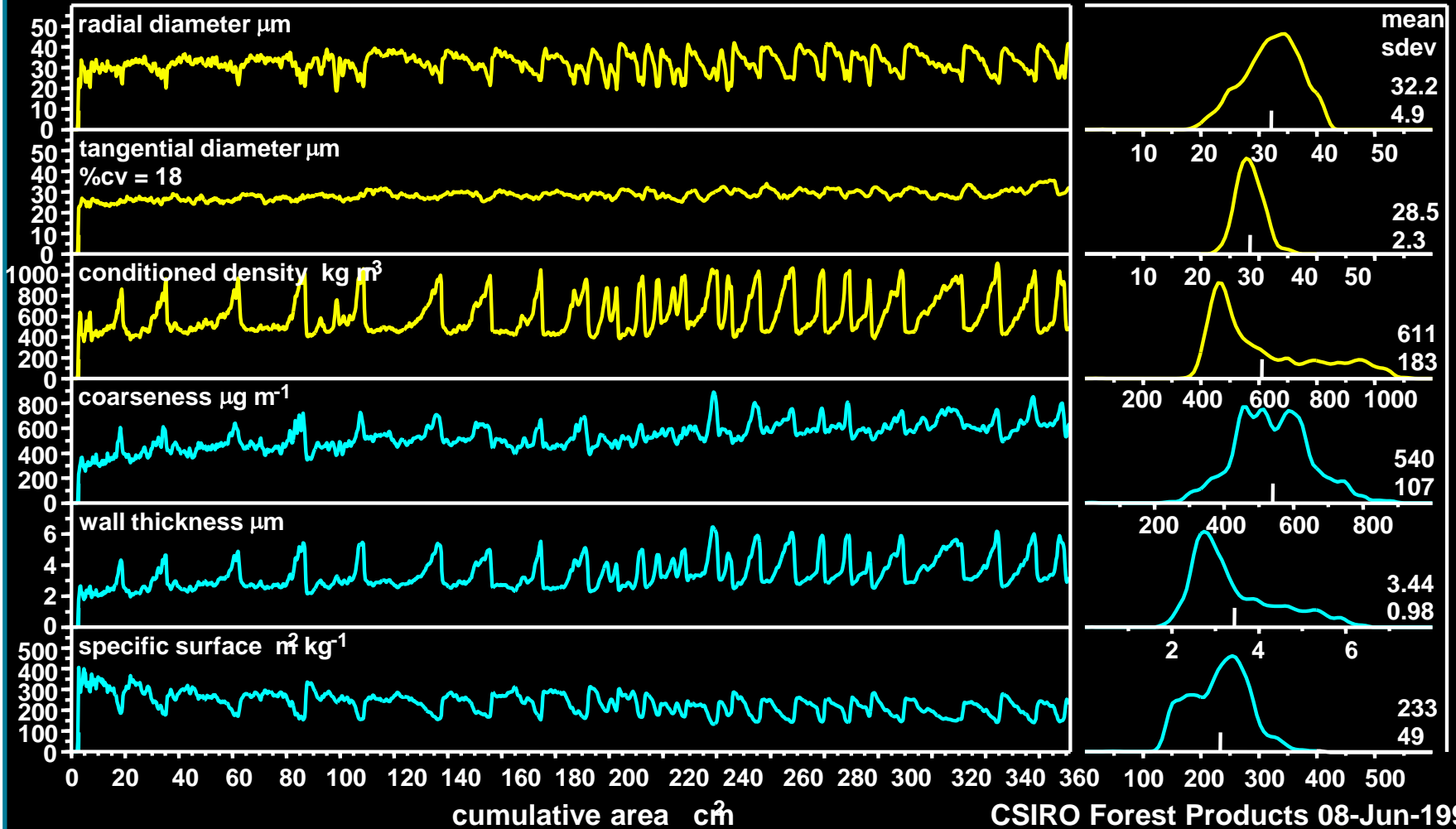
Where have we come from?

SilviScan 1: Densitometry and image analysis

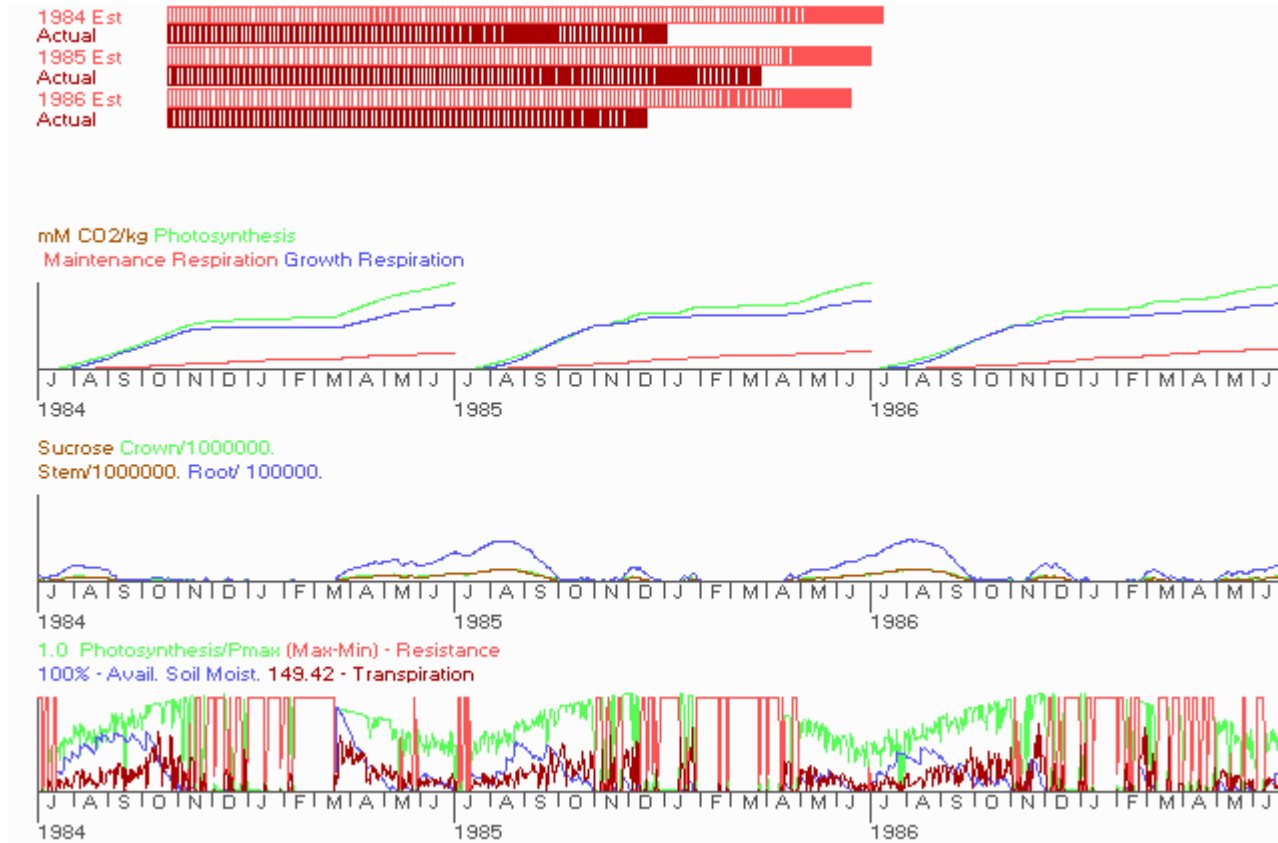


SilviScan 1: Fibre properties

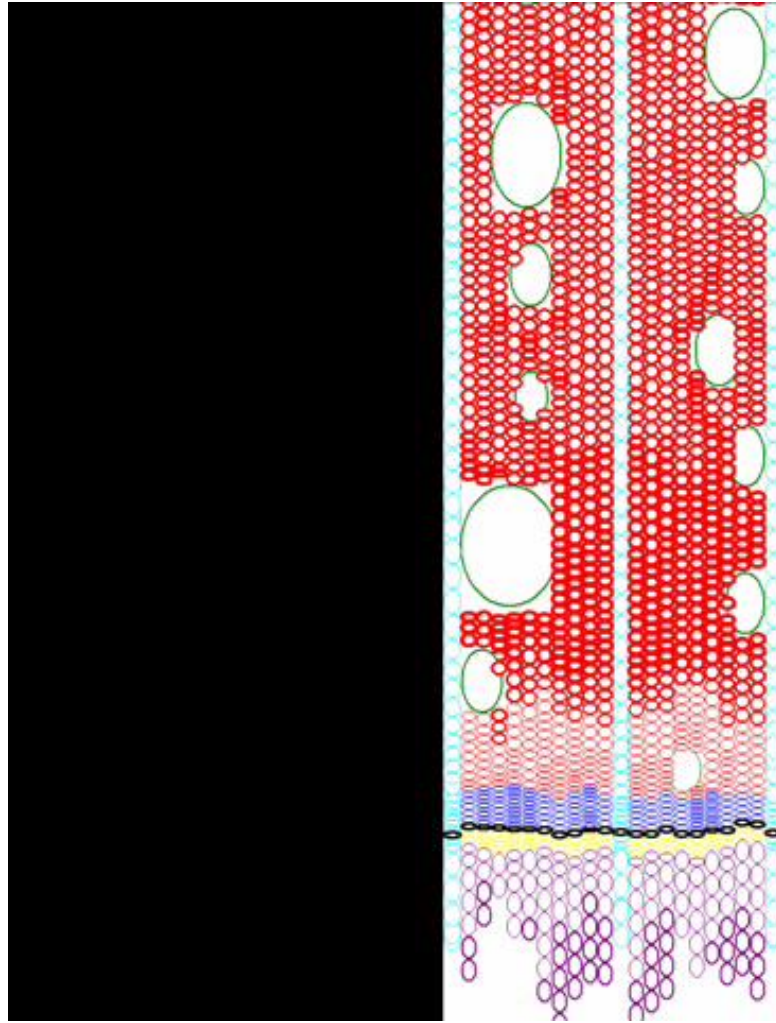
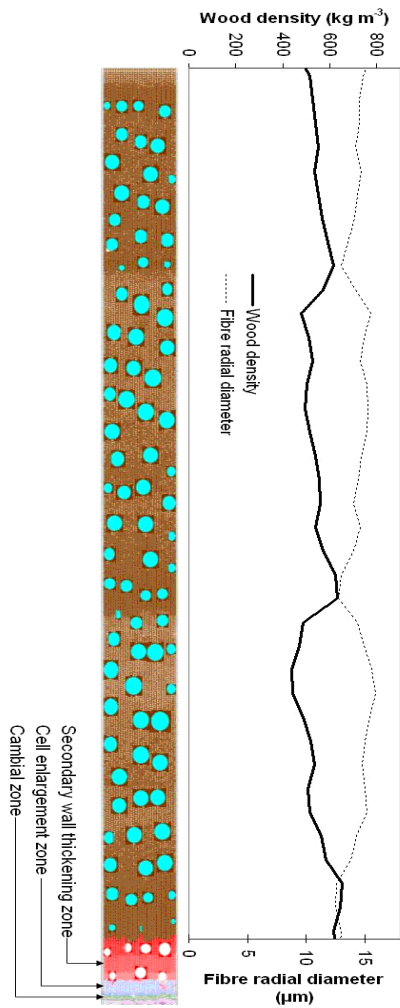
Wood fibre transverse properties, excluding tangential variance Length : 108.7 mm File : radiata
 Radiata pine Area : 371 cm² Weighting : area



TreeRing model (Fritts, Shashkin, Downes)

