

Reconciling productivity and drought risk in *Eucalyptus globulus*: a regional perspective

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Plantation growing of *Eucalyptus globulus* on farmland is a major new industry in the south west of WA. Water availability is emerging as one of the primary determinants of tree growth. The amount of water available to trees is determined by both the current balance of rainfall and evapotranspiration and by the amount of water retained in profiles from previous shallow-rooted pasture or annual crops.

Direct and indirect measurements of soil moisture availability are now showing that bluegum plantations are capable of substantial draw-down of water that has accumulated in deep soil profiles. Measurements of soil and tree water potentials have provided strong evidence that plantations at 750 mm or less annual rainfall have in several instances depleted moisture to wilting point in profiles 9-12 m deep within 6-9 years of planting.

This stored soil moisture is likely to have contributed 300-1000+mm of water to the trees in the first 6-9 years of their growth. This is a substantial fraction of the current input from rainfall of 700 -800mm year⁻¹ (6300-7200 mm gross rainfall before allowing for interception losses of approximately 20% (1300-1450 mm). Instances of soil profiles impenetrable to bluegum roots are rare. Deep moisture depletion in a range of soil materials all point to root penetration by the planted trees. Bluegums were unable to support rapid growth rates when saturated groundwater is saline.

Increasing areas of bluegum plantations are now approaching their initial harvest. Many plantations will be turned over to a second rotation (2R) immediately by coppicing or within a year by replanting in the winter after harvest. In either case, relatively little recharge of deep soil profiles from winter rains is likely to occur before 2R plantations grow to the enough leaf area to potentially use all the available current annual rainfall. The effect of first rotation depletion on growth rates and overall productivity of the second rotation is being determined in a series of trials.