

Determining the natural durability of eucalypts in Australia

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Natural durability

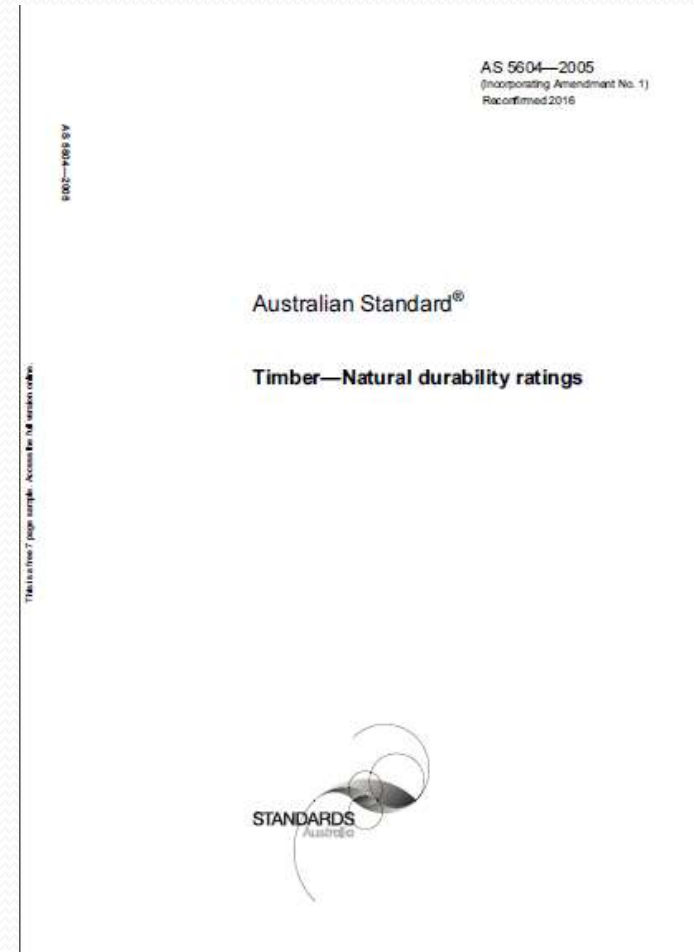
- Sapwood non-durable but usually treatable
- Outer heartwood may be naturally durable, rarely treatable
- Inner heartwood, pith, juvenile heartwood, often less durable
- Durability due to extractives, especially polyphenols or tannins for eucalypts



Eucalyptus deglupta, PNG

AS 5604

- Before 2003, information on in-ground natural durability, lyctus borer susceptibility and termite resistance was spread across several standards.
 - AS 1604.1: 2000 gave in-ground durability and lyctine susceptibility
 - AS 3660.1: 2000 termite resistant timbers
 - AS 2209: 1997 (poles) also gave in-ground durabilities, sometimes out of sync with 1604.1



AS 5604: 2005

NATURAL DURABILITY RATINGS OF TIMBER SPECIES

1	2	3	4		5
Standard common name and scientific/botanical name	Lyctid susceptibility of sapwood	Termite resistance of heartwood (inside above ground— applicable to H2 in AS 1604 series)	Natural durability class of heartwood		Marine- borer resistance of heartwood
			In-ground contact, D_{ig}	Outside above ground, D_{ag}	
alan <i>Shorea albida</i>	S	R	2	2	—
alder, blush <i>Sloanea australis</i>	S	—	4	—	4
alder, brown <i>Caldcluvia paniculosa</i>	S	NR	4	—	4
alder, pink <i>Gillbeea adenopetala</i>	NS	NR	4	—	4
alder, rose <i>Caldcluvia australiensis</i>	NS	NR	4	—	4
almond, rose					

In-ground stake test

- Installed 1968-69
- 77 timber species plus CCA or creosote treated pine
- Final inspection after 33-36 years
- 450 x 50 x 50 mm outer heartwood, butt log, 5 trees
- 10 replicates per site



