Respondent No: 560
Login: Anonymous
Email: n/a

Responded At: Jul 13, 2018 13:48:12 pm
Last Seen: Jul 13, 2018 13:48:12 pm
IP Address: n/a

Q1. **First name** Robert

Q2. **Last name** Bertram

Q3. **Phone** [redacted]

Q4. **Mobile** not answered

Q5. **Email** [redacted]

Q6. **Postcode** [redacted]

Q7. **Country** Australia

Q8. **Stakeholder type** Individual

Q9. **Stakeholder type - Other**

not answered

Q10. **Stakeholder type - Staff**

not answered

Q11. **Organisation name** not answered

Q12. **What is your preferred method of contact?** Email

Q13. **Would you like to receive further information and updates on IFOA and forestry matters?** Yes

Q14. **Can the EPA make your submission public?** Yes

Q15. **Have you previously engaged with the EPA on forestry issues?** Yes

Q16. **What parts of the draft Coastal IFOA are most important to you? Why?**

It is all important because it demonstrates the NSW government's contempt for the environment.

Q17. **What parts of the draft Coastal IFOA do you think have a positive outcome on the management of environmental values or the production of sustainable timber? Why?**

None of it, because the environment is declining.

Q18. **What parts of the draft Coastal IFOA do you think have a negative outcome on the management of environmental values or the production of sustainable timber? Why?**

All of it because of the belief that the environment is not rapidly declining

Q19. **What are your views on the effectiveness of the combination of permanent environmental protections at the regional, landscape and operational scales (multi-scale protection)?**

The are not effective because the fundamental requirements for land management are ignored.

Q20. **In your opinion, would the draft Coastal IFOA be effective in managing environmental values and a sustainable timber industry? Why?**

No, because the management ofenviromental values and the timber industry is not based on the National Forest Policy Statement

Q21. **General comments**

Further comment in the attached documents.

Q22. **Attach your supporting documents (Document 1)**

[redacted]

Q23. **Attach your supporting documents (Document 2)**

[redacted]

Q24. **Attach your supporting documents (Document 3)**

[redacted]

Comments on the IFOA remake

Since the first IFOA was implemented the NSW Scientific Committee has implicated forest die-back in the decline of koalas on the NSW south coast (NSW Scientific Committee, 2007) and listed forest die-back associated with Bell-miners, as a key threatening process (NSW Scientific Committee, 2008).

While the negative impacts associated these forms of die-back extend across tenures, there is no evidence to suggest the NSW government takes them seriously. Rather, the claims of ecologically sustainable management, in production forest or reserves, totally ignore die-back, as if it has nothing to do with forest management.

The proposal to continue the RFAs and current management for another twenty years is both dangerous and reckless.

Soils

The current and proposed approach to soils is arguably the greatest misrepresentation of facts and science perpetuated generally by the NSW government and particularly by the EPA.

It is well known that the release of soil landscape mapping, prior to the current IFOA , was delayed until after the Environment Protection Licence was implemented. The outcome means the Forestry Corporation is not required to either consider or account for real soil science. Rather, the EPA requires the use of less scientific information (Murphy et al, 1998) and allows the Forestry Corporation to test for soil dispersion at locations where sodium has been 'washed' from the soil. (Attachments 1 and 2).

Hence, Forestry is able to change credible science, develop its own bizarre ideas about forest health and prosecute members of the public who disagree.

When sub-soils disperse it is due to the effects of water, coupled with a reduction of soil inputs due to long term forest mis-management. Disturbance associated with logging and burning occurs in addition to 'natural' land degradation.

The notion that anyone can assess 'soil fertility' just by looking is unrealistic. For example the following quotes come from the Harvesting Plans for Cpt 3064 in Bodalla State Forest, approved for logging in 2005 and 2012.

> 2005
> **Resource Unit 1:** Site height 25-30 metres. Mature dominated stand with 30% of basal area within 50-70 cm dbhob, 60% within the 30-50cm dbhob and 10% of the basal area less than 30cm dbhob. Dry understorey with low to moderate site productivity. Maximum utilisation, STS heavy is recommended to remove mature to over-mature trees and provide release of younger trees and promote regeneration.
> **Resource Unit 2:** Site height 25 metres. Mature to overmature dominated stand with 25% of basal area within 50-70cm dbhob, 45% of stems within 30-50cm dbhob and 30% of the basal area less than 30cm dbhob. Frequent canopy openings along ridge tops with dry understorey. Poor site productivity. STS heavy is recommended so to remove commercially viable trees and encourage regeneration where possible.
>
> 2012

Resource Unit 1: Uneven aged mature to over mature and moderately stocked (BA range 26-30 m2/ha). These stands have limited future growth potential The condition of these stands can be described as being poor to average, with the remnant overstorey in very poor timber condition and advanced growth average and showing average vigour and form.
Resource Unit 2: Highly variable uneven aged across the unit areas of more intensive logging are mostly stands of regeneration with scattered patches over mature trees thoughout them The condition of these stands can be descrtibed as average to good, with the remnant overstorey in very poor timber condition and regrowth advanced growth average and showing good vigour and form.

According to the first quote Resource unit 1 has 'low to moderate site productivity', whereas Resource unit 2 has 'poor site productivity'. However, the second quote suggests Resource unit 2 'advanced growth average and showing average vigour and form', whereas regrowth in Resource unit 1 is only average.

Added to concerns about reducing soil fertility are previously unidentified areas of 'non eucalypt forest', in the aforementioned compartment and generally in the Southern and Eden regions.

Timber Estimates

The proposal that the same timber quotas are suitable for the next 20 years is unbelievable. However it shares the same degree of credibility as Forestry Corporation claims, as indicated in the following estimates, also from Cpt 3064 in Bodalla State Forest.

Cpt 3064 Harvesting plan - 2005

Native forest Cpt	**Est yield/ha**	**Est total volume**
Quota logs (HQL)	3m³/ha	600m³
High Quality Small	1m3/ha	250m3
Salvage logs	3m³/ha	600m³
Pulp logs	21t/ha (18m3/ha)	4100t (3600m3)
Poles/Piles/Girders	0m³/ha	0m³
TOTAL	25m³/ha	**5050m 3**

Cpt 3064 Harvesting plan - 2012

	CPT 3064
Event ID	14809
Gross area (ha)	435
Net area (ha)	357
Quota logs (HQL)	4m3/ha
High Quality Small	2m3/ha
Salvage	4m3/ha
Pulp	20t/ha (17m3/ha)
Estimated Total Yield (m3/ha)	27
Estimated Total Volume (m3)	5609

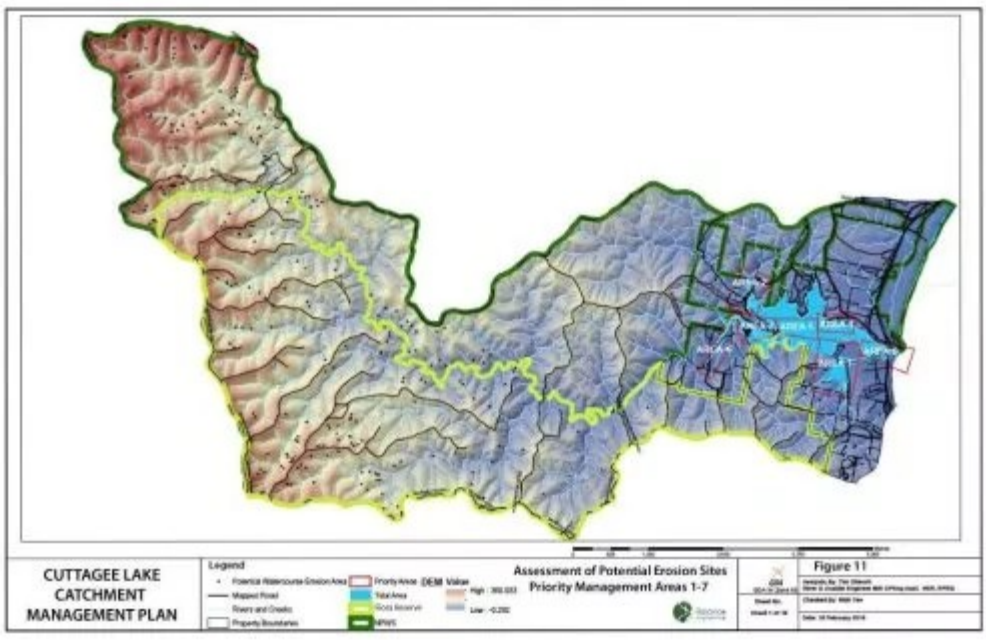
The difference between the estimates is that the first table is an estimate of yields when the whole compartment was proposed for logging. According to the second (2012) Harvesting Plan 3,512 m3 were removed, during light selective logging from Resource Unit 2 during the 2005 operations. The

compartment net area for the first operation was 347 ha, although this rose to 357 ha for the second operation, despite the inclusion of 13.7 ha of ‘non eucalypt forest’.

Exactly how much of the estimated 207ha net area of resource unit 1 was logged is not clear. However, the image below suggests not all of the resource unit was subjected to logging.

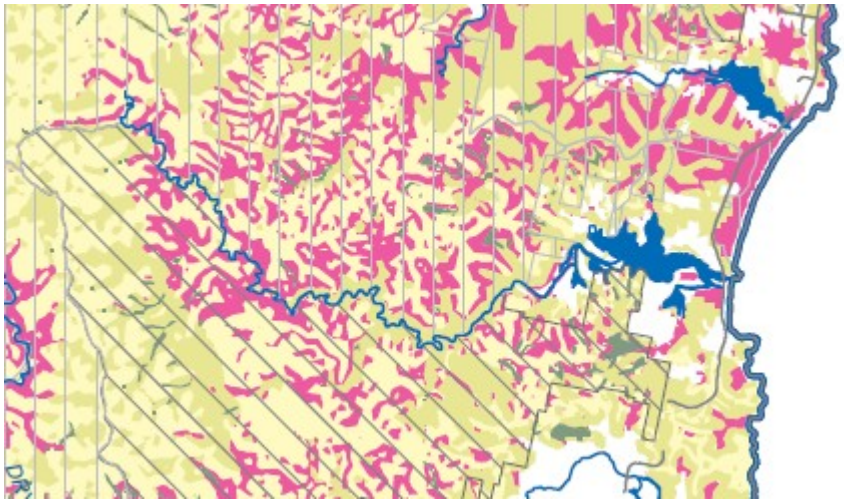
Die-back

The following map indicates potential erosion sites in the Cuttagee catchment in the Bega Valley Shire.



