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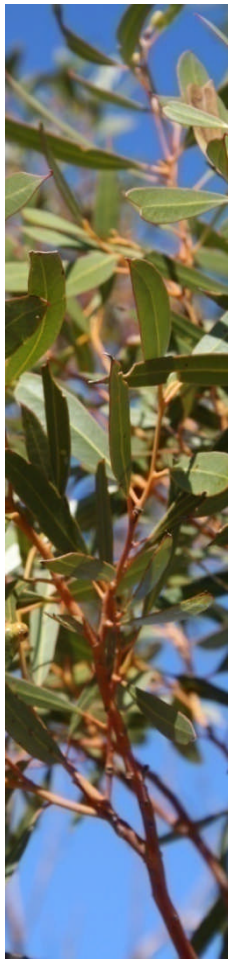

Economics of SRC and Impact of Competition for Water Resources

Amir Abadi

Future Farm Industries CRC

Australia

In collaboration with Bartle, J, Giles, R, Peck, A, Turnbull, P & McGrath, J.

Bioenergy and Water

IEA Bioenergy Task 43 Workshop

Sunshine Coast, Queensland,

Nov 25 2011

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Mallee harvester

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Woody Crop Program
R&D priorities

Aim: Development of commercially viable mallee biomass energy tree crop

1. Genetics and seed production
2. Yield measurement and estimation incorporating:
    - Design to capture water at least cost
    - Harvest regime (frequency)
    - Competition – between trees in the belt
    - Competition between trees and adjacent agriculture in alleys
3. Optimising production, harvest and haulage systems
4. Analysis of supply side costs and feasibility

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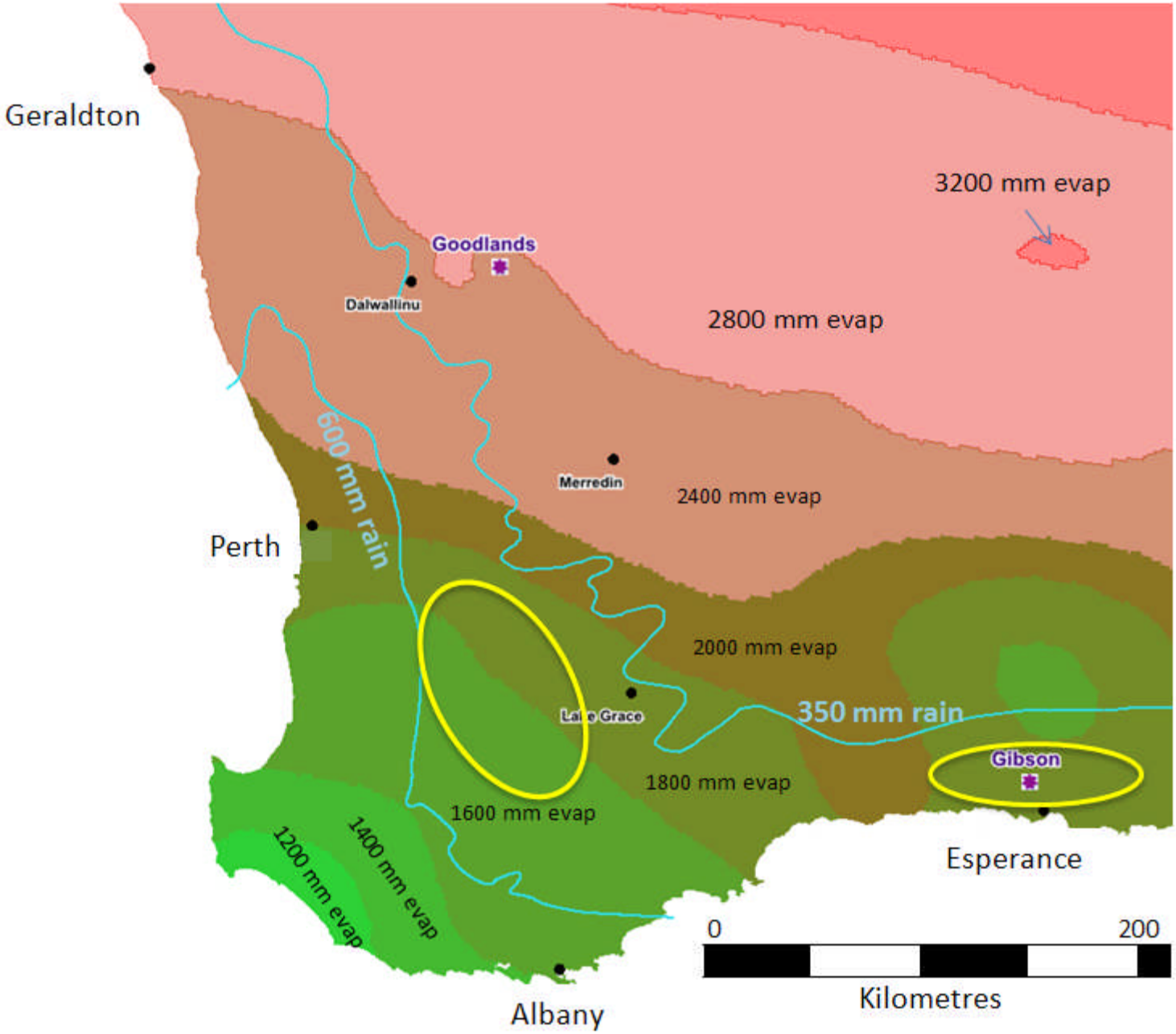

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WA case study
Great Southern and South Coast

