Willows in small Victorian streams: spread and geomorphic effects

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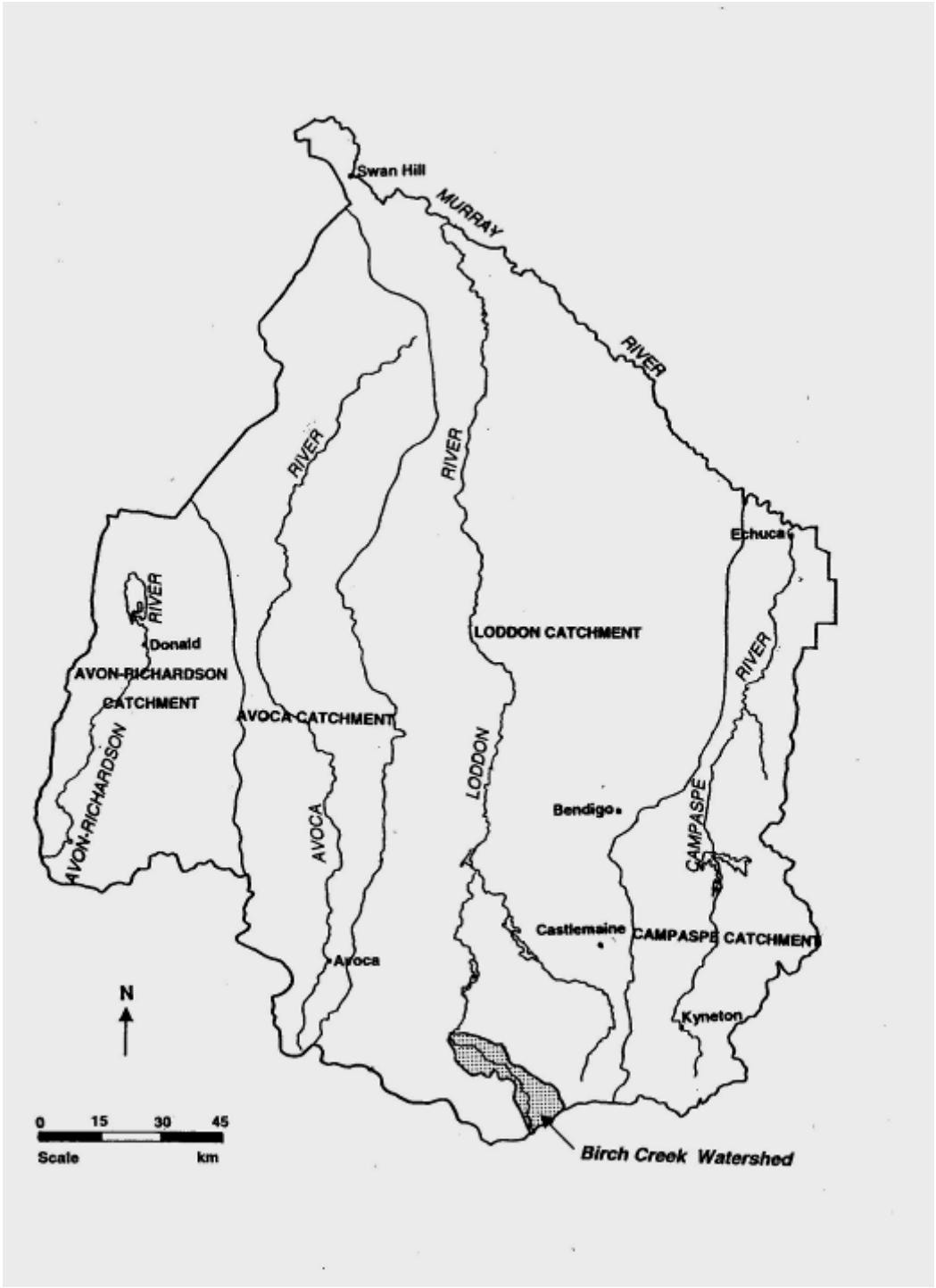
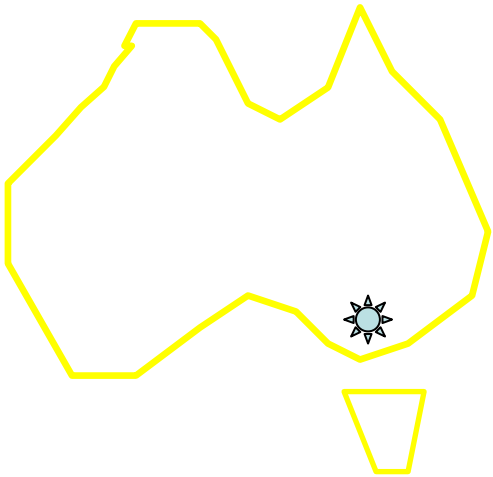
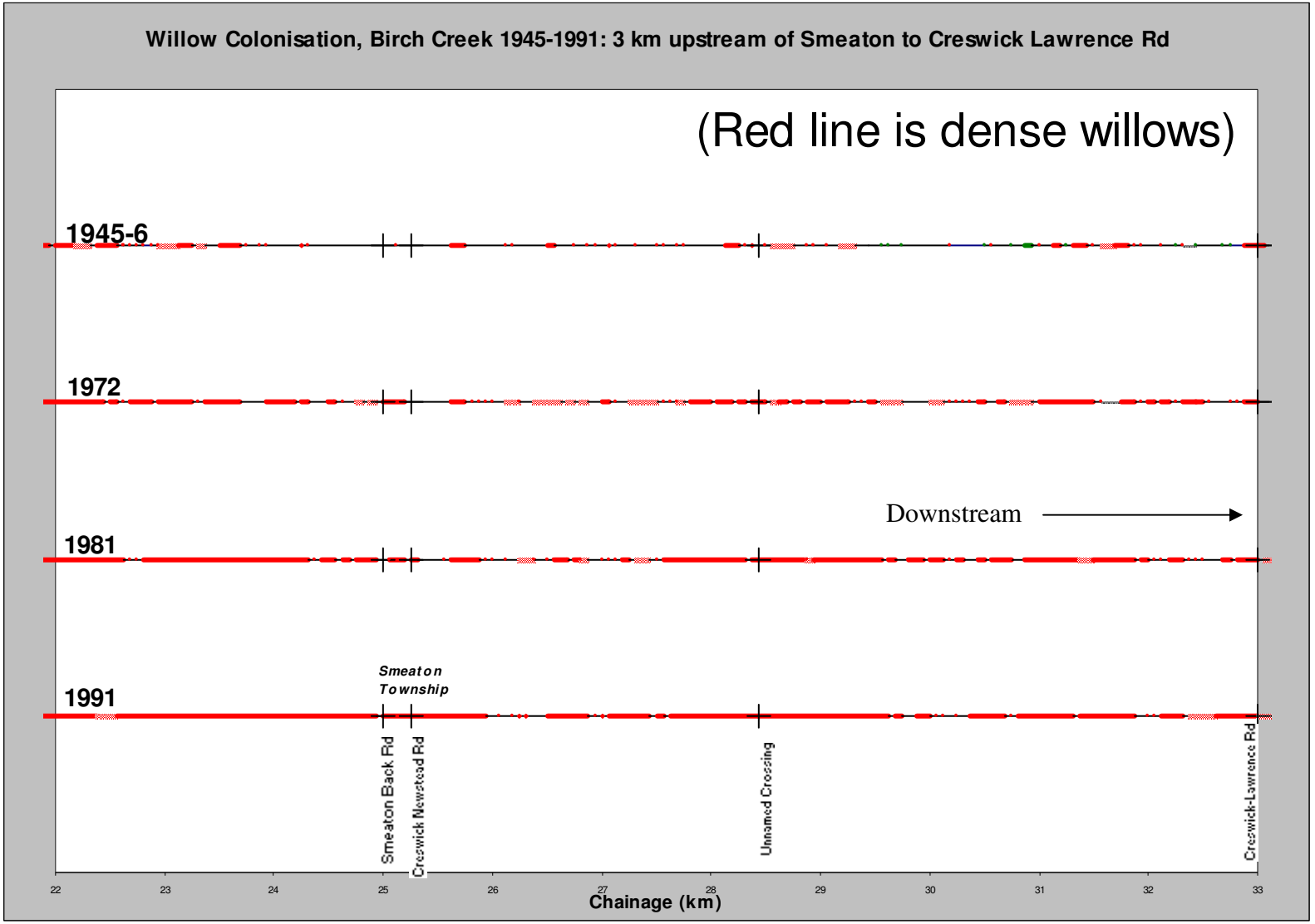
and Lizzie Pope


