Summary

- *This submission focusses on the science and economics underpinning the management of grazed woodlands in N.E. Australia[1] - with emphases given to Queensland examples.*
- *For perspective, the area of woodlands grazed by domestic livestock alone in Queensland is well over 60 M ha[2]. [It is greater than the total area of all land dedicated to agricultural pursuits (cropping, horticulture, dairying, sheep & cattle grazing in NSW].*
- *Management of grazed woodlands is predicated by the fact that this land (leasehold/freehold) has been assigned by government for the prime purpose of grazing and agriculture.*
- *The tacit assumption behind >100 years of land allocation was that 'blocks' initially released or after subsequent resumption and sub-division would comprise a "living area".*
- *However the last report detailing Queensland's "living area standards" (Berndt et al. 1998)[3] concluded that c.50% of that State's rural land holdings did not meet the living area standards of that time. [Tellingly, this sobering fact led the Queensland government to no longer undertake such assessments!].*
- *Seasons and commodity prices etc. obviously influence such findings, but it would be surprising if results would differ greatly in 2019.*
- *For grazing holdings with woodland vegetation there are several major influences affecting the viability (profitability) of the enterprise contained therein. These include:*
    - *(i) The area of the land that is actually wooded*
    - *(ii) Whether the 'intact' (uncleared) or any regrowth areas are 'thickening' – increasing in woody plant basal area, canopy cover or plant density*
    - *(iii) The structure of the retained woodland vegetation*
- *Appendix 1 provides an overview of Queensland's grazed woodlands and the grazing capacity of selected Local Government Areas as a whole, as well as within the woodland component of the vegetation in each nominated Shire.*
- *Grazed woodland managers regularly observe that that the woody component of the vegetation is thickening up (see Appendix 2). Left unaddressed this severely impacts pasture production potential (and thus the livestock carrying capacity) of affected land (Appendix 3).*
- *The evidence for woodland thickening is very extensive and unequivocal. Importantly it is not simply a recent phenomenon, but is shown to be a consistent rising trend occurring in the vegetation over many years and encompassing alternate cycles of 'drought and flooding rains'.*
- *Four completely independent and rigorous methodologies are highlighted to illustrate this thickening process in the grazed woodlands of NE Australia (Appendix 2).*
- *There would have been no 'Carbon Farming Initiative' or 'Direct Action Plan' activities in the woodlands of NW NSW and SW Qld if past and present Australian governments had not in effect acknowledged with these programs that our grazed woodlands are thickening up.*

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[1] The author is a former Senior Principal Scientist (Woodland Management) in the Queensland Department of Agriculture & Fisheries. He is now retired after an active career spanning 40+ years researching this topic. He still maintains a keen interest in grazed woodland management and has made numerous submissions to recent related inquiries, at both State and Federal government level.

[2] See Appendix 1.

[3] Berndt, R., Lack, B and Caltabiano, T. (1998) Living Area Standards (Handbook of Land Planning Guidelines, Part G – Chap G103: DNR: Brisbane).

- *Many additional photographic pairs and sequences, as well as anecdotal records and scientific reports are included in Appendix 2. These all strongly support the quantitative evidence of woody vegetation thickening.*
- *The consequences of on-going tree/shrub thickening in our woodlands grazed by domestic livestock (especially in NE Australia) are clearly illustrated by tree – pasture relationship curves (Appendix 3).*
- *These curves take the form of a negative exponential function. In other words there is a steep decline in potential pasture yields as tree/shrub retention and/or canopy cover or woody plant basal area steadily increase.*
- *Reduced pasture yield results in lower livestock carrying capacity and has a major impact on the financial viability of the grazing enterprise (Appendix 4). [There is an oft repeated truism spoken by range scientists – "the only sustainable agriculture is profitable agriculture"].*
- *Yet governments have in recent times ignored the fact that historically the allocation of rural land of all tenures has been for the prime purpose of grazing and agriculture.*
- *Queensland's Vegetation Management Act 1999 (as amended 2018) is a notable example. It imposes widespread bans and/or very strict regulations on the clearing of trees/shrubs and woody regrowth on rural holdings without acknowledging that in the absence of woodland management on-going thickening will further negatively impact the owner/lessee/manager's ability to maintain the viability of their rural enterprise.*
- *In effect the Government has re-prioritised land use in grazed woodlands from a prime focus on agricultural production to one where conservation objectives supplant the former long endorsed main purpose. No compensation has been offered for damage to property values and future loss of production since the 2018 amendments to the VMA 1999 were passed.*
- *Losses in property values as a result of this Government legislation are easily verified by visiting the office of any rural property agent. They will quickly advise on the disparity of grazing land values per ha between cleared, partially cleared and fully wooded holdings in the same district and bounded by similar land systems*
- *By its legislative actions government is seeking to obtain questionable (in many cases) conservation objectives 'on the cheap'. It attacks the livelihoods of rural producers with woodland holdings in a retrospective and unconscionable manner (relative to the past 100+ years of land allocation). Government can of course resume land for alternative purposes but it is a reasonable community expectation that appropriate compensation will be paid for improvements in the value of the land, resulting from the owner/lessee's inputs that made it fit for purpose in the first place.*
- *To the extent that no compensation has been offered to landholders deleteriously and financially affected by Qld's VMA 1999 (as amended 2018) suggests that the real cost of just compensation for damage caused by that Bill to rural enterprises in the grazed woodlands, must be huge.*
- *Yet research has shown that a practical approach to restructuring our grazed woodlands, based on detailed field trials, can lead to a tree-grass (pasture) balance and structure that will deliver on both production and conservation objectives (See Appendix 5).*
- *The fact that agenda driven politicians, green bureaucrats and conservation zealots completely ignore such studies is telling. Their actions suggest that they have no real understanding or interest in the continued well-being and livelihood of rural landholders in the grazed woodlands. It is surely time for a rethink!*

Appendix 1

Queensland's Grazed Woodlands

The basis of the analysis of Queensland's grazed woodlands and their potential thickening impacts (see Appendix 2) was to partition the State into units arranged on Shire boundaries (as existed in 2003). Data were obtained[4] for each local government area in Queensland. This area was constrained by identifying those Shires most affected by woodland thickening from a grazing perspective. Many Shires in south-east Queensland were deemed to be largely urbanized or cleared and some areas of western Queensland are naturally open (e.g. most Mitchell grasslands) and were regarded as not affected by tree thickening. However, even in the excluded Shires, the proliferation of native trees may be locally significant e.g. gidgee (*Acacia cambagei*) ingress into Mitchell grasslands in the Longreach district.

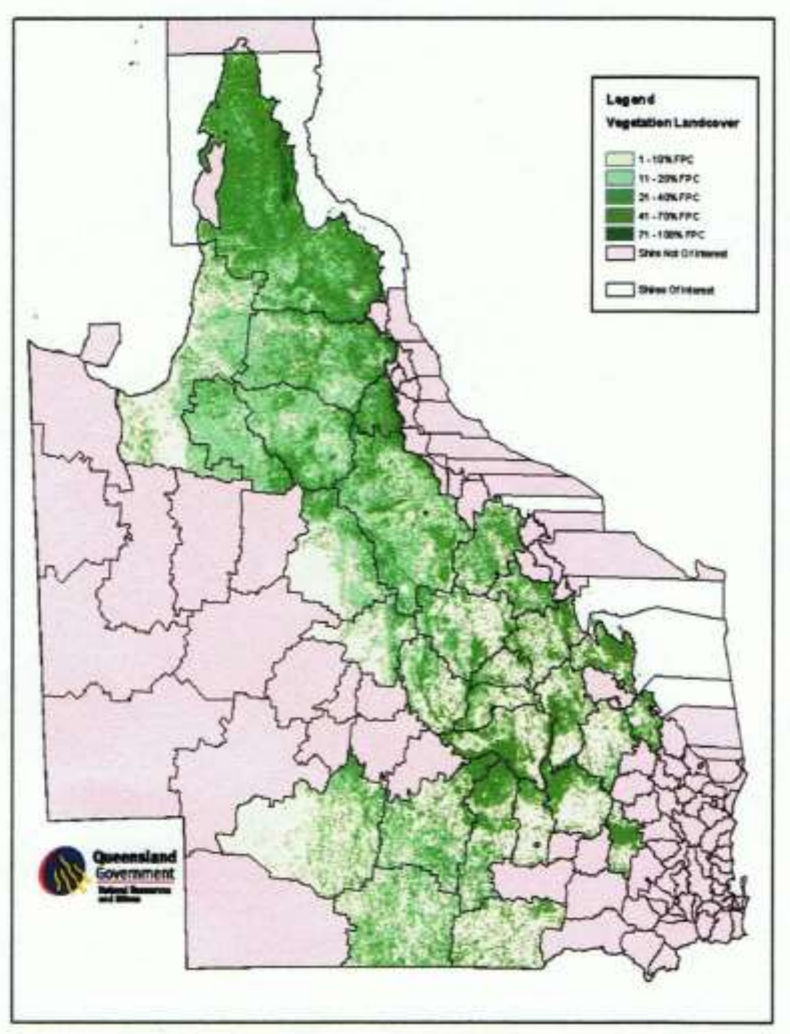

Figure 1. Shires, as defined by 2003 boundaries, where tree/shrub thickening could have an impact on future livestock carrying capacity if/when/after clearing control bans are imposed on selected areas – whether at the paddock, property or district scale. See text for exemptions.

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[4] NR&M (2003)

The area of wooded vegetation cover in each Shire was calculated from the percentage identified as wooded in 1999[5]. The total area wooded in the selected Shires was calculated to be 68.3 m ha (Table 1). A conservative approach to determining the area subjected to thickening was adopted by allowing for the exclusions identified above. For the purpose of this analysis, 50 m ha was chosen as the **minimum** area of grazed 'intact' woodland that is affected by tree/shrub thickening in Queensland's grazing lands. [This minimum would still apply in 2019].

