# Effectiveness of poplar and willow trees in slope reinforcement

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# Do poplars do the job?

The effectiveness of conservation trees in stabilising soil on slopes was questioned by MAF in 2006 following major storms in three North Island regions, AND A SURVEY OF FARMERS (who rated effectiveness between 2.5 [young trees] and 3.0 [older trees] on a 1-5 scale

More objective data were needed

This study was to gather a larger data set to inform the debate

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# Previous studies

Researchers evaluated effectiveness following a major storm in 1988 (Cyclone Bola) and showed that

- 20.9% of the land became immediately unproductive for pasture growth, and
- without the trees this figure would have been 24.2%, a saving of 3.3% in lost production (i.e. <14% improvement)
- An average tree in the study stabilised 8.4 $m^2$ of ground
- Predicted that at 75 sph land slippage would be reduced from 8.2% to ~1.4% (a reduction of 83%)

Weakness of the study was poor DBH, age, spacing data

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# Factors affecting root development

- Plant genetics
- Competition
- Above ground stress

- Soil nutrients
- Water availability

- Soil bulk density
- Slope
- Soil depth
- Nature of the bedrock

- TIME

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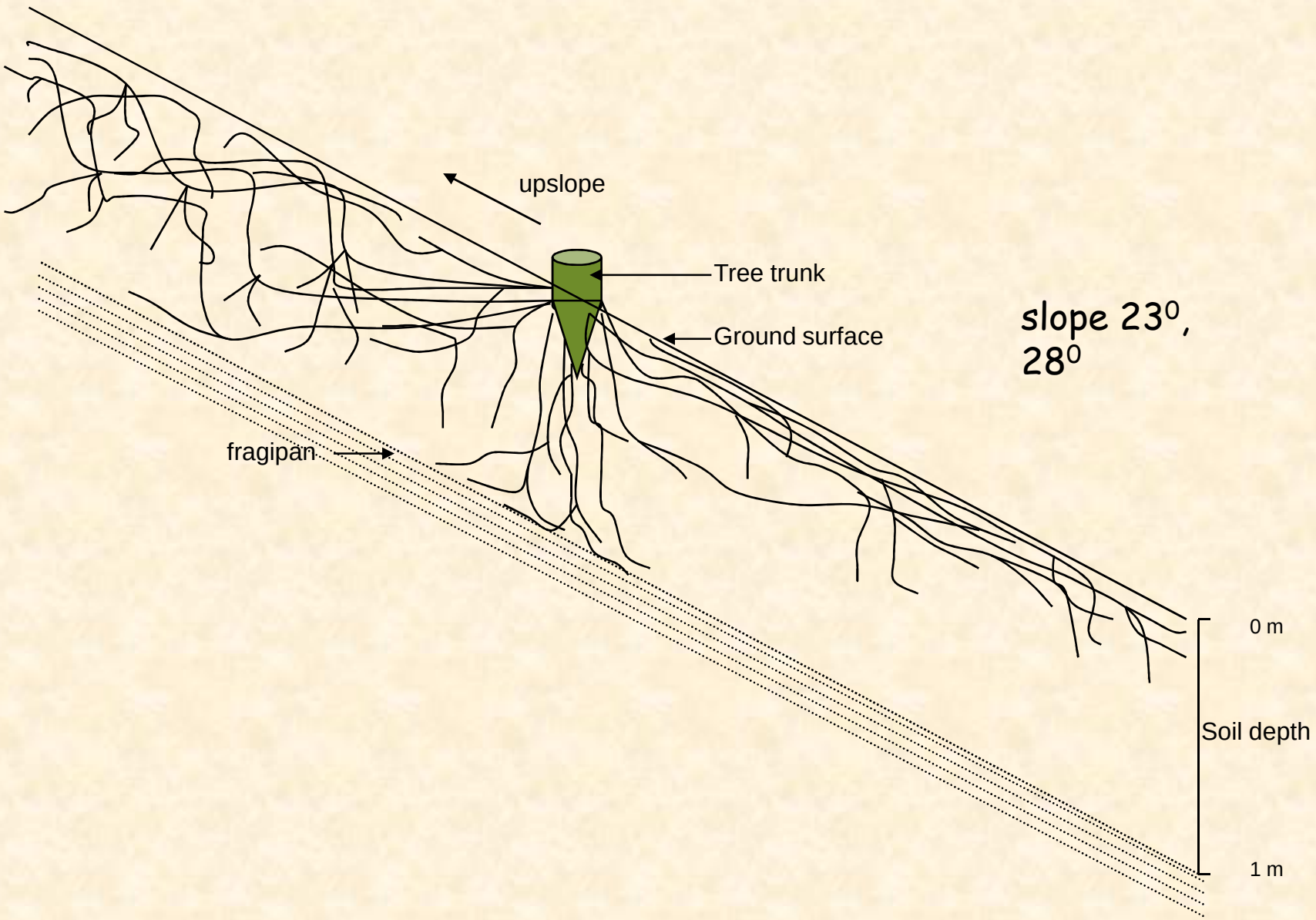


