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BEACON Submission to Preliminary Assessment Report, Riverina Bioregion Regional Forest Assessment River red gum and other woodland forests

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River Red Gums deserve their reputation as an Australian icon and an integral part of our national identity. They are extensions from our forests, delineating the continent's water arteries into our arid heartland. They provide essential homes, roosts and foods for a plethora of species. Their dappled shade provides a place to rest and contemplate in an arid landscape

The NRC claims that this document fulfils its first term of reference (which it has paraphrased) which was originally:

> *1. Carry out a regional forest assessment of the scientific bioregion:*
>
> *a) for the purposes of section 15 of the Forestry and National Park Estate Act 1998*
>
> *including an assessment of the following: environment and heritage values*
>
> *(including Indigenous heritage), economic and social values, ecologically*
>
> *sustainable forest management, and timber resources; and*
>
> *b) otherwise such that the assessment will also meet the requirements of the*
>
> *Environment Protection and Biodiversity Conservation Act 1999 (C'th).*

Its TOR requires that

> *The Commission should have regard to the following as they relate to the bioregion:*
>
> *• Nationally agreed criteria for a comprehensive, adequate and representative reserve system;*
>
> *• other complementary methodologies for protecting conservation values;*
>
> *• the impacts of drought and climate change on the forests and communities;*
>
> *• opportunities for ongoing and future employment within affected local communities;*
>
> *• appropriate forest management practices in order to promote long term productivity and forest health;*
>
> *• international or intergovernmental obligations, agreements or arrangements;*

- *NSW Government policies, programs and Catchment Action Plans;*
- *opportunities for Indigenous involvement in forest management;*
- *appropriate access for commercial, recreational and community uses; and*
- *the existing science and body of knowledge about the region.*

This submission deals with

1. Nationally agreed criteria for a comprehensive, adequate and representative reserve system;
2. Other complementary methodologies for protecting conservation values;
3. The impacts of drought and climate change on the forests.

In Summary:

1. Nationally agreed criteria for a comprehensive, adequate and representative reserve system

It is claimed (p10) that

> "Previous regional assessments have applied nationally agreed criteria for establishing a comprehensive, adequate and representative reserve system for forests in Australia (JANIS, 1997). Typically these assessments targeted reservation of set percentages of pre-European extent of particular forest ecosystems and vegetation classes, and reserves were designed around old-growth and wilderness areas, and viable habitat values".

The resulting discussion gives the impression that this is not applicable in the Riverina. For example it is claimed that (p10):

> "However, unlike previous assessments these flood-dependent red gum forests have been highly modified by historic water management and silvicultural practices. ... The current extent and condition of forests is a direct result of 75 years of river regulation and 120 years of silviculture."

This is wrong and misleading as large areas of the forests previously assessed were also highly modified by logging and silvicultural practices. Most coastal areas east of the Great Escarpment, and many new reserves contain no substantial areas of oldgrowth or wilderness. The intent of JANIS was that biodiversity, rather than oldgrowth or wildernesss, should take precedence, stating "Providing that all criteria are considered when making the final reserve design, biodiversity should take precedence". The fact that there are not extensive areas of wilderness or old-growth left in the Riverina does not excuse application of the National Forest Policy Statement or the JANIS reserve criteria.

NRC identify that 7.6% of River Red Gum communities in the Riverina are protected, noting (p65):

> The estimated current area of river red gum dominant and co-dominant forest and woodland in the NSW Riverina is 401,000 ha (from Benson et al 2006; Benson 2008). Of this, an estimated 30,400 ha is reserved in National Parks and Nature Reserves.

The NRC has failed its responsibility to properly identify and account for the JANIS reserve criteria, and thus comply with the National Forest Policy Statement. It would seem that the NRC are intent of applying the flexibility provisions built into JANIS without attempting to identify why the required levels of inclusion in "dedicated reserves" is "not possible or practicable ". Indeed the NRC fail to recognise that the JANIS flexibility provisions still require the targets to be fulfilled through other means. It states:

> 4.1.2 Informal Reserves

In situations where it is not possible or practicable to include conservation values into Dedicated Reserves, it is appropriate for areas to be reserved under other secure tenure or management arrangements (e.g., within approved forest management plans). In practice such areas should be set aside specifically for conservation purposes and meet the following principles:

- they are established in approved management plans and managed accordingly;
- there is an opportunity for public comment on changes to reserve boundaries;
- they are able to be accurately identified on maps;
- they are of an area and design sufficient to maintain the values they seek to protect.

Some of these reserves could have flexible boundaries that might change over time to reflect forest dynamics and the effects of climate change, but any changes must satisfy the criteria which exist to protect conservation values.

4.1.3 Values Protected by Prescription

Where the nature of a forest value that is needed to contribute to the CAR reserve system makes inclusion in either Dedicated or Informal Reserves impractical (for example, very rare values, values with fragmented distributions, or values naturally occurring in linear form such as riparian vegetation), then protection may be prescribed in Codes of Practice or Management Plans and where appropriate, identified on maps.

- These prescriptions should meet the following principles:
- there is an opportunity for public comment on proposed changes;
- they have a sound scientific basis;
- they are adequate to maintain the values they seek to protect.

The NRC needs to comply with the National Forest Policy Statement and faithfully implement the nationally agreed JANIS reserve criteria. The first step in this process requires identification of what is needed to satisfy the criteria.