Swan Hill
MURRAY
RIVER
RIVER
RIVER
RIVER
Echuca
LODDON CATCHMENT
RIVER
Donald
AVON-RICHARDSON
CATCHMENT
AVOCA CATCHMENT
AVON-RICHARDSON
AVOCA
LODDON
Bendigo
CAMPASPE
Castlemaine
CAMPASPE CATCHMENT
Avoca
Kyneton
N
0 15 30 45
Scale km
Birch Creek Watershed

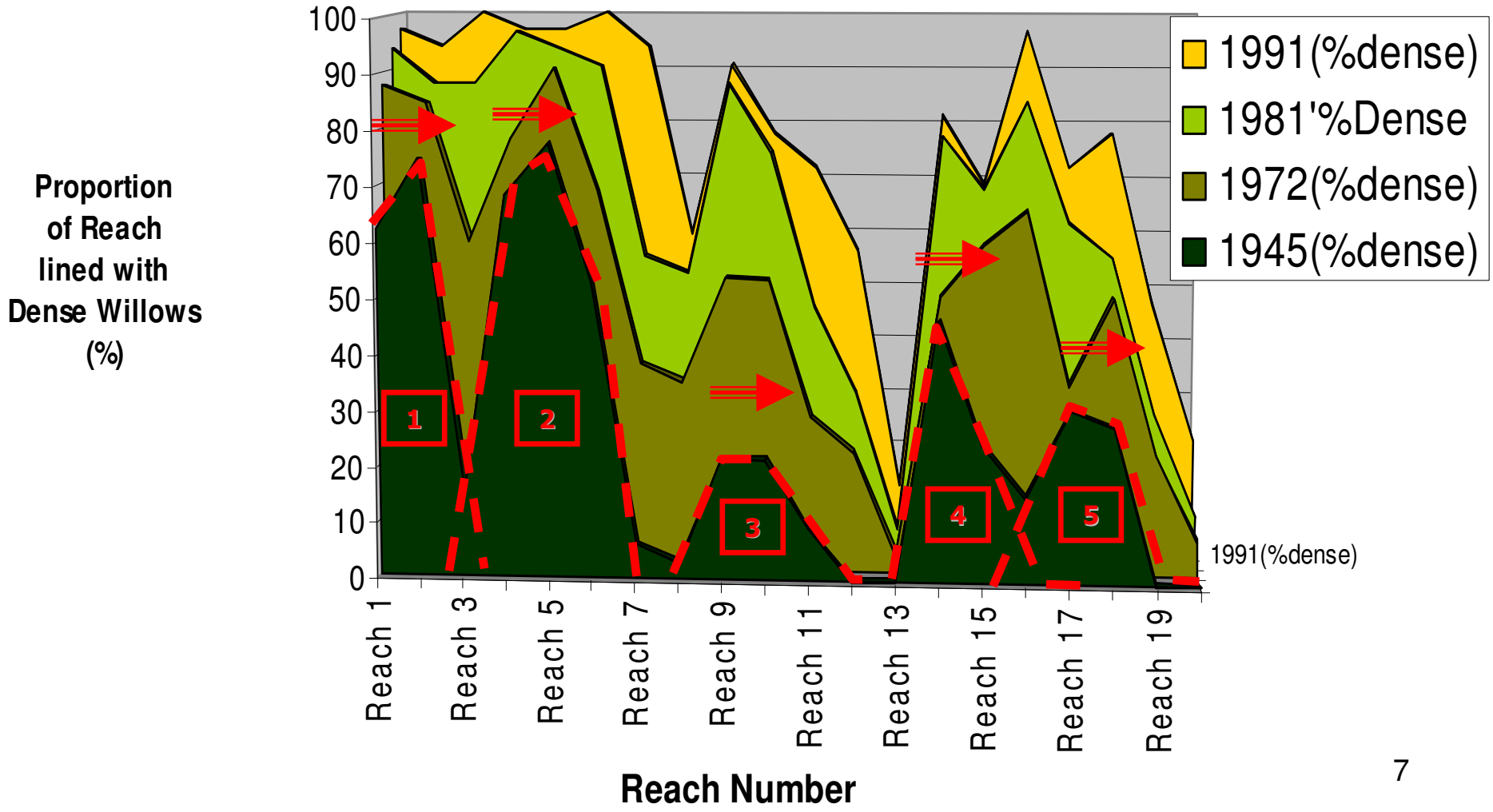


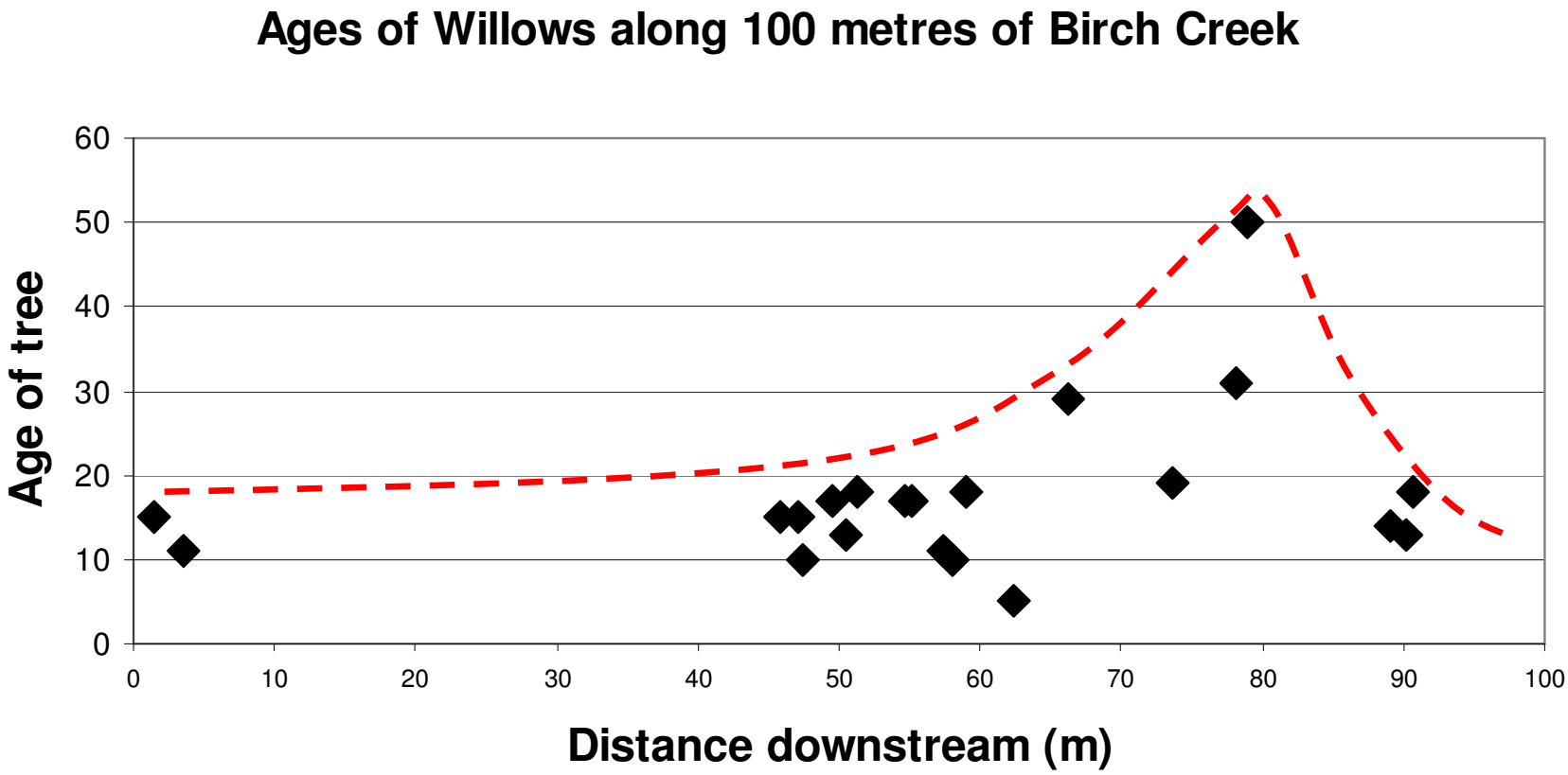
How do willows disperse?