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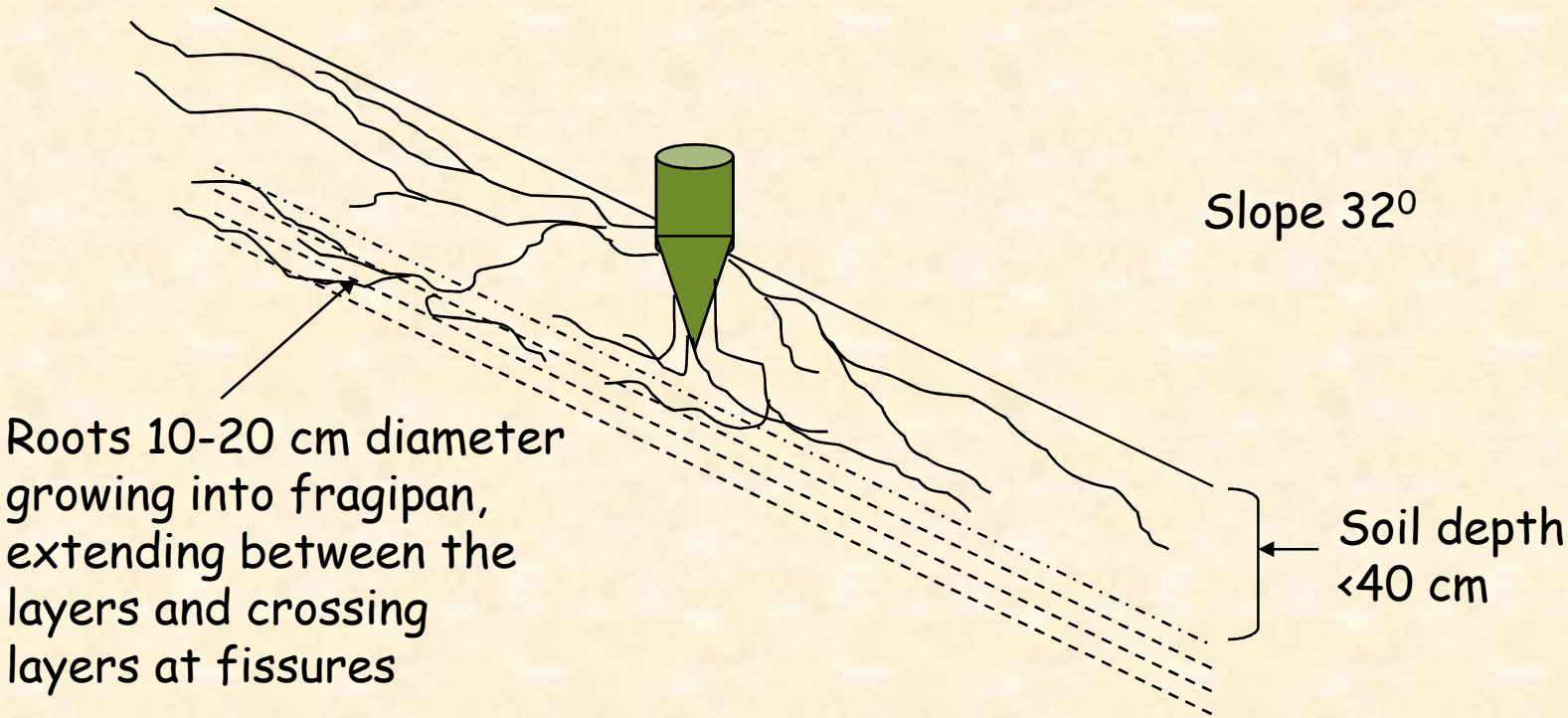


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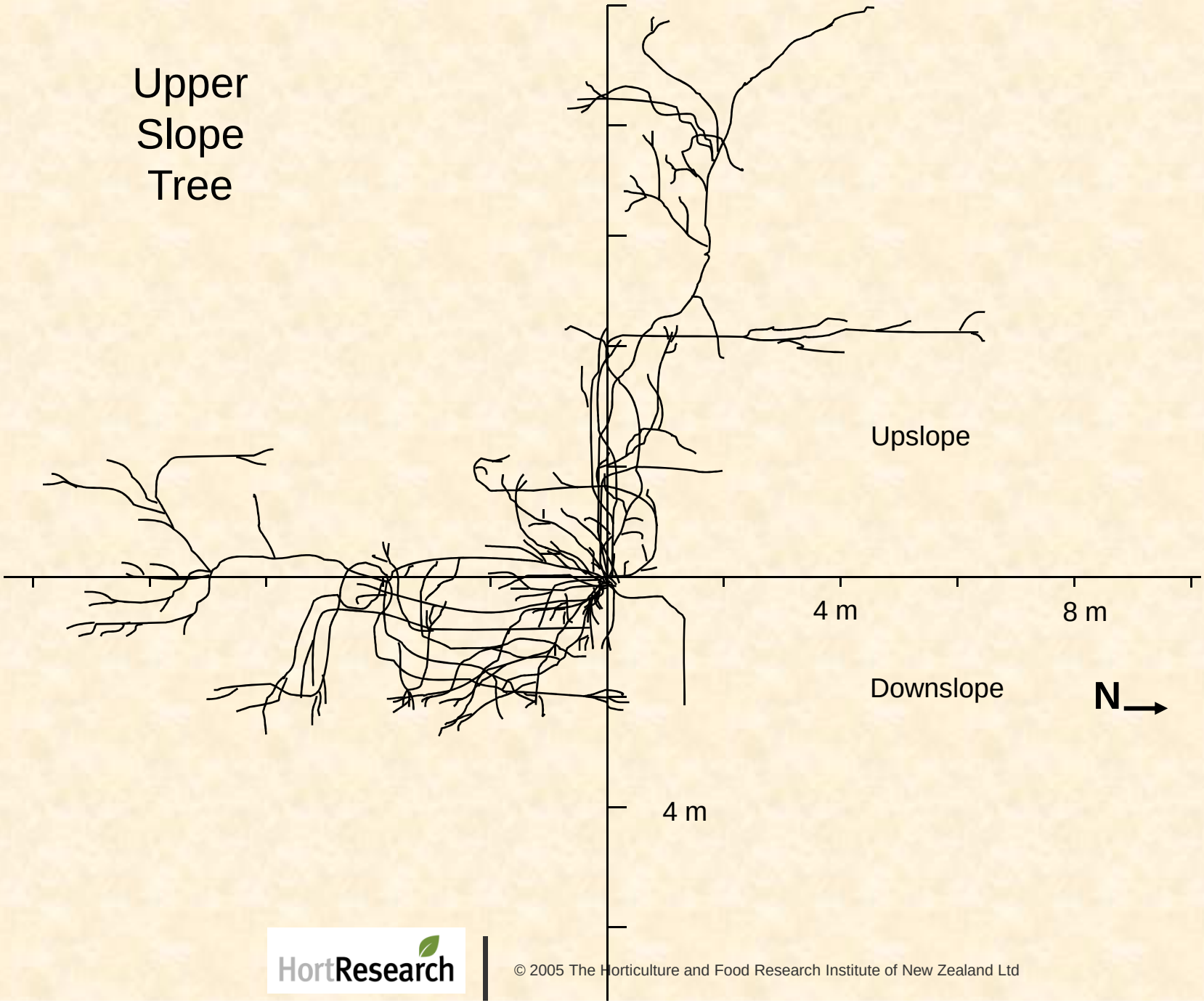


