

# **Submission to the Senate Finance and Public Administration References Committee:**

## **NATIVE VEGETATION LAWS, GREENHOUSE GAS ABATEMENT AND CLIMATE CHANGE MATTERS**

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### **Summary**:-

This submission primarily addresses the impact of native vegetation laws in Queensland on landholders and illustrates some of their effects on diminution of asset values and productivity. It deals with our personal experience of compensation arrangements to landholders resulting from these laws.

It aims to emphasise:-

**The negative exponential relation between woody plant cover and pasture production potential, which is the basis of sustainable production in grazed rangelands**

**The effect of development restricts by the Vegetation Management Acts on the safe carrying capacity of an example grazing property and thus on it's viability**

**The loss in commercial market value on that property from restrictions introduced by the Vegetation Management Acts - around 75% in this area**

**The losses of income potential from reduced livestock grazing potential resulting from the Vegetation Management Acts**

**The potential for further losses from vegetation status re-assessment under the the Vegetation Management Acts**

**The absence of compensation and the inadequacies of "compensation" for losses resulting from the Vegetation Management Acts**

**A list of other management considerations, Workplace Health and Safety considerations, the inability to control grazing pressures due to macropod populations,**

**Raises issues with the measurement regime underlying the Vegetation Management Acts**

**The use of the flawed "salinity hazard mapping" as reason to deny clearing permits and the potential disruptive effects of delays in processing of vegetation management applications**

**(In brief outline) questions of the inclusion of green house gas abatement in these Vegetation**

**Management Acts in the face of the current Climategate and IPCC-Gate revelations and enquiries, and the on-going questioning of the surface-measurement picture of global warming of any abnormal description**

**The increased level of stress caused to rural property operators from the cumulative effects of the Vegetation Management Acts**

## **Personal Background:-**

I was raised on an 8515ha family sheep and cattle property in south west Queensland. My wife and I bought this property from other family members commencing in 1992, and currently operate it, running sheep, cattle and rangeland goats. The decision to purchase this property was partly motivated by its development potential. In this role we have personally experienced the effects of native vegetation laws on grazing property value and operation - more than half of which now has restrictions due to the Queensland Vegetation Management Acts.

**1965 - 1998** I was involved in rangelands research with Charleville Pastoral Laboratory, Queensland Department of Primary Industries. Research projects in south west Queensland included estimating productivity of tree and pasture layers in thinned mulga scrubs, quantifying dietary and nutritional intake of sheep grazing mitchell grass and mulga pastures, relations between pasture utilisation rates and grazing animal performance in mitchell grass and mulga pastures, research input to the Southwest Strategy Safe Carrying Capacity Estimation project and input to the 1995 Queensland inquiry on establishing tree clearing guidelines for leasehold lands. I have experience in vegetation mapping, Geographic Information Systems and statistics.

**1998 - 2010** Full time grazing property manager and part time rangelands consultant, mainly on vegetation mapping issues. In this latter role (as part of the Devine Agribusiness contribution) I provided input to the **Productivity Commission Inquiry on "Impacts of native vegetation and biodiversity regulations" 2004.**

## **Scope of this Submission**

This submission reflects my experience and expertise, which is primarily in the rangelands areas of south west Queensland with grazing enterprises.

