

One Billion Trees Programme

Helping New Zealanders plant the right trees, in the right place, at the right time

Riparian planting around headwater streams



When it rains, any water that doesn't soak into the ground becomes runoff. This runoff picks up nutrients from things like fertiliser, other chemicals, animal waste, and loose soil sediment as it runs across the land and is carried to the closest stream, river or lake.

When trees and plants grow around waterways, runoff has to pass through their roots and the soil around them. This filters out many contaminants before they enter the water.

Agricultural activities can affect water quality through:

- fertilisers used to improve pasture growth. This adds to the nitrogen, phosphorus and potassium content of the soil (commonly known as NPK).
- animal waste (urine and faeces) adding nutrients to the soil
- defoliation (removal of grass) due to grazing can result in reduced soil cover and greater runoff during rain events.

Planted forests can affect water quality. Potential sources of contaminants from planted forests include:

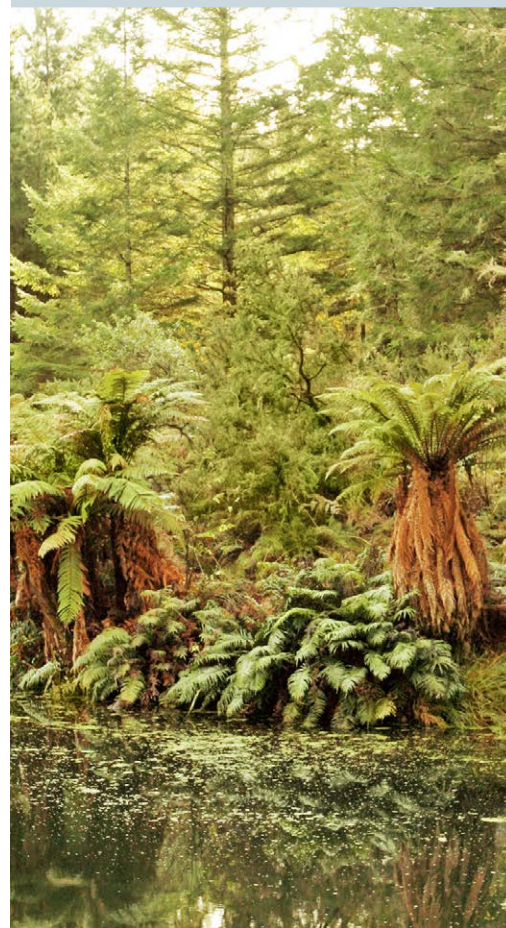
- leftover nutrients in soils and groundwater from past agricultural activities
- fertiliser or pesticides applied as part of forest management
- disturbances during and after harvesting, particularly increased sediment (silt and clay) in waterways.

Runoff is much less common in established forested areas. This is because tree roots act like water filters, soaking up the water and absorbing nutrients.

Planting around waterways

Planting the areas around freshwater lakes, streams, wetlands and rivers is called riparian planting. Riparian planting of native species or permanent forests around headwater streams complements wider planting on erosion-prone or unproductive land. It is helpful for:

- water filtration
- pollution control
- controlling erosion from the banks of water channels
- enhancing habitat for wildlife.



Riparian zones are forested or vegetated areas of land around waterways and act as a buffer between land and water. The buffer zone helps protect waterways from neighbouring land uses.

What happens upstream effects downstream

Headwater catchments catch rainwater high in the landscape, and headwater streams bring that water downhill.

Because they sit high in the landscape, headwater streams and the areas around them influence:

- the amount of water going downstream
- the quality of water going downstream
- the delivery of organic matter (like leaves and branches) and inorganic matter (like silt, gravel, and clay) downstream
- the amount of sediment ending up downstream.

All these things influence the composition of land- and water-based life downstream.

Because of this, it's a good idea to plant riparian areas in the headwater catchments before trying to plant them downstream.

Benefits of foresting around headwater catchments

| Forest riparian function/process | Impact | Management/project goal |
|--|---|---------------------------------------|
| Shade | Moderation of stream and riparian temperature regimes Reduced primary productivity (algae) | Improved water quality |
| Stream bank stability | Reduction in stream bank erosion Maintenance of in-stream habitat | |
| Sediment and nutrient filtration, storage, uptake and processing | Sediment and nutrient regulation | Sediment and nutrient reduction |
| Increased riparian and channel roughness | Trapping sediment, woody debris and other material in flood events Increased water storage, retention, infiltration into groundwater | |
| Increased organic material like leaf litter, branches, large wood, terrestrial insects | Food resources Contribution to riparian and in-stream habitat diversity | Freshwater and riparian biodiversity |
| Riparian forest growth | Increased photosynthesis | Carbon sequestration Timber supply |

Filtering sediment, nutrients and other contaminants from water

The biggest benefits of planting forest around headwater streams are in water quality.

Trees and plants in riparian zones catch contaminants from upland areas before they enter the stream system. Contaminants include:

- sediment
- nutrients (for example nitrogen, pesticides)
- microbial contamination (often caused by feral animal waste)
- woody debris (branches and logs, for example).

