Balancing Tree & Grass (Pasture) Cover in Grazed Woodlands

Bill Burrows – September 2020

A sensible compromise between competing conservation and livestock production objectives in grazed, thickening woodlands is possible - if common sense and goodwill are exercised by the competing proponents. Such a workable outcome is achievable because of the negative exponential relationships between potential pasture production and woody plant basal area* – that are observed in most grazed woodland communities in northern Australia (See Burrows 2002[1]; Scanlan & Burrows 1990[2]). [Note: exceptions to the following might apply, if the woodland has an unusually high ratio of useful fodder trees and/or saw logs present].

$f(x) = 629 + 1310 * e^{(-0.2706*x)}$
$g(x) = -52.3*x + 1939$

20% of initial tree basal area (b.a.) retained in 'intact' tree strips – remaining tree b.a. (80%) fully cleared for pasture

20% of initial tree basal area retained as 'evenly' scattered trees, after thinning out the remainder over the entire paddock

Potential Pasture Production (y – kg/ha/year)
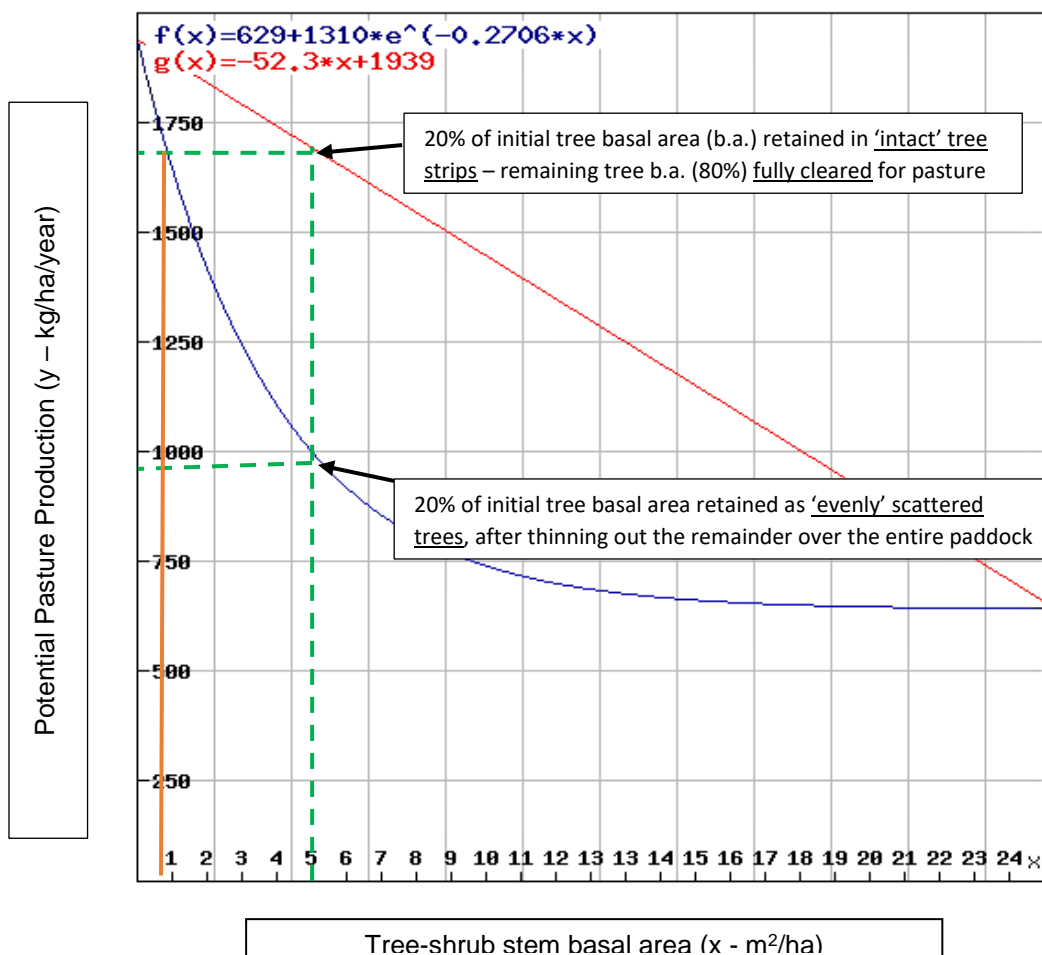
Tree-shrub stem basal area (x - m²/ha)

Figure 1 - Effect of retaining the same basal area*(= total trunk area that covers the soil) in intact strips or clumps (straight upper red line) OR as scattered stems (curved blue line), on associated potential pasture production in a poplar box woodland – Dingo, Central Queensland. Exponential relationship (curved line) is from Site E3 in Scanlan and Burrows (1990)[2]. [Also see Burrows 2019[3]]. Note: relative responses are seasonally dependent – with the impacts that increasing tree basal area has in depressing pasture yield, most obvious under drought conditions and on sites with infertile soils.