Approximately 92% of the catchment is forested land managed managed by the NSW state government. According to one source (Jurskis & Turner 2002) Bell-miner associated die-back can be found in all of the coastal catchments in the Bega Valley Shire

The next map indicates forests within the catchment that are described as having a predisposition to decline.



EDEN REGION
PREDISPOSITION TO FOREST DECLINE

Predisposition
- High - Veg
- High/Low
- Low
- Non Euc
- Plantation

- Waterbody
- NPWS Estate
- Forests NSW Estate

- Highway
- Road
- River/Creek

The following photo was taken a few weeks ago and shows dead and dying vegetation on the southern edge of Cuttagee lake.

According to Bega Valley Shire Council -

> " . . . Cuttagee Lake is an Intermittently Closed and Open Lake or Lagoon or better known as an ICOLL.
> ICOLLs are unique coastal lakes which alternate between periods of an open and closed entrance states and fluctuating water levels.
> Cuttagee has been closed for some months now and the water level has been elevated in the lake.
> While an ICOLL's fringing vegetation communities are generally very resilient to changing water levels and salt water intrusion, periods of prolonged closures and high water levels can at times lead to some die back.
> This is all part of the natural cycle of dynamic coastal lakes, and while some vegetation may be lost during closure periods, there are also many positive implications.
> By allowing the lake to reach higher water levels, fringing wetlands and marsh environments become inundated which is an important part of the lake's natural processes.
> It also kills many foreshore weeds which are not as resilient as the native riparian vegetation.
> Council has in place a formalised Entrance Management Policy for Cuttagee Lake - for more information visit Council's website."

Unfortunately the explanation for the death of lake side vegetation is not consistent with the facts. While the lake has been closed the water levels have not been elevated.

The EPA needs to produce the science to explain why the environment is rapidly declining and demonstrate this decline is not associated with soils and their management.

References

Attachment 1- Comments on the Murrah Flora Reserves Draft Final Working Plan (2018)

Attachment 2 – Supplementary comments on the proposed federal listing of koalas as a Vulnerable species (2011)

Forests New South Wales (2008) *Eden region forests predisposition to forest decline.* Forests New South Wales PO Box 273, Eden, NSW 2551, Australia

Jurskis, V. and Turner, J. (2002) *Eucalypt dieback in eastern Australia: a simple model*. State Forests of NSW, PO Box 273, Eden, NSW 2551, Australia

Murphy, C; Fogarty, P; and Ryan, P. (1998) *Soil Regolith Stability Classification for State forests in Eastern NSW* – ISSN 1324-6860

NSW Scientific Committee (2007) Koala, Phascolarctos cinereus, population occupying the coastal sub-catchments between Dignam's Creek and Wapengo Lagoon near Bega in south-eastern New South Wales -rejection of endangered population listing
http://www.environment.nsw.gov.au/committee/finaldeterminations2004to2007.htm

NSW Scientific Committee (2008) Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners - key threatening process listing
http://www.environment.nsw.gov.au/committee/finaldeterminations2008to2010.htm

Comments on the Murrah Flora Reserves Draft Final Working Plan

Table of Contents

Preface

The adaptive approach proposed in the final draft assumes a capacity to learn from experience. Unfortunately the general community have little information to demonstrate the NSW government has learnt much about koalas, or their requirements, in the seven years since the $3.87 million 'Corridors and core habitat for koalas on the NSW Far South Coast' and the $5.6 million 'Foundations for River Recovery and Return of Koalas to the Bega Valley' projects received federal funding.

Rather, the final draft suggests forest condition or 'health' is 'complex' issue and passive monitoring is proposed. The final draft appears to imply that there is no common or causal factor linking the " . . . degradation of browse quality (Lawler et al. 1997) and defoliation (Jaggers 2004)" with wide spread eucalyptus die-back.

Continued used of broad acre fire is proposed, without evidence it will reduce the potential for wildfire and seemingly in the fixed belief that soil fertility cannot and has not reduced on any tenure since the European invasion.

These comments attempt to highlight some of the misconceptions around the claims of ecologically sustainable forest management and despite the uncertainties, proposes active adaptive management for the last endemic koalas in the South East Corner Bioregion.

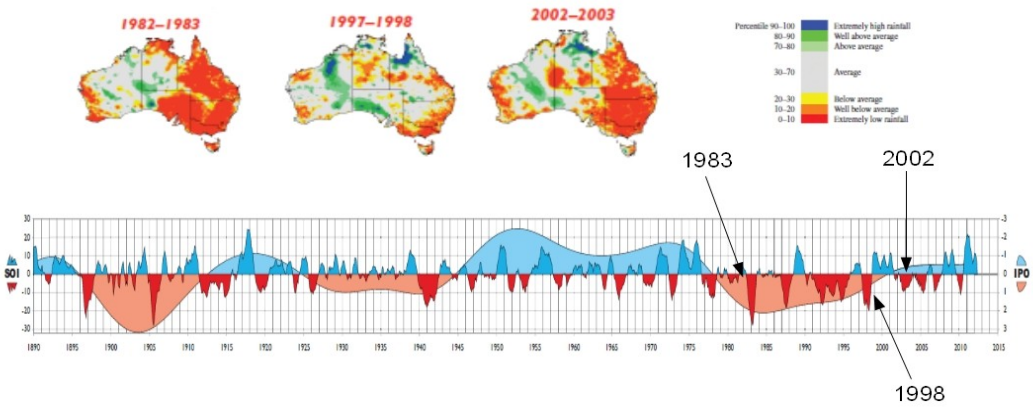
Climate

" . . . *Climate change, particularly drought and rising temperatures, has been a hitherto hidden factor that has been a major driver of the decline of the koala in the Eden region*." (Lunney et al 2014)

The final draft indicates temperatures in South East and Tablelands Region have been increasing since about 1960. Hence changes in temperatures are unlikely to have been major driver leading to the loss of habitat capable of supporting higher density koala populations.

Similarly, rainfall given its generally high variability, is unlikely to have been a factor leading to the loss of habitat that previously supported higher density koala populations.

Historically, El nino and La nina events, respectively associated with below average and above average rainfall, have had the greatest impact on the weather. These events are modified by the Pacific Decadal Oscillation (PDO), as indicated in the graphic below.



Recent El nino episodes – drought and dieback

" . . . *A PDO phase (positive or negative values) lasts for approximately 20 years. Research has shown that during periods when the PDO is positive, El Niño and La Niña impacts on Australian rainfall tend to be weaker. When the PDO is negative those impacts are likely to be stronger. In other words, the PDO accentuated the low rainfall influence of the recent El Niño.*

The PDO was defined as positive from 1977 to 1998–99; it appears that it has since changed phase to negative.

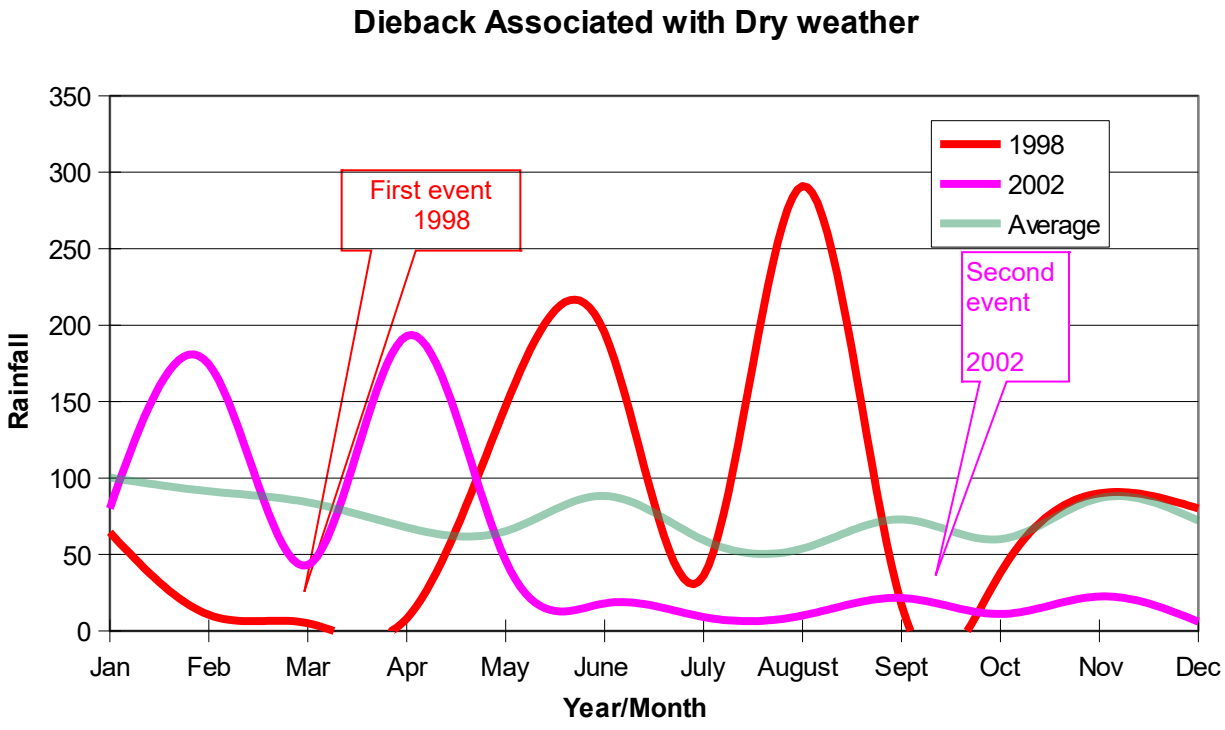
Records show there were several El Niño events during the most recent positive PDO phase. The 1982–83 drought was a very strong event with strong impacts in eastern Australia. A moderate El Niño event in 1987–88 did not result in a severe drought. The 1991–95 El Niño lasted for some time, but did not have particularly strong impacts. Most recently, the 1997–98 El Niño was a strong event, but had only moderate impacts.

