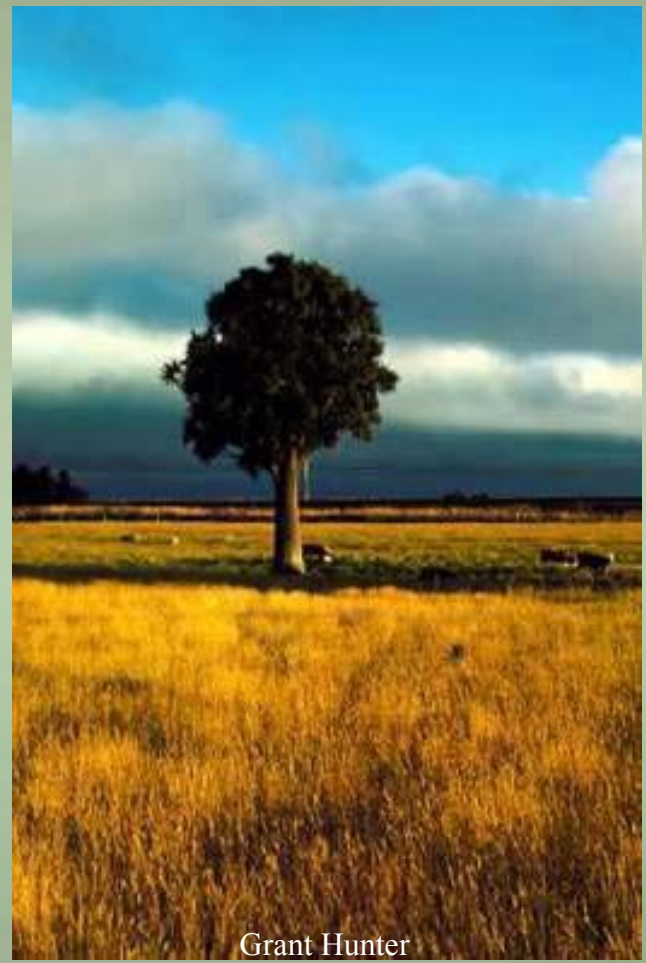
Manaaki Whenua
Landcare Research

Stabilising characteristics of NZ riparian plants

Chris Phillips & Mike Marden

Outline

- Set the scene
- The question
- What we did
- What we found
- What it means
- Summary


Grant Hunter

INTEGRATED CATCHMENT MANAGEMENT for the Motueka River

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An aside …… context? Would you ….

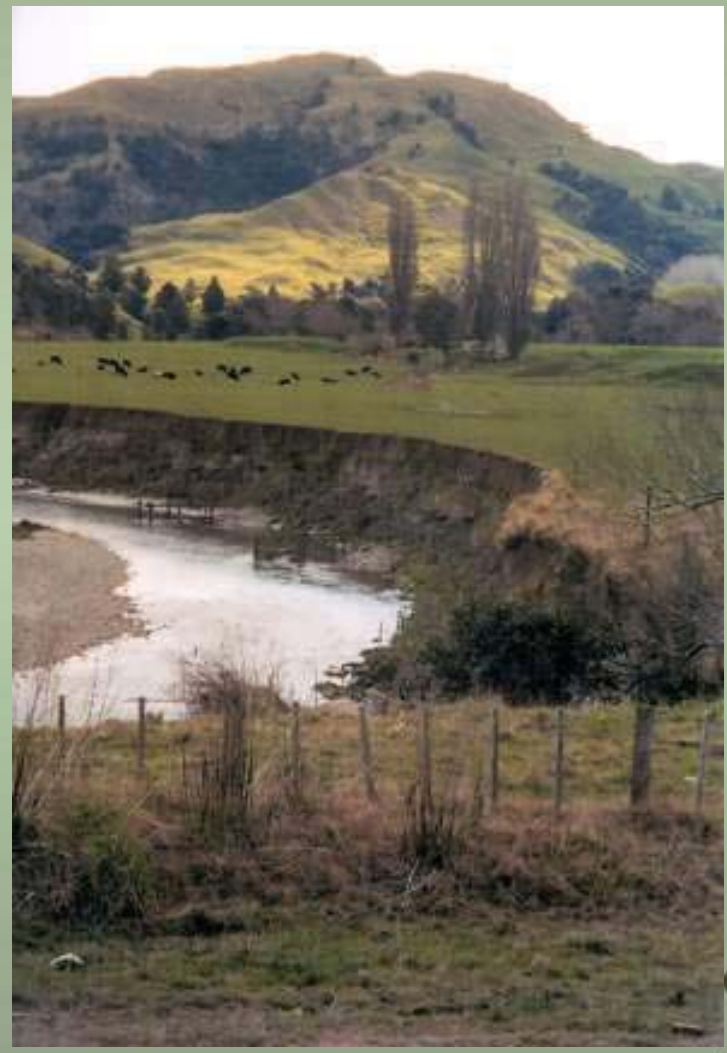
- Take on a new breed of sheep or cow on your farm because someone said it would be good?
- Would you want to see numbers on growth performance? Mortality? Costs/benefits?
- Would you match the animal to the farm or accept that it is ok for any farm?