1.1. Ecosystems

In accordance with the NSW Vegetation Classification, 27 vegetation types occurring on State Forests are identified in Table 4 (along with estimates of their existing, pre-European and reservation extents) and a further 35 occurring in the region are hinted at in Table 5, though not fully identified. These are amalgamated into 17 vegetation groups, and then 12 of these are assessed for reserve adequacy in Table 8. This is a messy, confusing and misleading approach.

The amalgamation of different vegetation types when identifying reserve adequacy masks the real reservation adequacy of the individual types and conservation priorities. For

example “River Red Gum SQ2” is shown as having 3.3% of its original extent reserved, though one of its constituent types (5) has none of it reserved. Similarly “River Red Gum SQ3” is shown as having 9.7% reserved, when its constituent type 9 has none reserved, type 10 has 0.1% reserved and type 8 has 0.3% reserved. This makes Table 8 misleading.

Information on the area of each ecosystem in the Riverina, broken down by tenure, needs to be provided in a single table.

It is also misleading that the report does not identify what the JANIS reserve criteria require. This does not enable the casual reader to appreciate what the national benchmarks are and how the existing reserve status compares to the benchmark.

JANIS (1997) establishes “15% of pre-European distribution ... as a desirable objective”, with “the priority for reservation of a forest ecosystem ... related to how much remains relative to its initial distribution and its vulnerability to threatening processes”, noting:

(1) As a general criterion, 15% of the pre-1750 distribution of each forest ecosystem should be protected in the CAR reserve system with flexibility considerations applied according to regional circumstances, and recognising that as far as possible and practicable, the proportion of Dedicated Reserves should be maximised ...

It is poor process that the report fails to identify ecosystems that are vulnerable in accordance with the JANIS criterion:

(2) Where forest ecosystems are recognised as vulnerable, then at least 60% of their remaining extent should be reserved. A vulnerable forest ecosystem is one which is:

i) approaching a reduction in areal extent of 70% within a bioregional context and which remains subject to threatening processes; or

ii) not depleted but subject to continuing and significant threatening processes which may reduce its extent.

Based on the limited data provided, in accordance with the first criterion (i), and excluding rare and endangered ecosystems, the following ecosystems are vulnerable and require a reservation target of 60% of remaining extent or 15% of original extent, whichever is greater:

Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone

Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains

Inland Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW Southwestern Slopes and Riverina Bioregions

JANIS notes “Vulnerable ecosystems include those where threatening processes have caused significant changes in species composition, loss or significant decline in species that play a major role within the ecosystem, or significant alteration to ecosystem processes”.

It is apparent that River Red Gum dominated communities are particularly vulnerable and subject to ongoing threatening processes. For example it is noted that (p13):

> *Many of the trees are highly stressed, dying or dead, and without a return to a wet period the future of the forests in their current form looks bleak.*
>
> *If the current drought conditions continues in line with the ‘step change’ prediction of climate change, then much of the existing river red gums forests will not persist in their present extent, structure and condition. Many of the most productive red gum forests may revert to a less productive condition. Some currently less productive stands may transition to mixed river red gum and box woodlands or derived scrublands as dryland species begin to dominate.*
>
> *These changes are having, and will continue to have, profound impacts on the ecology of the forest,*

Similarly it is noted (p51):

> *The condition of river red gum within state forests and elsewhere of the Riverina is generally in decline as a result of substantially reduced flows due to river regulation and compounded by climate change. Condition may also be reduced immediately following harvesting, although long term decline in condition has not been linked to forestry activities specifically. ...*
>
> *Forests NSW performed a similar assessment of the health of the NSW Central Murray State Forests (Millewa, Werai and Koondrook areas) in 2005. Most of the 1843 eucalypts assessed on the NSW side of the border were severely stressed (701) or stressed (500). Only 11% were healthy and 1% was dead.*
>
> *...*
>
> *More recently Turner and Kathuria (2008) used satellite imagery techniques to assess forest health condition across 48,000 ha of native river red gum forests in the Gunbower Koondrook Perricoota Icon Site along the NSW – Victorian border. The key findings of this assessment ... that most of the river red gum plots (87%) exhibited either an unhealthy status (<25% of original canopy remaining) or stressed (25-50% of original canopy remaining).*

The future prognosis, due to river and groundwater diversions and climate change is clearly bleak, for example it is noted (p131):

> *There is considerable evidence that due to the ongoing drought, and what is likely to be a step change in rainfall and runoff patterns, that the river red gum forests of the Riverina bioregion are under severe stress.*

It is apparent that based on the information provided communities dominated by River Red Gum satisfy the criteria for vulnerable ecosystems and thus in accordance with part (ii) of the

criterion the following ecosystems are vulnerable and require a reservation target of 60% of remaining extent or 15% of original extent, whichever is greater:

River Red Gum-sedge dominated very tall open forest in frequently flooded sites along major rivers and floodplains in south-western NSW

River Red Gum herbaceous-grassy very tall open forest on inner floodplains in the lower slopes subregion of the NSW South West Slopes Bioregion and the eastern Riverina Bioregion

River Red Gum - Warrego Grass – herbaceous riparian tall open forest mainly in the Riverina Bioregion

River Red Gum - Warrego Grass - Couch Grass riparian tall woodland of the semi-arid (warm) climate zone (Riverina and Murray Darling Depression Bioregions)

River Red Gum - wallaby grass tall woodland on the outer River Red Gum zone mainly in the Riverina Bioregion

River Red Gum - Black Box woodland of the semiarid (warm) climatic zone (mainly Riverina and Murray Darling Depression Bioregions)

River Red Gum - Lignum very tall open forest or woodland on floodplains of semi-arid (warm) climate zone (mainly Riverina and Murray Darling Depression Bioregions)

River Red Gum grass - swamp woodland to open woodland on cowals (lakes) and associated flood channels in central NSW

It is poor process that the report fails to identify ecosystems that are rare and endangered in accordance with JANIS criteria and for which JANIS requires:

(3) All remaining occurrences of rare and endangered forest ecosystems should be reserved or protected by other means as far as is practicable.

