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Media Release

Phase farming with trees: the acceleration of farm-forestry to combat dryland salinity

27 March 2006

The salinization of land and water resources is a major environmental problem in Australia, with projections of up to 17 million hectares of farmland being affected by 2050. This has been caused by the replacement of deep-rooted natural vegetation by shallow-rooted agricultural plants and reforestation is often proposed as a method of restoring the previous balance. In the greater than 600 mm/year rainfall areas of Western Australia, where there has been extensive establishment of *Eucalyptus globulus* plantations in the last 15 years, there is now evidence that previously salt-affected rivers, such as the Denmark, are recovering.

Despite this, land use systems that use trees to reduce salinization are not currently available for the large areas of Australia's agricultural zone with rainfall less than 600 mm/year. Reasons include (a) uncertainties about returns, (b) uncertainties about where to plant trees for greatest impact on salinity and (c) conflicts with agricultural activities. Similarly, the effects of trees on groundwaters are often localized and trees will have to be dispersed across paddocks. Belts of trees can compete with crops whereas scattered trees across paddocks will interfere with crop production.

Using Joint Venture Agroforestry Program funding (Projects CAL 3A and 6A), the Forest Products Commission and scientists from The University of Western Australia and CSIRO embarked in 1999 on an alternative approach to tackling the salinization of farming systems in the less than 600 mm rainfall zone of southern Australia. We have termed this "phase farming with trees" (PFT), as it has similarities with phased grazing systems that use lucerne.

Our concept is of trees grown at high planting densities in very short term rotations (3-5 years) that rapidly de-water farming catchments at risk of salinity, while producing utilizable products such as wood fibre and biomass. The tree phase would be followed by an agricultural phase of some 20-30 years during which the soil would refill with water. If successful this system would allow the rapid expansion of tree planting in low rainfall areas across southern Australia, with potential benefits including:

- the rapid restoration of local water balances,
- the utilization of a resource (stored soil water) which is currently contributing to environmental problems,
- the production of wood fibre and non-wood products,
- an impact on Australia's net carbon dioxide emissions by providing a feedstock for bionergy, and
- the development of more sustainable agricultural systems through a reduction in salinization, providing a disease and weed break and "biological ploughing" of sub-soils.

So much for the theory. Will this system work in practice, or be totally impractical? To test this we embarked on a three pronged approach. This included:

1. Modelling, with this suggesting that the system may work in the deep (>10 m) soil profiles, that are common in south-western Australia, but not in areas with free water tables or deep sandy soils with high rates of recharge.
2. Examination of 15 existing *Eucalypt* plantings across south-western Australia. There was evidence that soils had been dried to depths of up to 10 m depth after 7 years, across a range of soils.
3. Field experimentation, on land normally used for cereal production near Corrigin, WA (300 mm/year annual rainfall). Here we assessed a range of tree species (*Eucalyptus globulus*, *E. occidentalis*, *Acacia celastrifolia, Pinus radiata and Allocasuarina huegeliana)*, established at planting densities between 500 and 4000 trees/ha to determine (a) if the concept of soil water depletion to depths of several metres in 3-4 years was possible, and (b) if it is feasible to further accelerate the rate of water depletion, and hence decrease the duration of the forestry phase. Results have been very promising with soil water beneath *E. occidentalis* at 4000 trees/ha depleted to 6.5 m depth after only 3 years. Total dry matter production (above and below ground), ranged from 9-25 t/ha.

The PFT system is thus a highly promising technique of reducing recharge of water under agricultural systems. There remain, however, a number of impediments before the PFT system can become a recommended practice. The first revolves around profitability, which is directly related to current policy settings that value environmental services provided by reforestation and developing markets for renewable energy. In broad areas the cost of establishment of the trees will far outweigh the returns from tree products. A strong candidate product is biomass for bioenergy production; however that industry is still in the early stages of development. Importantly, there are no direct buyers for one of the major outputs of the system – a reduction in recharge and stabilization of agricultural systems. The second impediment relates to returning the paddocks to cropping after a rotation of trees and in particular the removal of roots. We are currently assessing this, revisiting some of the techniques that were used 30-40 years ago to convert broad tracts of bushland to agriculture.

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Further reading

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