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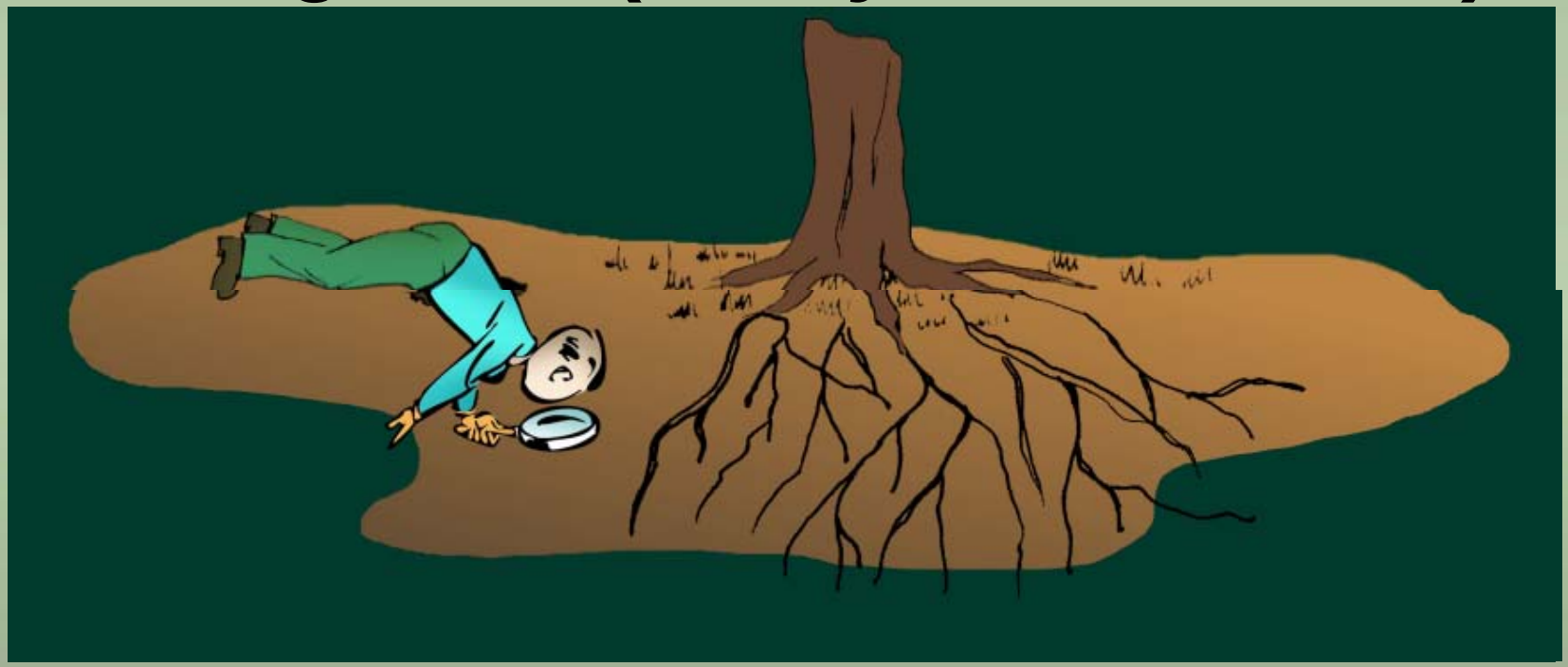
Stabilising characteristics of the New Zealand cabbage tree (*Cordyline australis*)



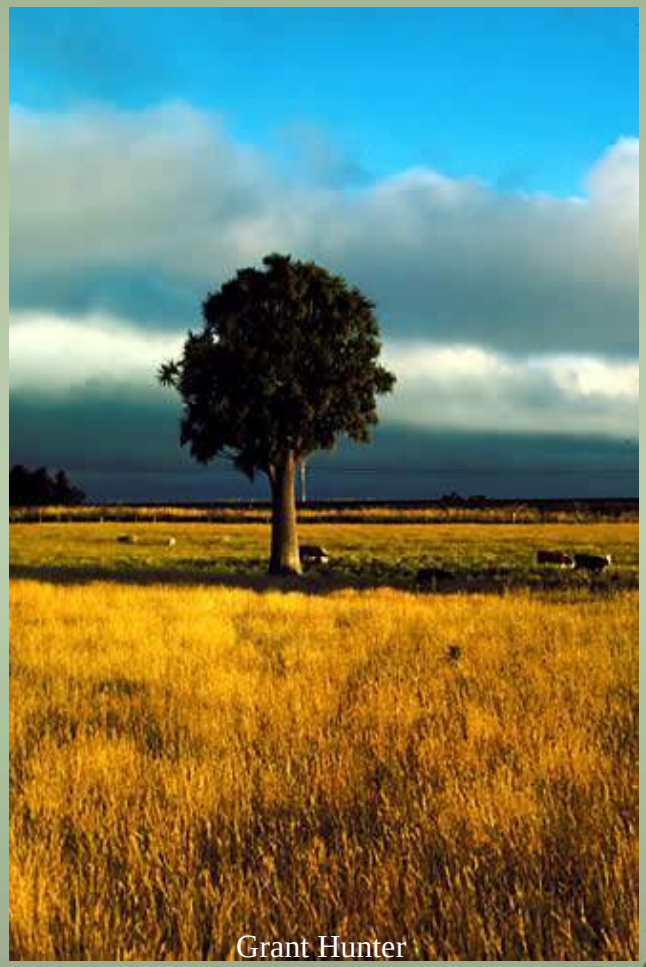
Chris Phillips

with contributions from Alex Czernin & Mike Marden

Outline

Why do we need revegetation? Why natives?