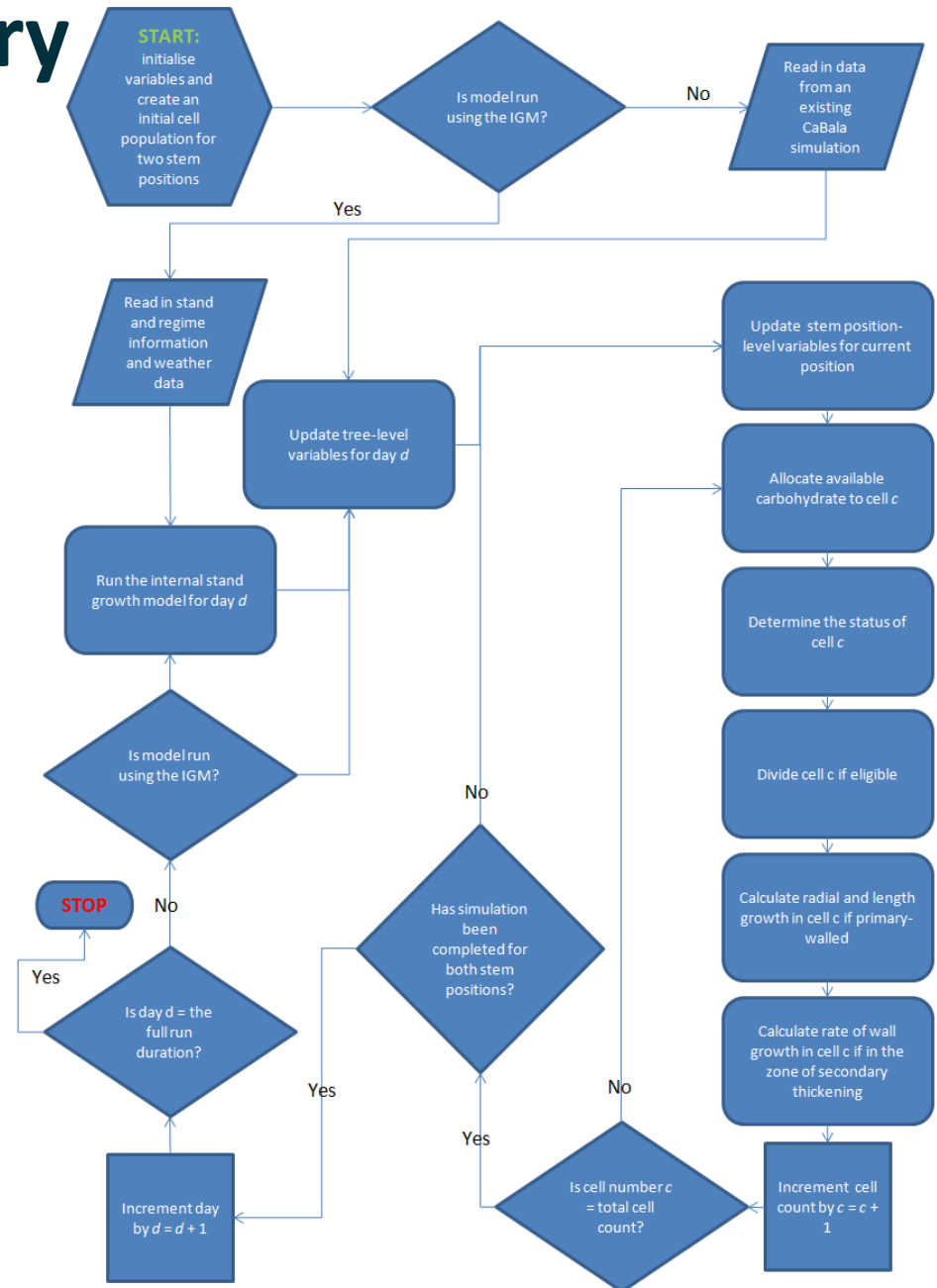


Cambium for eucalypts: Drew et al.

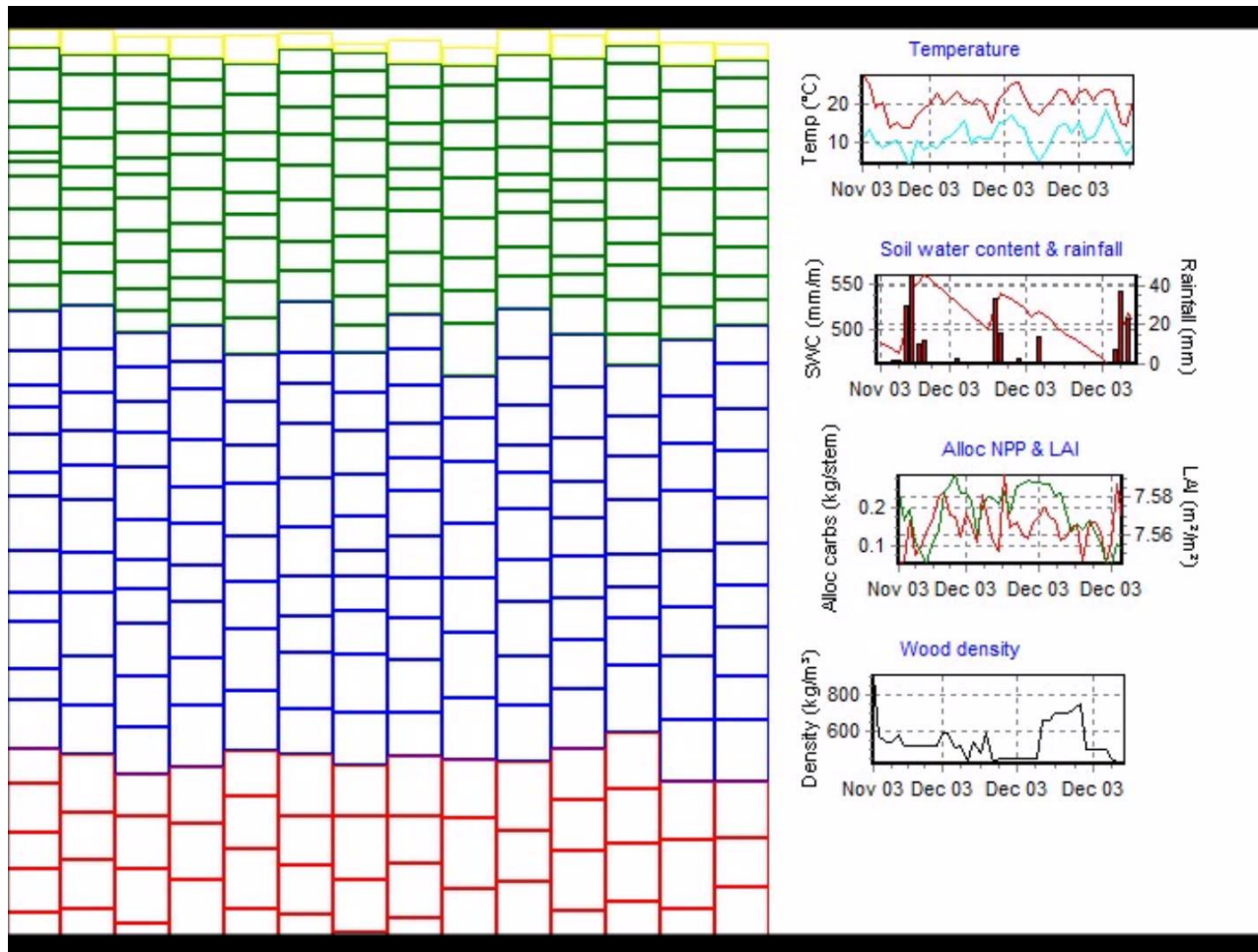


E-Cambium summary

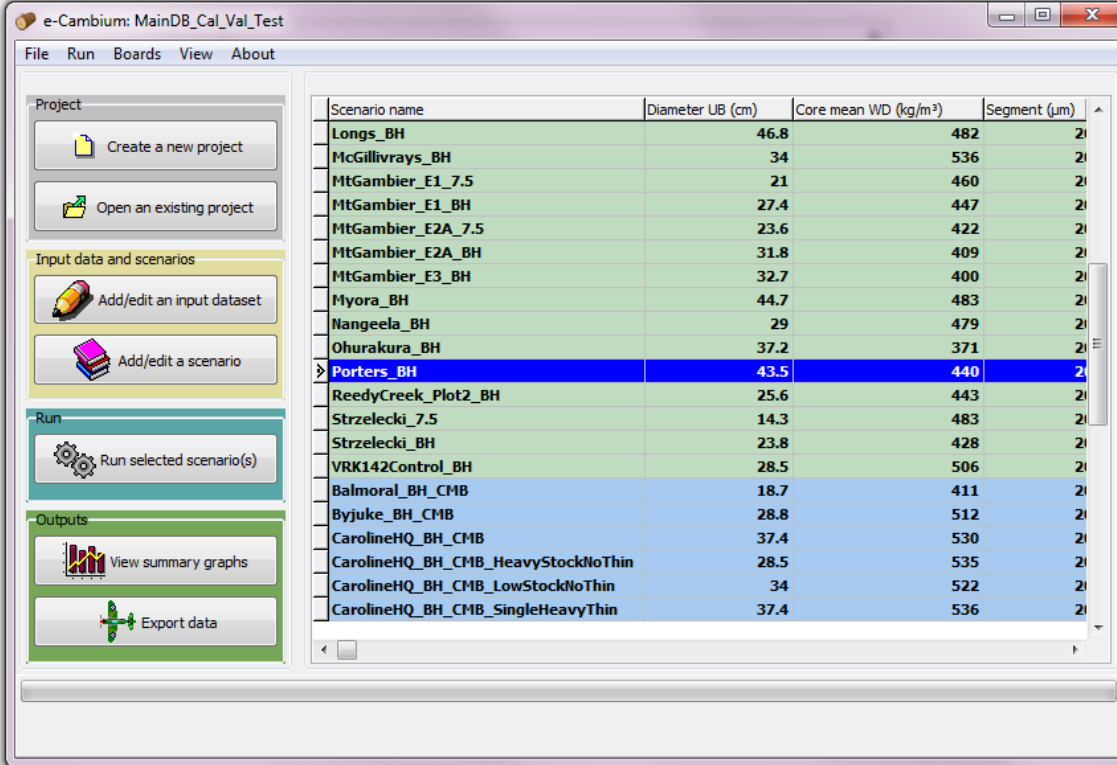
- Model runs on a daily time-step
- A population of simulated cells is monitored each day
- Potential to use input from models like CaBala or the internal growth model (IGM; a modified version of 3PG)



Simulation of cell development



Model GUI: Main interface



The screenshot displays the main interface of the e-Cambium software. The window title is "e-Cambium: MainDB_Cal_Val_Test". The interface includes a menu bar (File, Run, Boards, View, About) and a sidebar with several functional groups:

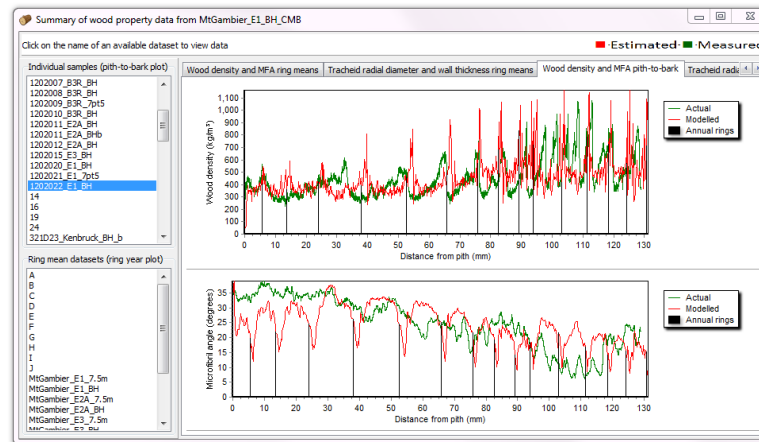
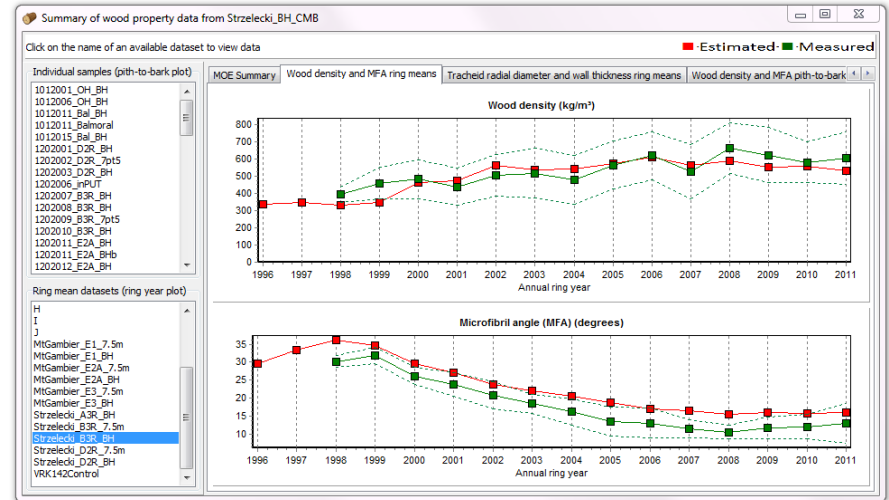
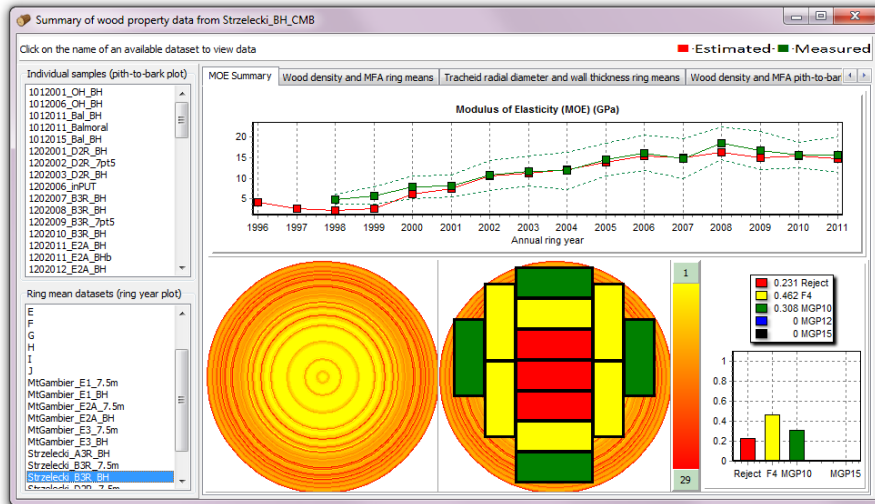
- Project:** "Create a new project" and "Open an existing project".
- Input data and scenarios:** "Add/edit an input dataset" and "Add/edit a scenario".
- Run:** "Run selected scenario(s)".
- Outputs:** "View summary graphs" and "Export data".

