

Soil water stores in second rotation blue gum plantations

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¹ CRC for Forestry, Programme One (Managing and Monitoring for Growth and Health); managing site resources to sustain productivity through multiple rotations (subproject 1.2.1)

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While much has been published about changes in **water yields** from **catchments** following the establishment of **plantations**, it seems that little is known about soil water storage in the period **between plantation crops** and what this might mean for **sustainability** of plantation production. Many plantations are either still in the **first rotation** or early in the **second rotation** so there is currently little evidence about **changes in site condition** from one rotation to the next.

Results from Programme One research and earlier **silvicultural research** in Western Australia suggest that **reduction in soil water stores** during the first rotation has the potential to reduce yield in second rotation blue gum plantations. This research also highlights the potential for site-specific silviculture to **manage drought risk** and minimise the **potential yield reduction**.

CRC Project 1.2 (managing and sustaining) measured soil water recharge in blue gum plantations in **medium and high rainfall** areas at five sites in **Western Australia**; extending data collected at the same sites during a previous eight-year project (1998-2006) conducted by CRC partners.

At all five sites, the **trees dried out the soil profile** to at least eight metres during the first rotation, creating a **soil water deficit** greater than 800 mm. At a **high rainfall site**, this deficit was **completely recharged in the first year after harvest**, but, at two **lower rainfall sites**, significant soil water **deficits persisted** for at least 18 months after harvesting (400 and 200 mm respectively were recharged at Scott River and Boyup Brook). Soil water recharge was less pronounced in areas where more annual rainfall occurred in **summer**.

After harvest the stumps were allowed to **re-sprout or coppice**. Eighteen months after harvest the **soil water deficit was significantly greater** than at a similar age during the first rotation at both **low rainfall sites** (Boyup Brook and Wellstead). At Boyup Brook, a **winter rainfall** site, the absolute deficit was about 200 mm eighteen months after harvest, while at Wellstead the deficit was still about 600 mm.

There are now more than 400,000 hectares of **blue gum plantations** across southern Australia, and most are established on **former farm land** where levels of soil water and nutrients are high.

Project results show that in medium rainfall zones (600-800mm), **time between rotations** is not always enough to **restore the soil water used up during the first rotation**. If plantation water usage exceeds rainfall, first rotation growth may deplete the soil water store, particularly on deep soils such as those that are common in southwestern Australia. In areas of **winter rainfall**, soil water stores may be **replenished**, but the research suggests that where rain falls mainly in **summer**, soil water **deficits persist**. If the soil profile is not completely recharged between the rotations, and without **increased efficiency of plantation water use**, second rotation **yields** may decline.

The persistent soil water deficits seem most acute where **coppice** is used to regenerate stands because biomass and leaf area establish faster in coppice plantations than in seedling plantations and **deep and established root systems** prevent a soil water recovery period. **Seedlings use less water** in the first couple of years, allowing more time for soil water replenishment before the second rotation trees start to mature.

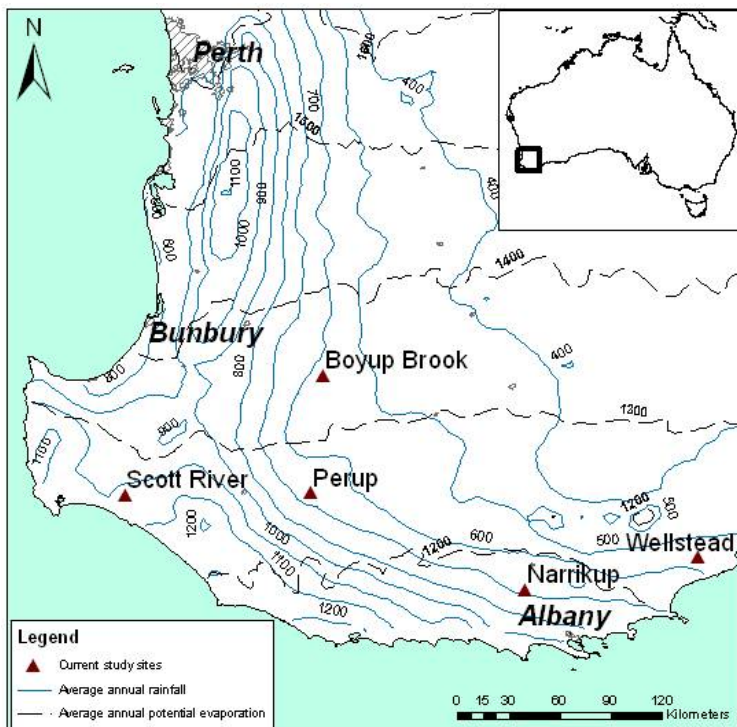
The objective of our research was to quantify all components of the **inter-rotation water balance** including changes in soil water storage during the early second rotation as a basis for **developing models** of the growth, carbon and water balance of second rotation plantations.

Project researchers are now working with decision support tools to explore the **productivity implications** of changed soil water conditions during the second rotation under a range of **silvicultural and climatic scenarios** to identify how to match inter-rotation **management** and establishment silviculture to site conditions.

Organisations supporting this science

This work began in 1998 and was completed with financial and in-kind support from CSIRO, the Forest Products Commission of Western Australia, Hansol PI, Albany Plantation Forest Limited, WAPRES, Timbercorp, Great Southern Limited, the CRC for Forestry and all contributors to Programme One (Managing and Monitoring for Growth and Health).

Field site locations



This map shows field site locations in relation to average annual rainfall and potential evaporation.

More information

CRC for Forestry website

<http://www.crcforestry.com.au/research/programme-four/water/index.html>

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