- Neighbourhood dispersion (*falling over*)
- Hierarchical dispersion (*floating sticks*)

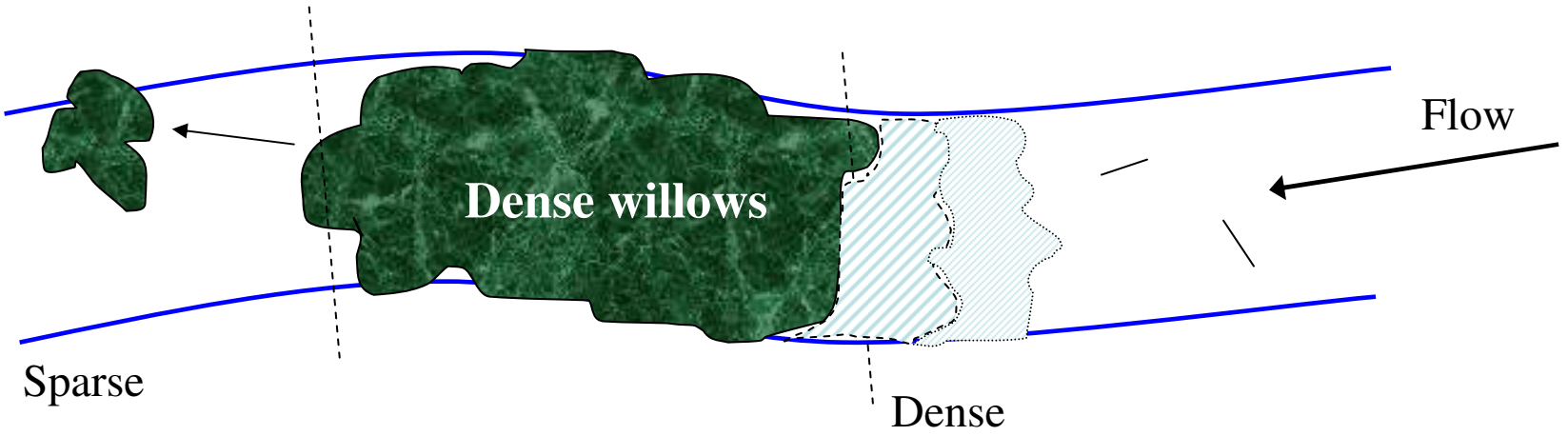

Willow Colonisation, Birch Creek 1945-1991: 3 km upstream of Smeaton to Creswick Lawrence Rd
(Red line is dense willows)
1945-6
1972
1981
1991
Downstream
Smeaton Township
Smeaton Back Rd
Creswick Newstead Rd
Unnamed Crossing
Creswick-Lawrence Rd
22
23
24
25
26
27
28
29
30
31
32
33
Chainage (km)

Willow Colony Distribution 1945-1991:
5 colonies, LINEAR spread at 60 – 80m per year:




Ages of Willows along 100 metres of Birch Creek
Age of tree
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
Distance downstream (m)

