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The Mallee Resource Assessment Project

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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

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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

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Knowledge and data gaps being addressed

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

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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.

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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.

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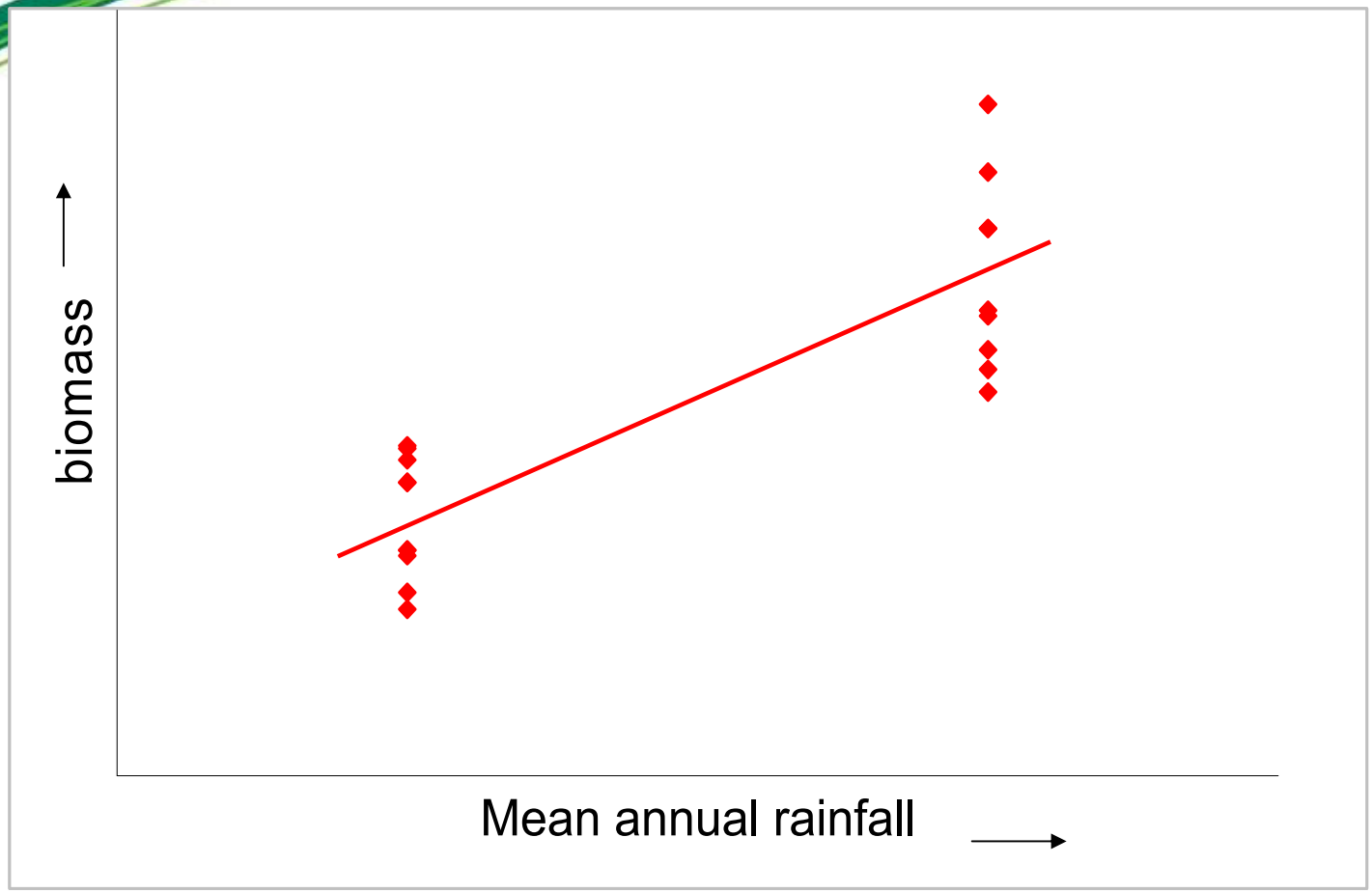
Intensive sampling



