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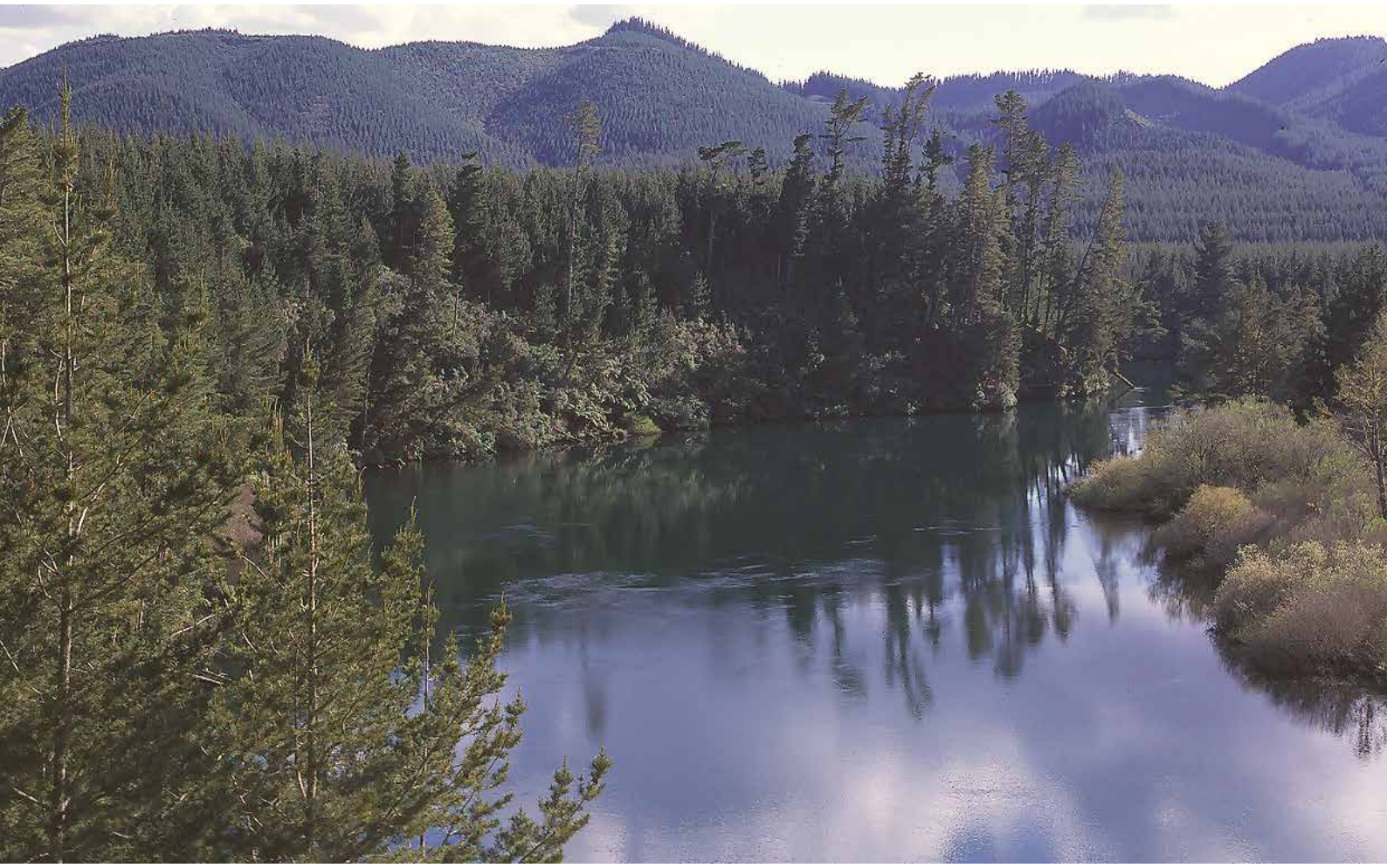

Water quality

New Zealand planted forests environmental facts.

There are some 1.7 million hectares of planted forests in New Zealand, 90% of which are in radiata pine.

These forests contain an estimated 24,220 km of streams that, for most of the forest growing cycle, provide a source of high quality water to downstream users.

There is increasing pressure on our water resources. However, with prudent stewardship and ongoing improvements to management practices, New Zealand's forests will continue to provide sustainable sources of high quality water.

Forests generate high quality water

Water quality is a term used to describe the physical, chemical and biological characteristics of water, and it is affected by the long term cyclic nature of planted forests in New Zealand.