In-ground stake tests



Sydney after 35 years

Stake test results

- Most naturally durable:
 - *Acacia acuminata*
 - *Euc. polyanthemos*
 - *E. wandoo*
 - *E. microcorys*
 - *E. paniculata*
- Both CCA and creosote treated pine lasted longer than all naturally durable stakes



Rating scale: 8 = sound, 3 = unserviceable
0 = destroyed

E.g. of post life near Melbourne (Warrandyte)



Durable eucalypt post 20+ years



CCA pine post 4 years
Too much untreatable heartwood

Lyctine susceptibility = Powder post beetles

- Important for eucalypts
- More urgent than for *Anobium* in radiata pine
- Immune if low sapwood starch, or vessels too thin for ovipositor to lay eggs
- If susceptible (and most are to some extent), the sapwood needs to be treated before or when seasoned.
 - Indoor timbers, treat with boron
 - Outdoor timbers, treat with Cu-based preservative, or LOSP



Termite resistance, house framing

H2 Australia = termites only, no decay



Coptotermes drum test



Mastotermes darwiniensis

H2 termite resistance

- Relates mainly to *Coptotermes acinaciformis* not *Mastotermes darwiniensis*
- Recent work on softwood heartwood an exception
- Resistance may improve if all framing is the durable timber, no baitwood (as for boron treated framing)

One year drum H₂ drum test
Showing % mass loss
First 4 timbers are 'termite resistant'

Heartwood	Cops	Masto
Red ironbark	12	82
Spotted gum	11	88
Sugar gum	14	96
River red gum	29	4
Swamp yate	27	100
Messmate	42	100
Mountain ash	99	100

Marine borer resistance



Natural durability of eucalypts from low rainfall areas

- Initially CSIRO/RIRDC funded
- Trees <25y, 30-50y, 80+ y
- Yardstick timbers
- Above ground decay field test
- One replicate from each of 10 trees per species



