



Manaaki Whenua  
Landcare Research

# Stabilising characteristics of NZ riparian plants



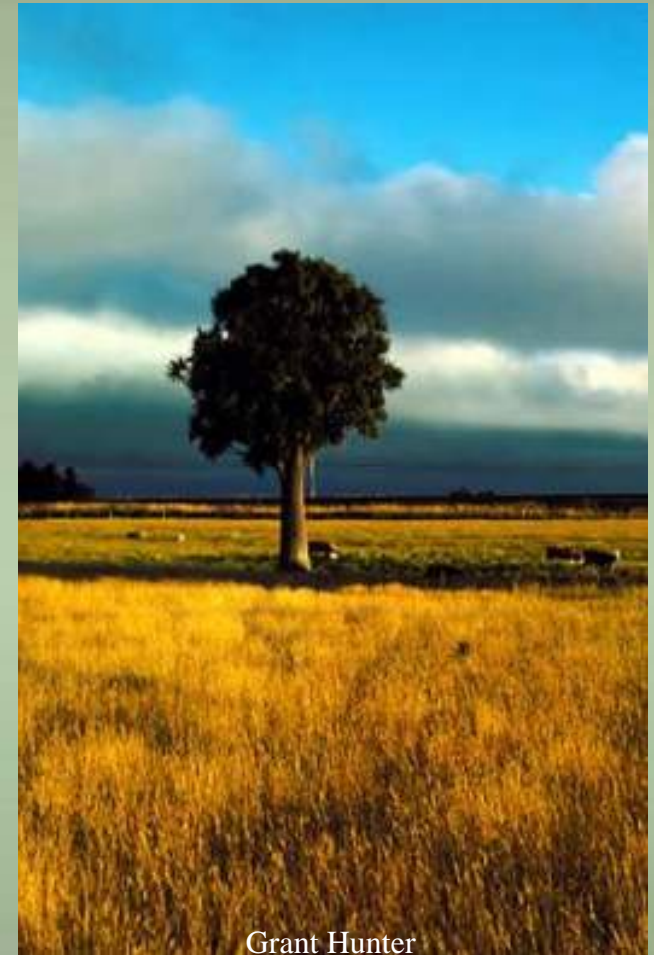
**Chris Phillips & Mike Marden**  
(and Donna Rowan)