Vegetative spread of willows



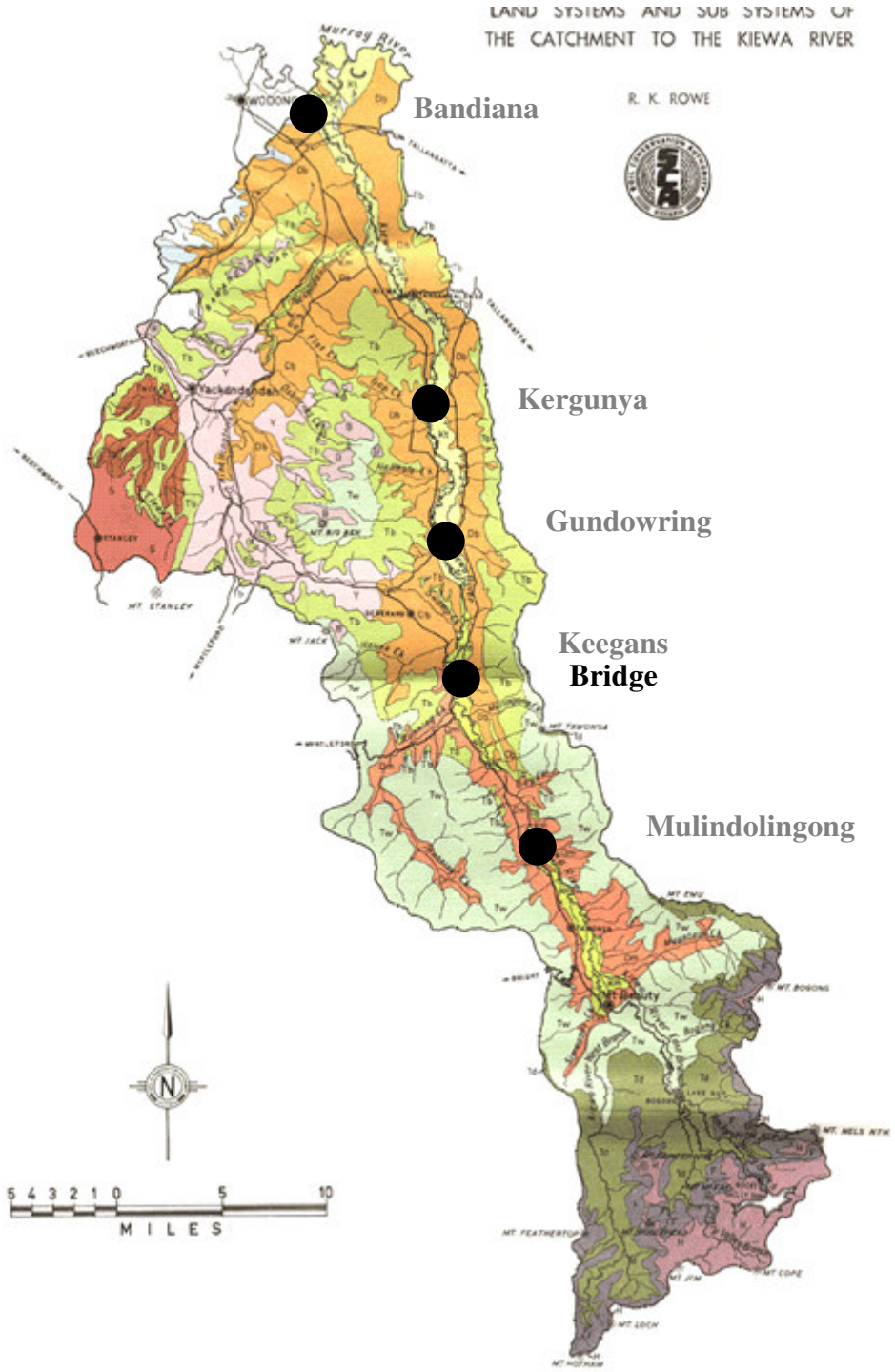
Implication of linear spread

- Can consider each dense clump independently
- Use dense clumps to control spread
- Hold the line by targetting ‘pioneers’ between dense clumps

Cost of willow control

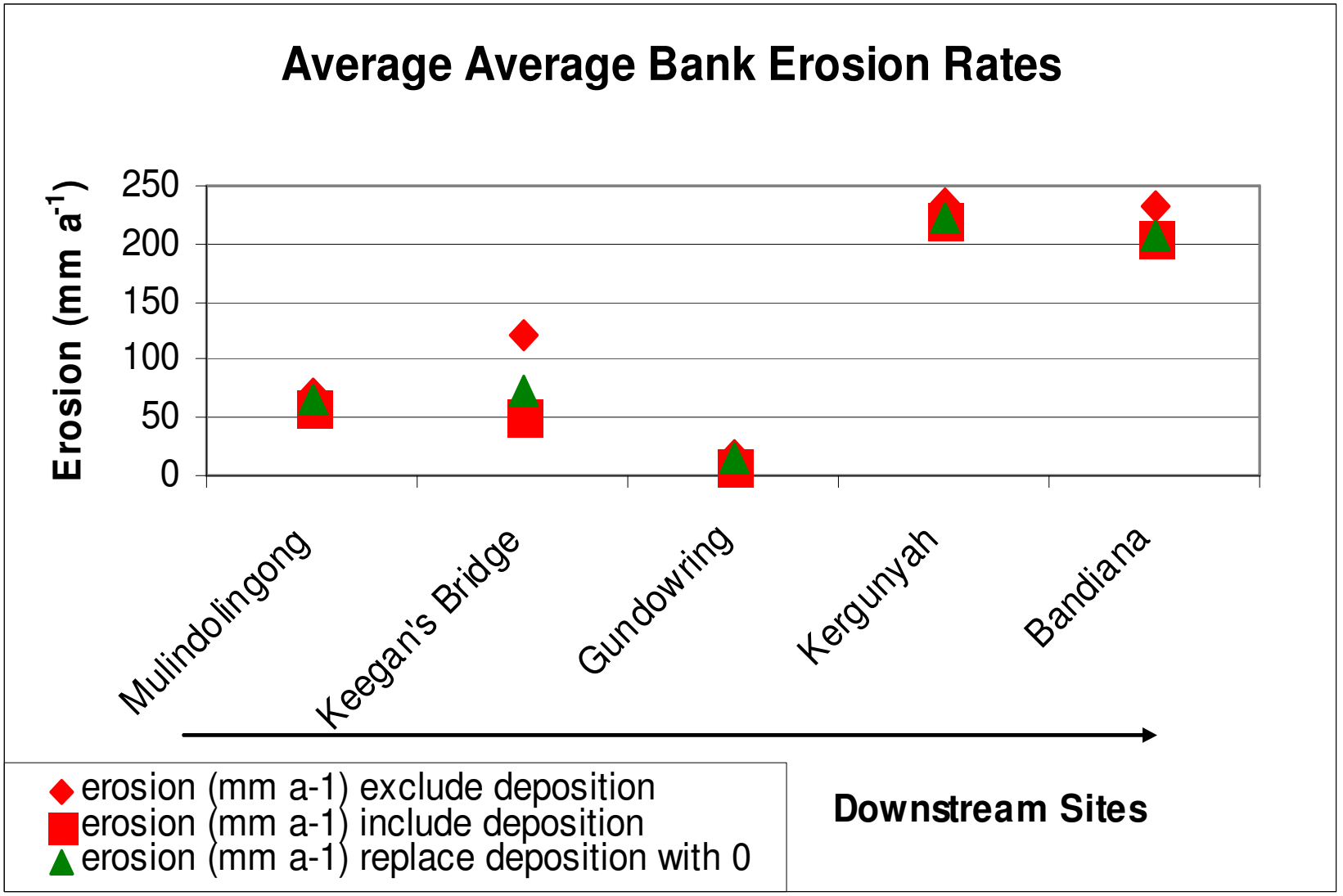
	Prevention	Managing dense stands
Next 20 years	$4,500	$100,000
Last 45 years	$40,000	$280,000