Flat panel decay test installed at Innisfail
Above ground = H₃ exposure

Final inspection after 9 years

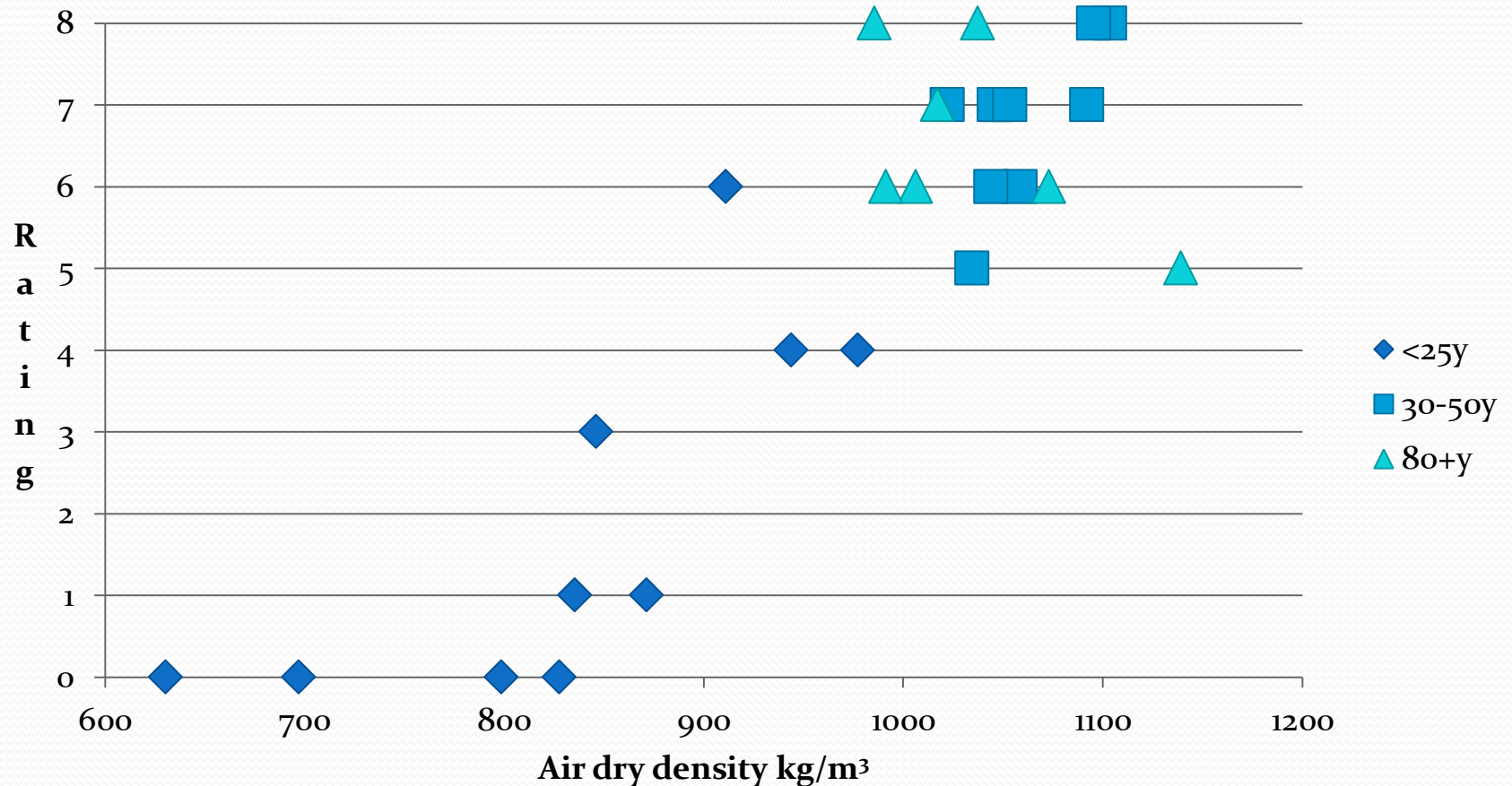