MAKING A DIFFERENCE FOR A TRULY CLEAN, GREEN NEW ZEALAND



# Outline

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



Grant Hunter



# 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?



# 2 strands of recent work

## Riparian plant trial

## Cabbage trees

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

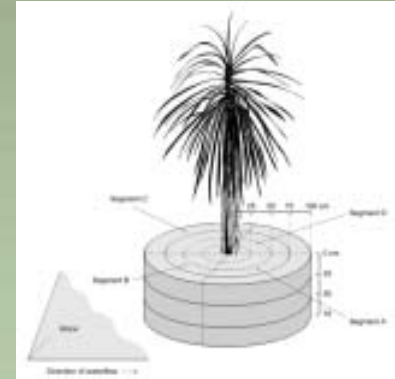


Marden, Rowan, Phillips

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



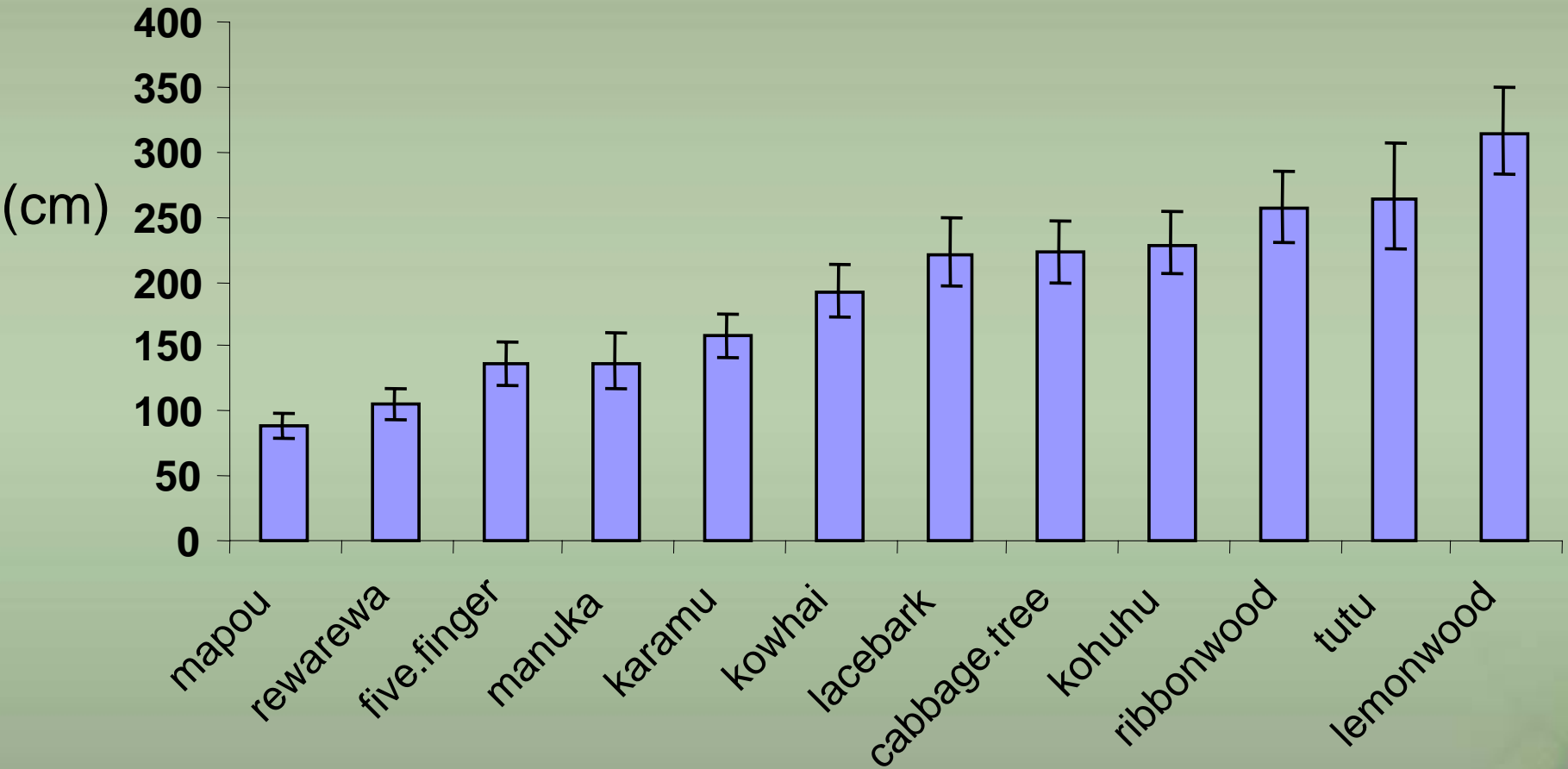
*Pittosporum tenuifolium* (kohuhu)



*Coprosma robusta* (karamu)



