Coal trains p.3

Tree/shrub population trends in Queenslands grazed woodlands – implications for management

W. H. Burrows, QBII, Rockhampton

1). Importance of woodlands to the grazing industry

The total area of wooded vegetation in Queensland, based on 1991 satellite imagery is 84M ha, with 76 M ha having a foliage projective cover greater than or equal to 12% (Henry *et al.* 2002). To-day this equates to a grazed woodland area of c.55-60 M ha, when areas of wooded national parks, State forests, urban areas, roads, other reserves and subsequent clearing activity are subtracted. Thus the grazed woodlands account for about one-third of Queensland's grazing lands and support about 3 M cattle equivalents

2) Scale and rate of thickening

A range of sources (e.g. historical records, anecdotal reports, paired contemporary and historical photographs, permanent monitoring plots, aerial photo interpretation, stable soil carbon isotope analyses) now support the contention that tree/shrub cover is generally increasing in Queensland's grazed remnant ("intact") woodlands (Burrows 2002). These trends parallel those summarized for the world's grazed savannas by Scholes and Archer (1977) – for a contemporary overview visit: http://rangeweb.tamu.edu/archer/ (Woody plant encroachment bibliography). – and see Asner et al. (2003) for a just published Texas, USA analogy.

Interestingly a report to the Australian Department of Environment, Sport and Territories (Noble 1997) clearly outlined the degree and extent of woody plant thickening in Queensland's woodlands. The TRAPS monitoring program has documented an overall annual tree basal area increment (meaned over 14 years) of 2.1% for the State's grazed eucalypt communities (Burrows *et al.* 2002). This is supportive of aerial photo interpretation data collected for the drier areas of central Queensland – 21% increase in tree basal area from 1952-1991 (R. Fensham, personal communication).

The general conclusion is that tree thickening is unidirectional towards more and more tree/shrub cover over time (see Burrows 2002 for ecological citations). This is despite the fact that extreme droughts can also contribute to widespread tree deaths. The persistence of tree/shrub cover, under current management, is well illustrated by the transformation of the Cobar peneplain which was open box country when sheep/cattle grazing commenced (Royal Commission 1901); but today remains as closed shrub woodlands clearly visible on all contemporary satellite images of Australia.

3) Economic impact

Burrows (2002) presents many experimental findings highlighting the common negative exponential relationships between increasing tree /shrub cover or basal area and pasture production. So any increase in tree/shrub cover will reduce potential pasture production and hence livestock carrying capacity. An example of future tree

thickening impacts on potential pasture yield is provided by Bray *et al.* (2002). These results, along with economic analyses such as those by Bartholomew and Wilson (1995) and Stafford Smith *et al.* (1999) emphasise why land clearing is attractive from a landholder perspective.

Based on a beef industry being worth c. $2 billion to the Queensland economy each year the livestock production from the State's grazed woodlands would be currently valued at about $600 million per year. At the present rate of tree/shrub thickening and in the absence of intervention to limit the process, it is estimated that current livestock carrying capacity on such land (3 M cattle equivalents) would fall to negligible levels in 50 years.

An important consequence of thickening continuing unabated is that grazing pressure on the non-wooded areas of landholdings is likely to appreciably increase as managers attempt to maintain production. This could lead to changed structure and composition of the remaining pastures leading to biodiversity impacts on them, as well as those that would also be occurring in the thickened woodlands. If graziers increase grazing pressure there could also be increased soil erosion from impacted sites, along with offsite consequences. However a positive result of increased tree/shrub cover would be that rainfall run-off and potential salt mobilisation would be reduced. Of course down stream towns and irrigators may have a different perspective on reduced streamflows?

4). Managing remnant woodlands on grazing holdings

The minimal aim of managing woodland communities on grazing holdings should be to at least maintain overall stock carrying capacity at current levels. This could be achieved by:

(a) increasing the productivity of non wooded areas, or
(b) permitting an on-going clearing regime to be implemented to maintain current livestock production in the woodlands.

Certainly there is much scope for intensification of animal production on already cleared or naturally 'open' areas. However this often requires use of exotic pastures or marginal cropping. Neither alternative is generally practical in the semi-arid woodlands or where fertility or slope problems mitigate against their use. Furthermore conservationists are becoming increasingly strident in opposing the use of productive exotic pasture species such as Leucaena and buffel grass on grazing land.

Thinning of remnant woodlands is currently under discussion by the Ministerial Advisory Committee for Vegetation Management. DPI has carried out the only detailed study comparing clearing strategies for Queensland's eucalypt woodlands. This trial, which ran from 1987 – 2001, clearly showed that it was uneconomic to thin eucalypts to 20% retention as scattered trees, whereas retaining the same tree population in intact blocks along side fully cleared areas, was quite beneficial to production (Burrows 2001, 2002).

