



Department of
Agriculture and Food



The Mallee Resource Assessment Project



Peter Ritson

Forest Science & Industry Development

DAFWA

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Why the Mallee Resource Assessment Project?

- Reliable estimates are required of the **current** and **future** productivity of mallee plantings, including ...
 1. Biomass harvest yields and carbon sequestration from harvest plantings
 2. Carbon sequestration from not-for-harvest plantings



Who is funding the Mallee RAP?

Core RAP (growth measurement plots,
destructive sampling, etc.)

1. DAFF (OMA grant)
2. DAFWA/FPC

Root:shoot studies

1. DAFF (OMA grant)
2. DCCEE (CSIRO lead)
3. DAFWA/FPC





Knowledge and data gaps being addressed

1. Productivity of current plantings
2. Biomass prediction equations
3. Measurements of growth rates.



To measure current productivity – RAP design principles

1. Robust (unbiased) estimates of productivity in current plantings is required as a guide to future productivity.
2. Where technology gains have been quantified they can be factored into predictions of future productivity.

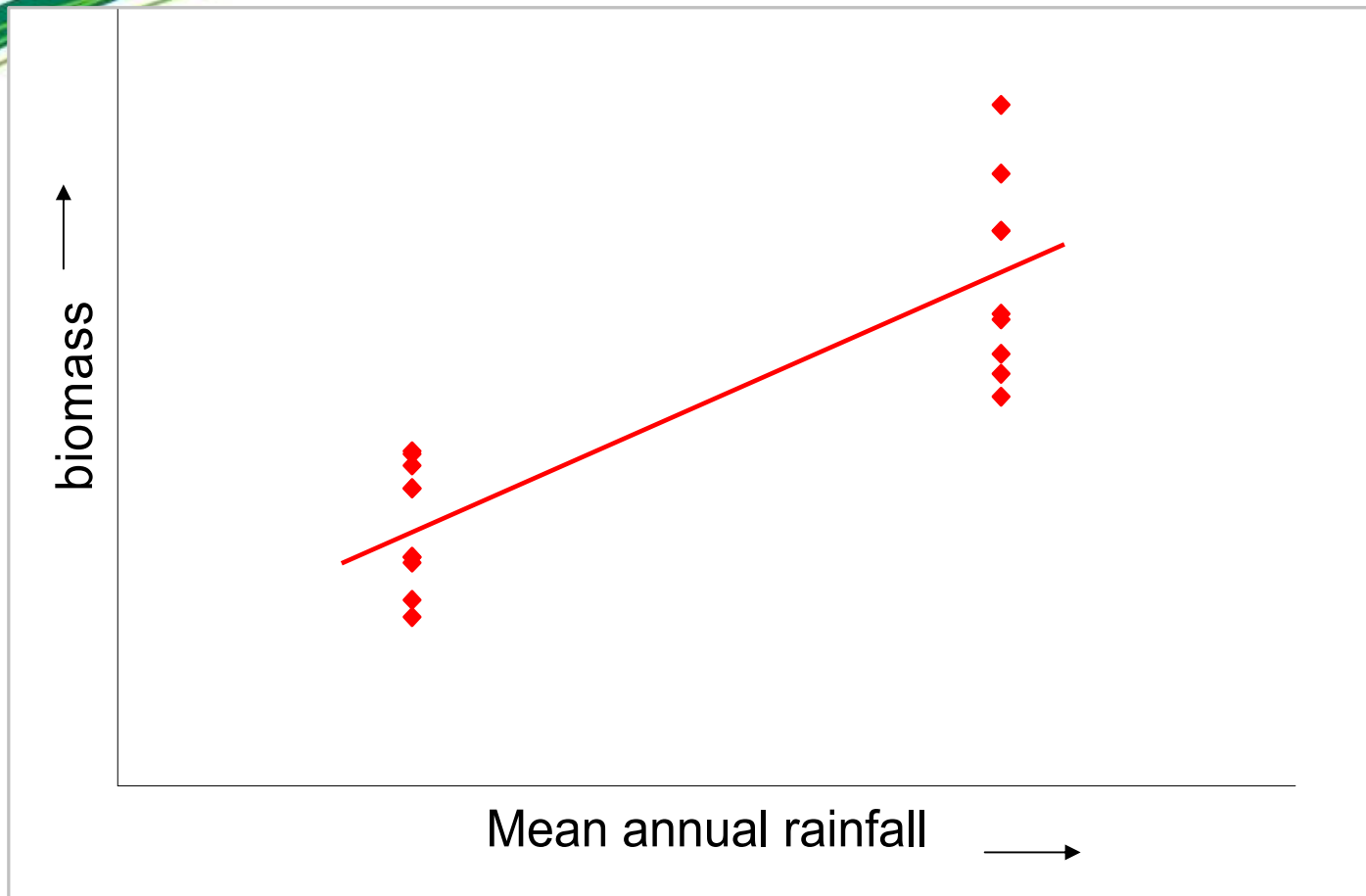


RAP design principles, cont.