The main area contains a table with the following data:

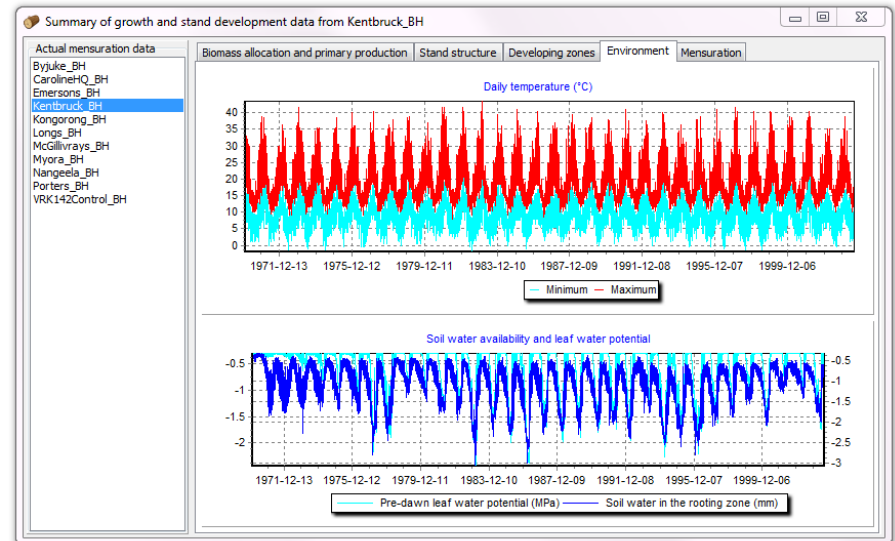
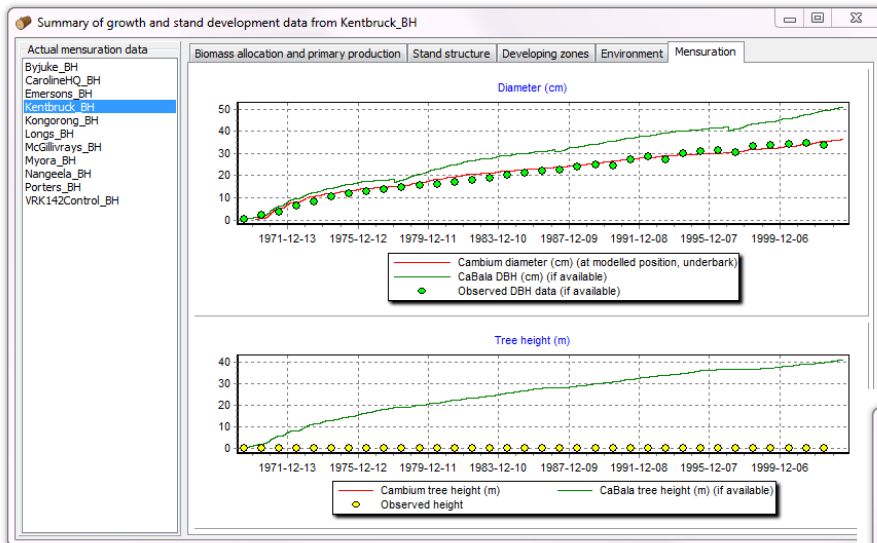
Scenario name	Diameter UB (cm)	Core mean WD (kg/m ³)	Segment (µm)
Longs_BH	46.8	482	21
McGillivrays_BH	34	536	21
MtGambier_E1_7.5	21	460	21
MtGambier_E1_BH	27.4	447	21
MtGambier_E2A_7.5	23.6	422	21
MtGambier_E2A_BH	31.8	409	21
MtGambier_E3_BH	32.7	400	21
Myora_BH	44.7	483	21
Nangeela_BH	29	479	21
Ohurakura_BH	37.2	371	21
Porters_BH	43.5	440	21
ReedyCreek_Plot2_BH	25.6	443	21
Strzelecki_7.5	14.3	483	21
Strzelecki_BH	23.8	428	21
VRK142Control_BH	28.5	506	21
Balmoral_BH_CMB	18.7	411	21
Byjuke_BH_CMB	28.8	512	21
CarolineHQ_BH_CMB	37.4	530	21
CarolineHQ_BH_CMB_HeavyStockNoThin	28.5	535	21
CarolineHQ_BH_CMB_LowStockNoThin	34	522	21
CarolineHQ_BH_CMB_SingleHeavyThin	37.4	536	21



Software GUI: Wood properties graphics



Software GUI: Other graphics



Study sites for data collection

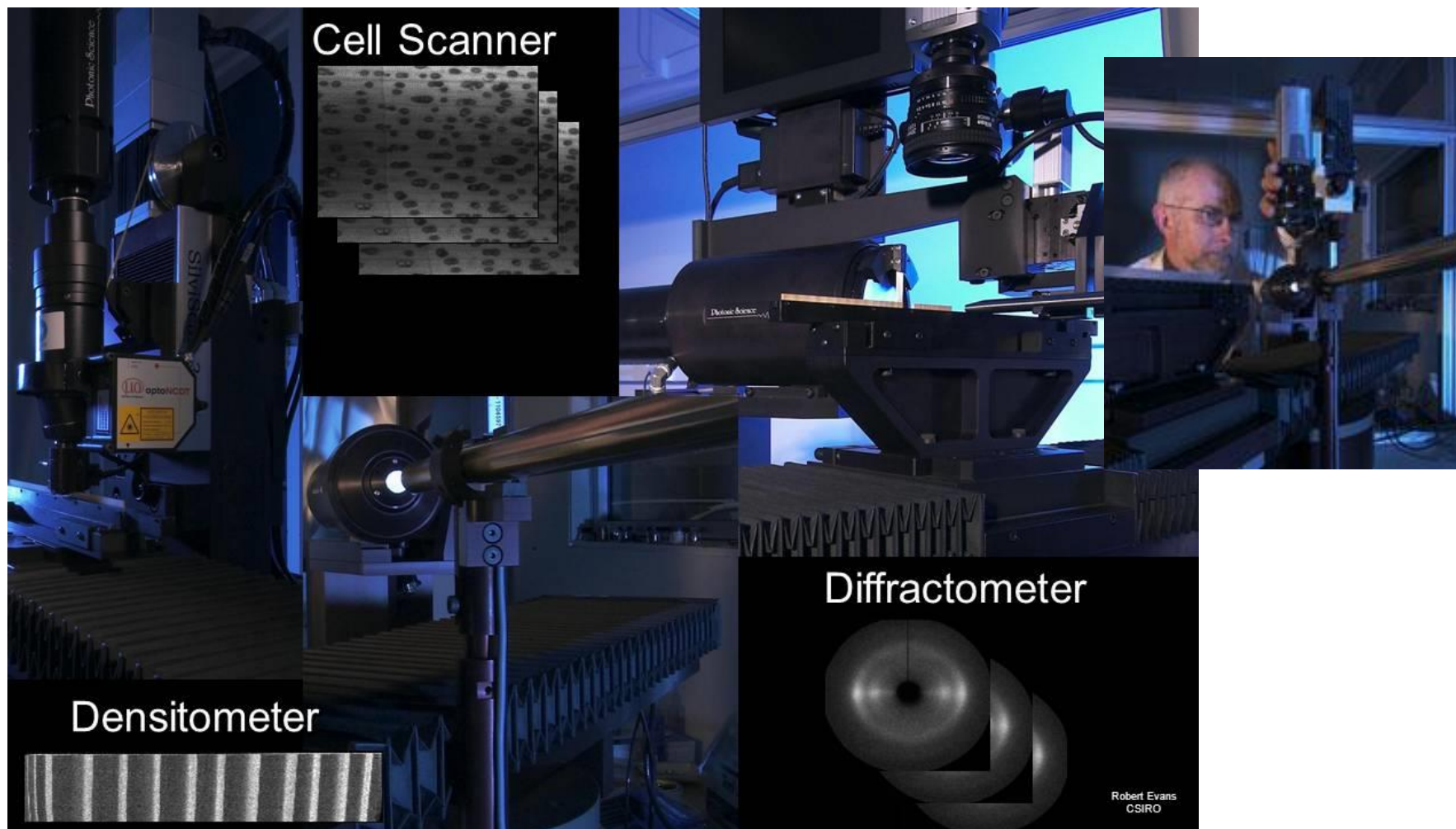


**Forest & Wood
Products Australia**

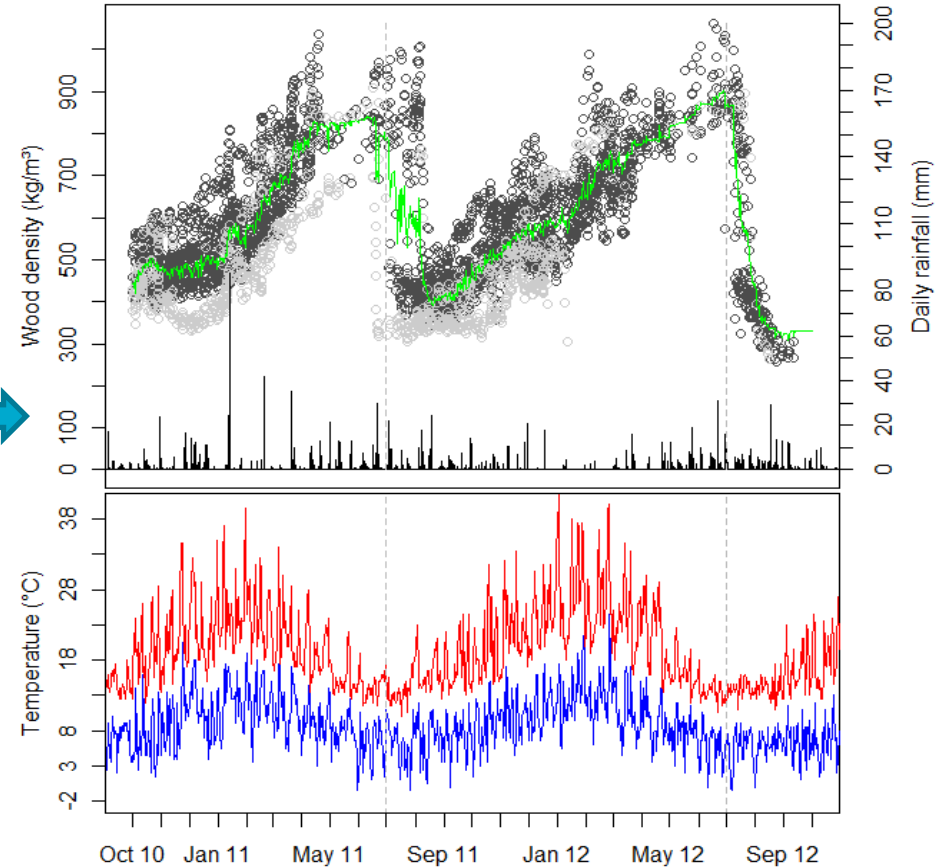
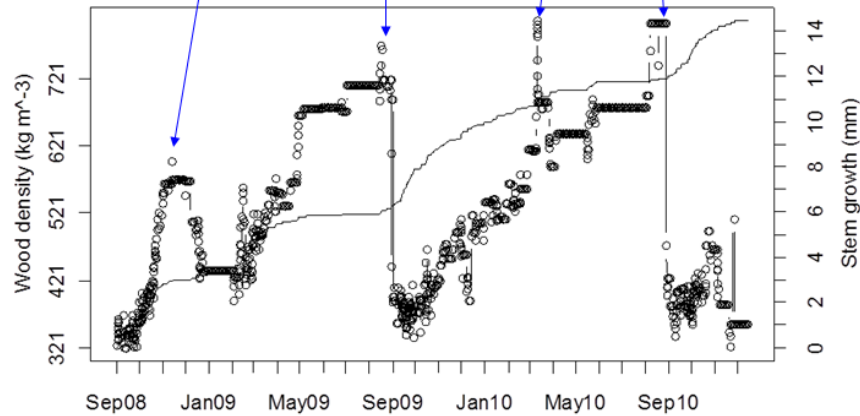
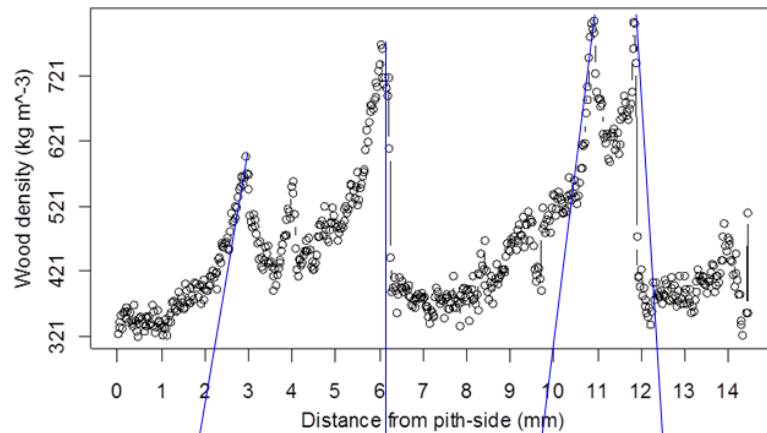
Knowledge for a sustainable Australia