There have been many reasons advanced for the ingress or increasing cover of woody plants in our remnant woodlands and grazing lands. Most rangeland ecologists agree

that it is changed fire regimes, associated with the introduction of domestic livestock into areas previously managed by hunter-gather aborigines for the previous 45,000 years, that has been the main catalyst for change. Other suggestions, are that rising atmospheric carbon dioxide levels and favourable climatic conditions could assist woody plant expansion. But the dominance of the grazing – fire management effect is evidenced by innumerable fence line contrasts in which woody communities and grassland areas are juxtaposed on either side of paddock fences and property boundaries. Consequently it has been suggested that fire could be used to maintain productivity of the woodlands. However fire has minimal impact on the growth (and competitiveness) of standing eucalypts, although it is possible that some *Acacia* spp. and Cypress pine stands could have their stand densities reduced by fire. But generally the most effective use of fire as a management tool could be in limiting successful seedling establishment (see discussion by Burrows 2002).

5) Greenhouse implications

Burrows *et al.* (2002) documented a carbon sink in Queenslands grazed woodlands which, if accounted for, reduce Australia's published net greenhouse gas emissions by 25%[1]. Should a tree clearing ban be enforced the existence of this carbon sink could have an enormous impact on Queensland's and Australia's reported net emissions. The rules governing what may or may not be acceptable for in inclusion in national greenhouse gas inventories are presently being reviewed. A draft of these proposed IPCC Good Practice Guidelines includes "forest grazing" as a recognisable management activity affecting carbon stocks. This may well clear the way for woody plant 'thickening' to be accepted as an identifiable management outcome, which should be accounted for in national inventories. If this situation eventuates it opens the way for incentive payments ("carbon offsets") to be traded by landholders with thickening woodlands. However there are also many problems to be overcome before any such hypothetical scheme could be implemented.

Conclusion

Queensland's grazed woodlands are a huge and important economic resource. Failure to manage them sustainably will not only impact on the woodlands themselves but also affect associated pastures on grazing holdings. There is no credible argument that woody plants are not proliferating in wooded grazing land not subjected to land clearing. There is also little doubt that this is reducing livestock carrying capacities. In the absence of such argument any debate over the ultimate cause of thickening is irrelevant to the landholder and his/her goal to maintain a sustainable, profitable enterprise. Given the size of the resource (55-60 M ha) it is inevitable that any tree clearing bans could have significant on-site and off-site impacts. This already applies to controls implemented under the Lands Act (1994) and Vegetation Management Act (1999), but would be considerably larger under a total tree clearing ban. Importantly, while there would be immediate effects from the latter (e.g. grazing land values), it is

[1] This C sink is equivalent to that in 30 M t of Qld export coal (85% C). Average coal train pulling 3000 t coal is 1.5km long. Therefore the C fixed in the woodlands each year approximates that in 10,000 coal trains (or 15,000 km of coal train - this length of train is 3.5 times that of the train line from Sydney-Perth with the wagons juxtaposed head to tail across the entire length!!). -- Or equivalent to the C in a coal train 1.2 times the diameter of the earth (12742 km)!!

the long term gradual decline in carrying capacity which would be of most concern to the future of the State's grazing industries.

References

Asner, G.P., Archer, S., Hughes, R.F., Ansley, R.J. and Wessman, C.A. (2003). Net changes in regional woody vegetation cover and carbon storage in Texas Drylands, 1937-1999. *Global Change Biology* **9**: 316-335.

Bartolomew, B. and Wilson, T. (1995). *New timber clearing guidelines: the likely affect on farm profitability in two clearing zones.* (Economic Analysis Section, DPI: Brisbane).

Bray, S.G., Burrows, W.H., Tait, L.J., Back, P.V., Hoffmann, M.B. and Anderson, E.R. (2002) Monitoring Queensland's grazed woodlands – implications for greenhouse and pastoral industries. *Proceedings of the 12th Biennial Conference, Australian Rangeland Society*, Kalgoorlie, W.A. pp.105-110.

Burrows, W.H. (2001). Deforestation for pasture development - has it been worth it? *Proc. XIXth International Grassland Congr.*, Brazil. pp. 913-918.

Burrows, W.H., Henry, B. K., Back, P.V., Hoffmann, M.B., Tait, L.J., Anderson, Menke, N., Danaher, T., Carter, J.O. and McKeon, G.M. (2002) Growth and carbon stock change in eucalypt woodlands in northeast Australia: ecological and greenhouse sink implications. *Global Change Biology* .**8**: 769-784.

Burrows, W.H. (2002). Seeing the wood(land) for the trees – An individual perspective of Queensland woodland studies (1965-2005). *Trop. Grassld*s **37**: 202-217.

Henry, B.K., Danaher, T., McKeon, G.M. and Burrows, W.H. (2002). A review of the potential role of greenhouse gas abatement in native vegetation management in Queensland's rangelands. *Rangeland Journal* **24**: 112-132.

Noble,I. (1997). *The Contribution of "Vegetation Thickening" to Australia's Greenhouse Gas Inventor.* Report of a Workshop (Prof. Ian Noble, Convenor). (Department of Environment , Sport and Territories: Canberra). 14pp.

Royal Commission (1901) *Royal Commission to Inquire into the Condition of Crown Tenants – Western division of New South Wales.* (Government Printer: Sydney).

Scholes, R.J and Archer, S.R. (1997). Tree-grass interactions in savannas. *Annual Review of Ecology and Systematics* **28**: 517-544.

Stafford Smith, M., McKeon, G., Buxton, R. and Breen, J. (1999). The integrated impacts of price, policy and productivity changes on land use in northern Australia. *Proceedings VIth International Rangeland Congress* **2**: 864-866.

10 March 2003