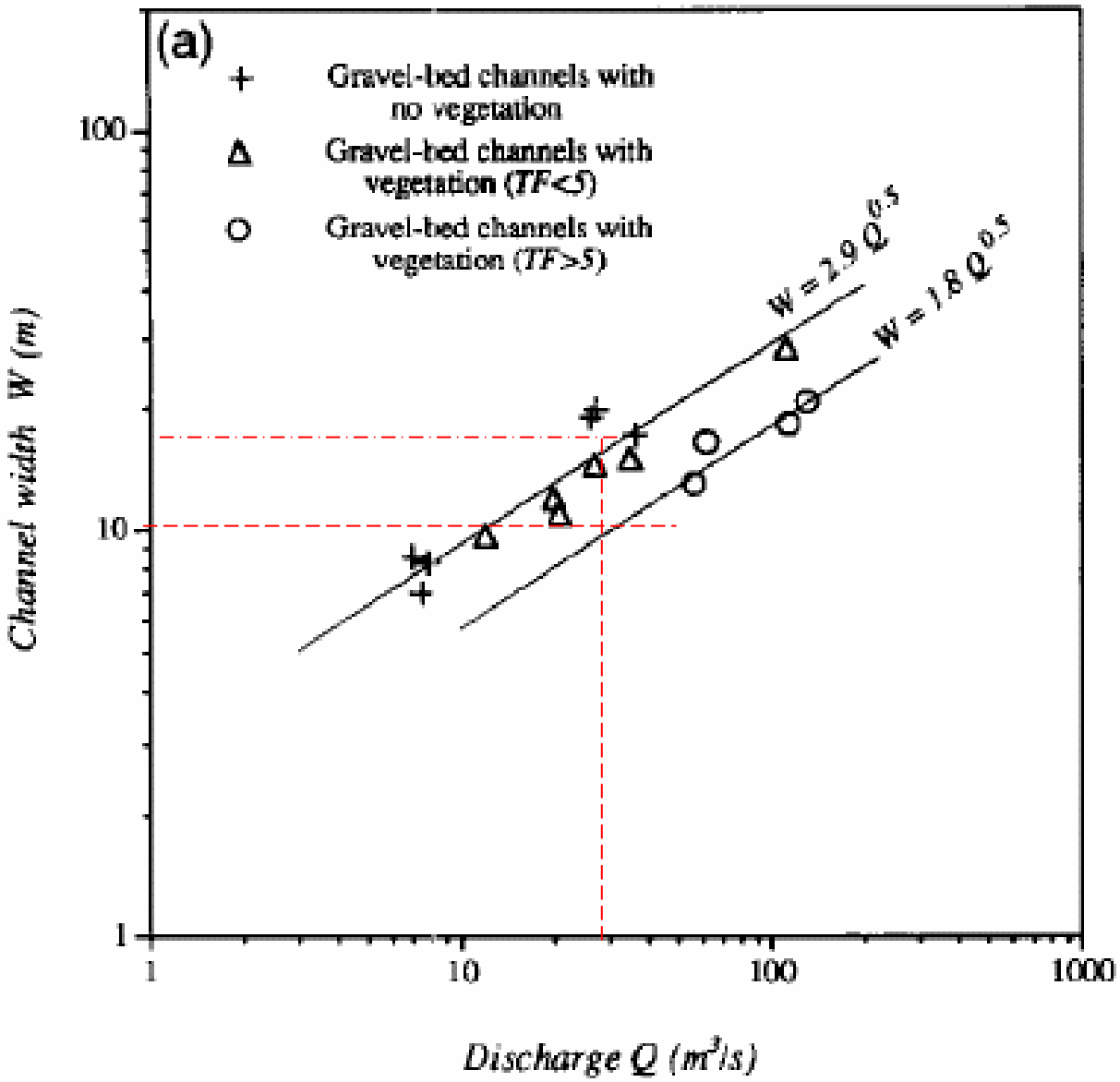

CATERPILLAR



Erosion mechanisms Kiewa River

Gundowring

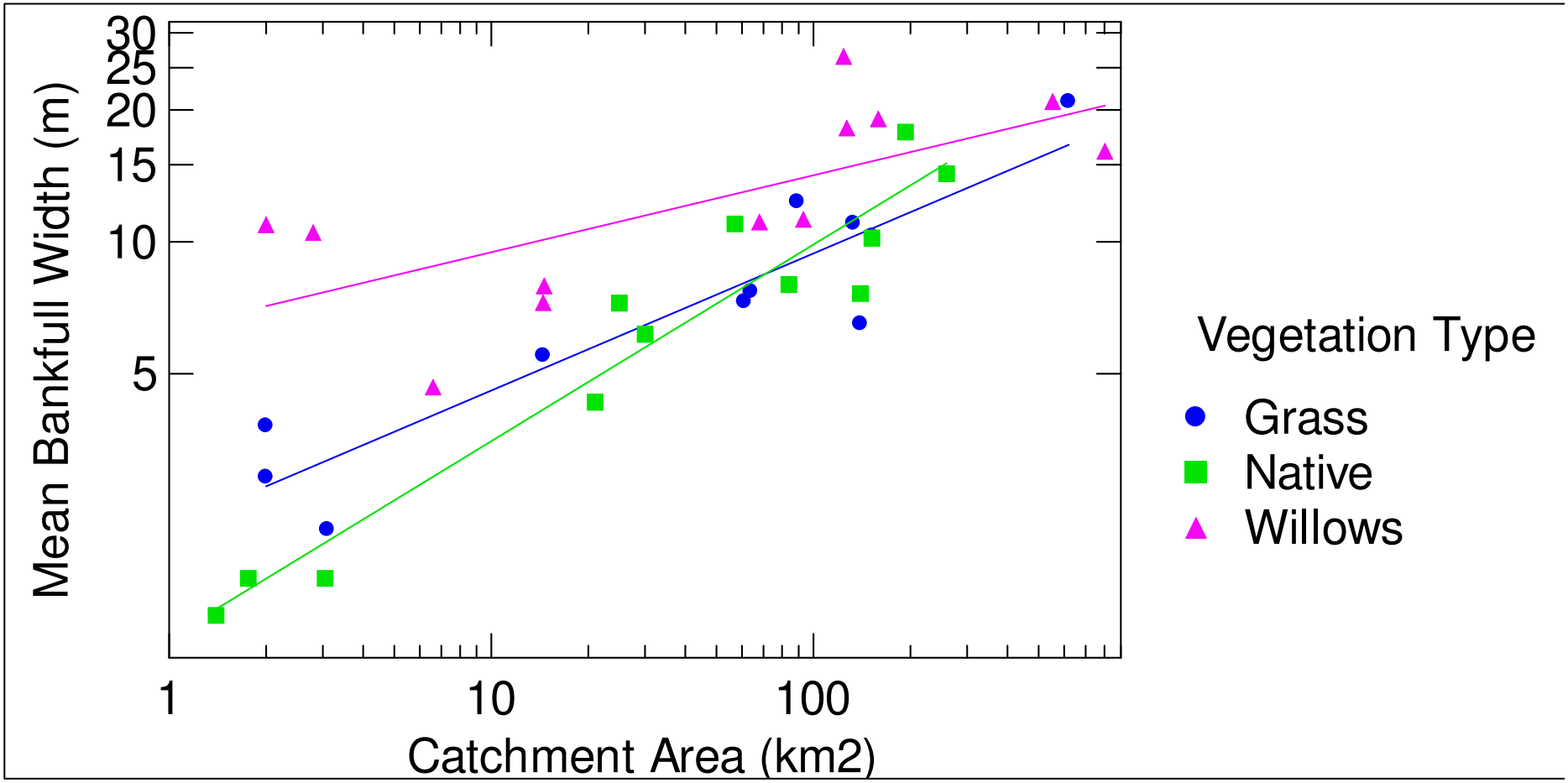

Average Average Bank Erosion Rates
Erosion (mm a-1)
250
200
150
100
50
0
Mulindolingong
Keegan's Bridge
Gundowring
Kergunyah
Bandiana
Downstream Sites
erosion (mm a-1) exclude deposition
erosion (mm a-1) include deposition
erosion (mm a-1) replace deposition with 0



Remove veg = wider

(Huang & Nanson, 1997 p.243)

Vegetation type vegetation. width



(from Lizzie Pope, Hons thesis, 2005)

Do tree roots alter the erosion rate of cohesive bank sediments?

