# REPORT TO THE MINISTER FOR THE ENVIRONMENT

BY
THE MINISTERIAL ADVISORY GROUP ON KARRI AND TINGLE MANAGEMENT

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22 October 1999

## EXECUTIVE SUMMARY

### *1. INTRODUCTION*

In brief, the terms of reference require that, taking into account economic use, environmental stewardship and community values and consistent with ecologically sustainable forest management principles, the Group prepares silvicultural prescriptions and logging plans that give effect to the Government's decision to:

1. End large scale clearfelling in karri forest
2. End logging and woodchipping in old growth karri and tingle forests after 2003
3. From 1999-2003, maintain industry commitments for karri
4. From 1999-2003, minimise logging in old growth karri and tingle
5. After 2003, maintain karri supply at 50,000 cu m/yr on a non-declining basis.

Ecologically sustainable management can be operationally defined as the management of forest on all land tenures to maintain the overall capacity of forests to provide goods, protect biodiversity, and protect the full suite of forest values at the regional level.

The Group adopted definitions of forest types that are critical to the understanding of their report, because these types require different silvicultural prescriptions and are identified distinctively on accompanying maps:

1. Karri Old Growth Forest
2. Karri Two-Tiered Forest
3. Karri Tingle Old Growth Forest
4. Karri Tingle Two-Tiered Forest
5. Karri Regrowth Forest
6. Jarrah Forest

define

### *2. SILVICULTURAL PRESCRIPTIONS*

#### Occupational Health and Safety

The risks posed by the use of selection systems in Karri Old Growth or Karri Two-tiered Forests are substantial and militate against their use. Selection systems using mechanical harvesting may be possible in Karri Even-aged Regrowth Forest and trials of these systems are warranted.

*Recommendation: Occupational health and safety*

2.1.1 Clearfelling rather than selection systems should continue as the preferred silvicultural prescription in Karri Old Growth and Two-tiered Forest. ✓

2.1.2 Selection systems may be feasible using mechanical harvesting in Karri Even-aged Regrowth Forest. Trials of these systems need to be instituted in this forest type. Done

2.1.3 Monitoring and review of occupational health and safety in logging operations should be continued and involve all relevant stakeholders. ✓

**Fire Protection**

Forest fire is an ever-present summer risk for forest workers, adjacent landowners, and forest-based communities. No fire fighting force can suppress a major wildfire like that at Dwellingup in 1961. Fire protection strategies have to be implemented to reduce the risks of wildfires starting, or their intensities, if they start. Fire suppression strategies have to be implemented to deal with wildfires when they arise. Both protection and suppression presently depend heavily on the logging workforce and equipment in the Southern Forest Region. Additional resources will have to be made available to cater for the post 2003 reduction in logging.

*Recommendation: Fire protection*
The Group recommends that:

2.2.1 The suppression resources available to CALM for employment of fast-attack crews in the Southern Forest Region in summer must be increased to allow much greater use of helicopters (and possibly planes) with water-dropping capabilities.

2.2.2 The suppression resources both within the forest region and in adjacent areas need to be re-assessed in the light of the changes in logging, and make provision for a wider network of stand-by contractors, especially for bulldozers and similar equipment.

2.2.3 Additional protection resources should be made available for helicopter lighting and associated activities (firelines etc) for prescribed burning in the karri region.

2.2.4 The community needs to be educated on the need for prescribed burning and to recognise that it may be necessary to declare special days for prescribed burning.

2.2.5 The recommendations of the Expert Panel on Ecologically Sustainable Forest Management concerning the burning of flats and low woodlands need to be pursued as a matter of priority.

2.2.6 Further research is needed on alternative methods of site preparation and regeneration in concert with the move towards smaller coupes in Karri Even-aged Regrowth Forest after 2003.

**Aesthetic Impacts**

The group considered the aesthetic and other impacts of ending large scale clearfelling in karri forest. Greater use of formal Visual Resource Management principles and practices should be pursued in the Southern Forest Region.

*Recommendation: Aesthetic impacts*

2.3.1 A landscape architect should be assigned responsibility for Visual Resource Management in the Southern Forest Region.

2.3.2 All logging plans should be assessed with respect to potential visual impacts, and prescribed burning, road construction and similar activities should be assessed and monitored to ensure adverse impacts are minimised.

2.3.3 Greater attention needs to be given to the aesthetic impacts of logging on neighbouring landowners and communities.

## Nyungah People and Cultural Heritage

The Group noted the concerns of the Nyungah community regarding the lack of employment and involvement of members of their community in forestry, and the forest industries, despite the evidence of an important relationship with these areas of forest prior to European settlement. Greater involvement should be fostered and notice given of any proposed roading or logging in areas of concern. Cultural heritage management needs to be supported by a field guide on the Code of Practice.

