



# Do woodland trees improve pastures?

In the eucalypt woodlands of Australia's far north, trees may actually be pasture friendly. **Steve Davidson** reports.

**A**s tree clearing continues apace in Australia, not least in Queensland, it is timely to consider the effect of trees on pasture growth and quality. Do trees enhance or diminish pasture yield and quality? Is it really a good idea for graziers to continue removing them from paddocks so enthusiastically? What about the long-term effects of tree clearing?

Trees in the open eucalypt woodlands of sub-tropical and tropical Australia are often killed or cleared to improve the productivity of the associated pasture for grazing beef cattle. The rationale for this is that trees compete with the grasses for water, light and soil nutrients and that removing the trees will boost pasture yields.

Many studies indicate that pasture yields increase as tree density in these woodlands declines. In the denser woodlands of central and southern Queensland, trees out-compete pasture so effectively that without some tree killing, commercial beef production would be possible.

In the more open woodlands of northern Queensland, the benefits of tree clearing are less certain. In the 1980s and early 1990s, John McIvor and Chris Gardener of CSIRO Sustainable Ecosystems, (then CSIRO Tropical Agriculture), showed that tree clearing typically boosts pasture productivity by 30–50% in woodlands, but that regrowth of eucalypts reduced this benefit. Economic analyses suggested that clearing only paid off in the longer term if pasture productivity gains from clearing exceed 50%.

But recent research suggests that trees in these more open woodlands may in fact provide some benefits to the pasture. When Janice Jackson and Andrew Ash, also of CSIRO Sustainable Ecosystems, investigated the relationships between trees and grasses in open eucalypt woodlands in north-eastern Queensland, they found that trees have some positive effects on native pastures.

## Tree-soil-grass interactions

To investigate the effects of eucalypts on pasture, the scientists collected soil from beneath ironbark trees (under the tree canopies) and from in-between areas from two localities in open eucalypt woodlands near Charters Towers, Queensland. One locality had greater soil fertility than the other.

Two common native grass species, golden beardgrass (*Chrysopogon fallax*) and black speargrass (*Heteropogon contortus*), were grown in the collected soils, in a glasshouse, and the scientists applied various shade and water-stress treatments to simulate both the independent and combined effects of these factors on plant growth.

This controlled experiment followed an earlier field study of tree-grass interactions and soil fertility in the same ironbark woodlands, in which soil fertility, pasture biomass, and other factors, were measured at various distances from trees.



Above left: Northern woodlands are quite open and the value of tree clearing on beef grazing properties is not clear cut.

Above centre: Black speargrass grown in soil collected under the eucalypt canopy grew better than grass grown in soil from outside the canopy zone – especially in the case of the less fertile Cardigan woodland site.

Above right: Soil from woodlands was used in glasshouse pot experiments to investigate the effects of shading and water-stress on pasture growth.

Chemical analyses showed that nutrient levels – total nitrogen (N), potassium (K) and organic carbon (C) – were higher in soils from under tree canopies. Furthermore, plants grown in this soil produced 42% more biomass than plants in outside-canopy soil. These plants also grew taller and produced more tillers.

This tree-induced increase in pasture growth was much greater in soils from the low fertility site. Leaf quality or nutritive value, in terms of N and P concentration and dry matter digestibility (DMD), also tended to be higher in grasses growing in the soil from beneath trees.

‘Our latest findings generally confirm our earlier observations in the field,’ Jackson says. ‘Tropical woodland trees increase the availability of soil nutrients to pasture plants beneath their branches and this can enhance the quality and quantity of forage for cattle.’

‘The degree of enhancement depends on the background soil fertility levels, the tree effect on soil nutrient concentration being greater when overall fertility is low.’

### Cost and benefits

When the scientists compared pasture growth under conditions simulating the tree zone (shade, water stress and under-canopy soil) with growth under conditions mimicking the zone between tree canopies (unshaded, no water stress and using soil from outside the canopy), the former were taller and produced 46% more above-ground biomass.

‘Taken together, our studies show that soil fertility is enhanced beneath the canopies of trees in the open woodlands of north Queensland and this can promote the amount of forage produced and its grazing quality,’ Jackson says.

‘We add the proviso that, in dry years, there may not be enough water for the pasture to express these soil fertility difference . . . that is, to take advantage of the higher fertility under eucalypts to produce greater biomass.’

‘Soil moisture is key to the triggering of pulses of biological activity in rangelands and the earlier field study reflected this with water availability limiting plant growth so that pasture biomass was similar under and between trees, despite better soil fertility near trees.’

Nonetheless, pasture quality was generally higher under trees. So it’s a fairly complicated picture.

‘In related work, we found that the better forage quality under trees can lead to higher feed intake in cattle, which may offset some of the benefits in pasture productivity and stock carrying

capacity due to reduced competition after tree clearing,’ Ash says.

‘Although tree clearing for increased pasture production has resulted in large benefits in productivity of beef enterprises in southern and sub-tropical woodlands in Australia, the benefits are not as great in the more open woodlands of the tropical north.’

From a forage quality standpoint, it looks as if graziers will, in fact, gain advantages if trees are retained.

‘Consider the problem of significant eucalypt regrowth following tree clearing, which requires regular and expensive follow-up treatment – and the potential risk of dryland salinity – and the value of clearing in these tropical woodlands becomes highly questionable.’

### More about tree clearing

Jackson J and Ash AJ (2000) The role of trees in enhancing soil nutrient availability for native perennial grasses in open eucalypt woodlands of north-east Queensland. *Australian Journal of Agricultural Research*, 52:377–386.

Jackson J and Ash AJ (1998) Tree-grass relationships in open eucalypt woodlands of northeastern Australia: influence of trees on pasture productivity, forage quality and species distribution. *Agroforestry Systems*, 40:159–176

McIvor JG and Gardener CJ (1995) Pasture management in semi-arid tropical woodlands — effects on herbage yields and botanical composition. *Australian Journal of Experimental Agriculture*, 35:705–715.