*The moderate El Niño event of 2002–03 was the first to occur during the current negative phase of the PDO and, as we experienced, the impacts were amongst the most severe in a century. While the PDO remains negative, it is possible that another El Niño event could bring the same severe results". (*Commissioner For Sustainability And The Environment 2004)

Despite the strong impacts from the drought during 1982-83, forests did not show signs of die-back. However, moving forward to 1997-98, during the same PDO negative phase, forests in the South East Corner Bioregion (SECB) turned brown for the first time since European occupation.

The following chart provides rainfall data, recorded at the Murrah, for the years 1998 and 2002.

Total rainfall for 1998 (982 mm) was far greater than 2002 (634 mm), although the short dry period in the former year was during summer. However, forest decline (Jaggers 2004), associated defoliation and tree mortality were evident during both years.



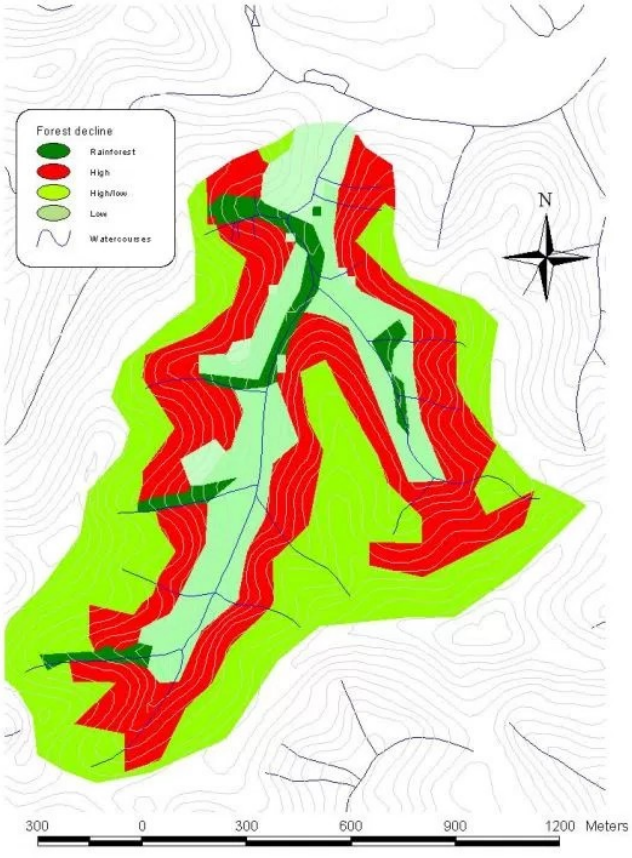
A rational explanation for this decline is a reduction in soil Water Holding Capacity (WHC), due to dispersion, in the years following the 1982 drought. Soil erosion is generally associated with surface water run-off. The volume of surface water, called Hortonian flow, is dependent either rainfall intensity, when the volume of rain exceeds the infiltration capacity of the soils. Or when the soils become saturated, so additional rainfall cannot be absorbed and runs off the soil surface.

In the flora reserves, when soils are saturated, water in the soil flows over the less permeable sedimentary rocks and eventually returns to the surface, where it joins the Hortonian flow prior to entering watercourses. The potential negative impacts on soils from erosion and dispersion are greatly increased with prolonged heavy rainfall.

Heavy rainfall is generally agreed to have an intensity of 7.6 mm of rain per hour or greater. For example in March 1997, 246 mm mm of rain was recorded at the Murrah over a 24 hour period. The average intensity, 10.25mm per hour, significantly exceeded the heavy rainfall definition. However, during that 24 hour period downpours of 83mm and 43mm per hour were also recorded.

The graphic below illustrates the forest decline categories (Jaggers 2004) for floristic assemblages (Keith and Bedward 1999) for a small catchment in the flora reserves.

On ridges, terraces and upper slopes (bright green) is ‘Type 32: coastal dry shrub forest’, classified as having a High/Low probability of decline. Down slope (red), where sub surface water flows are greater, is ‘Type 34: coastal gully shrub forest’, classified as having a High probability of decline. At the lowest elevations (light and dark green) are respectively ‘Type 13: hinterland wet fern forest’ and ‘Type 6: coastal warm temperate rainforest’.



The former (Type 13) is classified as have a low probability of decline, however these areas are also subject to the key threatening process, Bell Minor Associated Dieback (BMAD), probably associated with aluminium toxicity, and are being overtaken by Water vine (*Cissus hypoglauca*). Rainforest is not classified although it too is being overtaken by Water vine.

Geology and Soils

The final draft correctly identifies the dominant geology of the reserves as sedimentary rocks from the Ordovician period. These parent materials are also among those with the highest nutrient content in the Eden region (Kelly & Turner 1978).

However, the availability of these nutrients is limited because of the soils low to very low Cation Exchange Capacity (CEC) (Tulau 1996).

Prior to 1996, when most of the logging took place in the flora reserves, the then Environment Pollution Licence for native forest logging required an estimate of potential soil loss, using the Universal Soil Loss Equation (USLE).

The USLE employs the following equation:

$$A=RxKxLSxCxP$$

Where: A is rate of soil loss in tonnes/hectare/year

R is a factor for rainfall erosivity

K is a factor for soil erodibility

LS is a factor for slope length and gradient

C is a factor for ground cover management

P is a factor for management

In the case of Compartments 2180 and 2181 in Mumbulla State Forest (SFNSW 1994), an estimated 60% or 71 hectares of the area approved for integrated logging had slopes ranging from 15- 25 degrees. Maximum distances for cross bank drainage on tracks was 30 metres for areas with slopes 15-20 degrees and 20 metres for slopes of 20 to 25 degrees.

However, the Harvesting Plan employed an average slope length of 10 metres and a weighted slope of 15 degrees. Hence estimated soil loss was 132.8 tonnes per hectare. The following equation is based on a 22 degree (40%) average slope and a 30 metre distance for cross bank drainage.

A= 3257 x 0.02 x 4.98 x 0.45 x1

A = 202.8 tonnes per hectare

The point being that small changes to the equation factors particularly R, that does not account for storms or south coast lows, along with K, generally underestimated in sedimentary geologies, or LS, can have a significant influence on the product.

With regard to the C factor, it is generally accepted that all soils subject to logging and the post logging or 'regeneration burn' are disturbed. Removing the C factor increases State Forests soil loss estimate to 236.1 tonnes per hectare and the product of the latter equation to 324.4 tonnes per hectare.

Under the current Environment Protection Licence erosion still occurs but there is no requirement to estimate soil loss. Rather, Forestry Corporation are required to determine if soils are dispersible.

" . . . *The interaction in water of the clay sized particles in aggregates can largely determine the structural stability of the soil. When an unstable soil becomes wet, the fine particles react as individuals and are readily eroded from the profile. Because of their fine nature, once they are entrained they tend to remain in suspension and this can causes serious turbidity problems in waterways for considerable periods following storm events*." (NSW EPA, 1999)

While the EPA appears to confuse erosion with dispersion, soil landscape mapping (Tulau, 1996) found all profiles of the Murrah soil landscape are dispersible and evidence from catchments in the reserves demonstrates that turbidity problems in waterways, are not constrained to storm events.

" . . . *It has been shown (Turner et al. 1978) that clear relationships exist between soil nutrient status and the species composition of coastal eucalypt forests; that is, soil nutrient status delineates forest communities. Further, Lambert and Turner (1983) found species with high tissue nutrient concentrations in these eucalypt forests to be located on soils of relatively high nutrient status. It would therefore appear probable that, during logging, relatively higher quantities of nutrients could be removed from the more fertile sites*." (Turner and Lambert, 1986)

While FCNSW are required to identify dispersible soils in pre-logging surveys, in most cases they are not identified due to the methods employed (Brown, B., 2012). On the other hand, the NPWS are not required to identify any soil limitations and neither forest management agency is required to have an understanding of soil formation processes.

Hence the final draft does not identify soil loss and dispersion as the major threat to koalas and there is no reference to managing and mitigating this threat.

Sustainable management of soils has been a low priority and secondary to work 'on tree growth and productivity' (Tulau, 1996). A recent example is a study titled 'North Coast Residues' (NSW DPI, 2017). The following quote is from chapter 5 titled "Extraction of biomass for bioenergy from NSW North Coast regrowth native forests: impacts on nutrient availability".

" . . . Calcium is relatively inert physiologically and may be accumulated in plants well in excess of requirement [15]. Whereas the distribution of Ca is largely extracellular, K is the most abundant cation within plant cells and has many physiological roles. Its loss may be more significant than Ca. However, nutrients such as potassium and magnesium are considered to be always in surplus in forests, irrespective of management regimes, due to input from rainfall[1],thus their loss due to harvest activities represent less of a concern." (NSW DPI, 2017)

While Calcium '*may be accumulated in plants well in excess of requirement'*, this outcome suggests alkaline soils (ie, derived from limestone). There is no evidence to demonstrate an excess of Calcium (Ca) in soils on the NSW coast generally and the Murrah Flora Reserves in particular.

Rather the evidence confirms soils are Ca deficient and this deficiency is the major factor influencing soil dispersion.

The suggestion that the distribution of Ca is 'largely extracellular' in trees neglects the fact that this nutrient is a major constituent and building block of cell walls. It is most likely that a deficiency of Calcium will have negative impacts on soils and on tree growth, as identified in the listing of 'Lowland Grassy Woodland in the South East Corner bioregion'.