3. The common practice of subjectively locating growth measurement plots is not adequate – objective (random) sampling is preferable.
4. Cannot measure all factors (site and management) affecting growth. Therefore extensive sampling is better than intensive.



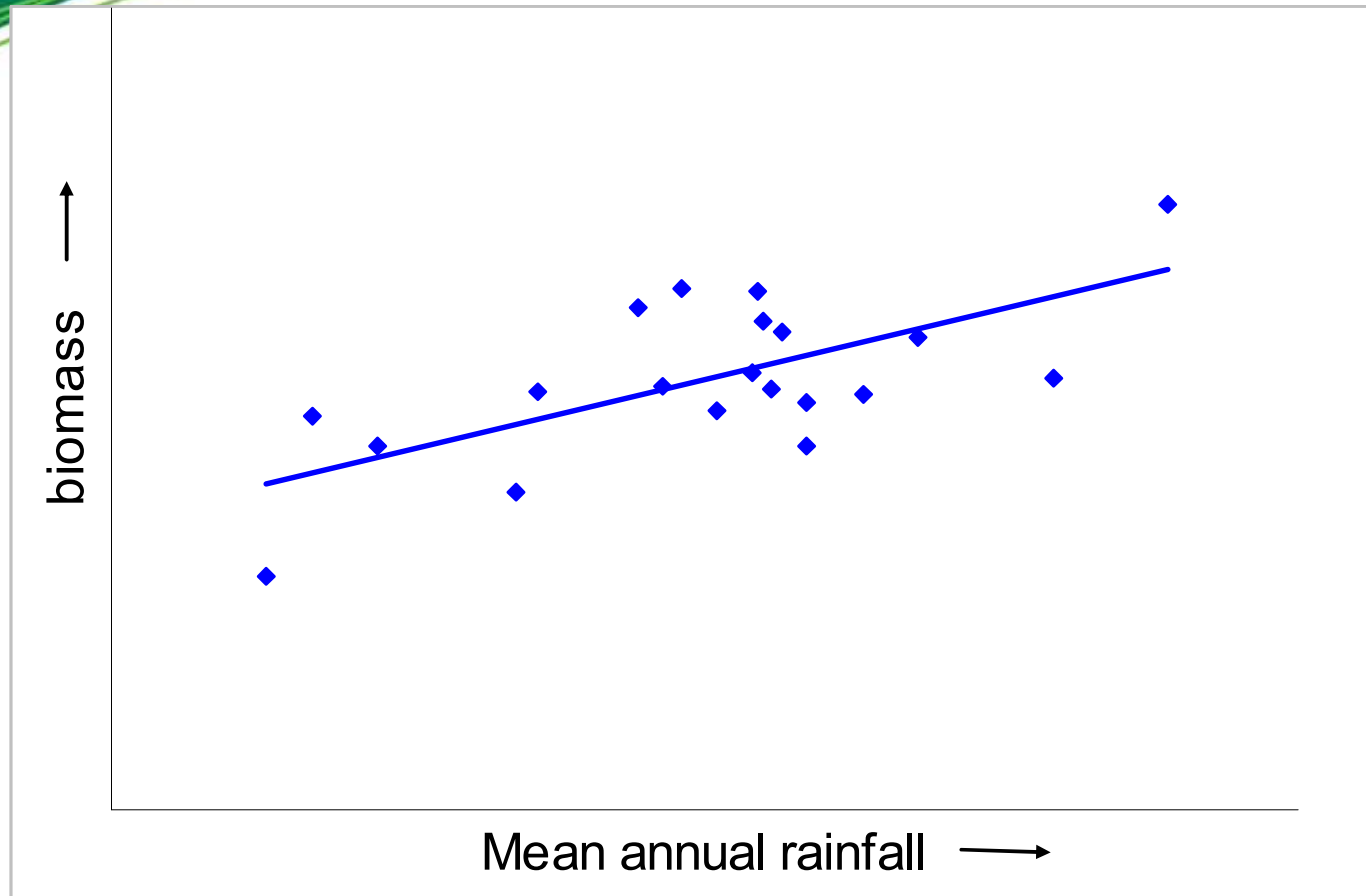
Intensive sampling



- Good estimate of variability within sites
- Poor estimate of trend in the population



Extensive sampling



- Good estimate of variability in population
- Good estimate of trend in the population



Model of current productivity

Estimate productivity according to:

1. Species (or sub-species)
2. Stand age
3. Environment (climate, soils, landforms)
4. Planting layout (e.g. belts or block plantings, spacing)
5. (if possible) management factors, e.g. site preparation, harvest events.