Wood properties from SilviScan-3



Relating distance to time



FWPRDC “Resource for Profit” study

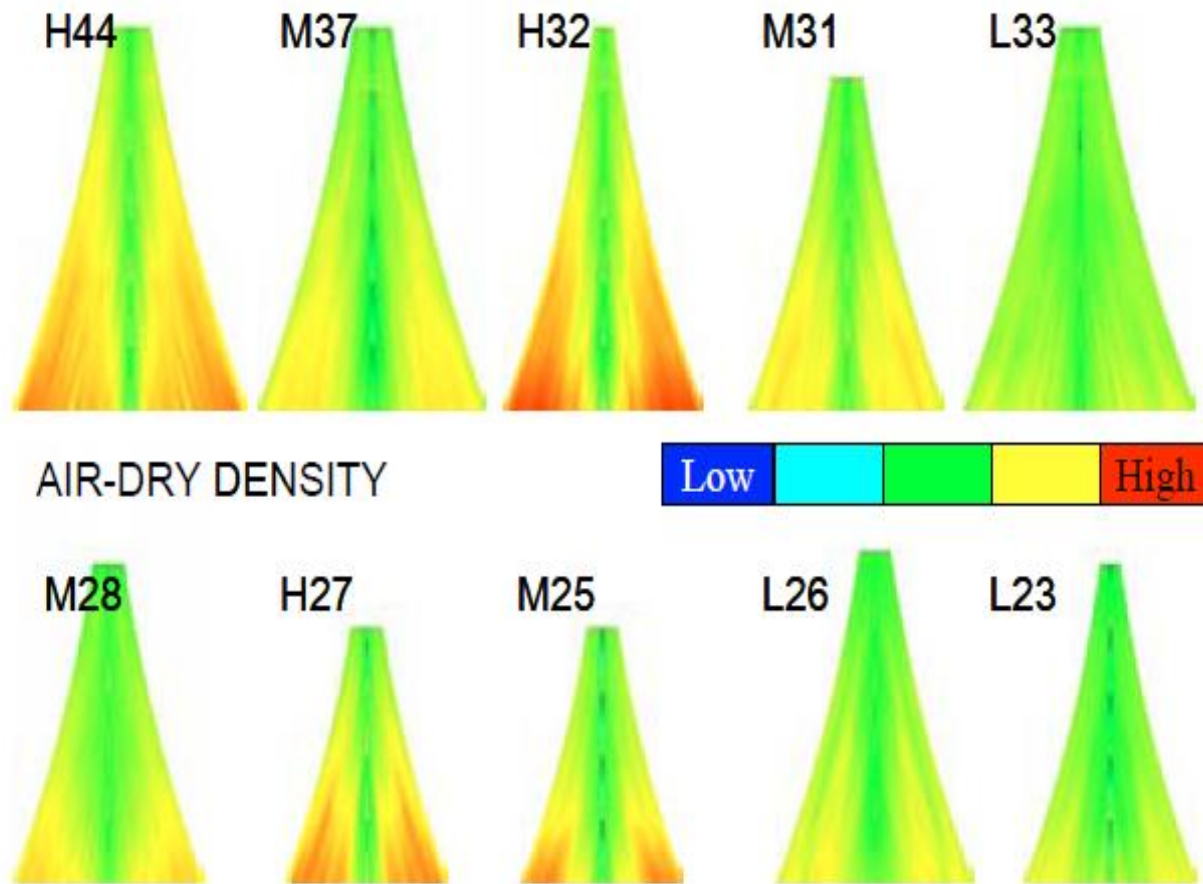


Figure 18: Site average whole-tree maps for SilviScan air-dry wood density



FWPRDC “Resource for Profit” study

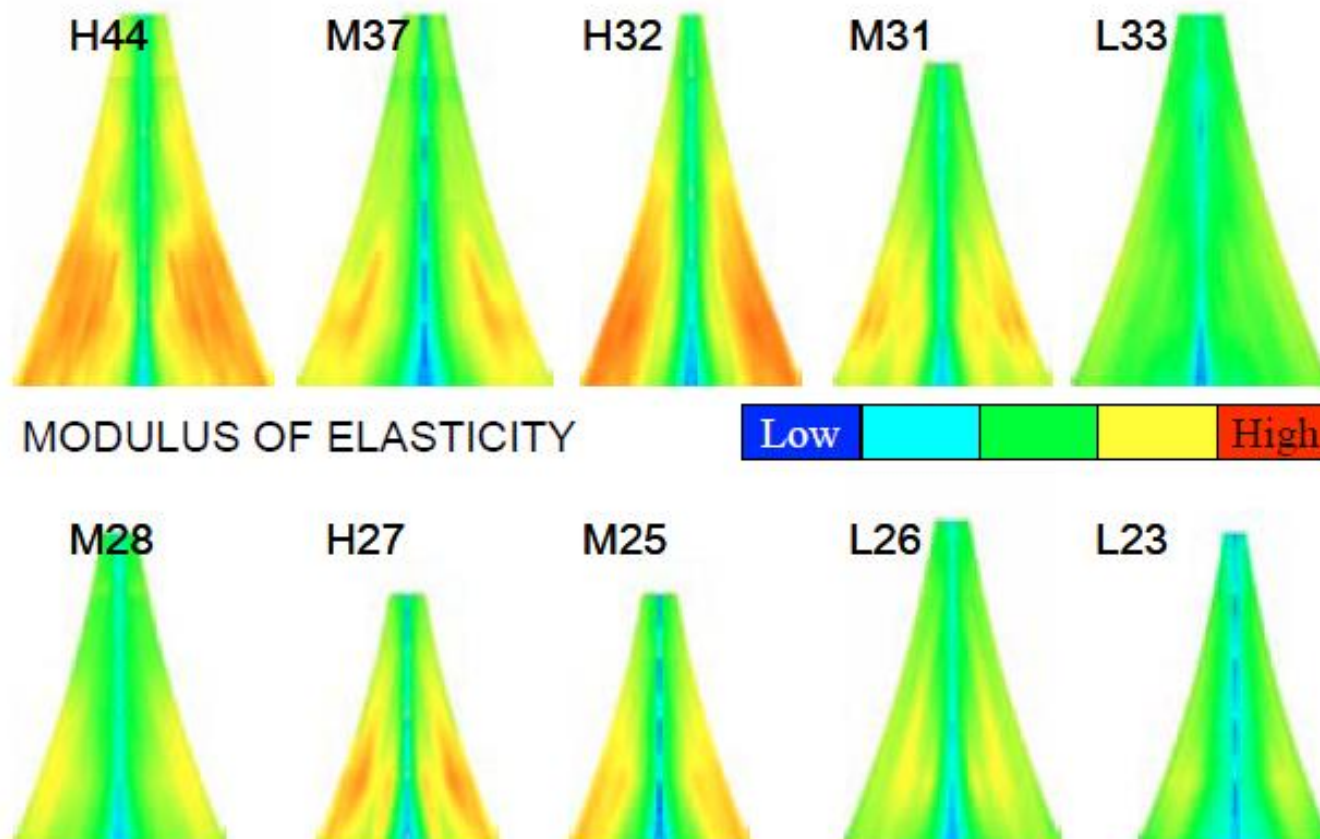
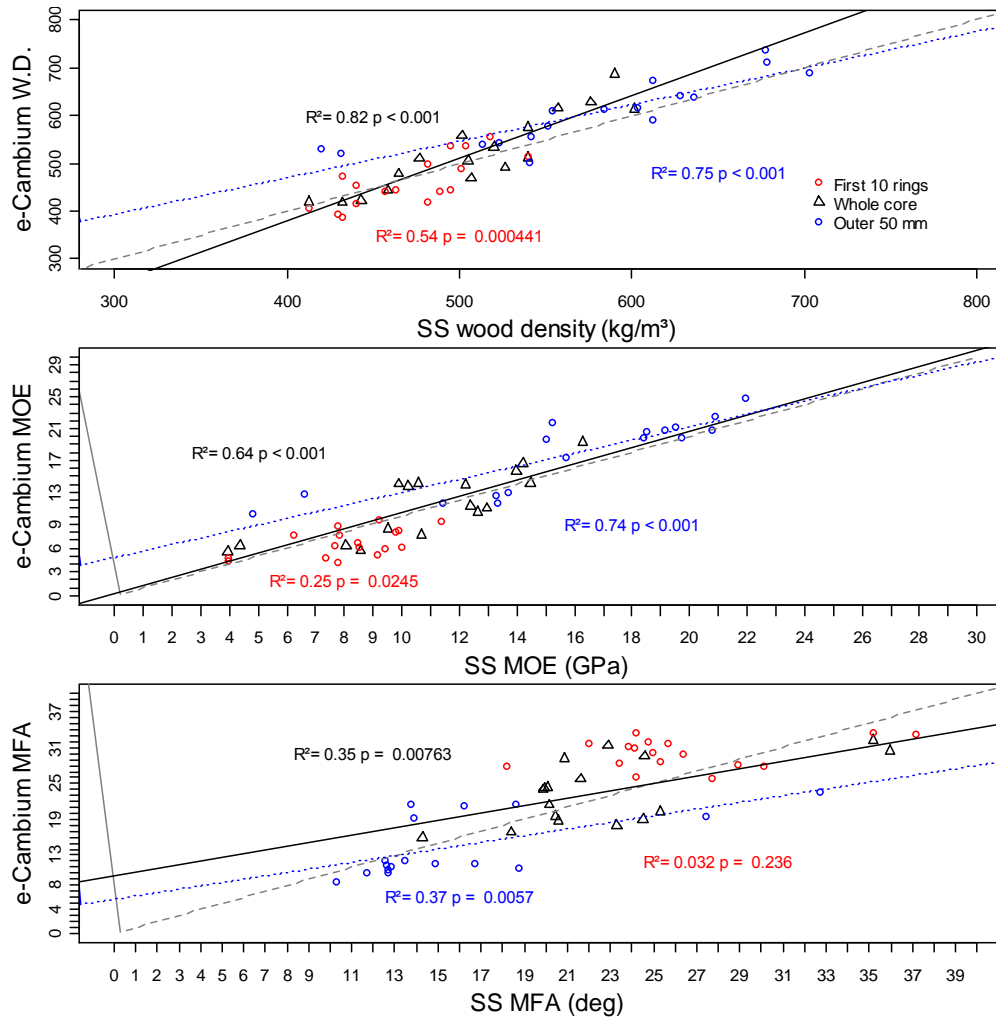