- Setting the scene
- Ecology of cabbage tree
- Iconic nature
- What we've been doing
- What we know
- Comparison with willow
- What does it all mean?
- Summary
- Some takeaways



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Why plants? - riparian functions

- Filtering of contaminants – bugs, sed., nutr.
- Bank stabilization
- Nutrient uptake by plants
- Denitrification
- Shading for temperature
- Shading for instream plant control
- Input of wood & leaf litter
- Enhancing fish habitat
- Controlling downstream flooding
- Recreation
- Aesthetics

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Willow sawfly

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The Big Question?

Can our New Zealand native plants perform a river bank stabilising function as well as introduced willows?

In geotechnical terms, how do we quantify the benefits of vegetation to soil stabilisation?

What do we want from our riparian plants?

- Rapid growth -->> surface cover
- Resilience/wide environmental tolerance
- Root depth - anchor plant
- Root spread – overlap with adjacent plants
- Strong surface root mat – hydraulic protection
- High root biomass – more the better
- Root occupancy – biggest volume
- Root strength – stronger roots more resistant to external forces

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2 recent strands of work

Riparian plant trial

Common name	Botanical name
Karamu	*Coprosma robusta*
Ribbonwood	*Plagianthus regius*
Kowhai	*Sophora tetraptera*
Lemonwood	*Pittosporum eugenoides*
Kohuhu	*Pittosporum tenuifolium*
Lacebark	*Hoheria populnea*
Mapou	*Myrsine australis*
Fivefinger	*Pseudopanax arboreus*
Cabbage tree	*Cordyline australis*
Rewarewa	*Knightia excelsa*
Manuka	*Leptospermum scoparium*
Tutu	*Coriaria arborea*

Marden, Rowan, Phillips (in press)

Cabbage trees

Czernin (2002)

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Ecology of *Cordyline australis*

- 5 species
- *Asparagaceae*, not *Liliaceae*
- Pioneer species
- Long lived – 100+ years
- Can regrow from stumps
- Uncommon root system
- Utilised by Maori for food
- Wide range of site conditions
- Favoured habitat- riparian
- Decorative use in gardens

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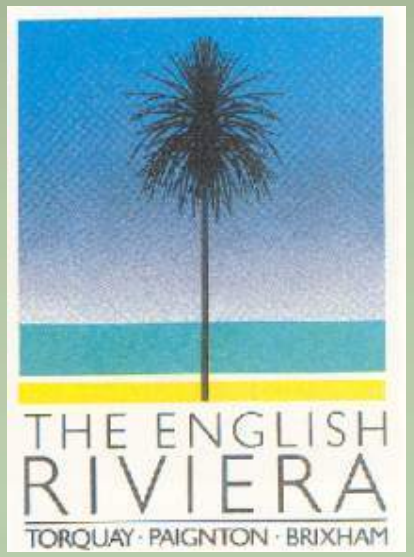
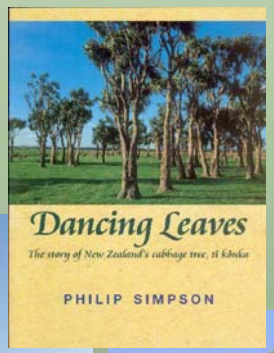
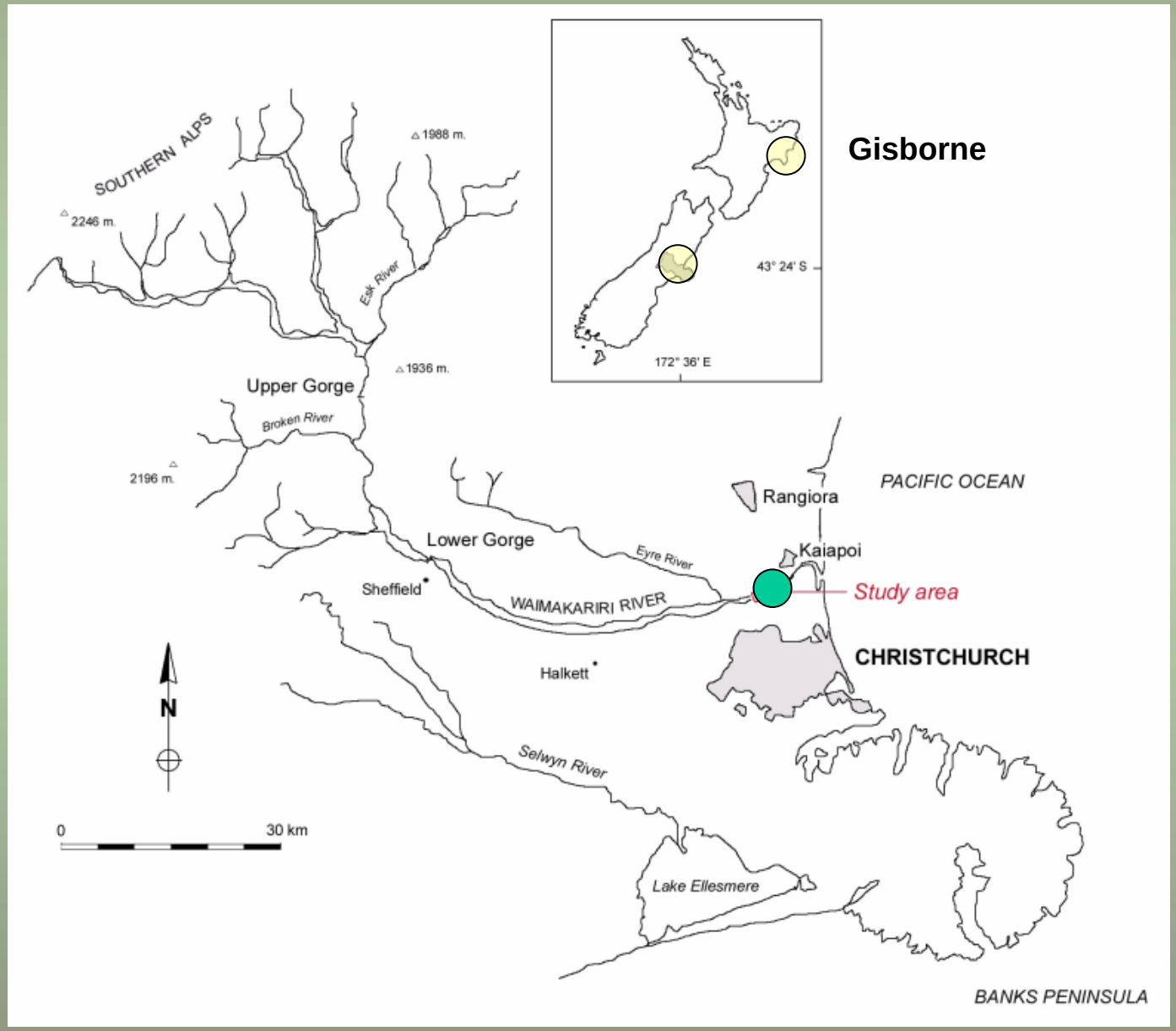
Iconic nature