" . . . *Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. At some sites, mature trees may exceed 40m, although regrowth stands may be shorter than 10m.*" (NSW Scientific Committee, 2011)

Previous research on the issue of nutrient loss due to past, along with current and proposed public forest management support the fact that critical soil nutrients are being depleted.

" . . . removals of Ca and B due to harvesting and burning represent a substantial proportion of exchangeable Ca and extractable B in the soil, and there is a potential risk that serious depletion of these nutrients may limit future long-term productivity of these forest ecosystems. High intensity burning of logging residues in these mixed species eucalypt forests should be avoided wherever possible." (Hopmans, Stewart & Flinn, 1993)

Similarly, the apparent changes to species mix in the reserves, appear to confirm a reduction in soil fertility.

" . . . Very good sites include E. nitens, E. elata, E. viminalis and E. smithii. On poorer sites, species such as E. sieberi, E. globoidea, E. consideniana, Angophora floribunda with Casuarina littoralis dominate and the very poorest sites include E. sieberi with C. littoralis and A.floribunda." (Turner and Lambert 1986)

To date there has been no credible attempt to ascertain the degree to which soils, in production forests, National Parks or reserves have been depleted. According to the 'North Coast Residues' report -

" . . . *A comprehensive nutrient budget analysis would consider long-term dynamics of losses (including any losses due to post-harvest regeneration burns) and inputs (e.g. via rainfall), which was outside the scope of this study. Regeneration burns oxidise much of the harvest slash and litter, and some nutrients (particularly N) are lost from the system by volatilisation and the convection of particulate matter. Where the regeneration burn is most intense, organic matter within a centimetre or more of the soil surface is also oxidised[1]. Losses of up to 200 kg /ha of N due to burning are typical for forest soils[16]. However, in contrast to native forests in Southern Australia, for the North Coast the area of forest in post-harvest burns is low, and where burnings are carried out they are of low-intensity."* (NSW DPI, 2017)

This and the former DPI quote have several references that are not included in the report. However, one is thought to be the research paper 'Nutrient inputs from rainfall in NSW'. According to the paper -

" . . . The primary objective of the program was to quantify temporal and spatial variation associated with chemical composition and nutrient inputs in rainfall as possible sources of nutrients for forests. In particular, the aim of this program was to quantify the long-term significance of nutrient inputs from rainfall in terms of forest nutrition and wood production sustainability." (Turner, Lambert & Knott, 1986)

The following table provides data from this research for one of the rainfall stations in the South East Corner Bioregion, at Mogo. There are some concerns with the information. For example, wetfall and dryfall were mixed, raising concerns that pH measurements may be biased (Bridgman et. al. 1988).

Station	Mean weighted average pH	Median conductivity	Mean Annual Calcium input (kg ha^{-1} yr^{-1})	Mean Annual Magnesium input (kg ha^{-1} yr^{-1})	Mean Annual Potassium input (kg ha^{-1} yr^{-1})	Mean Annual Sodium input (kg ha^{-1} yr^{-1})	Mean Annual Chloride input (kg ha^{-1} yr^{-1}	Mean Annual Sulphate -sulpher input (kg ha^{-1} yr^{-1}	Mean Annual Phosphate-phosphorus input (kg ha^{-1} yr^{-1}	Mean Annual Nitrate-nitrogen input (kg ha^{-1} yr^{-1}	Difference vs Total Cations
Mogo	4.6	51.5	4.2	4.27	9.38	33	34.9	0.89	0.028	0.18	-28.6

With regard to Ca, there were four other stations in the Bioregion where Ca inputs ranged from 1.8 kg ha^{-1} yr^{-1} near Eden to the highest, 4.2 kg ha^{-1} yr^{-1} at Mogo.

The following table provides an approximation of Ca in above ground biomass where an idealised tree and a small area (30 sq/meters) of surrounding litter weigh 1 tonne. The percentages of Ca are averages from the 'hubs' referred to in the North Coast Residues report.

	Bark	Branch	Leaves	Wood	Litter	Totals
Weight (kg.)	150	400	50	350	50	1000
% Ca	0.9 [1]	0.5 [1]	0.45 [1]	0.04 [1]	0.6 [1]	
Ca (kg.)	1.35	2	0.22	0.14	0.31	4.02

([1] NSW DPI, 2017)

In this example Ca constitutes 0.402 % of the total above ground biomass, presumably excluding large woody debris on the forest floor.

In the case of Compartments 2180 and 2181 in Mumbulla State Forest (SFNSW, 1994), an estimated 89 hectares were logged with an estimated volume of 9,500 tonnes of wood to be removed, including sawlogs and pulplogs. The following table employs the previous proportions, based on an average timber removal of 106.74 tonnes per hectare from the compartments.

	Bark	Branch	Leaves	Wood	Litter	Totals
Weight (tonnes)	45.5	121.35	15.5	106.74	16.4 [2]	305.3
Ca%	0.9	0.5	0.45	0.04	0.6	
Ca (tonnes)	0.4095	0.6068	0.0698	0.0427	.0984	1.2271

([2] Price et al., 2015)

If it is assumed that the Ca removed from the compartments in wood (42.7 kg per hectare) is the only loss from the operation, the replacement time, from an input of 4.2 kg of Ca per hectare per annum, it would take 10.17 years to replace the Ca. At the lower rainfall input figure of 1.8 kg per hectare per year, 23.72 years would be required to replace the Ca.

However, if it is assumed that in addition to wood removed, all of the logging debris and litter are consumed by the post logging fire, the combined loss from bark, branches, leaves, wood and litter equals 1.23 tonnes of Ca per hectare. The amount would take 292.86 years to replace from rainfall given an input of 4.2 kg of a hectare per annum. At a rainfall input rate of 1.8 kg per annum the Ca replacement time is 683.33 years.

In dense stands of 40 year old black forest oak, accumulated fine fuel can exceed 50 tonnes per hectare (pers obs). Based on a notional 0.6% of this litter being Ca, a potential loss from fire of 300 kg per hectare is possible. This amount of Ca would take 71.43 years to replace from rainfall given an input of 4.2 kg of a hectare per annum. At a rainfall input rate of 1.8 kg per annum the Ca replacement time is 166.76 years.

A comprehensive nutrient budget analysis would also consider inputs including Sodium, that counters the positive influence Ca has on soils.

The NSW Department of Primary Industries points to soil pH and Cation Exchange Capacity as useful indicators of soil fertility. (DPI: https://www.dpi.nsw.gov.au/agriculture/soils/structure/cec)

" *Soil pH is important for CEC because as pH increases (becomes less acid), the number of negative charges on the colloids increase, thereby increasing CEC*."

The DPI also suggests " . . . *Clay has a great capacity to attract and hold cations because of its chemical structure. However, CEC varies according to the type of clay. It is highest in montmorillonite clay, found in chocolate soils and black puggy alluvials. It is lowest in heavily weathered kaolinite clay, found in krasnozem soils, and slightly higher in the less weathered illite clay. Low CEC values can be improved by adding organic matter*"

The evidence indicates that native marsupial species, many of which have become extinct or greatly reduced in numbers and range, played the largest role adding organic matter to the soil. There is also some limited evidence suggesting soil pH may have reduced since Soil Landscape Mapping was undertaken (Tulau, 1996). This reduction may also be partly attributed to a lack organic matter being dug into the soils. As the clays breakdown aluminium is produced and it moves downslope.

It is difficult to avoid the conclusion that soil degradation and loss is factor in both a reduction in koala habitat and the poor regeneration and growth of preferred feed tree species in the SECB.

Fire

" . . . Fire was an integral part of 'cleaning up Country' [opening up the mid storey by reducing fuel loads] over the thousands of years of Aboriginal land management. Fires were lit for many reasons: to make travelling easier; to protect sacred areas; to protect food resources from later

fires; to clear around camp sites; to signal to others; and to fulfil spiritual and cultural obligations. These burning practices had the effect of promoting suitable habitats for a range of different plants and animals, and have shaped ecosystems including the dry sclerophyll forests of south eastern Australia. There were also areas which were not burnt, including areas around sacred sites and rainforest. (OEH 2014)"

In the final draft the words in brackets '*opening up the mid storey by reducing fuel loads',* have been added to this quote from the Plan of Management for Yuin Bangguri (Mountain) Parks. Removed from the quote are the references, of note because there appears to be no reference to 'mid storey' in the first reference.

Rather, the Australian Heritage Commission paper indicates -

" . . . The knowledgeable use of fire depends on detailed knowledge of soils, land forms, surface and underground water, and types of vegetation, as well as time of year, time of day, and type of wind. April Bright, in her detailed discussion of fire, speaks of big winds and slow winds, hot burns and cool burns. She notes that different combinations are appropriate for different land forms and different times of year. . . . As the land lost its Aboriginal productivity, settlers with an eye to the future moved on in search of new fields and greater profits. They left behind battered ecosystems which would never regain their first fertility, but would gradually stabilise as drought forced the remaining settlers to withdraw their stock or fallow their fields." (Rose D. 1996)

The second missing reference in the final draft (Gott B. 2005) relates to the sentence ". . . *These burning practices had the effect of promoting suitable habitats for a range of different plants and animals, and have shaped ecosystems including the dry sclerophyll forests of south eastern Australia."*

In an article (Salleh, A. 2005), published on the Australian Broadcasting Corporation's Science Online website, Dr Gott is quoted as saying ". . . *studies like hers may be useful in helping to preserve biodiversity in areas that have not so far been irreversibly changed from pre-European settlement*." The article also indicates " . . . *Referring to some contemporary "gung ho" advocates of burning, Gott says it does not necessarily follow that just because Aboriginal people once regularly burned, we should today. . . . The Aborigines didn't just burn anything."*

Previous studies (Price et al. 2015) found fuel reduction burning did not provide leverage over wildfire in the SECB. At the information day held at Tanja (13 Jan 2018) a paper titled 'Is there an inherent conflict in managing fire for people and conservation' was on display.