- Annual rainfall 450-600 mm
- Wet cold winters, dry summers
- Typical soil mix: shallow duplex, deep sands, loams and clays
- Dryland farming systems - NOT marginal,
- 25-50% of farm in grain crops
- Remainder of farm in pasture for grazing livestock
- Hydrology
  - water logging ¼ yrs on shallow soils
  - run off not useful for regional water supply or env. flows
  - rising dryland salinity in low lying areas on-site valley floors
  - off- site threat to infrastructure and biodiversity assets (Ramsar listed lakes)

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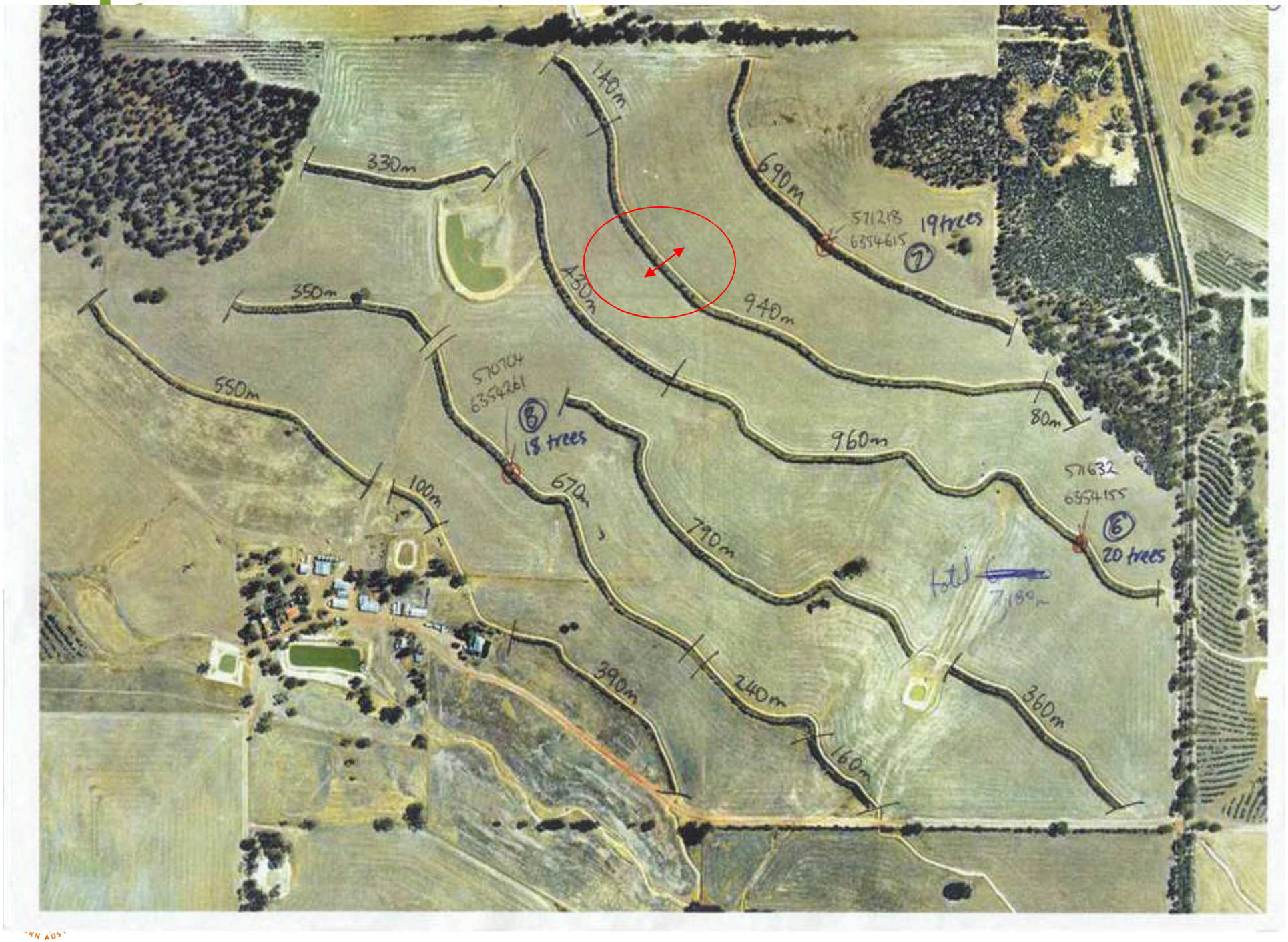
Mallee energy tree crop belt and alley layouts

- Banded two row belts (6-12 m wide)
- Maximise water harvest - wide adjacent alleys under agriculture
- Alleys are multiples of widest gear (e.g. 3-4 x 30m)
- Minimise competition with agricultural crops
- Maximise tree yield
- On contour with 1-2% slope for capture of runoff
- Reduction of recharge
- Harvest age: 6, 10, 14, …
- Mallee biomass yield 70 t/ha/harvest or 12 t/ha/annum


140m
330m
690m
571218
6354615
19 trees
7
430m
350m
940m
550m
570704
6354261
8
18 trees
80m
960m
571632
6354155
6
20 trees
100m
670m
790m
total
7,189m
390m
240m
360m
160m