## Submission Details

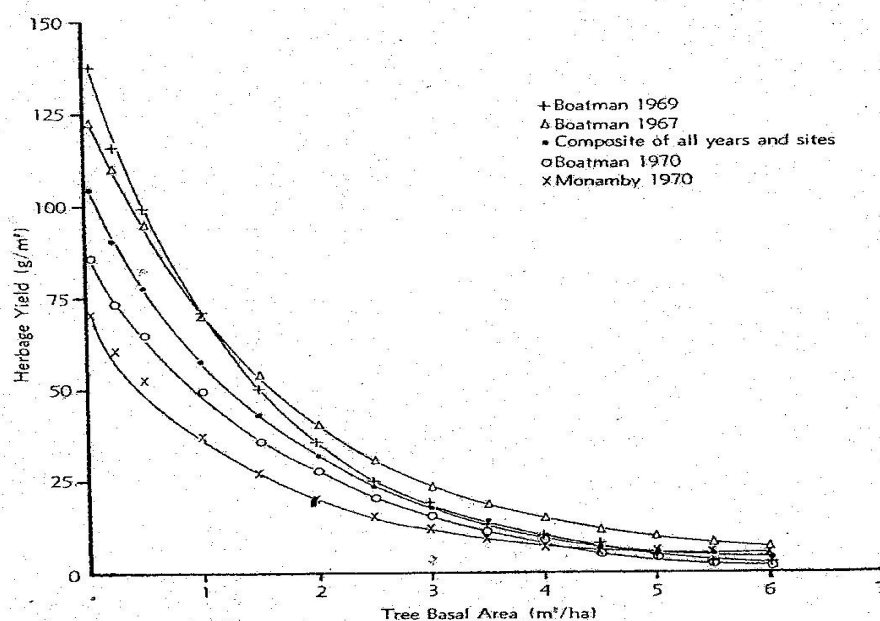
### 1. Relationship between woody plant cover and pasture production

The effect of woody vegetation increase on the productivity of the ground layer is well defined in the scientific literature (references in Beale 1973, Burrows 2002)..

**Increasing woody vegetation leads to exponentially lower production of the ground layer.**

**And it is productivity of the ground layer that governs grazing productivity.**

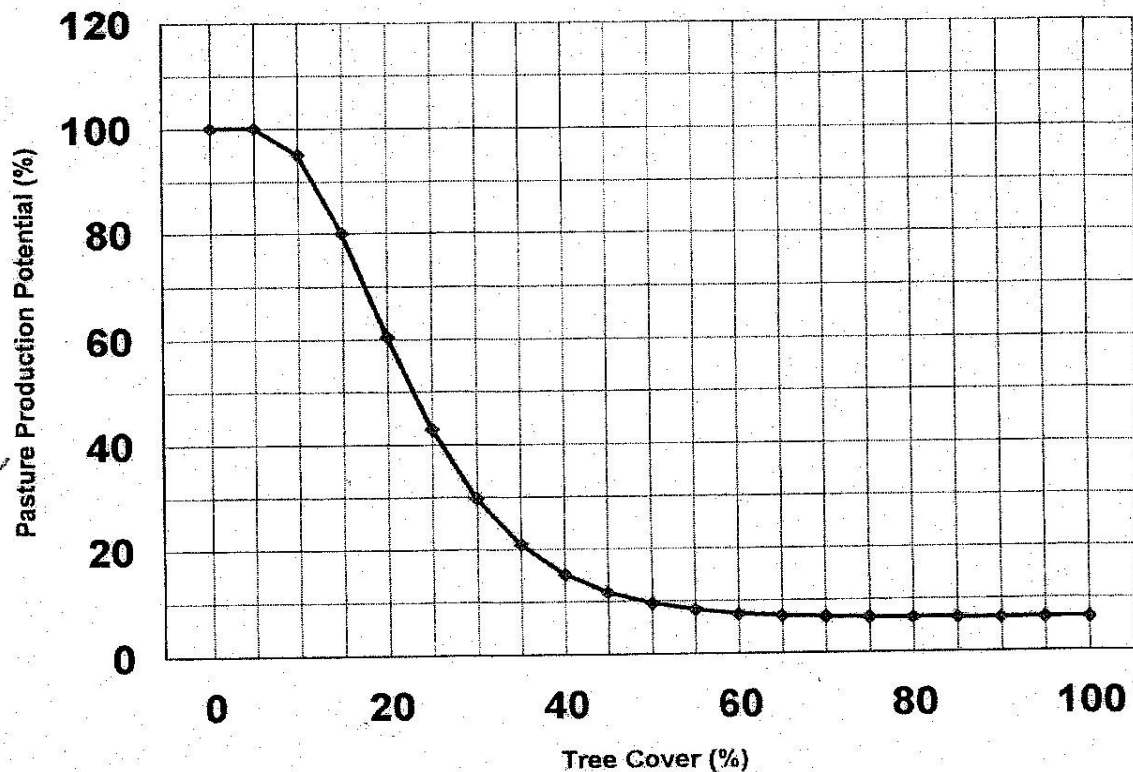
An example of this relationship is provided by Beale (1973) for south west Queensland mulga communities (Figure 1), showing the effect of woody vegetation (expressed as woody basal area) on herbage production. Other particularly relevant examples are given in Burrows (2002).



