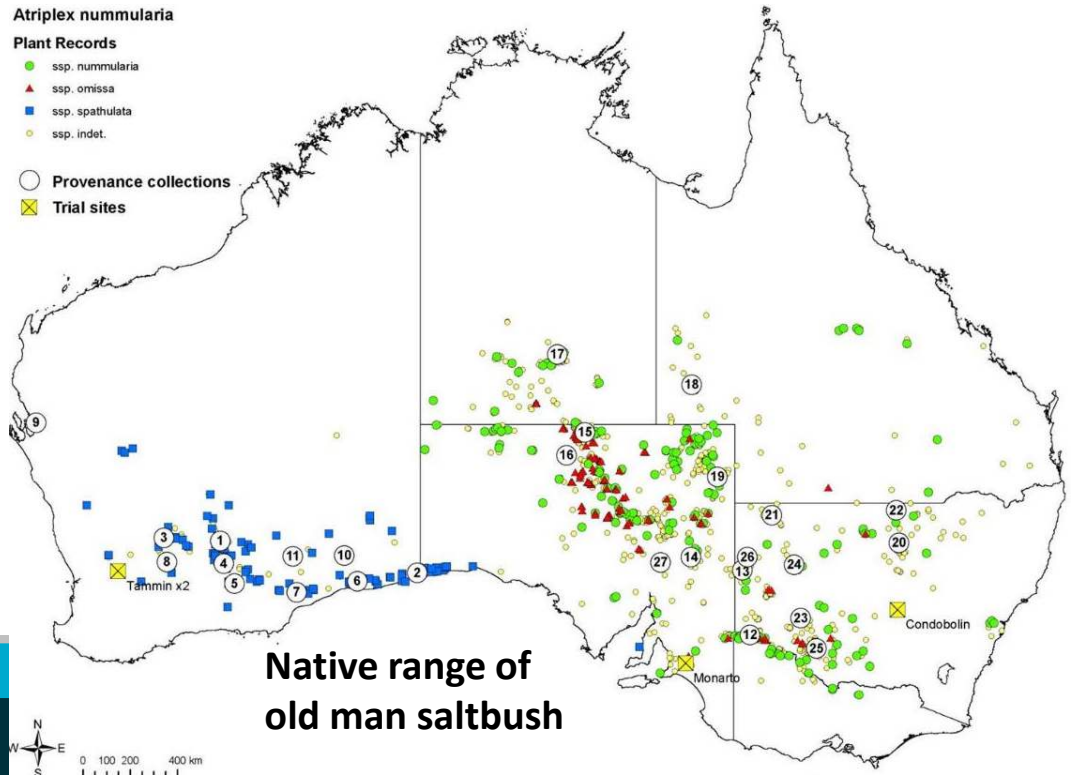
Variation in productivity and feeding value among eight species of Australian native shrubs

Hayley Norman, Matt Wilmot, Elizabeth Hulm, Paul Young, Josh Hendry, Andrew Toovey, Dean Thomas

Why focus on the Chenopodiaceae family?

- Well adapted to dry, saline and/or nutrient deficient conditions
- Economic studies demonstrate that these shrubs can lift whole-farm profitability, reduce supplementation and reduce risk by buffering poor seasons
- Productive on ‘marginal’ soils, so adoption has a lower opportunity cost when compared to many perennial systems



Native range of old man saltbush

Why focus on the Chenopodiaceae family?

- Shade and shelter for livestock
- Nutrients to manage heat stress
- Secondary compounds that may reduce methane and gut parasites
- Manage salinity

‘Shrub Nitrates’ project

- 8 species, 20 accessions (12 blocks/site) – 1300 planta/ha
- Replicated grazing comparisons of shrubs and adjacent pastures or stubbles
- Economic modelling to ID targets for plant improvement
- Methane emissions?

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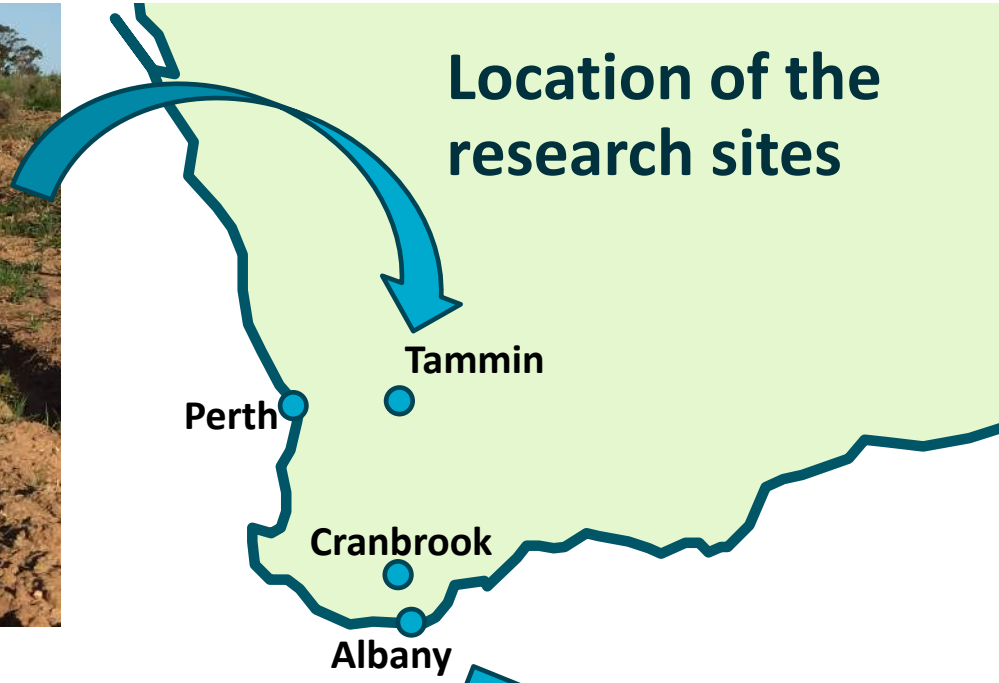
Tammin

- 340 mm rainfall
- Saline clay loam
- Last wheat crop

Location of the research sites



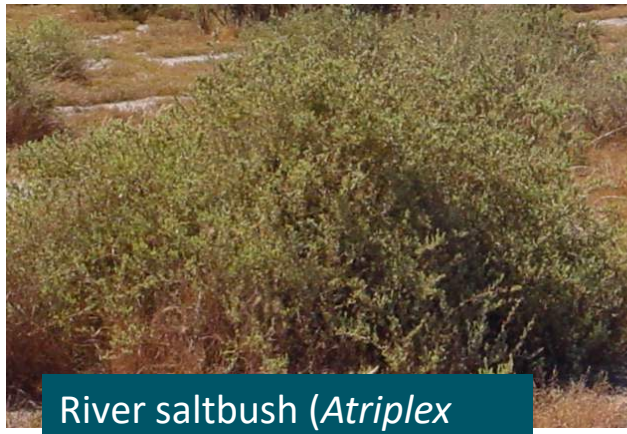
Cranbrook

- 500 mm rainfall
- Saline clay loam
- Long term pasture

Oldman saltbush (*Atriplex nummularia*, 10 acc.)

silver saltbush (*Atriplex rhagodioides,* 1 acc.)

Mallee saltbush (*Rhagodia preissii*, 2 acc.)



River saltbush (*Atriplex amnicola,* 1 acc.)

Ruby saltbush (*Enchylaena tomentosa,* 2 acc.)

tar brush (*Eremophila glabra,* 1 acc.)

Small-leaved bluebush (*Maireana brevifolia,* 2 acc.)

nitre bush (*Chenopodium nitrariaceum,* 1 acc.)