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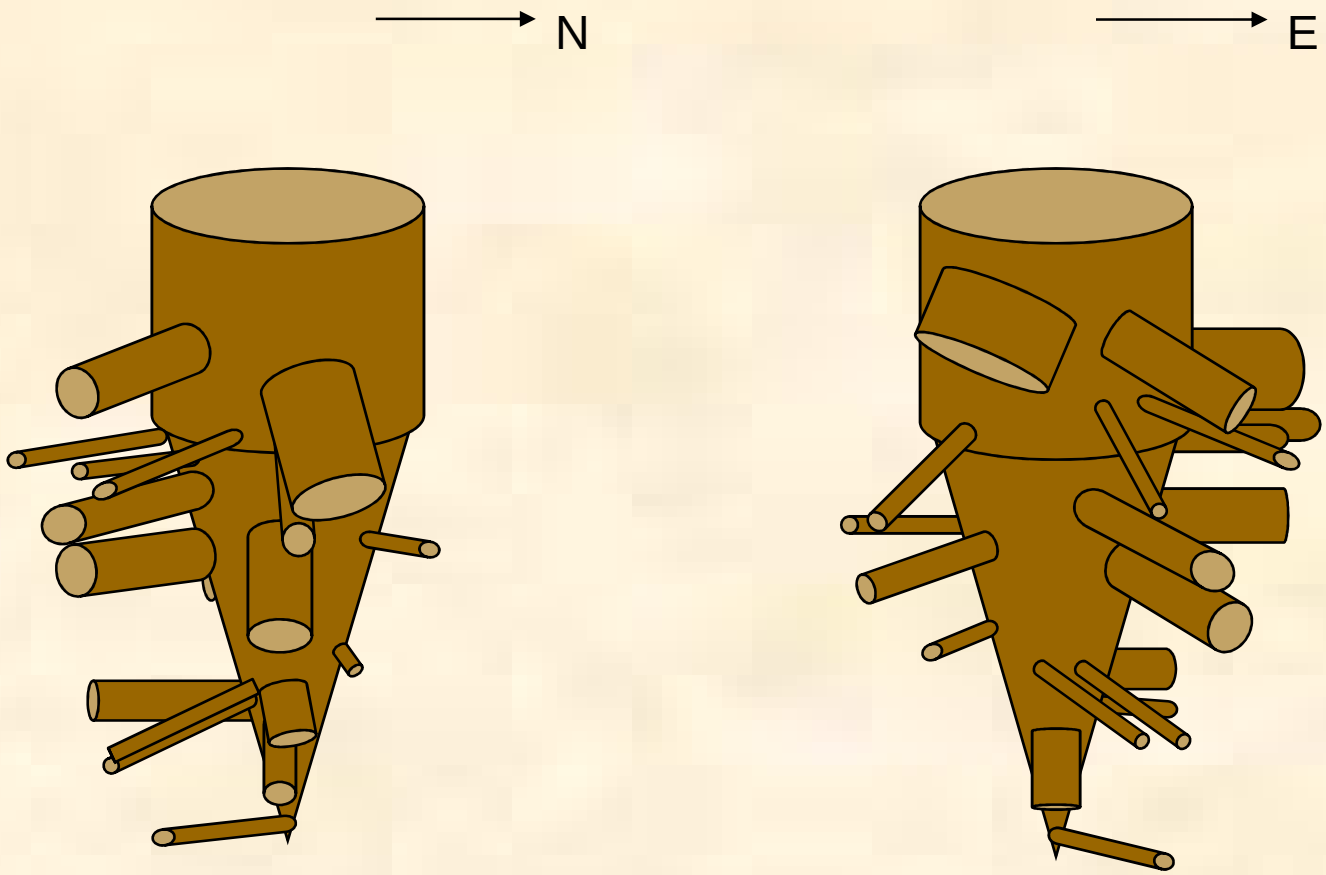
# TREE 8 Carter Farm North and East orientation and relative size of roots