**FIGURE 1**  
Relation between herbage yield ( $\text{g/m}^2$ ) and tree basal area ( $\text{m}^2/\text{ha}$ ).  
(From Beale, I.F. 1973)

Field experience in south west Queensland lead to the development of a modified relationship (Figure 2 (Beale 1999)) in which pasture production potential was related to woody foliage projected cover. This relationship was used in the South West Strategy Safe Carrying Capacity model (Johnston et al 1996a, 1996b) which is the basis of calculations presented in the **Safe Carrying Examples** section later in this submission.

**Figure 2. Relation between Woody Foliage Projected Cover and Pasture Production Potential**  
(From Beale (1999) South West Natural Resource Management Group Vegetation Management Forum Charleville, August 1999).



From Figure 2 it can be seen that there is little effect on pasture productivity from woody cover levels of up to around 10% - i.e. there is no productivity-based justification for clearing boundary to boundary (**but also see Section 5**). However above this level there is a drastic exponential drop in potential pasture production - by the time woody cover get a to around 30%, potential pasture productivity has dropped to around 30%.

**Summed up tersely, in south west Queensland, standing still on management of the canopy cover of woody vegetation is going backwards on grazing productivity.**

**Thus restrictions on the ability of a property owner to manage increases in woody vegetation cover is a restriction on the productivity of their property.**

And there is ample documentation of the on-going increase in woody cover in these areas. (Burrows (2002), Beale (2004) )

Two examples of woody thickening on our property are a 1933-36 photo of a paddock clear from north to south boundary where the same view is now greatly restricted, and an early (c.a. 1902) homestead site named "Mountain View" where the mountain view is now only available via cherrypicker at around 10 metres height.

## **2. Property Safe Carrying Capacity - Examples of Various VMA Restrictions**

We use the South West Strategy Safe Carrying Capacity Model (Johnston et al 1996a, 1996b) to indicate stocking rate management strategies for our 8515ha property. **Table 1** shows the 1999 base carrying capacity for that property. Comparisons are shown for full practical development, in contrast to development as possible within current VMA restrictions. These carrying capacities can only be maintained with on-going woody vegetation management. Finally we show the drastic reduction in carrying capacity that would result from being unable to manage woody vegetation thickening - and this reduction would occur within about 20 years.

**Table 1. Safe Carrying Capacity Estimations for 1999 (base year), Full Development, VMA-Restricted Development and with No Development Allowed (For 8515ha property)**

|               | <b>1999 (Base Year)</b> | <b>Full Development</b> | <b>VMA-Restricted Development</b> | <b>No Development Allowed</b> |
|---------------|-------------------------|-------------------------|-----------------------------------|-------------------------------|
| <b>DSE</b>    | 3548                    | 6325                    | 4641                              | 1371                          |
| <b>Cattle</b> | 106                     | 190                     | 139                               | 41                            |

## **3. Examples of Loss in Land Values Resulting From Queensland Vegetation Management Acts.**

Quote:- **Joyce, B.: Clearing Ban Is Theft** (Queensland Country Life P. 6 23 April 2009)

Here are two examples from around Mungallala on the magnitude of the loss of value of land assets imposed on landholders by the Vegetation Management Acts (VMA). These examples are prior to the current moratorium on regrowth clearing on endangered areas, but they provide illustration of the same problem magnified by this moratorium. They do not include the loss of commercial production, estimates of which are provided in the Productivity Commission Inquiry Report No 29, 8<sup>th</sup> April 2004 "Impacts of Native Vegetation and Biodiversity Regulations" Submission 171 (which covers Lots 82 - 85 in this discussion) and which is attached.

### **Example 1 "E"**

E is a leasehold block of about 44,000 acres which has been the subject of a buy-out under the provisions of the VMA. The payout (which included the value of commercial development foregone under the provisions of the VMA (2004)) was reportedly about \$60/acre. This does not include the commercial value of development foregone prior to the introduction of the VMA – for which "F" to the south of E (on the market for about \$75 per acre) provides some guide, with Eversfield locally rated as of somewhat less value – say \$65 per acre..