According to this paper Price et al. " . . . *did not consider the extensive logging in the bioregion that would have had a substantial influence on the nature of fuel loads. In addition, the bioregion had very few years in which wildfire occurred. While our study considered a smaller spatial domain than Price et al. (2015b), our results suggests leverage is possible in this region as fuel treatments played a role in reducing wildfire size."* (Bentley and Penman 2017)

Unfortunately, there is no evidence provided in the paper to confirm the nature of fuel loads in the reserve has been adequately considered. Rather there appears to be a reliance on state wide guidelines for burning in particular the "*Guidelines for ecologically sustainable fire management"* (Kenny et al 2004).

On the issue of local management guidelines states -

" . . . *These guidelines are indicative only and are based on broad, generalised communities. For the purposes of local management, the process used to produce these guidelines can be applied to local species lists utilising the fire response databases. Local expert knowledge should be used to guide interpretation of appropriate management procedures. Where threatened species have conflicting fire regime requirements, a combination of ecological information and management priorities should be used to determine the appropriate fire management approach in any given area."*

Models of this kind capture the salient relationships between key variables and indicate possible responses. In doing this, they simplify or do not attempt to deal with much of the variation in key factors that may occur in reality (Gill 2001). This does not mean that such predictive tools are invalid or useless. It does mean that they have to be used with caution and with due regard for the domains of key variables on which they are based (Gill 2001).

No information is provided in the final draft to demonstrate leverage has been achieved by broad acre prescribed burning, either in the reserve or adjacent National Parks. However, extensive burns have been undertaken in Kooraban National Park and it appears koala numbers in the park have further declined.

The following photo, taken after recent burning in the flora reserve, is confirmation that much of the vertical fuel remains and it is 'cured' (McCormack 2002) . In addition the once thick ground cover, previously bound together by the actions of various fungi, has been largely eliminated.

In the process, rather than a notional 32.8 tonnes of CO2 per hectare sent into the atmosphere from undisturbed forests. The fire is likely to produce in excess of 142 tonnes of CO2 per hectare. So every 100 hectares burned equates to the annual CO2 output from 747.4 people average Australians.

Coupled with remaining cured vertical fuel loads, the new litter is loose, dry and arguably more likely to aid in progressing a fire, under 'blow-up' conditions.

However, the paper does suggest " . . . *Additional complementary strategies beyond landscape fuel reductions are needed to reduce impact from exposure in the event of a wildfire.*" (Bentley and Penman 2017)

The following photo shows the outcome, in an area logged in 1980, of physical fuel reduction to manage vertical fuel loads. The fuel reduction was undertaken within 20 metres of a ridge line access road to a Voluntary Conservation Agreement area, adjacent to the flora reserve.

In this case the area was logged and subsequently burned in a ‘back-burn’ lit to extinguish a fire that emanated from a burning bark heap some kilometres to the south west (Lunney & Moon 1988). According to the logging history, (ibid), public forests adjacent to area were logged in 1979 and the fire occurred in late November 1980.

While there are apparently no records for areas logged on private land, the areas indicated as being logged on public land appear not to represent all the areas logged or reflect an accurate time for the logging. On the left and foreground in the photo below are the remains of an unburnt bark dump, further up-slope in what was ‘Type 32: coastal dry shrub forest’ (Keith and Bedward 1999).

Growing in the foreground and toward a peak in the bark dump is Water vine. On the right of the phototare two small trees, a Sweet pittosporum (*Pittosporum undulatum*) and a Blue olive-berry (*Elaeocarpus reticulatis*). None of these species are associated with coastal dry shrub forest, rather they are associated with Type 6 – Coastal warm temperate rainforest.

A small proportion of the vertical fuel loads, in the area subject to physical fuel reduction, were small dead trees (<100 mm DBH). These consisted mostly of Silver-top ash, but with a few Black forest oak, Stringy barks and Iron barks. These trees were removed first and employing slow pyrolysis, produced 450 litres of Biochar. The two largest trees are both dead stringy-barks, that were retained.

The char was broadcast at an initial rate of 0.5 litres per square metre across the fuel reduction area (700 m^3). This material adds carbon to the soil and has a pH of 8.5 that may assist in reducing soil acidity and increasing biological activitiy. The remaining vertical fuels, all Black forest oak, were mostly removed and the needles and small branches placed on top of the char.

Larger branches and stems from the area, approximately 4.5 m^3, have been cut and stacked for drying and future biochar production and firewood respectively. In addition to Biochar, slow pyrolysis of woody biomass produces Syngas, suitable for direct application as a fuel for heating, cooking or power generation. The process also produces 'wood oil' that, when refined, produces a distillate, suitable for use in diesel powered motors.

As indicated in the final draft, the unauthorised felling of large dead trees for firewood collection is an ongoing issue. However, a reasonable person may form the opinion that it is hypocritical for management to burn these and many other trees, across vast areas and seemingly based on the notion that there are no negative impacts.

There are over 200 km of roads in and around the flora reserves, including Sindels Road, not referred to in the final draft, in the Mumbulla section. A 20 metre physical fuel reduction buffer along these roads totals 800 hectares. On the assumption that half of the forests were logged 40 years ago the potential volume of black forest oak is around 25,500 m^3.

A continuous flow slow pyrolysis pilot demonstration facility in North Sydney, with a capacity of 300kg per hour (7.2 tonnes per day), runs a 200kW electric generator and produces Biochar. The potential volume from half of the road length in the reserves alone, is sufficient to run such a facility for 10 years. A mix of faster burning Silver-top ash and slow burning Black forest oak is an ideal fuel wood combination.

Physical fuel reduction, if properly managed, greatly reduces the release of climate change gases, maintains soil cover and soil formation process. It has the capacity to generate employment and facilitate the move away from fossil fuelled transport.

A suitable facility would also provide the opportunity for land holders to exchange wet woody-biomass for either Biochar or dry firewood. It may also generate sufficient funds to adequately police the removal of firewood from the reserves.

Encroachments

“. . . The Governments recognise the unique nature of Australia's biota and that the natural inter-relationship between native flora and fauna is essential for the health of the forest ecosystem. Accordingly, they will manage for the conservation of all species of Australia's indigenous forest fauna and flora throughout those species' ranges, and they will maintain the native forest cover where a reduction in this cover would compromise regional conservation objectives, consistent with ecologically sustainable management.” NATIONAL FOREST POLICY STATEMENT - A NEW FOCUS FOR AUSTRALIA'S FORESTS (1994)

One of the ‘encroachments’ in the flora reserve is thought to be the feral predator exclusion fence in the Murrah River catchment. While the initial thought was to constrain the exclusion fence to private land. Based on advise received from Earth Sanctuaries, to fence a sub catchment of the Murrah river, an approach was made to State Forests to ascertain its interest in the proposal.

In a response, dated March 1995, then regional manager for State Forests Mr C. Nicholson, indicated State Forests was most interested in what he described as an ‘exciting proposal’. Based on this positive response, much time was spent on costing the proposal and securing further support from various parties, including Merrimans Land Council.

That achieved, a second approach was made to State Forests requesting a letter of support for the exclosure, in order to apply for funding from the Natural Heritage Trust. The response from then State forests south- east regional manager Mr C. Brown, was attached to the funding application along with other letters of support. The funding application was approved and State Forests were notified in January 1999. In response to this notification, dated 15 February 1999, State Forests indicated “ . . . This matter is currently under review, therefore I will contact you on completion and advise you accordingly”.

The project proponents were not informed as to the outcomes of State Forests review.

The first year of what was to be a two year project was consistent with State Forests koala management plan (SF 1997), required as part of the 1994 Environmental Impact Statement. This involved planting several hundred forest red gum (*E.tereticornis)* along the flats on private land adjacent to the Murrah River.

While the initial growth in several locations was promising, overtime the negative impacts of low soil fertility, changed hydrology, floods, sand deposition and later dry weather took a significant toll. Consequently an outcome from this aspect of the project was an understanding that there are very few locations capable of supporting the long term growth of this species.

In the few locations where trees have survived, as indicated in the photo below, of an 18 year old forest red gum with a DBH of 300 mm and over 10 metres in height, reasonable growth has been achieved.

The second year of the project involved the construction of the exclosure, meetings were held with State Forests staff and the project proponents were advised to apply for an occupation permit for the area. The application for an occupation permit was submitted early in 2001 and State Forests eventually acknowledged receipt of the application in May.

During this time construction of the fence continued on private property within the creek catchment.

At this point there was general agreement among the projects proponents that an outcome State Forests still unseen review, was to delay the project as much as possible. Hence a decision was made to continue the construction of the fence along the private property access roads up to Knights Creek road.

Another meeting was held with State Forests staff in December 2001 and the location of the fence along Knights Creek road agreed. Given the delays to the project, the proponents were required to apply for an extension to the project's timetable and this extension was approved.

In the absence of any information from State Forests and on the basis that it could provide an occupation permit for the area, in March 2002, preparations were made to complete the fence along Knights Creek road.

In April 20002 State Forests requested that these preparations cease until a formal agreement was made on the following issues.

- A Memorandum of Understanding is developed detailing the obligations of the parties
- Access is arranged for future logging and hazard reduction burning operations
- Access to Telstra for maintenance/repair to communication cables

- Responsibility for future maintenance of the fence
- Location of the fence in relation to roads/trails and drainage structures etc
- Adequacy of the fence design in relation to windfall of surrounding trees etc.

No Memorandum of Understanding was put forward and there have been no issues regarding the following four bullet points, over the past 16 years. With regard to the adequacy of the fence design, it takes a large tree falling on it to bring the fence to the ground. Experience with large fallen trees has found repair requires removing the tree, the potential repair or replacement of up to two fence droppers, restraining supporting wires and stretching the netting back into place.

In May the project paid State Forests $231 to progress the occupation permit application.

On the first of July 2002, a team from "Bushcare' undertook an assessment of the project. The team visited one property and clearly had preconceived ideas about the project. The assessment was not provided to the project proponents.