Table 1: Selected Shires, their areas and the calculated areas wooded within each Shire[6]

Shire	Area (000ha)	Area Wooded 1999 ('000ha)
Aramac	2331	946
Balonne	3109	1039
Banana	1572	466
Bauhinia	2360	1213
Belyando	3020	1488
Booringa	2776	1674
Bowen	2959	2041
Broadsound	4240	2100
Bungil	1332	431
Calliope	1906	1106
Carpentaria	6420	3294
Chinchilla	869	476
Cook	18330	17349
Croydon	2948	2703
Dalrymple	6812	5739
Duaringa	1771	867
Emerald	1040	487
Etheridge	3921	3381
Flinders	4139	2094
Herberton	969	925
Jericho	2183	1191
Livingstone	4697	2994
Mareeba	5345	4607
Murweh	4069	2428
Nebo	1001	633
Paroo	4766	2984
Peak Downs	811	350
Quilpie	6753	2452
Taroom	1860	843
Total	**85979**	**68303**

[5] NR&M (2003) – the total grazed wooded area would not have changed very much today (2019), given the clearing restrictions variously put in place after the passing of the VMA (1999), along with its numerous iterations

[6] Calculated using data from NR&M (2003) - National Parks and reserves are excluded.

Table 2: The number of Beef Equivalents running in wooded areas in Shires affected by woodland thickening (based on 2003 data).

Shire	Beef Equivalents in the Shire	Number of Beef Equivalents in Shire Woodlands
Aramac	71599	22400
Balonne	153455	30776
Banana	371476	45759
Bauhinia	365507	95241
Belyando	299058	83674
Booringa	146757	63346
Bowen	282798	168817
Broadsound	211559	52147
Bungil	194189	31228
Calliope	72034	29444
Carpentaria	289744	75321
Chinchilla	64712	24386
Cook	74814	70435
Croydon	52830	48046
Dalyrmple	544961	396656
Duaringa	03539	84220
Emerald	157985	48316
Etheridge	193044	155765
Flinders	247206	62902
Herberton	7664	6701
Jericho	245989	100146
Livingstone	147503	69015
Mareeba	104725	84432
Murweh	167273	71143
Nebo	160898	74316
Paroo	62323	32868
Peak Downs	90244	30371
Quilpie	86570	23841
Taroom	220016	47657
Total	**5390472**	**2129369**

Appendix 2

Tree-shrub thickening on grazing land

It is rarely acknowledged that huge areas of grazed 'intact' (uncleared) woodlands and regrowth are thickening up (especially in Northern Australia) and have been since the arrival of domestic livestock (see following references). This thickening trend (an increase in woody plant basal area, canopy cover or plant density) is inarguable and long term in nature. It transcends both El Niño and La Niña years (or alternate episodes of "drought and flooding rains").

Two references listed below are especially germane. Liu *et al.* (2015) found that the woodlands of NE Australia increased aboveground biomass by c.1200 kg/ha/yr over a 20 year monitoring period (1993-2012). This result was obtained from passive microwave observations with calibrated sensors based on a range of satellite based platforms. It is net of any concurrent losses in biomass due to tree clearing, woody plant deaths and fires occurring during the monitoring period. The result is in close agreement with detailed ground based measurements (c. 1060 kg/ha/yr increase in above ground biomass) over the same general area and for analogous and overlapping timeframes (Burrows *et al.* 2002).

[These observations lead to fascinating conclusions. The measurements overlaid a time of peak clearing activity in Queensland. This is because the observations were made during the period leading up to and following the introduction of that State's widely telegraphed Vegetation Management Act (1999). If we assume that the <u>average</u> area cleared was 400,000 ha/yr (very generous to the upside) and total standing biomass stocks averaged 80 t/ha (Table 2, Burrows *et al.* 2002) then one could hypothesize that biomass loss due to clearing totalled c. 32 Mt/yr. In contrast there are a very conservative 60 M ha of grazed woodlands still standing in Queensland (Table 1, Appendix 1) with mean above ground biomass increment-based on the above two studies - of c. 1.1 t/ha/yr. So for the State's <u>grazed woodland</u> vegetation average above ground growth increment, *in toto,* is c.66 Mt/yr. Or if we were to base estimates on 20 year trends twice as much biomass was gained as a result of woodland thickening in Queensland as was lost during similar time frames, which included peak periods of woodland clearing!].

References and related sources

{<u>*Illustrations that are inserted in the bibliography below usually pertain to the source referenced 'above them' - immediately preceding the figure or table*</u>}.

[<u>Note:</u> These citations are not a literature review but a quick snapshot of some papers and data that should lead to a wider perception of woodland thickening in Northern Australia - and elsewhere. (Note the 4 overlapping study site maps (**I – IV highlighting) -** depicting completely different & independent monitoring techniques covering similar grazed woodland areas [Also note red arrows indicating sampled areas]. Yet these contrasting methodologies all detect very similar long term population trends!). Readers may wish to follow this subject up by perusing the literature that is additionally cited in the enclosed sources].

Back, P.V., Anderson, E.R., Burrows, W.H. and Playford, C. (2009a) Woody plant responses to various clearing strategies imposed on a poplar box (*Eucalyptus* *populnea*) community at Dingo in central Queensland. *Tropical Grasslands* **43**: 37-52.

Back, P.V., Anderson, E.R., Burrows, W.H. and Playford, C. (2009b) Research note: Poplar box (*Eucalyptus populnea*) growth rates in thinned and intact woodlands in central Queensland. *Tropical Grasslands* **43**: 188-190.

Back, P.V., Burrows, W.H. and Hoffmann, M.B. (1999) TRAPS: a method for monitoring the dynamics of trees and shrubs in rangelands. *Proc.VIth Int Rangeland Congr.* **2**: 742-744.

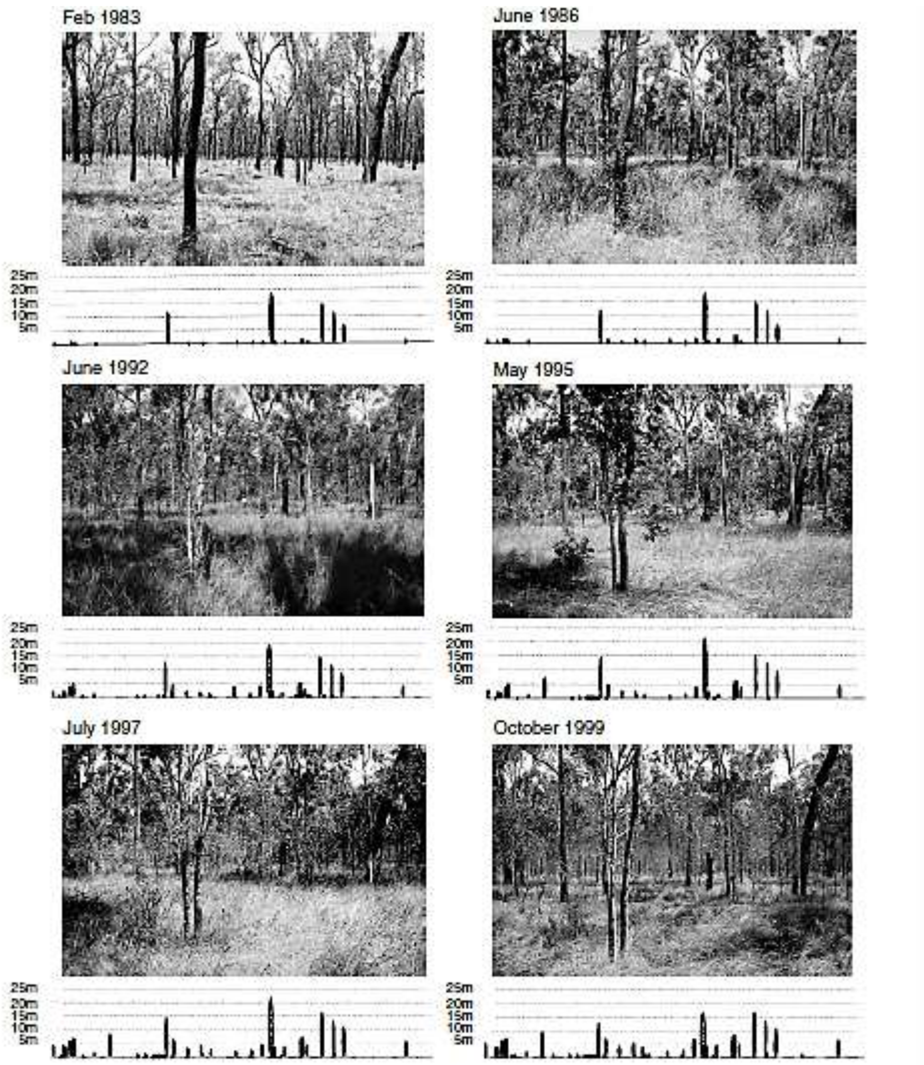


Figure 2. Photographic record of changes in a narrow leaf ironbark (*Eucalyptus crebra*) transect in central Queensland. TRAPS-generated graphic beneath each photo depicts the height and number of plants recorded within the particular permanently positioned transect band; reduced height in some trees from July 1997 to October 1999 resulted from a wind storm.