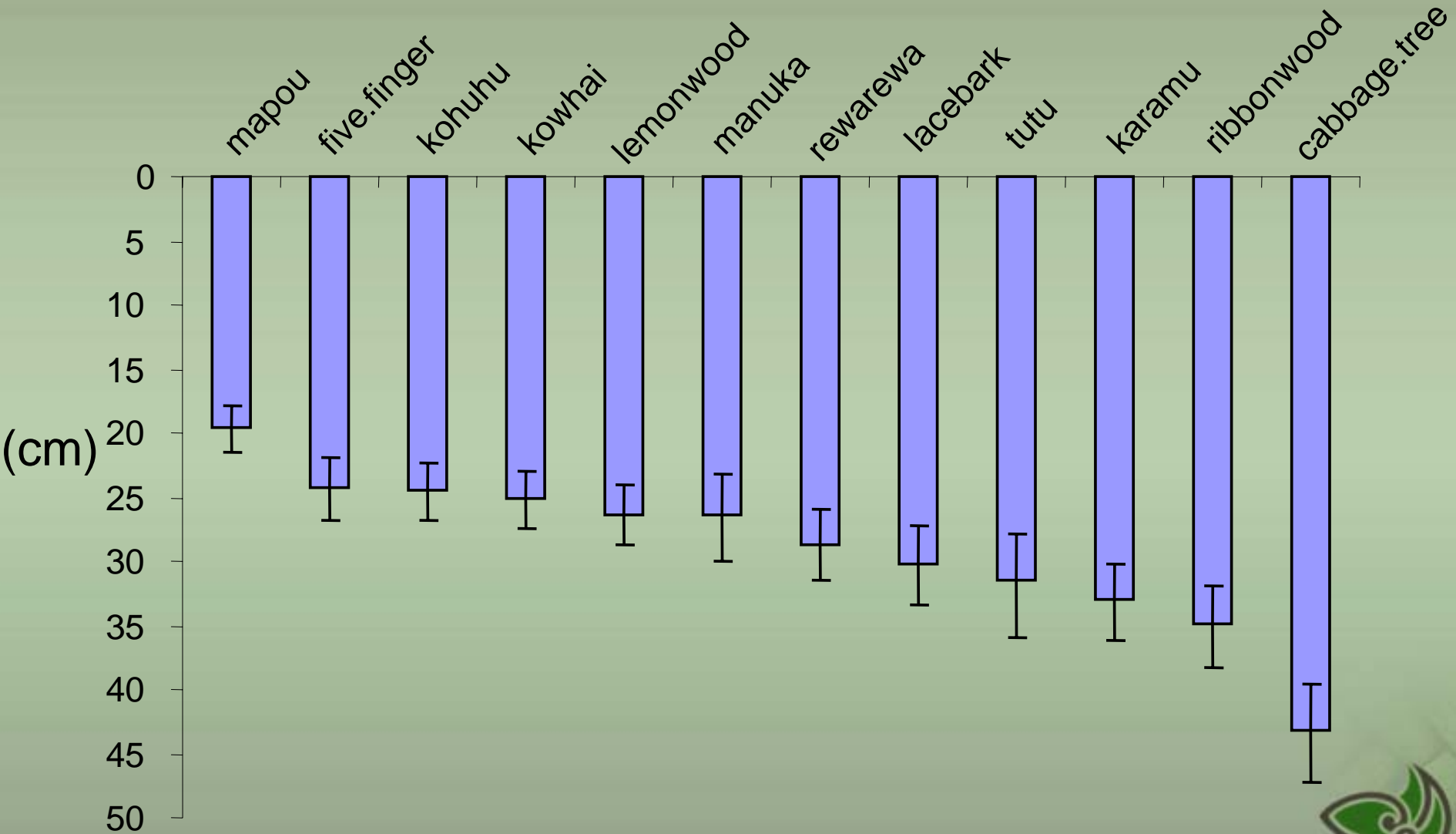
# Root spread – 5 year old