Based on the limited data provided, qualifying ecosystems for 100% reservation targets are:

RARE

Slender Cypress Pine - Sugarwood – Western Rosewood open woodland on sandy rises mainly in the Riverina and Murray Darling Depression Bioregions

ENDANGERED

Black Box open woodland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina and Murray Darling Depression

> Weeping Myall open woodland of the Riverina and NSW South-western Slopes Bioregions
>
> White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
>
> Yellow Box - White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South-western Slopes Bioregions

There are also listed endangered ecological communities which should be set a 100% reservation target. On Page 84 it is noted:

> *Of these* [Six Endangered Ecological Communities (EECs)]*, four are known to occur within state forests in the NSW Riverina, including inland grey box woodland, myall woodland, sandhill pine woodland and white box-yellow box- red gum woodland. The distribution of these has been mapped by Forests NSW (Figure 23). The total area of each in State Forest is 450 ha, 140 ha and 2,100 ha, respectively - a total of about 2,700 ha ...*

The presentation of information on ecosystems by NRC is poor, confused and incomplete. There is no attempt to identify the reservation requirements for ecosystems in accordance with JANIS. This precludes any sensible assessment by the public. This shoddy assessment does not accord with NRC's TOR.

1.2. Species

JANIS notes

> Reserves should be designed so that, to the extent practicable, all elements of biodiversity have the opportunity for expression but with particular emphasis on those components of biodiversity that are dependent on reservation for protection.

The NRC does identify a range of listed threatened species occurring in the region, though not all. TSC and EPBC listed threatened species, including 51 fauna species or populations, 18 flora species, 6 terrestrial ecological communities , and 2 aquatic ecological communities. For some of these there is a brief description of some habitat requirements, maps showing known localities at a very broad generic level, and some mention of whether they are known to occur in particular forest blocks. This is a grossly inadequate basis to enable threatened species and the other elements of biodiversity to be responsibly accounted for.

There is a need to comprehensively identify all threatened species occurring in the Riverina, their key habitat requirements, threatening processes and reservation requirements.

While it is right that priority should be threatened species, JANIS identifies that a broader approach is required, including as criteria:

> (5) The reserve system should seek to maximise the area of high quality habitat for all known elements of biodiversity wherever practicable, but with particular reference to:
>
> - the special needs of rare, vulnerable or endangered species;
> - special groups of organisms, for example species with complex habitat requirements, or migratory or mobile species;
> - areas of high species diversity, natural refugia for flora and fauna, and centres of endemism; and
> - those species whose distributions and habitat requirements are not well correlated with any particular forest ecosystem.
>
> (6) Reserves should be large enough to sustain the viability, quality and integrity of populations.

Aside from its half-hearted assessment of threatened species, NRC fail to make any attempt to identify special groups of species, or wildlife corridors, or areas of high species diversity, or natural refugia for flora and fauna, or centres of endemism.

To comply with the JANIS criteria NRC needs to identify wildlife corridors, areas of high species diversity, natural refugia for flora and fauna, and centres of endemism.

One special group of species that should have been considered are hollow nesting species. 400 species of Australian vertebrates use tree holes in Australia, including 17-20% of land birds and 42% of mammals. In general, small hollows in eucalypts, suitable for wildlife such as Feathertail Gliders, will take about one hundred years to form, medium-sized hollows, such as those used by small parrots, will form in two hundred years, whilst the very large hollows, necessary for large cockatoos and owls may take even longer.

There are numerous hollow dependent species in the Riverina, including a variety of owls, cockatoos, parrots, tree-creepers, kingfishers , bats, possums and gliders, including a variety of threatened species such as Powerful Owl, Barking Owl, Pink Cockatoo (omitted by NRC), Superb Parrot, Regent parrot, Turquoise Parrot (omitted by NRC), Brush-tailed phascogale (omitted by NRC) and Squirrel Glider.

The Red Gums provide a disproportionate role in providing hollows for such species across the Riverina landscape.

The suite of species largely reliant upon River Red Gums, and other large eucalypts, for roosting and nesting hollows need to be clearly identified as a special, and vulnerable, suite of species in accordance with the JANIS criteria.

It is recommended that for the Riverina expert workshops be held to identify species of conservation concern, assess their relative reserve priority, identify priority areas for reservation for each species and identify significant wildlife corridors. Workshops will need to held for each group of species (i.e. reptiles, amphibians, nocturnal birds, diurnal birds, bats, arboreal marsupials, terrestrial mammals) and include the leading experts on the species as well as experts with local knowledge.

2. Other complementary methodologies for protecting conservation values

There are still many Red Gums left that predate European settlement of the area (ie over 200 years old) and some are probably 500-1000 years old (Jacobs 1955). This is later recognised (p28) *"Standard prescriptions put in place since the mid 1970s to protect large mature trees have ensured that the NSW Central Murray State Forests retain pre-European age trees and hollow-bearing habitat trees (GHD 2009)".* Such old growth trees deserve special recognition.