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

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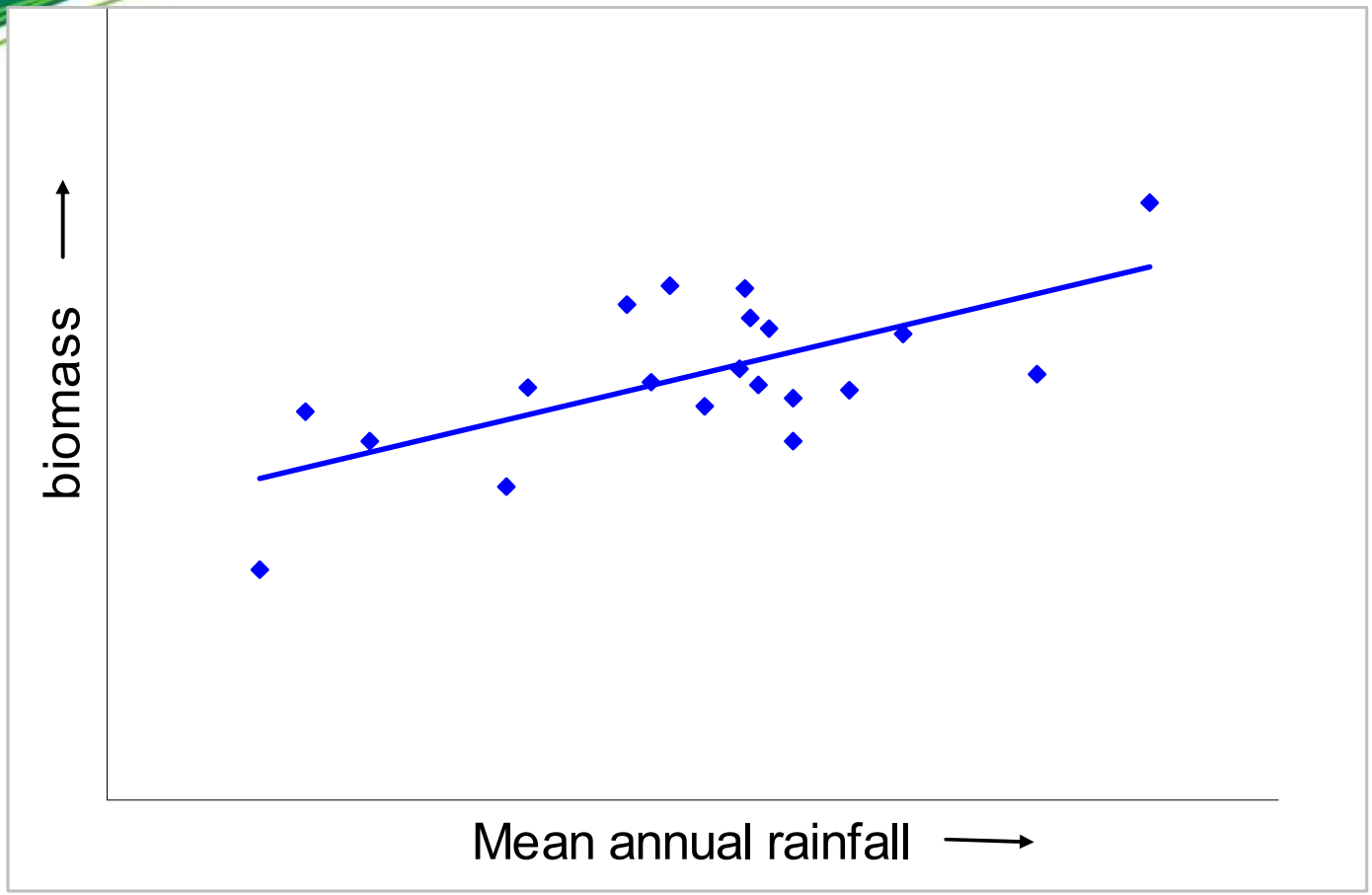
Extensive sampling



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

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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.

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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.