Substituting in Fig. 1 equations - for 20% basal area retained in intact strips of trees (5 m²/ha of, say, a 25 m²/ha maximum site basal area capacity), the potential pasture production in the above example is **1677 kg/ha/yr** (Fig. 1; y = f(x)). For the same tree basal area retained as evenly scattered trees (after thinning) the potential pasture production is only **967 kg/ha/yr** (Fig. 1; y = g(x) – read corresponding 'x' and 'y' values from green dashed lines). [To have a similar pasture production potential per ha compared with trees retained with **20%** of their stem basal area contained in 'intact' woodland strips (and **80%** fully cleared as inferred above), a scattered tree treatment would need to retain no more than 0.8 m²/ha –brown line - or just **3.3%** of the same initial tree basal area [25 m²/ha]. These tree-grass relationships suggest that leaving trees scattered over a paddock in thickening woodlands, assigned for beef production, is unlikely to pay in the longer term[1] – or much sooner if initial tree basal areas are already 'high'.

Therefore, in grazed woodland communities [pastoral holdings] in Northern Australia the preferred tree structure (distribution) that optimises livestock carrying capacity as well as habitat for arboreal fauna would retain trees in strips ('wildlife corridors') or clumps ('shade/shelter sites') - with the remaining paddock areas managed to limit tree competition with pasture. This vegetation structure is applicable whatever percentage of tree basal area is targeted for retention, and over any woodland landscape currently assigned as agricultural land and used to graze domestic livestock.
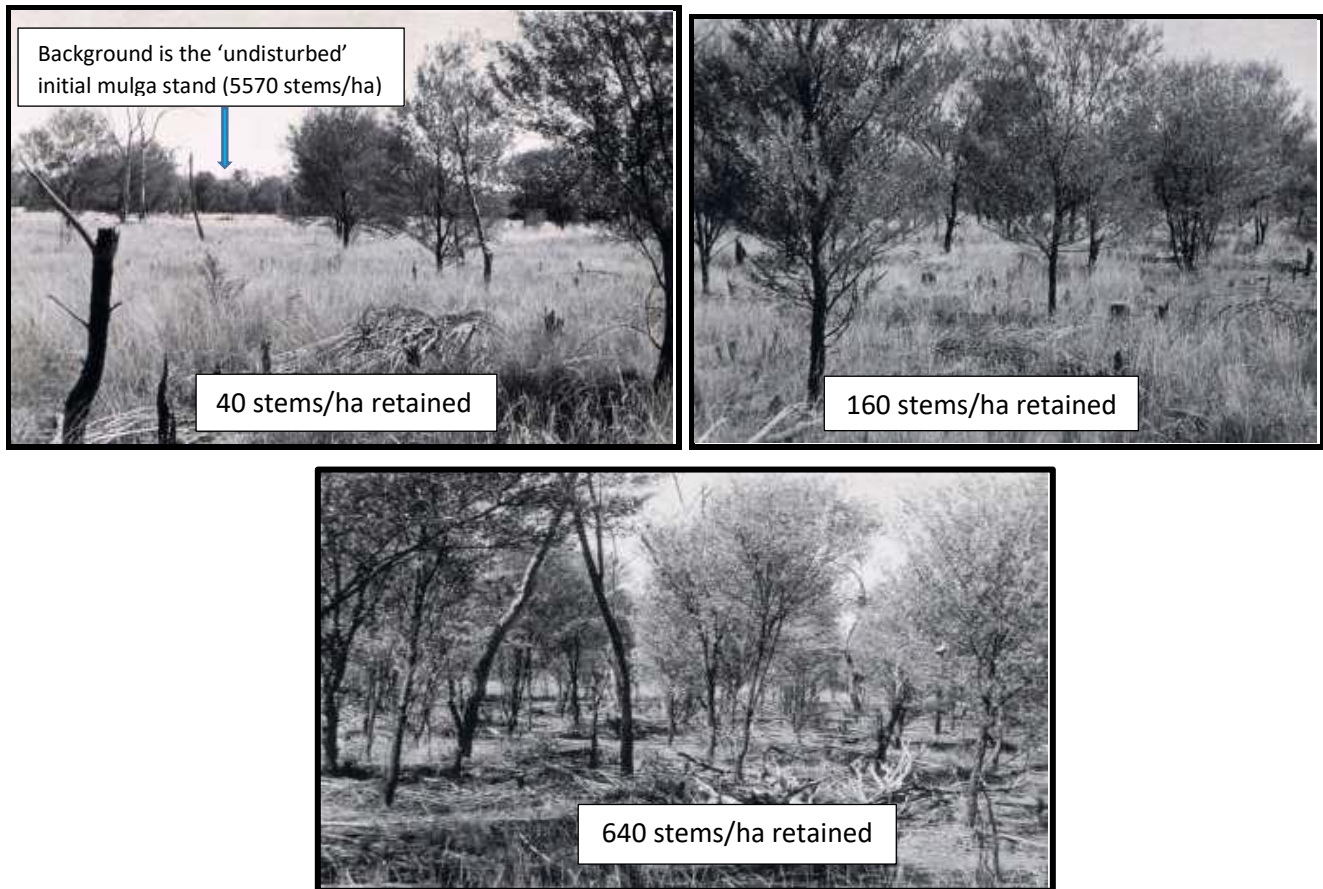
[1] *Tropical Grasslands* **37**: 202-217.   http://www.tropicalgrasslands.info/index.php/tgft/pages/view/tropicalGrasslands Find Burrows (2002) in Volume 37 p. 202 & click on the arrow for the full pdf