In western NSW riverine eucalpt woodland has been identified as supporting the most bird species relative to its extent and thus the most critical ecosystem for maintaining bird diversity. 15 birds that nest in tree hollows and 20 species which nest in trees have decreased in western NSW.

The present generation of hollow bearing trees (mostly large River Red Gums) is being lost at an accelerating rate through death and decay hastened by water diversions, declining rainfalls, and increasing evaporation. Current levels of regeneration are insufficient to replace existing trees. A time bomb is quietly ticking away, for those species requiring live hollow-bearing trees it may have already exploded in many regions.

The poor state of River Red Gums on public lands has been documented by NRC, as shown by the excerpts included in the section of this submission on ecosystems (see above). This loss of old and mature trees is causing a hiatus in the availability of roosting and nesting hollows.

In relation to private property, Commonwealth of Australia (2007) note:

> Estimated rates of loss of paddock trees in south-eastern Australia of up to 40% in 30 years indicate that few paddock trees will survive past the next century if current attrition rates continue (Carruthers and Paton in press). In the south-east of South Australia, paddock tree decline over the next 50 years has been estimated to be as high as 36%, based on authorised clearance records (Carruthers *et al*. 2004) and regional dieback estimates, with 65% of the predicted loss from authorised clearance.
>
> ...
>
> In the medium to long-term the continuing loss of dead hollow-bearing trees, lack of regeneration of future hollow-forming trees and declining health of scattered trees on private land are potentially serious threats. Many nest trees are near the end of their lifespan (Gibbons and Lindenmayer 2002) and there is a landscape-scale cessation of eucalypt regeneration in the sheep-wheat belt of south-eastern Australia (Robinson and Traill 1996, Reid and Landsberg 2000).

2.1. Habitat Tree Retention

Habitat tree retention rates in logging operations on both public and private lands are:

- Removal is prohibited within a specified exclusion zone up to 20m wide
- At least five Habitat trees and five recruitment trees must be retained per hectare in a modified harvesting zone, up to 30m wide, established around and adjacent to certain exclusion zone.
- A minimum of two Habitat trees and two recruitment trees per hectare must be retained across the net harvest area.

For private lands the 20m exclusion zone is only applied to prescribed streams, with this being reduced to 5m of any drainage feature with an incised channel, though *"forest operations must not occur in any wetland other than wetlands that comprise a River Red Gum broad forest type or within 20 metres of any wetland*". The exclusion zone is measured from the mean water level of the Prescribed Stream. The modified harvesting zone is applied within 20–50 metres of any permanent watercourse, water bodies or major wetlands (leaving a gap 5-20m around all drainage features that are not prescribed streams.

The rules appear to be different for public land, NRC citing them as:

> *Along waterbodies - An exclusion zone, a minimum of 20m wide, must be established around and adjacent to each large permanent or semi-permanent waterbody or nominated waterway (stream, runnel, swamp and lagoon). A modified harvesting zone, a minimum of 30m wide, must be established around and adjacent to each exclusion zone … The 20m wide exclusion zone must be measured perpendicular to and from the bank of the waterbody or waterway*

There was no link to where the relevant DECCW Section 120 licences are and they were not able to be located in a web search. Both the public and private logging codes should be identified (for public access) and their adequacy considered in accordance with the National Forest Policy Statement requirements. Based on this example it appears there are significant discrepancies.

It needs to be recognised that the limited protection provided to trees within 50m of some watercourses and some wetlands and the retention of 2 hollow-bearing habitat trees per hectare, with one recruitment tree each, is grossly inadequate to maintain biodiversity, particularly given the increasing death rates. As noted by Smith (2000);

> *Current prescriptions require the maintenance of at least 5 habitat trees per hectare. This is less than 30% of the average stocking of habitat trees in unlogged native forest. Loss of habitat trees is the single greatest cause of biodiversity reduction in logged forests. If all habitat trees in unlogged native forest were fully utilized a 70% reduction in abundance of hollow dependent fauna could be expected in logged forest under current standards. … This finding suggests that current standards for habitat tree retention are inadequate to maintain the natural diversity of hollow*

dependent fauna in logged forests. However, retention of higher densities of habitat trees is likely to significantly reduce timber yields.

Smith (2000) goes on to state;

Hollow dependent birds from surrounding cleared and partially cleared pastures and woodland may congregate in patches of old growth Red Gum along rivers to select and defend nest sites for breeding. Because birds are attracted to remnant Red Gum forests along rivers for long distances competition for tree hollows can be fierce. For this reason the minimum requirement for tree hollows is much higher in Red Gum forest. All habitat trees with obvious large hollows (>10cm entrance diameter and 25 cm depth) should be retained within 60m of watercourses.

Given the declining health of these forests and the overwhelming importance of areas adjacent to water for roosting and nesting of birds and hollow dependent fauna, logging exclusion zones of 60m (measured from the high bank) should be established around and adjacent to each large permanent or semi-permanent waterbody, river, stream, runnel, swamp and lagoon.

Outside the exclusion zones a minimum of 12 hollow-bearing trees should be retained per two hectares. Where this density is not available, twelve trees should be selected from trees with diameters within the largest 30% of the stand. Trees suitable for retention as hollow-bearing trees must be selected from trees with diameters within the largest 30% of the stand, and be living trees with good crown development and minimal butt damage. Retained hollow-bearing trees should represent the range of species that occurs in the area. Hollow-bearing trees must be evenly scattered throughout the net logging area.