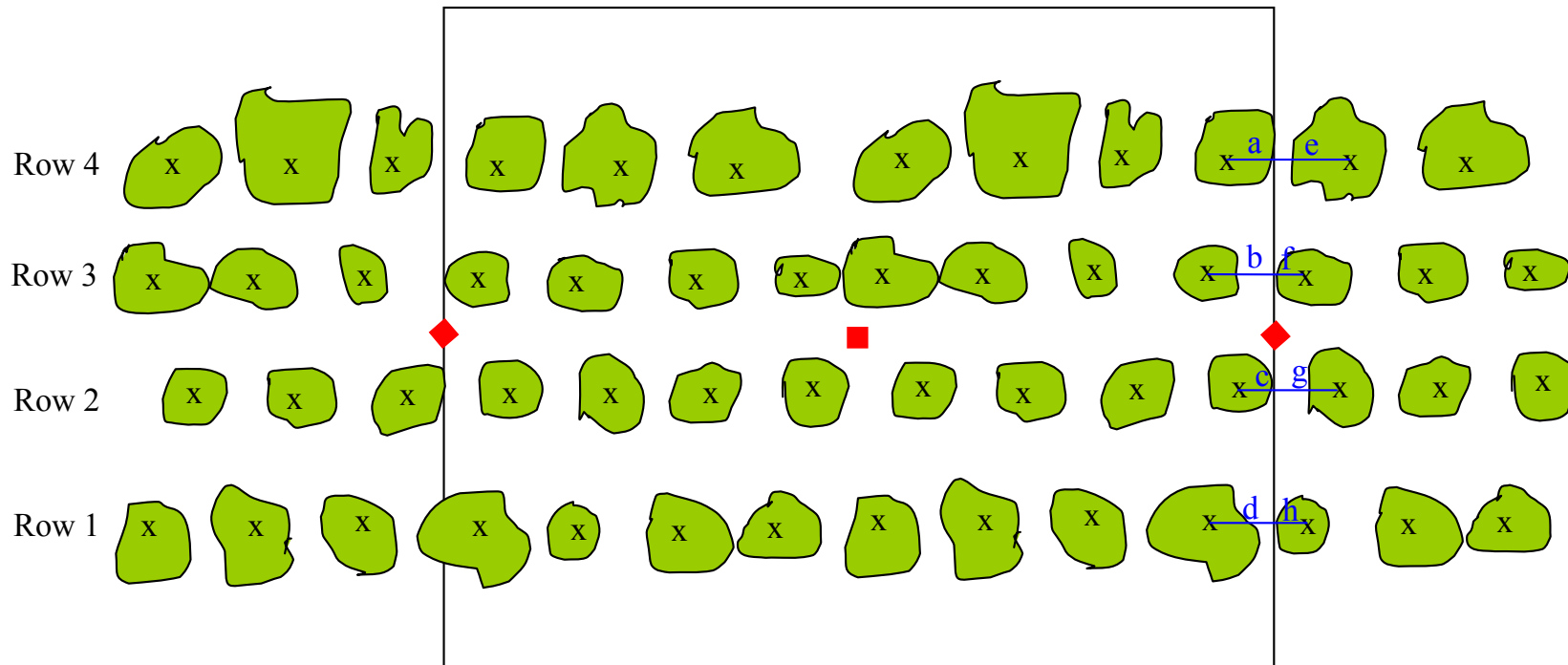


Sampling strategy

- Sampling restricted as follows:
 - Two cells (Narrogin region, Northern Ag.)
 - Two species from each cell
 - Ages 5, 10 and 15 years from each region.
- Target a minimum 15 sample plots for each cell x species x age combination, i.e. target 180 plots.
- Random sampling essential for plot locations.