- What about native plants and their introduction back into NZ's managed landscapes?

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

The Issue



The cure-all?

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 plants?

- 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

What do we want from our plants?

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2 strands of recent work

Riparian plant trial

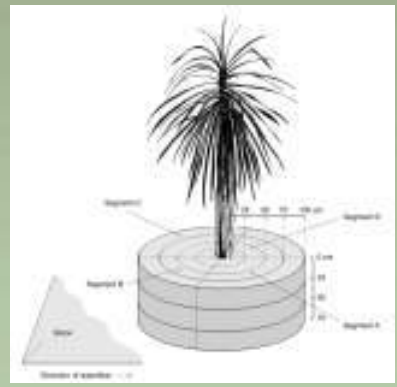
Common name	Botanical name
Karamu	*Coprosma robusta*
Ribbonwood	*Plagianthus regius*
Kowhai	*Sophora tetraptera*
Lemonwood	*Pittosporum eugenoides*
Kohuhu	*Pittosporum tenuifolium*
Lacebark	*Hoheria populnea*
Mapou	*Myrsine australis*
Fivefinger	*Pseudopanax arboreus*
Cabbage tree	*Cordyline australis*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

Marden, Rowan, Phillips

Cabbage trees

Czernin (2002)

Methods – plant trial



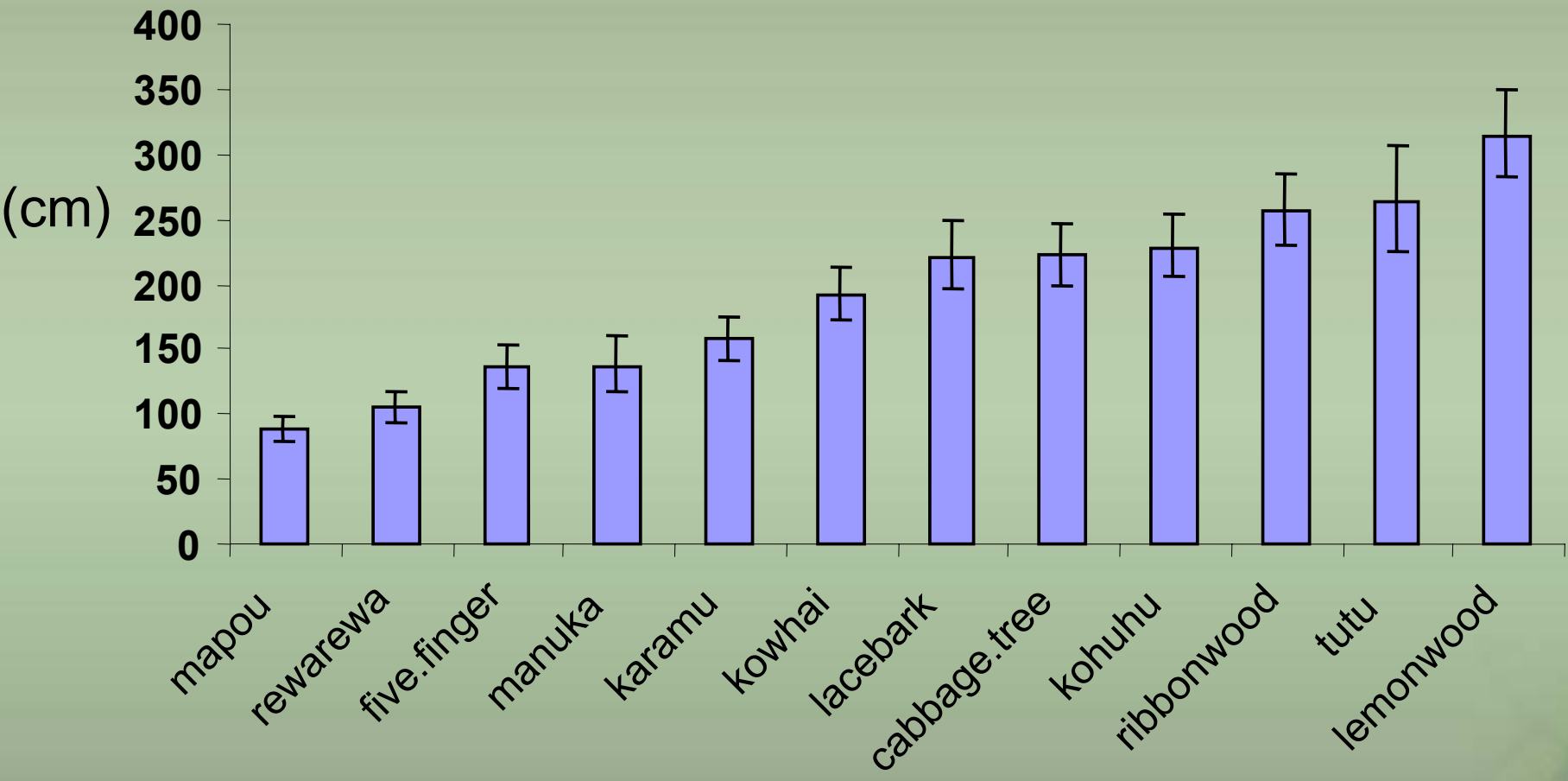
- 10 plants / species/ age class – 1 to 5 years
- 1 and 2 yr old plants from pots
- 3-5 yr old plants extracted from trial plot
- measured dbh, root collar, tree height, canopy width
- above-ground components - stem, branches & foliage
- root system extracted intact - air lance
- below-ground - root bole (stump) & roots
- roots – diam. size classes measured for length
- all components oven dried and weighed
- tensile strength of roots tested

Root spread

Pittosporum tenuifolium (kohuhu)

