Forest Flows Research Programme

SCION FORESTS PRODUCTS INNOVATION

Forest water release

Forest water release refers to the movement of water within and out of a forest. It plays a crucial role in the hydrological cycle. Both streamwater and groundwater contribute to water release.

The majority of rain that falls on forests is released and is made available to downstream users.

Soil moisture sensor installed at a Forest Flows site.

Scion's Forest Flows research programme fills a gap in forest hydrology research over the last 40 years. Intensive, integrated sensor networks were set up at five primary forest sites across New Zealand. They cover a range a catchment sizes and are across a rainfall gradient (800 to 3000mm per year). Rainfall, tree growth, soil moisture, water age and more have been measured and analysed.

Rainfall gradient

It is important to understand what is happening at both low and high ends of the rainfall gradient.

At all forest sites water was released to groundwater and streams, even during dry spring and summer periods.

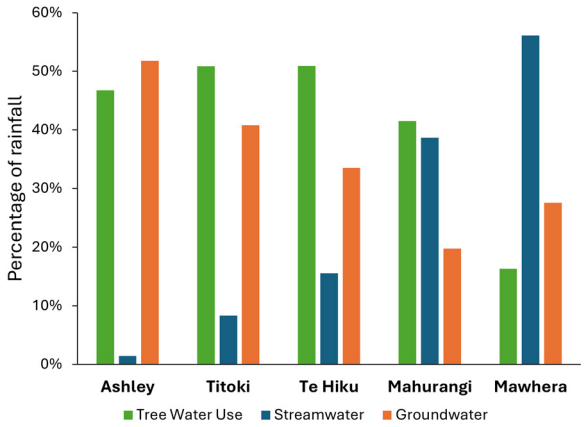
This rainfall varied seasonally with 200mm to 723mm in summer and 164 to 1021mm in winter.

Over one year, rainfall across the 5 sites, ranged from 995mm from Titoki to 2587mm at Mawhera.

Tree water use (evapotranspiration)

It is commonly assumed radiata pine uses 42% of water, and uses all the available water during summer. Forest Flows research found radiata pine used 16 to 51% (average 37%) of rainfall annually through tree water use.

Tree water use is higher in spring and summer during the growing season and decreases in autumn and winter.



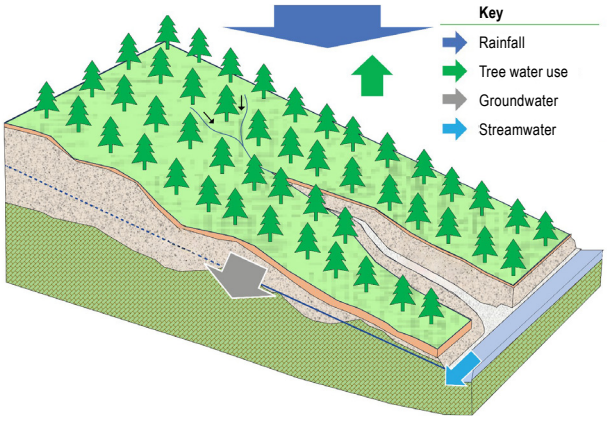
Water release and tree water use as a percentage of annual rainfall at Forest Flows sites.

Groundwater and streamwater

This study measured shallow groundwater at 10 metres and found it ranged from 20 to 52% (average 32%) of rainfall reached this depth; rainfall that reached the stream averaged 31%.

During spring and summer months, shallow groundwater and streamwater was still replenished by rainfall, showing a forest's ability to slowly release water throughout the year while also regulating the amount of water that is released during the wetter autumn and winter months.

The use and release of rainfall via tree water use, groundwater and streamwater enables forests to maintain its own water balance while also providing water downstream throughout the year.



Tree water use and release of rainfall in a catchment.

Water release from streamflow ranged from 0 to 56% (average 31%). The overall water release (streamwater and groundwater) ranged from 49 to 84% with average of 59% across all the sites.

Many previous forest hydrology studies only measured streamwater. We have shown that groundwater is an important mechanism for water release from forested catchments. This water can either recharge deep groundwater or enter the stream and is available further downstream.

Contact information

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About Scion

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

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

NIWA Taihoro Nukurangi

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