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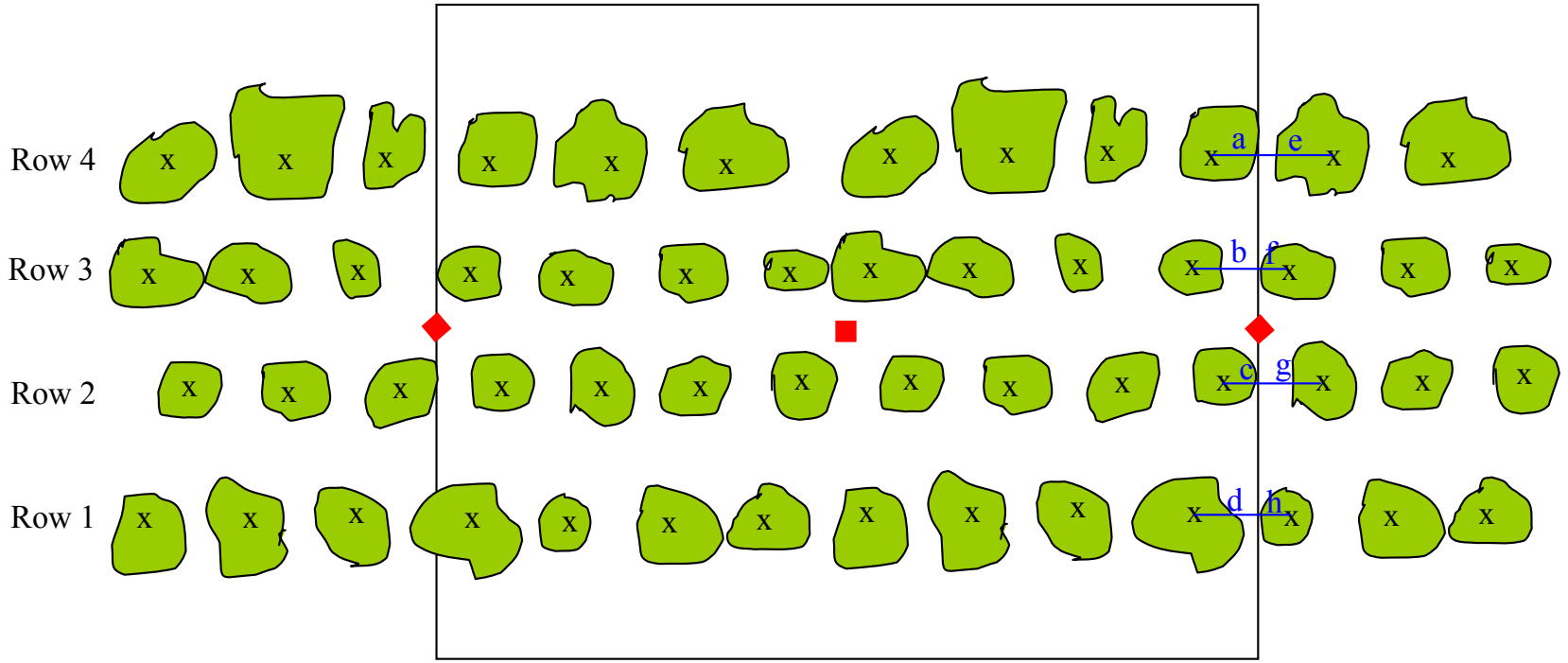
A sample plot in belt plantings