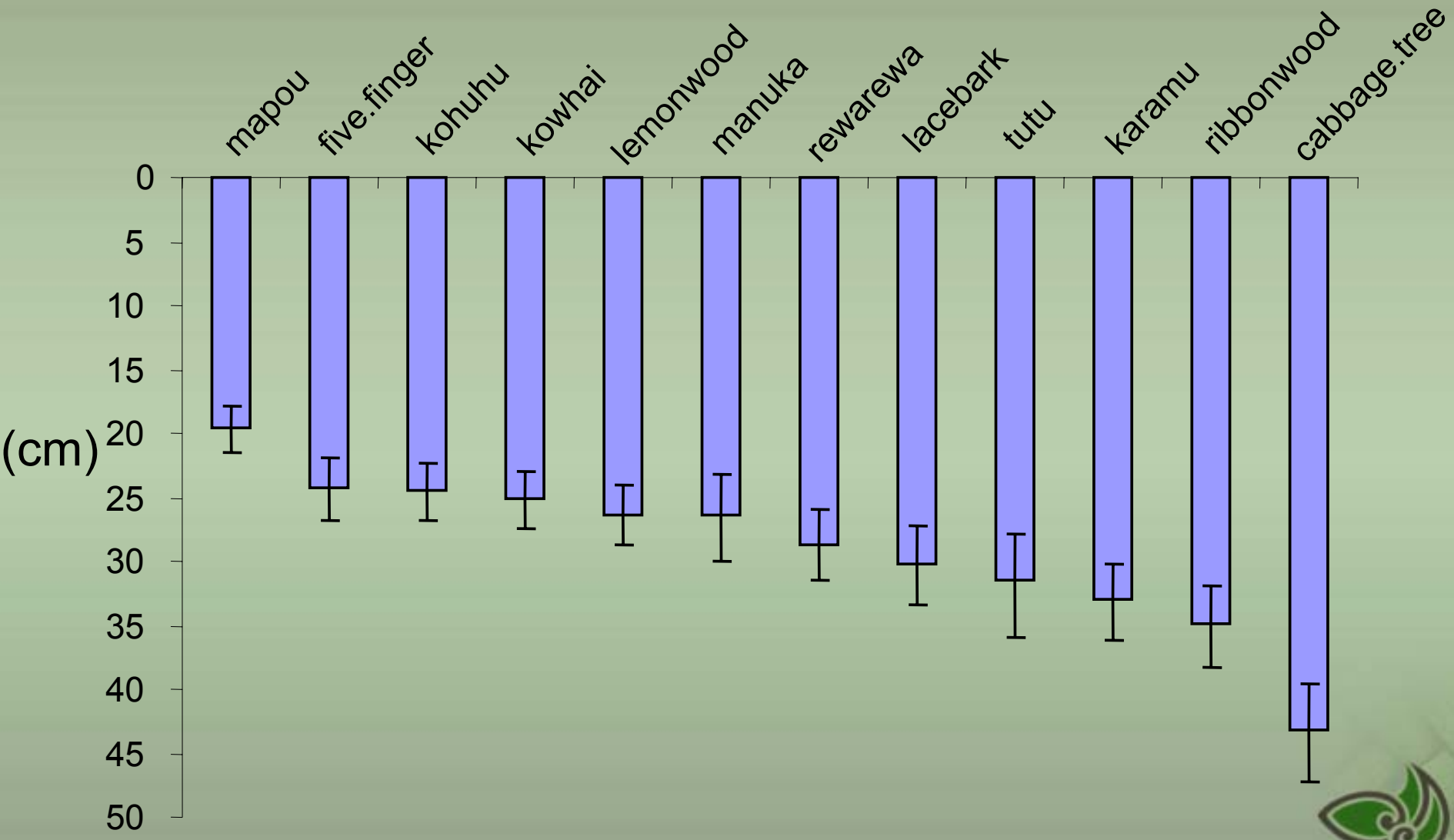
Coprosma robusta (karamu)