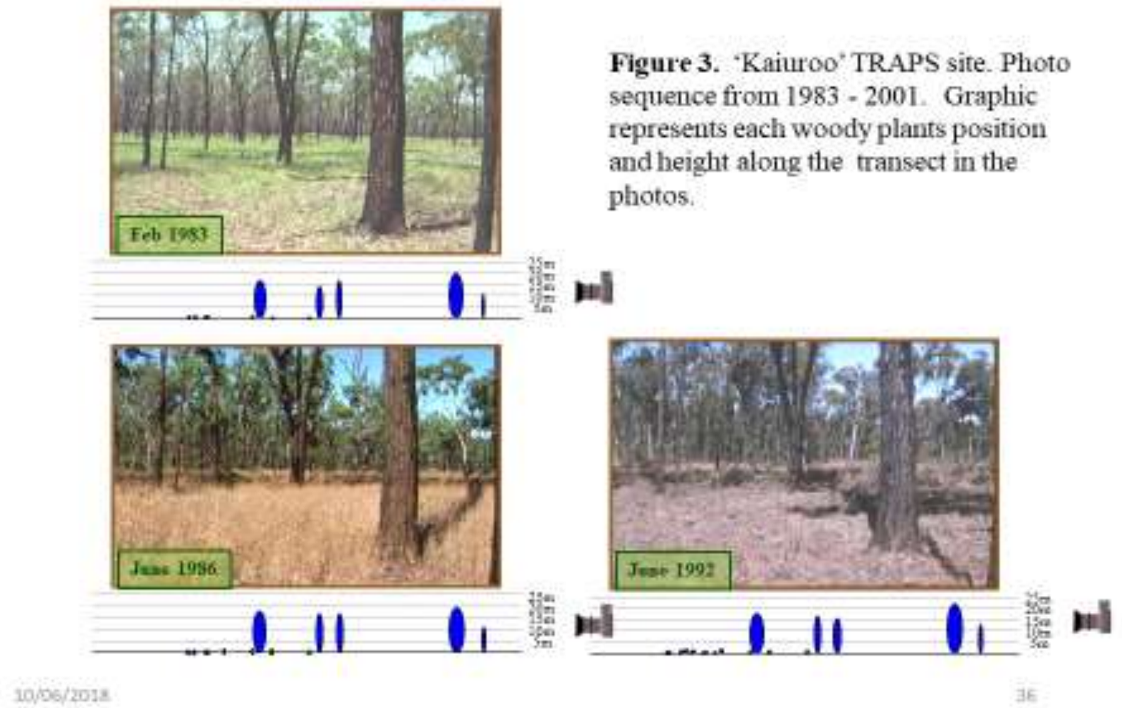


Figure 3. 'Kaiuroo' TRAPS site. Photo sequence from 1983 - 2001. Graphic represents each woody plants position and height along the transect in the photos.

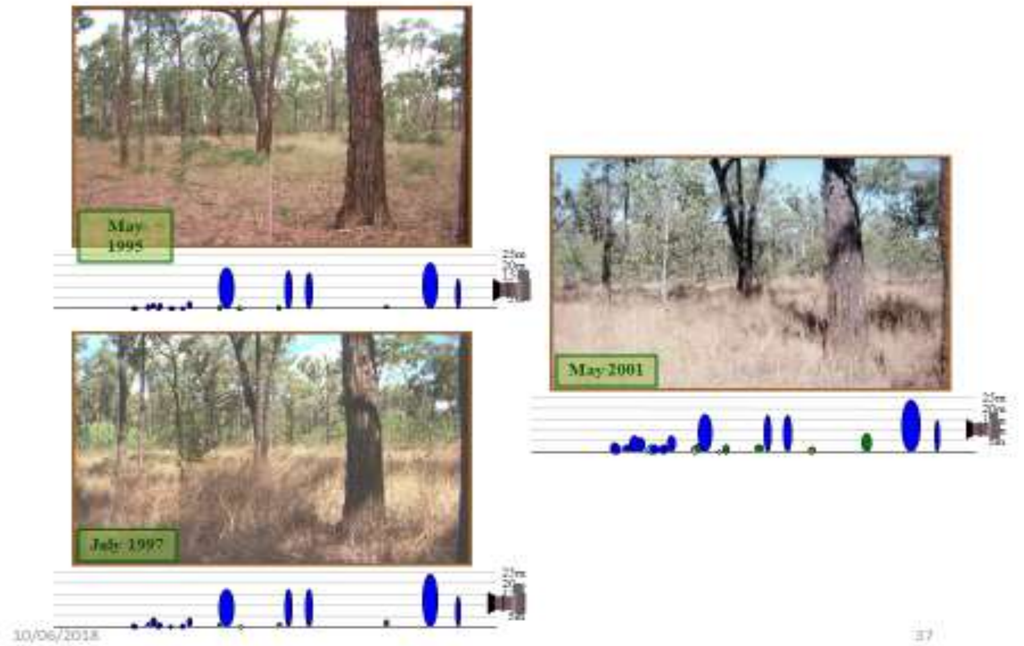
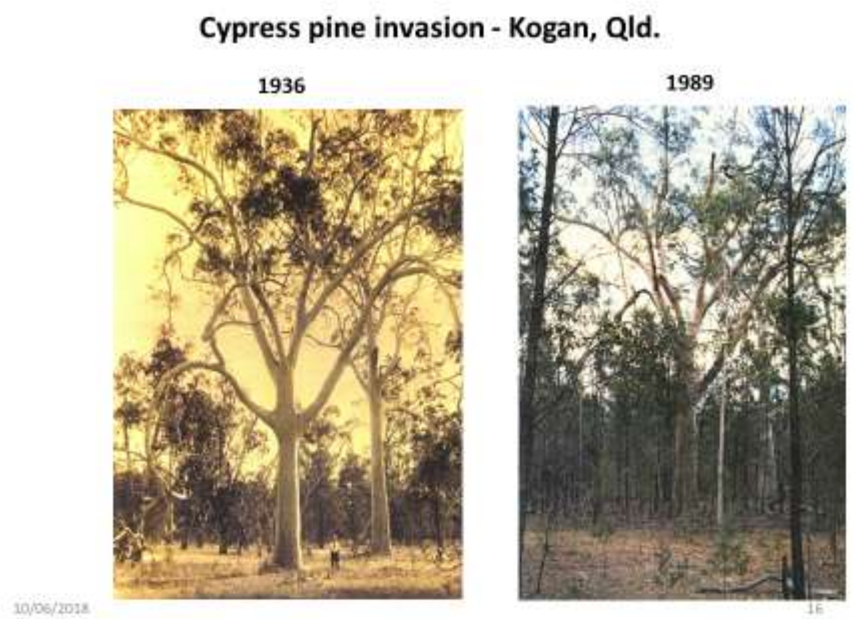


Figure 4 Another view of Kaiuroo iron bark thickening.

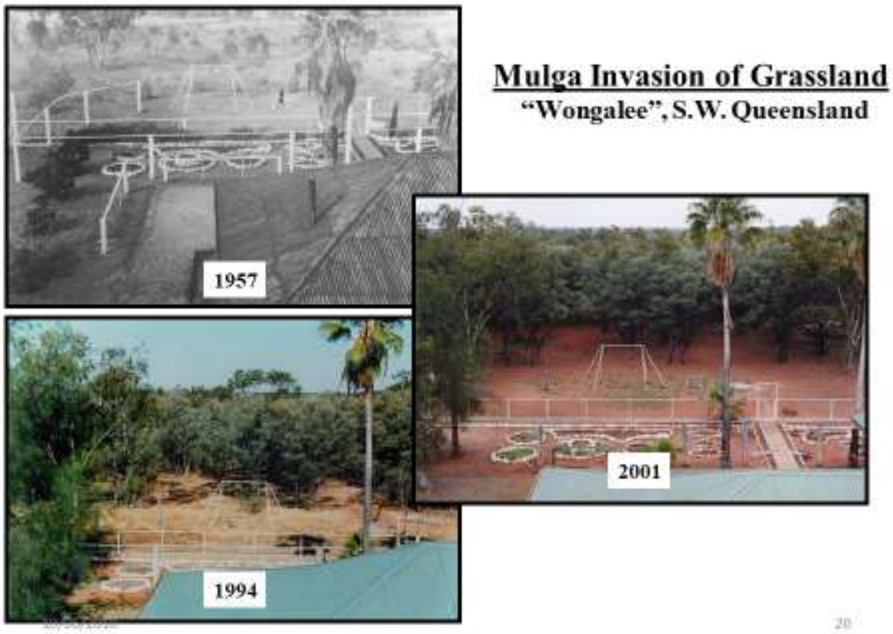
1982

2004

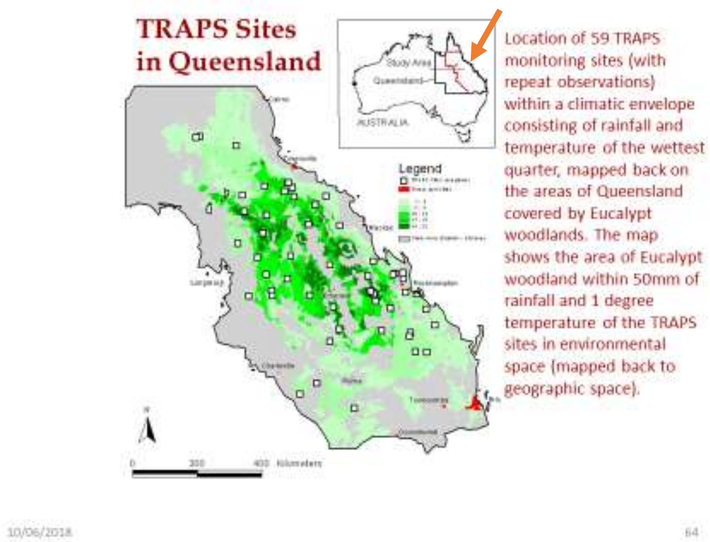
Binnington, K. (1997) *Australian Forest Profiles* 6. *White Cypress Pine.* (National forest Inventory, BRS: Canberra).



Burrows, W.H., Compton, J.F. and Hoffmann, M.B. (1998) Vegetation thickening and carbon sinks in the grazed woodlands of north-east Australia. *Proc. Aust. Forest Growers Conf, Lismore.* pp. 305-316.



Burrows, W.H. *et al.* (2002) Growth and carbon stock change in eucalypt woodlands in northeast Australia: ecological and greenhouse sink implications. *Global Change Biol.* **8**: 769-784.



I.