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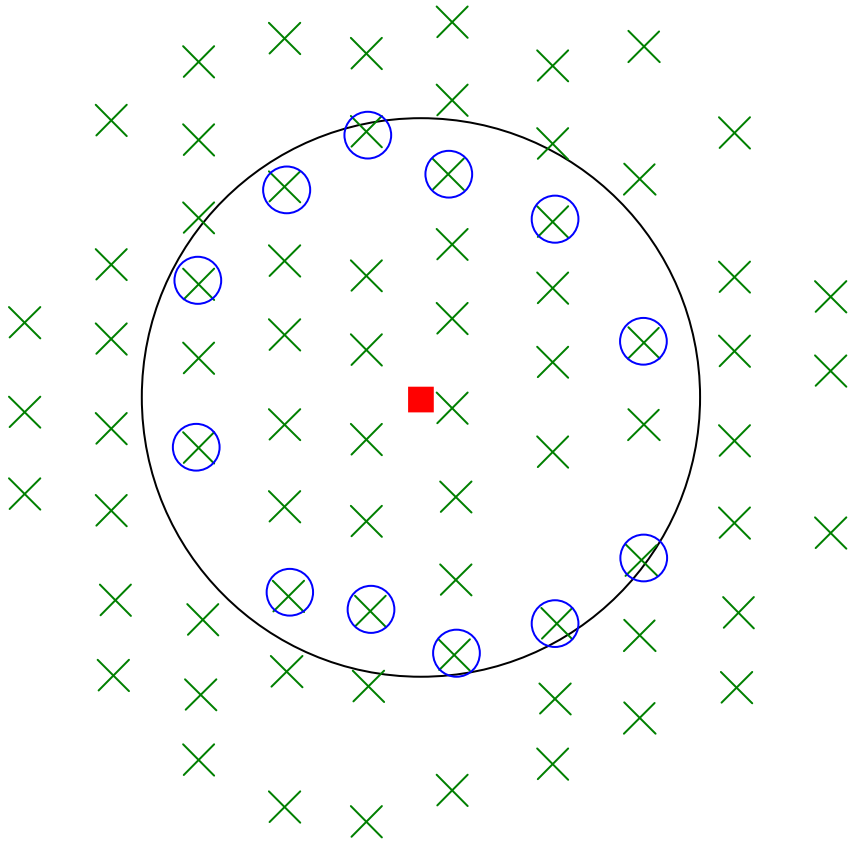
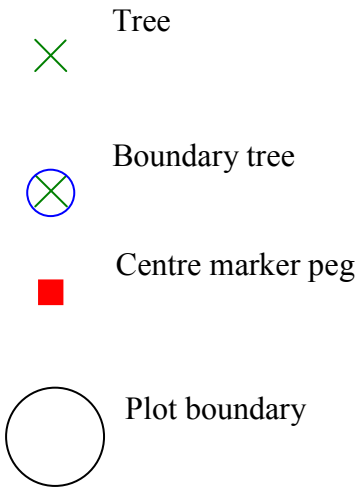
A sample plot in block plantings





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Site data for each plot

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

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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)

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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.

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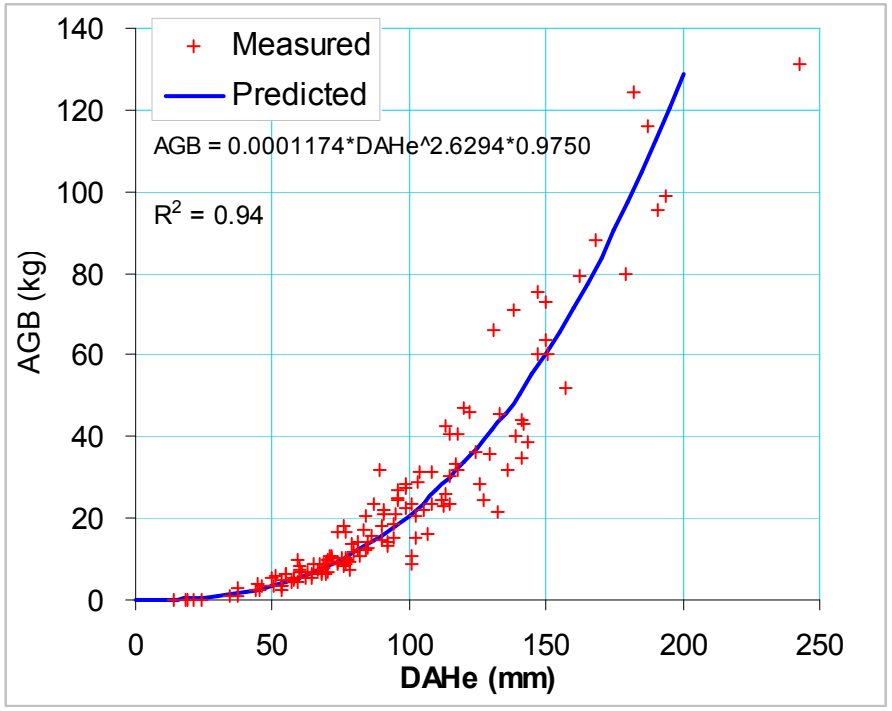
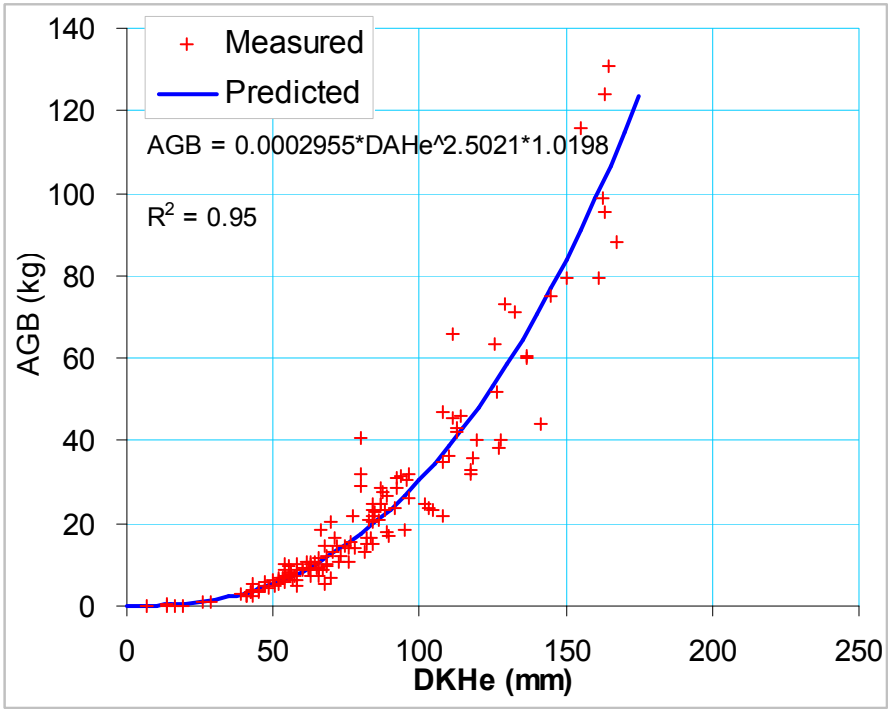
Prediction of above-ground biomass in *E. loxophleba* subsp *lissophloia*