Submerged Jet Device for Testing Resistance of River Banks

Scour Hole

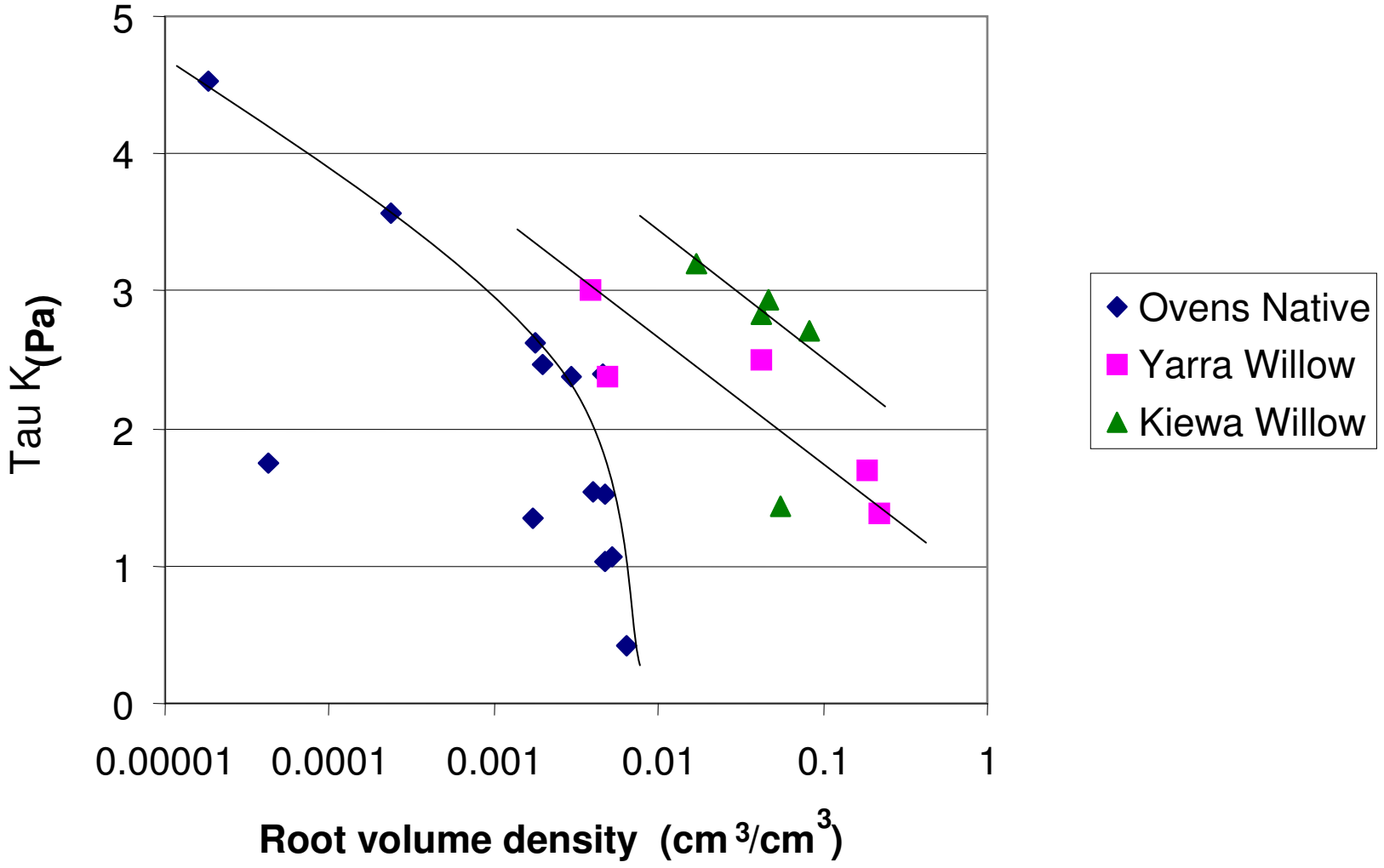
Relatively low resistance

Relatively high resistance

Site characterization and location of jet tests

- Isolated bank face with minimal or no surface vegetation
- Surface soils characterized by mud drape over cohesive soils.
- Bank top colonized by large native tree species (red gum)

Critical tractive force vrs. root volume density



