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TREES SUPPRESS PASTURES – IT AIN'T NECESSARILY SO!

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ABSTRACT
In eastern Australia, woodland clearing or thinning to enhance productivity from pastoral activities was common practice at latitudes greater than 20°S. Ecological theory says that in water-limiting woodland environments, evergreen trees compete with the understorey pastures and restrict pasture growth. We report on results from an ironbark woodland at 23°S in a 650mm rainfall environment where there was no initial pasture growth response to the chemical removal of appreciable tree competition. Data was collected by both the Swiftsynd primary productivity method and the Botanal pasture sampling method. Possible reasons for this apparent ecological anomaly are discussed but no convincing explanation reached.

INTRODUCTION
In environments where perennial grasses grow well, conventional wisdom has it that trees compete with the grasses for resources, particularly water. Experimental data (Scanlan and Burrows 1990) shows a general curvilinear decline in pasture (mainly grass) production as evergreen tree density or stem basal area per hectare increases. This occurs for a range of vegetation dominants (Scanlan 2002) from eucalypts to acacias to shrubs like *Eremophila* and *Cassia*. Pasture and savannah primary production models such as GRASP (McKeon *et al.* 1995) reflect this paradigm by apportioning soil moisture between trees and pasture in the upper layers of the soil profile.

When a trial was set up to study woodland dynamics in the Peak Vale Land System (Gunn 1967) near Rubyvale in central Queensland, one of the treatments chosen was tree clearing, along with spring burning and grazing pressure. This paper summarises the outcome of the removal of tree competition on pasture production over the ensuing six years in the absence of grazing.

METHODS
An open silver-leaved ironbark (*Eucalyptus melanophloia*) woodland with mean tree basal area of 6m^2/ha was chosen. Bloodwood (*Corymbia erythrophloia*) and prickly pine (*Bursaria incana*) were minor components, with ghost gums (*C. papuana*) restricted to the drainage lines. The soil was a gritty red duplex soil (Dr 2.12, Northcote *et al.* 1975) of low fertility and available water holding capacity, 70 mm in the upper 60cm. The associated pasture was a good condition native one dominated by blackspear (*Heteropogon contortus*), desert Mitchell (*Bothriochloa ewartiana*) and golden-beard grass (*Chrysopogon fallax*).

The trees were killed with 'Velpar' (hexazinone) in March 1994, using the 'nick and squirt' technique. Small ironbark trees, of which there were many, were treated by squirting chemical on to the soil surface at their base. In all, there were 12 one hectare plots used in this experiment in a factorial design with three replications. Half were left untreated. The other management factor applied was spring burning to half the plots. Conditions did not allow for a successful burn every spring but it was achieved in 4 of the 6 years after 1994.

Thereafter, standing pasture biomass was assessed each autumn using the Botanal technique (Tothill *et al.* 1992) and tree size and regrowth was recorded in 1995, 1997 and 1999.

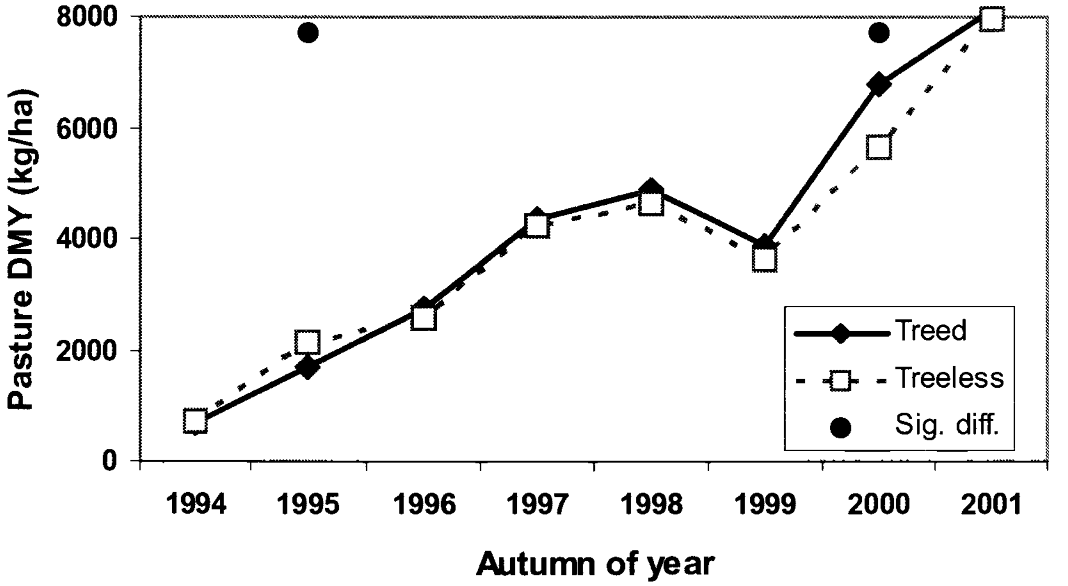

Figure 1: Effect of killing trees with hexazinone on standing autumn pasture dry matter (ungrazed) over the next seven years at Rubyvale, central Queensland

RESULTS

Tree death was rapid and complete where Velpar was used. However, killing the trees had no significant impact on pasture production in most years (Figure 1). This result occurred consistently over a range of seasons that varied from very good (1997/98) to quite dry (1996 and 2000 – Figure 2). Spring burning had no impact on this result (data not presented) although it did affect the total amount of pasture recorded in most years. More intensive sampling of some plots for model calibration using the Swiftsynd methodology (Day and Philp 1997) produced a similar result (Silcock *et al.* 2006).