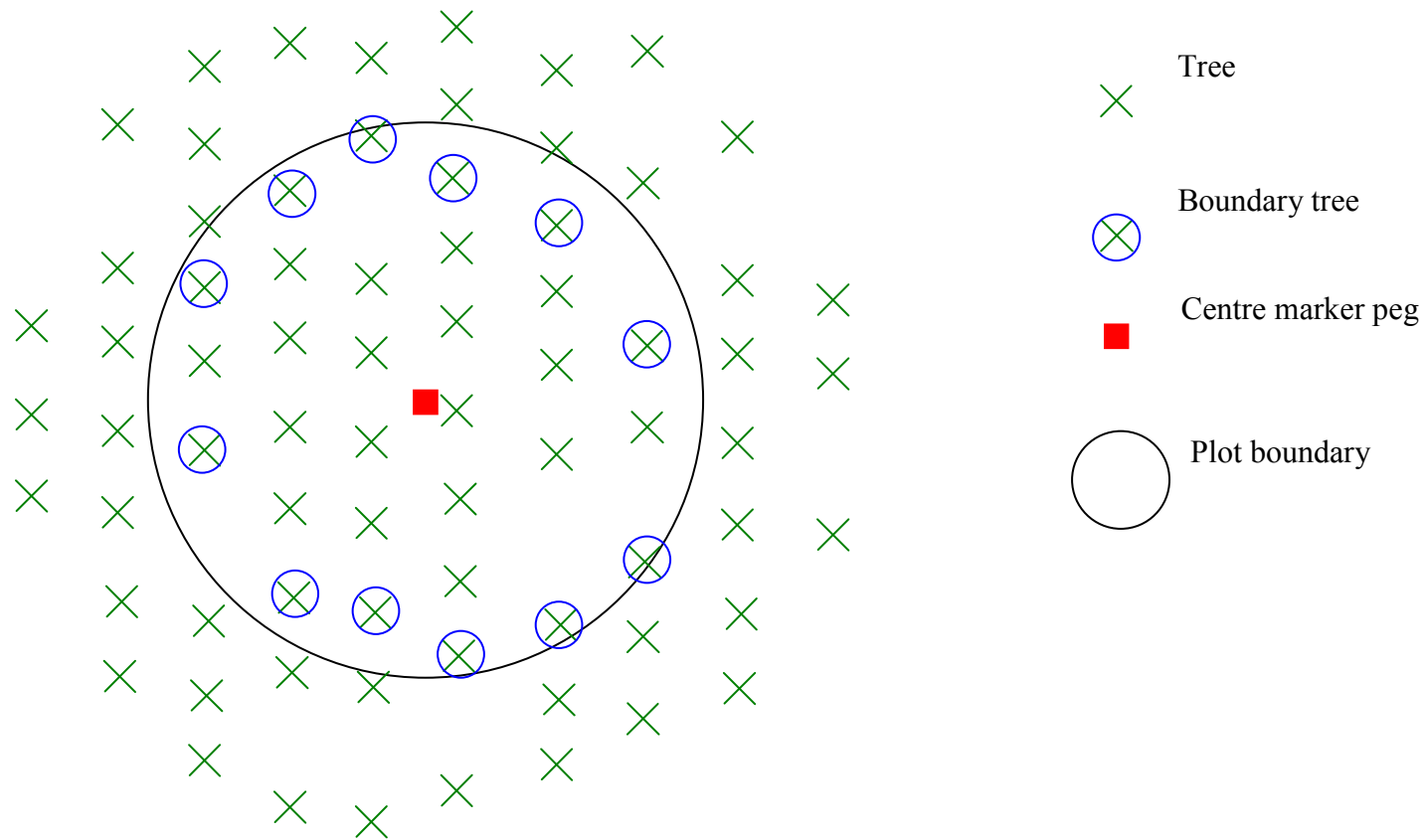


A sample plot in belt plantings





A sample plot in block plantings





Site data for each plot

1. Climate variables (from climate surface)
2. Soils variables
3. Landform, e.g. slope, aspect (from contour maps)





Tree measurements

Measure diameter of each live stem or branch > 10 mm diameter at height:

- 0.1 m, i.e. Diameter at Ankle Height (DAH)
- 0.5 m, i.e. Diameter at Knee Height (DKH)



