

Erosion control: *Poplar and willow planting*

Why plant poplars and willows?

Poplars and willows are well suited to preventing and controlling erosion due to their extensive and deep root network.

When erosion occurs, it takes 30+ years for eroded hills to recover 70% of original production, with slow gains to 80% after 60+ years – that's at least two generations of farmers. Soil is too valuable to food production to allow such losses. Well-spaced planted poplars and willows on hill country can reduce soil loss by as much as 90%.

These trees provide additional benefits, including shelter and shade, fodder, timber, and good pasture growth below the trees. When planted appropriately, space-planted poplars and willows can qualify for the Emissions Trading Scheme.

Are poplars and willows invasive?

All poplars and willows are useful for erosion control, but some varieties, such as grey and crack willow, are invasive alongside watercourses.

Poplar and willow varieties distributed by regional councils and private nurseries have been selected and developed in New Zealand for decades. Problematic traits such as vigorous suckering, brittleness of timber, and poor growth form have largely been eliminated.

We only supply non-invasive willows and poplars as unisexual or non-breeding hybrid selections – meaning they can't set seed and become a weed problem. However, some cultivars can become large and may require maintenance or eventually need to be removed.

What cultivars should I plant?

The performance of a cultivar is dependent on site conditions, so it is important to plant the right cultivar in the right place to ensure they thrive.

Poplars: Otahuaio and Kawa are best suited to mid to low slopes and basins where there is good soil moisture. On south facing hills with good moisture, these varieties can be planted a little higher up the slope compared to a drier north facing slope. For areas that are drier and more exposed to wind, cultivars such as Veronese, Fraser and Crowsnest are better suited.

Willow: The Tangoio willow is ideal for slope and gully erosion control. It has high tolerance to wind and is relatively dry-tolerant.



Support for landowners – subsidised poplar and willow poles

Each winter, we offer poplar and willow trees to help prevent and control erosion across the region.

To qualify for subsidised poles, landowners need to:

- Have a free Soil Conservation Plan developed by our Land Management Advisors.
- Commit to maintaining the trees so they can do the job they've been planted to do.

How do I order poplar and willow poles for purposes other than erosion control?

After soil conservation orders have been filled, poles can be purchased for purposes other than erosion control, such as stock shade, a shelterbelt or amenity, directly from our nursery at 185 Flyger Road in Mata.

For more info on subsidised poles or to order, please contact our Land Management team:

P 0800 002 004

E nursery@nrc.govt.nz

Erosion types and recommended treatment

Slips

Slips occur when a slope loses strength and stability. This loss of strength and stability can be due to several factors, including steepness of the slope, loss of tree roots which held the slope together, diverted runoff from roads and tracks, and water percolating down through large cracks in the soil following a very dry summer. Other factors include rock or consolidated clay layers underlying the soil providing a slip plane, saturated soil following constant weather or intense rainfall, or streams, gullies or tracks undercutting the base of the slipped area.



Shallow slip caused by intense rainfall infiltrating down through cracks formed in summer lubricating the layer between the topsoil and harder subsoil creating a slip plane (i.e., a greasy back)



Contractors planting poplar poles to prevent slips like the one in the top left of the image.

Remediation recommendations	
Slip erosion extent	Poplar pole spacings
Serious slipping	<ul style="list-style-type: none"> • 5m at toe • 8-10m towards sides & head of slip
Moderate slipping	<ul style="list-style-type: none"> • 8-10m
Prevention - open spaced planting	<ul style="list-style-type: none"> • 15-20m across hill slope
<p>Notes:</p> <ul style="list-style-type: none"> • Slips tend to move up the slope over time, so concentrate planting on the mid slope and upper parts of the slope above the slip scars. • On mudstone soil, deposited material at the toe of the slip may move in future, so also needs to be space planted. 	

Earthflow

Earthflows mainly occur on mudstone soil and is usually triggered when support has been removed from adjoining slopes (e.g., from streambank, gully erosion or earthworks/track cuttings) and/or from continual saturation (e.g. from springs). It presents as slumping at the head and bulging at the toe with depression areas that have many cracks and fissures in the middle. There is usually a hard rock or clay layer (slip plane) under the whole movement, which the upper layers of earth are sliding on. This rock layer is lubricated by water and movement can be accelerated where streams undercut the toe or sides.

Repairing earthflows relies on diverting water away from the top of the slip and draining wet areas mechanically or via mass tree planting. It's best to remove or line all dams, as these can lubricate flows, and ensure run-off can move freely and does not flow into hollows or behind banks.

Earthflows can exhibit extensive momentum. It can take tree roots between five and ten years to spread out. Even with water control, drainage, and widespread tree planting it may take some years to achieve good control.



Shallow earthflow triggered by stream undermining the toe of the slope and continual saturation from a spring.

Remediation recommendations	
Earthflow erosion extent	Poplar pole spacings
Serious	<ul style="list-style-type: none"> • 6-8m
Moderate	<ul style="list-style-type: none"> • 10-15m
Prevention – open spaced planting	<ul style="list-style-type: none"> • 15-20m
Notes: <ul style="list-style-type: none"> • Plant the entire earthflow but concentrate on protecting the toe and sides of the earthflow from stream bank or gully erosion. • Thin trees to 15m spacing once established (5-10 years). • Preferably remove or line all dams as these can lubricate flows. • Ensure run-off can move freely and does not flow into hollows or behind banks. 	

