Comparison of water use by grazed grasslands and remnant Callitris woodlands during a drought period

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Callitris (*Callitris columellaris* Cupressaceace) is a native timber species common in inland Australia, and to the Wagga region. The purpose of this study was to compare water use by a grazed perennial pasture relative to water use by an adjacent grazed remnant Callitris woodland over the 1994 drought period.

Methods

This study was conducted on a single paddock of the NSW Agriculture, Agricultural Research Institute property, located on the Houlaghans Creek floodplain, Wagga Wagga. Two areas were selected, one in the grassland well away from any trees in the paddock and one located well within an adjacent Callitris woodland. At each location, three neutron moisture probe access tubes were installed to a depth of 2m. Rain gauges were installed at both sites. In both the grassland and the woodland, the dominant pasture species were perennial ryegrass, danthonia species and subterranean clover. Soils at the site are derived from alluvium parent materials and the soils texture was silty loam.

Fortnightly estimates of evapotranspiration were made by taking into account precipitation over the period and commensurate changes that occured in the amount of water stored over the two metre soil profile; surface runoff and deep drainage were assumed to be negligible.

Results and Discussion

The amount of water used by the grassland and the Callitris woodland were similar over the period of study. Given that both sites were very heavily grazed, much of the estimated evapotranspiration from the grassland was assumed to be soil evaporation rather than transpiration. However, in the Callitris woodland, a considerable amount of shading of the soil surface occurred and a considerable layer of mulch composed of leaf litter and animal dung was apparent, which assisted in protecting the soil surface, reducing soil evaporation. Hence at this site the major component of evapotranspiration was assumed to be transpiration via Callitris.

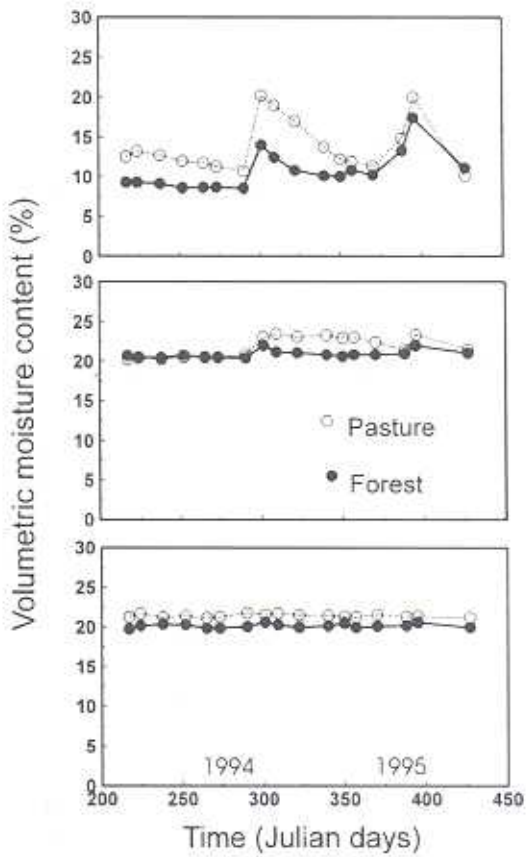

Figure 1. Changes in the volumetric soil moisture content to a depth of 2 m under a grazed grassland and remnant Callitris woodland during the 1994 drought.

An additional finding from this investigation related to the depth of water used by the two vegetation communities. Figure 1 illustrates the change in soil water content down to a depth of 2 m over the season. Marked changes in the moisture content of the soil layers down to 60 cm were apparent where both inputs due to heavy rainfall events and losses via evapotranspiration were visible.

Interestingly for the 15 and 30 cm layer, the soil was always drier under the Callitris than under the grassland, but for most of the major rainfall events,

the apparent increase in soil moisture content of each layer under the grassland was more marked than under the Callitris woodland. This suggests that the Callitris had an active water imbibing root system in the surface layer to a depth of approximately 60 cm, and when water was readily available in this layer, this available water was readily imbibed and transpired by the Callitris. Similarly, when precipitation infiltrated the soil to a depth of 90 cm (day 300), the soil moisture was more readily used by the Callitris than the grassland.

It is interesting to note however that neither the Callitris nor the grassland used much soil moisture at the 120 or 180 cm layer. However, as wilting point (tension -1500 kPa) for these soils at these depths corresponds to a soil volumetric moisture content of approximately 20 %, it seems very likely that the soil moisture content at these depths was beneath the lower limit of extraction for both the woodland and grassland species.

Further work is being undertaken in this program and attempts are currently being made to quantify:

- the depth that Callitris is capable of removing soil water;
- the rates of transpiration by individual Callitris species; and,
- the impact of grazing on transpiration of soil water by the grassland understorey in Callitris communities and in grassland communities.