Further correspondence from State Forests was received in August suggesting ' . . . your application is proceeding through the relevant channels. As you are well aware there are many issues that need to be addressed ie. Native Land Title, State Forests issues etc, and when all of these have been addressed I will notify you of the outcome of the application."

This was followed by more State Forests correspondence in October, requesting confirmation about where the fence was located. Another request to the NHT to extend the project was refused.

In June 2003 State Forests finally provided its conditions to the occupation permit application. The conditions seemed tailor made to undermine the effectiveness of the management practices required for the project's success and excessively weighted the balance of power in State Forests' favour. The permit did not include permission to build the fence and many of the conditions were unacceptable to the projects proponents.

Later that year State Forests suggested that its management is ' . . . in line with the principles of ecologically sustainable management and the Integrated Forestry Operations Approvals".

If public forest management was in line with ecologically sustainable management, the main issue the project proposed to address, dieback, would not exist and the project would not have been proposed in the first place. The Integrated Forestry Operations Approvals cannot be reconciled with the principles of ecologically sustainable management.

In 2004 there was a visit from then DPI, Principal Auditor for Compliance Mr. Rey Caldwell. Mr. Caldwell referred to the (still unseen) Bushcare assessment. He was surprised that the assessment had not been passed onto the project proponents and relayed some of the claims made in it. All of the claims were refuted. After checking the books and other information, Mr Caldwell was a little bewildered as to how the Bushcare assessment had been carried out and the conclusions it had drawn. He advised taking several others actions, although it was clear the State Forests position would not change.

Later in the year then Director, South Branch, Environment Protection and Regulation Division, Department of Environment and Conservation, offered the following suggestion.

" . . . The Koala is listed as Vulnerable in NSW and DEC is continuing its recovery efforts to address the threats to koalas in southeast NSW. Current projects include establishing a monitoring program for Koalas across reserved lands in southeast NSW, implementing initiatives to encourage the retention and rehabilitation of koala of koala habitat on private land and integrated feral predator control across public and private land in the region. These actions together with your own Murrah/Bunga Koala recovery project will contribute to the statewide koala recovery program in NSW.

As a consequence of funding being approved for the 'Corridors and core habitat for koalas on the NSW Far South Coast' project, the area identified for reservation from logging included all of the public forest within the exclosure area.

Consequently, another approach was made to the Forestry Corporation NSW. In response, current manager Mr D. Tuan, placed great reliance on the discredited 'Bushcare' assessment and confirmed FCNSW's desire to control management of the reserved areas.

Key Threatening Processes

The final draft acknowledges 'High frequency fire' is listed as a key threatening process under the Threatened Species Conservation Act (NSW SC 2000). Missing from the final draft are other applicable threatening processes namely the 'Removal of dead wood and dead trees' (NSW SC 2003) , 'Loss of hollow-bearing trees' (NSW SC 2007) Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners (NSW SC 2008).

On the latter threat, Bell Miners first occupied areas of the flora reserves and adjacent private forests in 1994. Concerns about the defoliation and death trees was and remains, the major factor that led to funding for the Murrah river exclosure.

Moving forward to 2005, a national forum on Bell Miner Associated Dieback (BMAD), was held in Lismore, on the NSW north coast. Guest speaker at the forum was Dr Bernard Bormann who talked about adaptive management in the context of a paper titled *'Options forestry – Acting on Uncertainty'* (Bormann & Kiester 2004).

Consequently, a working group was convened and a strategy formed that, " . . . aims to:

• provide a focus for the BMAD Working Group in communicating the significance of dieback and raising public and government awareness of the issue;

• promote research into the causes of dieback;

• support trial and implementation of control measures;

• assist in the coordination of on-ground control programs;

• develop dieback risk assessment criteria and risk management guidelines; and

• lobby for the resources to deal with and prevent dieback effectively"

While it is understood that trails have been undertaken to reduce the weed Lantana, apparently on the basis that it supports nesting opportunities for Bell Miners. There are no results of field trials on the BMAD Working Group website. (http://www.bmad.com.au/index.html)

Currently there appears to be no evidence demonstrating progress has been made understanding or addressing the issue, over the past 14 years.

It is also understood that the most recent koala surveys in the flora reserves have been recording locations where BMAD is evident. This information is not to be found in the final draft. However, the proposal that black forest oak is suppressing the growth of preferred koala feed species, seems similar to the notion that lantana is the cause of BMAD.

Koalas

As indicated in the final draft -

" . . . Koalas are also known to select feed trees based on leaf chemistry. The koala surveys have been recording leaf chemistry of occupied and unoccupied trees. The results show, however, that there are no measurable differences in leaf chemistry between trees at occupied and unoccupied sites. It is concluded that the range and density of the koala population is not significantly limited by leaf chemistry and therefore it is possible that the existing low-density koala population is capable of expanding to unoccupied forest if threats are controlled (Stalenberg et al. 2014)*."*

While the range and density of the koala population may not be limited by leaf chemistry, in the flora reserves. The outcomes of the research raises the question of whether measurable differences in leaf chemistry (Lawler et al. 1997), has been the major factor behind the recent extinction of endemic koalas in the Southeast Forest NP or indeed, the rest of the SECB.

It is not known if similar research was undertaken in the Southeast Forest NP, prior to the koala trans-location proposal. However, there is some certainty that a poor understanding of the threats, leads to management that cannot control them.

*" . . . Tree species composition in koala diet was not consistent with tree availability in sites but had a significant positive relationship with species' foliar moisture content. Neither the nitrogen / total phenolics ratio nor the moisture*nitrogen / total phenolics ratio can explain the food tree species preference of koalas."* (Wu, McAlpine and Seabrook 2012)

Although the quote above is based on research undertaken in south west Queensland, the finding that " . . . *Only leaf moisture was significantly correlated with koala food tree species preference."* seems likely to be a consistent feature of koala feed tree preferences.

While it is possible that currently unoccupied areas suitable for koalas may exist in the flora reserves, the greatest remaining threat, the weather, particularly dry weather (NSW SC 2007), cannot be controlled. Rather management for koalas needs to acknowledge the underlying issues and take a proactive approach that increases the forests capacity to withstand threats.

Pest animals

The long-term fox and wild dog baiting programs have definitely led to an increase in common native species. However, a downside from the loss of dogs is the loss of a fox predator. Similarly, a reduction in fox numbers reduces the number of cat predators.

Another downside of the program is the increasing daily road kill along the Tathra to Bermagui road, that provides an ongoing food source, particularly for foxes.

Numbers of rabbits, foxes preferred food, appear to have declined, although long term populations, at the camping ground in Bermagui for example, provide a permanent pool from which the species can disperse. Such rabbit populations may also be sustaining core populations of foxes.

Foxes are regularly observed in the flora reserves and it can only be deduced that a proportion of the animals may not take 1080 baits. A fuller understanding of fox behaviour in and around the flora reserves may provide greater insights into the species.

Of course if foxes were totally eliminated, it is likely cat numbers would increase. However, recent technological developments have greatly increased the potential to greatly reduce or eradicate cats.

Conclusions and Suggestions

" . . . *But what if the uncertainty surrounding the outcomes of major forest policies is actually much larger than has been apparent—or admitted to? What if overconfidence in decisions has led to unintended consequences, in what Gunderson (1999a) called "spurious certitude"? These questions motivate us to reassess types, extents, and drivers of uncertainties; to think about how different uncertainties might be combined to better understand how much confidence in a policy is justified; and to develop a new approach to forestry research and management—an approach that seeks advantage in highly uncertain situations rather than shying away from them.*" (Bormann & Kiester 2004).

Whether it is State Forest or National Park, the fundamental basis of public forest management in NSW is a high degree of unwavering confidence that the inter-relationship between native flora and fauna is not essential for the health of the forest ecosystem.

Similarly, there is a high degree of confidence that unintended consequences, particularly dieback, in it various forms, are not associated with past and proposed forest management. This spurious certitude is not compatible with true adaptive management.

The evidence points to reducing soil fertility as the major threat to koalas. Management that attempts to grow trees without consideration of this threat, or the fact that mature trees are dying or otherwise declining in vigour, totally misses the point.

The NSW government should -

1. Support long term community efforts to re-introduce native species, essential for forest ecosystem health, into protected areas. Should the animals breed more protected areas should be established, to aid with future broadscale reintroductions.
2. Develop more certainty around efforts to eliminate foxes and cats, to assist the broad scale return of native species.
3. The first and foremost objectives of fire management should be the protection of life, property and community assets. As a review of environmental factors is not required,

rigorous assessments should undertake in areas subjected to broadacre burning to quantify nutrient loss. This information should be made publicly available.

4. Support the aspirations of the Gulaga and Biamanga management boards to reintroduce experimental traditional fire management practices, where it may provide protection for life, property and community assets.
5. Should there be a fire the protection of fire fighters is paramount. The development of a small, local, carbon neutral industry, based on the physical removal of woody biomass in the oldest regrowth stands along roads, tracks and trails, requires support from the community and all levels of government.

Attempts were made, during the writing of these comments to ascertain the references not referred to in the North Coast Residues (DPI 2017) and attain a copy of the document '*Logging records for Mumbulla, Tanja, Murrah and Bermagui State Forests, Reserve numbers 187, 188, 189 and 190'* (FCNSW 2016), referred to in the final draft.

Neither of these attempts were successful.

Robert Bertram

January 2018

References:

Bentley, P. Penman, T. 2017 *Is there an inherent conflict in managing fire for people and conservation?* International Journal of Wildland Fire 26(6) 455-468 https://doi.org/10.1071/WF16150

Bormann, B. Kiester A. 2004 *Options forestry – Acting on Uncertainty.* Journal of Forestry 102(4): 22–27.