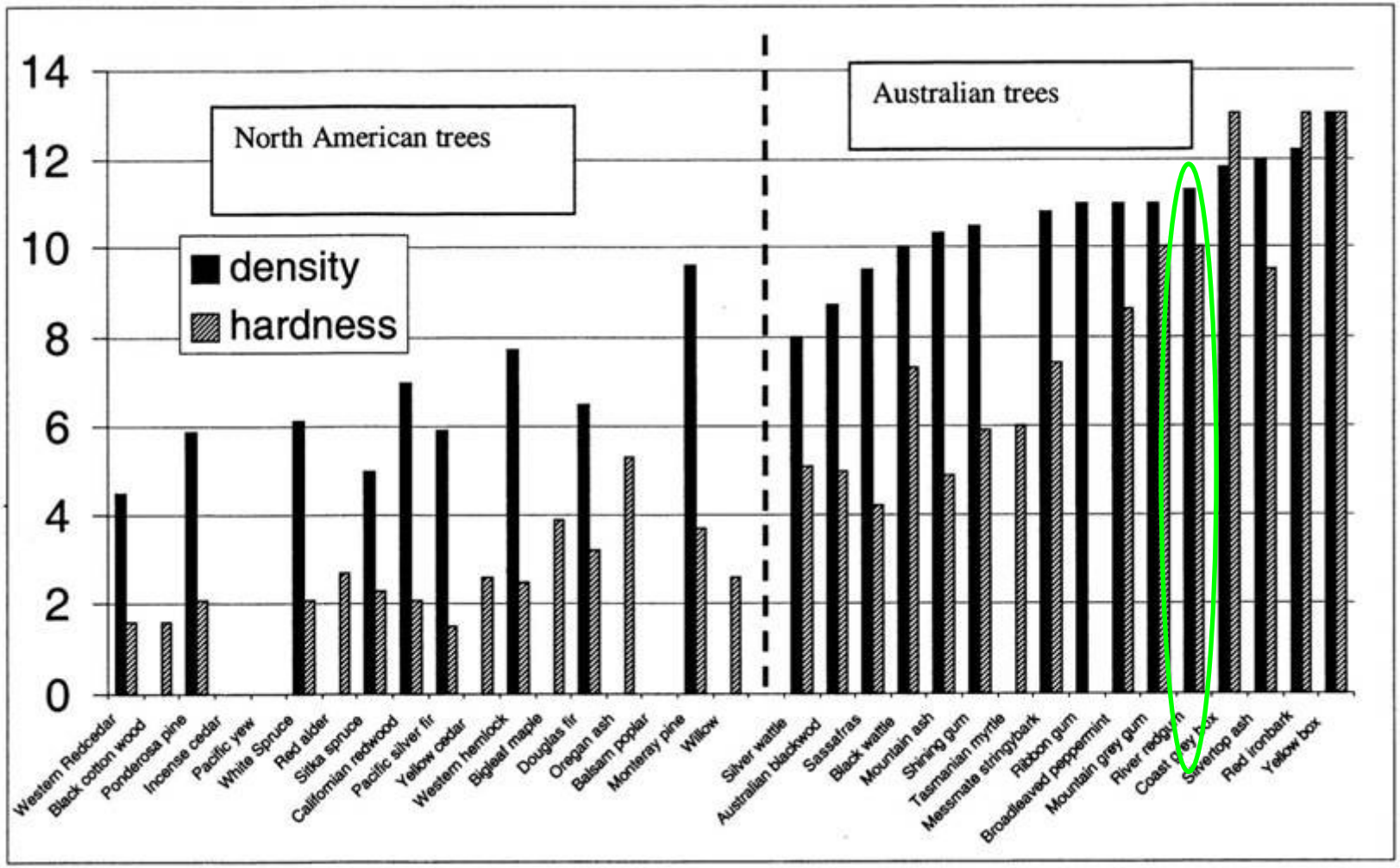
Consequences of removing willows?

- Headcuts
- Sediment pulse
- Nutrients
- Warming

Conclusions

- Willow dispersion
- Erosion and deposition
- Willows
  - Reduce bank erosion rates
  - Increase width of smaller streams
  - Decrease width of larger streams
  - Trap sediment
- Removing willows will trigger channel change!

Density & hardness of North American and Australian trees



(Data from Karen White)