EFFECTIVENESS OF SPACE-PLANTED TREES FOR CONTROLLING SOIL SLIPPAGE ON PASTORAL HILL COUNTRY

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Introduction

Spaced trees of *Populus* (poplar), *Salix* (willow), and *Eucalyptus* (eucalypts) have been grown to stabilise erodible pastoral hillslopes for more than 40 years. There is negligible quantification of the effectiveness of different densities and sizes of trees for reducing soil slip erosion. This erosion type can significantly alter sediment/nutrient distribution on slopes and reduce pasture productivity.

Information on tree spacing and size is essential for predicting those tree-pasture systems that are likely to be resilient during future storm events, and for refining recommendations for future tree planting and management programmes. This study aimed to determine the effectiveness for erosion control of a range of spaced tree plantings following storms in Manawatu (February 2004) and Wairarapa (July 2006).

Materials and Methods

65 sites, each comprising 5-10 trees on mid-upper slopes; variable tree age/size and density; pasture control sites < 1 km from tree sites.

Assessments for aspect, slope, and tree spacing, height, canopy radius, and diameter at breast height (DBH). Fresh soil slippage within 10 m of trees was mapped and percentage of slippage within tree and pasture sites estimated.

Results

Sites were most frequently NE to NW in Manawatu and SE to SW in Wairarapa. Slope of all tree sites averaged 27°.

Slippage occurred on 10 tree sites and 45 pasture sites. Sites with trees averaged < 1% soil slippage and the extent of slippage was 95% less than on pasture sites (Table 1).

Tree height ranged from 10.9 m for *Salix* spp. in Wairarapa to 28.6 m for *Populus* spp. in Manawatu (Table 2). *Populus* and *Salix* trees in Manawatu were taller, and had greater canopy radius and DBH than those in Wairarapa. Trees of *Eucalyptus* had the highest DBH. Tree density was 37 – 55 stems per hectare.

Six sites with *Populus* had slippage and at four of these, DBH was 26-30 cm. DBH of *Populus* at sites without slippage averaged 54 cm. Slippage occurred at two sites with *Salix* trees which had DBH of 18 cm and 30 cm. DBH of *Salix* trees at the four sites without slippage averaged 35 cm.

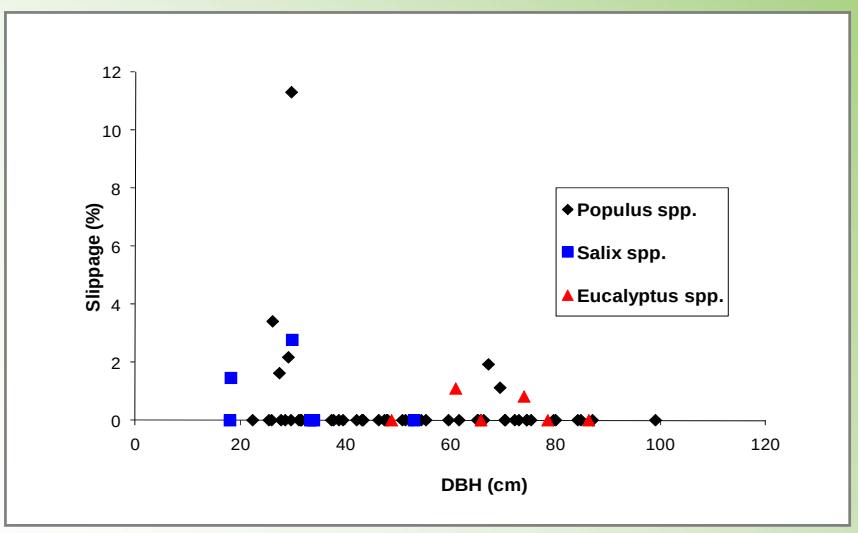
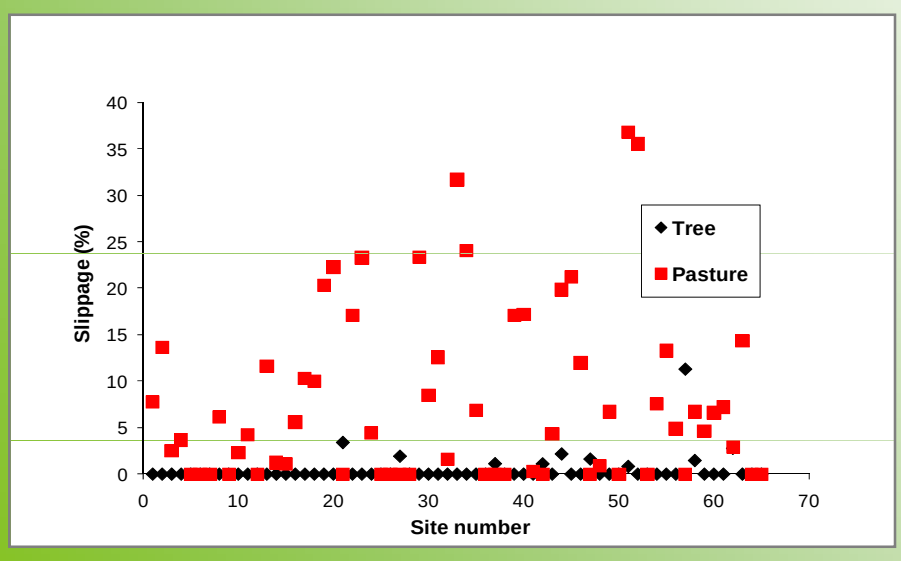


Table 2. Mean site and tree characteristics in August 2007 (*n* = number of sites).

Region	Species	*n*	Slope (°)	Slippage (%)	Height (m)	DBH (cm)	Canopy radius (m)	Stems per hectare
Manawatu	*Populus*	39	28	0.2	28.6	58.3	5.5	43
	Salix	1	24	0.0	20.6	53.0	5.7	52
Wairarapa	*Populus*	14	27	1.1	17.5	36.0	3.9	50
	Eucalyptus	6	29	0.3	18.8	69.1	5.9	37
	Salix	5	26	0.8	10.9	26.7	3.6	55

Table 1. Soil slippage (%) on tree and pasture sites in August 2007 (*n* = number of sites; mean and s.e. in brackets).

Region	*n*	Extent of slippage (%)	
		Tree sites	Pasture sites
Manawatu	40	0.2 (0.1)	7.8 (1.4)
Wairarapa	25	0.9 (0.5)	8.2 (2.1)



Discussion and Conclusions

Established trees reduced soil slippage by 95%, providing quantitative support for previous survey findings and experiences of land managers and farmers.

Populus and *Salix* trees in Manawatu were generally larger than those in Wairarapa and likely had more extensive root systems. The higher prevalence and severity of soil slippage on sites with trees with DBH < 30 cm was possibly because of inadequate root development.

Established trees at 30-60 sph (13 m to 18 m spacing) were very effective in reducing soil slippage. It is recommended to plant 3m poles at a spacing of 12 -15 m but if tree survival is 100%, results suggest that thinning could be practised without jeopardising soil conservation effectiveness.

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