Tree regeneration from seed and suppressed saplings was negligible during the trial. However, in the absence of grazing and fire, small ironbark saplings were more evident in patches by 2001.

DISCUSSION

This is an abnormal result. However, because it happened consistently over 7 years and was informally reported from nearby properties, there must be other factors operating to allow unrestricted pasture growth beneath a woodland. Pasture yields were good and typical of this land type. An independent assessment done in June 1997 in similar vegetation on the same property (P.V. Back, pers. comm.), showed a slight but significant decline in standing pasture yield due to trees after a very good early summer season —

$$\text{Pasture yield (kg/ha)} = 5350 - 251*\text{TBA (m}^2\text{/ha)} \quad (R^2 = 0.621)$$

This is not nearly as strong an affect as other data from the ironbark woodlands found (Scanlan and Burrows 1990).

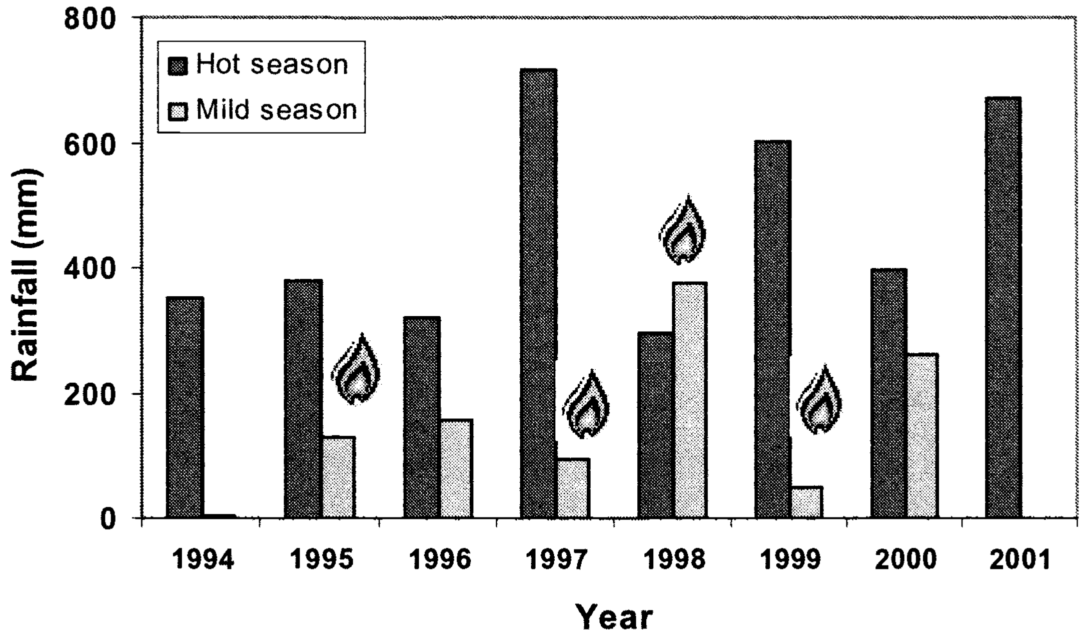

Figure 2: Seasonal rainfall pattern during the trial period. Hot season = Oct – Mar Mild season = Apr – Sept

Initially it was thought that the tree root systems may have still been debilitated following the severe regional drought of 1992-93. Widespread death of eucalypts was reported around Charters Towers after the drought (Fensham and Holman 1999), especially of silver-leaved ironbark. The canopy of many ironbarks at our site was not voluminous but they were not insignificant. Significant tree death had not occurred at our site nor did it happen unassisted during our study. Rates of refoliation after spring fires were typical, in our view, and measurements taken in early 1998 showed complete canopy recovery within one summer (Jones unpublished data).

The same lack of tree impact on the pasture was recorded at the same time on the adjacent grazing trial paddocks that were treated with herbicide at the same time. So the result is general in terms of the grazing pressure applied. The trees did not show any obvious signs of ill-thrift or severe insect or pathogen loads during the trial. A year or so after the trial began, bracket fungi were observed on many large trees killed by our herbicide. This, according to foresters who we consulted, would be expected and such fungi are not regarded as primary pathogens of eucalypts.

The lack of a pasture response to tree killing on this land system (1850 sq km) is currently only explained by a lack of competition for moisture between the current tree and pasture layer. Do these trees stimulate soil insect activity to an extent that they greatly enhance moisture infiltration that primarily advantages the shallower-rooted pasture? Was their canopy lacking the foliage density (foliage projected cover - FPC) that would normally be expected for their trunk diameter?

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