North-facing slope
Prevailing wind is from the west

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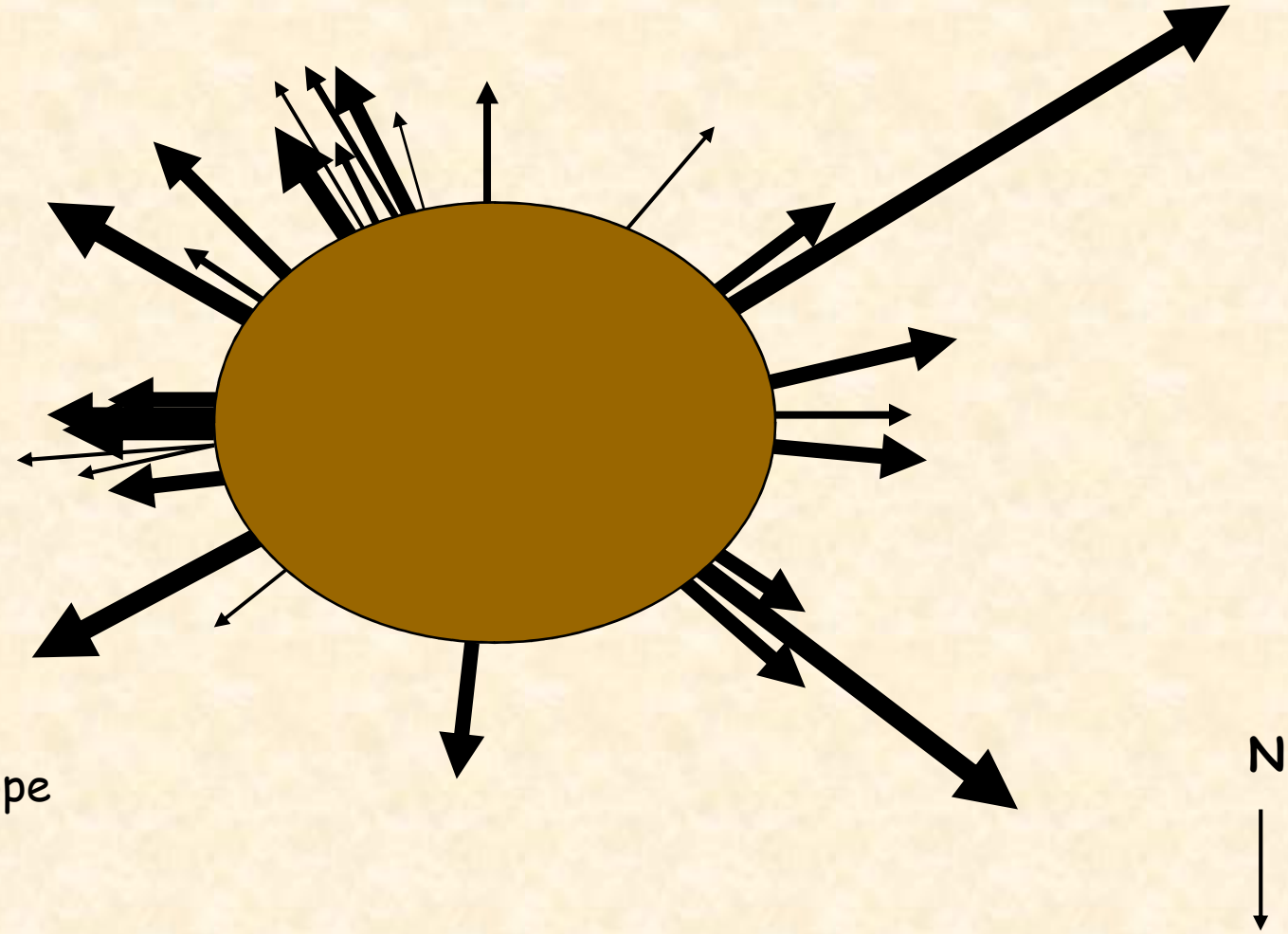
# Tree 8 Root orientation off the crown




Root CS area ~ arrow font x arrow length

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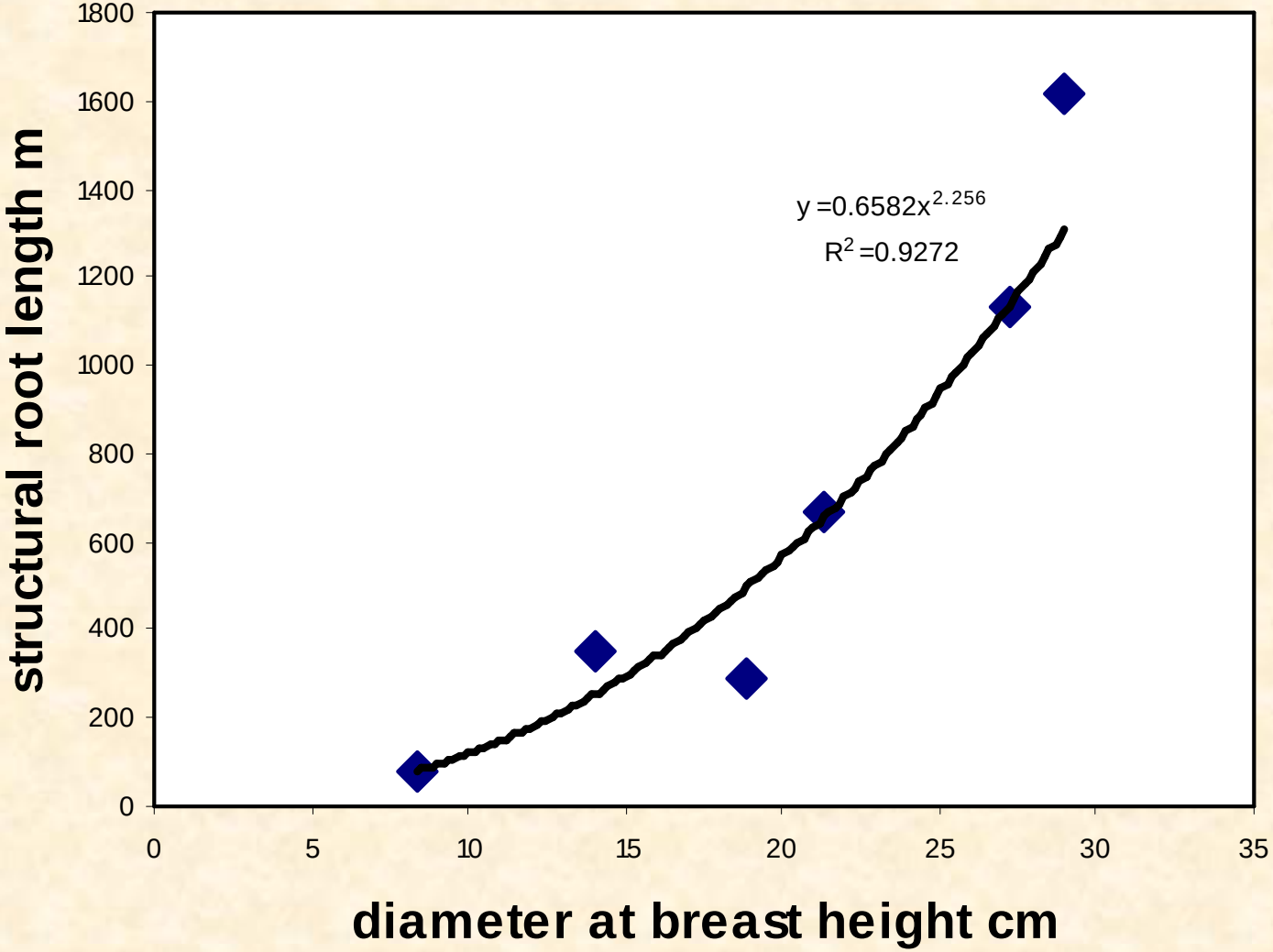
# DBH is a predictor of coarse (structural) root length and mass