E has recently been sold by the Queensland Trust for Nature (with conditions on non-development as per VMA) for \$750,000 (as advertised in Queensland Country Life) – i.e. about \$17 per acre.

Thus it can be argued that the provisions of the VMA have reduced the value of E in the order of:-

|                                 |         |          |                    |
|---------------------------------|---------|----------|--------------------|
| <b>Cleared before VMA – Say</b> | \$65/ac | 44000 ac | <b>\$2,860,000</b> |
| <b>Currently</b>                | \$17/ac | 44000 ac | <b>\$ 750,000</b>  |
| <b>Loss in Value</b>            |         |          | <b>\$2,110,000</b> |

### **Example 2 Lots 82 – 85**

Lots 82 – 85 are smaller in area and closer to Mungallala – which the Unimproved Capital Value process argues justifies the assumption of higher land values than for larger blocks further from towns.

Lot 82 adjoins "E", Lot 85 adjoins "L", a largely cleared, well buffel grassed property recently sold for around \$105 per acre. The aggregation of Lots 82 – 85 is also in the neighbourhood of "P", on the market for about \$90 per acre.

Due to its VMA status the current value of the aggregation of Lots 82 - 85's is more likely to be in the order of that for E (\$17 per acre) – as Lot 82 borders on Eversfield, and these lots are subject to the leasehold land management provisions of the various Queensland Land Acts (*c.f.* management conditions were applied to "H" and "I", leasehold properties in south west Queensland, *c.a.* 1965).

Thus it can be argued that the provisions of the VMA have reduced the value of this aggregation in the order of:-

|                                 |          |          |                    |
|---------------------------------|----------|----------|--------------------|
| <b>Cleared before VMA – Say</b> | \$100/ac | 12123 ac | <b>\$1,212,300</b> |
| <b>Currently</b>                | \$17/ac  | 12123 ac | <b>\$ 206,091</b>  |
| <b>Loss in Value</b>            |          |          | <b>\$1,006,209</b> |

We have other areas where development opportunities are restricted under VMA provisions. These are on our freehold country - which is of higher value. Thus the overall loss is more than shown above. However I have used the leasehold portions as our example as they are discrete lots and adjacent to those lots providing sale values.

The commercial values for cleared areas used here are of properties for sale at the moment and sold recently in the area. These prices may be argued, but smaller lots north of Mungallala have sold for higher prices. And the calculated losses in value will not be reduced to trivial levels until the price of unclearable land approaches that of cleared land – commercially an unrealistic expectation.

These two examples provide an indication of the commercial losses (**reductions of around 75% at least in value**) being imposed on land-holders by the VMA and for which they are in-eligible for compensation. Losses in productivity, which were addressed in the Productivity Commission Report 29 (8th April 2004) "Impacts of Native Vegetation and Biodiversity Regulations", are in addition.

**See also Davidson et al (2006) for a wider view.**

#### **4. Productivity Losses**

Comparisons of grazing livestock enterprises in Murweh Shire are shown in the Attachment to Appendix K: Returns Data (Productivity Commission 2004) show that returns are much more favourable on cleared properties.

A summary (not updated to reflect 2010 costs and returns) of returns from potential development of the example lots of                      used in **Section 3** was prepared by Kenny, Beale and Flynn (2003):-

|  |      |       |                  |
|--|------|-------|------------------|
| <b>Incremental PBIT as a result of development</b> |      |       | <b>28359</b>     |
| Capital Costs                                      | Ha   | \$/Ha |                  |
| Pasture Development                                | 4170 | 35    | 145950           |
| Water  |      |       | 30000            |
| Project Lifetime                                   |      |       | 25 yrs           |
| <b>Net Present Value</b>                           |      |       | <b>\$161,006</b> |
| <b>NPV / Ha</b>                                    |      |       | <b>\$38.61</b>   |
| <b>Internal Rate of Return</b>                     |      |       | <b>13.61%</b>    |

**This development is now prevented by current vegetation management laws.**

**And that means achieving a viable enterprise on the remainder is considerably harder.**

#### **5. Losses from Vegetation Status Re-assessment**

Under the VMA's vegetation not protected by a Property Map of Assessable Vegetation (PMAV) is subject to reclassification if it is deemed to meet three criteria

- *more than 70% of the height,*
- *more than 50% of the cover*
- *of similar original composition.*

As I pointed out in **Section 1**, there is little gain in productivity from clearing below 10% cover.