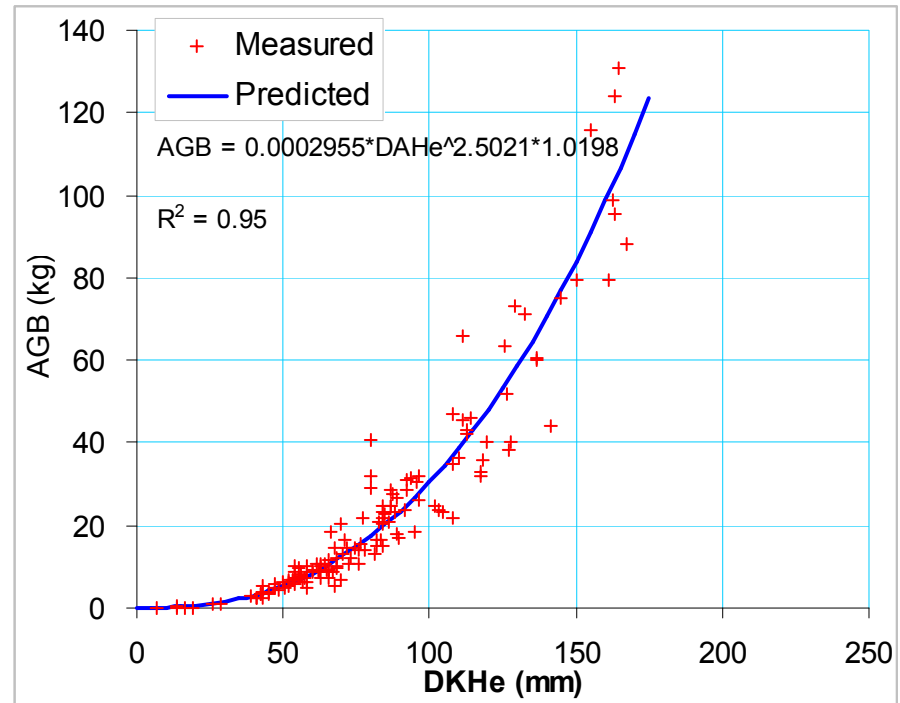
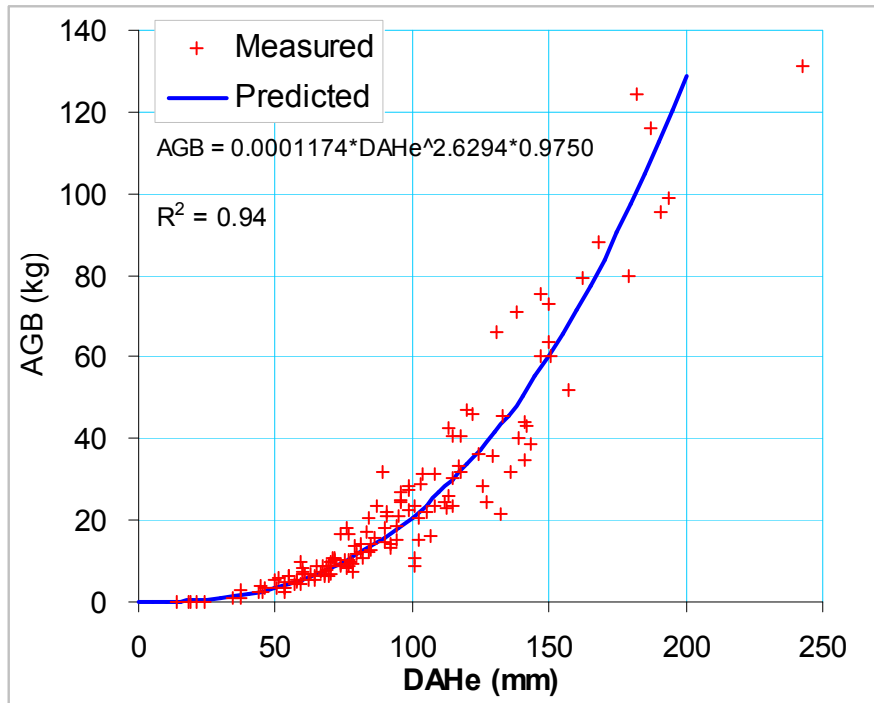


Biomass prediction equations

- We use prediction equations to reliably estimate the biomass (dry weight) and carbon store of the mallees in a sample plot from the stem diameter measurements:
 1. Above-ground biomass (shoot biomass) predicted from stem diameter measurements.
 2. Root biomass predicted from root:shoot ratio.



Prediction of above-ground biomass in *E. loxophleba* subsp *lissophloia*



DAH = Diameter at Ankle height (0.1 m); DKH = Diameter at Knee height (0.5 m)



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Destructive sampling to develop biomass prediction equations





Root sampling

- Can't easily excavate all the roots of an individual mallee in a planting because the roots intertwine.
- Therefore, work with plots of mallees. Measure the above-ground biomass (shoot biomass) of all mallees in the plot to calculate a plot total.
- Then, dig up and get the dry weigh all the roots in the plot to calculate a root:shoot ratio.