[2] *Australian Journal of Ecology* **15**:191-197.   https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1442-9993.1990.tb01527.x
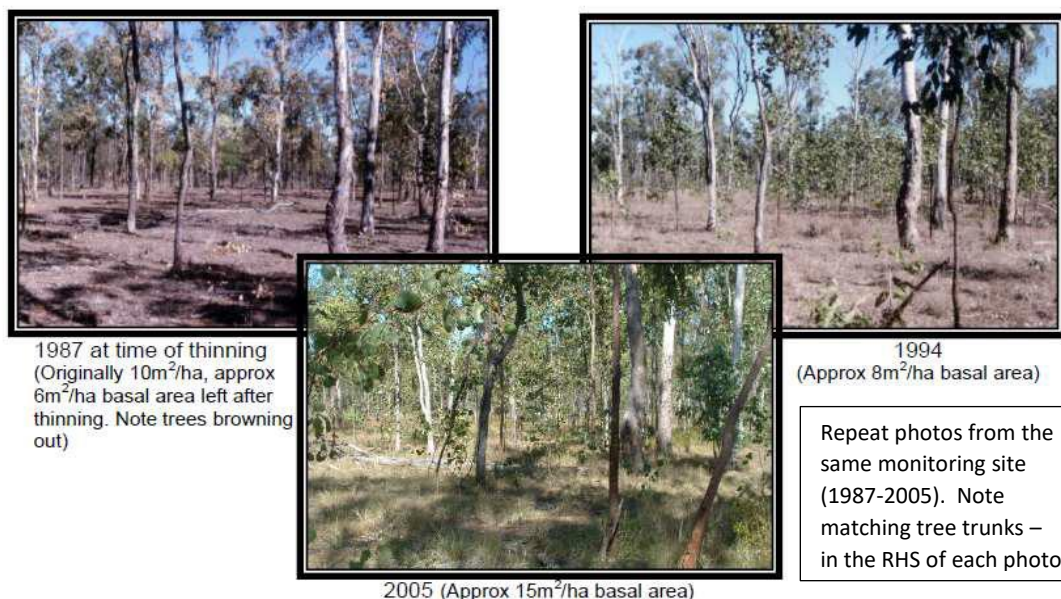
[3] https://www.aph.gov.au/Parliamentary_Business/Committees/House/Standing_Committee_on_Agriculture_and_Water_Resources/Landpolicyimpacts/Submissions See Link to Burrows Submission (#14) & click on its pdf for an overview of the tree-grass balance in grazed woodlands.

Pasture & tree responses to imposed thinning treatments

Pasture response to mulga thinning at Boatman Station. (SE of Charleville) - The pre-thinning (1964) stand density was <u>5570 stems per ha</u> (Beale 1973 *Tropical Grasslands* **7**: 135-142).

Background is the 'undisturbed' initial mulga stand (5570 stems/ha)

40 stems/ha retained

160 stems/ha retained

640 stems/ha retained

--------------------------------------   -------------------------------

Thinning eucalypts - Apart from the banning of broad-scale tree clearing, thinning intact grazed woodlands is severely constrained under current Queensland legislation. Leaving trees/shrubs scattered throughout a paddock also leads to rapid seedling regeneration or root suckering from woody plants that are retained. The example below is for a grazed poplar box woodland in Central Queensland: Note that 7 years after initial thinning there was significant recovery in tree basal area (a measure of tree competiveness with pasture) and 18 years after initial thinning was applied the thinned plot now had a tree basal area that was **50% greater** than that existing before the activity took place! (Back *et al.* 2009 *Tropical Grasslands* **43**: 37-52 & 188 – 190. <u>Link:</u> http://www.tropicalgrasslands.info/index.php/tgft/pages/view/tropicalGrasslands - Find 2009 Volume 43 p. 37 & click on the arrow for full pdf; likewise look for Volume 43 p. 188 & click on the arrow for full pdf of the companion Back *et al.* research note].

1987 at time of thinning (Originally 10m²/ha, approx 6m²/ha basal area left after thinning. Note trees browning out)

1994 (Approx 8m²/ha basal area)

Repeat photos from the same monitoring site (1987-2005). Note matching tree trunks – in the RHS of each photo

2005 (Approx 15m²/ha basal area)

======================   *[WHB – 17.9.2020]*