**But leaving cover levels in the range of 10 - 20% may be sufficient to invite re-assessment as remnant vegetation**

And the signature granting these PMAV's is the same one as on the freehold titles of eroded value. Which does nothing to improve the huge loss of trust of anything government that is now present in rural areas..

**Thus an unintended consequence of these acts is to ensure that areas that were previously unlikely to be cleared will now assuredly be cleared.**

#### **6. "Compensation"**

In Queensland some funding was made available as "**enterprise assistance**" for properties that qualified as affected by the VMA, or as "assistance to exit the industry". It was made known by the Queensland political establishment of the time that it was not to be called "compensation". We initially looked like being assessed as "non-viable", and, as most of our area had been affected by



the VMA prior to 2004, were not eligible for the buyout provisions. So had we opted to exit the industry, it would have been at a considerable financial penalty..

That invokes a whole another layer of stress, as summed up by MacDonald (pers. comm):-

THE R.A.S. SCHEME RASPBERRY

I've never seen a "viabull", nohow,  
I'll prob'ly never see it.  
I tell you now,  
That's it's a cow,  
When you try to be it.

Oh yes, I wrote the Viabull, somehow,  
And you are free to quote it!  
I'll just tell how here and now,  
Nothing's really changed, nohow  
Since I damn well wrote it!

Eventually (with assistance from our agribusiness advisors) we received \$100,000 as "enterprise assistance".

While this enabled us to undertake property development, the politicians of the era were correct when they maintained that **"It was enterprise assistance, it was not compensation"**:

As outlined in Sections 2 - 5

**- TRUE - IT WAS NOT NEARLY ENOUGH TO BE COMPENSATION**

## **7. Mustering Costs and Other Effects**

One of the realities of today's property management is that properties have much lower levels of manpower available. Our property used to have two full-time men plus additional assistance. It is now run with one full-time man and as little outside assistance as we can manage. Thus anything that increases time required for its undertaking is a serious problem. I have not attempted any costings, but mustering of stock in unmanaged woodlands takes longer, costs more and reflects in general herd management and:-

## **8. Workplace Health and Safety Considerations.**

Mustering in unmanaged woodlands also carries a potential problem of worrying proportions.

Our eldest son works for one of the larger cattle companies and is familiar with on-property WHS requirements. While mustering cattle through fallen mulga and scrub (example photographs below) recently he made the comment that

**"Dad, this has to be a WHS issue".**

If so, then it has the potential to provide yet another intrusion of the vegetation management acts upon rangeland grazing production.



## **9. Macropods**

I have held a macropod harvesting license for a number of years. My harvesting experience can be summed up as:-

*If you wish to see macropods look in the afternoon.*

*If you wish to see how much woody regrowth you have, go out at night with a spotlight to try harvesting macropods.*

The mosaic of small blocks of land in this area, some cleared and grassed adjacent to others heavily wooded (like ours) which provide a haven, provides an ideal habitat for macropods.

*And one of the basic requirements for pasture management is control of the grazing regime, which, in this instance, we do not have.*

## **10. Roadside clearing**

One of the conditions that go with leased land is "The provision of a secure boundary fence".

We have had issues with damage to boundary fences from uncleared woody vegetation from lanes and roadsides falling on them. An extreme example was, after a wind storm, having to clear about 95 tree clumps from a fence of about 3km - from lane vegetation which was overhanging the fence.



Yet my initial enquiry on clearing got the answer that I could "clear 1.5 metres" - a width entirely impractical for the amount of fence line we have, the height of trees adjacent with which we are dealing and requiring a method which would be entirely impractical for the length of fence line involved! Yet previous versions of the Lands Act allowed clearing of 4 metres and sky-lining - which provided a reasonable compromise - but not all the time (lane on right).



See **11a. Biology in the hands of government** also.

As with **Mustering**, anything that causes un-necessary extra work is something that is done at the expense of something else.

