Plant & Food Research
Rangahau Ahumāra Kai

RESEARCH BRIEF 19

How poplar trees influence water flow on slopes

Water flow on pastoral slopes following rainfall transfers sediment and contributes to slope erosion. Pasture cover reduces flow rate allowing more time for water absorption. Trees also influence water flow in ways that complement and enhance the effect of pasture.

View of spaced poplars with water capturing equipment

The influence of poplar trees on water flow on pastoral slopes was measured for young, spaced poplars in several ways: changes in soil water, interception by tree canopy, surface runoff during rainfall, water flow down tree stems.

The 7-year-old poplars were growing on a pastoral slope at Ballantrae research farm (photo), a section of which had no trees, a section had unpruned trees, and a section had trees pruned to 4 m. Trees were planted in a grid, ~7.5 m apart.

Soil moisture

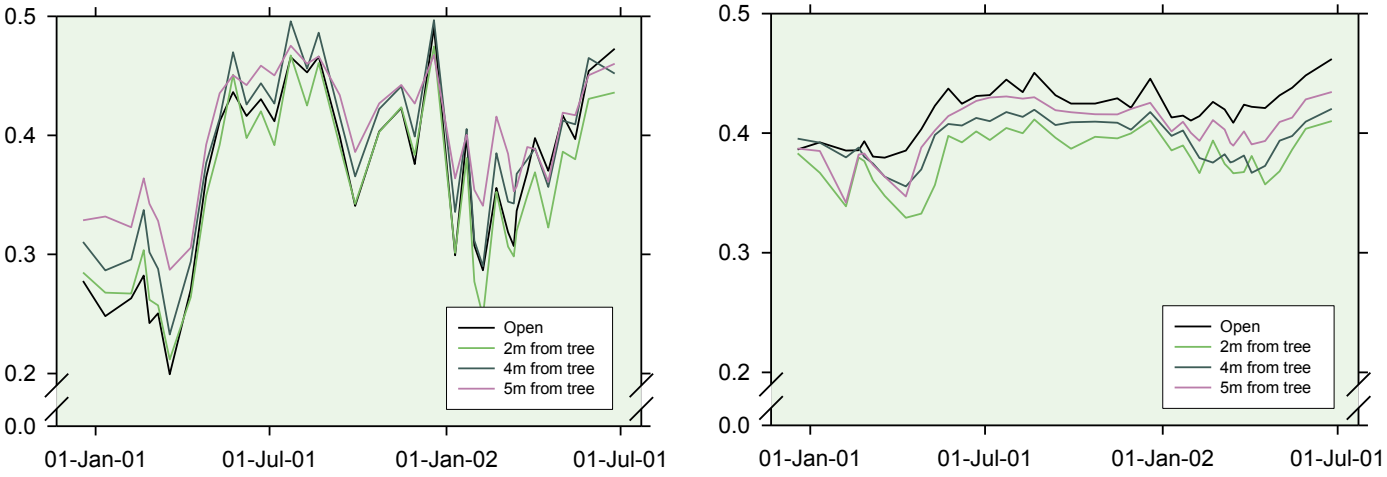

Figure 1. Seasonal soil moisture changes at 200 mm and 600 mm depth and at increasing distances from a 7-year-old poplar tree growing on a pastoral slope. Mean canopy radius was 2.3 m.

Transpiring trees lower soil moisture (Figure 1), increasing winter water absorptive capacity and reducing slope erosion risk.

Rain interception

Figure 2. Average rainfall (mm) reaching the ground during September – April. Trees were 7 m apart.

The tree canopy intercepts rainfall (light green box, Figure 2), some of which is evaporated back into the atmosphere and the rest directed down as stemflow. Even beyond the canopy (mid-green box, Figure 2) throughfall is reduced as rain is often accompanied by wind which increases the rain interception area of the canopy. These effects will be less during dormancy.