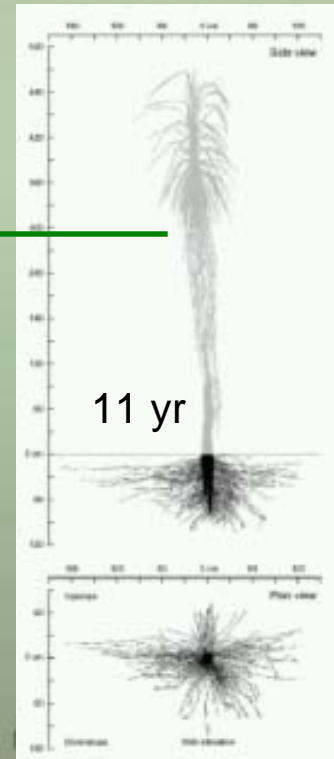
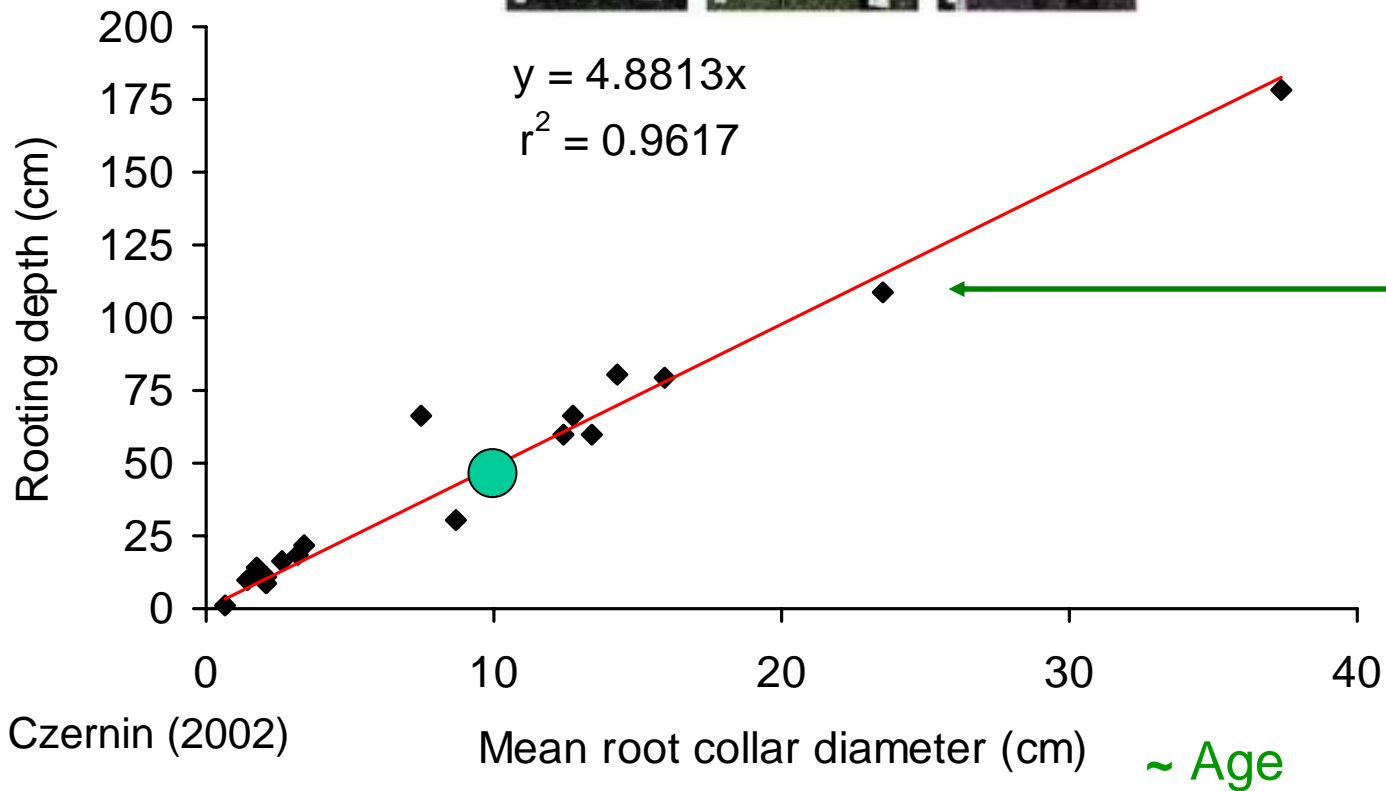
# Results - root depth