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Root sampling





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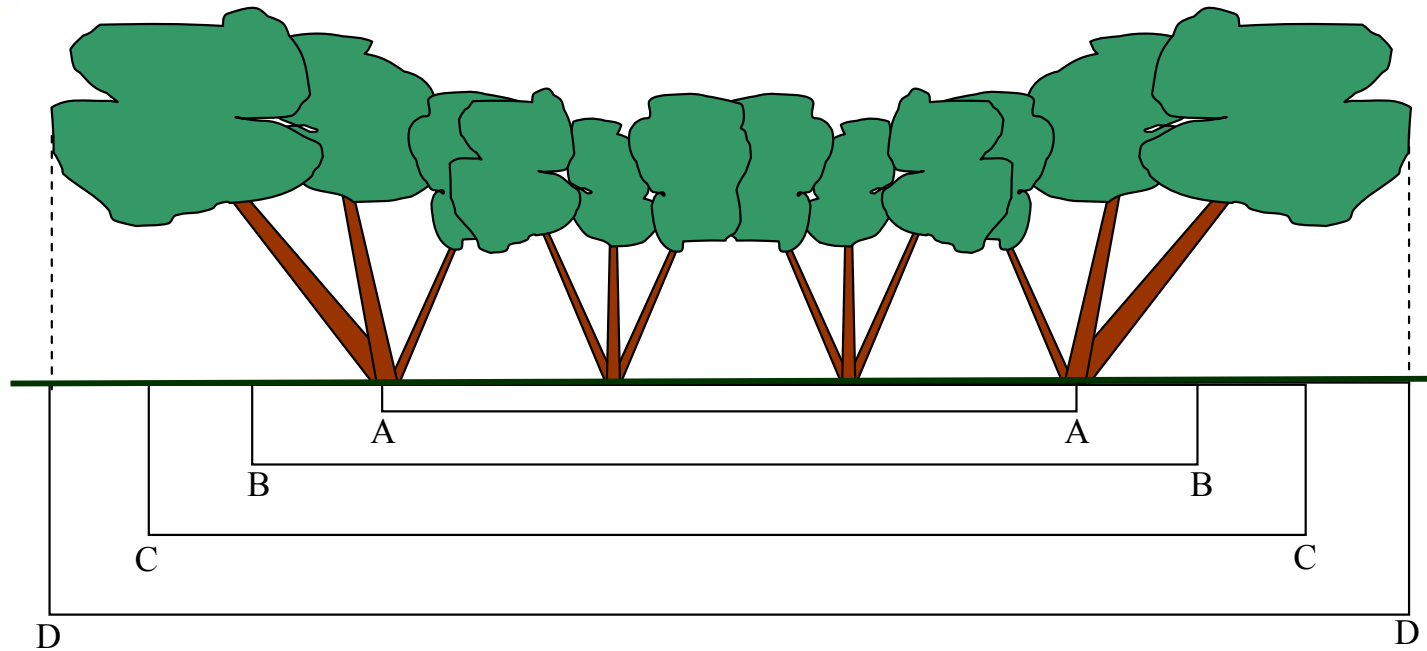


More root sampling





How to measure the width (and area) of mallee belts?



AA: distance between outside planting lines

BB: add half a row width out from the outside planting lines

CC: add a standard distance (e.g. 2 m) out from the outside planting lines

DD: crown extent

EE: (not shown) root extent.