Feeding value
'Edible' biomass
Voluntary intake
Nutritional value

Meat &
Wool

Meat & Wool

(Leaves & stems <3mm)

- **Regrowth after grazing**
- **Time of growth**
- Persistence

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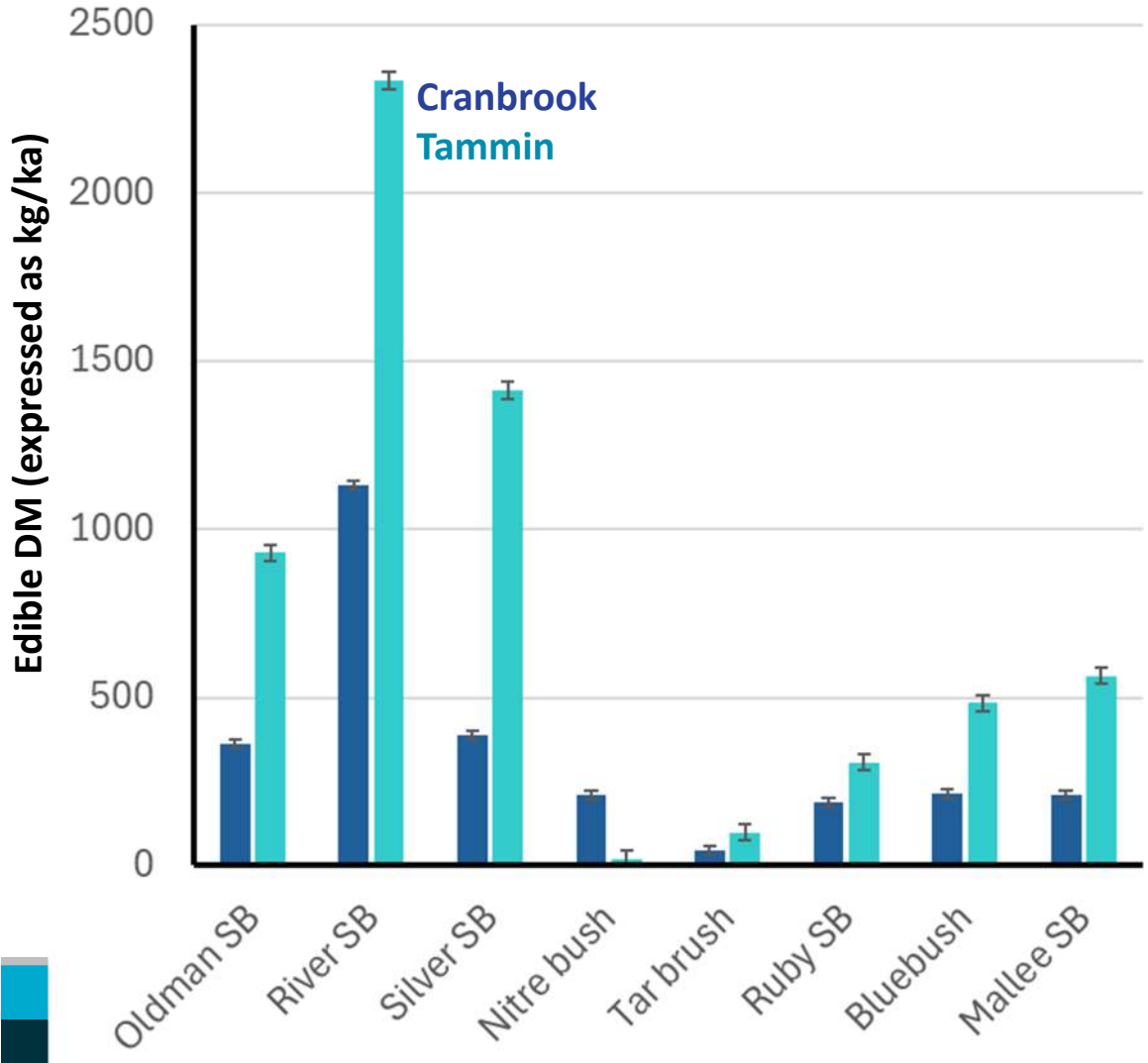
- Ease of prehension
- **Relative palatability**
- Intake constraints

Feeding value	=	'Edible' biomass	+	Voluntary intake	×	Nutritional value

Meat & Wool		(Leaves & stems <3mm)
		• **Regrowth after grazing**
		• Time of growth
		• Persistence
				• Ease of prehension
				• **Relative palatability**
				• Intake constraints
						• **Energy**
						• **Protein**
						• Fibre
						• Vitamins & minerals
						• **Antinutritionals & imbalances**
						  • **Salt**
						  • **Nitrate**
						  • **Oxalate**

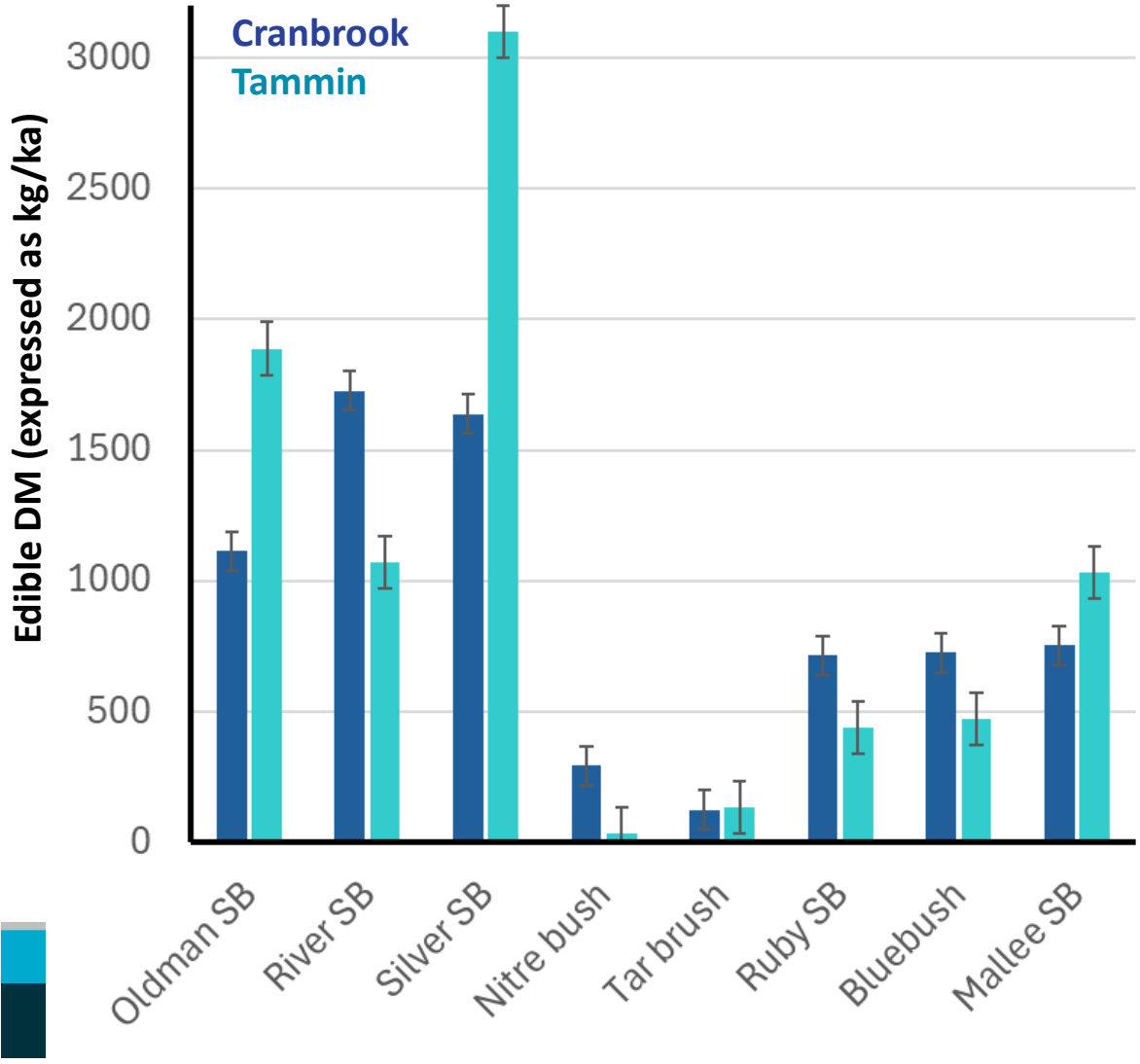
Feeding value	=	‘Edible’ biomass	+
Meat & Wool		(Leaves & stems <3mm) • **Initial growth** • **Regrowth after grazing** ~~• Time of growth~~ ~~• Persistence~~	

