

## Using short rotation woody crops to reduce recharge and produce bioenergy

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Reforestation of recharge areas is often advocated as a means of tackling salinity. The hydrologic impacts of trees in dryland-farming landscapes can be localized and belts of trees can compete with crops for water and nutrients. Dispersal of trees across paddocks interferes with crop production. Another approach may be to insert short rotation woody crops (3-5 years) into existing agricultural systems on a 20-25 year cycle. The premise is that the trees will rapidly de-water soil profiles and thus create a buffer of dry soil that will be refilled during the subsequent agricultural phase. This is analogous to phase farming with perennial legumes and grasses, but differing in terms of rates of soil water depletion and the ability of tree roots to explore hostile subsoils.

The premise of using short phases of woody crops to control recharge has been investigated through:

1. Modelling which suggests success in >10 m deep soils but not in areas with shallow soils, unconfined aquifers or sandy soils with high rates of recharge (Harper *et al.* 2000),
2. Examination of the root distribution of 7 year old eucalypts, with evidence of soil water depletion to 10 m depth in clayey subsoils that have high-bulk densities (Robinson *et al.* 2006), and
3. Field experimentation on cereal land, with 300 mm/year rainfall, in south-western Australia, with a range of tree species and planting densities. Soil water depletion of 440 to 780 mm occurred beneath high density (4000 stems/ha) plantings of *Eucalyptus occidentalis* within 3 years of planting (Harper *et al.* 2008), with biomass yields of 15-22 t/ha/3 yr (Sochacki *et al.* 2007). Both the rate of water depletion and biomass production varied with tree species, planting density and landscape position and there appears to be potential to further improve on the results achieved to date.

Unresolved issues include the development of cost-effective establishment and harvesting techniques, the length of persistence of the dry-soil buffer particularly under a changing climate, and developing a market for the products.

While the lack of a payment for salinity benefits is common to all salinity treatments, the markets for bioenergy are more promising, with rapidly increasing global energy demand and impetus towards renewable fuels, particularly in terms of mandated renewable energy targets. Large future markets may develop when enabling technologies, such as the conversion of woody biomass to liquid fuels, are developed. When that occurs phase farming with trees offers a method of producing both food and fuel from the same land, whilst increasing the sustainability of current agricultural systems.

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