## **11. Aspects of the Vegetation Management Act encountered in practice**

### **a. Biology in the hands of government**

There are frequent announcements on the importance of stock routes and road reserves as conservation corridors. But let us look at the instance of a "3-chain" road (approx 60m), a common occurrence here.

***Lane width***                ***60m*** (approx)

***Road clearing***            ***35m*** (approx)

***Fence line clearing***    ***8m*** ( 2 sides by 4m)

***Retained vegetation***    ***17m (2 strips 8.5m wide approx)***

Either side of these roads landholder are required to retained strips of minimum 200 metres width, which must also meet length/width requirements that these roadside strips cannot.

***I personally have seen no evidence that biology becomes more efficient when it is in the hands of government.***

## b. Vegetation Management Act Mapping and Sampling

There have been questions in the rural media on the accuracy of mapping used for VMA purposes.

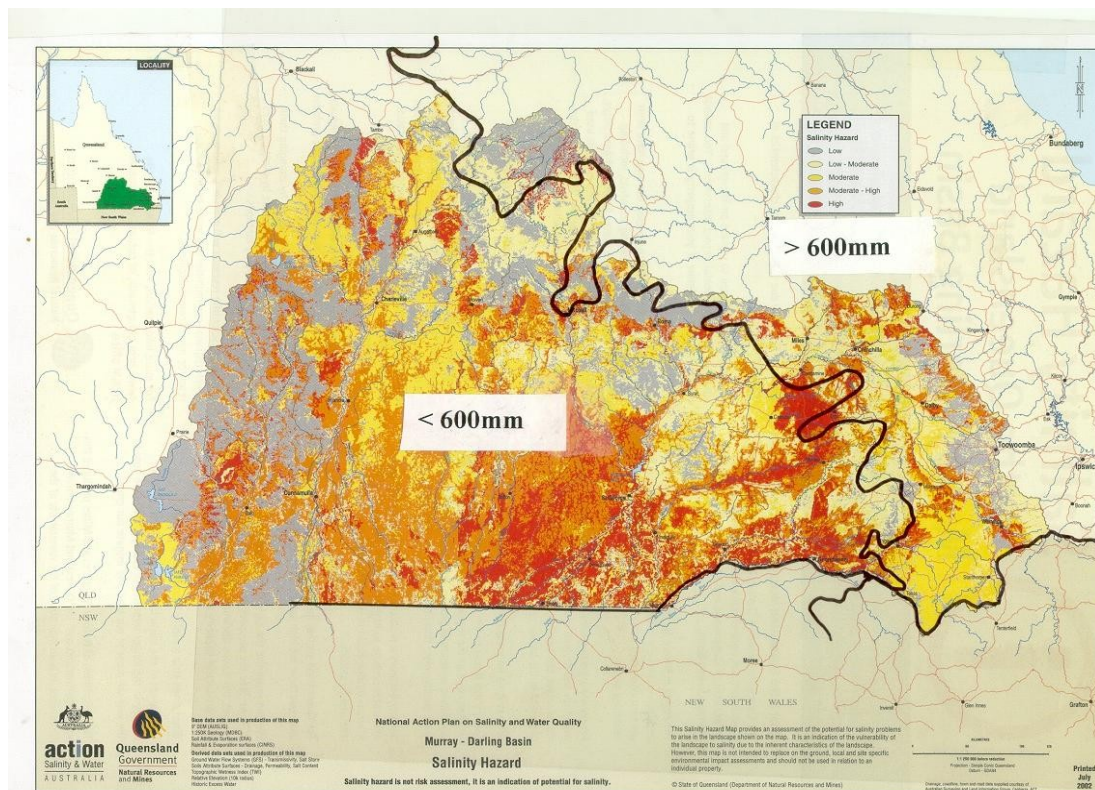
I attended a farm forestry day where this mapping was summed up as **"Have a close look at your vegetation map, because there is every chance that it is wrong"**. My experience with consultancies on vegetation issues would not disagree with this verdict- and that includes issues with the mapping for our property, on which I can expand if required.