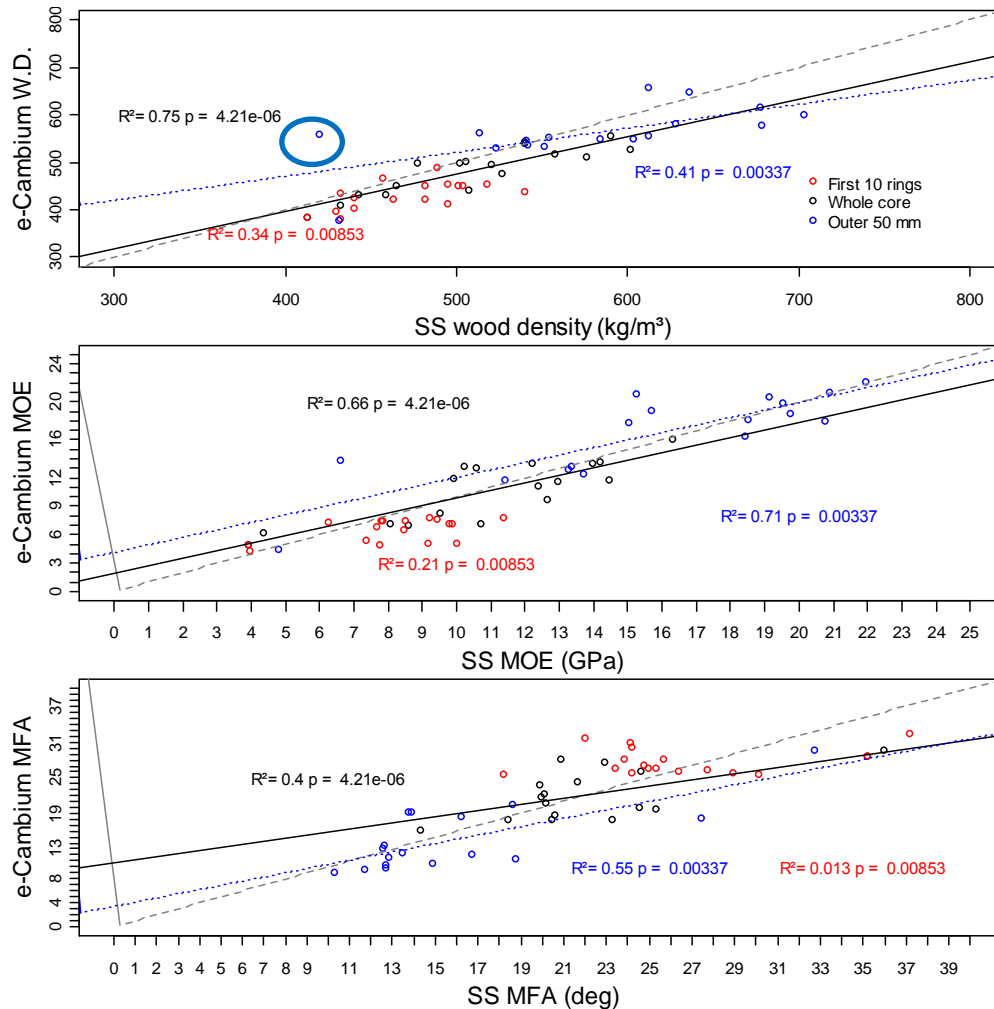
Figure 20: Site average whole-tree maps for SilviScan estimated Modulus of Elasticity