The evidence (ie Mackowski 1987, Smith 1999) illustrates that in natural forests there is a natural mortaility rate in the order of 50% of trees between each age classes. With mortality rates increasing with age and declining site quality. This means that in a natural forest in order to retain one tree in an age class, you need to retain at least twice as many trees in the next youngest age class. In a natural forest at least 2 trees are required in the next size class down, then two for each of them need to be retained in the next size class down and then 2 for each of them in the next size class down, and so on.

Processes change in a logged forest as retained trees are freed from competition but also made more vulnerable to damage and windthrow. Retention of only one recruitment tree per hollow-bearing tree is patently inadequate as it assumes there will be no mortality what-so-ever between age classes and fails to account for the succession of age classes required to maintain hollow-bearing trees in perpetuity.

As part of the CRA process an ESFM Biodiversity Workshop was held at Coffs Harbour in August 1998 to review the conservation protocols for fauna (DUAP 1998). There was unanimous agreement that 2 recruitment trees should be retained for every hollow-bearing tree and that marking of retained trees should be permanent (particularly recruitment trees) and the number recorded.

A minimum of 24 recruitment trees should be retained per two hectares. These are trees, which are capable of developing hollows and providing replacements for existing hollow-bearing trees as they die out. Recruitment trees must be healthy trees with good crowns and minimal butt damage, mature and late mature trees (>50 cm dbh or largest available), have or have the potential to develop hollows, represent the range of suitable species that occurs in the area, and be retained scattered throughout the net logging area. Recruitment trees should be permanently marked.

Both NPWS (1999) and Smith (2000) recognise the known importance of standing dead trees as roosts, nests and perches for a variety of animals, and their importance for decomposer organisms and the ecological process which they support. Many of the hollow-dependant birds in the Riverina nest in dead trees, so they will become increasingly important as the numbers of live trees decline. NPWS (1999) require the retention of 10 stags >30 cm dbh per 2ha and Smith (2000) requires the retention of all dead trees with hollows.

Where more than 12 stags >30cm dbh per two hectares occur in the net logging area, a minimum of twelve stags >30 cm dbh should be retained per two hectares of net logging area where it is safe to do so. If there are less then 12 stags per two hectares, then all stags should be retained where it is safe to do so.

2.2. Species specific prescriptions.

Current prescriptions for specific threatened species have been developed over the past 16 years by DECCW, under constant pressure from conservationists and flora and fauna experts to improve them, and strong pressure (particularly political) from Forests NSW and loggers to water them down. During this time DECCW have not undertaken any pre and post logging monitoring to test the efficacy of their prescriptions, and thus have been operating in ignorance, informed by expert opinion and deformed by political pressure. DECCW seem to be driven by the notion that what they don't known won't hurt them, though it is hurting the survival prospects of an array of threatened species. DECCW have no idea if their prescriptions reduce impacts on threatened species to an insignificant level. Expert opinion suggests otherwise. Many of DECCW's prescriptions have now been watered down to such a level that they are likely to be totally ineffectual.

For example, while there are (untested) species specific prescriptions for a variety of threatened species on private land there is no requirement to survey for them, and thus no trigger to implement the prescriptions.

It is also important to recognise that it is not just species listed as threatened that are aversely affected by forestry activities and therefore require ameliorative measures to be applied to lessen logging's impacts upon them.

It is recommended that for the Riverina expert workshops be held to identify species of conservation concern, assess their relative vulnerability to logging activities, identify precautionary interim prescriptions to reduce logging impacts on populations to insignificant levels (i.e. below the threshold for a Species Impact Statement), identify specific performance measures for each prescription, and identify appropriate monitoring programs to assess the efficacy of prescriptions. Workshops will need to held for each group of species (i.e. reptiles, amphibians, nocturnal birds, diurnal birds, bats, arboreal marsupials, terrestrial mammals) and include the leading experts on the species as well as experts with local knowledge.

2.3. Silvicultural Standards in Logging Areas

It is noted (p51):

> *Floodplain Riparian Woodland (EVC 56) occurs in the Victorian Riverina and is a close relative of river red gum types in NSW. Benchmark stands of EVC 56 exhibit the following characteristics:*
>
> *- support about 15 large trees (> 80cm dbh) per hectare*
>
> *- support regenerating red gum saplings*
>
> *- possess a projected canopy cover of about 25%*
>
> *- comprise a total species richness of 23+ taxa (all natives, no weeds), and*
>
> *- support a total length of 300m of fallen logs per hectare (DSE 2004).*
>
> *Any river red gum stand in the Riverina which resembles this structure would be considered to be in good condition.*

Given the declining health of River Red Gums, any stands that satisfy the identified benchmark conditions should be mapped and be priorities for reservation.