This is not surprising for rangeland areas when one reads the methodology used for regional ecosystem mapping (Neldner et al 2005) and finds that it appears to be based on Clementsian succession and then applied to rangelands areas where "State and Transition" (e.g. Westoby 1980; Westoby et al 1989) rules. This, along with sampling and other problems which, in my opinion, are contained in that methodology, suggests to me that a review of this methodology by a competent rangelands scientist would not only drive the proverbial truck through it, but also have room to park the road train. Obviously Burrows (2005a) doubts this methodology as well (**See attached**).

## c. The use of the Queensland Salinity Hazard Mapping to deny clearing permits

This mapping was released with great political fanfare on the threat of salinity around 2002. (See Marohasy (2005) for more details).

**This includes the map Premier Beattie said he stood by at the Summit and that he said CSIRO had endorsed".**



**Map 1. Queensland Salinity Hazard Map with 600mm Rainfall Isohyet Added**

It should note that the Premier was using sleight of tongue when he said *"Its methodology has been checked and endorsed by the CSIRO, the National Land and Water Audit and AFFA"*. (Marohasy 2005). **This is NOT an endorsement of the RESULTS of this mapping by those organisations.**

And it was based, in my opinion, on very dubious grounds in rangeland areas. I note that the Queensland Salinity Management Handbook (1997) states that:-

**In general areas receiving less than 600mm/yr are not usually at risk of salinity because insufficient rain falls to satisfy plant demand and recharge the groundwater. (See Map 1 above)**

In addition

**"In March 2005 at the Australian Water Summit in Sydney I listened to a speaker from Geoscience Australia explain how technology used by the Queensland government to develop the salinity hazard maps and other maps used in catchment management planning were based on old technology. I queried this during the question session and Brian Spiers (a member of the Conference audience) volunteered that the Queensland scientists who put the original maps together were not skilled in the technology that they were using. This includes the map Premier Beattie said he stood by at the Summit and that he said CSIRO had endorsed". (Marohasy 2006, emphasis I.F. Beale)**



situation was unfortunate and one he hopes "will never be repeated".

#### **Salinity map a bit artful**

THE Ringer hears that some southwest graziers, scientists and artists have acquired such an aesthetic appreciation of the composition of the State Government's salinity hazard map that they are referring to it as 'Red Poles'. Why? Because the map, made up of what they claim are just random splotches and splashes of red and orange, is just as controversial and costly to the taxpayer as the National Gallery of Australia's infamous 1973 purchase of Jackson Pollock's abstract artwork, Blue Poles.

Yet I have had several encounters where clients were initially denied permits to clear, with the refusal based on this map.

**d. Speed of response to VMA applications - As an example,** I am currently involved with a consulting job that started in August 2009 and which is still awaiting the result of the grinding of government wheels to decide whether more work is required or not. As is the customer for a result.

Such time delays are not unusual.

And these delays risk the applicant falling foul of the next move of the goal posts in this vegetation management game.

## **12. Greenhouse Gas Abatement and the Vegetation Management Acts - a brief discussion**

Anyone following the current developments in climate science (e.g.

**Climategate** (the release of e-mails, computer code etc from the University of East Anglia's Climate Research Unit) and its follow-up enquiries and revelations from the UK Parliamentary enquiry and other sources,

**IPCC-Gate**,

**GISSTemp** global temperature calculation code dissections (See e.g. <http://chiefio.wordpress.com/> particularly the GISSTemp threads),

**Harry\_Read\_me** file from Climategate discussions and dissections around the Hadley global temperature source, available on the internet, two such being

<http://diggingintheclay.blogspot.com/2009/12/harryreadme-update.html>

<http://wattsupwiththat.com/2010/03/04/crutem3-code-did-not-adhere-to-standards-one-might-find-in-professional-software-engineering/>

**Vanishing thermometers and other data problems** in the inputs to both GFISSTemp and Hadley calculations of global temperatures (See e.g.

<http://chiefio.wordpress.com/>,

<http://diggingintheclay.blogspot.com/2010/03/of-missing-temperatures-and-filled-in.html>)

**The collapse of the hockey-stick** of warming in the late 20th century and the re-appearance of previous warming periods

**Lucia at The Blackboard** (<http://rankexploits.com/musings/>) has a running series on how well the IPCC “spaghetti-graph model results” are doing in “projecting” global temperatures since their start. And the results aren’t too good. If you look at

<http://rankexploits.com/musings/2009/how-far-off-are-the-ar4-aogcms/>

you’ll see that this mix that isn’t “projecting” too well includes two versions of CSIRO’s model.