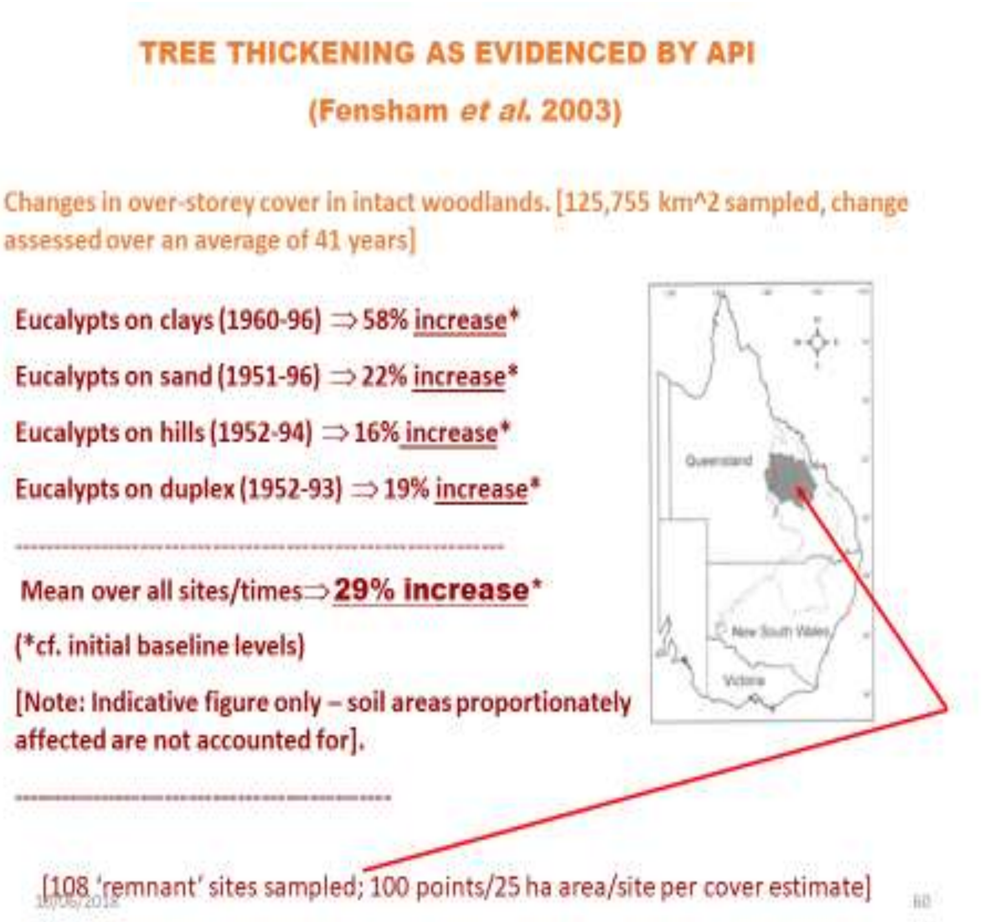
Crowley, G.M. and Garnett, S.T. (1998) Vegetation change in the grasslands and grassy woodlands of east-central Cape York Peninsula, Australia. *Pacific Conservation Bio.* **4**: 132-148.

Detmers, R.G. *et al.* (2015) Anomalous carbon uptake in Australia as seen by GOSAT. *Geophysical Res. Letters* **42**: 8177-8184.

Domin, K. (1911) Queensland's plant associations: some problems of Queensland's botanogeography. *Proc. Roy. Soc. of Qld* **23**:63-67.

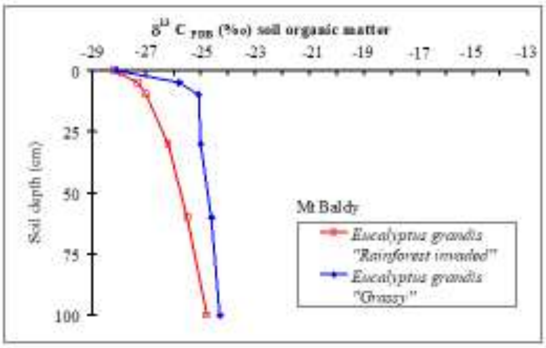
Fensham, R.J. (1996) The disappearing grassy balds of the Bunya Mountains, south-east Queensland. *Aust. J. Bot.* **44**: 132-148.

Fensham, R.J. *et al.* (2003) Modelling trends in woody vegetation structure in semi-arid Australia as determined from aerial photography. *J. Environ. Manage.* **68**: 421-436.



II.

Harrington, G.N. and Sanderson, K.D. (1994). Recent contraction of wet sclerophyll forest in the wet tropics of Queensland due to invasion by rainforest. *Pacific Conserv. Biol.* **1**: 319-327. [Note: <u>Also see Stanton (1992) citation in this listing below</u>].



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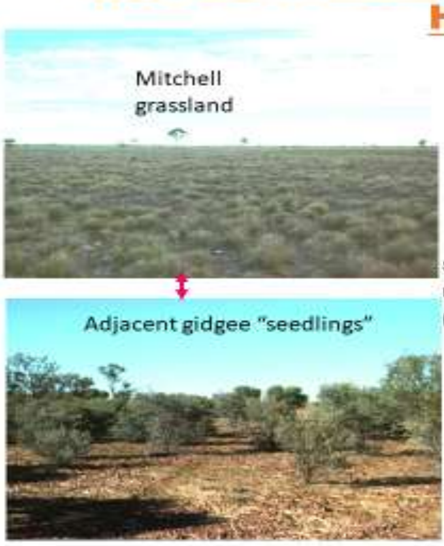
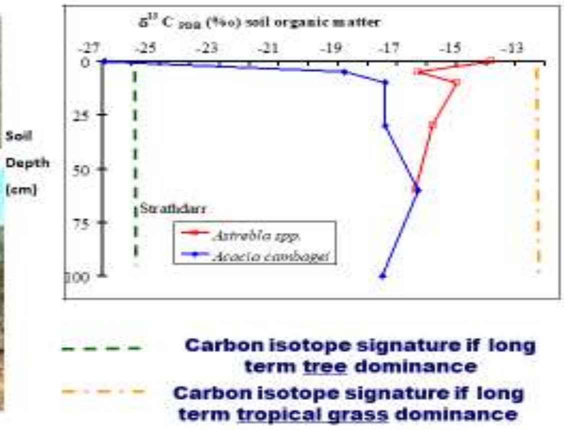
Krull, E.S. *et al.* (2005) Recent vegetation changes in central Queensland, Australia: evidence from $\delta^{13}C$ and ^{14}C analyses of soil organic matter. *Geoderma* **126**: 241-259.

INTERPRETING UNKNOWN VEGETATION HISTORY





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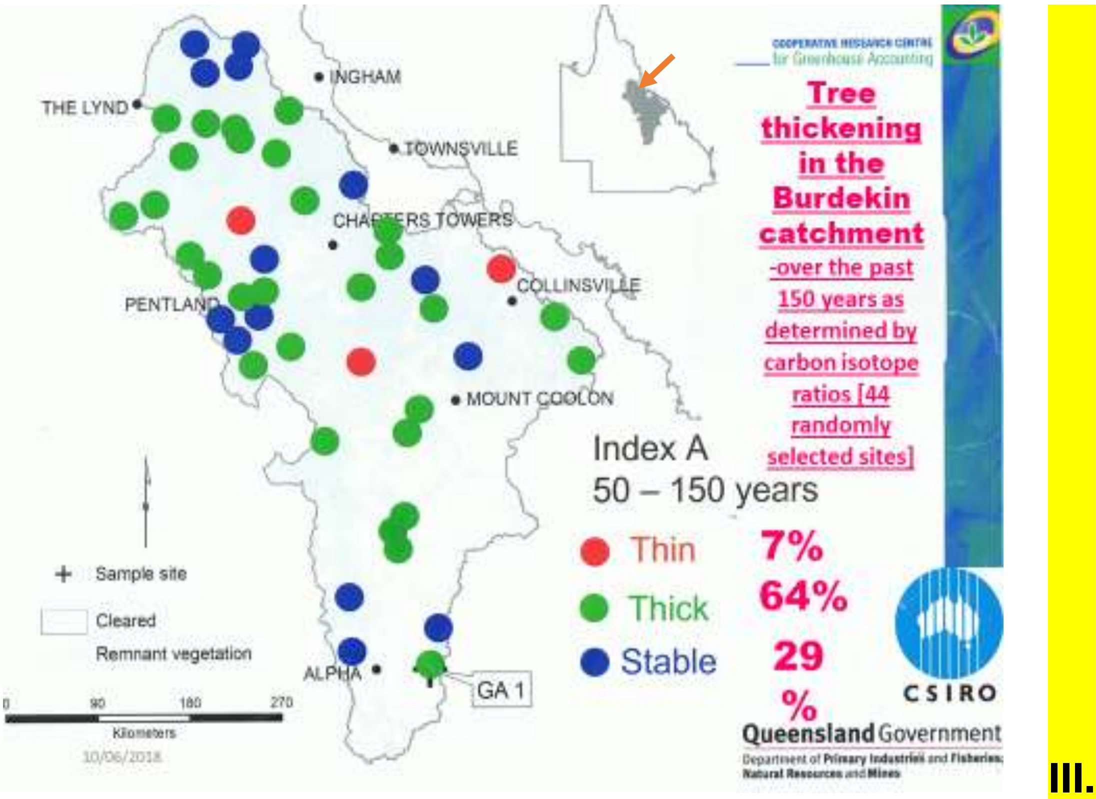
Krull, E.S. *et al.* (2007) Development of a stable isotope index to assess decadal-scale vegetation change and application to woodlands of the Burdekin Catchment, Australia. *Global Change Biol.* **13**: 1455-1468.



Liu, Y.Y. *et al.* (2015). Recent reversal in loss of global terrestrial biomass. *Nature Climate Change* **5**: 470-474. [Note red arrow depicting area sampled in NE Australia in Figure 5 below. Diagram beneath the world map shows a 20 year increasing trend in net above ground C/biomass content in this region of NE Australia].