Mean EDM production (kg/ha) in the first two years



- Tammin more productive than Cranbrook
- River saltbush was the most productive species (2.5 t/ha EDM at Tammin).
- Silver & oldman saltbush next best
- Tar brush, nitre bush, Mallee saltbush, ruby saltbush and bluebush produced < 500 kg EDM/ha

Mean EDM production (kg/ha) 9 months after heavy grazing



- Cranbrook; river and silver saltbushes (~1,700 kg EDM/ha), oldman saltbush (~1,200 kg EDM/ha)
- Tammin; silver saltbush (~3,000 kg EDM/ha) was the most productive species at Tammin, followed by oldman saltbush (~2,000 kg EDM/ha)

Feeding value	=	‘Edible’ biomass	+	Voluntary intake	×	Nutritional value

Meat & Wool		(Leaves & stems <3mm)		~~• Ease of prehension~~
				• **Relative palatability**
				~~• Intake constraints~~
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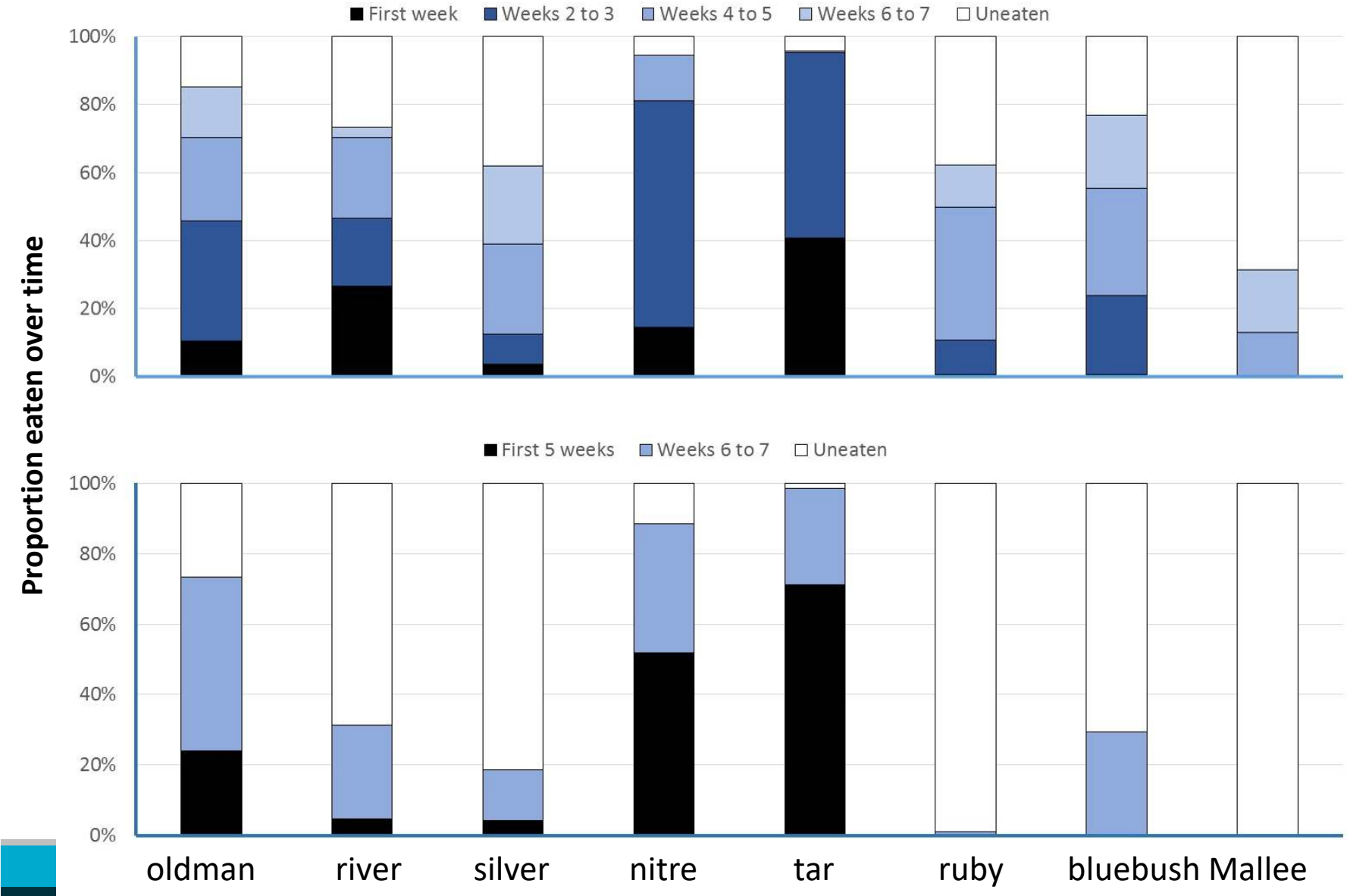
Relative palatability at Cranbrook



Feeding value	=	‘Edible’ biomass	+	Voluntary intake	×	Nutritional value
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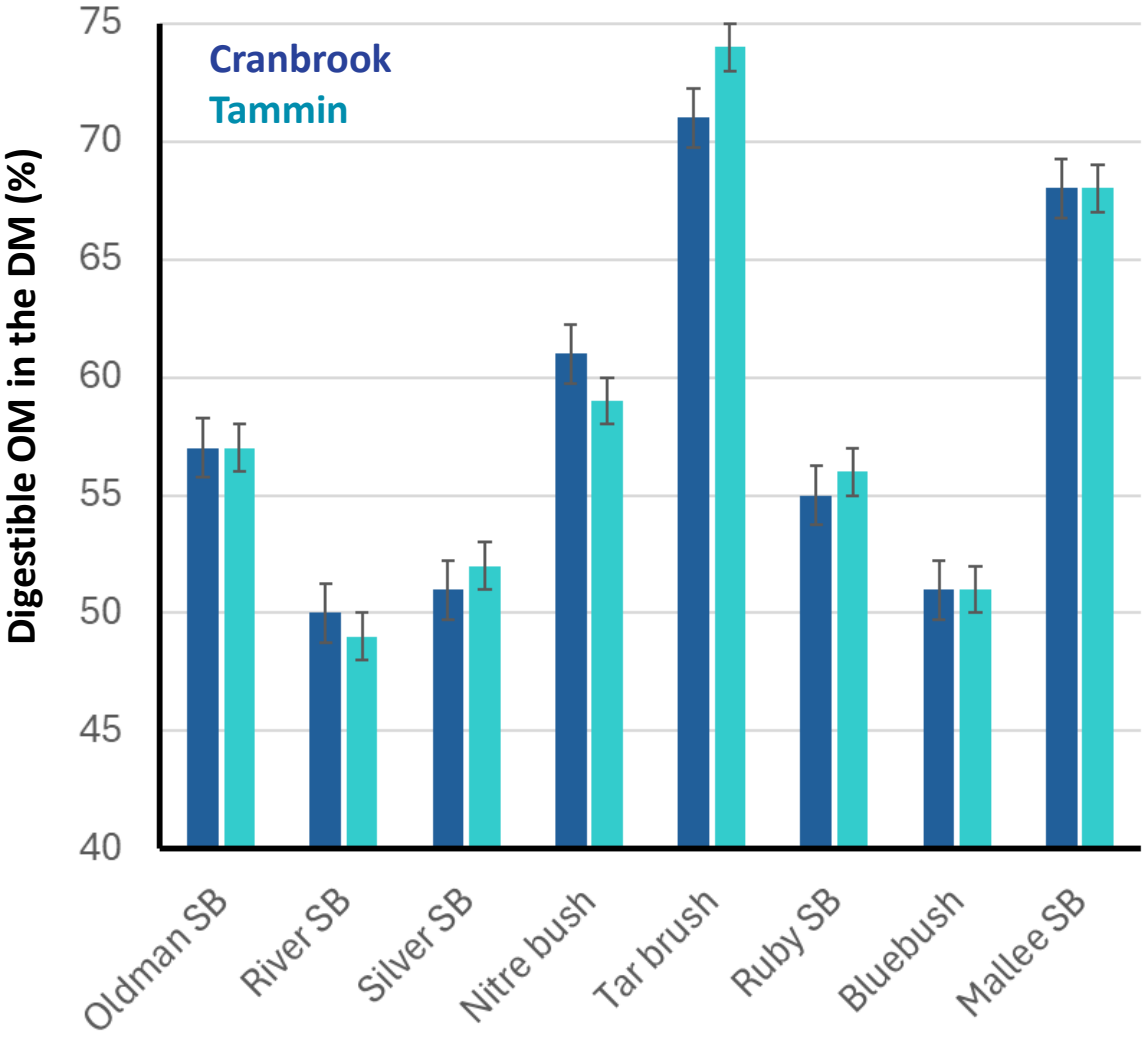
Mean energy - digestible organic matter in the edible DM (%)