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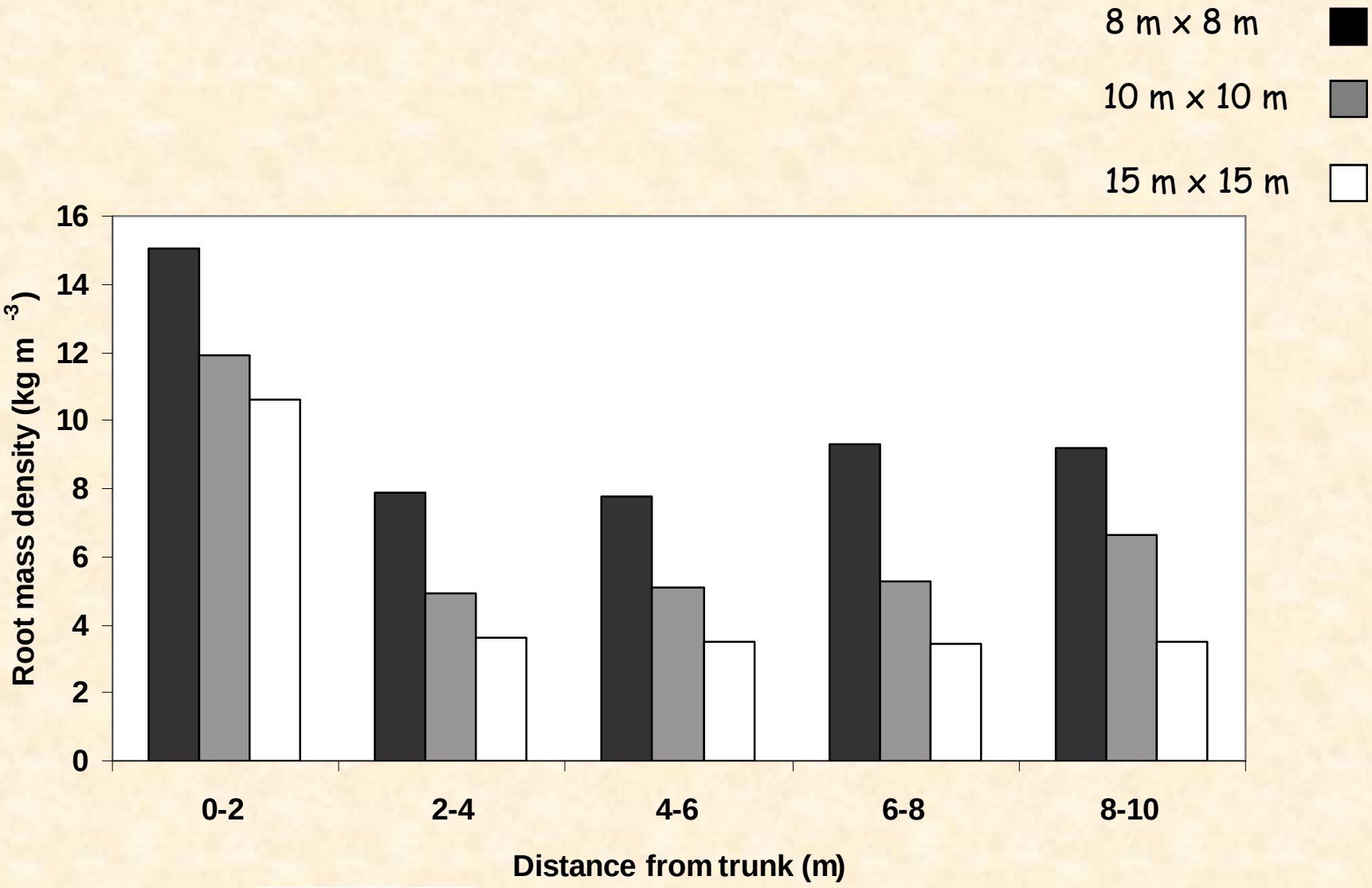
# Structural Root Mass Density Contributed by All Trees Around A Single Tree aged 9.5 yrs