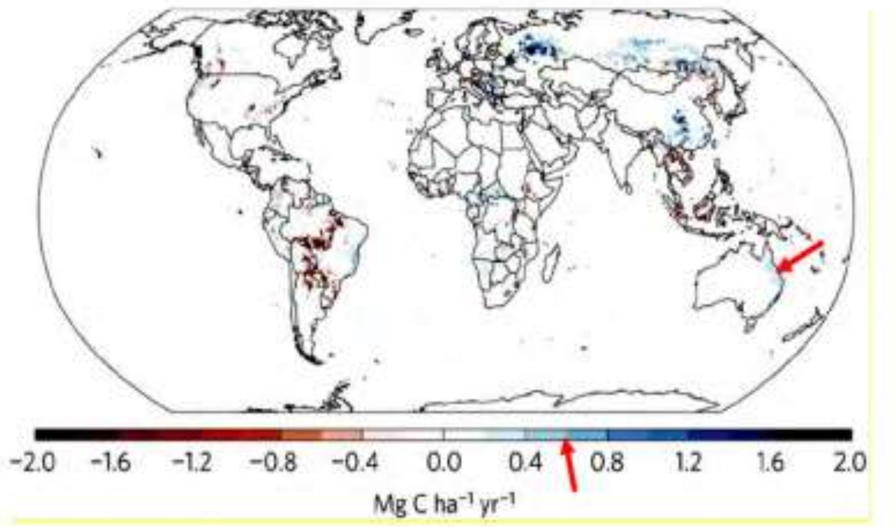
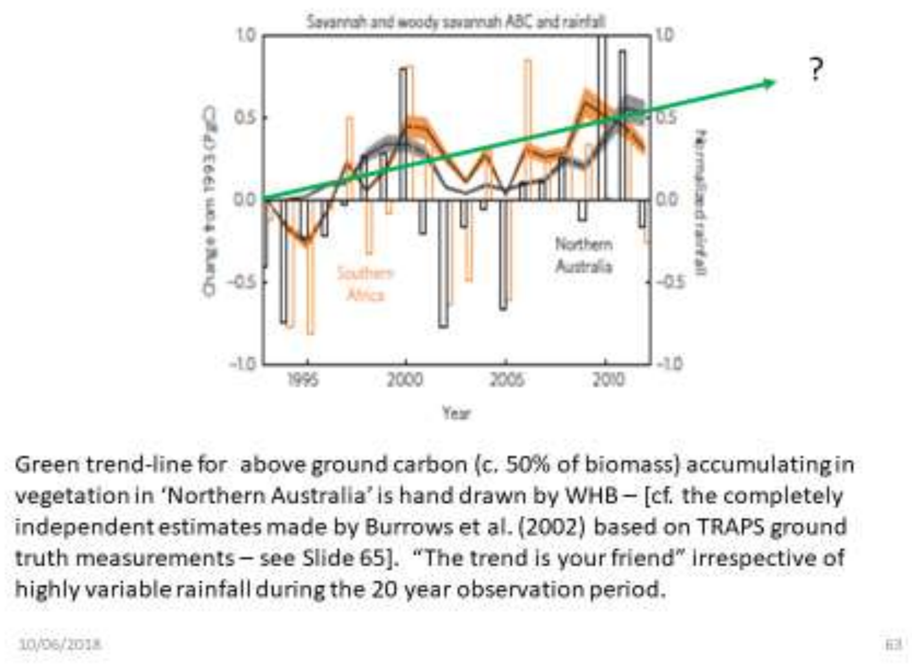


Figure 5. Aboveground biomass increments in NE Australian woodlands meaned over 20 years (including La Nina + El Nino periods) of rainfall variability. (Biomass≈50% Carbon).



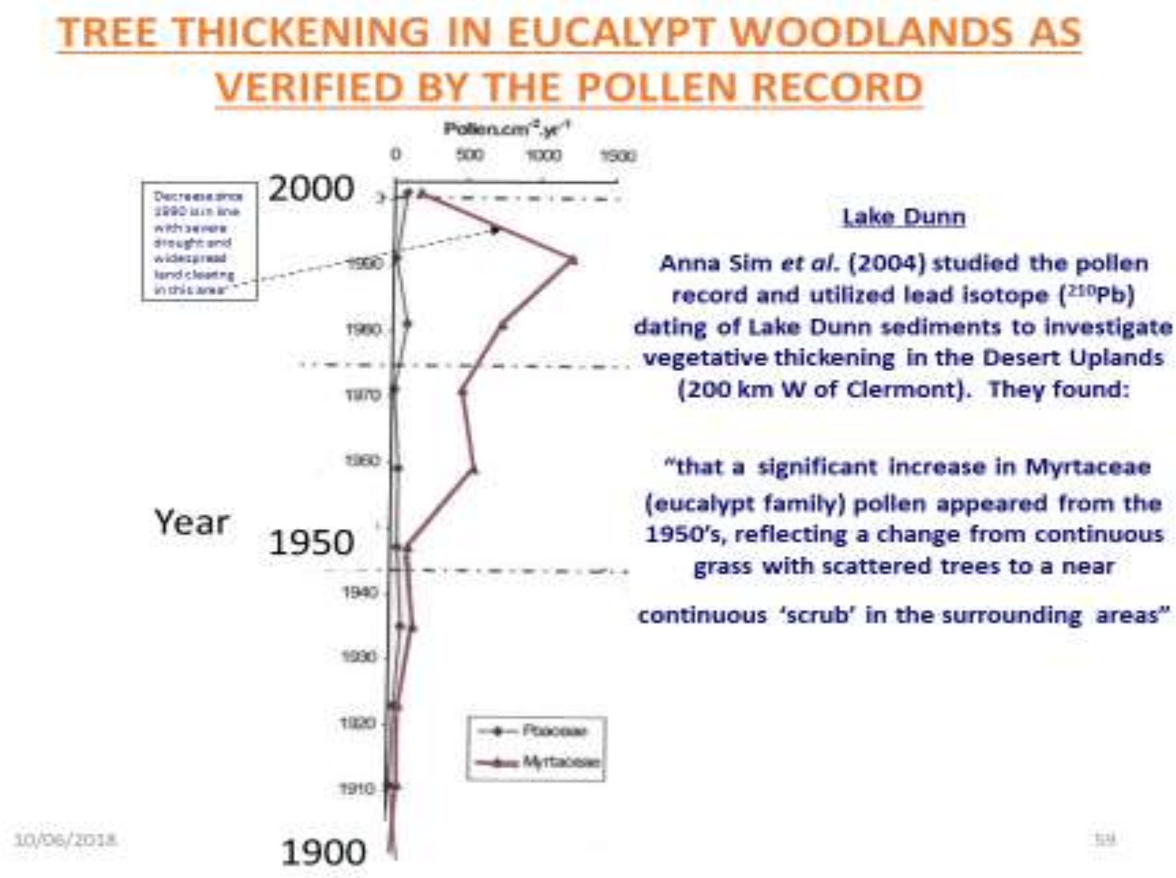
IV.

McCallum, B.S. (1999) An investigation of native tree incursion into native grassland at Moorinya National Park, North Queensland. B. App. Sci Hons thesis, JCU, Townsville.

Sattler, P.S. and Williams, R.J. (eds) (1999) The Conservation Status of Queensland's Bioregional Ecosystems. (EPA: Brisbane).

Sharp, B.R. and Whittaker, R.J. (2003).The irreversible cattle-driven transformation of seasonally flooded Australian savanna. *J. Biogeog.* **30**: 783-802.

Sim, A., Heijnis, H. and Mooney, S. (2004) Use of the pollen record to investigate vegetation thickening in central Queensland over the last 120 years. *Proc. AQUA Conf.*: Hobart.



Stanton, J.P (1992) The neglected lands: Recent changes in the ecosystems of Cape York Peninsula and the challenge of their management. *Proc. Qld Geogr. Soc.* **7**: 1-18.

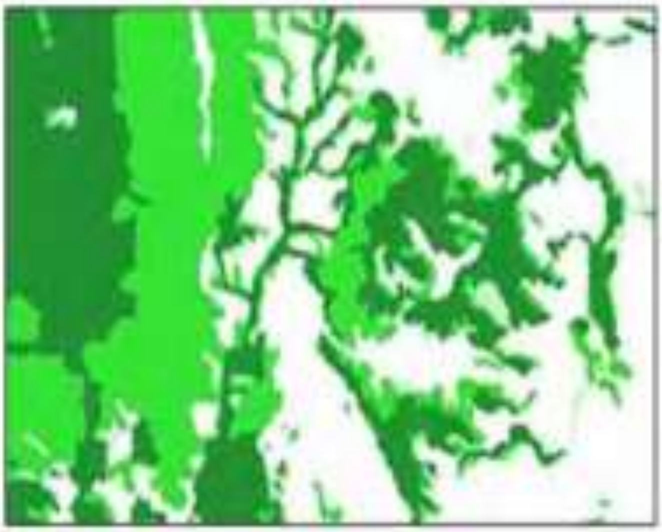


Figure 6. Overlaid digital boundaries in Iron Range N.P. Cape York, Qld showing rainforest expansion. The original area in 1943 (dark green) had expanded to the larger area (light green) by 1991.

Whipp, R.K. *et al.* (2012) Changes in forest structure over 60 years: tree densities continue to increase in the Pilliga forests, NSW, Australia. *Aust. J. Bot.* **60**: 1-8.

Books: (with tree/shrub thickening anecdotes and research citations)

Blainey, G. (1982) *Triumph of the Nomads* (Sun Books: Melbourne).

Gammage, W. (2011) *The Biggest Estate on Earth – How Aborigines made Australia.* (Allen & Unwin: Sydney)

Jacobs, M.R. (1955) *Growth habits of the eucalypts.* (Gov't Printer: Canberra).

Lewis, D. (2002) *Slower than the eye can see: environmental change in northern Australia's cattle lands, a case study from the Victoria River District, Northern Territory.* (Tropical Savannas CRC: Darwin).

Noble, J.C. (1997) *The Delicate and Noxious Scrub.* (CSIRO: Canberra)

Pyne, S.J. (1991) *Burning Bush – A Fire History of Australia.* (Allen & Unwin: Sydney).

Rolls, E.C. (1981) *A Million Wild Acres.* (Nelson: Melbourne).

Royal Commission (1901) Royal Commission to Inquire into the Condition of Crown Tenants – Western Division of NSW. (Gov't Printer: Sydney).

Wright, J. (1981).*The Cry for the Dead.* (Oxford UP: Melbourne).

International analogues:

Gibbens, R.P. and Heady, H.F. (1964).The influence of Modern Man on the Vegetation of the Yosemite Valley. (California Agricultural Experiment station, Extension Service: Manual 36).

Hastings, J. R. and Turner, R.M. (1965). The Changing Mile. (University of Arizona Press).

