Submission to the Productivity Commision - "Industries in the GBR Catchment and Measures to Address Declining Water Quality."

Effect of Tree Clearing in the GBR Catchment on Runoff & Soil Loss

There has been great debate over the last ten years (at least) about the effect of tree clearing in the GBR catchment on runoff and soil erosion. Without fail, the green veiw is that tree clearing increases runoff and accelerates soil erosion. The veiws of the primary producers in the grazing industries (primarily beef) are that tree clearing followed by good grazing management practices will reduce runoff and soil erosion.

The attached extract is from:- "Scanlan JC & Turner EJ (Eds) 1995. The Production, Economic and Environmental Impacts of Tree Clearing in Queensland.- A Report to the Working Group of the Ministerial Consultative Committee on Tree Clearing 9 October 1995." I was one of the authors of this publication and wrote the majority of the sections on runoff and soil movement. The published data shows that the tree clearing/soil erosion/runoff story is not consistent across Qld's extensive grazing lands. It varies depending on landform, soil type, vegetation community and grazing management practices.

This original 1995 publication has been rewriten and published as:- "Native Vegetation Management in Queensland - Background, Science and Values" Edited by SL Boulter,. BA Wilson, J Westrup, ER Anderson, EJ Turner, and JC Scanlan. (QEPA, QDNR&M, QDPI) 2000. Copies are available from QDNR&M Indooroopilly phone 07 38969515. This publication provides more detail than the original; however I am not aware of it being available in digital form.

One of the measures that the Productivity Commission may consider for improving GBR water quality, is that of tree retention/ tree clearing.This extract is submitted in the hope that science can be used as the basis for recommending measures with respect to tree management to address declining water quality on the GBR. The environmental movement will be pushing hard for a ban on tree clearing. From my knowledge of the grazing industry, they are after access to regulated tree clearing under a permiting system.

A ban on tree clearing will curtail options for increased levels of beef production in the 2010 and 2020 scenarios, and produce doubtfull/unclear outcomes for water quality in the GRB lagoon.

I would be pleased to discuss this submission in more detail with members of the Productivity Commission. I will post a signed copy of the submission to the Commission on the 26th August 2002.

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(Extract from:- Scanlan JC & Turner EJ (Eds) 1995 "The Production, Economic and Environmental Impacts of Tree Clearing in Queensland" A Report to the Working Group of the Ministerial Consultative Committee on Tree Clearing. 9 October 1995)

Runoff

The most important factor controlling runoff is the level of surface cover. The effect of trees on soils and pasture, produce contrasting effects on runoff and erosion in woodland situations. The reduced pasture production observed in *Eucalyptus* woodlands of northern (Gardener *et al*. 1990), central (Scanlan and Burrows 1990) and southern Queensland (Walker *et al*. 1972) would suggest that runoff and erosion may be higher in grazed woodlands than in cleared areas due to the lower pasture cover in the former areas. However, the presence of tree leaf litter can complicate this as there tends to be some buffering of the system – more trees leads to less pasture but increased leaf litter (Burrows *et al*. 1990). The surface porosity and depth of the A horizon also tends to be higher under trees (Dowling *et al*. 1986), tending to increase the infiltration rates of the soils beneath trees (Johns 1981).

Runoff studies have been conducted in a number of locations in Queensland:

- In mulga lands, runoff under mulga leaf litter exceeded that from grassed areas by 2.8mm/year (Miles 1993).
- Measurements of small catchments in Gayndah in a silverleaf ironbark/black speargrass community on a granite duplex soil showed no significant differences in runoff following clearing (Prebble and Stirk 1988).
- In central Queensland, small catchment studies in a brigalow community on fertile clay soils showed that clearing a brigalow scrub and establishing buffel grass pasture increased runoff by 21mm/year. Using historic rainfall data in the PERFECT simulation model, (Littleboy *et al*. 1992) estimated that runoff doubles from 3% to 6% of the annual water balance (Lawrence *et al*. 1993).
- In the Upper Burdekin River Catchment, runoff was 50% to 70% lower under treatments that were cleared (with either native or sown pastures) compared with timbered areas (with E. *crebra, E. erythrophloia*); stocking rate had little effect on runoff (McIvor *et al*. 1995). Simulation studies by (Scanlan and McIvor 1993) indicated that runoff was reduced by between 37% to 60% when trees were cleared from native pastures (at the same stocking rate). Stocking rate has an effect on the level of the reduction through the direct effect on surface cover.
- (Pressland *et al*. 1991) showed the importance of cover in reducing both runoff and soil loss in grazed woodlands of north Queensland.
- A combination of neutron moisture meter studies and simulation modelling led (Williams *et al*. 1993) to predict that there would be an increase in runoff if trees were cleared on neutral red duplex and red earth soils in north Queensland. This is supported by (Dilshad and Jonauskas 1992) working on similar soils in Northern Territory. However, this is contrary to the data collected by (McIvor *et al*. 1995) and the simulations of (Scanlan and McIvor 1993).
- (Williams *et al*. 1993) suggest a significant salinity hazard may exist in north Queensland. Clearing of woodlands on a wide range of soils was associated with increases in deep drainage in an environment having significant salt stores. They concluded tree clearing should only proceed after the evaluation of salinity risk. Induced salinity may not become apparent for at least 15-20 years after clearing (Coventry and Williams 1991).
- (Wylie 1984) found a correlation between severe eucalypt dieback in southern Queensland and clearing rates in excess of 50%. Twenty-five percent of property owners reported salting of their water supplies in the same study.

Soil Movement

Clearing woody vegetation is often equated with increased levels of soil erosion in the long term. While this is certainly true where erosive rainfall is received when surface cover is low and where disturbance leads to the exposure of a dispersive B horizon in the soil, it is not a necessary

consequence. A similar level of sheet erosion can be expected in ungrazed woodlands and in cleared, ungrazed areas. Accelerated sheet and rill erosion in both treed and grassed environments result from poor grazing and fire management. Because grass productivity is generally greater in cleared compared with treed areas, the intensity of grazing (stocking rate) that will accelerate erosion in treed areas is likely to be less than for cleared areas.

Heavy grazing may cause sheet erosion irrespective of the presence of trees (Gardener *et al*. 1990) as soil erosion in pasture land is greatly influenced by the extent of surface cover of vegetation (Ciesiolka 1987, McIvor *et al*. 1995). Densely timbered areas may have either more or less total cover of understorey plants and tree leaf litter than a cleared site depending on the species involved . Trees compete directly with grass for water and nutrients and, in all but the monsoonal zones, this usually results in less herbaceous cover under trees than in cleared areas (Mott and Tothill 1984). Tree litter complicates this effect. In *Eucalyptus populnea* woodlands there is a decline in total ground biomass (tree leaf litter plus pasture) as tree density increases due to the overriding negative effect of increasing tree density on grass cover. In *Acacia harpophylla* communities however, the highest total ground biomass is at the highest tree densities due to the higher relative production of tree litter. Ground cover is further modified by the interaction of grazing pressure, tree cover, use of fire and rainfall amount, intensity and distribution and the interactions between these create a complex set of erosion responses. Therefore generalisations about tree cover and surface soil erosion are not possible. Experimental data comparing areas before and after clearing are scant in Queensland. Studies that examine the rate of soil movement in grazed woodland systems are reported below:

- Studies on small plots in semi-arid tropical savannas of north Queensland showed that soil loss from areas with native pastures under trees was higher than for other pasture systems (cleared areas, with or without sown pasture). The soil loss from these pasture systems were from 13% to 56% of that measured from native pastures with live trees (McIvor *et al*. 1995).
- Simulation studies in the same area as above, showed a reduction in soil loss of between 53% and 85% when trees were removed from native pastures, with the actual figure being dependent on stocking rate (Scanlan and McIvor 1993).
- In mulga lands, cover levels above 34% reduced wind erosion losses to 0.2mm of soil per year compared with bare trampled ground which suffered from wind erosion losses exceeding 6mm per year. The extent of wind erosion is closely related to residual grass cover levels (Miles 1993).
- In soft mulga, average soil loss due to water erosion was 4.16 t/ha/year with 20% cover, compared with 1.1 t/ha/year when cover was 40%. Comparable figures for hard mulga were 6.57 t/ha/year and 0.65 t/ha/year (Miles 1993).

Clearing initially exposes the soil surface to higher surface temperatures which break down organic matter and reduce aggregate stability. Any associated mismanagement (such as overgrazing) combined with raindrop impact may lead to high surface strength of soils (Arndt 1965, Bridge *et al*. 1983), impeding seedling establishment. Any management practice that reduces soil cover is therefore detrimental.

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