Looking for tree age + density effects



Underside of panels

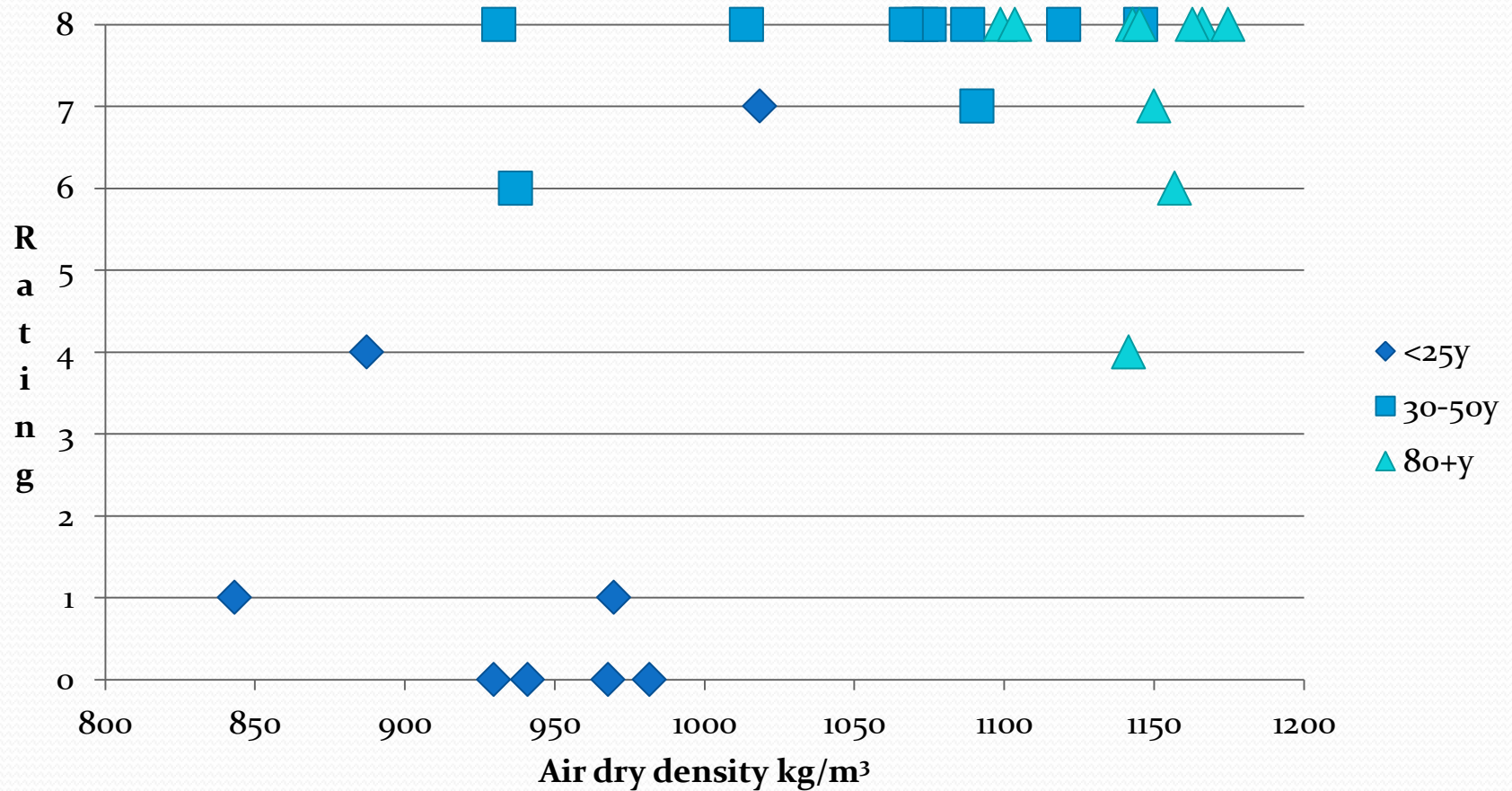
Decay rating vs density

Corymbia sp. (spotted gum)