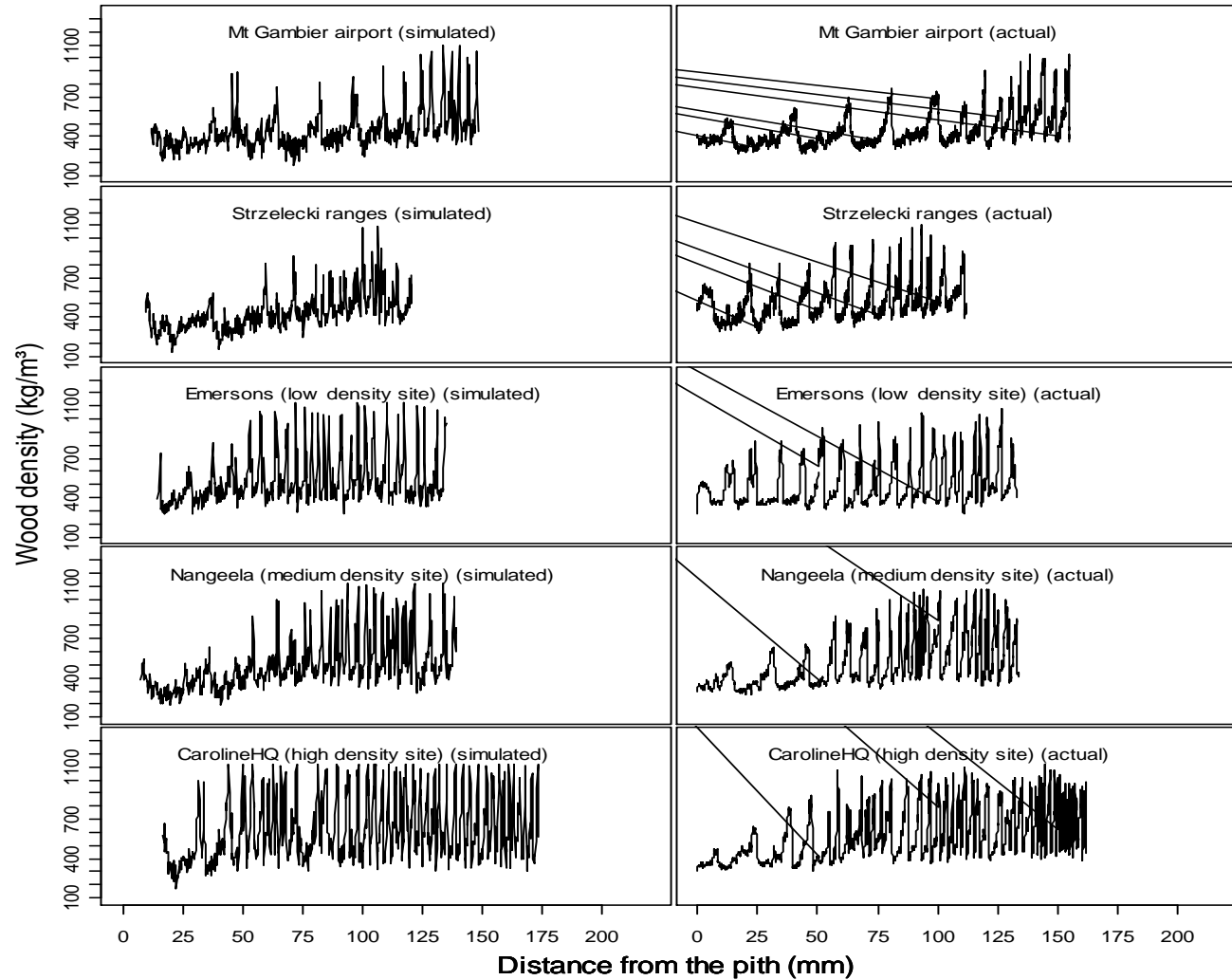
Model performance: using CaBala



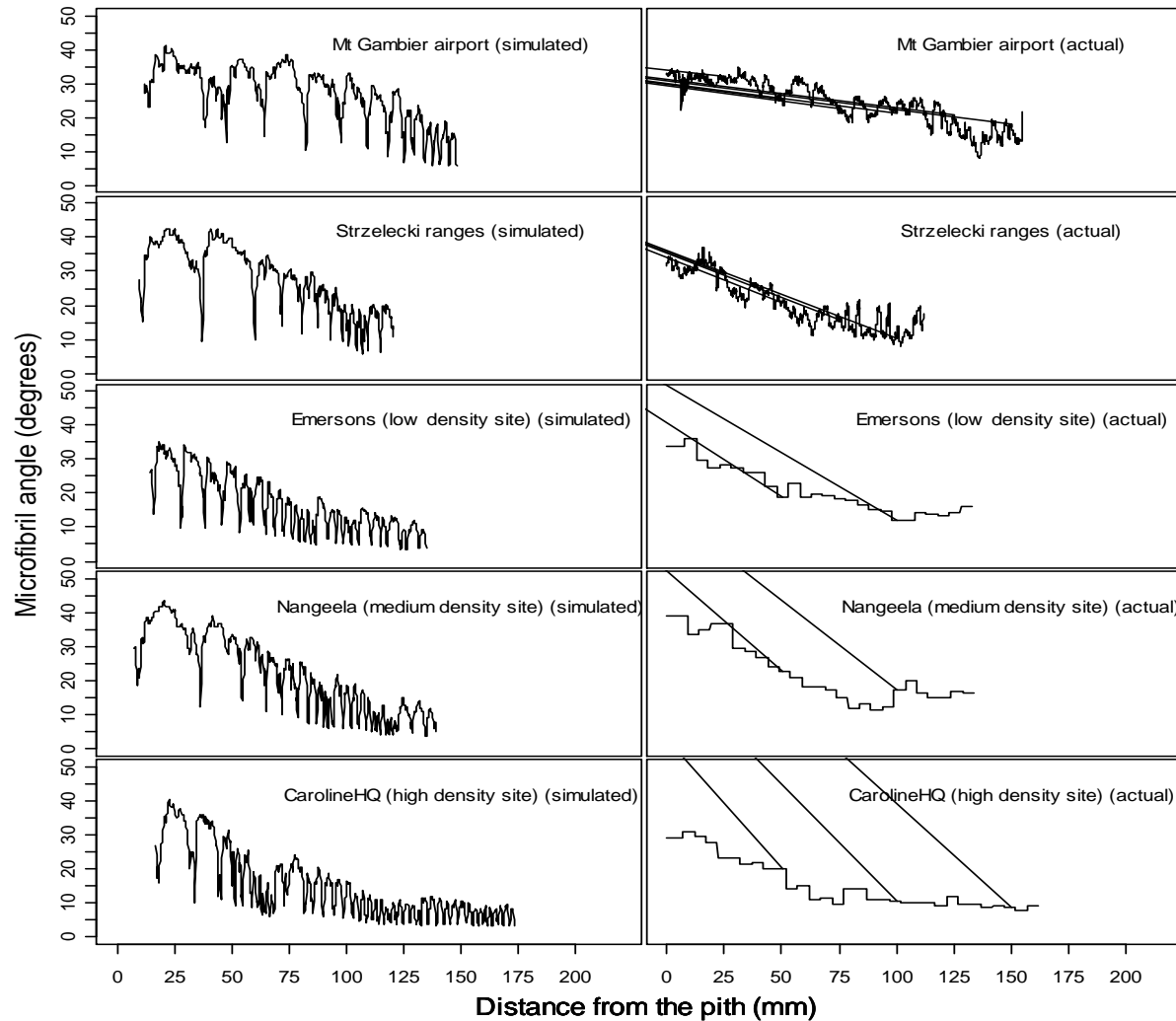
Model performance: IGM



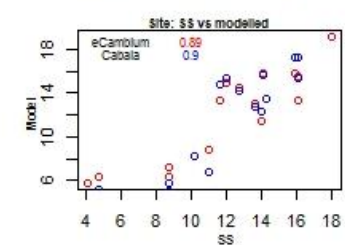
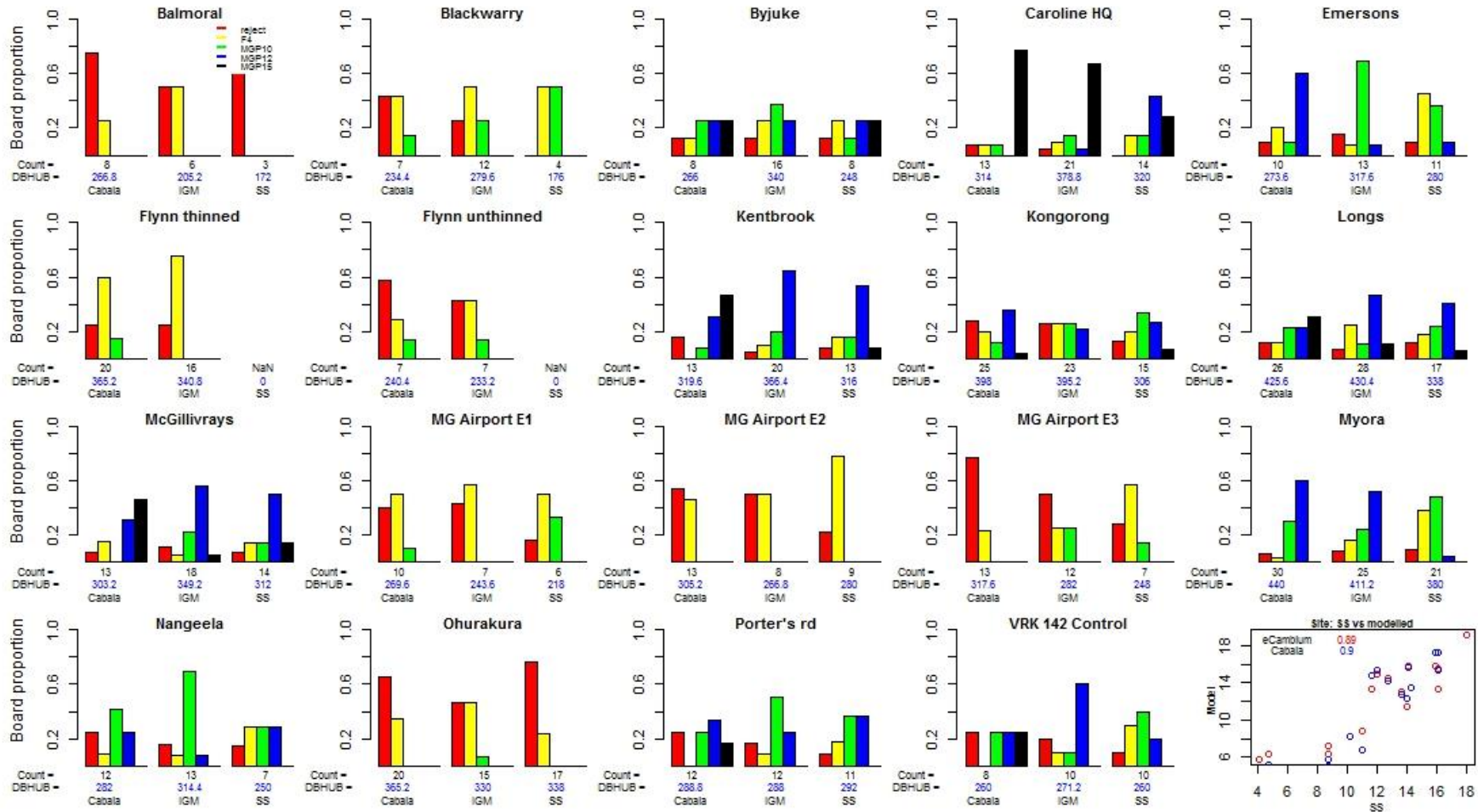
Detailed wood density predictions



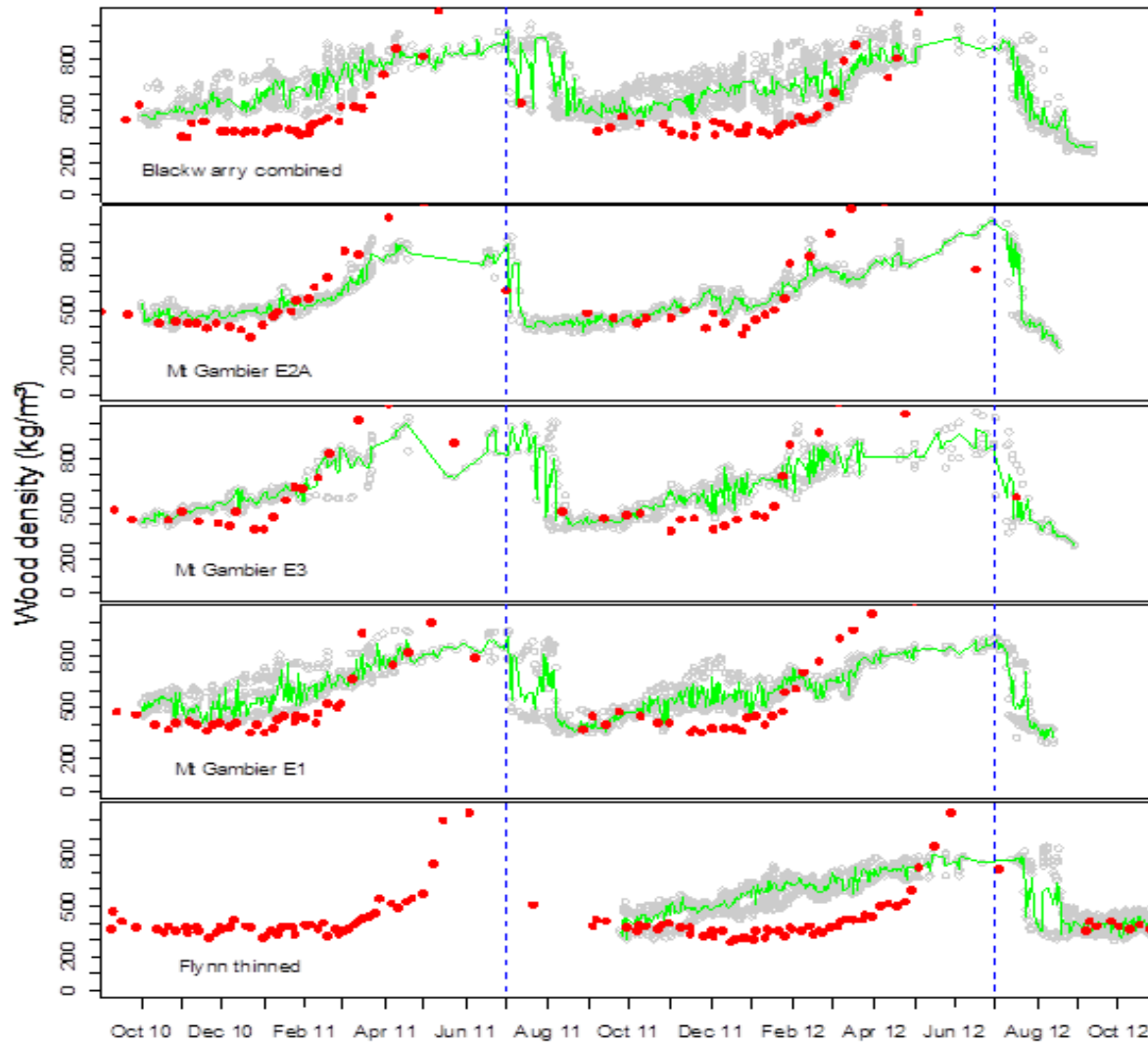
Detailed MFA predictions



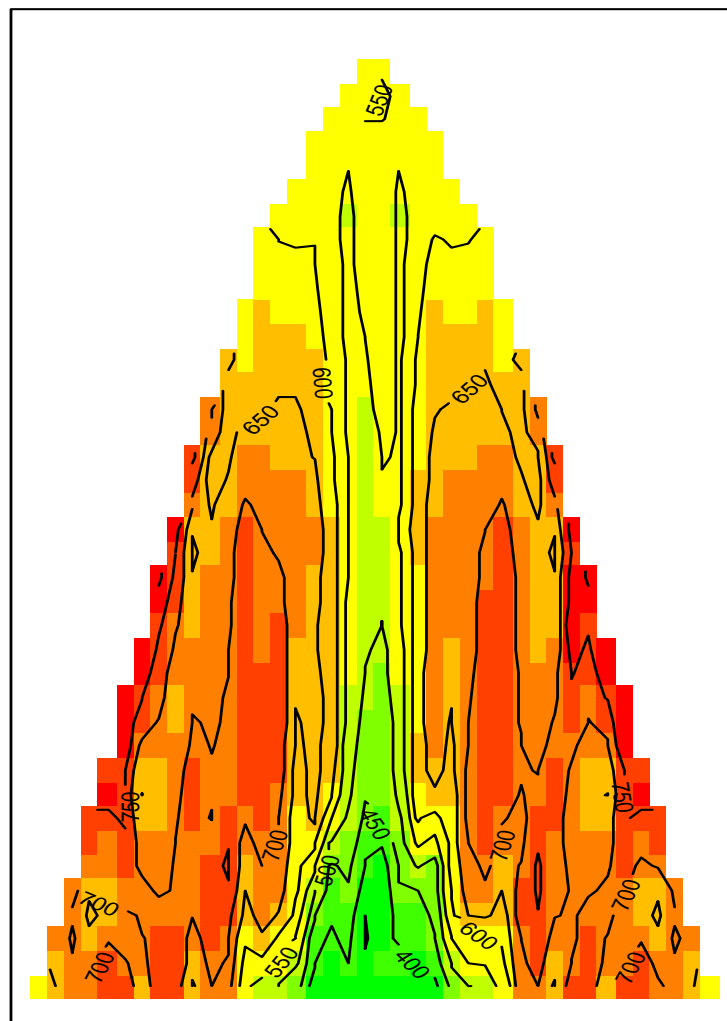
Strength grade predictions



Predicting wood properties and timing...