Surface runoff

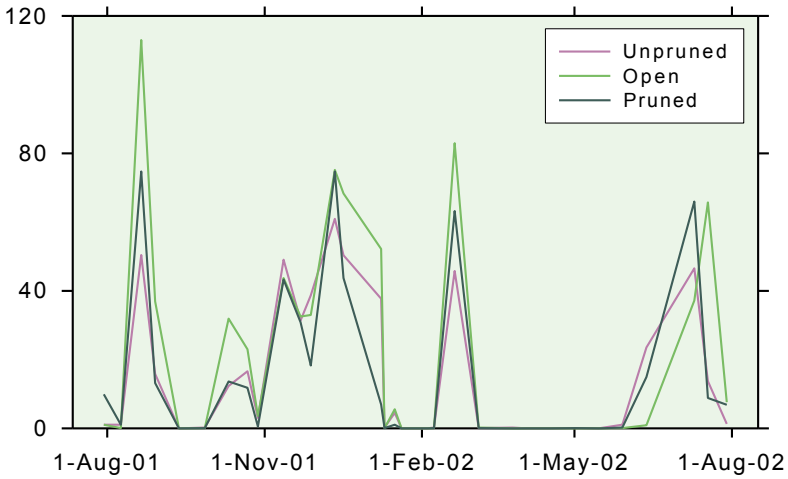

Figure 3. Surface runoff on a common pastoral slope following rainfall collected in three situations; below open pasture, below unpruned poplar trees, and below pruned poplar trees.

Surface runoff below treed areas was less than below pasture only. This would have been contributed by canopy interception in the growing season but was also measured in winter (Figure 3). Lateral roots of the trees create cracks for water penetration, and move water in all directions within the soil profile increasing absorption rates.

Stem flow

Stem flow collected from several trees showed that stem flow was greater during dormancy (1.6% of rainfall) than when leaves were present (0.9% of rainfall). Stem flow redirects water towards the tree trunk and roots reducing rain intensity. Water flow along the tree root surfaces distributes water deeper into the soil profile than occurs with pasture roots.

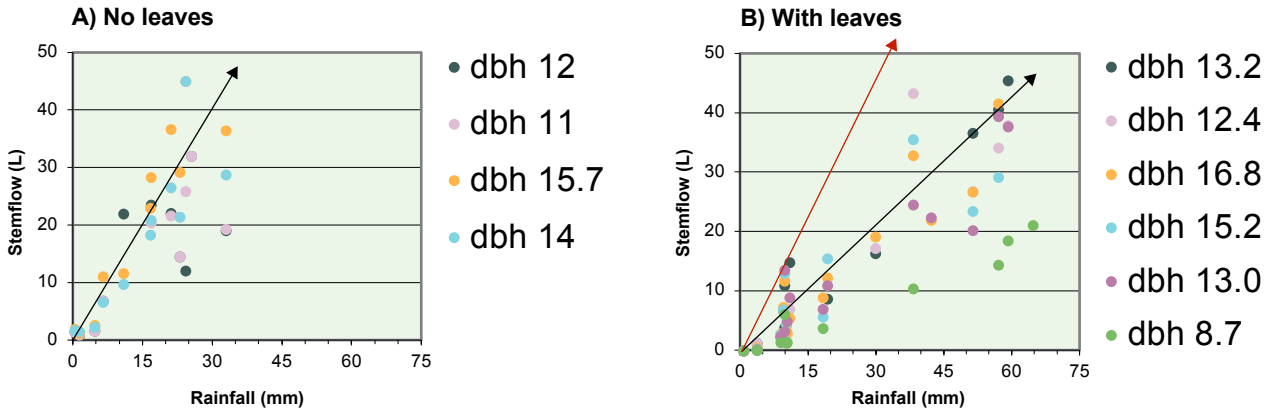

Figure 4. Stem flow collected from the trunk of poplar trees A) with no leaves, and B) with leaves. Tree size is indicated by dbh (diameter at breast height).

As the poplar trees age these effects on water flow will become more significant; interception of rainfall and stem flow will increase. re-evaporation of water from leaf surfaces will increase, and surface runoff will decrease. Pruning trees, while reducing their influence on water dynamics when the trees are young, promotes pasture growth under the trees which in turn slows runoff.

Poplars and pasture work together to reduces sediment transfer, retain fertility and support clean water.

A series of videos on poplar planting and management can be viewed by visiting **poplarandwillow.org.nz** or by using or clicking on the links here.

bit.ly/poplars-willows-videos

Stem flow captured in a plastic gutter and stored in a 40L container

For more information

This is one in a series of research briefs about Poplars and Willows that can be found at poplarandwillow.org.nz

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