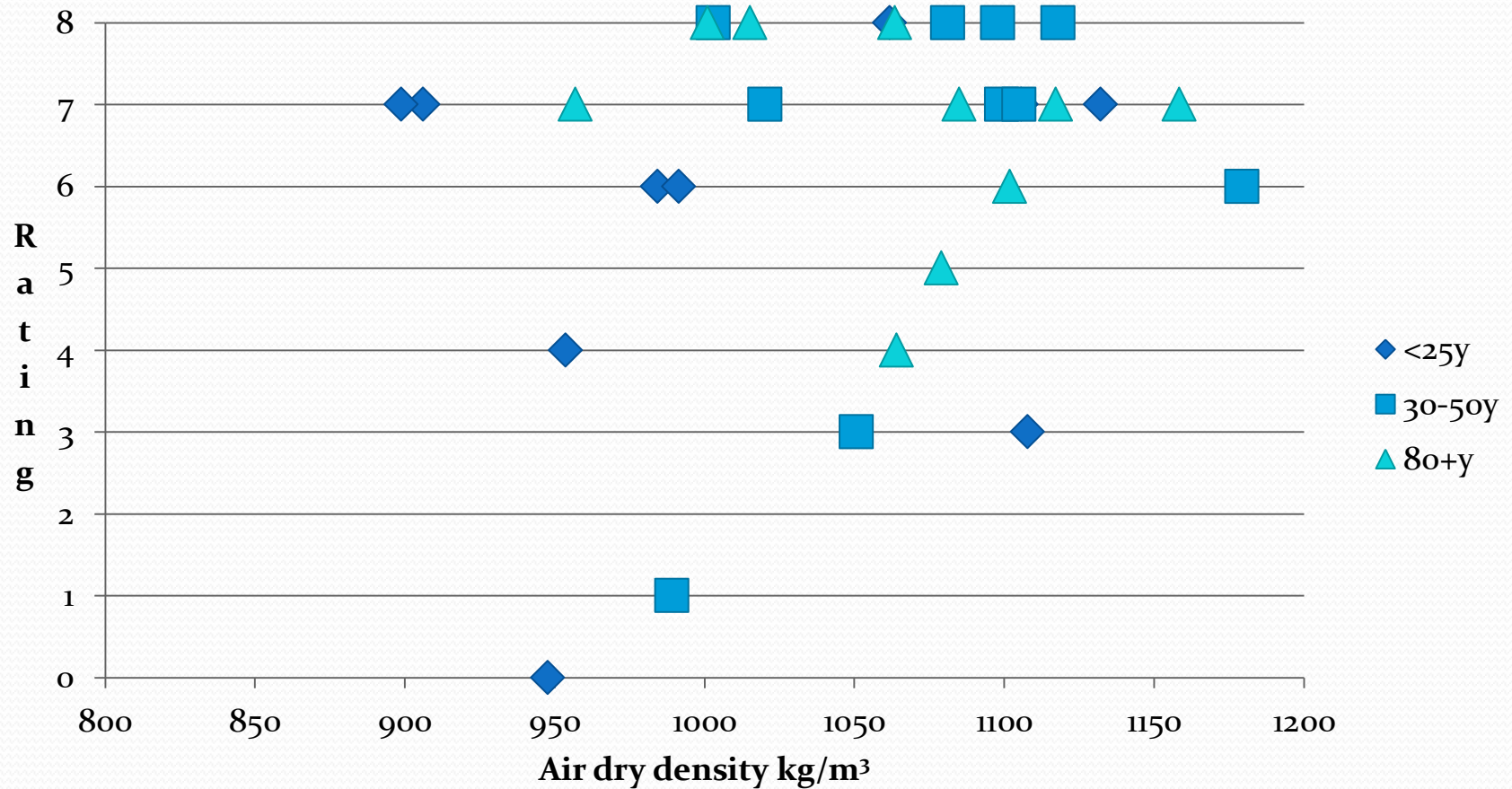
Decay rating vs density

E. sideroxylon (red ironbark)



Decay rating vs density

E. cladocalyx (sugar gum)



Decay ratings after 9 years

Also air dry densities kg/m³

Rating scale: 8 = sound, 0 = destroyed

	<25 year trees*	30-50 yr	80+ yr
Red Ironbark	1.6, 15.6y, 942	7.7, 1022	7.3, 1144
Spotted gum	1.9, 18.6y, 834	6.8, 1060	6.6, 1019
Sugar gum	5.5, 24.3y, 1009	6.3, 1074	6.7, 1064
Yellow gum	3.3, 15.6y, 961	6.4, 1021	
Swamp yate	0.4, 18.4y, 862	3.6, 1025	4.2, 1031
River red gum			7.6, 887
Messmate			1.8, 730
Mountain ash			0.0, 598

* Includes tree age in years

Eucalypt thinnings for stronger posts



CCA radiata pine
after 5 y

No decay but broke
during harvesting

Eucalypt plantations



Sugar gum near Horsham

The treatments examined were
ACQ, and creosote (PEC)



Blue gum Kinglake West

Eucalypt thinnings seasoned under hessian

(vinepost photos by Kevin McCarthy)