Shade from plants helps moderate stream temperatures

These benefits are greatest in smaller headwater streams. Less light getting into streams means reduced solar radiation. This reduces algal growth and helps cool and moderate water temperatures.

Streambank stability

Plant roots reinforce the banks of streams, helping provide better bank stability. This means:

- reduced bank erosion, so less sediment getting into the water
- improved habitat for aquatic life, especially from undercut banks and tree roots.

Flood mitigation

Riparian vegetation (plants and trees) can help in heavy rain or floods when sediment, nutrients and other things like woody debris flow through waterways. The root systems and stems of streamside and riparian vegetation slow the speed of flood waters through the waterway. They also:

- decrease the ability of the fast-flowing water to erode the banks
- help retain floodwaters and their contaminants for processing in the riparian area
- trap woody debris transported downhill and downstream during floods. In return the trapped debris provides a food source and habitat diversity for plants, animals and aquatic life in and around the waterway.

Food sources

Sometimes shade from the forest limits the growth of algae as a food source in headwater streams. When this happens, organic material from forested riparian areas:

- provides a diverse food resource for both water and land ecosystems from:
 - large pieces of wood
 - finer organic matter provided by branches, leaves and twigs
 - organic matter from insects
 - other waste or debris.
- contains higher quantities of plant biomass than non-forested areas.



Shade provided by riparian vegetation in a planted forest headwater stream.

Carbon sequestration

The scale of riparian forest planting is often small in comparison to other afforested areas. But trees in riparian areas, and large wood deposited in headwater streams, still capture and store carbon dioxide from the atmosphere. This is called carbon sequestration.

Biodiversity

Riparian areas are a source of high biodiversity, with plant, animal, and aquatic communities relying on them for food and shelter. They also provide ways for both land- and water-based animals to move around.

Riparian buffers around waterways

Riparian buffers on land used for agriculture

Stock can cause serious damage to waterways. It's a good idea to exclude stock from waterways, using fences to protect planted riparian areas.

The distance between your fences and the waterways will depend on how you're planning to manage the area between them.

Riparian buffers on land used for forestry

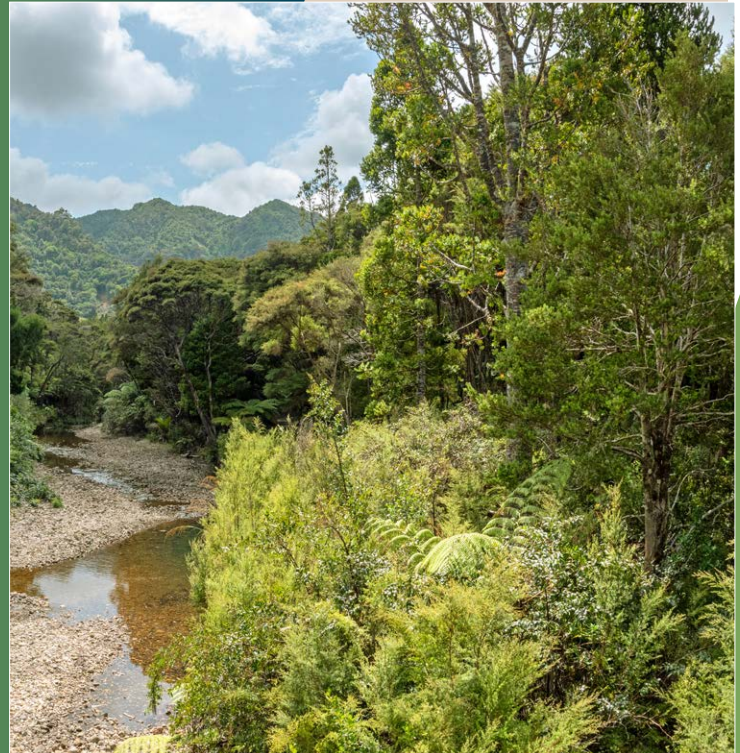
Harvesting of plantation forestry can damage headwater streams and their riparian zones.

Develop a harvesting plan **before** you plant a forest. It'll help make sure you're able to protect riparian areas from harvesting damage later.

To protect riparian areas, it's a good idea to extend setback planting boundaries beyond those outlined in the **National Environmental Standards for Plantation Forestry | Te Uru Rākau – New Zealand Forest Service | NZ Government (mpi.govt.nz)**. This may be particularly important in steep V-shaped headwater stream systems where riparian areas can be narrow.

Research has shown that:

- larger buffers provide bigger benefits.
- in general, riparian buffers less than 10m wide aren't wide enough to prevent harvesting damage. The greatest benefits of buffers this size are:
 - shade retention
 - improving stability on channel banks
 - limiting the transport of logging slash (woody debris from logging operations) into streams.
- widths of at least 30m or more on both sides of the stream limit the effects of harvesting, and maintain both riparian and stream ecosystem function and biodiversity.



Want more information?

Read the Summary report – **Planting eroding hill country in the Hawke's Bay region** (p38)

See p102 in the Technical report - **Planting eroding hill country in the Hawke's Bay Region: Right tree, right place, right purpose**

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