- Tar brush and Mallee saltbush had the highest energy

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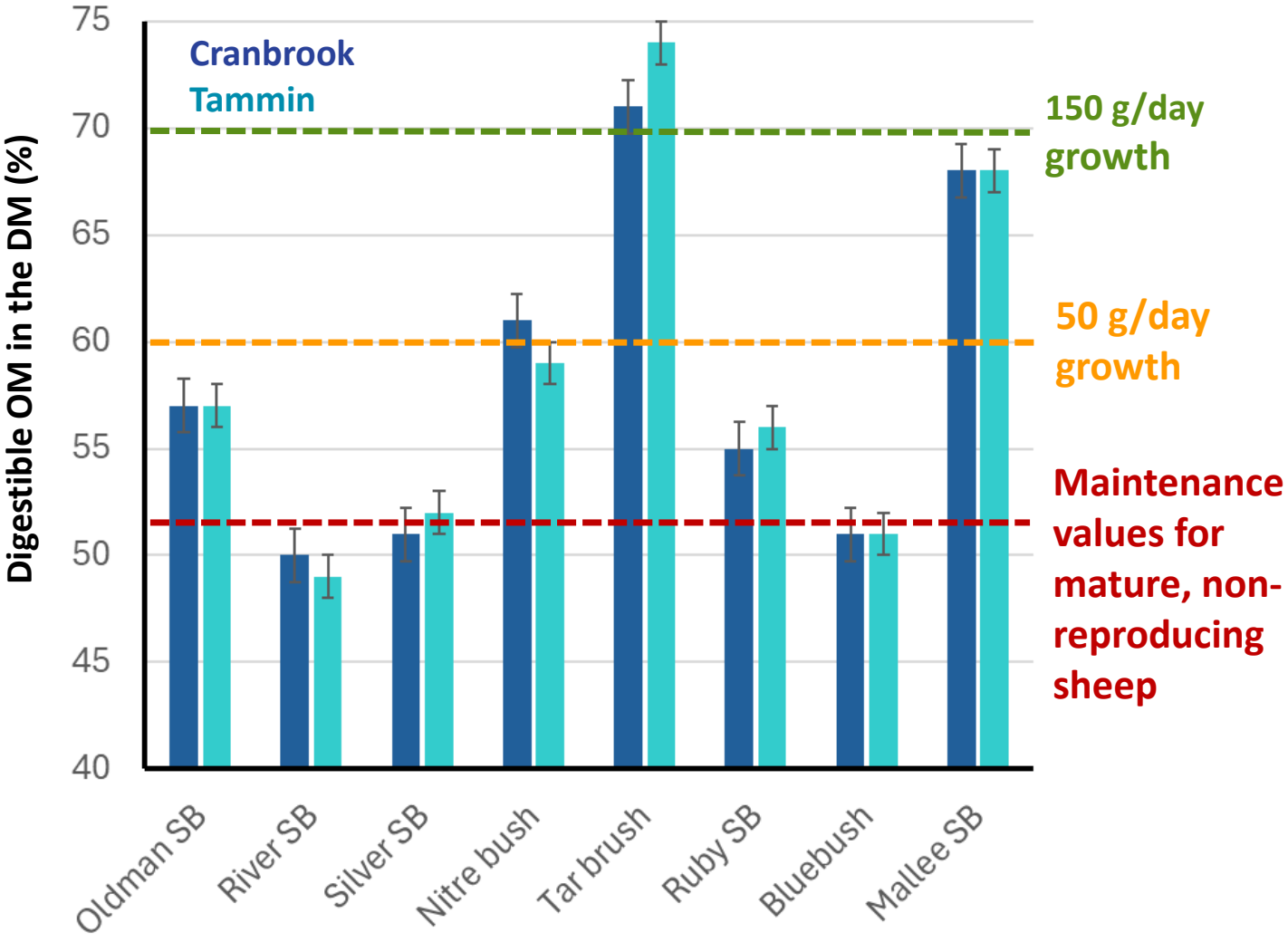
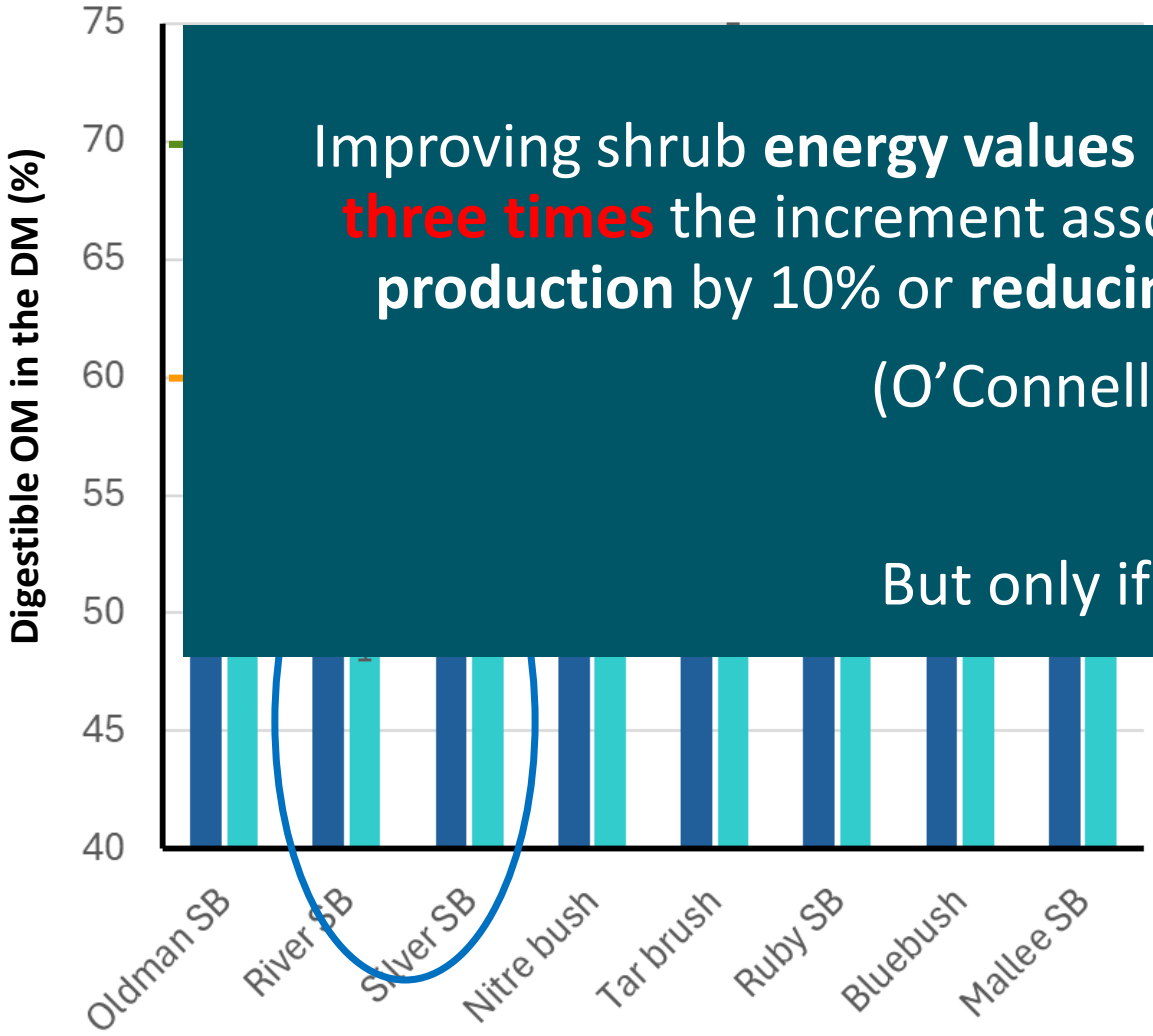