Klement, K. D. Kay, C. and Heitschmidt, R. K. (2001) Eighty years of vegetation and landscape changes in the Northern Great Plains: a photographic record. (Agricultural Res. Serv.: USA).

Scholes, R.J. and Archer, S.R. (1997) Tree-grass interactions in savannas. *Ann. Rev. Ecol. & Systematics* **28**: 517-544.

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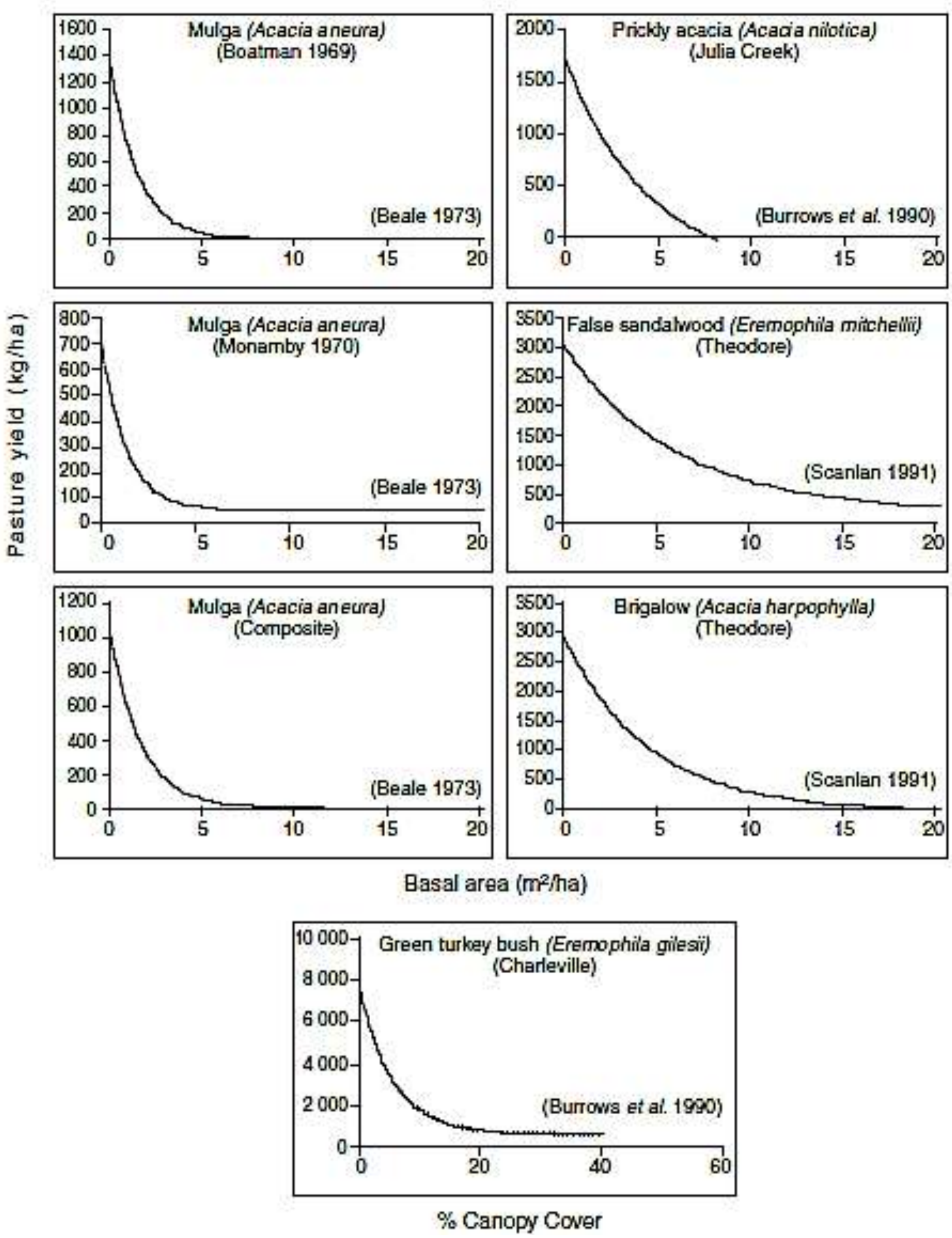
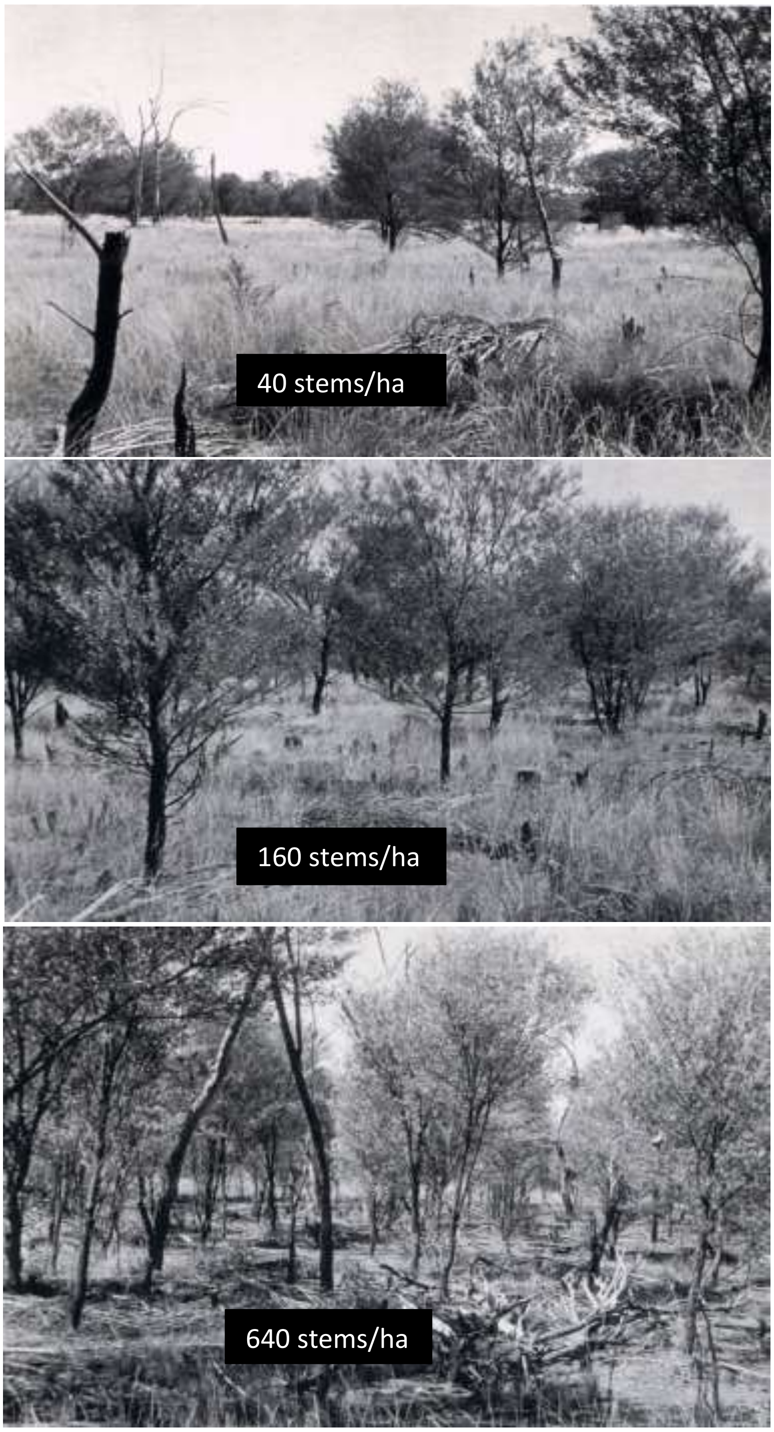
Xiao-Peng Song *et al.* (2018) Global land change from1982 to 2016. *Nature*. DOI: 10.1038/s41586-018-0411-9.