# Root depth – 5 year old

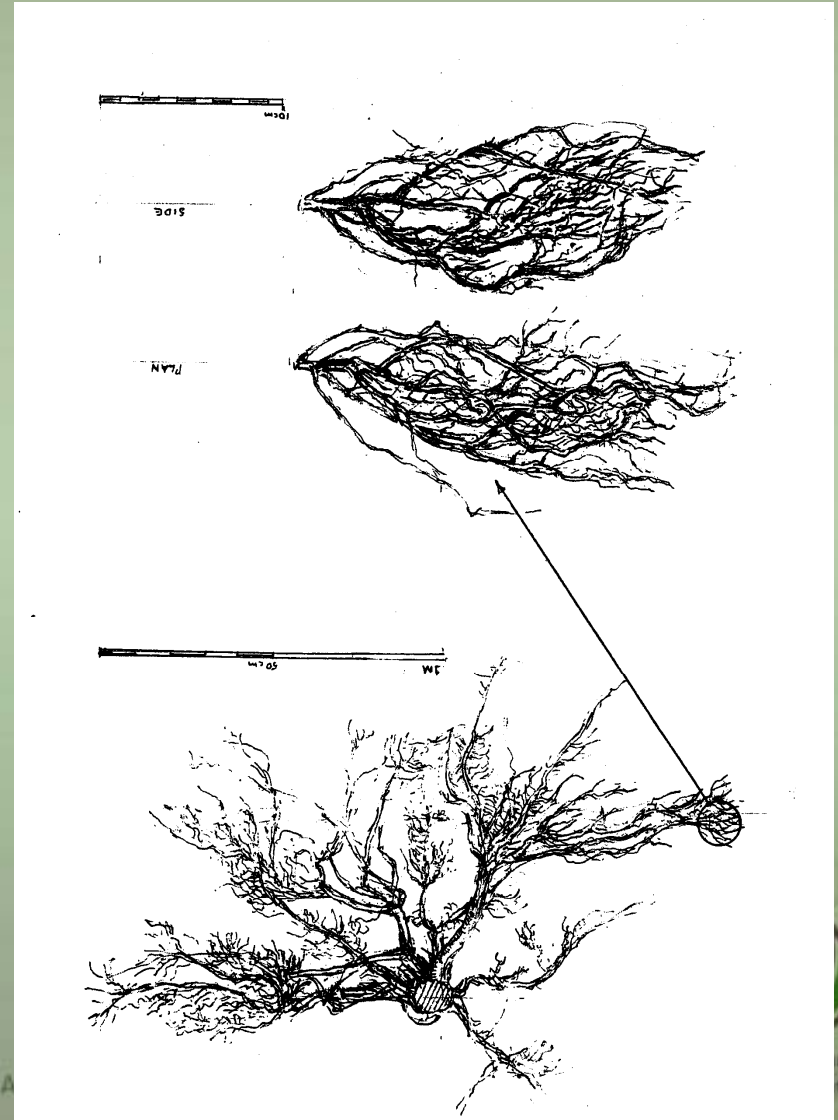


# Root depth – cabbage tree