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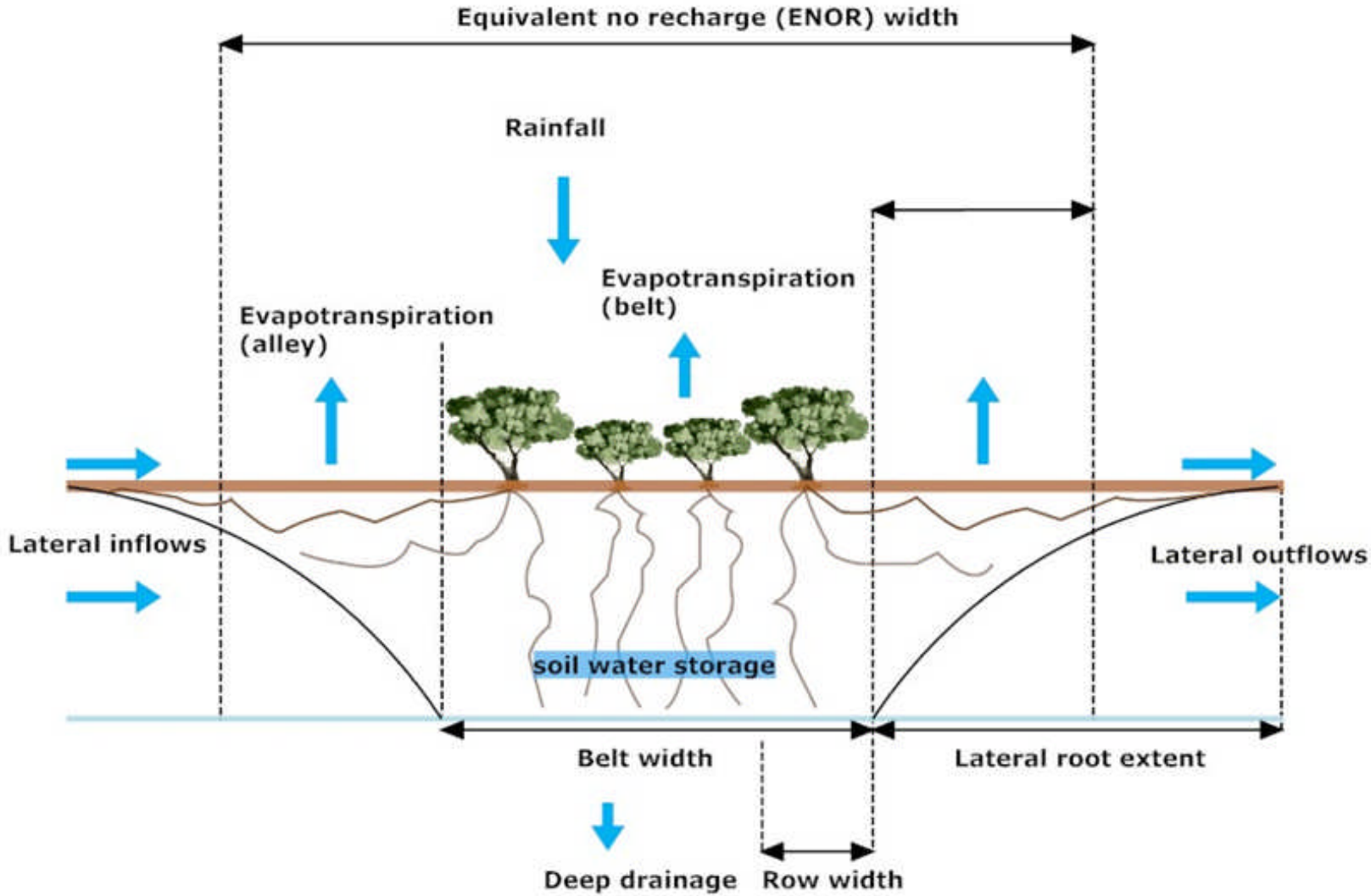
Paddock scale water balance of a multiple row mallee belt



conceptualised by Ellis et al. (1999, 2001) and reported by Bartle et al in Brooksbank (ed) 2011