*Recommendation: Nyungah people and cultural heritage*

2.4.1 Nyungah people should be involved in setting goals for the attainment of ecologically sustainable forest management and should be given adequate notice of any proposed roading or logging in areas of concern to them.

2.4.2 A field guide on the Code of Practice concerning cultural heritage should be developed.

## Beekeeping

The Government's decision to end logging of old growth forests after 2003 should assist this industry. Little definitive research about the impact of honey bees on native biological diversity is available. Given the special biodiversity values of tingle forest and associated communities, research on the effect of honey bees on these values is needed.

*Recommendation: Beekeeping*

2.5.1 Research should be undertaken on the effect of commercial honey bees on biodiversity values of tingle forest and associated communities.

## Silvicultural Prescriptions

The Group developed separate silvicultural prescriptions for the major forest types.

1. Karri Tingle Old Growth Forest and Karri Tingle Two-tiered Forest

The Group considers Karri Tingle Old Growth and Karri Tingle Two-tiered Forest have special values in relation to biodiversity.

*Recommendation: Karri Tingle Old Growth Forest and Karri Tingle Two-tiered Forest*

2.6.1 The Group recommends that no logging be permitted in these forest types.

2. Karri Old Growth Forest and Two-tiered Karri Forest

Two substantially different forms of clear-felling were canvassed with stakeholders. One involved small coupes and involving the more widespread use of visual resource buffers on all permanent roads: the other involved larger coupes (not exceeding 40 ha), with limited recognition of visual resource properties in relation to neighbouring landowners

and communities. A clear majority of stakeholders favoured larger coupes, given the trade-offs between aesthetics and extent of old growth logging implied in the terms of reference.

*Recommendation: Silvicultural prescriptions for Karri Old Growth Forest and Karri Two-tiered Forest*

2.7.1 Clearfelling systems should be maintained.

2.7.2 Coupe size should not exceed 40ha.

2.7.3 A rotation of 100 years is recommended, together with the use of visual resource buffers of at least 100m in width, and stream and wildlife buffers as presently prescribed.

2.7.4 Marginally more trees and some clumps should be retained for feathering the coupe boundary, and for structural (eg. clumps of advanced regrowth), habitat (eg. hollow bearing trees) and biodiversity (eg. marri and understorey tree species) purposes.

2.7.5 The aim of regeneration should continue to be to achieve the species mix of the former old growth on that site.

2.7.6 In small coupes where broadcast burning is not feasible, windrowing, heaping and burning, should be carried out, followed by site preparation, fertilising and planting. Further research is needed on the impacts of windrowing, planting and fertilising.

2.7.7 As far as possible, seed stock of trees and understorey should be drawn from the same zone. Research to delineate these zones should be updated using DNA markers.

2.7.8 Trials of 'understorey islands' with minimal disturbance in clearfelled coupes should be completed within two years.

2.7.9 Studies of regeneration and biodiversity on mixed species sites should be established by CALM research as soon as possible to enable biodiversity impacts to be gauged.

## 3. Karri Even-aged Regrowth Forest

Mechanical harvesting is feasible in Karri Even-aged Regrowth Forest enabling the possible safe use of selection systems. Trials of this system are needed to verify this approach. Selection or group selection systems may be usefully applied where adjacent visual resources or the sites are sensitive to exposure. However, clearfelling will probably be the preferred method for the greater part of the Karri Even-aged Regrowth Forest for economic and supply reasons.

*Recommendation: Silvicultural prescriptions for Karri Even-aged Regrowth Forest*

2.8.1 Clear-felling systems generally be maintained, at least until 2025, but selection systems are preferred in areas where adjacent visual resources or the sites are sensitive to exposure.

2.8.2 Coupe size should not exceed 20ha until a further review of operations has been undertaken.

2.8.3 A rotation of 100 years is recommended, together with the use of visual resource buffers of at least 100m in width and stream and wildlife buffers as presently prescribed.

2.8.4 Marginally more trees and clumps should be retained for aesthetic, structural, habitat, and biodiversity purposes. Precise prescription is not possible because this process must be opportunistic in character, taking advantage of suitably located habitat trees, clumps of regrowth or understorey trees.

2.8.5 The aim of regeneration should continue to be to achieve the species mix of the former forest on that site. This does not equate to the same mix of regeneration, the relative proportion of species will change over time according to site and the influence of competition and fire.