Root spread – 5 year old

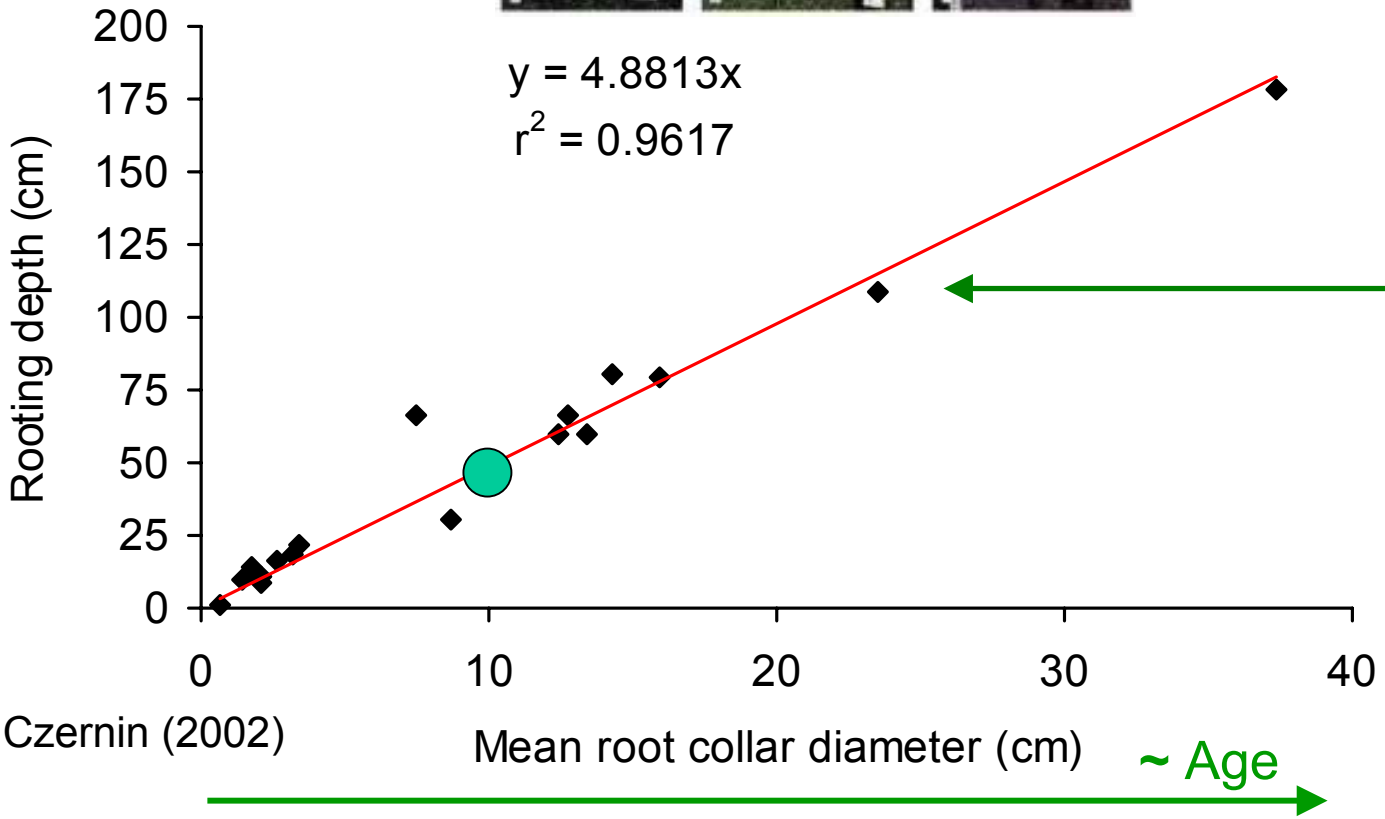


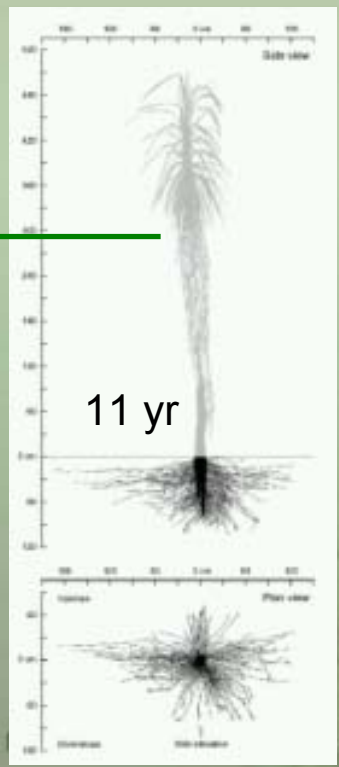
Results - root depth

Root depth – 5 year old

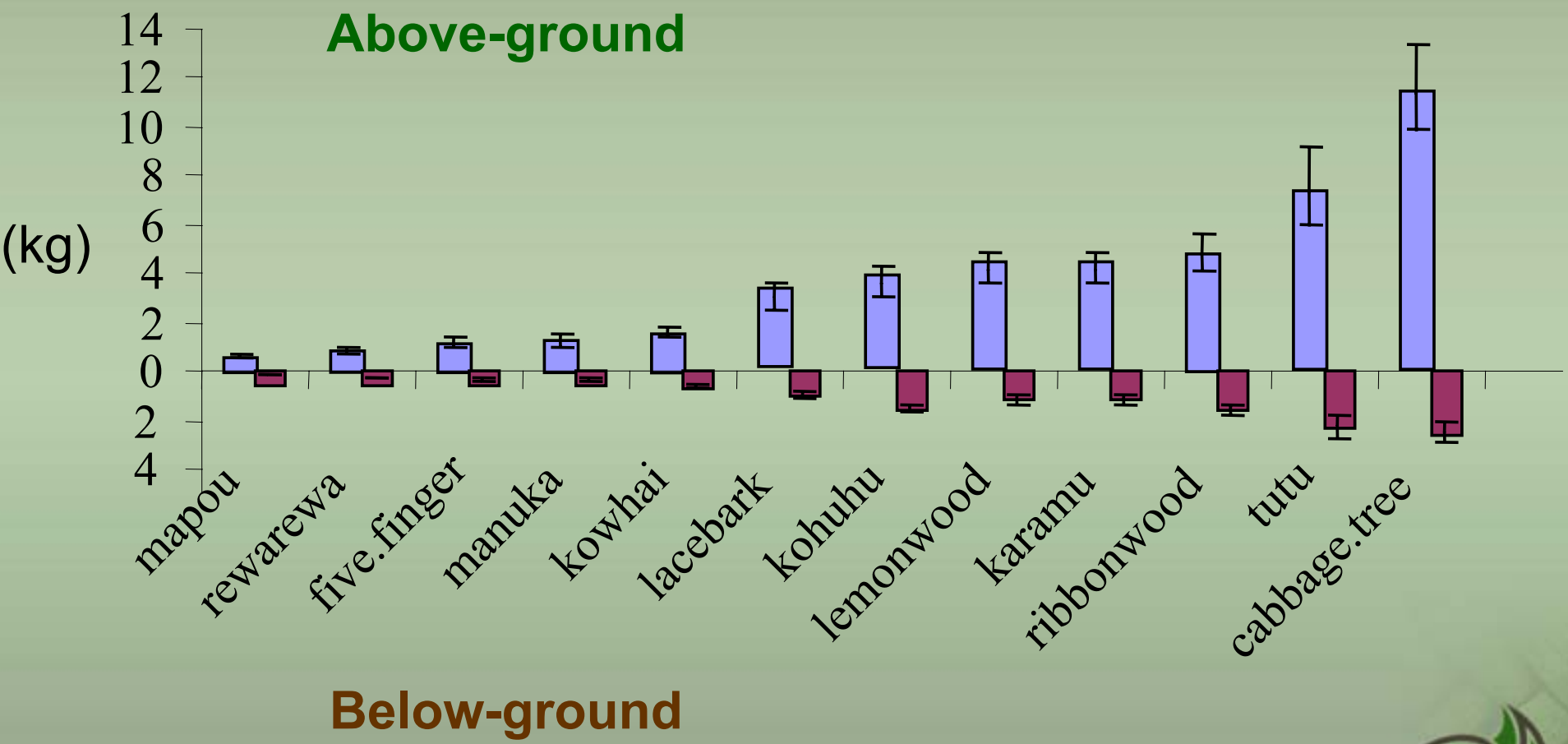


Root depth – cabbage tree

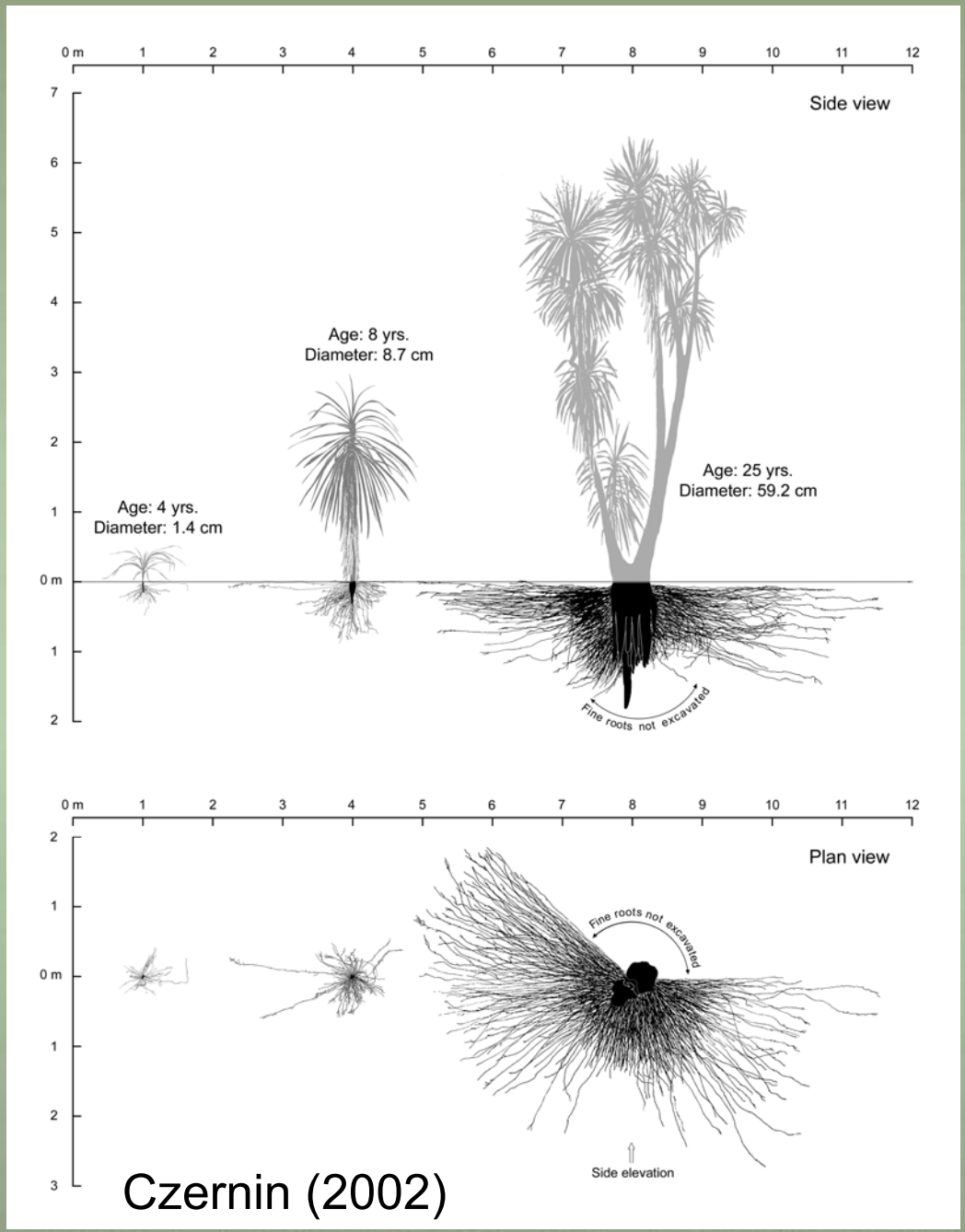




Biomass – 5 year old



Growth summary



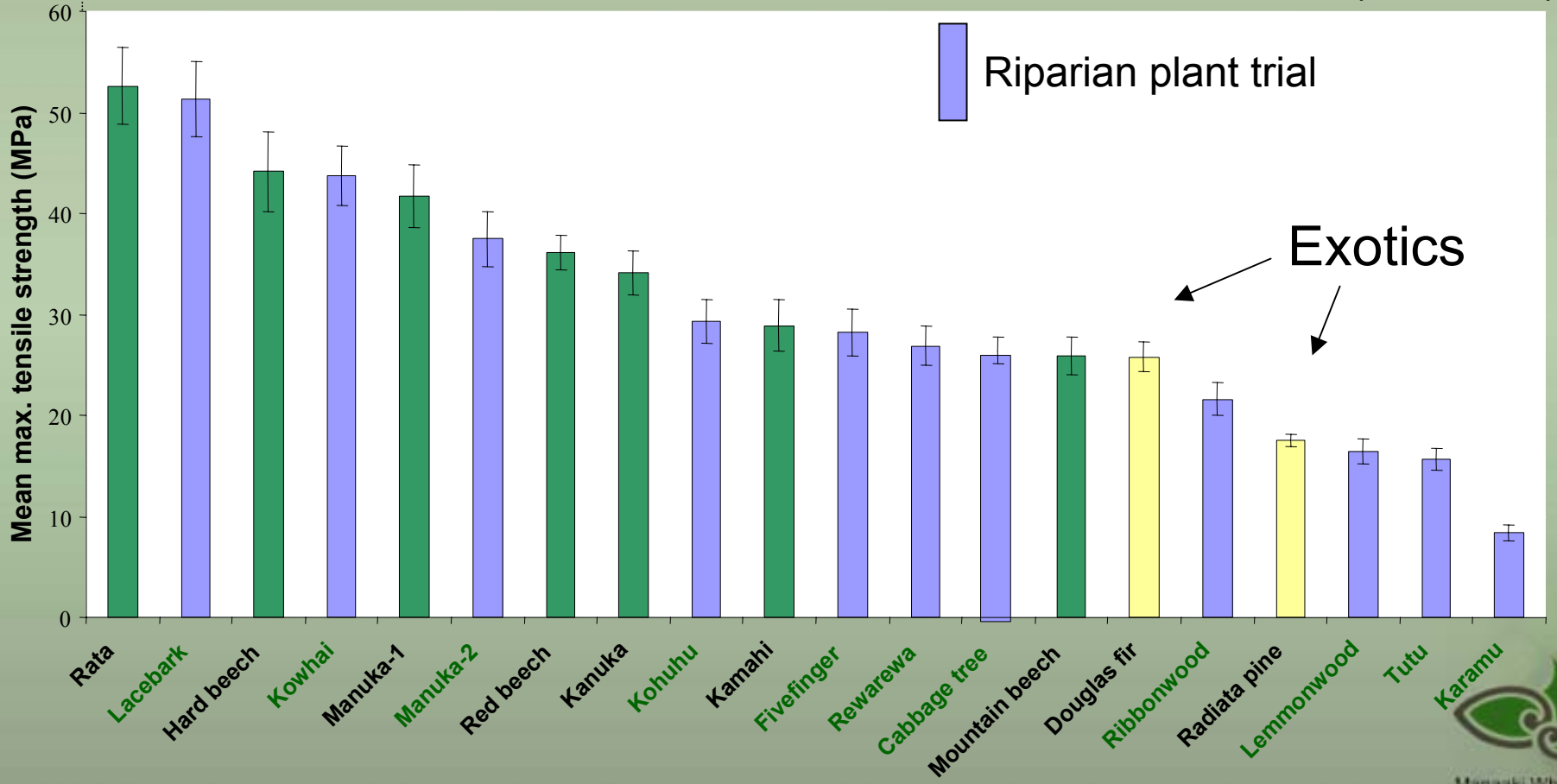
Czernin (2002)

Root tensile strength