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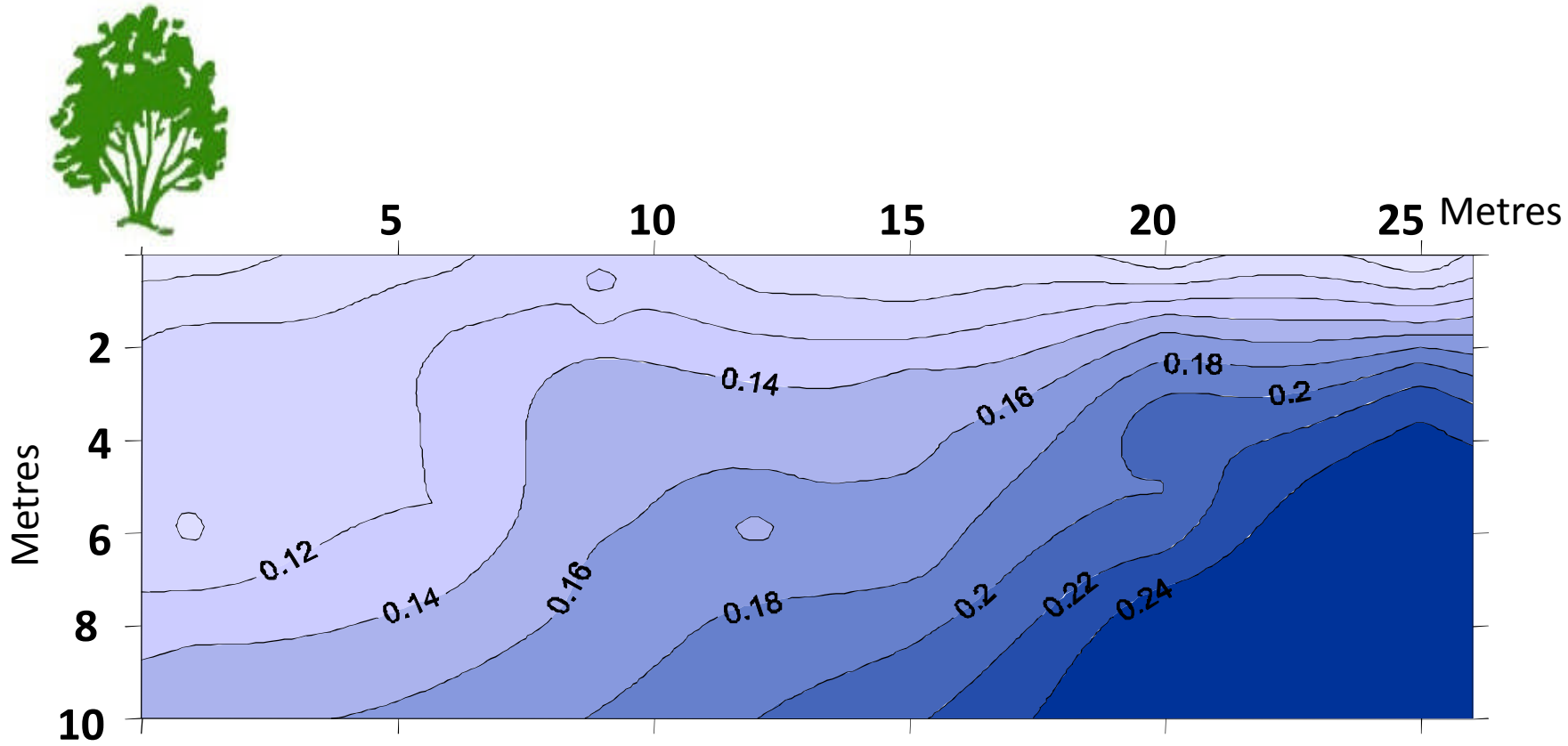
Soil water use of a mallee tree belt



Data by R. Harper et al

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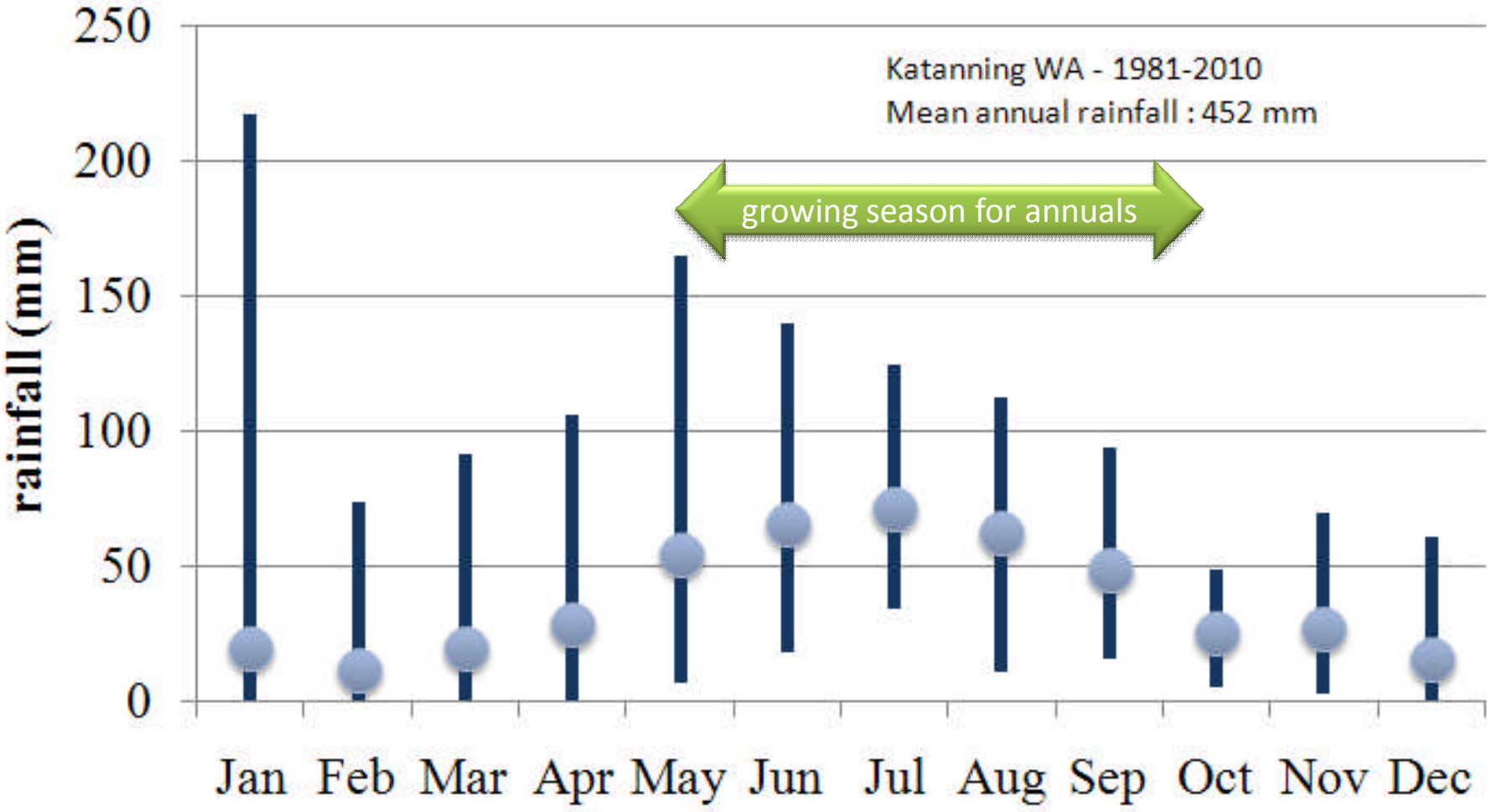
Rainfall variability