- Tar brush and Mallee saltbush had the highest energy
- River saltbush, silver saltbush and bluebush below maintenance requirement

The most productive species had the lowest energy values!

Energy - digestible organic matter in the EDM (%)



Improving shrub **energy values** by 10% would increase profits by **three times** the increment associated with increasing **biomass production** by 10% or **reducing establishment costs** by 10%

(O'Connell *et al*. 2006)

But only if they eat it!

reproducing sheep

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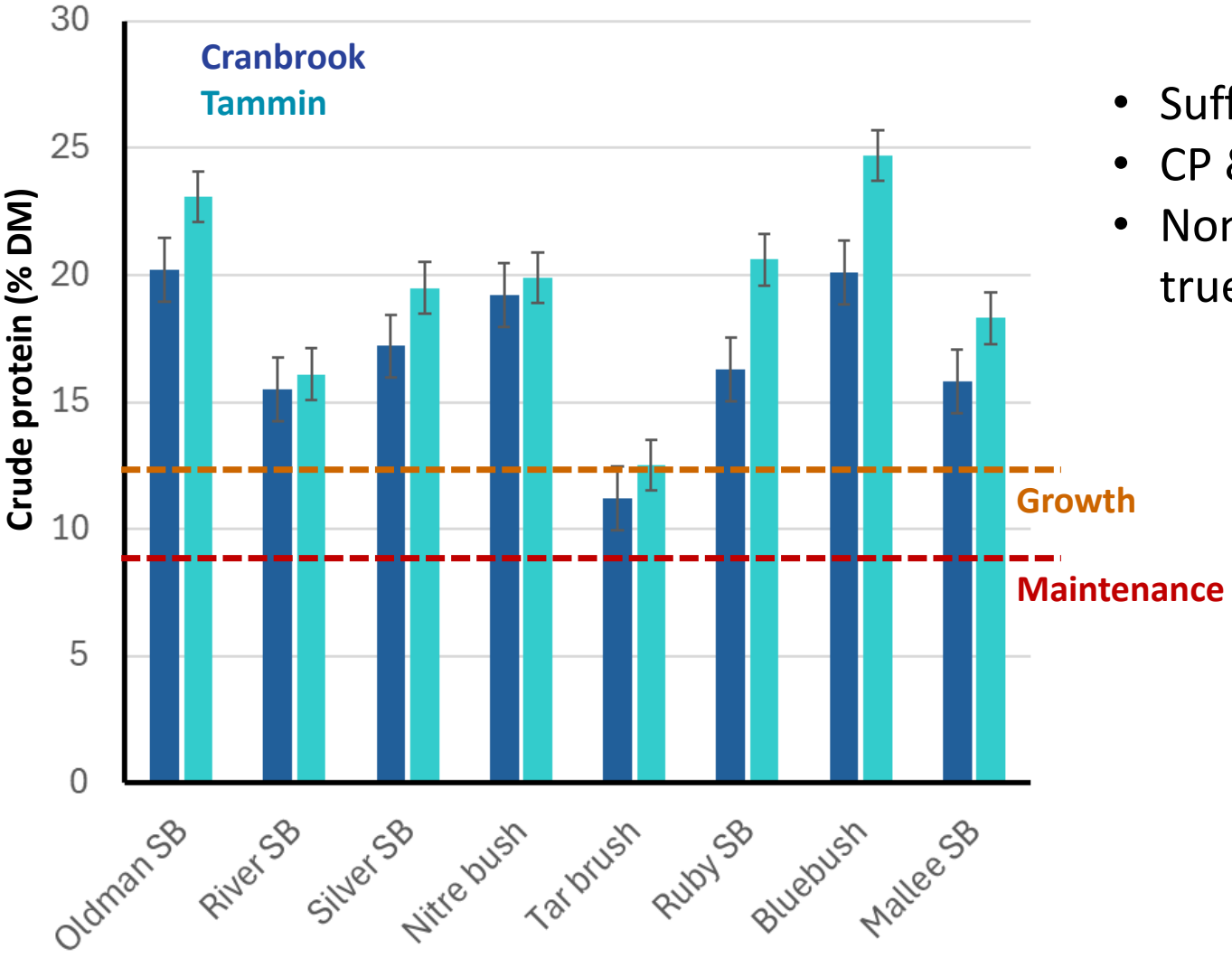
Mean crude protein content (% DM) of EDM



- Sufficient CP for maintenance & growth
- CP & S for wool
- Non-protein N compounds could mean true protein is lower