For those areas proposed to remain available for logging Smith (2000) goes to great lengths to outline the requirements for a sustainable silvicultural system. Smith (2000) considers that maintenance of uneven-aged forest structure with regrowth, mature and senescent elements is the best way to optimize both wood production and non-wood production objectives simultaneously. He notes:

> *"By maintaining an uneven-aged structure it is possible to sustain wood production and biodiversity values concurrently in the one stand. Biodiversity values are optimized with a higher proportion of senescent stems while wood production is optimized with a higher proportion of mature stems. A balance between biodiversity and wood production objectives is achieved by retaining a small percentage of senescent stems and selecting a minimum stocking of mature stems of high quality to grow into large stems (>70cm) in the late mature stage. Maintenance of uneven-aged structure in combination with low intensity (partial) logging enables most forest fauna species to persist within logged forests (Dunning and Smith 1986, Kavanagh and Webb 1998).*

Florence (1996) notes:

> *"Certainly, the uneven-aged forest offers the best scope for taking into account within the one stand, a range of management objectives. …A greater emphasis on the environmental factor would characterise a more intensive approach to selection practice. Such an approach would require a good ecological appreciation of species patterns and biological process in the forest, seek to achieve near-full production on all sites, and maintain diversity in the composition and structure of the forest.*
>
> *"There will be those who will argue that the concept of intensive selection silviculture in this way is too divorced from the present reality, the priorities of the State, financial constraints, and the availability of experienced field foresters. Nevertheless, thinking on the future of the forests should not be constrained by immediate demands on the forest and current management philosophies. State policies, management objectives and priorities may change as the forests become an increasingly valuable environmental resource, generating a professional responsibility to keep them in near peak silvicultural condition. Moreover, the forests are rich in species providing fine timbers offering combinations of strength, durability and attractiveness. If there are, as expected, higher value markets for them in the future, both domestic and export, the case for more intensive forms of uneven-aged forest management will become stronger."*

Butcher (1994) also recognised the need for maintenance of forest structure as a measure of sustainability:

"ESD (1991) supports these needs in stating that '…to ensure that there is a constant supply of the largest-sized trees required … it is necessary to develop a desired age or size class structure.' (p.38) and 'Monitoring of the forest, and particularly comparison of actual forest structure with predicted structure, is an essential part of sustainable yield management.' (p.39).

"Sustainable yield is therefore more critically related to sustaining a forest structure capable of supplying logs and other values than to the actual continuity of production flows. For example it is critical to continue to grow trees into the mature size classes if large diameter logs or trees with hollows are required, hence there need to be age classes continually contributing to provide the necessary perpetuation. This is most critical for those age/size classes which are hardest to replace, the large mature/senescent forest, or the climax community in a successional forest. Therefore to provide future communities with options forests at the regional level must still contain an appropriate proportion of these components."

Smith (2000) establishes a baseline using data from unlogged or lightly logged stands, which he then normalises (for consistency) and then establishes retention rates according to percentages of regrowth, mature and hollow bearing size classes. Smith (1999) recommended minimum stocking levels for each size class at the following levels:

- *40% of the unlogged average stocking for mature (merchantable) size classes;*
- *50% of the average unlogged basal area for senescent tree size classes most likely to contain tree hollows or a minimum of five trees in the two median habitat tree size classes;*
- *70% (dry forest) to 100% (wet forest) of the unlogged stocking of small diameter stems.*

His retention rates are based upon size classes of trees and basal areas, varied according to four broad productivity classes. This methodology is aimed at managing forests primarily for the highest value large sawlogs.

Smith's (2000) proposed minimum retention rates (stems per hectare);

Productivity Class	**Min Stocking 20-39 cm**	**Min Stocking 40-59 cm**	**Min Stocking 60-79cm**	**Min Stocking 80-99 cm**	**Min Stocking >100 cm**	**Minimum Basal Area**
1	50	12.5	4	2		11
2	60	25	5	2.5	1	16
3	80	30	8	3	2.5	23
4	60	35	10	4	4	28

Note that River Red Gum would mostly be comprised of classes 1-3,

Smith (2000) also requires that canopy gaps do not exceed 25m diameter.

Smith's retention rates are similar, but lower than, Curtin's (Florence 1996) idealised stocking for Blackbutt forest and, and as noted by Florence (pers. comm.) "*is more or less*

consistent with the optimum stocking for a mixed species blackbutt forest as described by M.R. Jacobs in Growth Habits of the Eucalypts')". It is worth noting that Blackbutt is generally considered an "intolerant" species and thus requires less overstorey for successful regeneration than "tolerant" species.

Curtin's idealised stocking for Blackbutt forest:

Productivity Class	**Min Stocking 20-39 cm**	**Min Stocking 40-59 cm**	**Min Stocking 60-79 cm**	**Min stocking 80-99 cm**	**Min Stocking >100 cm**	**Minimum Basal Area**
3?	67	31	14	7	-	22

It needs to be recognised that unlike when Curtin and Jacobs were developing their retention rates, there are now requirements to incorporate other values into forest management. It is apparent that from a purely timber production standpoint Smith's retention rates are close to optimum (if not below optimum). There is a concern that from a wildlife standpoint they are already sub-optimal, though they have the advantage of providing a retained framework for forests which is essential to support those trees needed to be retained for fauna in perpetuity.

For example, retaining an old hollow-bearing tree with 30 years left to live, and one or two small trees as recruitment habitat trees that may still take 100 years to develop hollows, will still result in a loss of hollow-bearing trees from the site for many decades. When this effect occurs across the forest (as it is) the result can devastate native fauna populations. Whereas, if the full range of age classes are retained (or promoted over time) then there should be a constant replacement of hollow-bearing trees as the veterans die out.