2.8.6 Where broadcast regeneration burning cannot be effectively carried out in small coupes, windrowing, heaping and burning should be carried out, followed by site preparation, fertilising and planting.

2.8.7 As far as possible, seed stock should be drawn from the same zone.

2.8.8 If successful in trials in Karri Old Growth and Two-tiered Forest, 'understorey islands' should be instituted in clearfelled coupes.

2.8.9 Formal trials of selection systems should be established by CALM research as soon as possible.

## *3. SCHEDULING THE LOGGING*

### Sustainable Yield

The extent of Karri Old Growth Forest logged has to be minimised In addition, the Group tried to avoid logging of sensitive areas of Karri Old Growth Forest in the following Blocks, wherever possible.

Blocks containing sensitive areas of Karri Old Growth Forest

| Name of Block | Name of Block |
|---|---|
| Beavis | Keystone |
| Burnett | Northcliffe |
| Carey | Ordnance |
| Dawson | Sharpe |
| Deep | Swarbrick |
| Gardner | Thomson |
| Giblett | Wattle |
| Jane | Wye |

Using the silvicultural prescriptions and constraints described above, the sustainable yield was simulated by CALM computer-based models designed to predict karri growth and yield. The results showed that the prescribed supply levels to 2003 can be met and that the 50,000 cu m/yr can be sustained thereafter on a non-declining basis. (See Figure 3).

*1. Year 2000 Coupes*

The locations of all proposed Year 2000 coupes in the karri forest region are shown on maps attached to the main report. Because of the various prior surveys and operations required prior to a coupe actually being opened for logging, little flexibility was available in the choices for the year 2000. Some stakeholder concerns relating to proposed Karri Old Growth coupes were able to be addressed by excluding the coupes concerned from logging, but those in Boorara East and Crowea had to stand, as they are critical to the supply of karri sawlogs in the year 2000.

*2. Year 2001-2003 Coupes*

The tentative status of the look-ahead candidate areas for coupes for 2001 to 2003 must be stressed. Due process in terms of the various surveys and controls has not been carried out. To cater for these uncertainties, the total areas of candidate coupes in the Karri forest types for 2001-2003 must be increased by about 50% over the accessed areas shown in the following table, to cater for subsequent likely exclusions.

| *Recommendation 3.1.1: Indicative Logging plan 2001-2003* | | |
|---|---|---|
| **Forest Type** | Indicative areas (ha) | Accessed areas (ha) |
| **Year 2000 Coupes** | | |
| Karri Old growth | 900 | Up to 1200 |
| Karri Two-tiered | 1200 | Up to 1700 |
| Karri Even-aged Regrowth | Negligible | Negligible |
| **Years 2001-2003 Coupes** | | |
| Karri Old growth | 1600 | 2100 |
| Karri Two-tiered | 2400 | 3400 |
| Karri Even-aged Regrowth | 3300 | 3600 |

Why ?

To summarise the extent and pattern of future logging:

- Between 2000 and the end of 2003, virtually all the Karri Old Growth Forest available for logging outside of those sensitive areas in the blocks listed above will be logged or accessed.
- Between 2000 and the end of 2003 virtually one quarter of the area of Karri Two-tiered Forest available for logging will be logged, and the remainder (three-quarters)

between 2004 and 2025. Thus by 2025, little or none of this forest type will remain other than in buffers and other informal reserves.

- Between 2000 and 2005, virtually all of the Karri Even-aged Regrowth Forest in Big Brook and Treen Brook, other than buffers and informal reserves, will be logged.
- Logging of jarrah forest throughout the karri region will continue at rates consistent with the Government's agreed levels of commitment for jarrah.

**Environmental Care**

The present system of exclusion of diverse ecosystems from logging operations, assessment of threatened flora and fauna populations, and creation of informal reserves along roads, rivers and streams is working well but needs review and refinement to ensure contemporary best practice.

*Recommendation: Environmental care*

3.2.1 Special emphasis should be given to protection of the surface seed store and associated biodiversity by heaping dry surface soil on log landings to be restored and spreading for regeneration as soon as logs are removed, preferably in the same season as heaping.

3.2.2 Seasonal logging (from October to June approximately) should be introduced in some areas in 2001 and throughout the Karri forest types by 2003, in order to minimise roading requirements, soil compaction and erosion, manage disease risk and improve protection of the soil seed store and associated biodiversity.

3.2.3 Greater use should also be made of temporary roading in logging, with restoration to forest and local understorey as an essential completion criterion. The time between heaping and redistributing topsoil should be minimised. Research on temporary road restoration should be undertaken.

3.2.4 Hydrocarbon management should be reviewed to reduce the risks of oil spills from machinery and other potential sources of pollution.