- Cultural
- Art
- Poetry
- Photography
- Sculpture
- Landscape





Study sites



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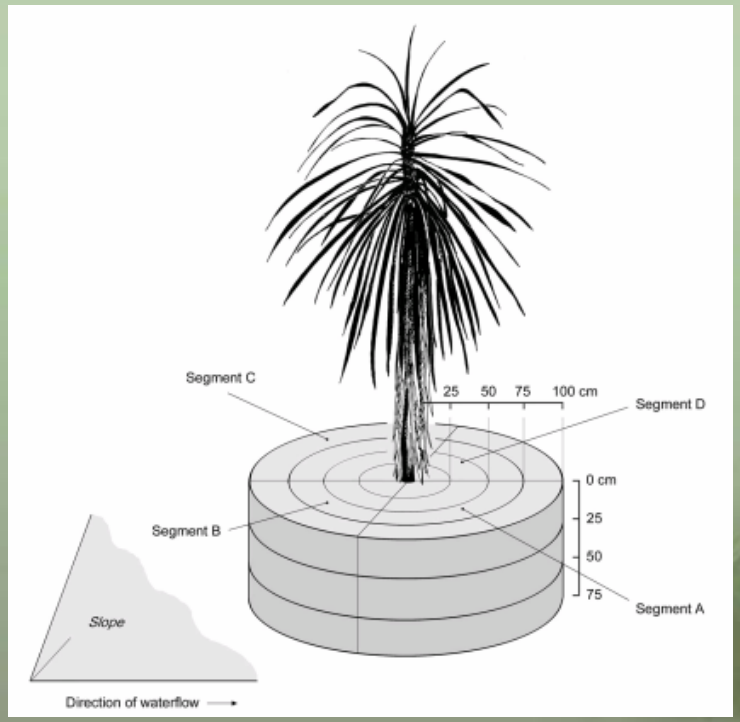
Methods

- Self-sown and planted
- Water or air excavation
- Morphology and biomass
- Partitioning of root system
- Root tensile strength
- Pullout tests
- Compare to willows & others