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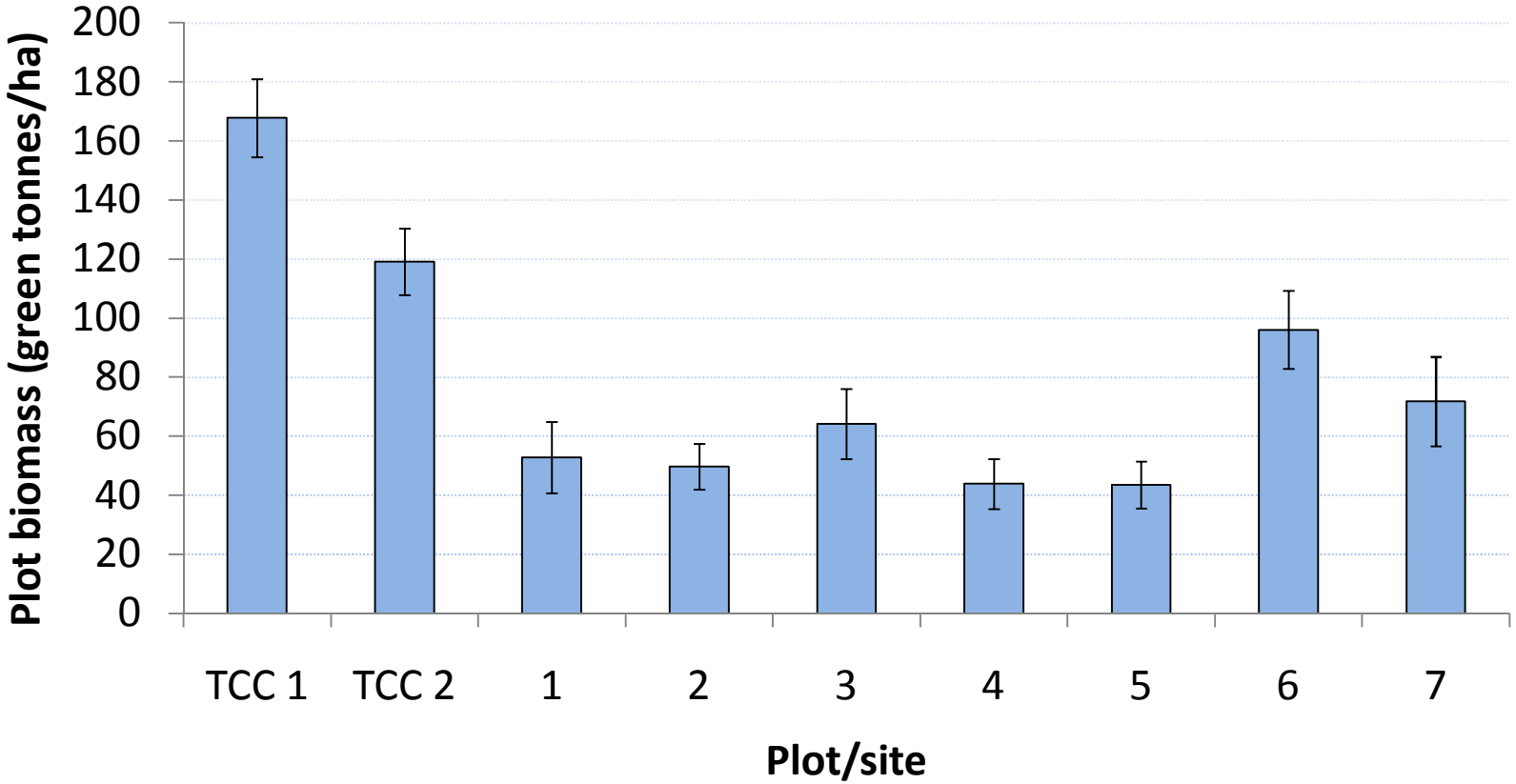
Biomass growth of mallees in belts



Biomass of the outer rows at age eight in the seven Gibson growth plots and two nearby research sites.