3.2.5 In concert with the development of a Code of Forest Practices covering public and private forests, a formal Environmental Management System based on the ISO 14001 process should be implemented with a view to achieving independent certification in the next three years.

**Community involvement**

To secure greater community acceptance, the existing processes for determining logging plans should be changed, in the view of the Group, towards greater public involvement in planning. In relation to sustainable yields and logging plans, a major change in policy is also needed to make the data and processes more transparent.

*Recommendation: Community involvement*

3.3.1 Processes for community involvement need to be improved, developed and fostered.

3.3.2 CALM data and processes need to be made more transparent.

**Mediation**

Continuing protests have the capacity to explode to the detriment of community relationships, as well as economic and other values. The introduction of a mediation process, even if seldom used, seems a desirable mechanism to avoid the flashpoint of wider community conflict being reached.

*Recommendation: Mediation*

3.4.1 A mediation process should be established using the services of mediators established in other fields.

## *4. IMPLEMENTATION AND FUTURE ISSUES*

**Coupe Management**

Several features relating to the letting of contracts and utilisation standards caused unfavourable comment by stakeholders. The only effective way of laying these allegations to rest is to have periodic independent audits of delivered log grades and sawn recovery conducted at regular intervals. CALM should also explore more regular inspections of grading on a cost-benefit basis. The integration of field management of logging operations needs to be closely integrated with the management of other CALM operations.

*Recommendation: Coupe management*

4.1.1 Independent audits of delivered log grades and sawn recoveries need to be instituted, and the results published.

4.1.2 CALM should explore more regular inspections of grading on a cost-benefit basis.

4.1.3 The Government should take note of the need to integrate field management in any restructure of CALM, such that field management of logging contractors does not become separated from management of other operations.

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**Jarrah Sawlog Supply**

Based on the simulations of the recommended silvicultural prescriptions and logging plan for the Karri forest types, it seems that the impact on the jarrah sawlog supply will not be so large as to seriously endanger the capacity to meet commitments. However, there is very little margin for error and the implication of any impact would be one of a greater pressure on utilisation of lower grade jarrah logs (e.g. Grade 3 sawlogs) and the pursuit of greater recovery of sawn timber from all log grades.

*Recommendations: Jarrah sawlog supply*

4.2.1 Implementation of the karri silvicultural prescriptions have to be located in karri rather than jarrah forest types, if the supply of jarrah sawlogs is to meet the Government's commitments.

4.2.2 Roading and logging procedures in the karri forest types must aim to reduce the risk of dieback spread to adjacent jarrah forest and associated communities, by moving progressively to seasonal logging and avoiding soil movement especially under wet soil conditions.

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## Marri Sawlog Supply

Recent developments and value adding in the marri sawn timber industry should be encouraged. In some areas of the Southern Jarrah Forest selectively cut in the past, marri predominates. There will be some reduction to the potential supply of marri with the cessation of logging in Karri Tingle Old Growth and Two-tiered, and in Karri Old Growth from 2004. Nevertheless, an adequate supply of sawlogs seems likely to be provided because current use is very much less than potential supply.

*Recommendation: Marri Sawlog Supply*

4.3.1 Recent developments and value adding in the marri sawn timber industry should be encouraged.

4.3.2 Further work is required to verify the sustainable marri sawlog supply but there is scope for an increase in supply.

4.3.3 If stain can be prevented by spray or end treatment, a marri (and other minor species) sawlog dump at Pemberton should be established for sale and supply to interested sawmillers.

4.3.4 Periodic review of conversion factors used for calculating stumpage payments should continue to be undertaken.

## Regrowth Karri Management

Changes to silvicultural prescriptions from those used at time of growth plot establishment should be factored in to projected wood supply in due course. Further refinement of present practice is needed, especially in relation to the possible use of selection systems in the Karri Even-age Regrowth Forest.

*Recommendation: Regrowth karri management*

4.4.1 Further research is needed to refine the regrowth karri data. Pending the results of this research, a sufficient allowance for internal defect and fire damage should be made.

**Regrowth Karri Utilisation**

The utilisation of regrowth karri sawlogs will become a major feature after 2003, because some 33% of the 50,000 cu m/yr supply will be in the smallest log sizes (less than 20 cm top diameter).

*Recommendation: Regrowth karri utilisation.*

4.5.1 The sale of regrowth karri sawlog after 2003 needs to recognise that the characteristics of regrowth are different from those of the old growth resource, involving technology and scale implications which need to be recognised and transparent to all.