Establishing minimum retention standards for each size class encourages the return of multi-aged stands over time. For example, in a stand dominated by 20-39 cm trees the land owner can remove a large number of these for timber, while still retaining some to grow into the next size class. Once they have grown sufficiently, they can again remove most of these while still being required to retain some to grow into the next size class, and so on. The end result is enhanced biodiversity values while still allowing for timber production.

Setting minimum retention standards based on tree size classes (rather than basal volumes) across logging areas, which account for both economic and ecological values, must be seen as a pre-requisite for ecologically sustainable forest management. Establishing a minimum stocking of trees in each size class for retention or restoration establishes a basic structure for the forest, which is essential to maintain the functioning of the habitat components required to be retained for biodiversity.

To implement ecologically sustainable forest management there is a need to identify the natural distribution of tress by size classes, ecosystems and productivity classes, and to use this as a basis for identifying minimum retention standards based on tree size classes. This should also establish minimum standards for species composition,

upper-storey canopy cover, understory structure, regeneration and large logs.

2.4. Grazing

Grazing, and associated burning, has a significant impact on the ecological communities of the Riverina. For example Schneider and · Griesser (2009) note:

> Grazing modifies the structure of the vegetation by reducing and sometimes eliminating the shrub layer and understory vegetation (Robertson and Rowling 2000). This in turn negatively influences avian species assemblages, with woodland species decreasing in abundance while generalist bird species become more widespread (Martin and Possingham 2005; Martin et al. 2006).

Commonwealth of Australia (2007) note:

> Uncontrolled grazing is a major threat contributing to the death and decline of trees on private land throughout the range (Cutten and Hodder 2002). For example, in four paddocks near Naracoorte regularly used for feeding, 76% of stringybarks had some degree of ringbarking caused by cattle, and 15% were dead (R Hill *in litt*.). Cattle can also kill mature Bulokes (Maron *in litt*.).

Smith (2000) notes:

> *"Grazing may impact adversely on ecosystem health by damaging the shrub understorey, trampling soil and polluting waterways, browsing rare plants and competing with kangaroos. However, by far the greatest impact of grazing practices is the use of frequent burning to remove and suppress the shrub understorey to promote fresh grass growth and green pick for stock, particularly in forests of northern NSW. This practice may not only reduce biodiversity but also suppresses wood production by removing the crop of new eucalypt seedlings and advance growth that develops continuously beneath the forest canopy and is essential to ensure adequate regeneration after logging. Stock may also cause direct browsing damage to tree stems, the most valuable section of the tree for wood production. Grazing should be excluded from logged areas for at least 10 years after harvesting and preferably permanently. Burning of wood production forest should not occur at intervals of more than every 5 years and preferably not more than every 15 years. No burning should be carried out that is not in accordance with the provisions and requirements of the Bushfires Act".*
>
> *"Post Logging Burning*
>
> *Should be confined to wet sclerophyll forest types and involve the burning of individual tree heads such that not more than 50% of the logged area is burnt".*

"Surveys in northern NSW have found that the best predictor of forest bird diversity is the cover and complexity of the shrub understorey (Smith et. al. 1994). Many birds depend on the shrub understorey to provide cover from predators when roosting (sleeping on branches) at night or to provide sites for nesting. Removal of the shrub understorey by intensive grazing or frequent burning can cause a three - fold reduction in bird diversity. Surveys of small mammals have shown that habitat complexity, particularly of the ground layer (low vegetation cover, litter and log cover, rock cover and soil moisture), is the best predictor of diversity."

CSIRO note:

Eucalyptus camaldulensis is very fire sensitive and even low intensity fires may cause cambial injury (Dexter, 1978). Fire kills regeneration and even mature trees are susceptible if the fire is intense enough since E. camaldulensis lacks a lignotuber.

Given that River Red Gum ecosystems have a reduced understorey due to flooding, it is important that this not be compounded by grazing and associated burning regimes. This emphasises the importance of creating extensive areas free from grazing and associated fire regimes.

3. The impacts of drought and climate change on the forests.

Some of the significant changes affecting the Riverina are:

- warmer temperatures and reduced rainfall and runoff causing a significant reduction of soil moisture
- significant reductions in winter rains and snowpacks in the Australian Alps reducing winter/spring river flows
- If, as it seems, , a step change in climate has occurred average surface water availability for the Murray region will fall by 30percent and end-of-system flows will fall by 50percent
- The very large 'landscape restoration' floods (100,000 ML/day, 10 days) which used to occur naturally about once every 11 years are unlikely to occur in the future.
- The smaller, long duration (20,000 ML/day, 60 days) floods which used to occur naturally about every one to two years are only likely to occur once every 5 to 10 years in the next few decades
- Groundwater is being extracted at an unsustainable rate throughout large areas, leading to major drawdowns in groundwater levels

The NRC assessment is confused as to the potential timeframes for likely climate changes. In some cases they seem to have only considered 2030 and a continuation of the current climate as a step change, in others it is unclear of the timeframes. A more structured approach is required identifying potential changes for 2030, 2050 and 2100 and clearly identifying the full range of consequences of likely scenarios.

CSIRO note:

> *Eucalyptus camaldulensis* obtains its water from three main sources: ground water, rainfall and river flooding. It is river flooding which enables the species to survive in semi-arid areas
>
> The unregulated flooding regime in western New South Wales consisted of peak flows in late winter and spring with low flows in summer and autumn (Dalton, 1990). Changes in the river flow patterns of the Murray, as a result of large scale dam building, has led to reduced extent and depth of winter flooding, reduced frequency of flooding, increased duration of non-flood periods, increased occurrence and variability of summer floods, increased river flow capacity (as a result of desnagging) and decreased total annual flow. These changes have produced major deterioration in much of the riparian forest, including reduced tree growth rate, accelerated mortality and minimal regeneration (Bacon *et al*., 1993).