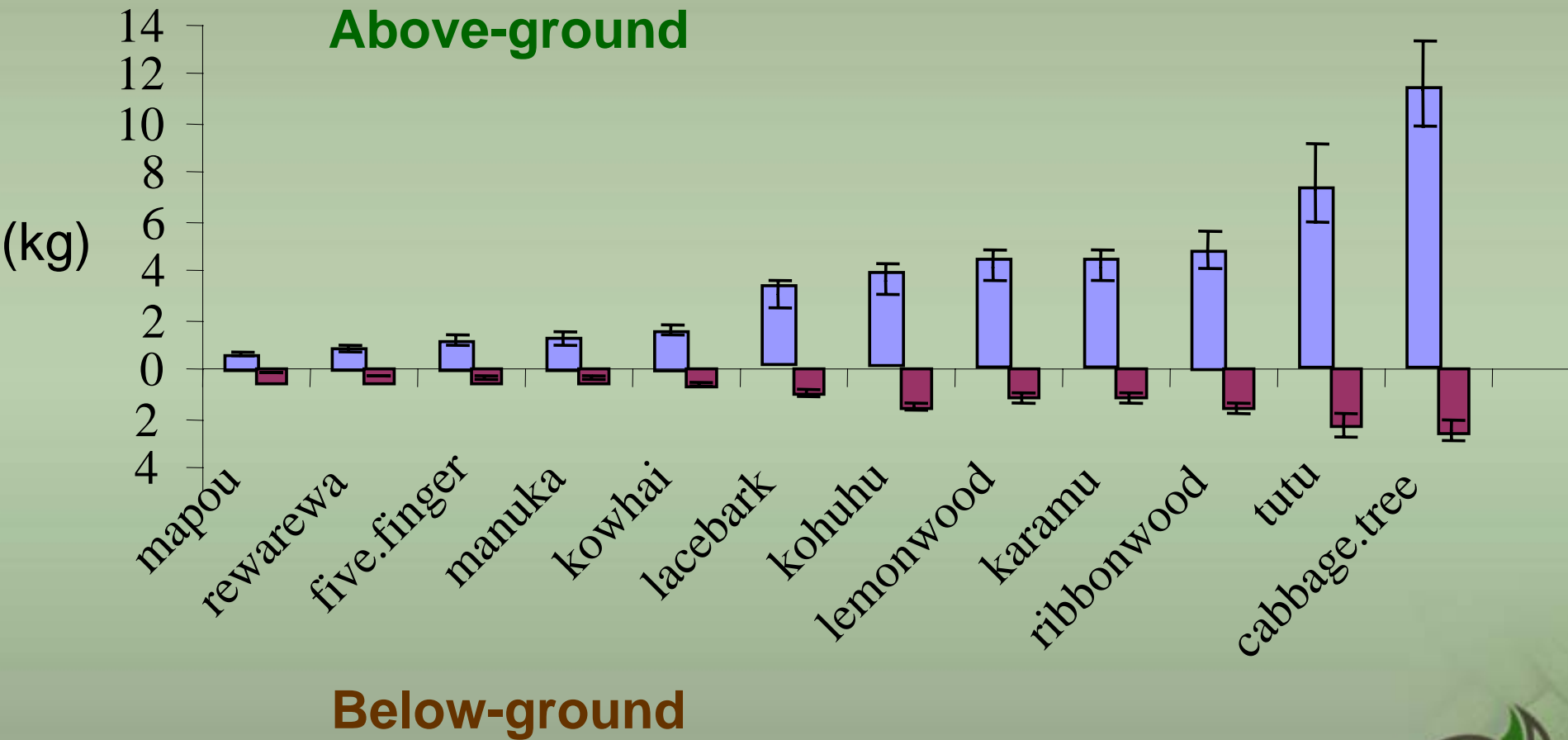


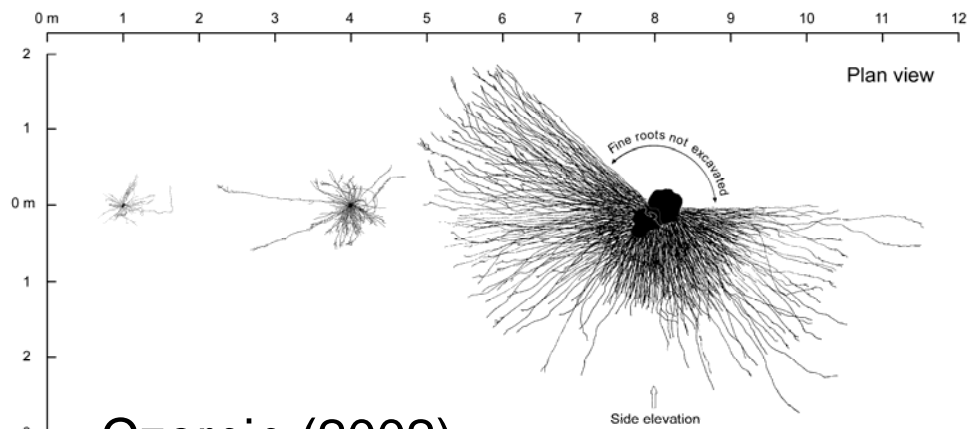
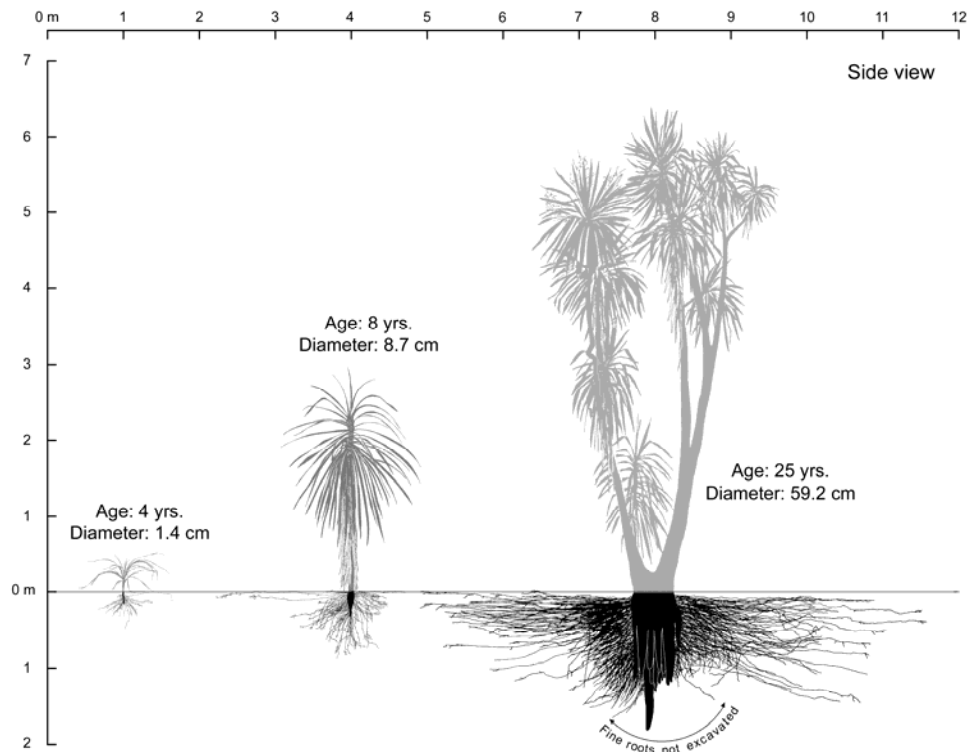
# Biomass