Results – above ground

Same age

Self-sown

Planted

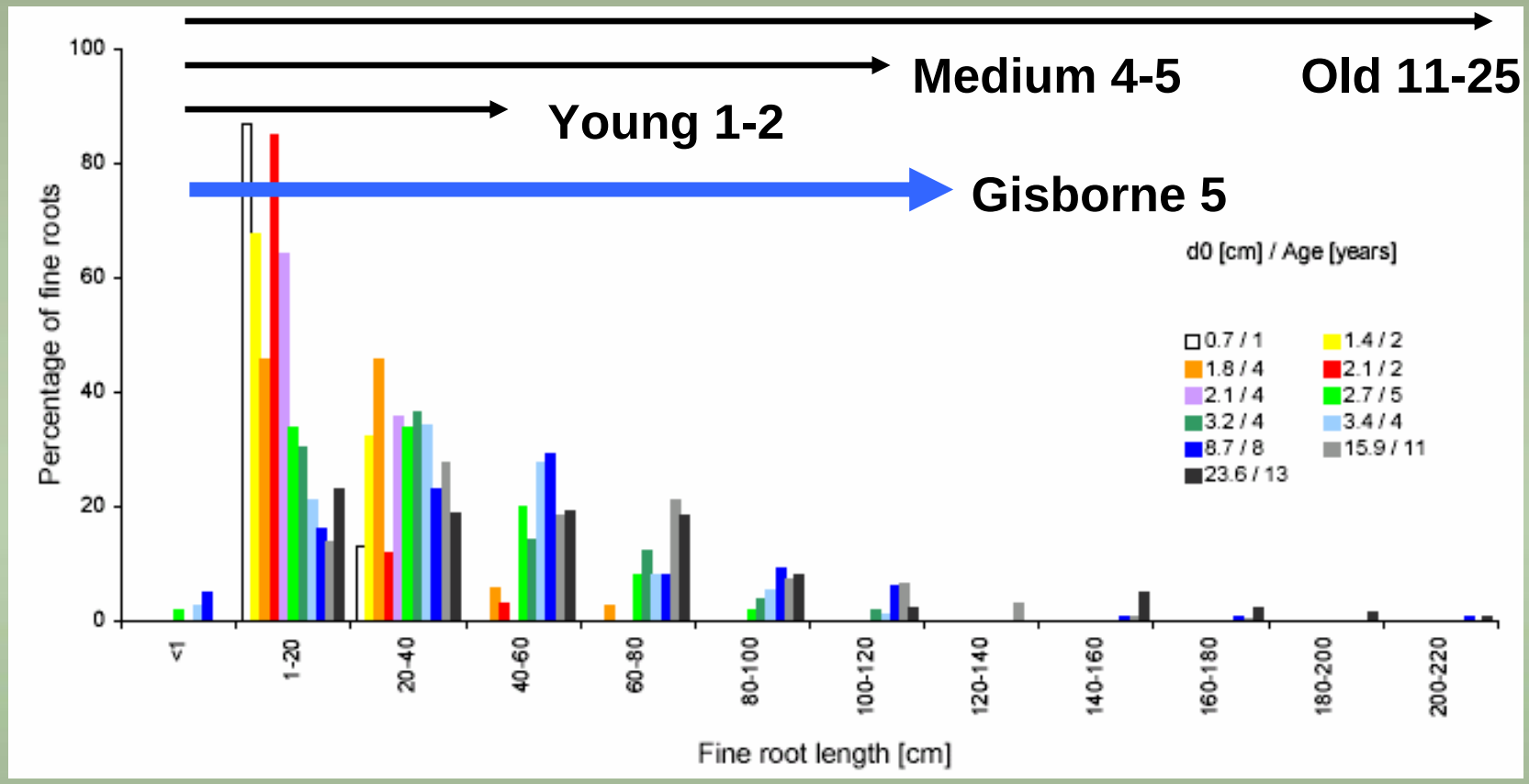
5

7

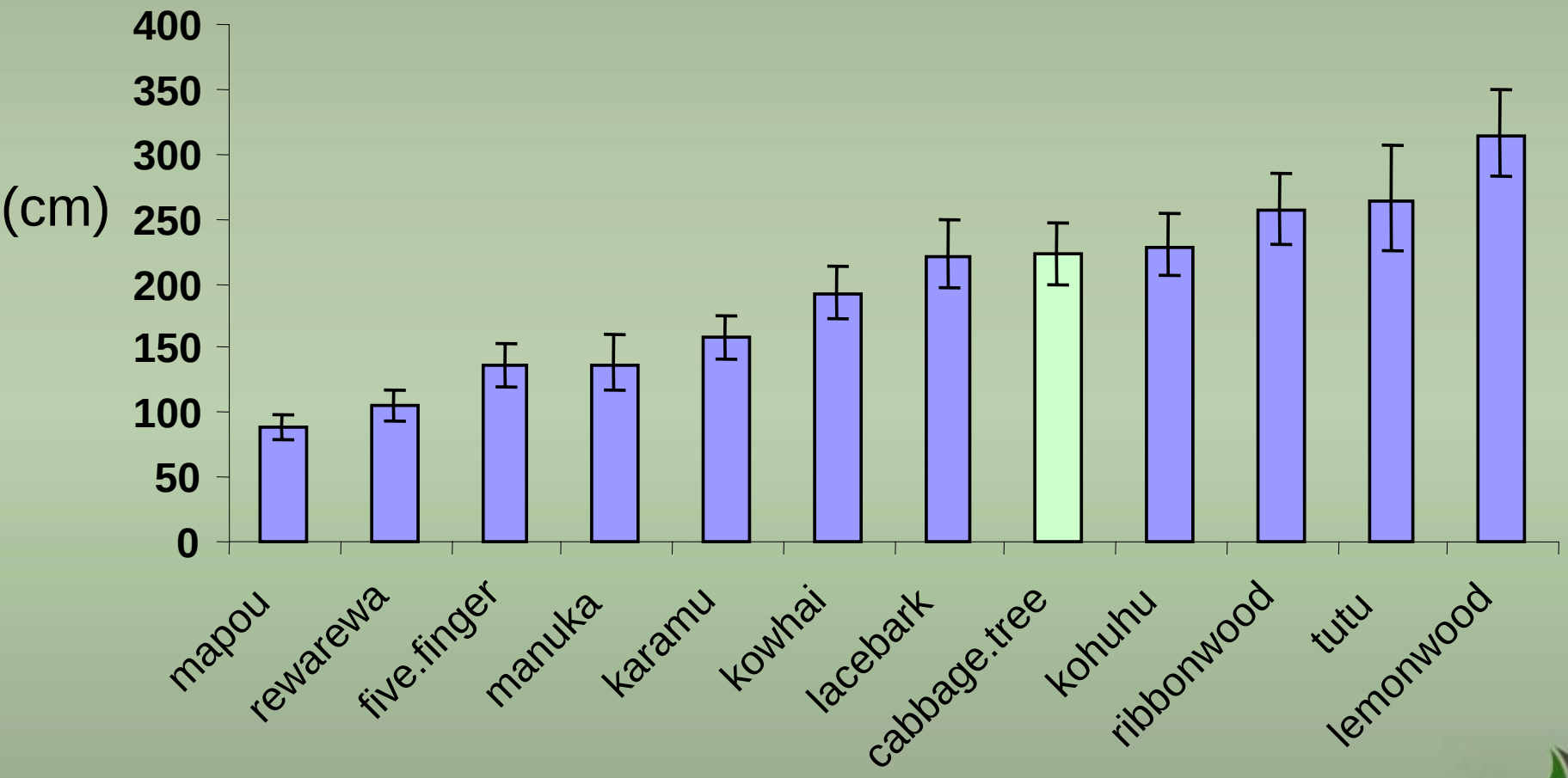
13

25

Root length/spread



Mean max. root spread – 5 year old