Appendix 3

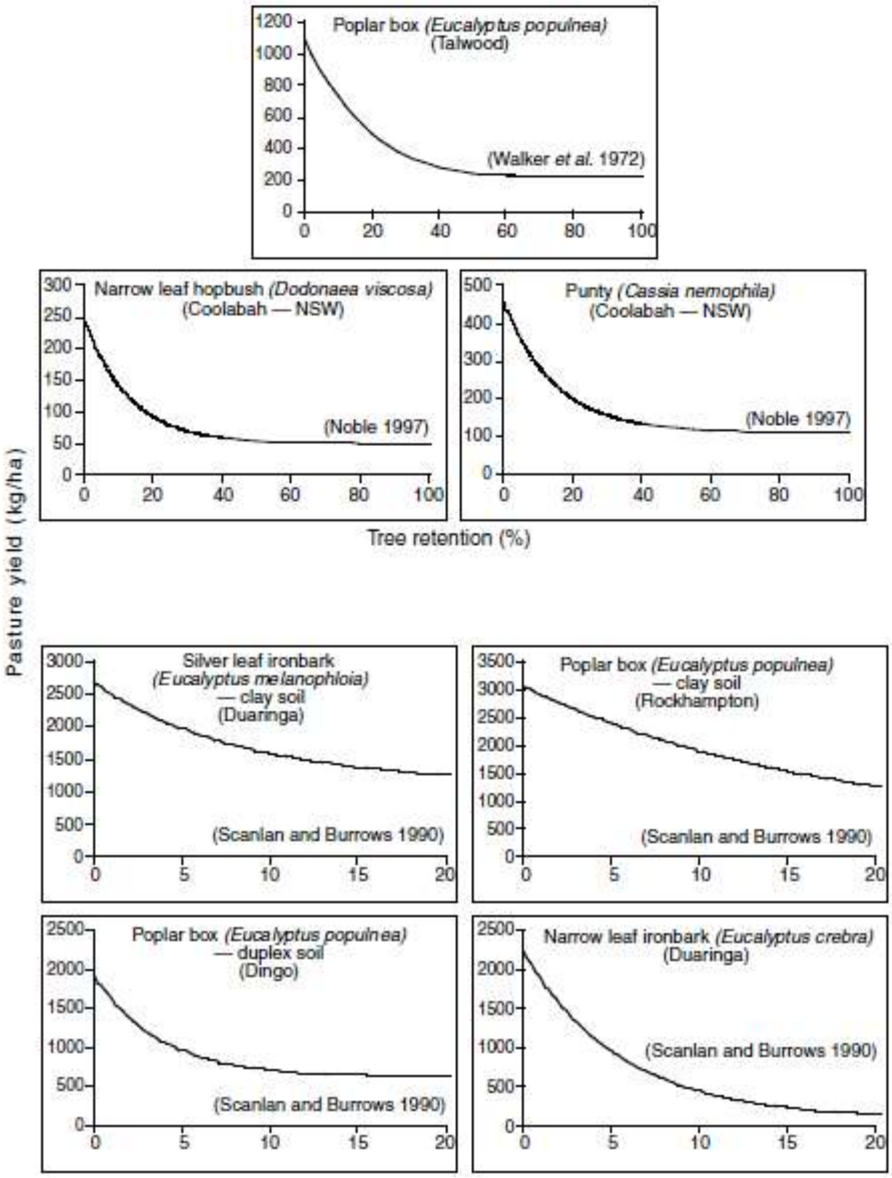
Tree – grass relationship curves

The effect increasing woody plant cover exerts on potential pasture production (& hence livestock carrying capacity) has been widely studied in Queensland (see Burrows 2002 for reference sources given on the following diagrams). The relationship between pasture yield and any expression of woody plant competition (e.g. stem basal area, canopy cover) follows a negative exponential pattern (see mathematical functions in Table 3). Basal area is the preferred parameter because it integrates the competitive impacts of plant size and number. The net result of this relationship is that even small numbers of woody plants (excluding fodder trees with palatable leaves) present in pasture can have a significant depressing effect on potential pasture production.

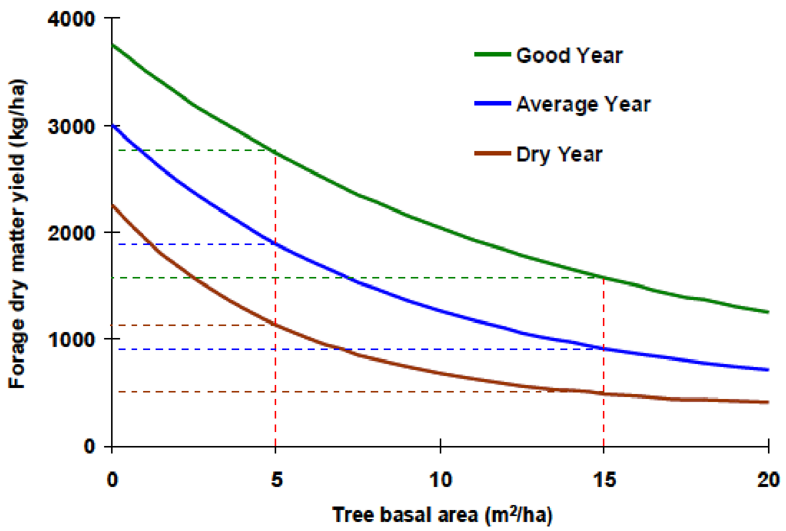




Pasture response to mulga thinning at Boatman Station. The pre-thinning stand density was 5570 stems per ha (Beale 1973).



Tree stand basal area (m^2/ha)



Data for a poplar box woodland at Dingo, CQ illustrating seasonal effects.

Table 3. Location, soil type and slope with the range of tree stand basal areas (X m^2/ha – measured 30 cm above ground level) and pasture yield (Y kg/ha) for *Eucalyptus* sites in Central Queensland. Regression parameters ($Y = A + B*e^{(-kX)}$) for each site are in bold. [After Scanlan and Burrows (1990)].

Site	Dominant Tree	Location	Soil type#	Slope %	No. of plots	Basal area range (m^2/ha)	Pasture yield range (kg/ha)♣
E1	*E. melanophloia*	150°04' E, 23°39' S **[Y = 131 + 1549*e^(-0.1220X) R^2 = 0.85]**	Ug 5.13	2	6	0-30.2	2581-1129
E2	*E. fibrosa*	150°16' E, 23°05' S **[Y = 715 + 1680*e^(-0.0833X) R^2 = 0.97]**	Db 1.12	0	7	0-47.5	2308-692
E3	*E.populnea*	150°16' E, 23°05'S **[Y = 629 + 1310*e^(-0.2706X) R^2 = 0.84]**	Dy 3.32	0	10	0-27.7	1816-490
E4	*E. crebra*	150°18' E, 22°52'S **[Y = -59 + 3599*e^(-0.0715X) R^2 = 0.92]**	Dy 3.32	3	9	0-24.6	3351-648
E5	*E. creba*	151°00' E, 23°53' S **[Y = 463 + 2173*e^(0.0854X) R^2 = 0.98]**	Dy 3.42	5	7	0-28.1	2755-665
E6	*E. populnea*	150°38' E, 23°38' S **[Y = 463 + 2590*e^(-0.0588X) R^2 = 0.91]**	Ug 5.34	0	8	0-31.7	3050-823
E7	*E. crebra*	150°27' E, 23°10' S **[Y=90 + 2141*e^(-0.1806X) R^2 = 0.89]**	Dy 3.32	1	7	0-25.3	1900-352
E8	*E. crebra*	150°26' E, 23°10' S **[Y = 151 + 1238*e^(-0.320X) R^2 = 0.93]**	Dy 3.32	15	8	0-17.3	1450-170

10/06/2018 # Northcote (1974) ♣ Yields correspond to tree basal areas shown (Pasture yield is highest where stand basal area is lowest). 25

Appendix 4

Economic impacts of woody plant thickening on grazing enterprises

- The major objection to Queensland's VM Act 1999 (as Amended 2018) is that it superimposes regulations and codes on rural land that has previously been assigned by Government for the prime <u>purpose</u> of <u>grazing and agriculture</u>. Further, the framers of the regulations and codes (along with their advisers) appear to effectively ignore the impact that their regulations will have on the future ability of the owner/lessee to maintain individual rural blocks as a viable agricultural enterprise.
- That "the only sustainable 'agriculture' is profitable agriculture" is a truism that has withstood the test of time (Ainesworth 1989). Yet amongst the stated reasons underpinning the VM Act is the aim to regulate the clearing of vegetation, which at the same time "*allows for sustainable land use*". Just a modicum of common sense tells us that the goal of sustainable land use is not possible in a self-contained and independent farm business, <u>unless the business is profitable</u>.
- In my submission to the Queensland Parliament's AEC Inquiry on the Vegetation Management (Reinstatement) Amendment Bill 2016 (http://www.parliament.qld.gov.au/documents/committees/AEC/2016/rpt19-11-VegetationMangt/submissions/214.pdf) I referred to a 2003 study which examined "The Impact of Tree Thickening in Grazed 'Remnant' Woodlands".
- In 2002 selected Queensland Shires (as defined at that time) containing intact ("remnant") woodlands grazed by domestic livestock, occupied 86 M ha (68 M Ha wooded) and supported 5.3 M beef equivalents in Queensland (See Table 1, Appendix 1)).
- There is little argument today that trees and shrubs in 'intact' grazed woodlands are proliferating ("thickening") throughout much of this zone, leading to a progressive decline in livestock carrying capacity, in the absence of ameliorative measures. [See: Appendix 3 for relevant data and citations, and view QImagery and Queensland Globe (Web site) photo "pairs" for evidence of woodland thickening and lost pasture production across the State and the years. Tip: Look for earliest available image (QImagery) vs. the latest available for the same digitised reference area (Qld Globe)].
- Apart from fodder trees in the mulga zone and areas elsewhere with access to saleable timber, the vast majority of Queensland's grazed woodland resource supports trees and shrubs that compete strongly with pasture production; and have leaves that are either unpalatable to domestic livestock and/or wood with no timber value.
- Given this reality, I am unaware of any economic study that does not show that thickening woodlands (including regrowth from past clearing) have a deleterious financial impact on all landholders restrained by legislation from responsible management of their grazed woodland resources. Resources used for the prime purpose of grazing and agriculture as set out, for example, in most GHPL (lease) documentation.
- Estimates of loss from woodland thickening (in the 2003 study referred to above) were calculated on a (conservatively chosen) minimum 50 m ha (>20% canopy cover) of grazed 'remnant' ('intact') woodlands. This area supported 2.1 m beef equivalents grazing in the woodlands *per se*, worth approximately $600 m per annum to Queensland's $3,000 m per annum grazing industry (in 2002 dollar terms).
- Based on these data a range of scenarios were analysed and sensitivity analyses undertaken to gauge the economic impact of tree thickening in the grazed 'remnant' woodlands within Queensland.
- Calculated net present value (NPV) of lost grazing production and reduced property values (50 year time frame) were $293 m to affected landholders and $879 m to the community at large. The range, assuming low and high site potentials, was $216 m ($649 m) to $324 m ($971 m) for landholder and community (bracketed) costs respectively. Note again that

these figures are based on 2002 interest rates and dollar values ($1 in 2002 ≡ $1.45 in 2017).