*Pseudopanax arboreus* (fivefinger)



# Biomass – 5 year old





Czernin (2002)

# Growth summary



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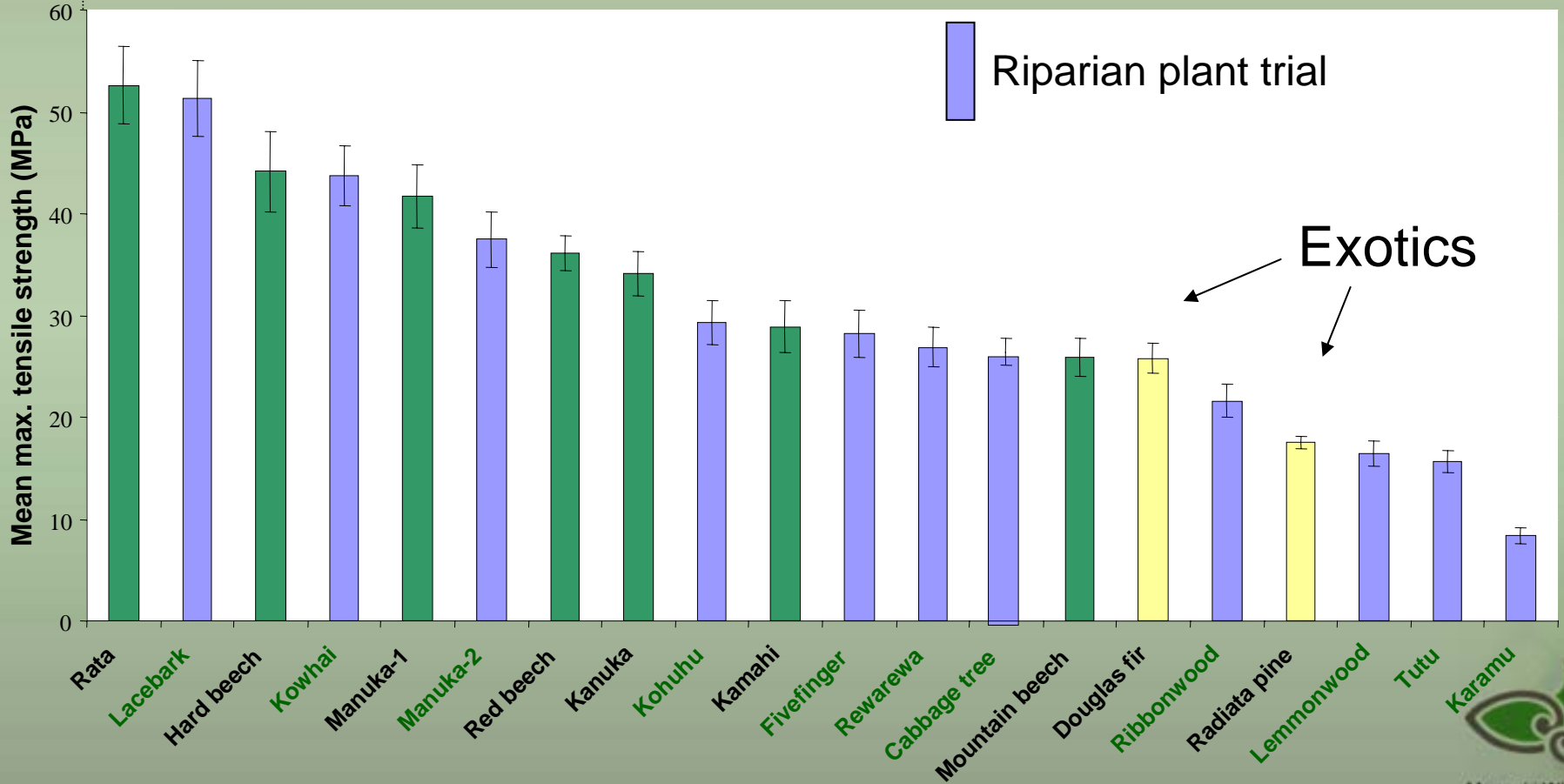
# Root tensile strength