Forests have a strong influence on the water quality of catchments. They moderate the local climate, which in turn influences the quantity, temperature and overall quality of stream water. As a result, planted forests almost always yield better water quality than other developed land uses, including agriculture and urban development.

Afforestation. Planting forests can improve the water quality from land that was previously in pasture within 5-6 years by reducing water temperature, nutrient levels and sediment yields. This highlights the potential of forestry as a remedial tool for degraded waterways.

Over a rotation. The largest part of the forest cycle is in mid- to mature rotation. Water quality during this phase is naturally variable, but is characterised by cool water temperature, low sediment and nutrient concentrations, and healthy invertebrate communities.

Mature planted forests have similar water quality attributes to those found in undisturbed indigenous forests. Streams are often cool and shaded, and are strongly influenced by the riparian vegetation type and channel width. The low light and cooler temperatures promote high levels of dissolved oxygen in the water, which is a good indicator of water quality and essential to supporting the aquatic environment.

Actively managing harvesting. Harvesting can adversely affect water quality through increased sunlight and temperature. However, residual shade provided by the stream bank, logging slash, surrounding topography and any remaining vegetation all have an effect on maintaining water quality attributes, with shade recovery dependent on the size of the stream and the regrowth of riparian vegetation.

Harvesting in steepland country can increase sediment yields reaching waterways from roading and post-harvest erosion. Sediment yields elevated by harvesting activities typically return to pre-harvest levels, or decline markedly, within two to six years of harvest.

Harvesting impacts can be modified by retaining riparian management zones and to a lesser extent, retaining moderate quantities of logging slash across small stream channels. Other interventions include minimising tracking, good hauler set-up and implementation, and applying sediment control structures and techniques to the earthworks associated with harvesting.

Retaining intact riparian management zones during harvest helps maintain low light levels and temperatures. Riparian zones can reduce the amount of harvesting debris deposited in the stream and contribute to bank stability. They are limited in their ability to filter out point source sediment and any associated sediment-bound phosphorus. Riparian management zones can also limit nitrate levels following harvest, helping to maintain the aquatic community at similar levels to those found in mature pine and indigenous forest streams.

The challenges of steepland forestry

Around a third of New Zealand's planted forest is in steep hill country (> 25°), which is often highly erodible and susceptible to extreme weather events. Steepland forests have a higher density of stream networks than those on flatter topography. These networks extend into the upper reaches of headwater catchments. When subjected to intense rainfall, flooding and debris flows can result.

Steepland harvesting. Reducing the total length of the roading infrastructure will reduce the potential for sediment generation. However there is a trade-off between roading length, keeping riparian buffers intact and logging across the stream channel.

Reduced road length and harvesting across stream channels can provide better water quality outcomes, although there will still be some impact on water quality, habitat and a range of other biological processes. It is preferable to prevent the export of sediment directly or indirectly into a river.

Recovery time depends on site conditions, harvest method, post-harvest management techniques and the scale of operations.

Post-harvest activities. A number of site establishment and silvicultural activities, such as pesticide (including herbicide) and fertiliser use, may affect water quality. Compared to other productive land uses, these activities occur infrequently during the growing phase of a production forest crop, and the risk of impacting water quality is low when applied using best practice.

Aerial application in rugged terrain with dense stream networks can increase the risk of affecting water quality.

Managing for maximum benefit

Planted forests produce high water quality for a large component of the forestry cycle, providing a valuable community service to downstream users. The period during harvest requires the most sensitive management.

To realise the maximum benefit, the forest sector operates under the RMA (Resource Management Act) plus a range of sector-developed manuals; the New Zealand Roading Manual; New Zealand Environmental Code of Practice; individual company environmental management systems for good practice for maximum environmental outcomes; and, in some cases, Forest Stewardship Council (FSC) standards.

Key links

Forests and Water: Creating prosperity from trees. https://www.youtube.com/watch?v=W1ZsLrRo3Pg
Growing confidence in forestry's future: www.gcff.co.nz

Ministry for the Environment overview of fresh water: http://www.mfe.govt.nz/fresh-water/about-fresh-water/fresh-water-new-zealand

Key references

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Baillie, BR, Rolando, CA. (2015). Long-term management of streams in planted forest steeplands. *New Zealand Journal of Forestry*, **60**(2), 21-24.

New Zealand Forest Owners Association (2007). *New Zealand Environmental Code of Practice for Plantation Forestry* (Version 1).

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About Scion

Scion is the Crown research institute that specialises in research, science and technology development for the forestry, wood and wood-derived materials and other bio-material sectors.

Scion's purpose is to create economic value across the entire value forestry chain, and contribute to beneficial environmental and social outcomes for New Zealand.

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