

Forestry and water flows in Te Hākāpupu / Pleasant River catchment

Commercial forestry has emerged as a land use in Te Hākāpupu / Pleasant River catchment over the last 30 years. It now covers almost half (47%) of the catchment. Will this impact the catchment's water flows? Research suggests that pine plantations in the upper catchment can reduce flows. Proving this, and determining by how much, is a challenge because many interacting factors are involved.

Land use change in Te Hākāpupu / Pleasant River catchment

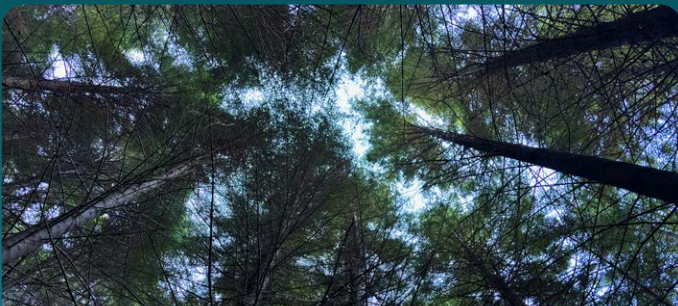


Figure 1: Commercial forestry is now a major land use in Te Hākāpupu / Pleasant River catchment.

The Toitū Te Hākāpupu / Pleasant River Restoration Project aims to improve water quality and enhance conservation, cultural, and community values throughout the catchment.

Over the last 30 years, land use in the catchment has changed from nearly all medium/low-intensity agriculture in the 1990s to nearly half (47%) commercial forestry (**Figure 1**). The forest areas are mainly on the steeper, inland parts of the catchment (**Figure 2**).

Climate change in this part of Otago is predicted to cause higher temperatures and more frequent extreme hot days but little change in annual precipitation. The community is interested to know if the increase in forestry will impact instream flows.

Factors affecting instream flows

A range of factors affect instream flows. Transpiration by vegetation is important. In vegetation, transpiration is the process of water movement from root systems through the plant to exit into the air as water vapour. It is naturally higher for forests than pasture because forest has more vegetation canopy per square metre of ground.

Transpiration is part of the wider process of evapotranspiration. Evapotranspiration also includes the transfer of water to the atmosphere from soil and water bodies. It rises with increasing amounts of sunlight, higher temperatures, and greater wind speeds.

Other factors that affect instream flows include:

- Rainfall
- Evaporation from soil and surface water bodies
- Groundwater discharge from aquifers
- Groundwater recharge from surface water bodies
- Sedimentation of lakes and wetlands

Sedimentation of lakes and wetlands can affect instream flows by reducing flow capacity and potentially altering flow patterns. The interrelationship of transpiration, evapotranspiration, and other factors influencing instream flows makes it difficult to calculate the effect of forestry specifically on instream flows. Even so, research provides some guidance.

Research into the impact of forestry on instream flows

Generally, in New Zealand, a reduction in annual water yield of 20-50% could be expected from commercial forestry compared to pasture or tussock land, based on paired catchment studies.

Research summarising 94 catchment experiments worldwide suggests the following trends:

- Increasing vegetation cover reduces water yield and vice versa.
- At the catchment scale, for pine and eucalypt forest types, there is on average a 40mm change in water yield per 10% change in land cover.
- For deciduous hardwood and scrub, this change in water yield is lower: about 25mm and 10mm per 10% change in land cover, respectively.

The impact of afforestation on instream flow may be less in a naturally low-flow catchment; however, how much less is unknown.

Finally, forestry can reduce peak flows during flood events compared to pasture, especially for small flood events. Peak flood flows were reduced by approximately a third due to afforestation at Berwick, which is about 40km south of Te Hikapupu / Pleasant River catchment.



Figure 2. Recently planted forest estate in Te Hikapupu / Pleasant River catchment.

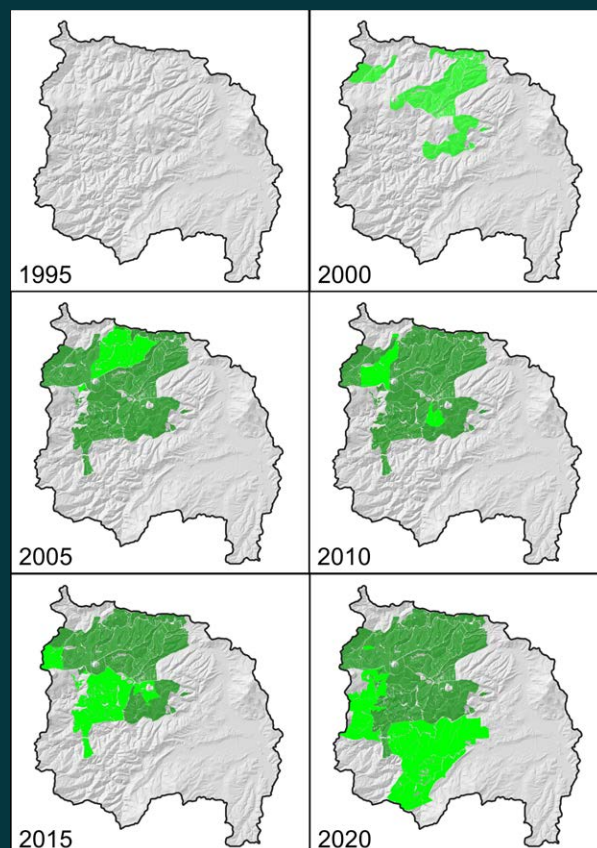


Figure 3. Expansion of commercial forestry in Te Hikapupu / Pleasant River catchment from 1990 to the present.

Will forestry change instream flows in Te Hikapupu / Pleasant River?

Expansion of commercial forestry in the catchment (Figure 3) is likely to reduce instream flows, but to what extent cannot be accurately determined at present. The exact amount depends on many interrelated factors linked to hydrology, land use (vegetation cover and vegetation type), and climate.

Much of the catchment's forest area is still maturing, and its impact on flows may change as the trees grow. The Otago Regional Council flow monitoring site on Te Hikapupu / Pleasant River at Patterson Road will help quantify changes in flow over the years. Variation in climatic conditions from year to year and longer climatic cycles may make it difficult to clearly identify the effect of forestry on flow in the short to medium term (5-10 years).

A partnership project by:



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