**Value Adding**

Beyond 2003, approximately 34,000 cu m/yr of the total supply will be available from Karri Two-tiered Forest with a wider array of size classes and log grades than has been true during the old growth era.

Some small sawmillers would welcome the opportunity to salvage logs from trees that have died and fallen in the Karri Old Growth Forest **outside** of National Parks and formal reserves.

*Recommendation: Value adding*

4.6.1 A limited trial of salvaging logs from trees that have died and fallen in the Karri Old Growth Forest outside of the National Parks and formal reserve should be pursued.

**Forest Practices**

Forest practices and processes can be regulated solely by Government agencies on a command and control basis, but this does not engender a sense of ownership of the process by the industry and community. A sense of ownership is important if good forest practices are to be instilled into daily work. The system established under the Tasmanian Forest Practices Act has much to commend it as a model.

*Recommendation: Forest Practices*

4.7.1 An independent body, similar to the Tasmanian Forest Practices Board with representation of landowners, industry and the Conservation Commission, should be established to develop and administer the Code of Forest Practices on public and private forests. The system needs to be transparent, externally audited, periodically reviewed; and with provision for stakeholder input, a proper appeal process, training and accreditation of officers, developing research needs and priorities, and funding from Government (on behalf of publicly owned forests and small landowners), and from large private growers and processors.

**Structural Adjustment**

The indirect costs of structural change that are implicit in the Government's changes need to be addressed to reflect the adjustment in economic use of the resource. Assistance to those individuals, households and businesses affected is essential but will only provide transient relief. It needs to be accompanied by a vigorous program of support and assistance for development projects generated by the communities concerned.

*Recommendation: Structural adjustment*

4.8.1 Structural adjustment assistance is essential to those individuals, households and businesses affected, and needs to be accompanied by a vigorous program of support and assistance for development projects generated by the communities concerned.

Estimates of percentage increases in aggregate annual costs for new karri prescription and plan have been prepared and are summarised in the following table.

| Operation | 2000 | 2001-2003 | 2004-2025 |
|---|---|---|---|
| Scheduling | 0% - largely complete | 100% - rework from scratch | 0% - similar to present, less volume, greater complexity |
| Pre-logging surveys | 20% - minor new surveys | 100% - rework from scratch - two years only | 0% - similar to present, smaller coupes, higher cost offsets reduction in cut |
| Roading | 60% - major roading for following years | 50% - more dispersed coupes | 0% - cost increases balanced by fewer coupes |
| Logging | 10% - greater dispersion of coupes | 20% - greater dispersion and seasonal logging | 0% - fewer but smaller coupes, |
| Regeneration burning and planting | 10% - greater dispersion of coupes | 20% - smaller average coupe plus some windrowing and burning | 0% - substantial cost/ha increases offset by reduced area |
| Prescribed burning | 20% - some catch up on backlog possible | 40% - catch up on backlog and small area helicopter burning | 30% - more small area helicopter burning |
| Fire suppression | 0% - little change needed while logging force remains unchanged | 20% - progressively more standby crews, resources and helicopters as logging winds down | 40% - increase in standby crews, contractors, resources and helicopters to compensate for wind-down of logging force |

**Incomplete Logging within Sensitive Areas.**

Logging has been interrupted by protest, and regeneration works remain incomplete or have not been commenced, in 11 coupes in sensitive areas of Karri Old Growth Forest. Various stakeholders were concerned about the wastage of logs and the failure to regenerate these areas was raised.

*Recommendation: Incomplete logging*

4.9.1 The Group recommends that CALM negotiates with community groups associated with protests on coupes in sensitive areas, and put in train log salvage and regeneration works. Any additional felling should involve these groups in the selection of the trees and delineation of the cells.

## *5. COMMUNITY TRUST AND INVOLVEMENT*

The support of the community is vital for the future of Western Australia's forest industry. Consultation with stakeholders by the Group established a broad though far from general consensus on two issues – a commitment to an ecologically sustainable forest industry, and a willingness to seek a way through the long-standing conflicts over forest policy issues.

*Recommendation: Community trust and involvement*

5.1.1 In preparation for the review of the Forest Management Plan, the proposed Conservation Commission should institute a transparent audit of data, models and other technical information used to set logging plans and silvicultural prescriptions.

5.1.2 The proposed Conservation Commission should appoint a panel of experts to review the implementation of each Forest Management Plan prior to its expiration. The panel should make recommendations for improvements in line with contemporary best practice.

The timing of initiation of many of the recommendations is important not only in terms of due process but also in terms of community involvement that is thorough, measured and without undue haste and requires the early commencement of the review of the Forest Management Plan.