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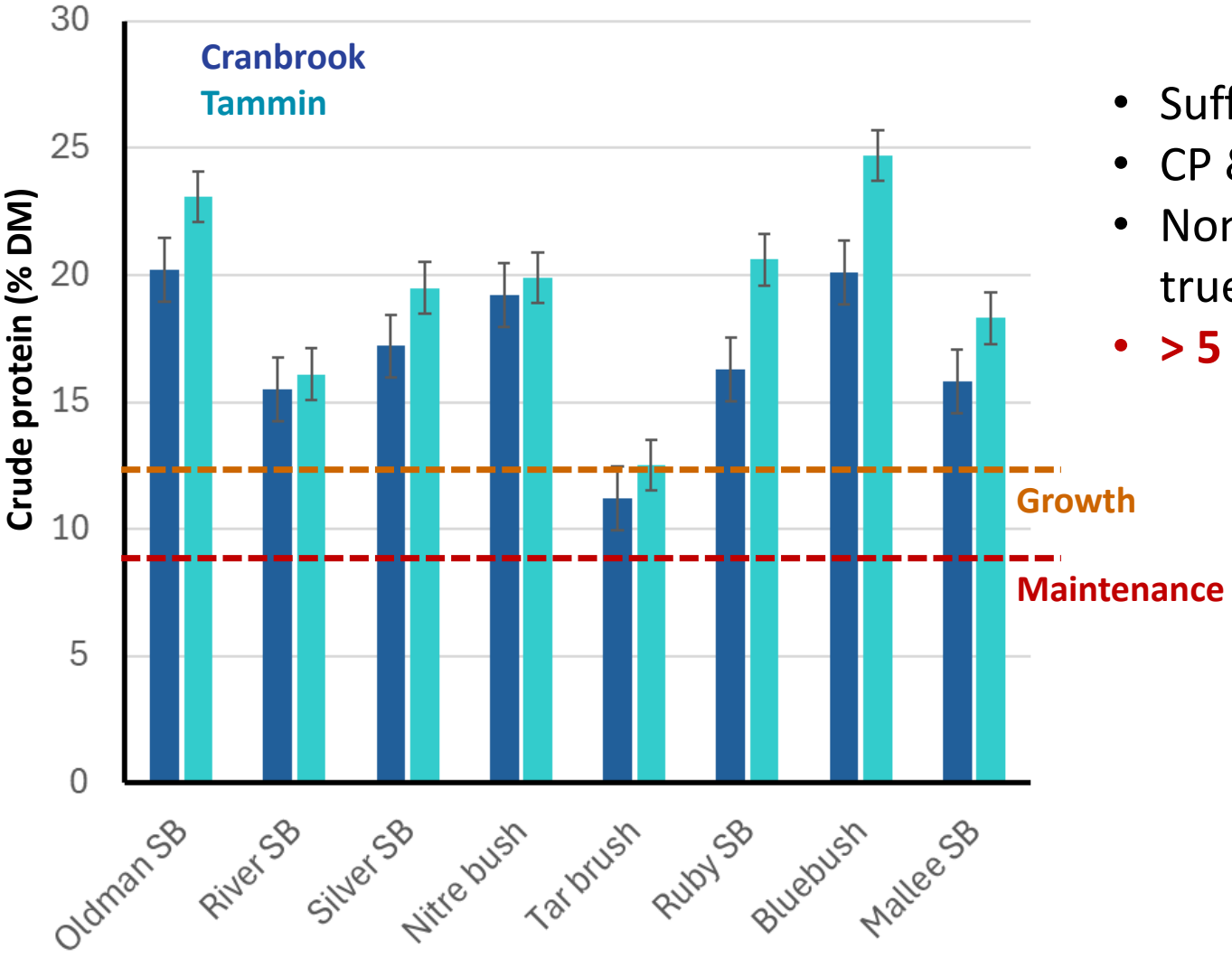
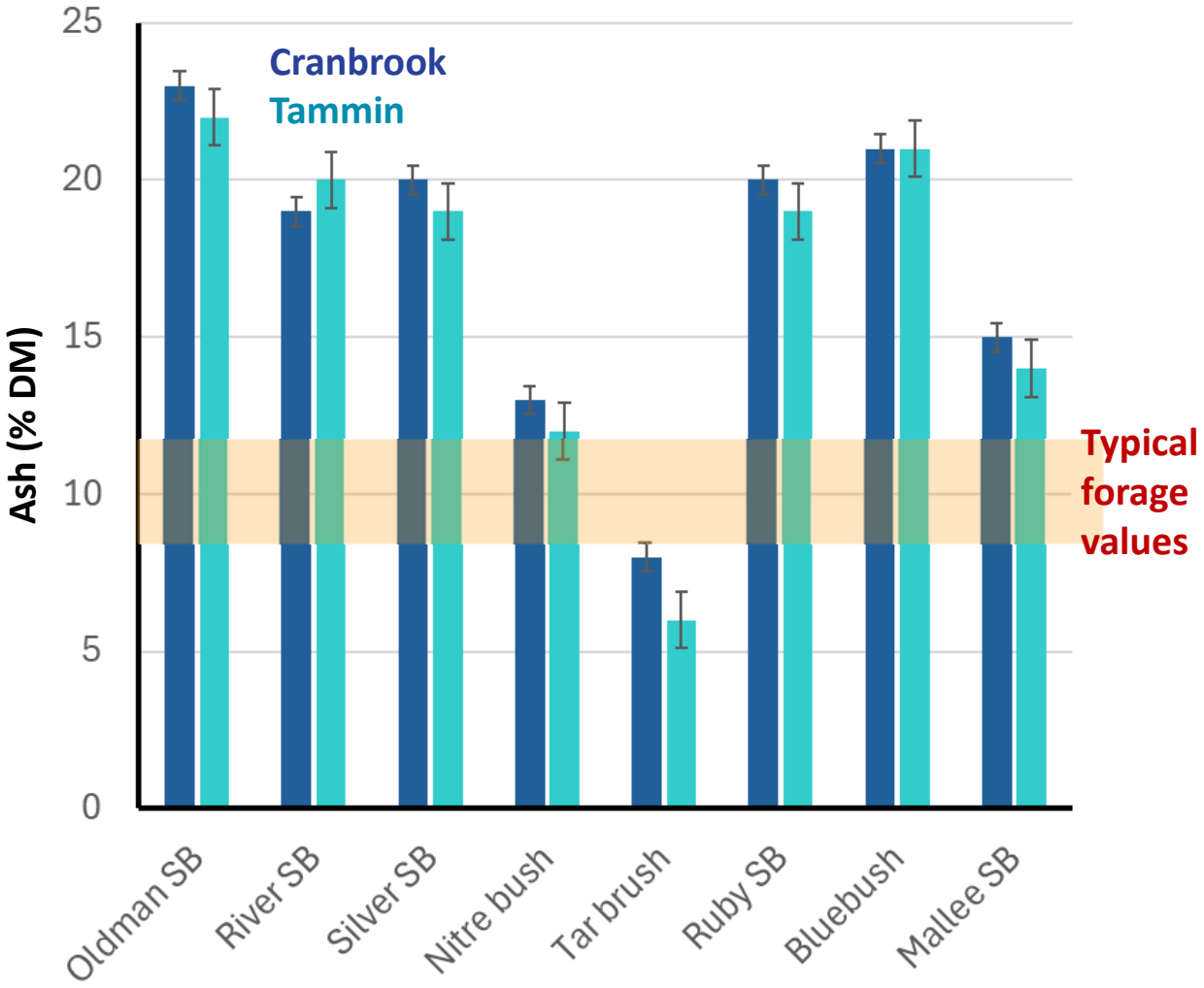


- Sufficient CP for maintenance & growth
- CP & S for wool
- Non-protein N compounds could mean true protein is lower
- **> 5 mg/kg nitrate may be toxic**