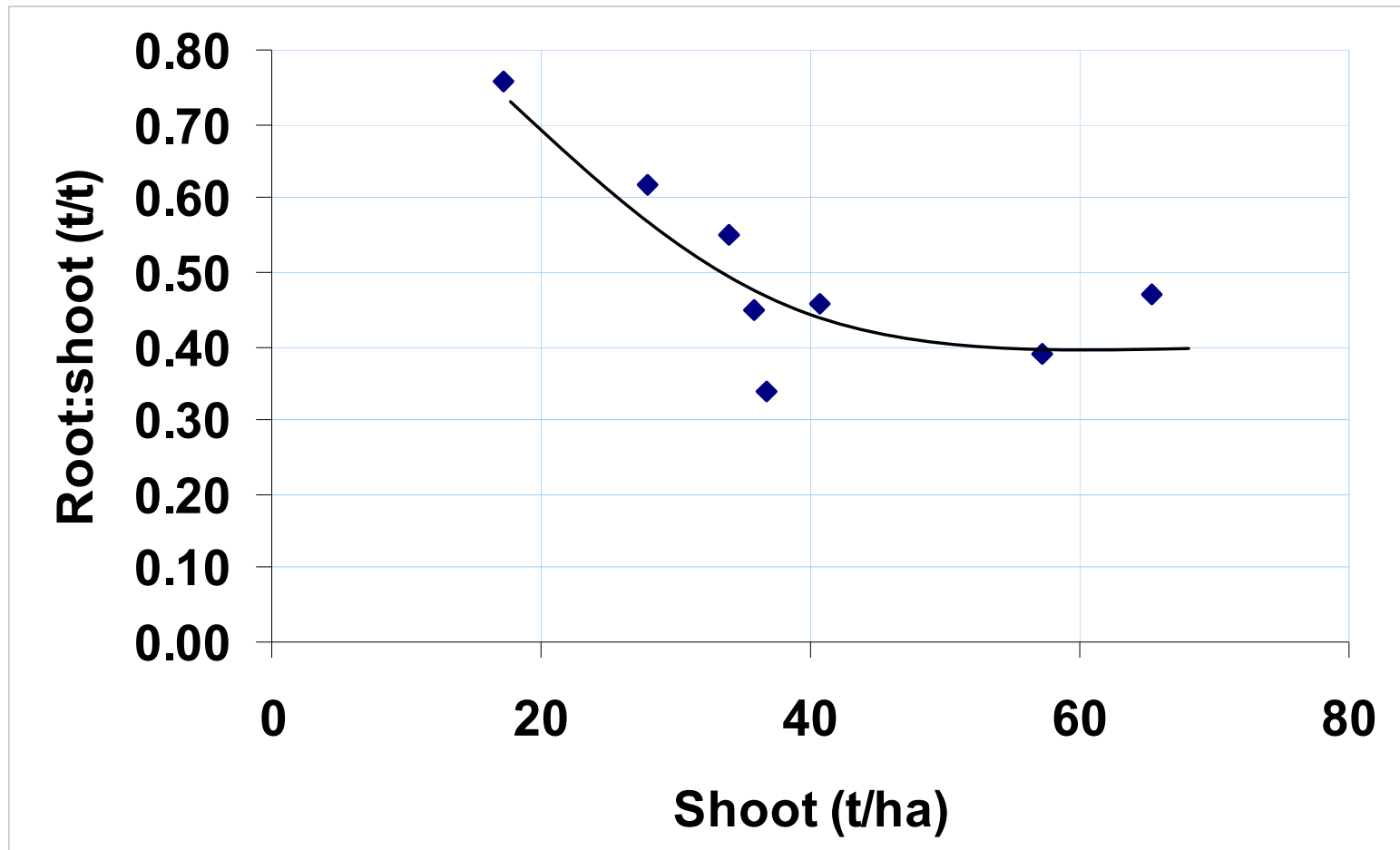


Some preliminary results from root:shoot sampling.

Site	Locality	Species	Age (years)	No. rows in belt	Root DW (t/ha)	AGB DW (t/ha)	Root:Shoot	Total DW (t/ha)	Total CO ₂ -e (t/ha)
Pepall 1	Dumbleyung	Lox. Liss	11	6	13.0	17.1	0.76	30.1	55
Pepall 2	Dumbleyung	Lox. Liss	11	6	17.3	28.0	0.62	45.2	83
Pepall 3	Dumbleyung	Lox. Liss	11	6	18.7	34.0	0.55	52.7	97
Bird 1	Wickepin	Lox. Liss	11	3	12.4	36.7	0.34	49.1	90
Bird 3	Wickepin	Lox. Liss	11	3	18.6	40.7	0.46	59.3	109
Quicke 1	Kulin	Lox. Liss	14	2	22.2	57.1	0.39	79.3	145
Quicke 2	Kulin	Lox. Liss	14	2	30.7	65.3	0.47	96.1	176
Quicke 3	Kulin	Lox. Liss	14	2	16.0	35.7	0.45	51.8	95
Min.					12.4	17.1	0.34	30.1	55
Max.					30.7	65.3	0.76	96.1	176
Average					18.6	39.3	0.50	57.9	106