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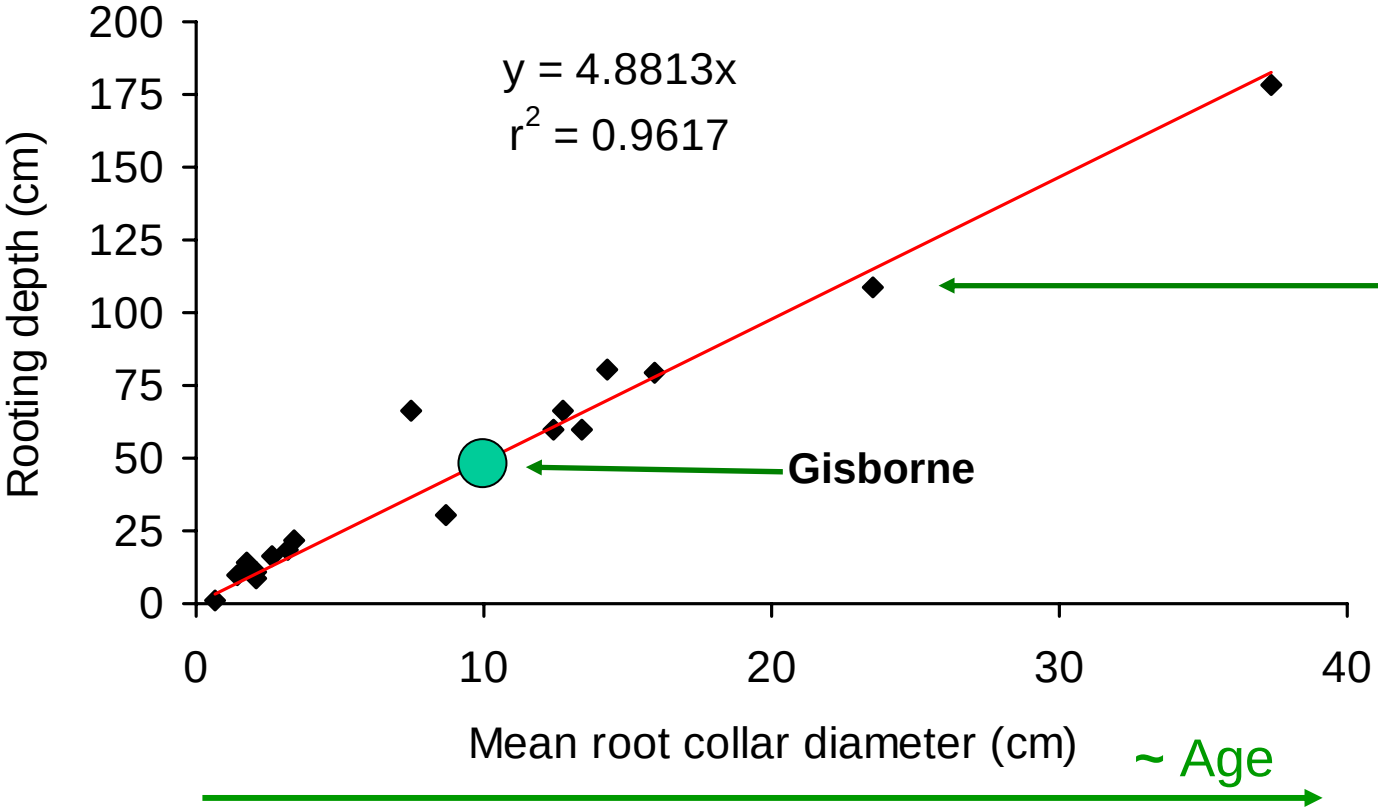
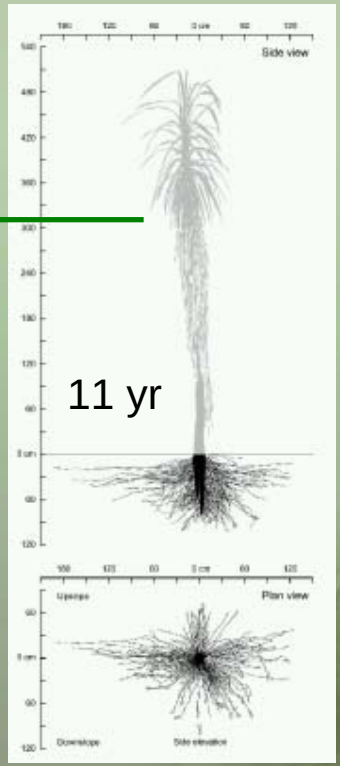
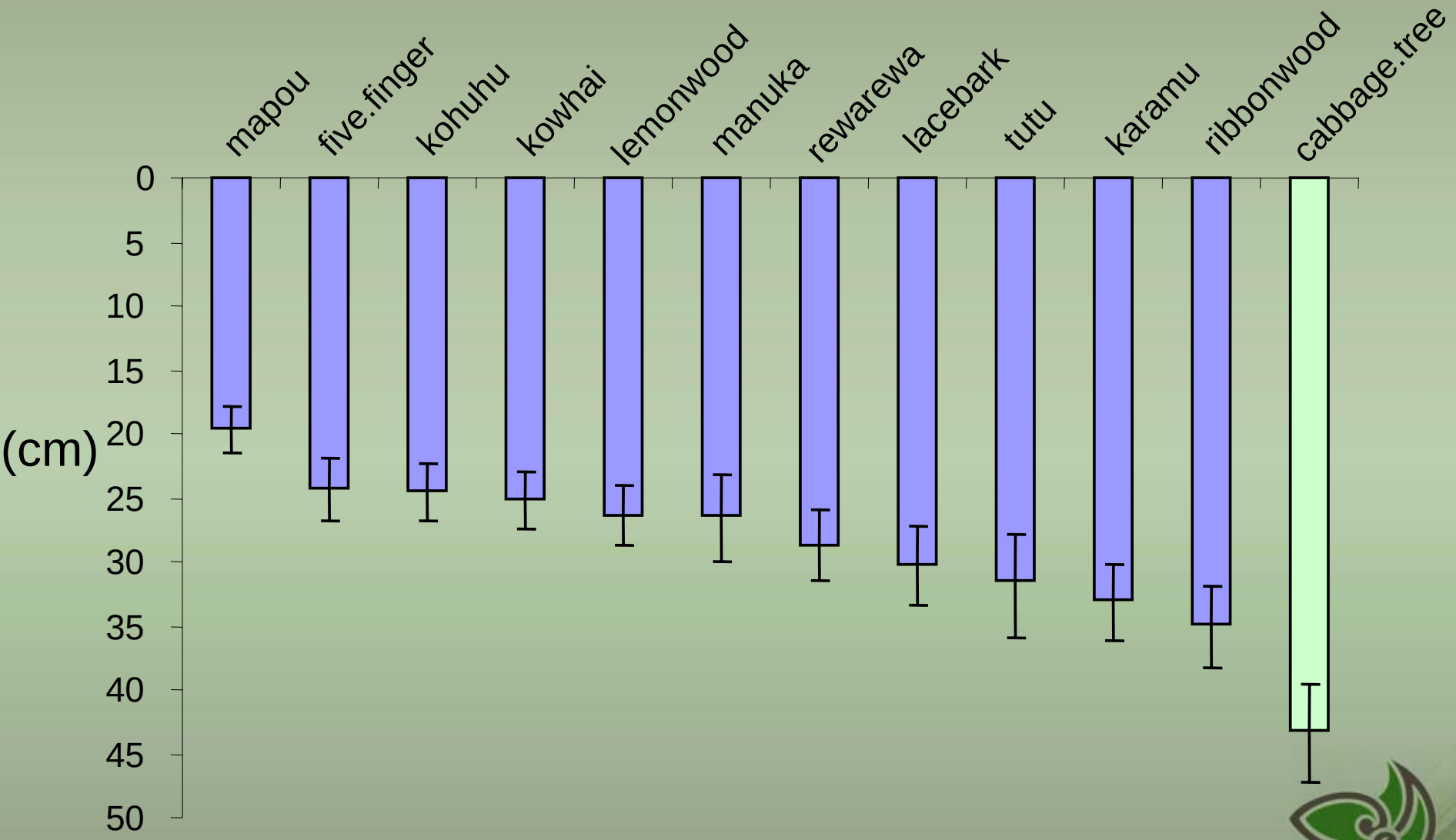
Root depth