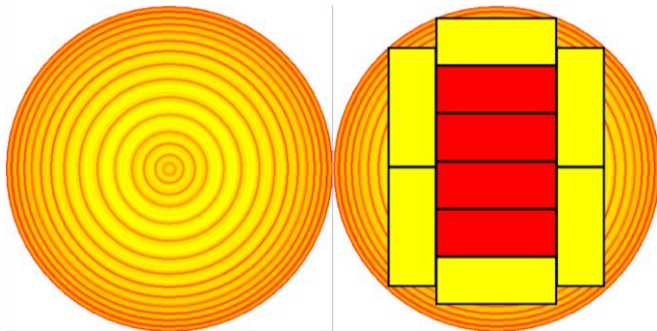


Potential for whole-tree predictions

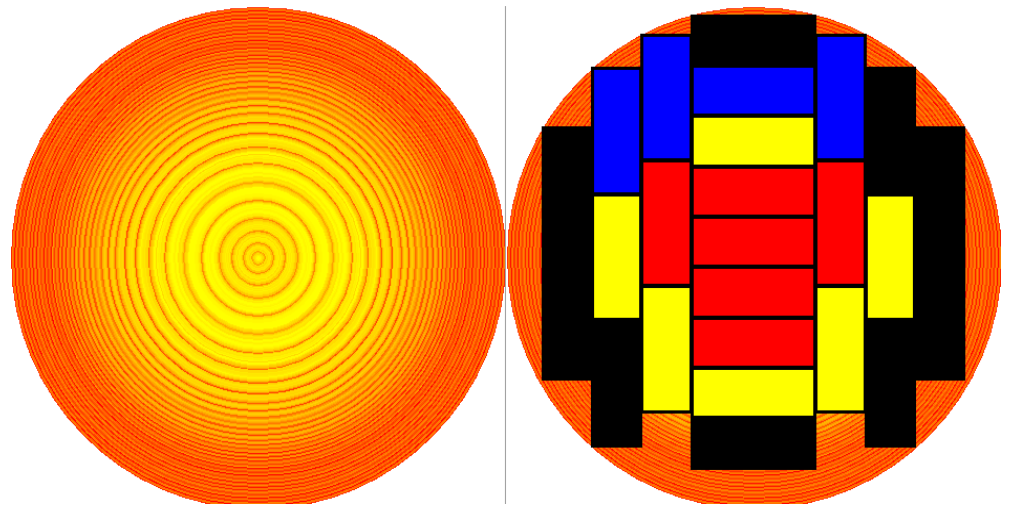


Growing a site on: Mt Gambier airport example

1975 - 1992

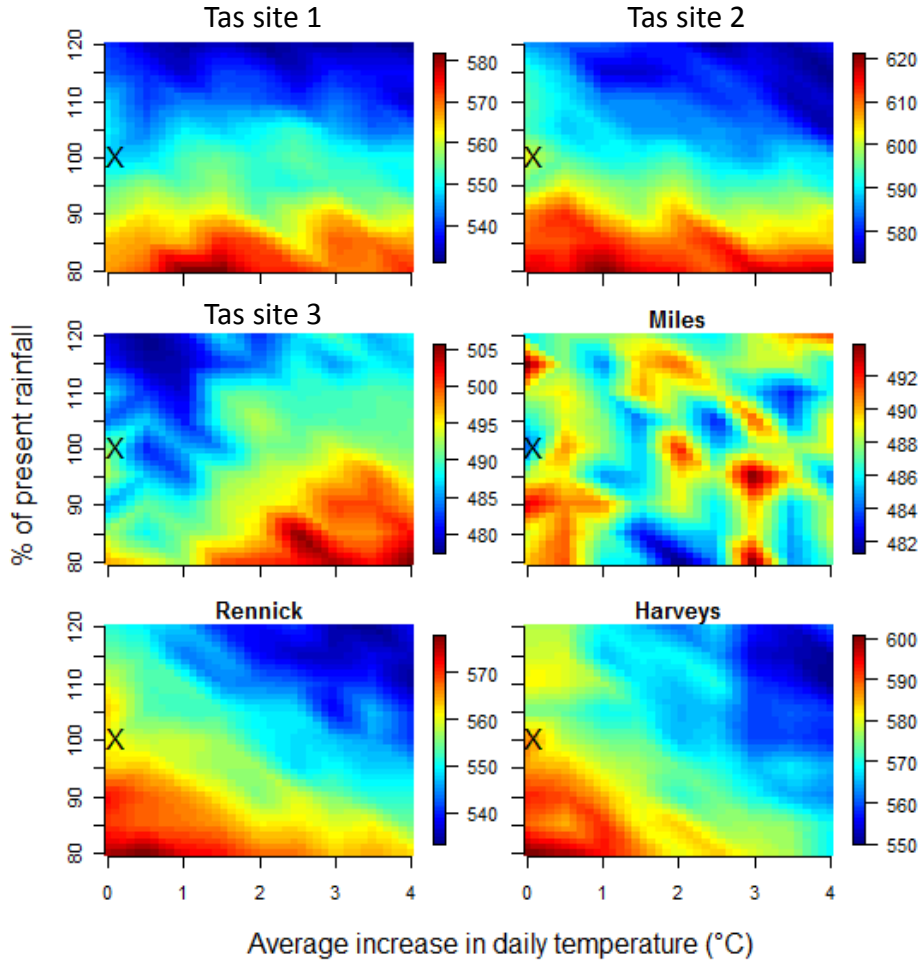


1975 - 2012

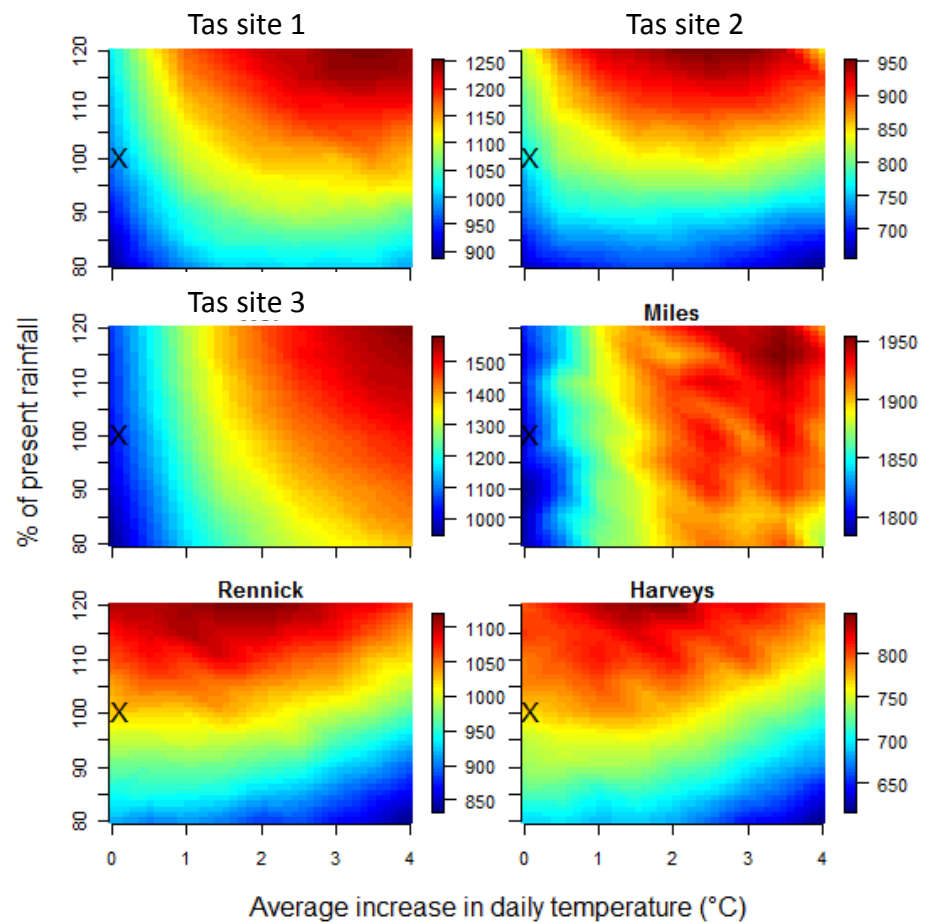


Wood properties under varied conditions

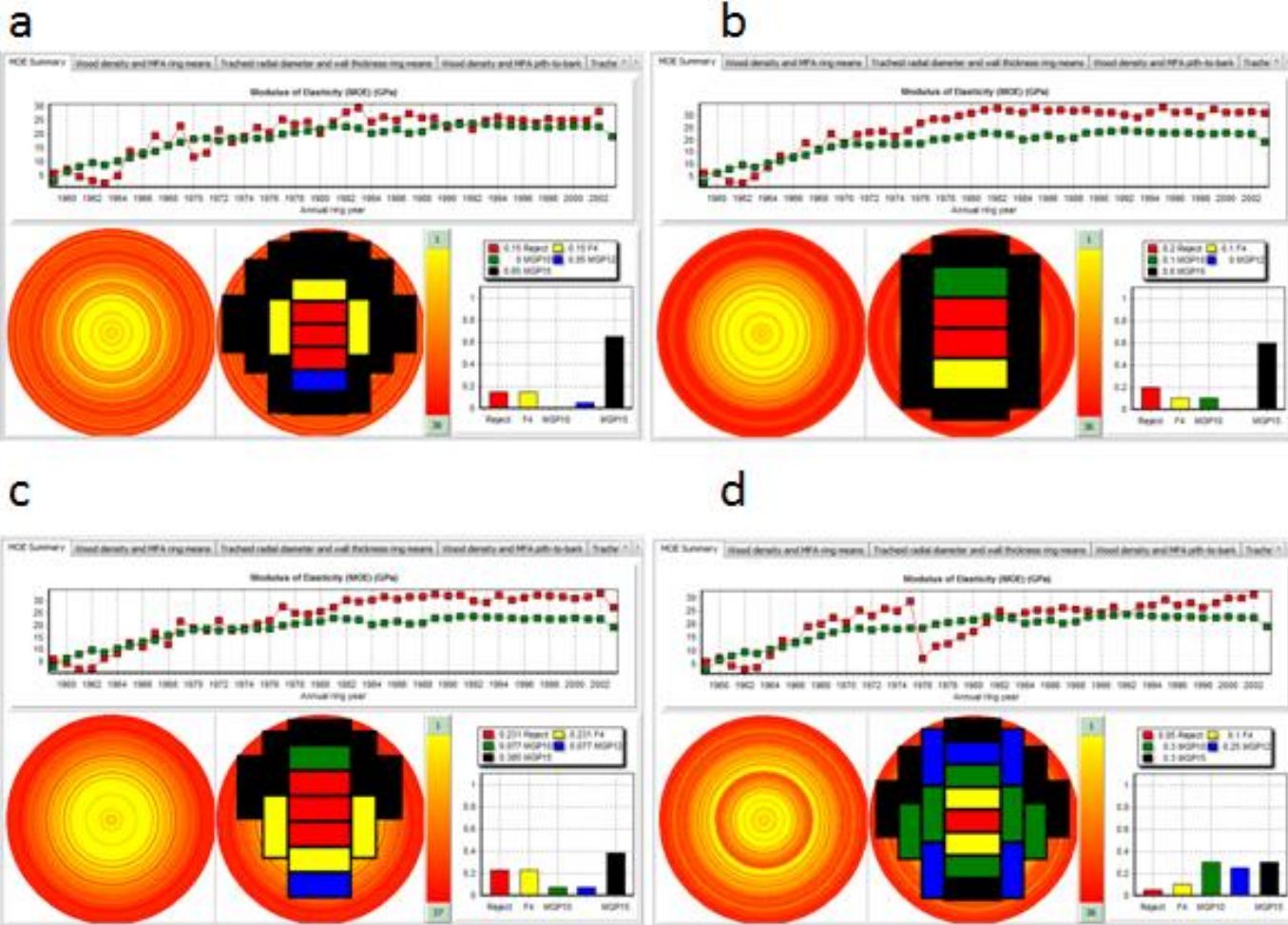
Predicted wood density



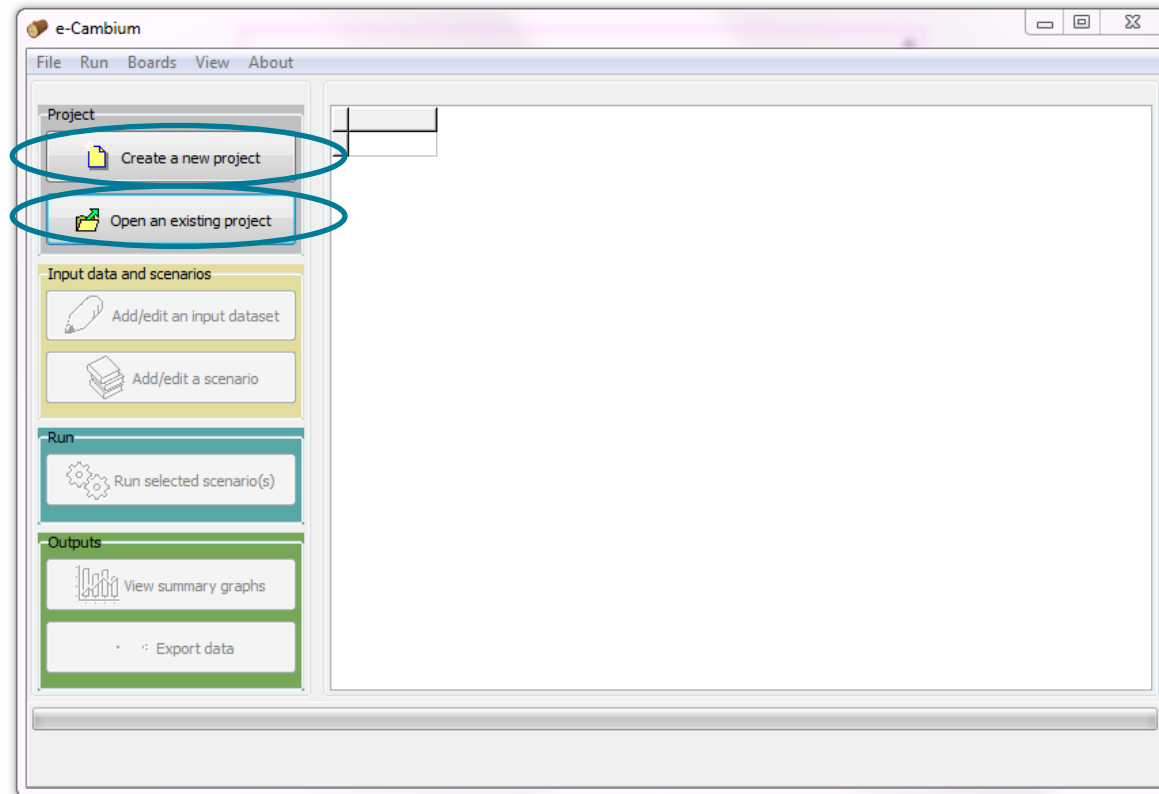
Predicted stand volume



Effects of differing silviculture



Getting started with e-Cambium



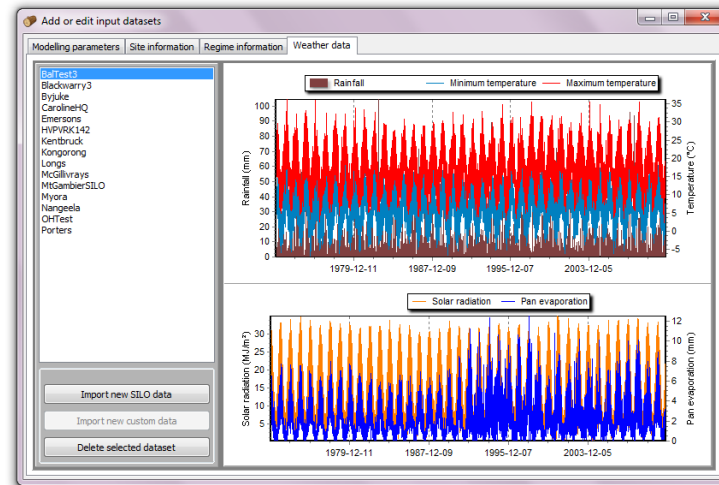
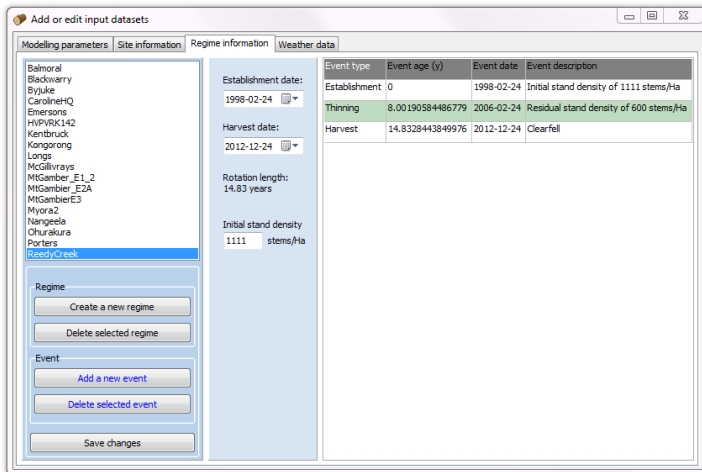
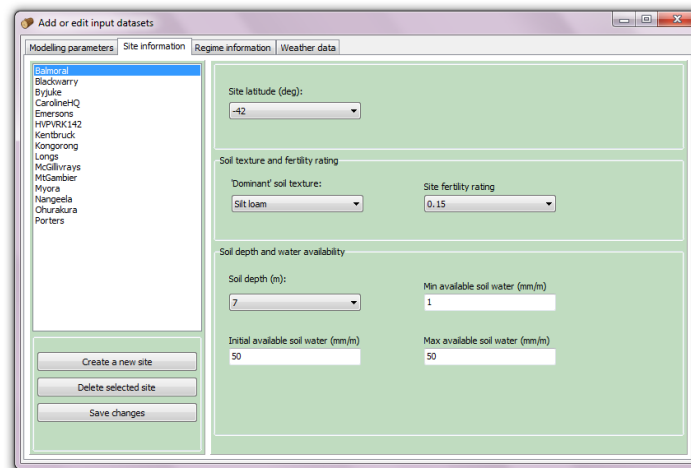
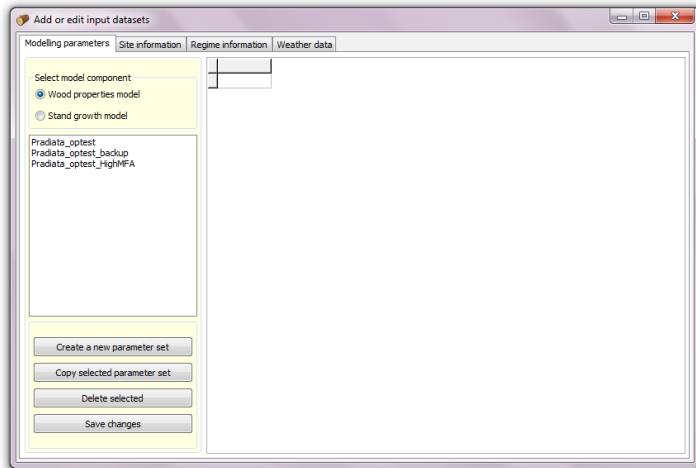
Working with a project: Adding/editing data

The screenshot shows the e-Cambium software interface. The main window displays a table of scenarios with the following columns: Scenario name, Diameter UB (cm), Core mean WD (kg/m³), and Segment (μm). The 'Add/edit an input dataset' button in the sidebar is circled in blue.

Scenario name	Diameter UB (cm)	Core mean WD (kg/m ³)	Segment (μm)
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Byjuke_BH_CMB	28.8	512	21
CarolineHQ_BH_CMB	37.4	530	21
CarolineHQ_BH_CMB_HeavyStockNoThin	28.5	535	21
CarolineHQ_BH_CMB_LowStockNoThin	34	522	21
CarolineHQ_BH_CMB_SingleHeavyThin	37.4	536	21



Adding/editing data for an IGM run



Working with a project: Adding/editing scenarios

The screenshot shows the e-Cambium software interface with the following components:

- Project:** Create a new project, Open an existing project
- Input data and scenarios:** Add/edit an input dataset, Add/edit a scenario (highlighted with a red circle)
- Run:** Run selected scenario(s)
- Outputs:** View summary graphs, Export data

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MtGambier_E2A_BH	31.8	409	21
MtGambier_E3_BH	32.7	400	21
Myora_BH	44.7	483	21
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Ohurakura_BH	37.2	371	21
Porters_BH	43.5	440	21
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CarolineHQ_BH_CMB_LowStockNoThin	34	522	21
CarolineHQ_BH_CMB_SingleHeavyThin	37.4	536	21



Creating scenarios

Add or edit an e-Cambium scenario

Scenario name:

Site:

Weather dataset:

Genotype:

Rotation regime:

Tree type:

Stem position (m):

Link to a CaBala scenario

Scenario name:

Select a CaBala scenario by opening an existing mbc file:

Use all scenarios in the CaBala project

e-Cambium parameter set:

Tree type:

Stem position (m):



Other GUI features

- Data import: bring in data from *.csv files or other, existing e-Cambium projects
- Data export: Export selected data to a *.csv (can be opened with MS Excel) file
- Initialisation: Set-up the start values for a run
- Summary statistics: Set-up the summary information to be shown in the e-Cambium main window
- Write daily data: Write detailed growth, structural and physiological data (e.g. LAI, leaf water potential, etc.) to disk