Bridgman, H., Rothwell, R., Tio, Peng-Hin., Pang Way, C. 1988 *The Hunter Region (Australia) Acid Rain Project*. Bulletin American Meterological Society. http://journals.ametsoc.org/doi/abs/10.1175/1520-0477%281988%29069%3C0266%3ATHRARP%3E2.0.CO%3B2

Brown, B. 2012. *Logging the South East Forests*, ABC South East, http://www.abc.net.au/local/stories/2011/12/12/3389180.htm

Commissioner for Sustainability and the Environment (2004) *Why Was The 2003 Drought So Bad?* http://reports.envcomm.act.gov.au/SoE2004/Region/Tech/drought.htm

Department of Primary Industries (NSW). 2017 *North Coast Residues: A project undertaken as part of the 2023 North Coast Forestry Project*, https://www.dpi.nsw.gov.au/forestry/north-coast-residues-project

FCNSW 2016, '*Logging records for Mumbulla, Tanja, Murrah and Bermagui State Forests, Reserve numbers 187, 188, 189 and 190*', unpublished records compiled by the Forestry Commission of NSW, Eden.

Gott B. 2005 *Aboriginal Fire Management in South-eastern Australia: aims and frequency.* Journal of Biogeography 32:1203–1208.

Hopmans, P. Stewart, H..Flinn, D. 1993 *Impacts of harvesting on nutrients in a eucalypt ecosystem in southeastern Australia.* Forest Ecology and Management, Volume 59, Issues 1–2, Pages 29-51

Jaggers J. 2004, *Estimating the extent of declining forest in south-east New South Wales*, Research Division, South East Region, State Forests of NSW, Sydney.

Keith DA & Bedward M 1999, Native vegetation of the South East Forests region, Eden, New South Wales, *Cunninghamia* 6(1): 1–218.

Kelly, J. and Turner, J. 1978 *Soil nutrient -vegetation relationships in the Eden area, 1. Soil nutrient survey*'Aust. For. 41: pp 127-34.

Lawler IR,·Foley WJ, Woodrow IE & Cork SJ 1997, *The effects of elevated CO2 atmospheres on the nutritional quality of Eucalyptus foliage and its interaction with soil nutrient and light availability*, *Oecologia* 109: 59–68.

Lunney D & Moon C 1988, 'A*n Ecological View of the History of Logging and Fire in Mumbulla State Forest on the South Coast of New South Wales*', Australia's ever-changing forests: Proceedings of the First National Conference on Australian forest history, University of New South Wales, University College, Australian Defence Force Academy.

Lunney D, Stalenberg E, Santika T & Rhodes JR. 2014, *Extinction in Eden: identifying the role of climate change in the decline of the koala in south-eastern NSW*, *Wildlife Research* 41: 22–34.

McCormick B. 2002 *Bushfires: Is Fuel Reduction Burning the Answer*? Science, Technology, Environment and Resourses Group, Australian Government. https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/CIB/cib0203/03Cib08

NSW Environment Protection Authority. 1999, *Environment Protection Licence, Appendix A – Eden Region*, Schedule 3, Module 3: Soil Dispersibility Assessment.

NSW Scientific Committee. 2000, *Final Determination to List High Frequency Fire Resulting in the Disruption of Life Cycle Processes in Plants and Animals and Loss of Vegetation Structure and Composition as a Key Threatening Process on Schedule 3 of the TSC Act.*

NSW Scientific Committee. 2003, *Final Determination to list Removal of dead wood and dead trees as a Key Threatening Process in Schedule 3 of the Act.*

NSW Scientific Committee (2007) - final determination *Koala, Phascolarctos cinereus, population occupying the coastal sub-catchments between Dignam's Creek and Wapengo Lagoon near Bega in*

south-eastern New South Wales - rejection of endangered population listing. *http://www.environment.nsw.gov.au/determinations/KoalaPhascolarctosCinereusPopulationSENSWRejectionEPL.htm*

NSW Scientific Committee. 2007, *Final Determination to list the loss of hollow bearing trees as a Key Threatening Process in Schedule 3 of the Act* (NSW SC 2007)

NSW Scientific Committee. 2008, *Final Determination to list Forest eucalypt dieback associated with over-abundant psyllids and Bell Miner as a Key Threatening Process in Schedule 3 of the Act.*

NSW Scientific Committee. 2011 *Determination to make a minor amendment to Lowlands Grassy Woodland in the South East Corner Bioregion Part 3 of Schedule 1 of the Threatened Species Conservation Act.*
http://www.environment.nsw.gov.au/determinations/lowlandgrassywoodland36a.htm

OEH. 2014, *Plan of Management Yuin Bangguri (Mountain) Parks incorporating Gulaga National Park and Biamanga National Park*, Office of Environment and Heritage, Sydney.

Price, O. F., Penman, T. D., Bradstock, R. A., Boer, M. M. & Clarke, H. 2015, *Biogeographical variation in the potential effectiveness of prescribed fire in south-eastern Australia*. Journal of Biogeography, 42 (11), 2234-2245.

Rose, D.1996 *Nourishing Terrains: Australian Aboriginal Views of Landscape and Wilderness*, Australian Heritage Commission, Canberra.

Salleh, A. 2005 *Aboriginal fire-farming has deep roots*. ABC Science Online
http://www.abc.net.au/science/news/stories/s1398157.htm

Stalenberg E, Wallis IR, Cunningham RB, Allen C & Foley WJ 2014, *Nutritional Correlates of Koala Persistence in a Low-Density Population*, *PLOS ONE* 9 (12): e113930.

State Forests 1994. *Harvesting Plan for Compartments 2180 and 2181*, Mumbulla State Forest, Narooma District, Eden Native Forest Management Area.

SFNSW (1997), *Koala management plan: Eden Management Area,* contact, Jim Shields, Native Forest Division, State Forests, NSW.

Tulau M. J. 1997. *Soil Landscapes of the Bega-Goalen Point: 1:100,000 Sheet*, map and report by the NSW Department of Land and Water Conservation, Sydney.

Turner J. and Lambert M 1986. *Effects of forest harvesting nutrient removals on soil nutrient reserves*, Forestry Commission of N.S.W, P.O. Box 100, Beecroft, N.S.W., 2119, Australia.

Turner J, Lambert M and Knott J 1986. *Nutrient inputs from rainfall in NSW*, Forest Research and Development Division, State Forests of New South Wales,121-131 Oratava Avenue, West Pennant Hills, 2125 P.O. Box 100, Beecroft 2119 Australia.
https://www.dpi.nsw.gov.au/content/research/areas/resources-research/forest
resources/pubs/Nutrient-Inputs-from-Rainfall-in-NSW-State-Forests.pdf

Wu H, McAlpine C, Seabrook L 2012, *The dietary preferences of koalas, Phascolarctos cinereus, in southwest Queensland*. Australian Zoologist, Volume 36 (1)

The adequacy of soil dispersion testing – a comparison of field test methods.

Introduction.

The requirement to undertake soils dispersion tests as part of pre-logging investigations for the then, Environment Pollution Licence (EPL), was first introduced in late 1995.

Harvesting plans for fourteen compartments (map at Appendix 1) were available and of these only 2 compartments, namely 2051 and 2052 in Murrah State Forest were found to have dispersible soils.

In contrast soil landscape mapping[1] for the compartments indicates they are all located on either the Murrah or Yellow Pinch soil landscapes which, laboratory analysis has found have dispersible soils.

The EPL specifies a single test that must be used to determine soil dispersion however, the regular finding of non-dispersible soils suggests either that the test or its implementation is inadequate.

Soil samples were obtained from Compartment 2001 currently being logged and according to the Harvesting Plan found to have no-dispersible soils.

Methods

The EPL requires the following -

> **STEP 1: Method**
> a. Select three air-dry aggregates from each layer of the soil at whichever site is being tested;
> b. Place approximately 75 millilitres of deionised water in a clean, wide-bottomed container. Place the three aggregates in the container of deionised water, spaced equally around the side. The deionised water must completely cover the aggregate. Do not stir, or otherwise disturb; and
> c. Record the degree to which the soil aggregates have dispersed and/or slaked at 10 minutes and 2 hours from when [they] were placed into the water.

A second field method[2] developed by the Australian Academy of Science (AAS) was also employed, requiring a larger soil sample and the following method -

- From each surface and subsoil sample weigh 100 grams of soil into a clean 600 millilitre glass jar with lid.
- Measure out 500 millilitres rainwater or distilled water to give a 1:5 ratio of soil to water. Making up a ratio of 1:5 soil to water (100 grams of soil and 500 millilitres water).
- Gently pour this water down the side, without disturbing the soil at the bottom.

[1] Tulau, M. (1997) Soil Landscapes of the Bega-Goalen Point 1:100,000 Sheet, Department of Land and Water Conservation, GPO Box 39, Sydney, NSW 2001.
[2] http://www.science.org.au/nova/035/035act01.htm

- Invert the jar slowly and gently once and then return to its original position (avoid any shaking). Then let stand for 4 hours, with no vibrations or bumping.
- Check the suspension above the sediment at the bottom of the jar and score the amount of cloudiness using the photographs for comparison. Make up another soil suspension and repeat the process if unsure.

Two of the samples were taken from 'in situ' soils at 0-100mm (A) and 250mm (B) and a third (C) at approx 400mm from exposed soils in a road cutting. The three samples were air dried for three days prior to testing as indicated in the following image showing from left to right samples B, A and C. At this point aggregates from sample C were the hardest and seemed most cohesive.