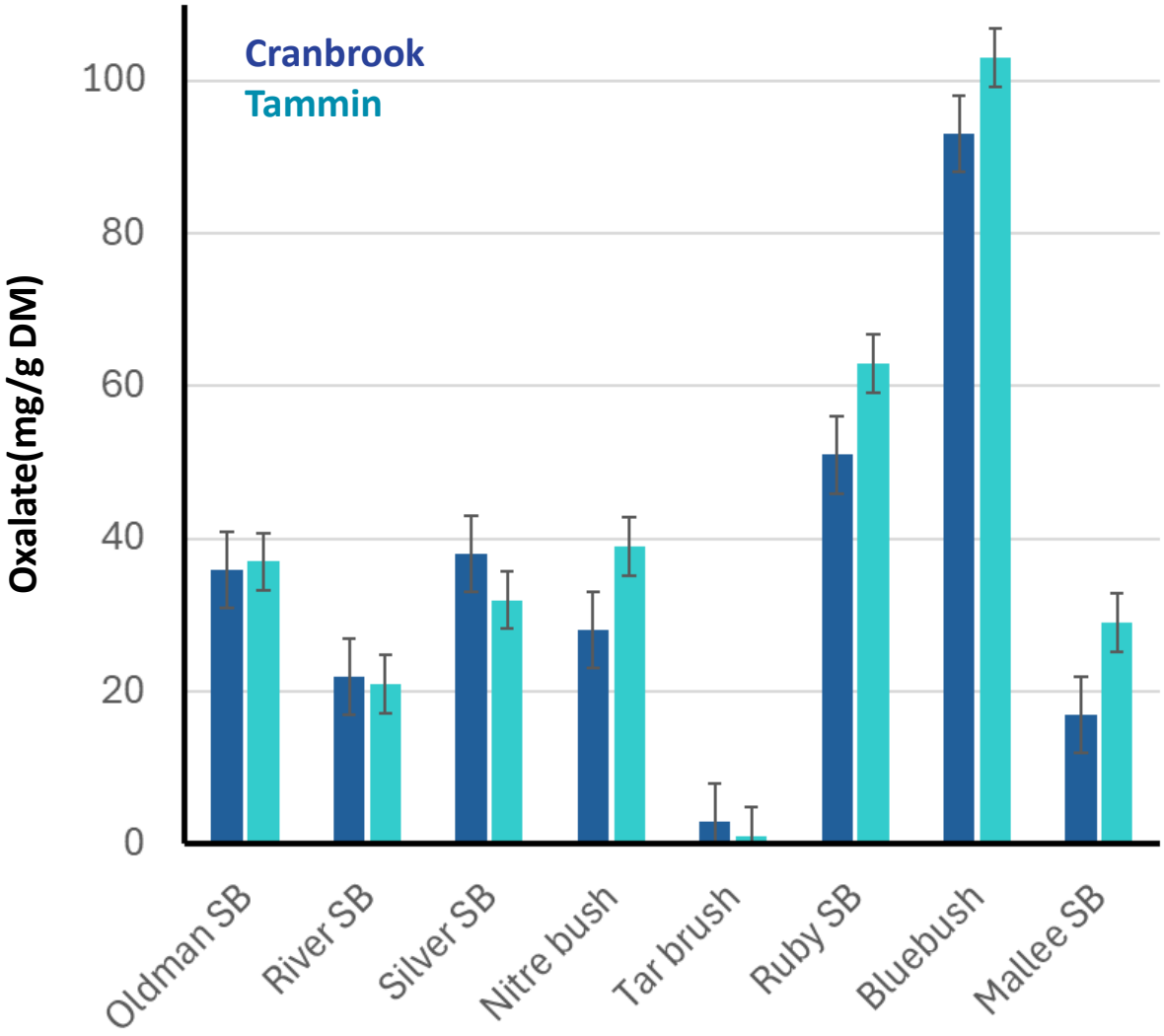
Nitrate mg/kg DM		
	Cranbrook	Tammin
Oldman SB	1.9	3.1
River SB	1.3	1.8
Silver SB	2.4	4.6
Nitre bush	**7.7**	**12.6**
Tar brush	0.3	0.4
Ruby SB	3.7	**7.5**
Bluebush	2.1	**12.1**
Mallee SB	4.2	**5.6**

Mean ash (salt) content of EDM



- Accumulate salt (drought tolerance strategy)
- Restricts intake (~175 g salt/day for sheep)
- Non-salty feed is needed to complement
- Contributes to more wool

Mean oxalate (mg/g DM) in the ‘edible’ dry matter



- Use organic acids for osmotic adjustment and as anions to achieve cation-anion balance

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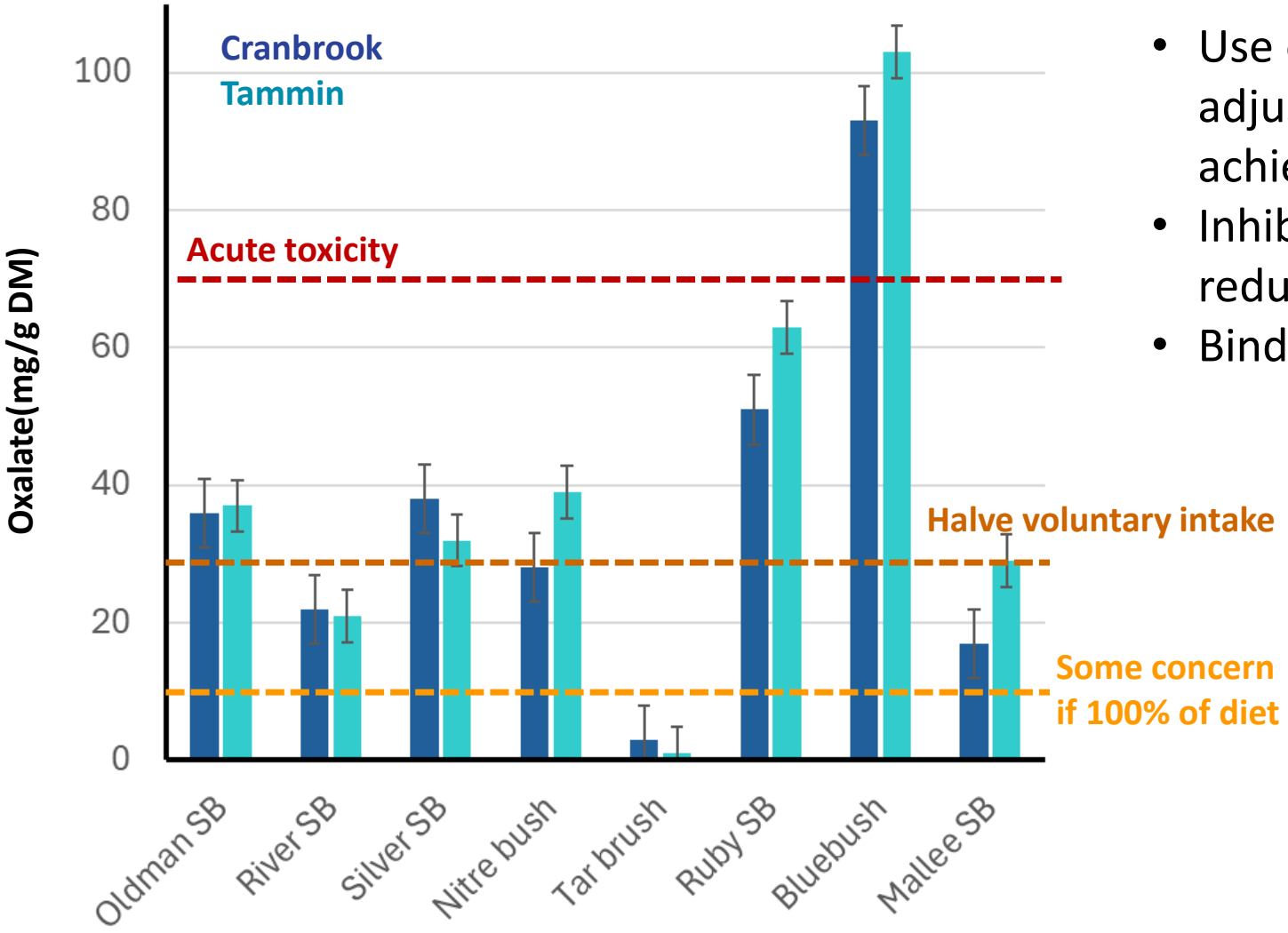

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- Inhibits respiratory enzymes and reduces blood Ca
- Binds minerals (Mn, Fe, Cu, Zn)