- Segment size: Set how coarse the “SilviScan type” data should be

Working with a project: Adding/editing scenarios

The screenshot shows the e-Cambium software interface with the following components:

- Project:** Create a new project, Open an existing project
- Input data and scenarios:** Add/edit an input dataset, Add/edit a scenario
- Run:** Run selected scenario(s) (circled in red)
- Outputs:** View summary graphs, Export data

The main table displays the following data:

Scenario name	Diameter UB (cm)	Core mean WD (kg/m ³)	Segment (µm)
Longs_BH	46.8	482	21
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MtGambier_E1_BH	27.4	447	21
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CarolineHQ_BH_CMB_LowStockNoThin	34	522	21
CarolineHQ_BH_CMB_SingleHeavyThin	37.4	536	21



Running scenarios

The screenshot shows the e-Cambium software interface with the following components:

- Project:** Create a new project, Open an existing project
- Input data and scenarios:** Add/edit an input dataset, Add/edit a scenario
- Run:** Stop model runs (highlighted with a red circle)
- Outputs:** View summary graphs, Export data

The main window displays a table of scenarios with the following columns: Scenario name, Diameter UB (cm), Core mean WD (kg/m³), and Segment (μm).

Scenario name	Diameter UB (cm)	Core mean WD (kg/m ³)	Segment (μm)
MtGambier_E3_BH	32.7	400	21
Myora_BH	44.7	483	21
Nangeela_BH	29	479	21
Ohurakura_BH	37.2	371	21
Porters_BH	43.5	440	21
ReedyCreek_Plot2_BH	5.5	323	21
Strzelecki_7.5	14.3	483	21
Strzelecki_BH	23.8	428	21
VRK142Control_BH	28.5	506	21
Balmoral_BH_CMB	18.7	411	21
Byjuke_BH_CMB	28.8	512	21
CarolineHQ_BH_CMB	37.4	530	21
CarolineHQ_BH_CMB_HeavyStockNoThin	28.5	535	21
CarolineHQ_BH_CMB_LowStockNoThin	34	522	21
CarolineHQ_BH_CMB_SingleHeavyThin	37.4	536	21
Emersons_BH_CMB	28.6	443	21
Kentbruck_BH_CMB	33.1	535	21
Kongorong_BH_CMB	28.8	469	21
Longs_BH_CMB	37.8	491	21
McGillivrays_BH_CMB	32.3	533	21
MtGambier_E1_BH_CMB	21.7	447	21

Running the model for ReedyCreek_Plot2_BH

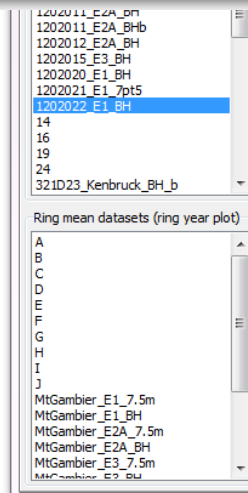
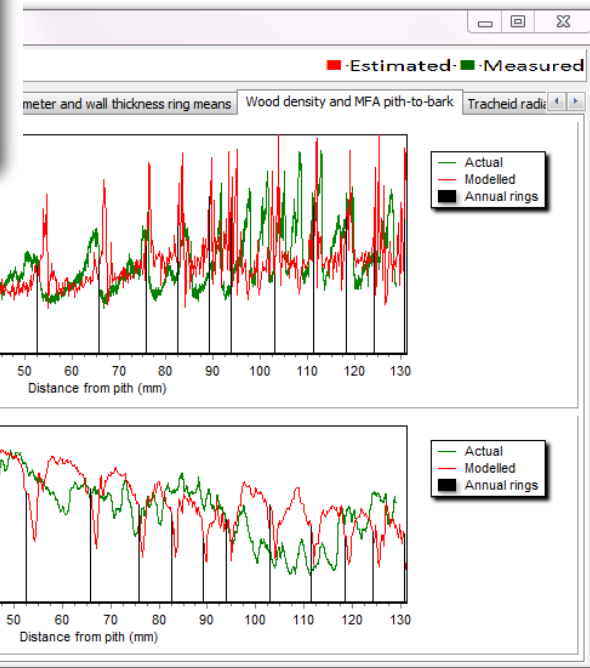
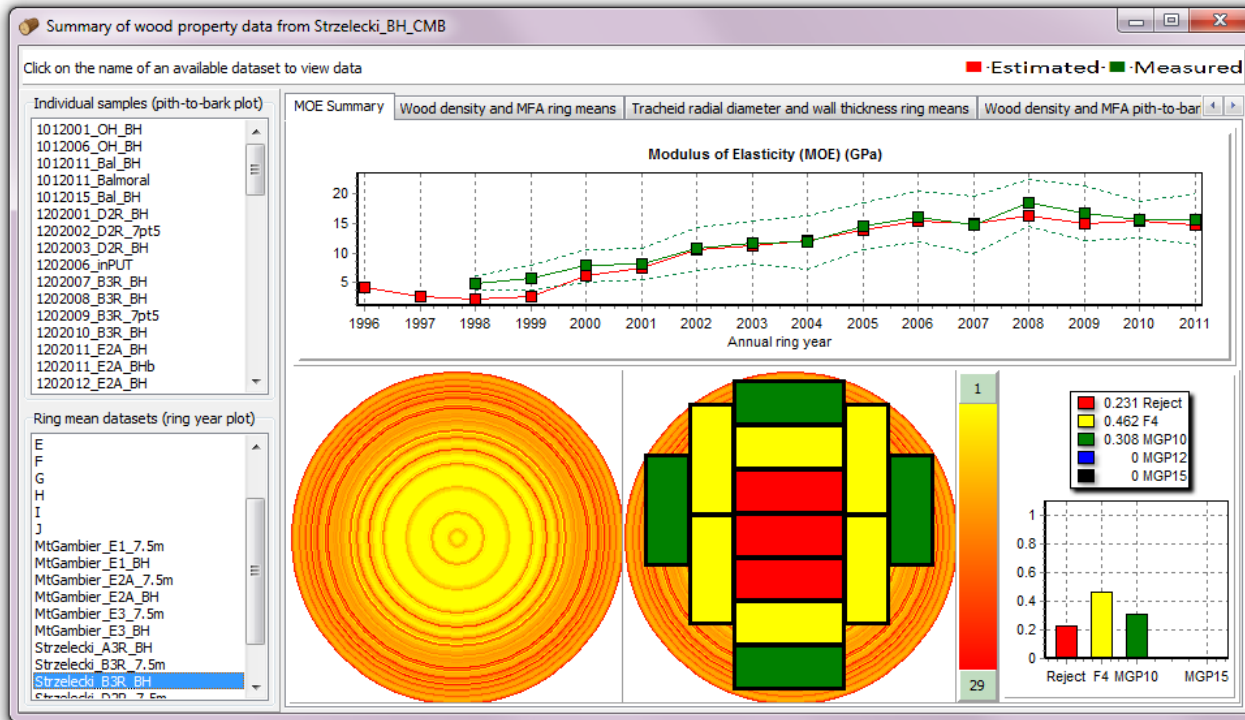
Viewing graphics

The screenshot shows the e-Cambium software interface with a table of scenarios. The 'View summary graphs' button in the 'Outputs' section is circled in red.

Scenario name	Diameter UB (cm)	Core mean WD (kg/m ³)	Segment (µm)
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Porters_BH	43.5	440	21
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CarolineHQ_BH_CMB	37.4	530	21
CarolineHQ_BH_CMB_HeavyStockNoThin	28.5	535	21
CarolineHQ_BH_CMB_LowStockNoThin	34	522	21
CarolineHQ_BH_CMB_SingleHeavyThin	37.4	536	21



Summary graphics: wood properties



Thanks for your attention

Please contact David Drew
([david.drew \(at\) csiro.au](mailto:david.drew@csiro.au)) to
obtain a copy of the software and
installation password and
information