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

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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

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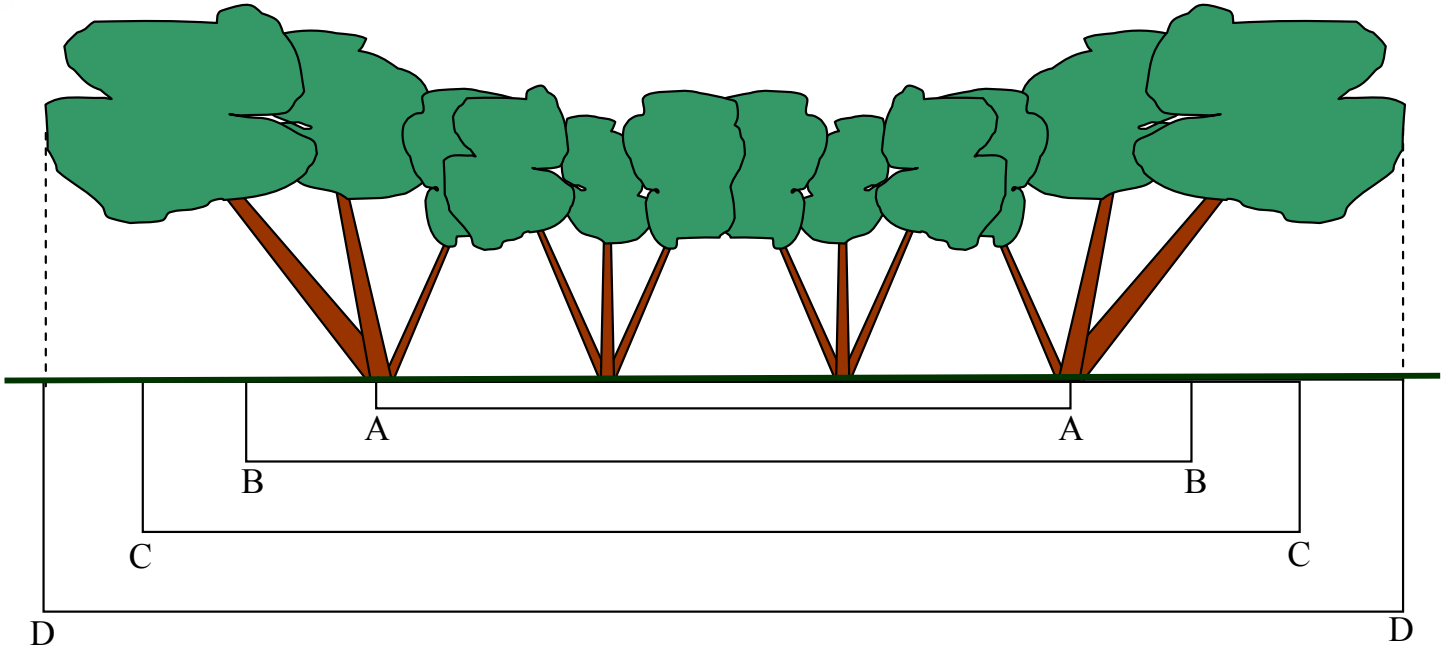
How to measure the width (and area) of mallee belts?