y = 4.8813x
r^2 = 0.9617
Rooting depth (cm)
200
175
150
125
100
75
50
25
0
0
10
20
30
40
Mean root collar diameter (cm)
Gisborne
~ Age


Side view
11 yr
Plan view

Root depth – 5 year old



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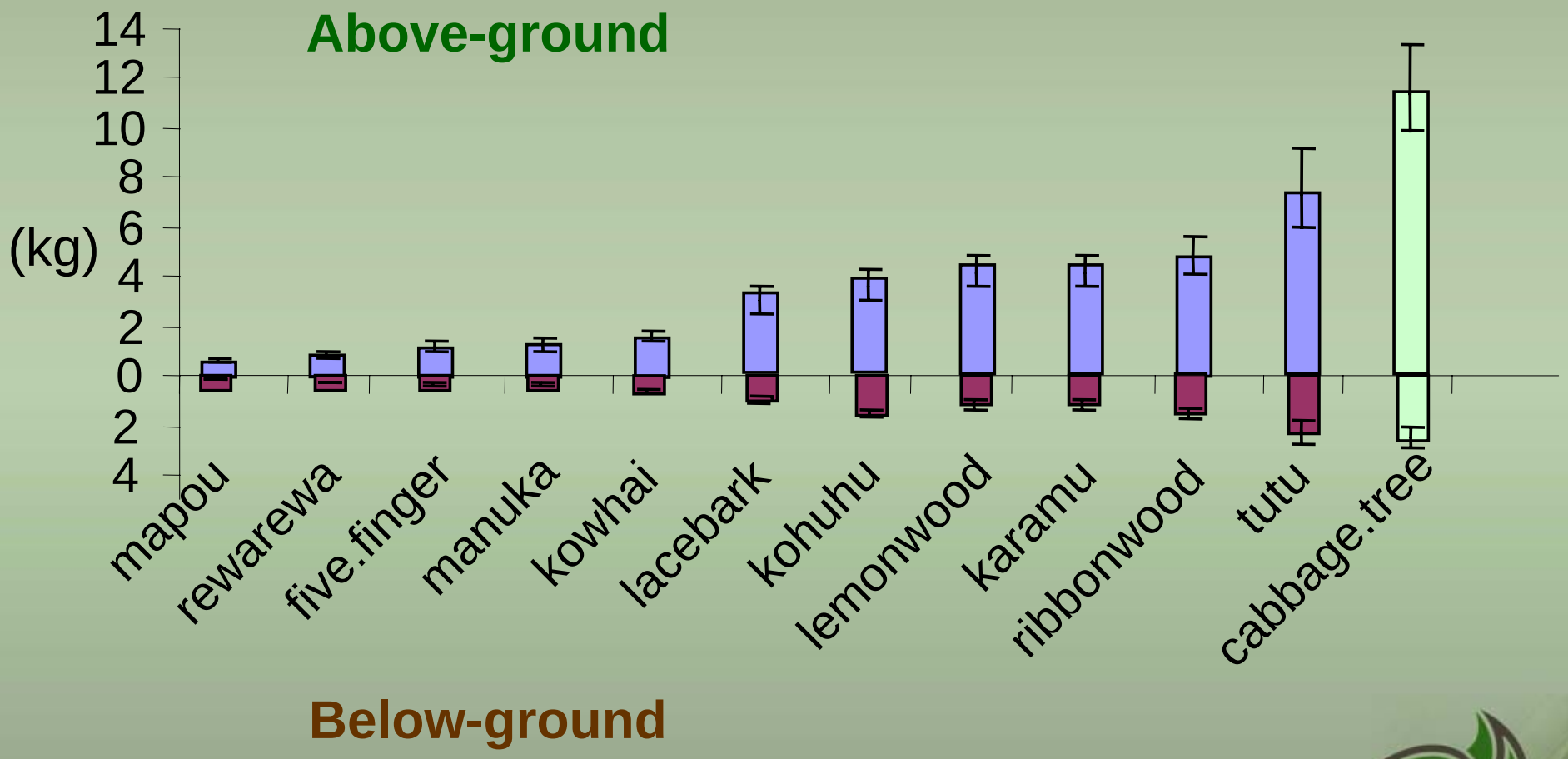
Biomass – 5 year old