So, in my opinion, one could consider taking any other projection based on this CSIRO modelling effort (for instance such as droughts, flooding rains and sea levels rises) with the proverbial grain (at least) of salt

for some leading examples, from which one might conclude that:-

**The science of AGW is definitely not settled - nor should it be, as (to use the quote attributed to Professor Scott of the University of Natal) "There is no such thing as the status quo - there is only the status fluctatus"**

**There seems a strong possibility that much of the current projected catastrophic global warming is an artefact of measurement and calculation errors**

**These Vegetation Management Acts may well need retrospective amendment with regard to their greenhouse gas ambitions, and, if so, will compensation be paid?**

(I have given an abbreviated outline in this section, which could be expanded if necessary)

### **13. Personal Stress**

As well as the items listed above there is the very important consideration of the levels of personal and family stress which result from the Vegetation Management Acts various applications.

And for me there is an additional stress - that of having to put my time, training and knowledge into reports such as this. I do not regret doing this with the training and knowledge, and view it as making a contribution, but the time is a diversion from my mainstream activities these days and thus an additional cost.

### **14. Bibliography**

Beale, I.F. (1973) Tree density effects on yields of herbage and tree components in south west Queensland mulga (*Acacia aneura* F. Muell.) scrub. *Tropical Grasslands*, **7**, 135-142.

Beale, I.F. (1999) South West Natural Resource Management Group Vegetation Management Forum Charleville, August 1999

Beale, I. (2004). Tree and shrub thickening in Murweh Shire. Report to the Productivity Commission. Productivity Commission Inquiry Report: Impacts of Native Vegetation and Biodiversity Regulations No. 29. (Accessed 01 March 2010)

Burrows, W.H. (2002) Harry Stobbs Memorial Lecture 2002. Seeing the wood(land) for the trees – An individual perspective of Queensland woodland studies (1965-2005). *Tropical Grasslands* **36**: 202-217.

Burrows, W.H. (2005a) Sorting fact from fiction - questionable 'science' and 'management' that underpin Queensland's Vegetation Management Act [transcript of a talk given to Property Rights Australia, Rockhampton Public Meeting – October 2005]. (Copy attached)

Burrows, W.H. (2005b). Re: “Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland (Version 3.1 – 2005)” (Copy attached).

Davidson, A. et al (2006). Native Vegetation: public conservation on private land. Cost of foregone rangelands development in southern and western Queensland. ABARE Research Report 06.13. 51pp.

Johnston, P.W., McKeon, G.M. and Day, K.A. (1996a). Objective "safe" grazing capacities for south-west Queensland Australia: development of a model for individual properties. *The Rangeland Journal* **18** (2): 244-58.

Johnston, P.W., Tannock, P.R. and Beale, I.F. (1996b). Objective “safe” grazing capacities for south-west Queensland Australia: model application and evaluation. *The Rangelands Journal* **18**(2): 259-269

Kenny, G., Beale, I.F. and Flynn, M. (2004). Submission No. 171. Property Rights Australia.

Productivity Commission Inquiry Report: Impacts of Native Vegetation and Biodiversity Regulations No. 29. (Accessed 01 March 2010)

MacDonald, N. (Pers. Comm.). THE R.A.S. SCHEME RASPBERRY

Marohasy, J. (2005). Mapping Salinity: What a Mess.

<http://www.jennifermarohasy.com/blog/archives/000871.html> (Viewed 4th March 2010).

Neldner, V.J., Wilson, B. A., Thompson, E.J. and Dillewaard, H.A. (2005) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 3.1. Updated September 2005. Queensland Herbarium, Environmental Protection Agency, Brisbane. 128 pp.

Salinity Management Handbook (1997). Qld. Department of Natural Resources.

Westoby, M. (1980) Elements of a theory of rangelands not at equilibrium. *Israel Journal of Botany* **28**: 169-194.

Westoby, M., Walker, B. and Noy-Meir, I. (1989) Opportunistic management of rangelands not at equilibrium. *Journal of Range Management* **42**: 266-274.