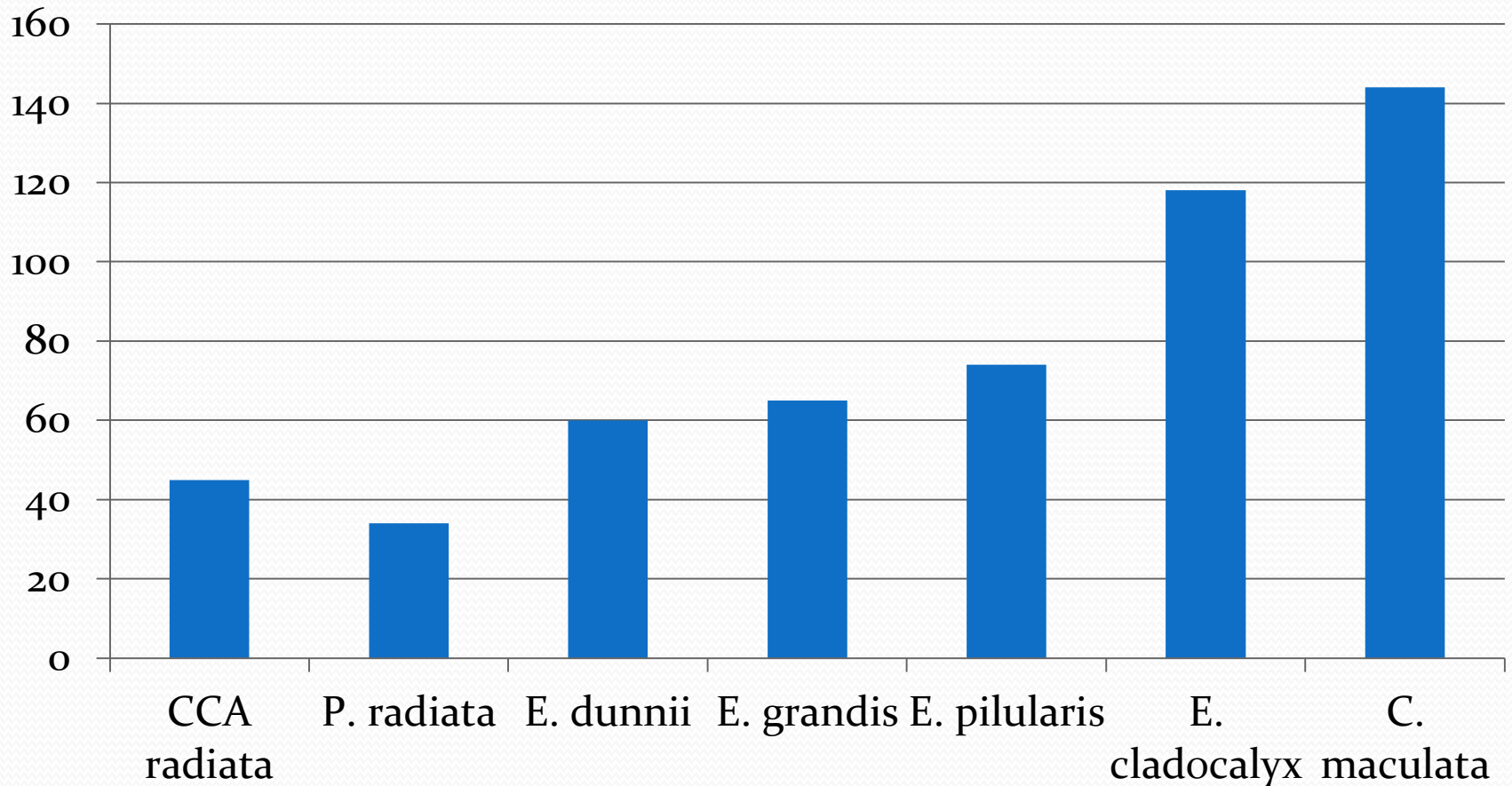


At Griffith vineyard, gang nails reduced euc splitting from 26 to 12% creosote treated.
And 53 to 36% for ACQ treated posts. Some species rarely split anyway.

Strength tested by Vic DPI in Mildura



Mean bending strength ACQ treated posts, MPa



Excessive splitting

(vinepost photos by Kevin McCarthy)



ACQ treated
Fail if splits wider than 8 mm



Plus longicorn borer damage if season
with bark on

'Non' splitting species as posts



PEC treated, treatment also
tends to reduce splitting of ACQ



9% of PEC euc posts had crud,
worst in *maculata*

Posts of round durable species still need treatment



Durability of a post made from inner heartwood?



PEC treated sugar gum.

Or cut sawn outer heartwood from larger trees

Fungal bioassays, 12 weeks



% mass loss 12 weeks fungal lab bioassay, after H3 weathering

	<i>F. lilacino-gilva</i>	<i>C. olivacea</i>	<i>G. abietinum</i>	<i>O. placenta</i>	<i>P. tephropora</i>
Pine sap	52.9	45.1	61.5	59.5	36.5
Messmate	38.0	33.4	33.3	1.8	49.6
Merbau	1.4	0.4	0.9	0.3	18.5
Spotted gum	12.8	12.4	5.7	1.4	17.4
Jarrah	10.8	10.3	1.9	0.4	7.5
H ₃ CCA pine	0.6	0.2	0.3	6.2	0.6

May be less differentiation if test unweathered blocks

In-ground, wet tropics, soil bins





Thank you