*Recommendation: Ministerial conditions and EP Act*

5.2.1 The review of the present Forest Management Plan should be initiated as soon as possible to ensure Ecologically Sustainable Forest Management principles and the processes of community involvement are given ample opportunity and are examined through due process under the Environment Protection Act.

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# 1. INTRODUCTION

## *Terms of Reference*

The Minister for the Environment, the Hon. Cheryl Edwardes MLA, established a Ministerial Advisory Group to consider matters relating to forest management changes announced by the Western Australian Government.

The Terms of Reference for the Group were as follows:

1. To recommend to the Minister for the Environment, plans which give operational interpretation to the forest management changes announced by the Premier, with special reference to old growth karri and tingle, taking into account economic use, environmental stewardship and community values and consistent with ecologically sustainable forest management principles.

2. To guide the development of silvicultural specification which reflect the Government's decision to:
   - end large scale clearfelling in the karri forest;
   - end logging in old growth karri and tingle forests after 2003;
   - end wood chipping in old growth karri and tingle forests from the expiry of the current wood chip supply contract in 2003;
   - review forestry codes of practice and contractor coupe management; and
   - review logging plans for 1999-2003 which minimise logging in old growth karri and tingle.

3. In recommending changes to silvicultural specifications, regard should be had to the Government's stated intention of meeting contractual commitments with regard to karri, maintaining the agreed 'step down' levels of supply of 1st and 2nd grade jarrah sawlogs, and delivering a non declining karri sawlog yield of 50,000 cubic metres per annum beyond 2003.

4. To report on:
   - aesthetic impacts of the proposed changes in silvicultural prescriptions
   - environmental benefits
   - relative costs of alternative silvicultural specifications
   - fire protection strategies; and
   - change in safety risks

   of the new silvicultural specifications and resultant logging plan for 1999-2003.
   New logging plans are required by 22 October 1999.

5. To provide a mechanism for stakeholders input into changes to silvicultural specifications.

### *Membership of Ministerial Advisory Group*

The Ministerial Advisory Group comprised the following independent experts:

- Professor Ian Ferguson (Chair)
- Mr John Gardner
- Dr Stephen Hopper
- Dr Joanna Young

Miss Natalie Foster provided executive support.

### *Program of Work*

The Ministerial Advisory Group undertook field visits on 11 and 12 August 1999, to a range of karri and tingle forest areas in the South-West of Western Australia. The issues under consideration during the visits included the following:

- Soil conservation
- Issues affecting ecological sustainability
- Product delivery and end use
- Development of new silvicultural prescriptions
- Regeneration
- Environmental performance
- Research and existing knowledge base
- Social issues and planning

Initial consultations with a selection of stakeholders were held on an individual basis in Manjimup on 6 September 1999 and in Perth on 7 and 8 September 1999. Stakeholders invited to be represented at individual meetings were provided with the Group's Terms of Reference and their views sought. Twenty three stakeholders representing conservation, industry and academia, were invited to attend initial consultations with the Group.

Community workshops were then held in Walpole and Pemberton on 27 September 1999 and in Manjimup and Perth on 28 September 1999. Approximately fifty nine participants attended the community workshops in total. Each workshop was of approximately three hours duration. Prior to attending the workshops, those invited were provided with the Group's Terms of Reference and definitions of forest types were also circulated.

The workshop participants were given an opportunity to ask questions and seek clarification as required. An independent facilitator, Ms Paddi Brown, assisted in the workshops by summarising areas of commonality and differences in the issues raised by participants. Workshop participants were also requested to make suggestions on mechanisms for further community involvement. Workshop participants were invited to provide written submissions to the Group by close of business 29 September 1999.

At each of the community workshops, maps were available for viewing. Following the workshops, maps of the year 2000 coupes were made available in selected locations in both regional and metropolitan areas. Stakeholders were invited to provide comment on the maps, and were requested to do so by close of business 6 October 1999.

Needless to say, the process was necessarily rushed because of the very tight deadline for the report. Stakeholders and staff of CALM nevertheless participated well and our thanks go to them for their perseverance and assistance, in the face of the exceptional demands on their time that were made to meet the Group's deadline.

A summary of the organisations and representatives who provided written submissions, attended individual meetings, participated in community workshops and/or provided input to the Group is at Appendix 1.

A summary of the issues raised by stakeholders in written submissions is at Appendix 2 and Summaries of the Community Workshops are at Appendix 3.

### *Forest Types*

To meet its Terms of Reference in the time available, the Ministerial Advisory Group obtained data from CALM regarding the definition, distribution, mapping and structure of karri and tingle forests. Limited local comment on mapping issues was obtained during stakeholder consultation. The Ministerial Advisory Group accepts that there is some level of error in the available maps, but also considers that these are the best available and provide a most useful starting point for ongoing deliberation on karri and tingle logging.