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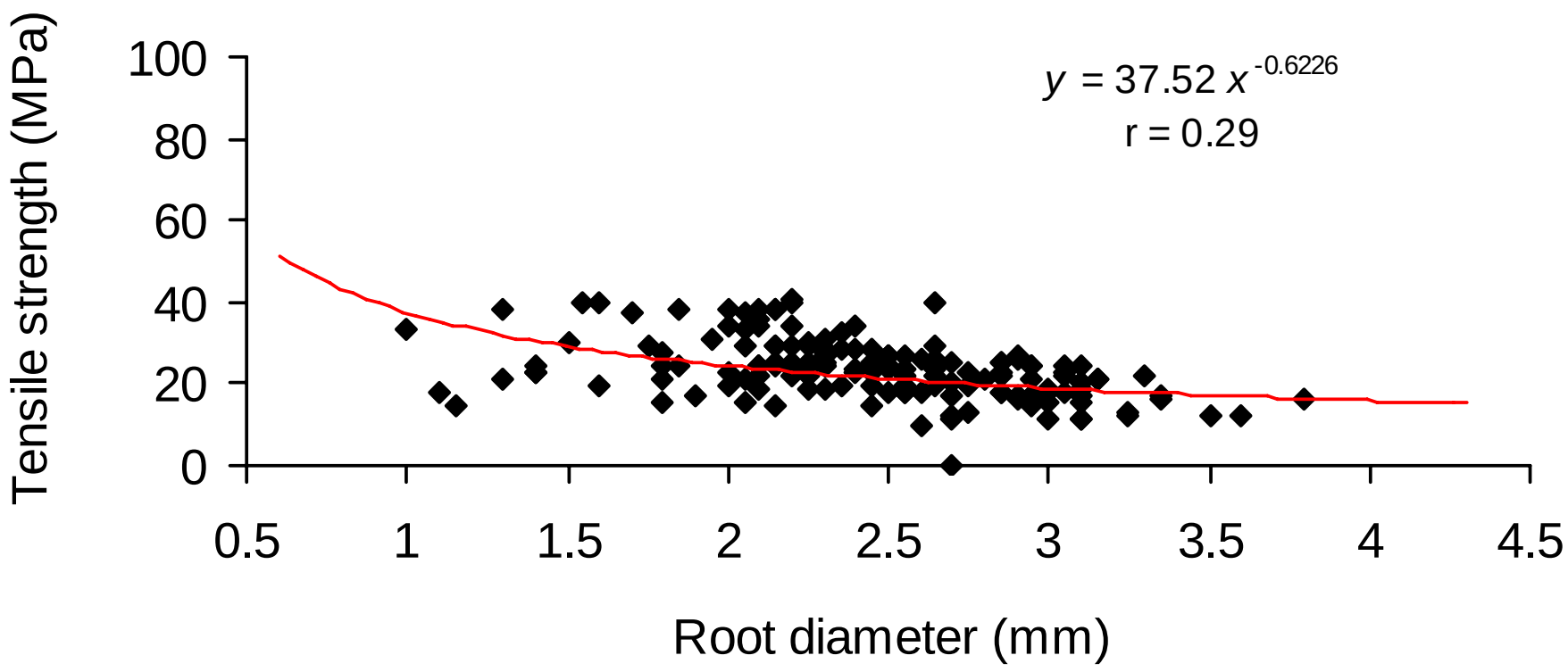
Tensile strength
Cabbage tree