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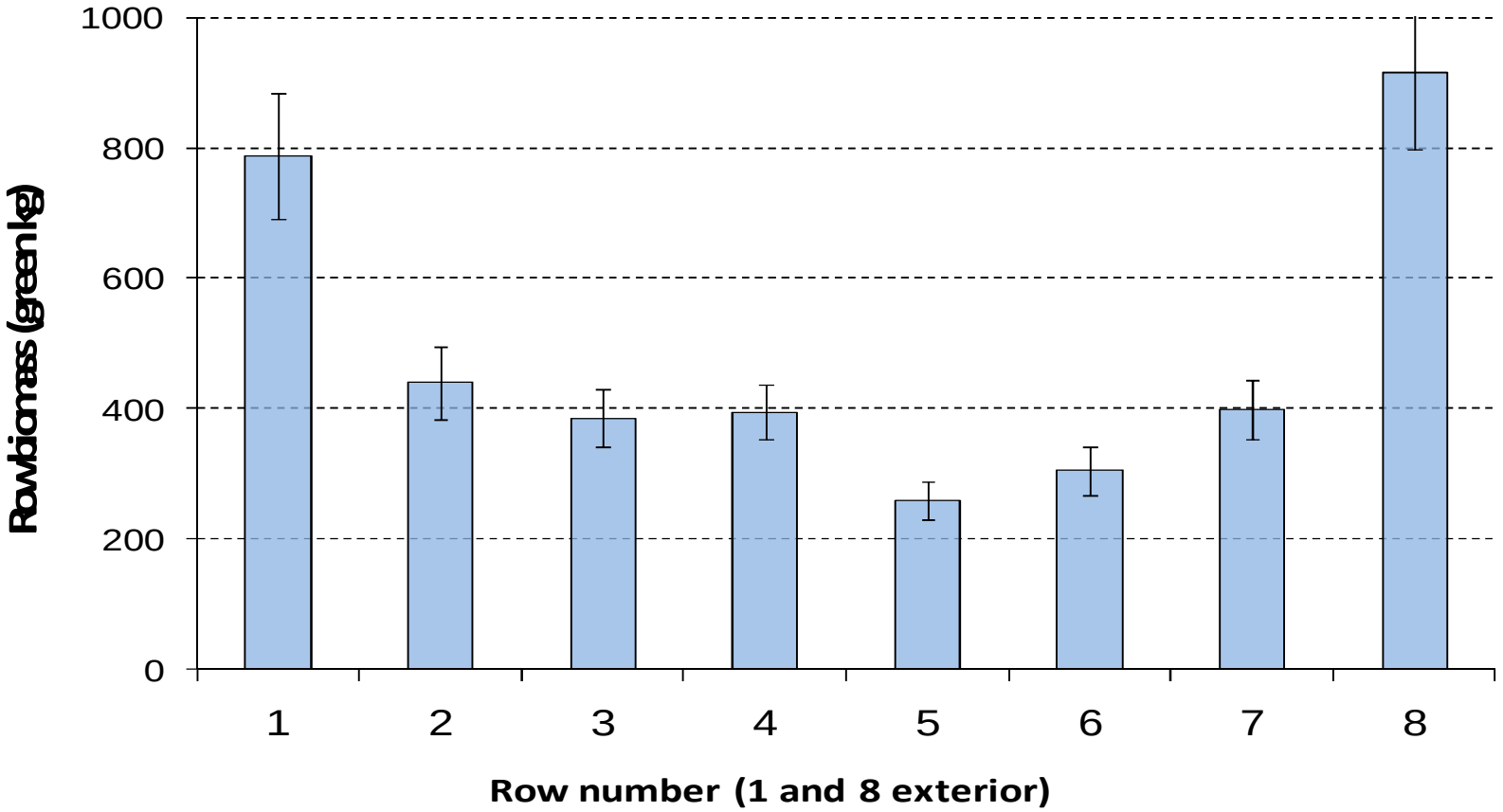
Competition Between Trees



At age eight (2009) within each row across 5 plots at the Gibson study site reported by Bartle et al in Brooksbank (ed) 2011.
Gibson mean annual rainfall = 494 mm; belt spacing (alley) >108 m

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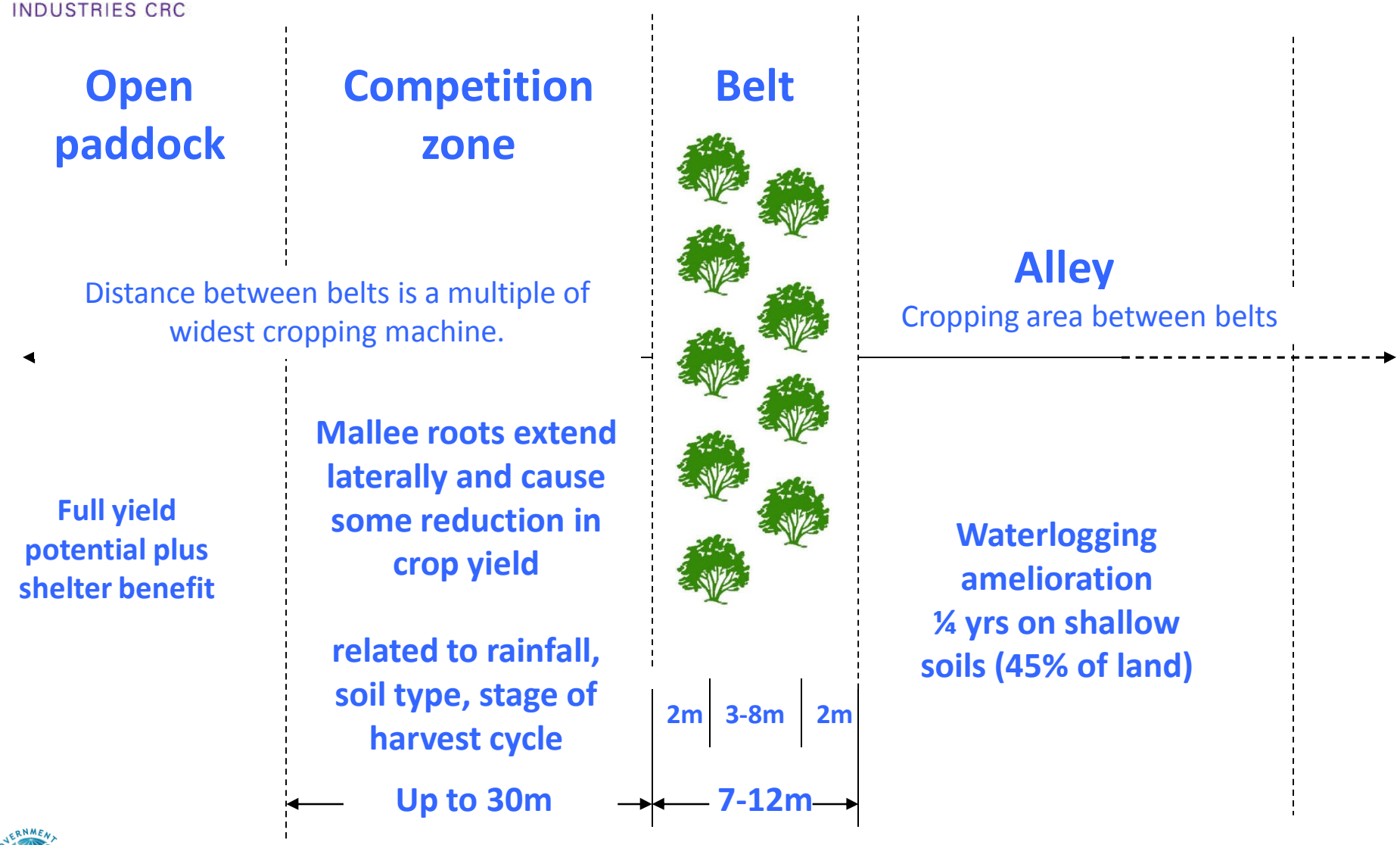
Mallee belt layout