(1 - 4 mm diameter)

Willows 30 - 75 MPa

Watson & Marden (submitted)



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
- species can withstand breakage and over-topple



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


MAYBE….

Decisions?

Ecologically designed vs functional performance?

- 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

Summary

- NZ natives take longer to grow than exotics – but not slow
- Some natives can regenerate, eg cabbage trees - good
- On own, natives not as good as willows for stabilising soils
- Effective after about 5 years
- Change the ecological mix to suit site
- Mixed plantings of natives and exotics?
- More work needed
  - non-woody spp
  - Mixed exotic/native
  - modelling

The end

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Species list and numbers extracted for partitioning

Common name	Botanical name	Number of plants extracted /species/year					
		1	2	3	4	5	Species Total
Karamu	*Coprosma robusta*	10	10	7	8	10	45
Ribbonwood	*Plagianthus regius*	10	10	10	10	10	50
Kowhai	*Sophora tetraptera*	10	8	8	8	10	44
Lemonwood	*Pittosporum eugenoides*	10	10	10	10	10	50
Kohuhu	*Pittosporum tenuifolium*	10	10	10	9	10	49
Lacebark	*Hoheria populnea*	10	10	10	10	8	48
Mapou	*Myrsine australis*	10	10	10	10	10	50
Fivefinger	*Pseudopanax arboreus*	10	10	10	8	8	46
Cabbage tree	*Cordyline australis*	10	10	10	10	10	50
Rewarewa	*Knightia excelsa*	10	10	10	10	9	49
Manuka	*Leptospermum scoparium*	10	10	5	0	5	30
Tutu	*Coriaria arborea*	10	10	10	8	5	43
Annual totals		120	118	110	101	105	554

Biomass

Pseudopanax arboreus (fivefinger)