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.

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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

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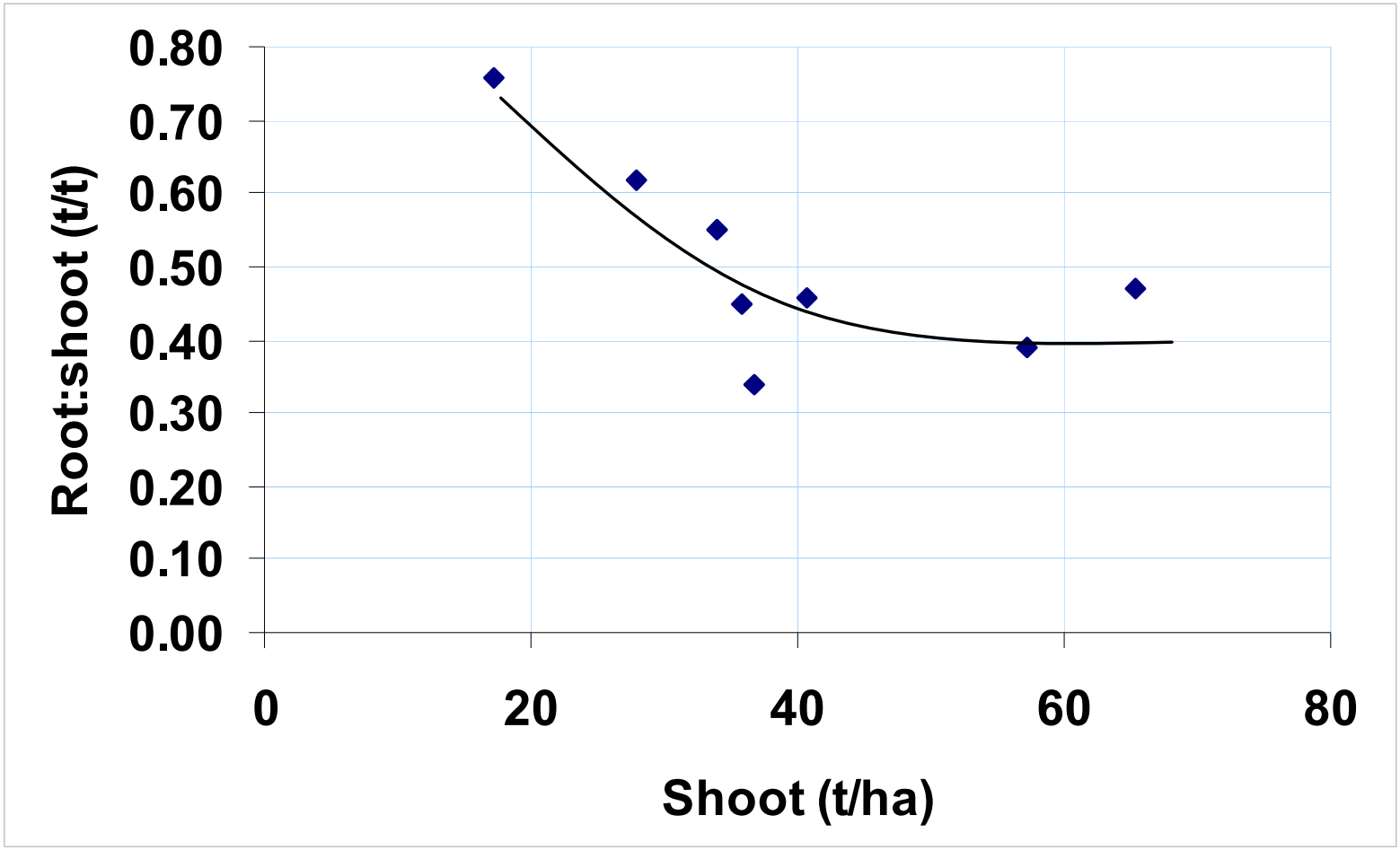
Predicting root biomass from above-ground biomass



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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).