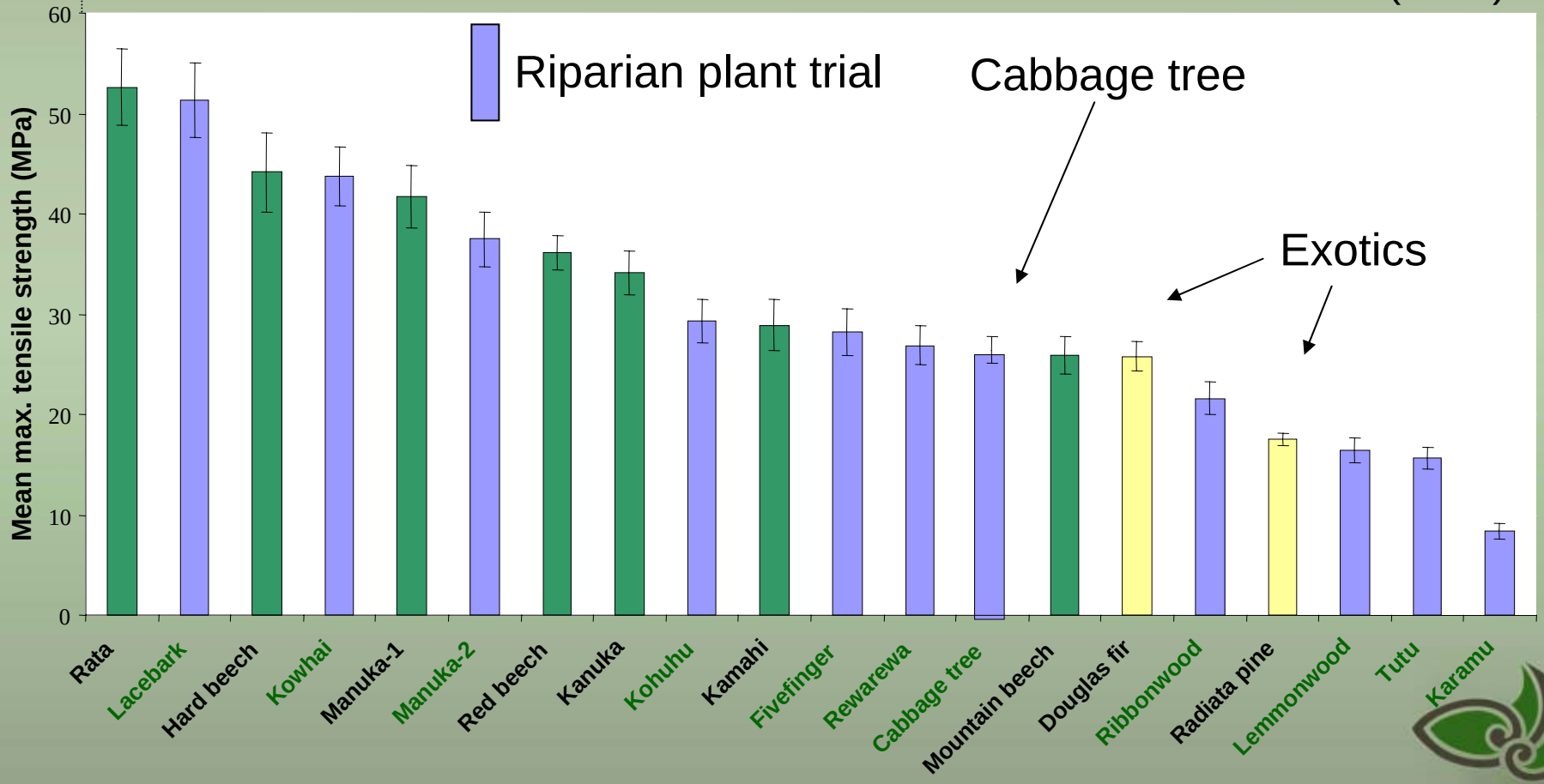


Root tensile strength – natives & others

(1 - 4 mm diameter)

Willows 30 - 125 MPa

Watson & Marden (2005)



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What to use?

Ecologically designed vs functional performance?

- Colonisers – moss, ferns, sedges, flax etc
- Depth – cabbage tree, ribbonwood
- Spread – lemonwood, ribbonwood
- Above gd biomass – cabbage tree, tutu
- Below gd biomass – cabbage tree, tutu
- Tree height – lacebark, ribbonwood, cab. tree
- Canopy spread – tutu, karamu
- Root strength – lacebark, kanuka, kohuhu

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Implications for bank stabilization - small streams

- no limitations, provided that bank height is not more than ~2 m and channel bed is stable
- success depends on density - formation of dense canopy & full root occupancy of the soil
- shallow soil stabilisation after 3-5 years
- improvement in deeper slope stabilisation expected within 7-10 years of establishment
- some sp. can withstand breakage and over-topple

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Implications for bank stabilization - large streams

- lack of roots in deeper soil layers limits usefulness in streams where bank undercutting occurs
- ineffective if bank height exceeds effective rooting depth ~ 2 m.
- banks would need to be graded and unstable channel beds artificially regraded prior to planting

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Pictorially ……..

Summary – cabbage tree

- Cabbage trees have a distinct taproot
- Root depth up to 2m
- Root spread up to 3m
- Root strength – TS 17-27 MPa
- Pullout resistance high
- On its own cabbage trees not as good as willows
- With other plants such as flax, may be as good

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Summary – natives in general

- NZ natives take longer to grow cf exotics – but not slow
- Some natives can regenerate, eg cabbage trees - good
- Woody plants effective after about 5 years
- Change the ecological mix to suit the site
- Mixed plantings of natives and exotics?
- More work needed on functional performance

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Take home messages

- We don’t know as much as we should
- Protection is better than fixing it
- Topsoil is key to reveg. success
- Salvage/re-use is a viable alternative
- Roads & streams can play big part in NZ’s biodiversity recovery
- More work needed on native establishment techniques

- Vegetation is not just for looking at – it can also have a range of engineering functions
- Our native plants can provide an E & SC service

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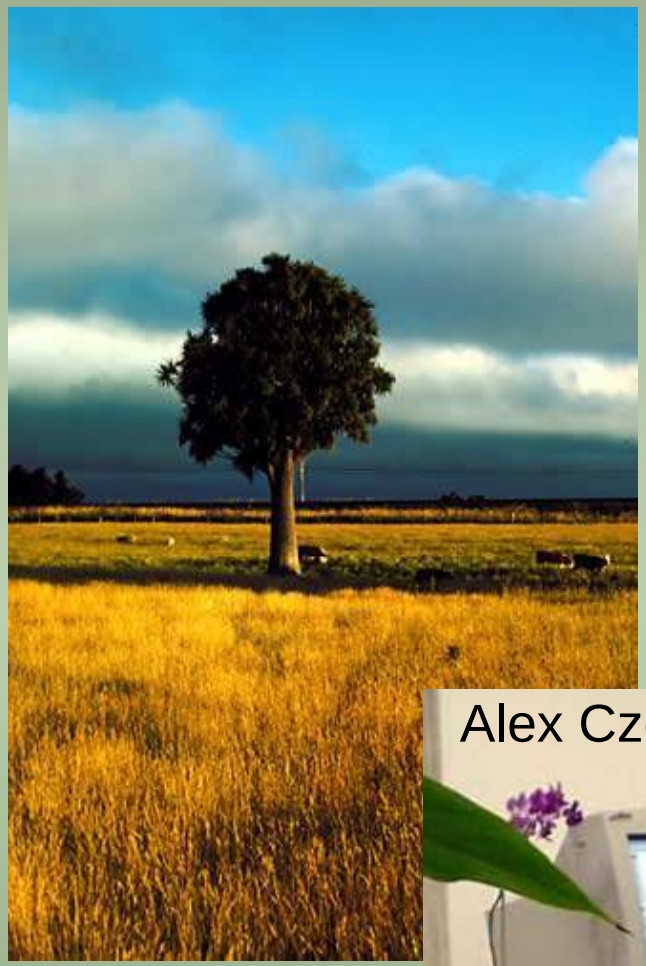
Thanks for listening



Note the cabbage tree on the screen!

Alex Czernin @ work in Austria

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