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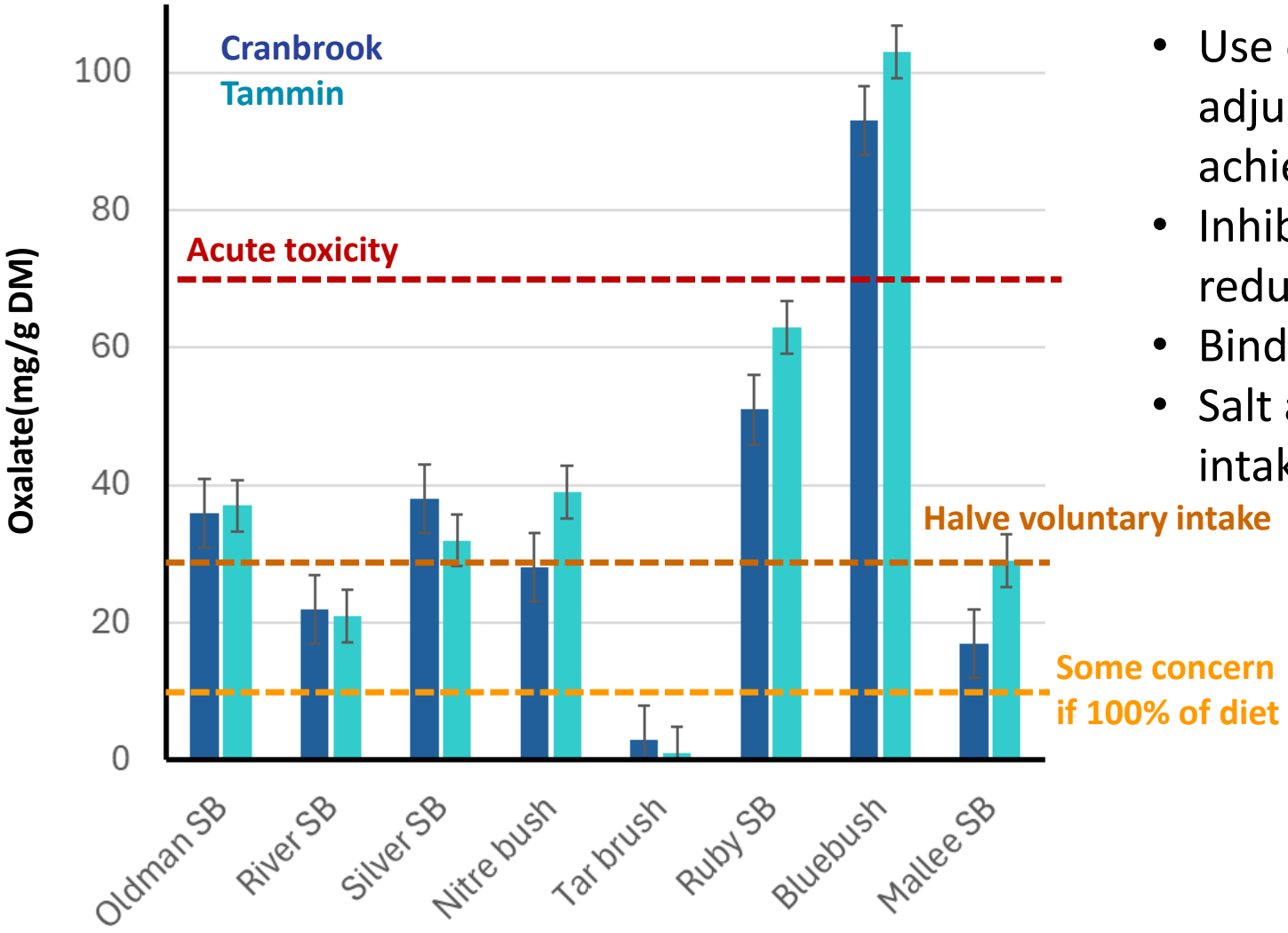

- Use organic acids for osmotic adjustment and as anions to achieve cation-anion balance
- Inhibits respiratory enzymes and reduces blood Ca
- Binds minerals (Mn, Fe, Cu, Zn)
- Salt and sulphur content keeps intake below toxic thresholds

Bluebush and ruby saltbush could be an issue – especially for lambing ewes

Grazing value in autumn

Cranbrook

- 2015 - wethers @ 15/ha grew 50 g/day over 6 weeks

  (630 grazing days/ha)
- 2016 - ewes @ 15/ha grew 75 g/day over 7 weeks, half of the shrub EDM remained

  (720 grazing days/ha)

Cranbrook

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  (720 grazing days/ha)
- GrassGro™ modelling;
  - Shrubs reduced supplementary feeding cost by $214/pasture ha
  - Shrubs with 20% higher energy would increase the GM of the livestock enterprise by 6-14%

Tammin

- 2015 - ewes grew 145 g/day
- Flockmates grazing wheat stubbles lost 81 g/day.
- GrassGro™ modelling found;
  - shrubs efficiently buffer against the poorest 10% of seasons
  - doubled the GM $40/pasture ha to $80/pasture ha

In conclusion

- Oldman SB the most promising species
- Variation in all aspects of feeding value
- Anameka™ old man saltbush commercialised in 2014
- Developing the next generation with a focus on seed establishment

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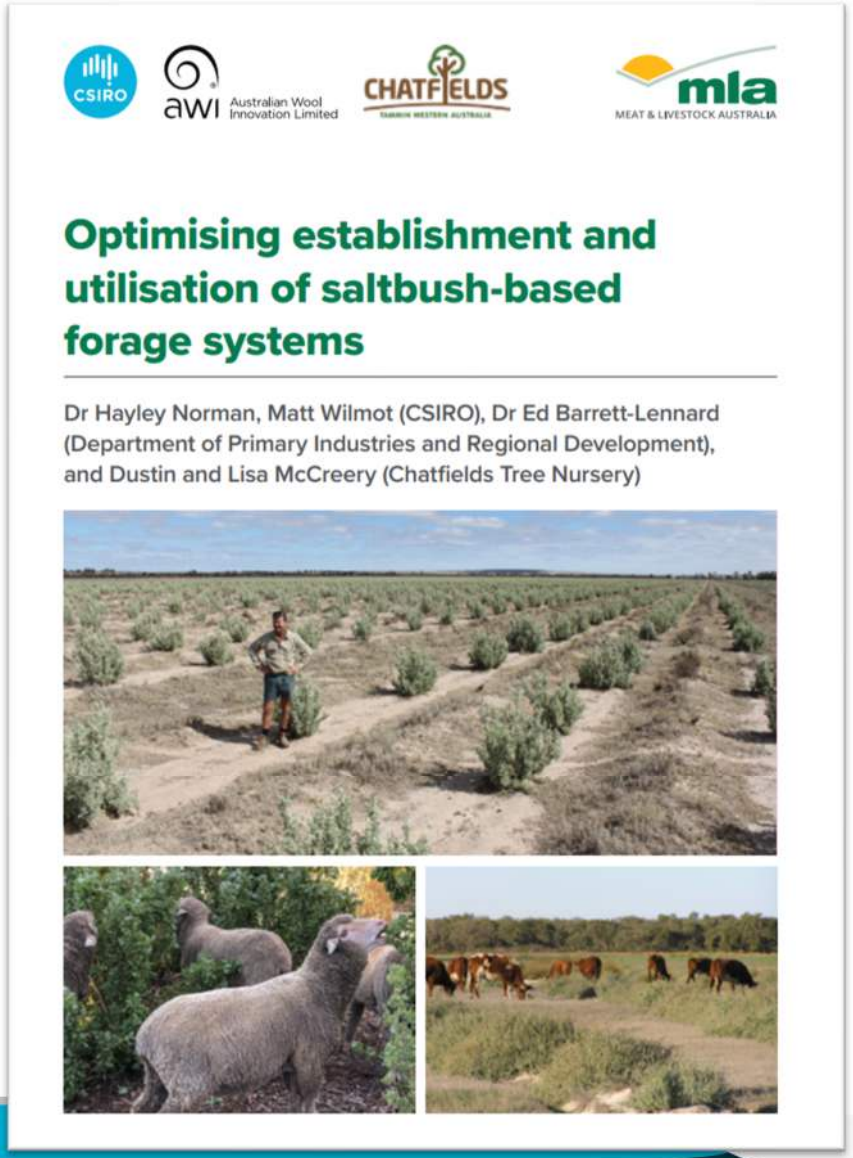
Economic models suggest Anameka can double the profitability of the shrub enterprise

In conclusion

- Mixtures may enable greater intake – however difficult to manage
- Based on nitrate and sulphate levels & intake, access to the shrubs could lead to a 20% reduction in methane from sheep grazing cereal stubbles (and little evidence of nitrate toxicity)



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