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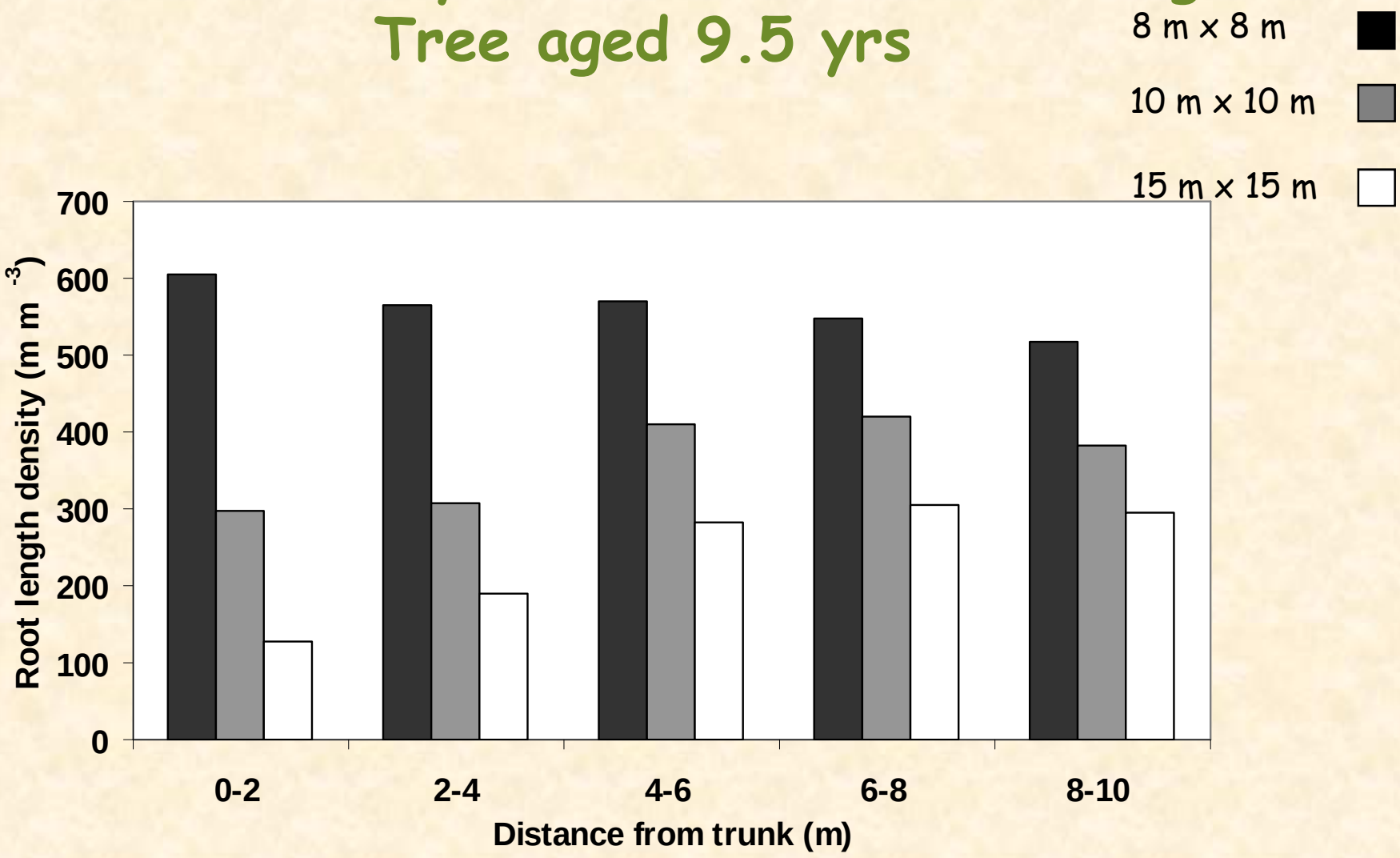
# Structural Root Length Density Contributed by All Trees Around A Single Tree aged 9.5 yrs

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# Measuring effectiveness of conservation trees in reducing slope erosion

2004: Region A (Manawatu) had a severe rainstorm producing widespread hill slope erosion and serious flooding

2005: Region B (Wairarapa) had a severe localised rainstorm producing serious hill slope erosion

2007 In each region we identified sites where there were tree plantings, visited them and measured

- Tree height, dbh, spacing, canopy, aspect, slope
- Distance to nearest erosion scar outside the trees
- Area of erosion within the trees

Compared severity of erosion with untreed (control) site

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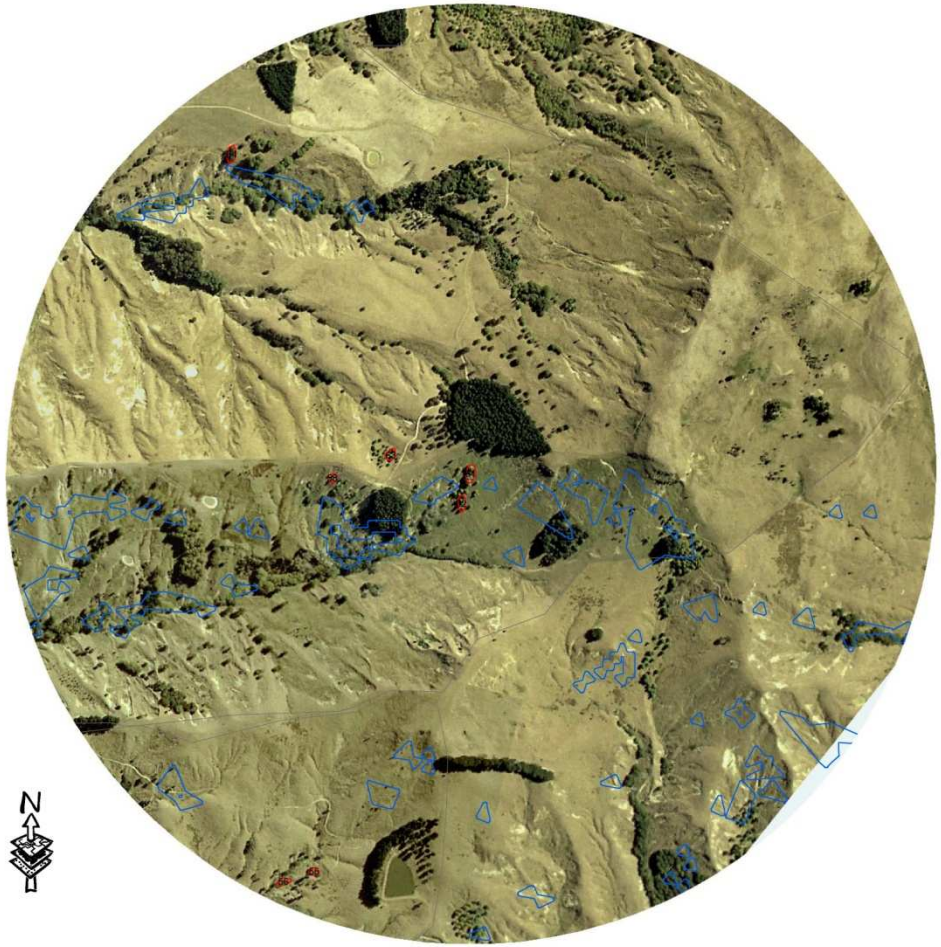
Areas that meet search criteria (generalised + 5m buffer)

