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WATER

FACT SHEET THREE

Forest Industry Council

Effects of pine plantations on stream flow and water yield

Why do landcare experts unanimously advocate the widespread planting of more trees in our catchments, particularly in the Murray-Darling Basin? The reason is our catchments have been degraded by 200 years of human intervention, the consequences of which are explored below.

Gully erosion caused by clearing. Photo courtesy of State Forests of NSW.

Salinity

As the Australian landscape has been cleared for agriculture and urban development, ground water tables have been progressively rising in some areas, particularly in the Murray-Darling basin and in south-western Australia.

This process is called 'recharge' and 'discharge' and leads to what is known as dryland salinity. 'Dryland' because it is a result of natural rainfall, rather than irrigation, adding water to the soil and causing raised water tables.

The salinisation is caused by the water in the soil dissolving salt from deeper in the soil profile and bringing it closer to the surface. As the water evaporates it leaves the salt at the soil surface which may make the soil sterile, and saline water ends up in creeks and rivers.

Together with irrigation-induced salinity, this process has led to the lower reaches of most catchments in the Murray-Darling river system as well as creeks and rivers in Western Australia becoming highly saline, and to buildings and roads being damaged by salty water coming to the surface.

Research in both areas has shown that dryland salinity can be slowed down by reforesting catchments in recharge areas. If sufficiently large areas are planted in time, the cycle may be able to be reversed.

Reforesting catchments with a renewable resource

Pines are a renewable resource proving a highly marketable commercial crop to meet community demand for timber while at the same time improving the environment.

Water flow

Pines with their deep roots and transpiration, are able to soak up water from the soil and release it back to the atmosphere as vapour. Pine plantations also reduce run off when compared to cleared agricultural land.

In a study of 28 sub-catchments of the Murrumbidgee, Vertessy (1999) found that, in general, the larger the proportion of the catchment that was planted to pines, the lower the proportion of rainfall that became runoff (i.e. reached the streams and left the catchment).

Again within the Murrumbidgee catchment, the joint State Forests of NSW and CSIRO Red Hill study near Tumut has shown that, as young pine plantation replaces cleared pasture and the trees grow older and dominate the site, less water runs off the site into the streams.

significantly.

In practice however, up to 25 per cent of most plantation areas remain unplanted because of gully protection areas, steep, rocky sites, roads, powerlines and so forth. Plantation estates generally have a mixture of ages from newly planted to thinned and mature pine.

Quantifying the impact for downstream irrigators

This questions is often asked: "We know all about the catchment hydrology benefits of plantations, but what will happen to water availability for the major irrigation areas if we continue to expand pine plantations in the upper catchments?"

For the answer, it is worth looking at the Murrumbidgee River, the catchment with the largest area of pine plantation in Australia.

All the pine plantations within the Murrumbidgee are upstream of Wagga Wagga and all the significant extractions of water for irrigation are downstream of that city.

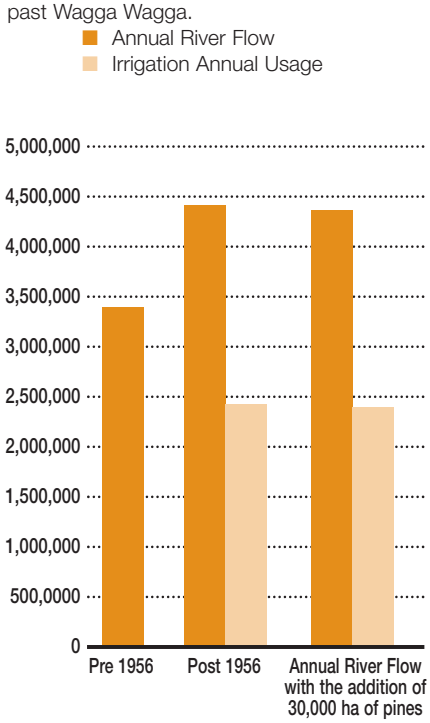
River flow figures are available for the past 100 years so we can examine what has happened to water yields while these plantations were being established.

The major flood year of 1956 is a convenient cut-off point in this examination, as most of the plantations were established after that date, and it is approximately half way through the century.

If we take the figure for 1956 out of the data completely and compare the pre-1956 average with the post-1956 average, we find that the annual river flow through Wagga Wagga was 3.4 million Megalitres (ML) in the period 1900 to 1955 but actually increased to 4.4 million ML in the period since 1956 (see Figure 1).

Half of this increase of one million ML is explained by diversions from the Snowy River through the Snowy Mountains Scheme. The other half

Figure 1. Murrumbidgee River water flows past Wagga Wagga.



of this increase is obviously due to a variety of influences including generally higher rainfall in the catchment during the latter half of the century. Perhaps land clearing for agriculture has also had an impact.

Either way, any long-term reduction in water yields due to the development of pine plantations has been more than compensated for by other factors.

What impact will increasing plantations in the Murrumbidgee have on water yield at Wagga Wagga as the NSW Government has committed to a further 30 000 hectares of pine plantation around Tumut?

The total use of Murrumbidgee water for irrigation downstream of Wagga Wagga has averaged around 2.4 million ML per year during the past 15 years.

Most existing research indicates that a pine plantation, when it reaches crown closure uses about 2 ML per hectare per year more water than cleared pasture and it probably averages around 1 ML per hectare per year through the life cycle of the plantation.

Thus, if nothing else changed, a further 30 000 hectares would use 30 000 ML or:

1) only 3% of the increase which has occurred in the period since 1956,

2) 0.7% of the average flow through Wagga Wagga since 1956,

3) or 1.25% of the water used by irrigators.

Ongoing research

Much of the research that has been undertaken to date has had two things in common:

1) pine plantations are compared with native (eucalypt) forest rather than cleared agricultural land, and

2) comparisons are made between catchments with different land uses.

The inherent differences between catchments associated with changing land use over time has not been well studied.

For these reasons, State Forests has embarked on an additional two studies into water use by pines:

1) The Red Hill study, started in 1989, compares two small adjoining sub-catchments - one remaining as pasture and the other established to pines. These will be compared throughout the life of the first pine plantation and will help us predict the impacts for different management scenarios.

2) Another study looks at larger catchments where long-term stream gauging and rainfall data are available. In this study, the change in the relationship between rainfall and runoff over time is examined and an attempt will be made to explain this in terms of an increasing area of pine plantation.

This research may be confounded by land clearing activity and changing plantation age classes over time but nevertheless it should add to our knowledge of plantations