(1 - 4 mm diameter)



Willows 30 - 75 MPa

Watson & Marden (submitted)



# Implications for bank stabilization - small streams

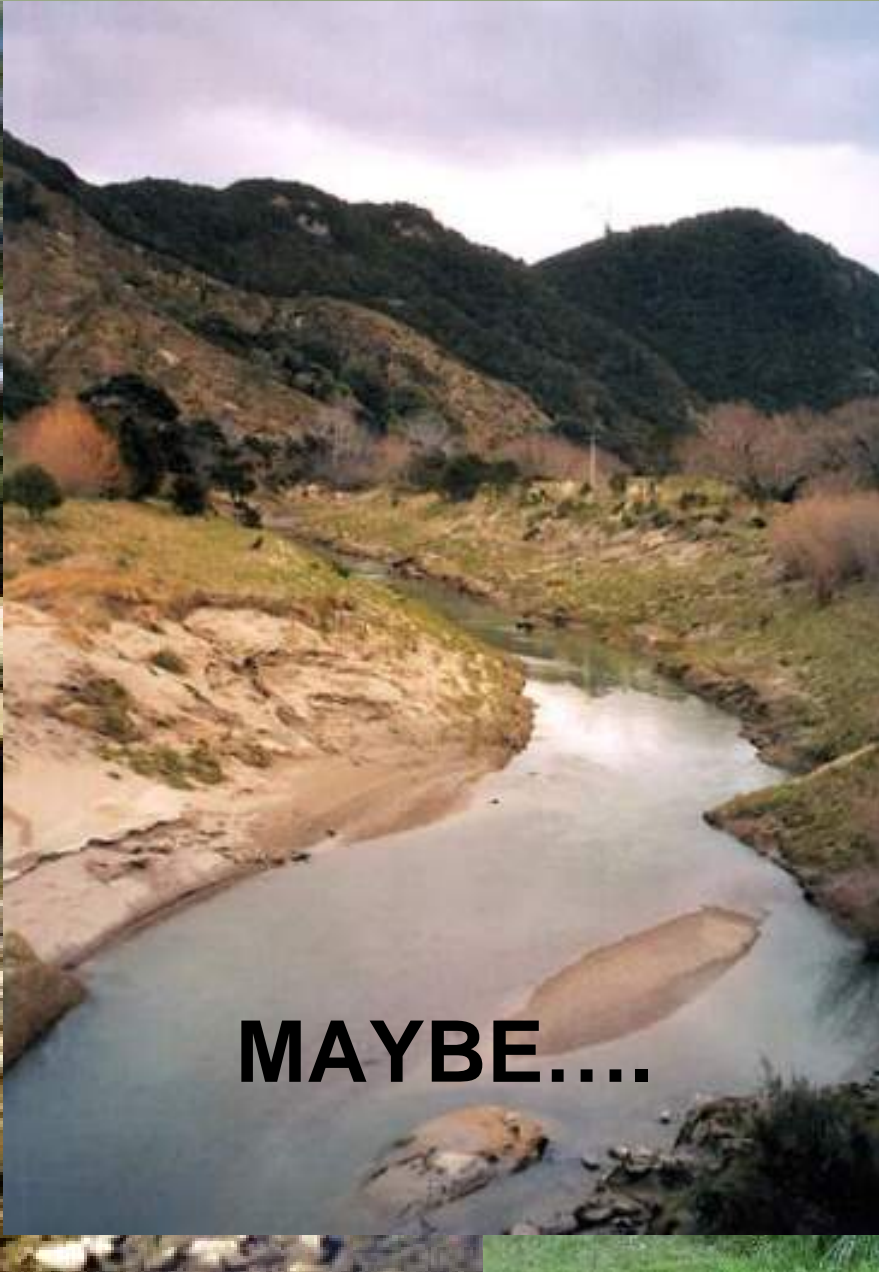
- no limitations, provided that bank height is not more than ~2 m and channel bed is stable
- success depends on density - formation of dense canopy & full root occupancy of the soil
- shallow soil stabilisation after 3-5 years
- improvement in deeper slope stabilisation expected within 7-10 years of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