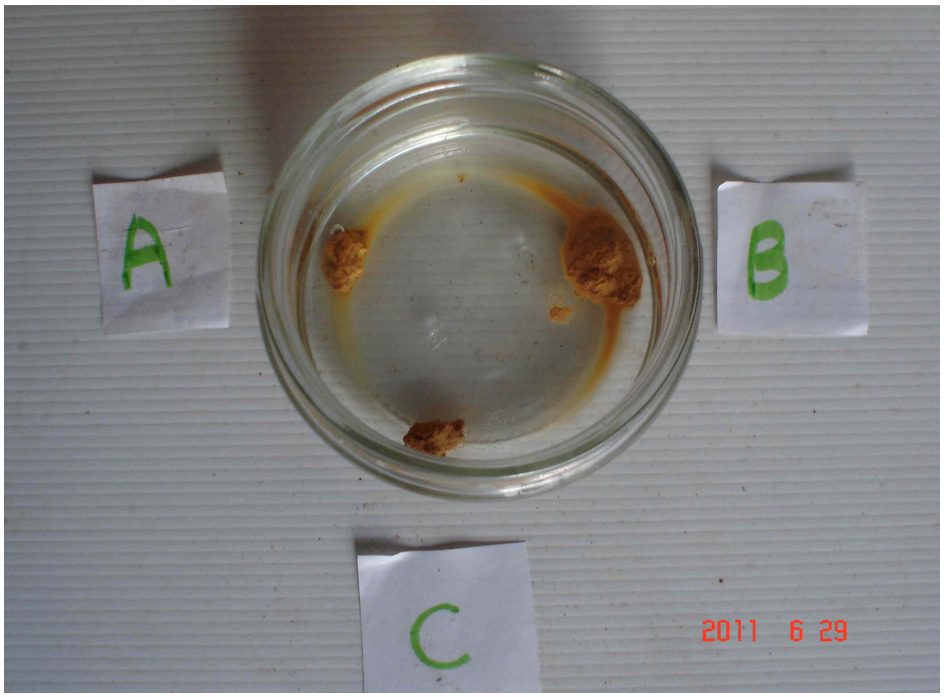
Results

The EPL provides the following rating system for soil dispersion.

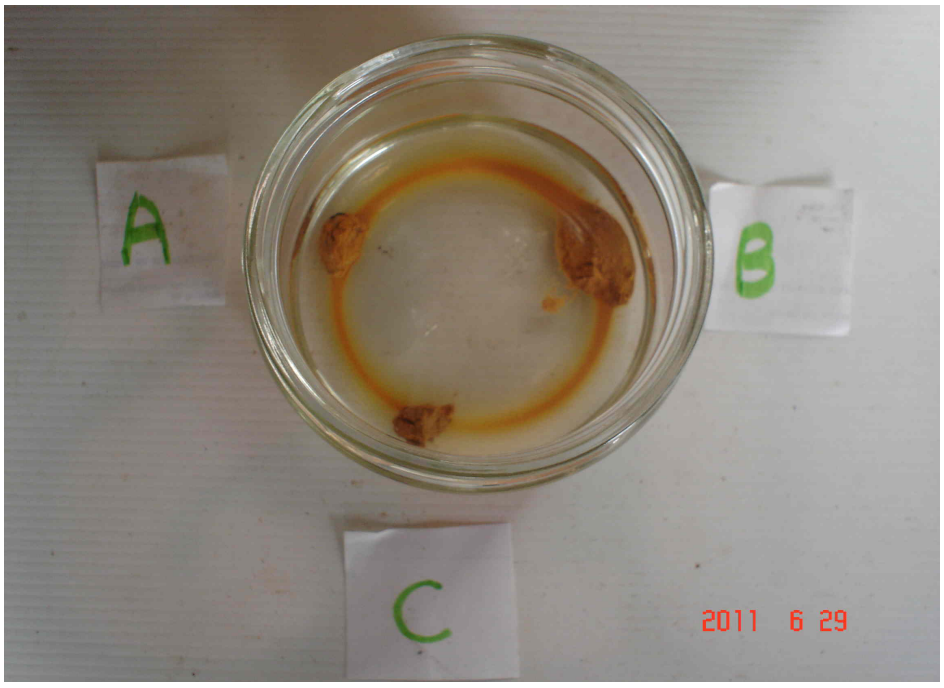
STEP 2: Dispersibility rating
a. Once the behaviour of the soil aggregates has been recorded in accordance with step 1, determine the dispersion rating, as follows:

Score **0** for no dispersion within 2 hours;
Score **1** for slight dispersion within 2 hours;
Score **2** for slight dispersion within 10 minutes or complete dispersion within 2 hours;
Score **3** for strong dispersion within 10 minutes or complete dispersion within 2 hours; or
Score **4** for complete dispersion within 10 minutes.

The following graphic shows the three aggregates ten minutes into the EPL test. At this time sample A scored a 2 and sample B either a 3 or 4.



The next graphic shows the samples at 2 hours, sample A has begun to collapse, sample B has completely dispersed but sample C had only slight slaking.



The AAS provides the following rating system for soil dispersion-

1. Clear or almost clear – not sodic
2. Partly cloudy – medium sodicity
3. Very cloudy – high sodicity

A white plastic spoon or spatula, that reflects light, when placed in the centre of the suspension can help identify the level of turbidity. Estimating turbidity using spatula visibility.

1. Plastic spatula visible – not sodic
2. Plastic spatula partly visible – medium sodicity
3. Plastic spatula not visible – high sodicity

As indicated in the following graphic using this field test found all of the soil samples to be highly sodic and dispersible.

Comment

While it is possible that soil samples gathered by Forests NSW are largely taken from road cuttings, of greater concern is that the negative impacts of sodic and dispersible soils are still not factored into forest management.

The EPL only requires consideration of stream crossings if dispersible soils are located and since the introduction of the dispersion test there has been no advance in understanding the sodic soil issue.

This lack of understanding is a particular concern given the likely association between sodic/dispersible soils and dieback associated with Bell-miners (BMAD) and dry weather and drought (DAD).

Soil sodicity, like salinity, is a significant management issue but the area of land affected by sodicity is far greater than that affected by salinity.

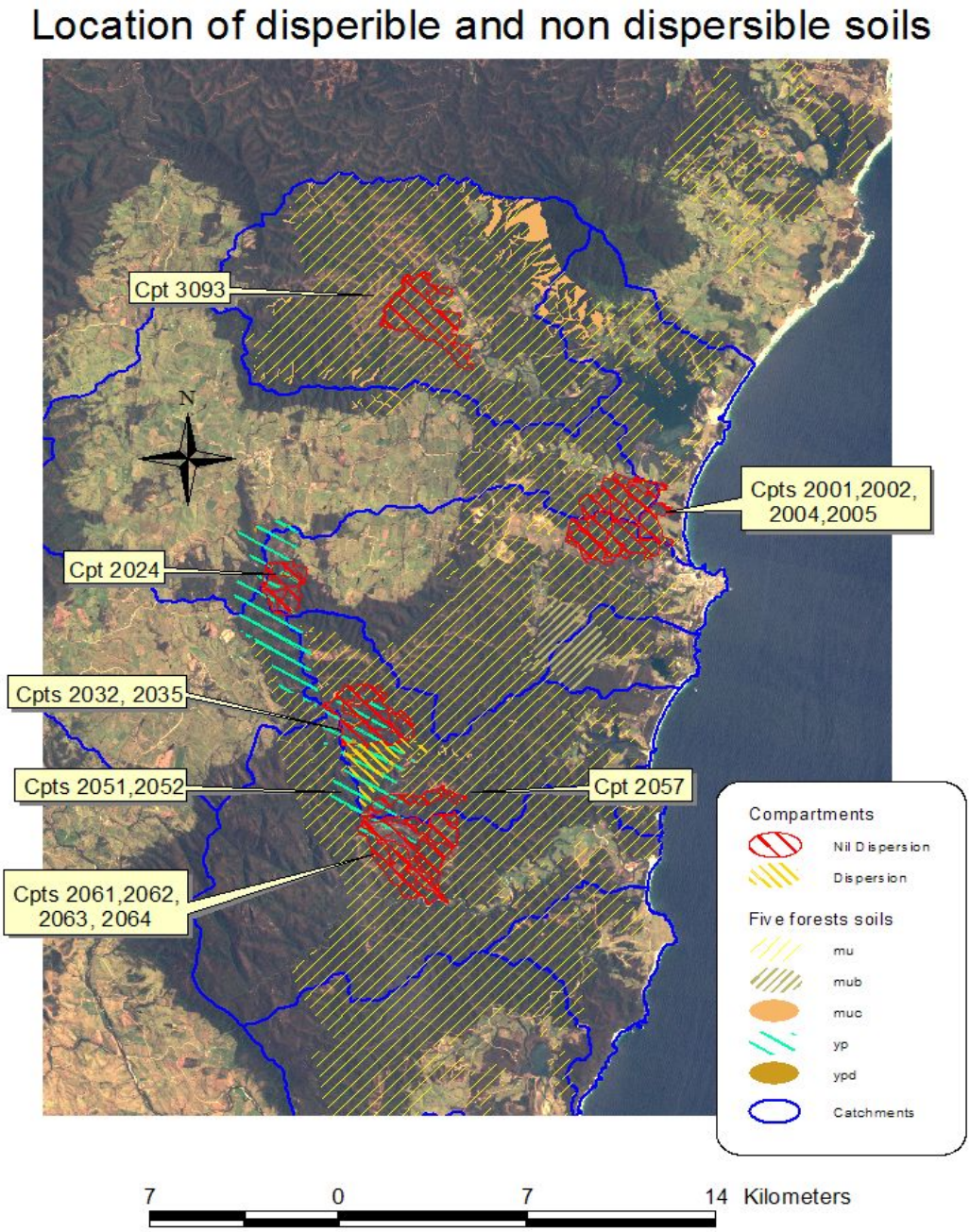
The Regional Forest Agreements are supposed to have ushered in 'adaptive management' however this aspect of the agreements is not legally enforceable. A prescriptive approach that has not changed in 16 years is totally inadequate given the national scale of the problem.

As soils host 80% of biodiversity the failure to adequately consider their limitations confirms that current forest management is unsustainable.

Robert Bertram

3 July 2011

Appendix 1


Location of disperible and non dispersible soils
Cpt 3093
N
Cpts 2001,2002, 2004,2005
Cpt 2024
Cpts 2032, 2035
Cpts 2051,2052
Cpt 2057
Cpts 2061,2062, 2063, 2064
Compartments
Nil Dispersion
Dispersion
Five forests soils
mu
mub
muc
yp
ypd
Catchments
7
0
7
14 Kilometers