- The trend of increasing tree and shrub thickening in both 'intact' and regrowth communities is ongoing, with resultant declines in stock carrying capacity and productivity. Despite this reality the State has seemingly abandoned the concept of "living areas" and the need to responsibly manage woodland vegetation on designated grazing/farming holdings to improve primary productivity and farm viability. The simple conclusion is that under the VMA and Other Legislation Amendment Bill 2018 most rural land managers will not have the option to maintain large tracts of their holding, even in its existing condition – either by managing tree thickening or controlling large areas of regrowth in paddocks. These paddocks are regrowing from past legal clearing to enhance pasture growth and animal production.
- Given the vast number and extent of rural holdings supporting grazed woodlands in Queensland, it is assumed that any responsible government would have examined the overarching economic impact, prior to imposing another layer of regulations and vegetation management codes on all affected rural leasehold and freehold tenures. Unfortunately there is <u>no evidence</u> that Queensland undertook such studies prior to the VMA 1999 (Amendment Bill 2018) being introduced to State Parliament.
- In the interim, published results have shown that reducing tree cover by half increased cash flow by $90,000 per year for a self-replacing cattle property of 20,000 ha near Charters Towers (Stafford-Smith *et al.* 1999). At Clermont a 20% tree retention rate, on an 18,000 ha beef holding, increases annual profit by $40,000 compared with 80% retention (Bartholomew and Wilson 1995). Clearing box woodlands near Dingo, with 20 percent retention in retained blocks and strips (Burrows 2002) gave NPVs of $40-64 per ha greater than for uncleared controls. In north-west NSW sheep country, the gross margin for land cleared of unwanted woody plants is <u>double</u> that for land with high tree-shrub densities (Scanlan *et al*. 1992). See Burrows (2004) for further discussion and keep in mind that all these returns need to be converted to present day $ values to highlight current impacts.
- ABARES' Davidson *et al*. (2005) provide a broad overview of the costs of preserving native (woody) vegetation on Australia's rural land holdings. **They conclude that the current regulatory approach to preserving remnant native vegetation is imposing a large cost on the farm sector** (My emphasis). They note that this large cost has not been fully considered in the formulation of environmental policies. They also suggest that the cost of meeting native vegetation regulations is likely to be an important factor in determining the future competitiveness of Australia's broad-acre agricultural industries on world markets. The authors conclude that a more flexible approach to native vegetation conservation may achieve better environmental outcomes at a lower cost to the farm sector.

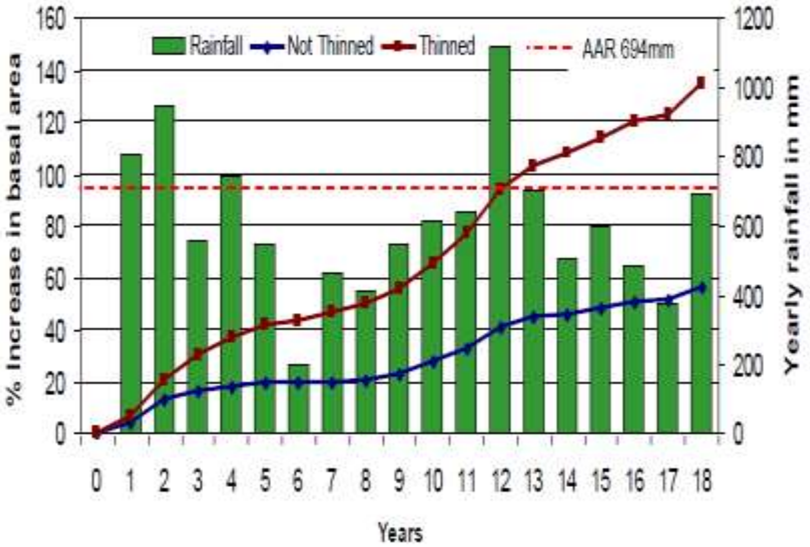
- **Thinning** - Apart from the banning of broad-scale tree clearing, thinning intact grazed woodlands is also severely constrained under current Queensland legislation. In any event leaving trees/shrubs scattered throughout a paddock leads to rapid seedling regeneration or root suckering from plants that were retained. Consider this example for a grazed poplar box woodland in Central Queensland:

1987 at time of thinning (Originally 10m^2/ha, approx 6m^2/ha basal area left after thinning. Note trees browning out)

1994 (Approx 8m^2/ha basal area)

2005 (Approx 15m^2/ha basal area)

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!



The basal area increase of poplar box trees in thinned and ‘intact’ (not thinned) stands over time. Rainfall influences are also apparent. [In extended dry periods it was not unusual to have individual tree circumferences shrink, although overall trends remain for increasing tree basal areas across the years.]

Table 4. Economic response relative to 'control' of various tree clearing treatments on a poplar box woodland site in Central Queensland. Treatment retaining 'scattered' trees ≡ "thinning". [Back *et al.* 2009; Burrows 2002].

Clearing method	NPV/ha
NPV = Net Present Value after 15 years from clearing	
Control (intact woodland – initial tree basal area 10m^2/ha)	
Retain 20% trees scattered over paddock, stem inject remainder	($21.00)[1]
Retain 20% trees in intact woodland strips — pull and burn remainder	$47.00
Retain 20% trees in intact woodland strips — treat remainder with tebuthiuron (1.5kg a.i./ha)	$40.00
Retain 20% trees in intact woodland strips — treat remainder with tebuthiuron (1.0kg a.i./ha)	$63.60

[1]Negative value.

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Appendix 5

Balance of Tree & Grass (Pasture) Cover in Grazed Woodlands

It is possible to find a sensible compromise between competing conservation and livestock production objectives in grazed, thickening woodlands if common sense and goodwill is exercised between the competing proponents! This is a consequence of the negative exponential relationships between potential pasture production and woody plant basal area that is observed in most grazed woodland communities. (See Appendix 3).

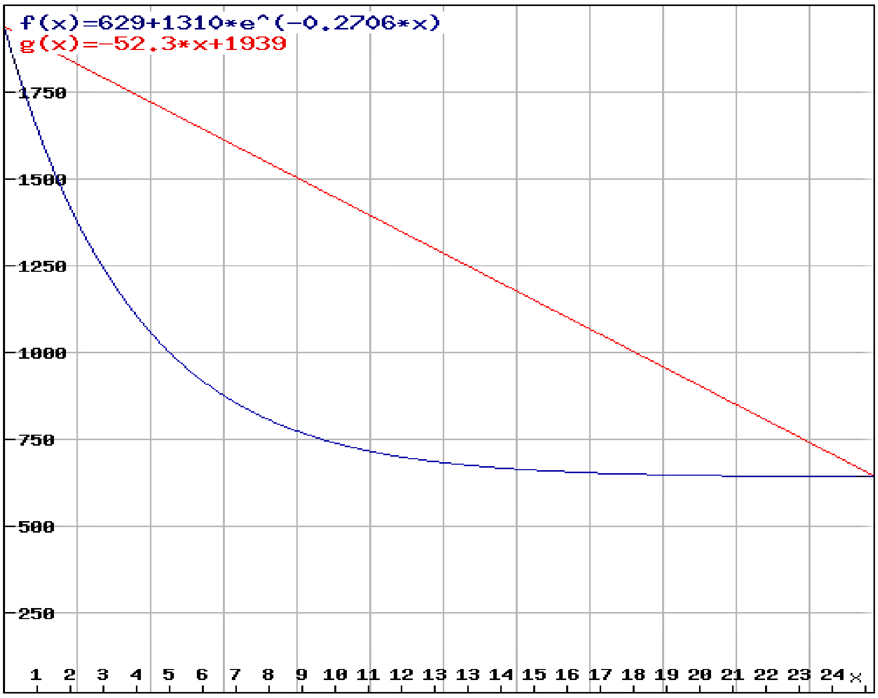

Figure 7 - Effect of retaining the <u>same basal area of trees</u> in intact strips (straight upper red line) or as scattered stems (curved blue line) on associated potential pasture production in a poplar box woodland – Dingo, Central Queensland. Exponential relationship is from Site E3 in Scanlan and Burrows (1990[7]). Please note that relative responses are strongly seasonally dependent – with the disparity in any derived livestock carrying capacity being most pronounced under drought conditions and on less fertile sites.

By simple substitution - for 20% (5 m^2/ha) tree basal area retained in intact strips, the potential pasture production in the above example would be 1677 kg/ha/yr (Fig. 7). For the same tree basal area retained as evenly scattered trees the potential pasture production would be 967 kg/ha/yr. [To have a similar pasture production potential per ha to where trees are retained with 20% of their stem basal area contained in 'intact' woodland strips (and 80% fully cleared as depicted above), a scattered tree treatment would need to retain no more than 0.8 m^2/ha (or 3.3%) of the same initial tree basal area of 25 m^2/ha].

These tree-grass relationships simply demonstrate that leaving trees scattered over a paddock in <u>thickening woodlands</u> designated for beef production cannot pay in the longer term (see Appendix 4) – or much sooner if initial tree basal areas are already 'high'.

[7] *Australian Journal of Ecology* **15**:191-197

In 1987, twelve years before the VMA 1999 was first introduced into the Queensland Parliament and 31 years before the current Bill was reincarnated, Department of Agriculture & Fisheries staff recognised the desirability of encouraging rural landholders to adopt a more considered approach to the management of their grazed eucalypt woodlands.

Accordingly, and with the support of meat industry research funds (then AMLRDC) they produced an extension video (of quality relative to its time) which was widely distributed within the grazing industry, and copies were made available on loan from most DAF regional offices. This video runs for 10 minutes and because of its file size has been uploaded to YouTube so it can be perused by readers of this digital submission.

See: https://www.youtube.com/watch?v=AmGWTfS3UN0&feature=youtu.be .
Please observe that this video entitled "Clearing Eucalypt Country 1987" is plainly annotated by the additional title descriptor "Note: Filmed before the VMA 1999".

The purpose of alerting members of the present Inquiry to this video is simply to reinforce the message that a Queensland Government agency, with research and extension staff stationed throughout the regions, long had a program of educating rural landholders about balanced and responsible use of their woodland resources. The clear difference between that program and the current Government approach is simply that the former acknowledges that the prime use of land assigned for agricultural purposes is for grazing and agriculture. By way of contrast the Queensland Government in its wisdom appears to have decided unilaterally that conservation should take precedence over agricultural production on land already assigned by government for the latter purpose.

The solution to the conflicting demands of production and conservation within our grazed woodlands is to reassess how the vegetation is structured. For the same potential pasture production far more trees/shrubs can be retained in wooded paddocks if the woody vegetation is confined to strips (= wildlife corridors?) and/or clumps (= shade/refuge areas?) rather than being left scattered or "park-like" over the entire paddock.

Such a balanced structure will enable the wooded block to continue to be responsibly used for its initial (primary) government approved purpose (i.e. grazing and agriculture) - while still satisfying the desires of reasonable conservationists. Simply ignoring one side of the 'contest' or the other will highlight the immaturity of the protagonists. And in Queensland's case with its' unicameral Parliament ensure a continued turnover of legislation each time there is an (inevitable) change of government. Poor fellow my country!

Bill Burrows

24 January 2019