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Trees compete with agriculture harvest reduces losses

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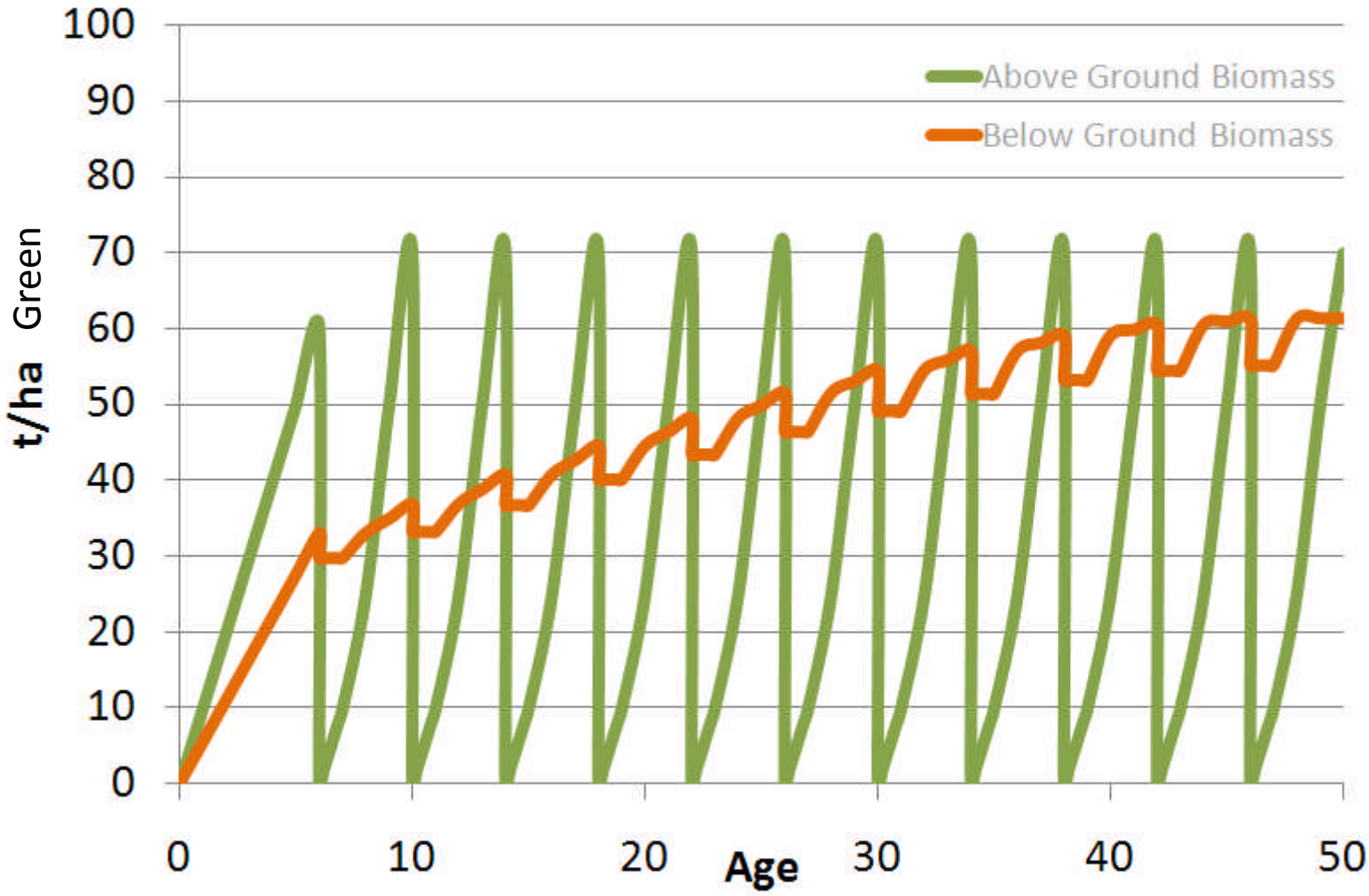
Growth and yield of coppiced mallees growing in belts with wide agricultural alleys



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450-600 mm annual rainfall GS-WA in belts