Study sites

Farm boundaries

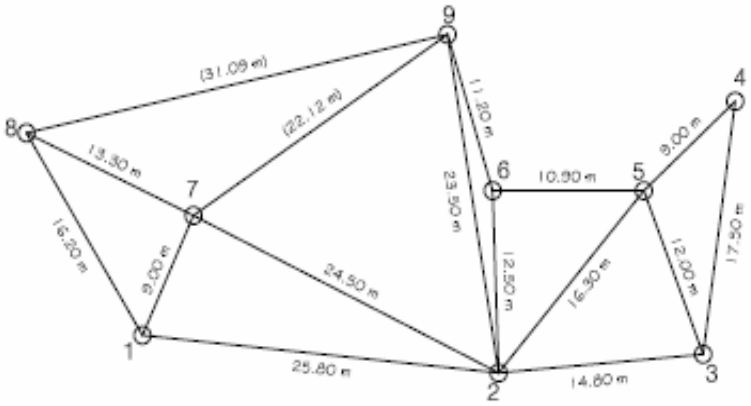
# Site #61

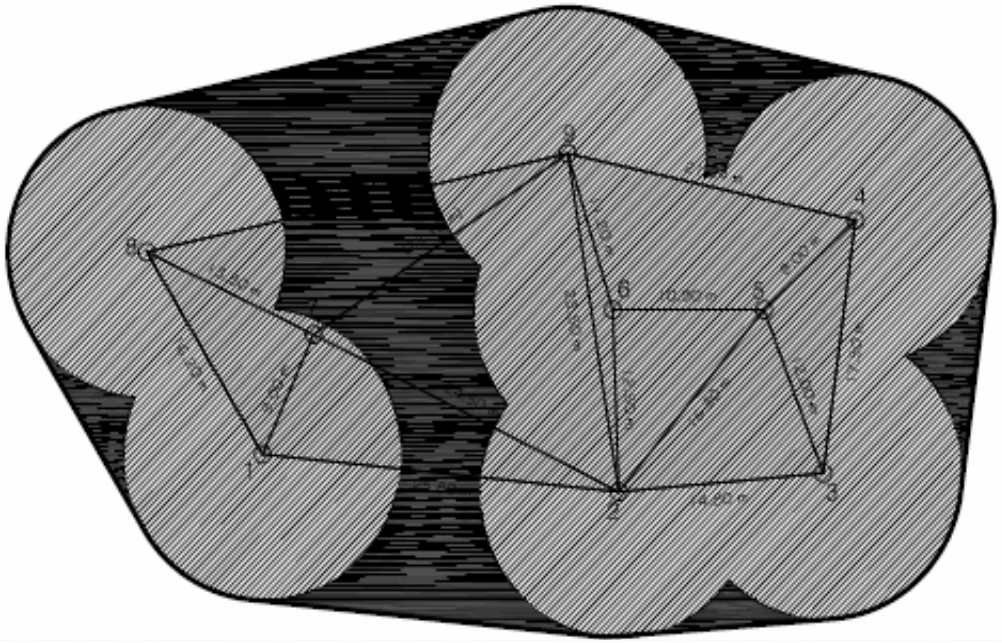


0 145 290 580 Meters

Aspect search is 45 degrees either side of the measured aspect (90 degree arc)
Slope search is one standard deviation either side of the measured slope average (average of tree slopes).

Search criteria
((slope >=23.78) AND (slope <=27.28))*((Aspect >=135) AND (Aspect <=225))

