Stabilising characteristics of NZ riparian plants

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(and Donna Rowan)
Outline

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

http://icm.LandcareResearch.co.nz/
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

<table>
<thead>
<tr>
<th>Common name</th>
<th>Botanical name</th>
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</thead>
<tbody>
<tr>
<td>Karamu</td>
<td><em>Coprosma robusta</em></td>
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<tr>
<td>Ribbonwood</td>
<td><em>Plagianthus regius</em></td>
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<tr>
<td>Kowhai</td>
<td><em>Sophora tetraptera</em></td>
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<tr>
<td>Lemonwood</td>
<td><em>Pittosporum eugenoides</em></td>
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<tr>
<td>Kohuhu</td>
<td><em>Pittosporum tenuifolium</em></td>
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<tr>
<td>Lacebark</td>
<td><em>Hoheria populnea</em></td>
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<tr>
<td>Mapou</td>
<td><em>Myrsine australis</em></td>
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<tr>
<td>Fivefinger</td>
<td><em>Pseudopanax arbores</em></td>
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<tr>
<td>Cabbage tree</td>
<td><em>Cordyline australis</em></td>
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<tr>
<td>Rewarewa</td>
<td><em>Knightia excelsa</em></td>
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<td>Manuka</td>
<td><em>Leptospermum scoparium</em></td>
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<tr>
<td>Tutu</td>
<td><em>Coriaria arborea</em></td>
</tr>
</tbody>
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Cabbage trees

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)
Results - root depth
Root depth – 5 year old

(mapou  five.finger  kohuhu  kowhai  lemonwood  manuka  rewarewa  lacebark  tutu  karamu  ribbonwood  cabbage.tree)

(cm)
Root depth – cabbage tree

\[ y = 4.8813x \]
\[ r^2 = 0.9617 \]

Czernin (2002)
Biomass

Pseudopanax arboreus (fivefinger)
Growth summary

Czernin (2002)
Root tensile strength

(1 - 4 mm diameter)

Willows 30 - 75 MPa

Watson & Marden (submitted)

Exotics

Riparian plant trial
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
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