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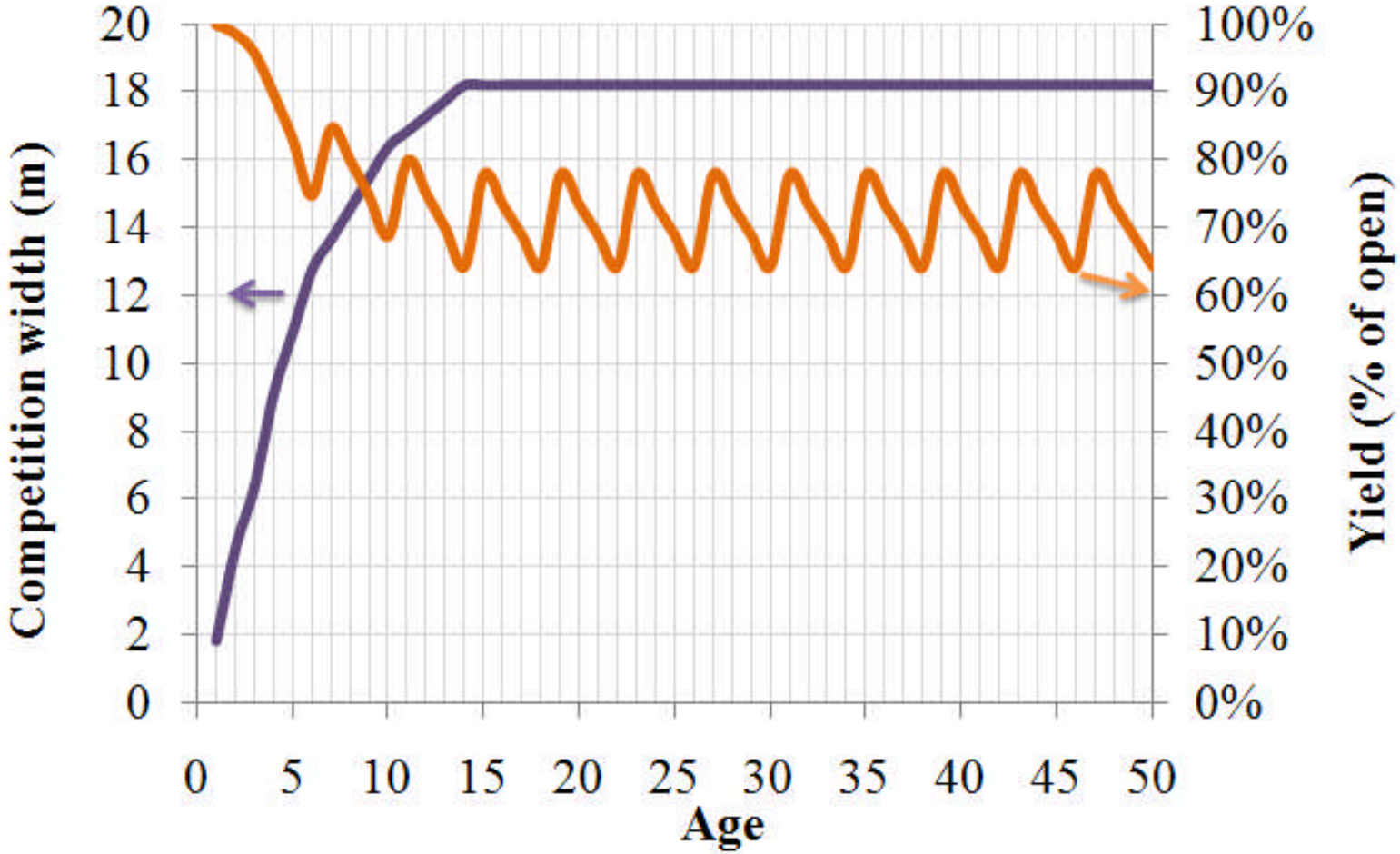
Competition



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Delivered cost of mallee biomass

Indicative costs for an established industry

Cost items	Lower Range $/gt	Upper Range $/gt
Land	8	9
Competition	13	22
Establishment	1	2
Fertiliser	4	7
Harvest and haulage	20	23
Supply chain admin	4	6
Transport to processor	10	15
Total cost	60	84

Wet (green) biomass is 45% moisture.
In dry tonne terms (15%moisture) : LR: $93/t & UR: $130/dt
Analysis is for a mature biomass industry and harvest is at 50-60 gt/hour
Longer rotations may reduce cost of fertilizer as wood fraction would increase in older biomass. Assume fertilizer is applied with ag applications

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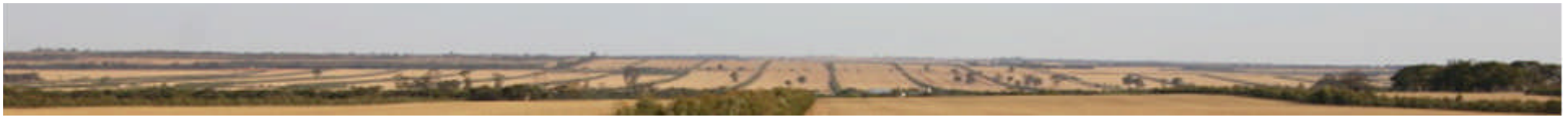
Mallee Biomass Revenues and Benefits

Revenues and benefits items	Lower range $/gt	Upper range $/gt
Sale of biomass	40	64
Carbon credits	Nil	2.3
Reduced water-logging & recharge	Negligable	14.5
Windbreak and livestock shelter	Negligable	0.2
Positive externalities	1	2.6
Total revenues and benefits	41	84
Gap (costs minus returns)	19	Nil



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