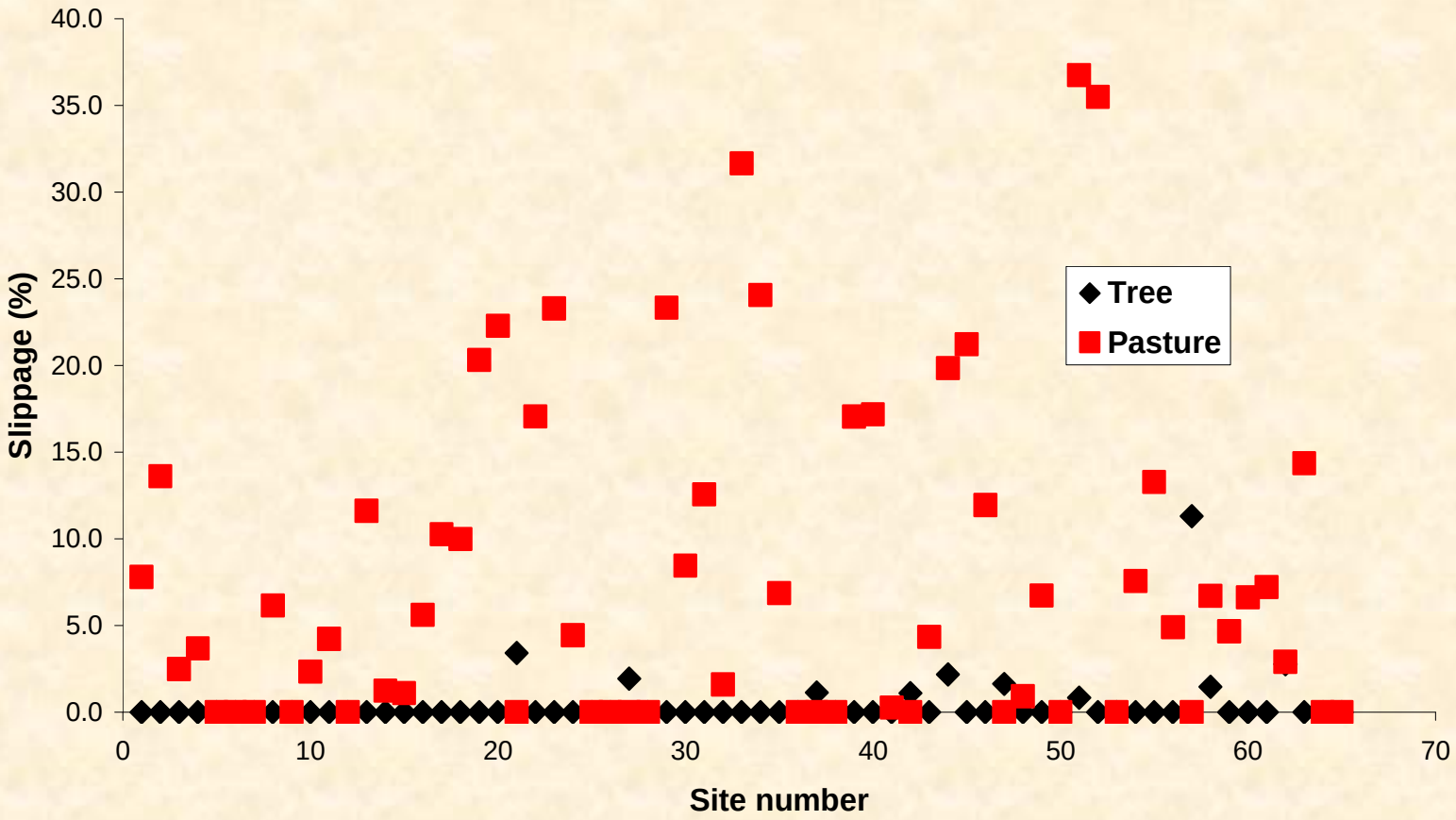


# SITE 9

| | |
|---|---|
| SHADED AREA 753.5 m² | (TOTAL AREA INSIDE POLYGON BETWEEN CENTRE OF EACH TREE) |
| SHADED AREA 1915.7 m² | (TOTAL AREA OCCUPIED BY 10 m RADIUS OF TREES CIRCLES) |
| SHADED AREA 553.2 m² | (AREA OF OUTER PARAMETER LESS THE AREA OF 10 m RADIUS TREE CIRCLES) |
| AREA INSIDE PARAMETER 2468.9 m² | (AREA INSIDE OF THE MOST OUTER PARAMETER) |

# Extent of slippage (%) on tree and pasture sites at 65 sites in Manawatu and Wairarapa in winter 2007

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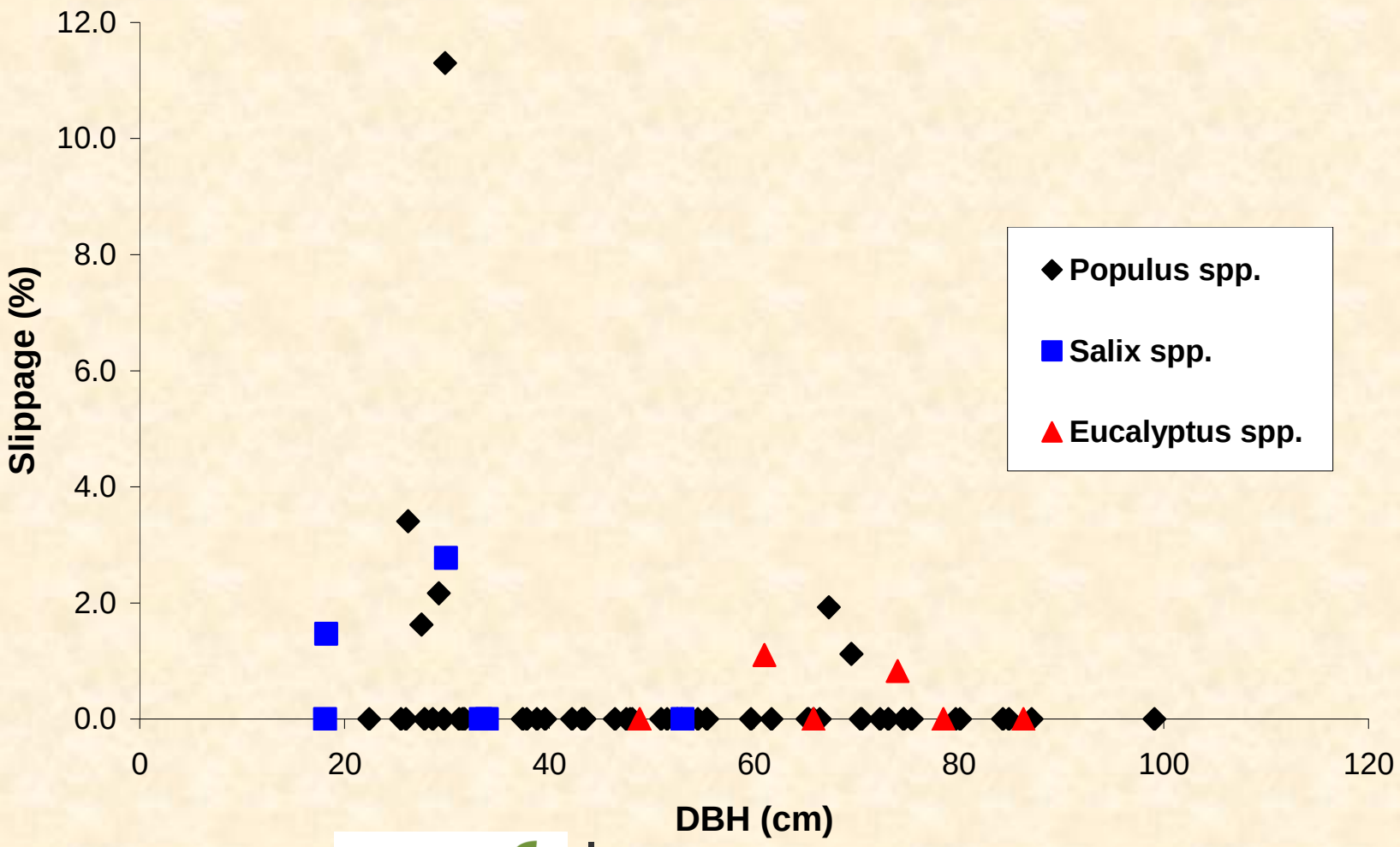
# Association between extent of slippage (%) and diameter at breast height (DBH; cm) for spaced trees growing at 65 sites in Manawatu and Wairarapa in winter 2007.

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Extent of slipping (%) around spaced trees and on corresponding pasture areas with similar aspect and slope (~27°), at 65 sites in Manawatu and Wairarapa, New Zealand, in winter 2007.

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

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