The reader is referred to Bradshaw *et al.*, 1997[1] for relevant background information pertaining to the aerial photographic interpretation used in the mapping of these forest types.

Definitions of forest types are given in Table 1. Karri is *Eucalyptus diversicolor*, tingle refers to any or all of yellow tingle (*Eucalyptus guilfoylei*), red tingle (*Eucalyptus jacksonii*) and Rate's tingle (*Eucalyptus brevistylis*), marri to *Eucalyptus* (*Corymbia*) *calophylla*, jarrah *Eucalyptus marginata* and blackbutt *Eucalyptus patens*. Illustrations of Karri Forest types are given in Figures 1a - c.

[1] Bradshaw, F.J., Collins, P.M. and McNamara, P.J. (1997). "Forest Mapping in the South West of Western Australia". CALM, Como.

## Table 1. Definitions of forest types.

*Karri Old Growth Forest*
The prefix 'Karri' includes all stands mapped by aerial photographic interpretation as pure karri, karri/marri, marri/karri, marri/karri/jarrah, karri/marri/jarrah and jarrah/marri/karri. Old growth forest is ecologically mature forest where the effects of disturbance are now negligible (the so-called JANIS definition). This includes areas of regrowth arising from past wildfire that are now more than 120 years old. The maps herein therefore depict a forest type that has not been previously logged, or in which that logging disturbance is now negligible, and which is in, or approaching, a mature forest structure.

*Karri Two-tiered Forest*
The prefix 'Karri' includes all stands mapped by aerial photographic interpretation as pure karri, karri/marri, marri/karri, marri/karri/jarrah, karri/marri/jarrah and jarrah/marri/karri. Two-tiered Forest has a two-layered canopy composed of trees that are distinctly different in age and crown structure. The stands result from selection logging or the incomplete removal of the original overstorey by agricultural clearing. This forest type is extremely variable in composition. The overstorey may vary in crown cover from 15 to 40%.

*Karri Tingle Old Growth Forest*
This forest type includes all stands mapped by aerial photography as karri/yellow tingle, yellow tingle, and yellow tingle/karri or karri stands identified as containing tingle by Wardell-Johnson. Old growth forest is ecologically mature forest where the effects of disturbance are now negligible (the so-called JANIS definition). This includes areas of regrowth arising from past wildfire that are now more than 120 years old. The maps herein therefore depict a forest type that has not been previously logged, or in which that logging disturbance is now negligible, and which is in, or approaching, a mature forest structure.

*Karri Tingle Two-tiered Forest*
This forest type includes all stands mapped by aerial photography as karri/yellow tingle, yellow tingle, and yellow tingle/karri or karri stands identified as containing tingle by Wardell-Johnson. Two-tiered Forest has a two-layered canopy composed of trees that are distinctly different in age and crown structure. The stands result from selection logging or the incomplete removal of the original overstorey by agricultural clearing. This forest type is extremely variable in composition. The overstorey may vary in crown cover from 15 to 40%.

*Karri Even-aged Regrowth Forest*
The prefix 'Karri' includes all stands mapped by aerial photographic interpretation as pure karri, karri/marri, marri/karri, marri/karri/jarrah, karri/marri/jarrah and jarrah/marri/karri but also includes karri/yellow tingle, yellow tingle/karri, or karri stands identified by Wardell-Johnson as containing some tingle. This forest type resulted from clearfelling, agricultural clearing or intense wildfire and is characterised by even-aged stands.

*Jarrah Forest*
This forest type includes all stands mapped by aerial photography as jarrah, jarrah/marri, marri/jarrah, jarrah/yellow tingle, yellow tingle/jarrah, jarrah/red tingle, and jarrah/blackbutt.

In the species mixtures referred to within the above definitions, the most common species (with the most stems more than 15cm diameter) is written first. The presence of a secondary tree species is normally not recorded unless it constitutes more than 20% of the stems of more than 15cm diameter. However, in the case of tingle, Wardell-Johnson attempted to identify and label all stands that included any tingle, including scattered individuals much less than 20% by number.

According to Attachment 1 of the Regional Forest Agreement, there are 54,061ha of remaining Karri Old Growth Forest, with 37,591ha (70%) in reserves, leaving 16,470ha (30%) in State Forest or other public land potentially available for logging. For tingles, 10,926ha of Karri Tingle Old Growth Forest remain, with 8,455ha (77%) in reserves, leaving 2,471ha (23%) in State Forest or other public land potentially available for logging. The distribution of Karri Old Growth and Karri Tingle Old Growth Forest and reserve status is shown in Figure 2.