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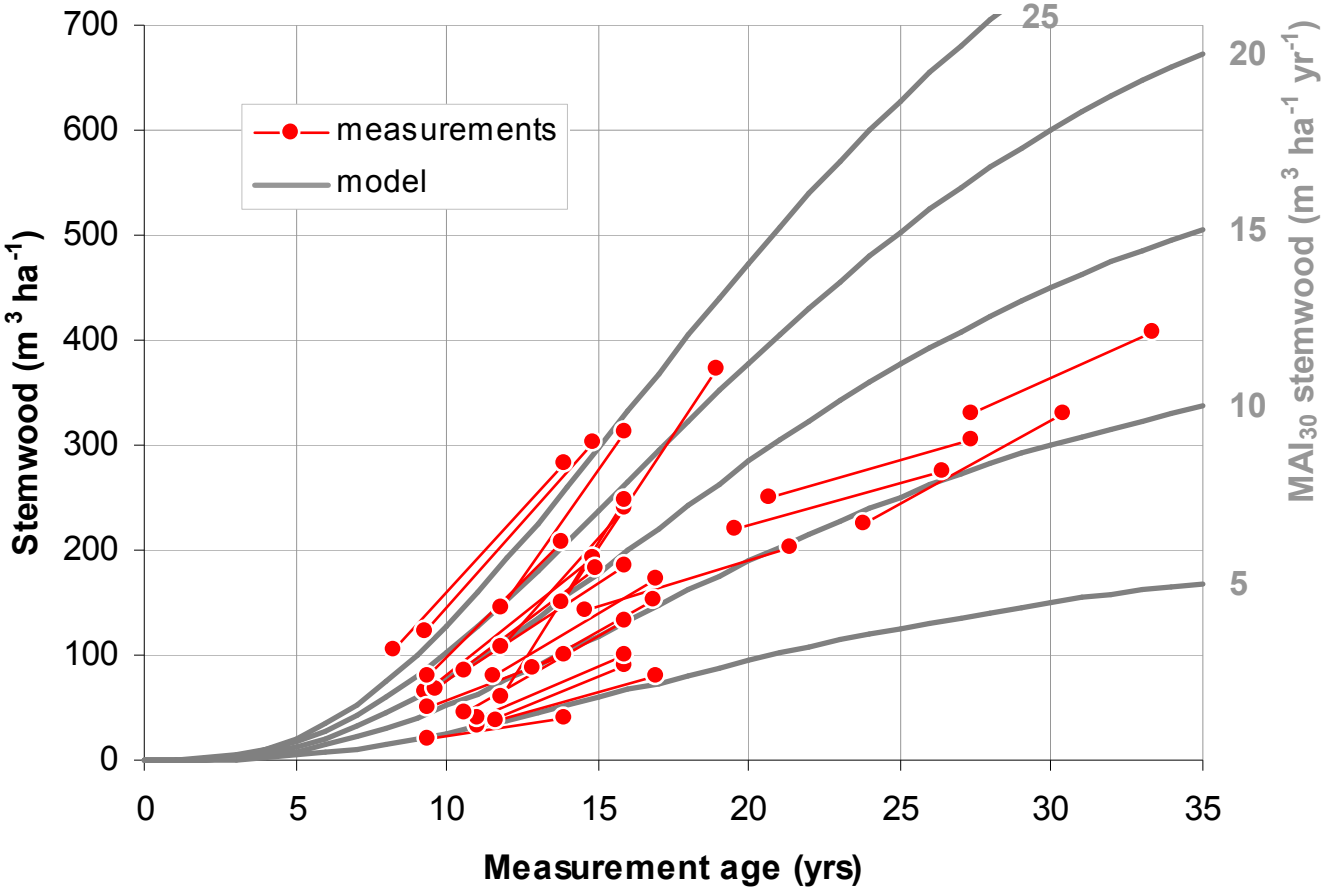
Example growth curves for Maritime Pine calculated from interval growth measurements in PSPs.



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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).