Predicting root biomass from above-ground biomass





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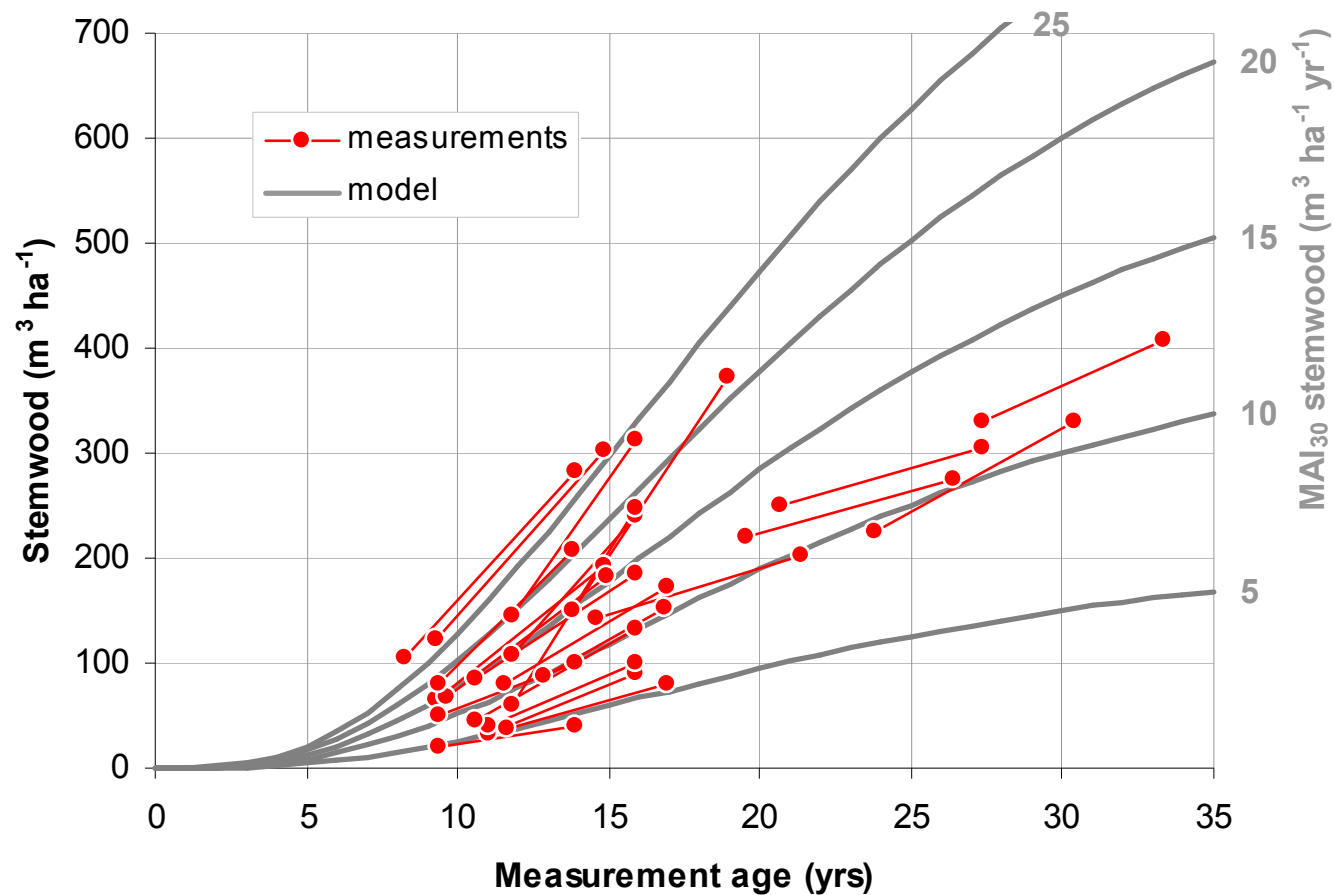


Measuring growth rates

- The sample plots where we have only measured the stem diameters are marked so they can be re-measured, e.g. in a few years.
- These Permanent Sample Plots (PSPs) are vital for calibrating growth models.
- For example, need a good estimate of the age of maximum growth rate to calibrate FullCAM (used in the NCAS and available in the NCAT).



Example growth curves for Maritime Pine calculated from interval growth measurements in PSPs.





Summary

1. Random sampling to estimate current productivity of mallee plantings.
2. Aim to calculate a productivity model, e.g. to estimate carbon stock as a function of species, age, planting layout, environment and management factors.
3. Refining biomass prediction equations to predict biomass and carbon in mallee plantings from non-destructive measurements.
4. The sample plots are marked so they can be re-measured – these PSPs provide vital data for growth modelling (predict future productivity of mallee plantings).