Gully

Gully erosion is the most widespread and serious form of soil erosion in Northland. Gullies tend to erode at their head, eating back into the landscape and removing support for surrounding hillsides, triggering slips and earthflows.

They are caused by concentrated stormwater or paddock drainage scouring down steep slopes, particularly on highly erodible soils. Increased water flow and velocity erodes the gully banks and beds down to the subsoil. On-going waterflow scours a hole where water drops over a lip of more resistant soil. The hole enlarges, collapsing the sides and working its way upstream. This process continues, sometimes very quickly, and is often made worse by discharges of water from the lip of drains and culverts where a drop causes considerable scouring.



Gully and rill erosion following grass reseeding.



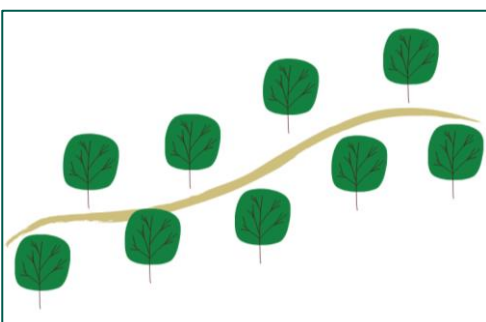
This gully has been planted with tree willow poles in the gully bottom and sides at 5m spacing. Poplar has been planted on the stable top of the bank at 8m spacing.

Remediation recommendations

Gully erosion extent	Poplar/willow pole spacings
Serious	<ul style="list-style-type: none"> • Poplars: 8m • Willows: 5m
Large gullies	<ul style="list-style-type: none"> • As above, potentially man-made structures
Small gullies	<ul style="list-style-type: none"> • 8-10m

Notes:

- Plant willows in a zig-zag pattern along the gully bottom. Roots will overlap across the bed to stop down-cutting. If sides are collapsing in, plant willows up the sides.
- Reinforce the bank by planting poplars along the top, setting them back 5m from the edge.
- Flumes and detention dams can be very effective but require expertise to design and install.



Staggered (zig zag) planting.

Tunnel gully (tomo)

Tunnel gullies are common in Northland, particularly on sandstone soils such as Waiotira loam and clay loam. They are caused by water draining through relatively free draining topsoil layers and reaching an impermeable layer. The water is forced to move downslope, forming an underground tunnel. As the tunnel grows larger, topsoil layers weaken and eventually collapse to form a hole. As further underground scouring occurs, tunnel gullies form. These are hazardous to stock, people, and machinery.

Planting poplar poles along gully networks traps sediment and infills holes over time.



Tunnel gullies forming on Waiotira clay soils.



Poplar planted to prevent tunnel gully erosion.

Remediation recommendations	
Tunnel gully extent	Poplar pole spacings
Serious	<ul style="list-style-type: none"> • Directly into any obvious holes • 5-6m along potential gully paths
Moderate	<ul style="list-style-type: none"> • Directly into any obvious holes • 8-10m
Small gullies	<ul style="list-style-type: none"> • 8-10m
Notes: <ul style="list-style-type: none"> • Permanently running water – treat as an open gully and zig-zag plant with willows. • Attempt to divert water to stable vegetated areas or consider installing drainage. 	

Streambank erosion

Streambank erosion is common in Northland and contributes to sediment entering freshwater. It is often caused by obstructions in the stream water flow, such as fallen trees, debris, or built-up gravel on inside bends. Outside bends on streambanks are particularly vulnerable to erosion, as scouring at the base of the bank can cause the upper banks to collapse. It is important to remove obstructions if practical to avoid further scouring.

Remediation recommendations		
Erosion extent	Willow spacing	Notes
Serious	<ul style="list-style-type: none"> • 1m – shrub willows • 5m – tree willows 	<ul style="list-style-type: none"> • Focus on eroding outside bends. Push/hammer stakes horizontally into the bank, with at least 50% of the stake embedded into the bank and the remainder left out to develop leaf matter
Moderate	<ul style="list-style-type: none"> • 8-10m – tree willows 	<ul style="list-style-type: none"> • Set poles back at least 3m from streambank edge
Prevention	<ul style="list-style-type: none"> • 20m on straighter stream bank sections 	



When constructing a new fence, ensure it is set back at least 3m from the top of the stream bank to comply with new stock exclusion rules. In areas where the bank is eroding such as outside bends, leave a wider buffer so there is enough space for the remediation planting to establish.

General planting tips

- It's best to plant the poles in small depressions and low-lying spots, small channels where water flows or pools as these are spots where erosion is likely to occur and where poles will thrive.
- On south facing slopes you can plant higher up the slope compared to drier north facing slopes.



- Plant poplar and willow poles the right way up by ensuring new leaf buds are pointing up.

- While sleeves offer some protection from sheep and light cattle, the best establishment occurs when stock is kept away from trees for at least two years.