...

Forest flooding, particularly in late winter, is a key factor in controlling the leaf skeletoniser moth by: providing conditions favourable to the growth of a fungal pathogen of the insect (*Aspergillus*); removing pupation sites within the ground litter; drowning the insect larvae. Reduction of flooding frequency through regulation has advantaged these insects (Dalton, 1990).

...

Stands of river red gum are associated with the surface flooding regime of watercourses and related ground water flow. The species is a profligate and opportunistic water user, and this is a contributing factor to the maintenance of water tables at depth. Even without large amounts of empirical data it is clear that loss of large tracts of the species in the Murray River corridor would have a major impact on the hydrology of the system, as well as on vegetation communities and associated biodiversity.

NRC note that (p13):

> *Many of the trees are highly stressed, dying or dead, and without a return to a wet period the future of the forests in their current form looks bleak.*
>
> *If the current drought conditions continues in line with the 'step change' prediction of climate change, then much of the existing river red gums forests will not persist in their present extent, structure and condition. Many of the most productive red gum forests may revert to a less productive condition. Some currently less productive stands may transition to mixed river red gum and box woodlands or derived scrublands as dryland species begin to dominate.*
>
> *These changes are having, and will continue to have, profound impacts on the ecology of the forest, the viability of the forestry industry, and the social and economic well-being of the local communities.*

It is noted that (p25):

> *The average annual rainfall of 404 mm and mean annual deficit of 1075 mm between rainfall and evaporation mean that floodwater contributions are required to support the moisture requirements of forests and wetlands (Leslie, 2001).*

It is noted (p51):

> *The condition of river red gum within state forests and elsewhere of the Riverina is generally in decline as a result of substantially reduced flows due to river regulation and compounded by climate change. Condition may also be reduced immediately following harvesting, although long term decline in condition has not been linked to forestry activities specifically.*

And (p135):

> *Further reductions in flood magnitude and extent for major river red gum stands across the bioregion have a range of environmental implications. In many of the forests, it is likely that proportions of high quality river red gum will continue to*

transition to a structure and vigour of lower quality stands. In the absence of regular flooding, parts of the river red gum communities at higher elevations will likely decline to a point where the forest will no longer be able to produce seed and propagate, resulting in parts of the stand assuming the structure of a derived grassland or chenopod community.

In the central Murray forests 70-90% of the Red Gums are unhealthy, dying or dead. In recent years growth rates of red gums have halved and mortality rates have doubled, a trend that is expected to continue. The size, extent, duration and frequency of flooding is in decline, which will result in corresponding declines in the extent and quality of red gum stands

It is noted (p68):

... concern about the implications of climate change are stimulating policy makers to put greater focus on future viability and resilience of conservation reserves.

In the case of flood dependent forests of the Riverina, the impacts of climate change are doubly important. Climate change seems to require a 'step change' increase in the focus we give to future viability, and the role we conceive for adaptive management of forest ecosystems to help them transition to a new climatic regime.

JANIS requires that the reserve system should seek to maximise the inclusion of natural refugia for flora and fauna. In this region the future refugia for Forest Red Gum flora and fauna are those areas that will maintain adequate water regimes. For example, the Barmah-Millewa Forest and associated wetlands are maintained by the large volumes of water (regular flooding) temporarily banked up behind the Barmah Choke. It is noted (p137):

Millewa is likely to provide the best long-term security for ecological communities and individual species associated with river red gum in the NSW Riverina. The forest is large and heterogeneous, providing opportunities for species to move and adapt, and requires relatively low flows (compared with downstream forests) to achieve reasonable levels of inundation. However there will be a decline in river red gum wetland extent.

It is evident that one of the principal criteria for the identification of River Red Gum reserves needs to be the incorporation of climate change refugia that are most likely to receive sufficient floodwaters to retain stands of River Red Gums under likely future river flow regimes. Identification and mapping of such areas is only partially undertaken and needs to be completed as a high priority.

References

Butcher, G. (1994) Forest Productivity. In 'The development of consistent nationwide baseline environmental standards for native forests, Draft Report'. Technical Working Group on Forest Use and Management, Joint ANZECC-MCFFA National Forest Policy Statement Implementation Sub-committee. Unpublished.

Commonwealth of Australia. 2007. National Recovery Plan for the South-eastern Red-tailed Black-Cockatoo *Calyptorhynchus banksii graptogyne*. Department of the Environment and Water Resources, Canberra.

Florence, R.G. (1996) Ecology and Silviculture of Eucalypt Forests. C.S.I.R.O., Australia.

JANIS - Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee (1997) Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia. Commonwealth of Australia.

Mackowski, C.M. (1987), Wildlife hollows and timber management, thesis for Master of Nat. Res., University of New England, Armidale, N.S.W.

Smith, A. (1999) Guidelines for implementation and enforcement of sustainable forestry on private lands in NSW. Draft report prepared for DLWC.

Smith, A. (2000) Guidelines for Sustainable Forestry on Private Lands in NSW. Draft report prepared for DLWC.

NPWS (1999) Terms of Licence Under the Threatened Species Conservation Act, Upper North East NSW