Ecologically sustainable management can be operationally defined as the management of forest on all land tenures to maintain the overall capacity of forests to provide goods, protect biodiversity, and protect the full suite of forest values at the regional level.
The Commonwealth of Australia's National Forest Policy Statement (1992) provides the framework for ecologically sustainable forest management through:

1. Integrated planning processes and management systems.
2. Codes of Practice and environmental prescriptions.
3. Management plans incorporating sustainable yield harvesting practices.
4. Management of native forests outside the reserve system complementing the objectives of nature conservation reserve management.

Appendix 4 summarises the management system and criteria for assessment of Ecologically Sustainable Forest Management used in the Regional Forest Agreement process.

The reader may well ask why this process did not achieve an outcome that was broadly acceptable to the Western Australian community. Although it is not the role of the Group to analyse that question, our view as to some of the important factors will be fairly obvious from our recommendations. Notwithstanding some difficulties in application, we believe the system is inherently sound and provides a basis on which better forest practices and management for all values will be progressively developed.

## 2. SILVICULTURAL PRESCRIPTIONS

### *Occupational Health and Safety*

Safety hazards associated with alternative silvicultural prescriptions were examined. In discussions with stakeholders, hazards associated with falling, log transport and fire management were identified.

The karri forest is one of the world's tallest hardwood forests. Mature karri trees have heavy boles and large crowns. Mechanical logging equipment cannot handle these trees. They must be cut manually and the lean of the bole and weight of the crown to a large degree control the direction of fall. Choosing as clear as possible an aerial path for the tree to fall is therefore of prime importance to the safety of the faller. In clearfelling, the faller normally selects an initial tree that can be felled safely and then works around this, progressively enlarging the gap. This may require prior scrub flattening by the bulldozer and felling of understorey trees. Such a process is seldom compatible with single tree selection or group selection systems, where the emphasis must be on removal of trees with the poorest crowns and health. These large trees are prone to catching elements of the surrounding forest canopy in the process of falling, because of leans, crown configuration, or butt defect, thereby endangering the faller.

The choice in Karri Old Growth and Two-tiered Forest hinges on the techniques of regeneration. Larger coupe sizes enable broadcast burning after logging, which creates a nutritionally favourable site for seed or planting stock to flourish with less competition from other understorey species. Very small coupes are difficult and expensive to broadcast burn because of the firelines required and oversight of many dispersed coupes. Many small, dispersed coupes also raise the potential for additional fire hazards and risks to fire fighters and local communities, both in terms of the increased complexity of regeneration burning and from possible reduction in strategic fire protection buffers across the forest. These factors were considered in developing the recommended silvicultural prescription.

Although selection logging systems are too dangerous to apply in Karri Old Growth and Two-tiered Forest, the situation is different in Karri Even-aged Regrowth Forest, where mechanical harvesters can be used. With these machines and the smaller boles and lighter crowns, some degree of directional control is possible by the machine, and operators are protected by the cabs. Even so, operators in Tasmania in similar forest have been reluctant to proceed with trials of group selection because of the showering of crown debris that can arise. Nevertheless, trials with different machines should be pursued.

*Recommendation: Occupational health and safety*

2.1.1 Clearfelling rather than selection systems should continue as the preferred silvicultural prescription in Karri Old Growth and Two-tiered Forest.

2.1.2 Selection systems may be feasible using mechanical harvesting in Karri Even-aged Regrowth Forest. Trials of these systems need to be instituted in this forest type.

2.1.3 Monitoring and review of occupational health and safety in logging operations should be continued and involve all relevant stakeholders.

### *Fire Protection*

Forest fire is an ever-present summer risk for forest workers, adjacent landowners, and forest-based communities. It is a risk that urban dwellers tend to take lightly or to forget as duration since the last major fire increases. Anyone who has witnessed a fire of the severity of that at Dwellingup in 1961, or anything like it, will know that the risk of a major fire cannot be taken lightly. No fire fighting force can suppress such a fire. Life and property are at substantial risk, as is forest biodiversity.

Western Australia has adopted strategies to reduce those risks, principally using large-scale prescribed burning to reduce fuel loads. Lower fuel loads on the forest floor greatly reduce the potential intensity of fires in the intervening period, making it more practicable to suppress any wildfire that does start, and reducing the resulting damage to the forest.

During the last decade, urban dwellers have shown increasing concern regarding the effects of smoke that sometimes arise from prescribed burning. Certain weather conditions favourable for burning in autumn or spring are sometimes associated with wind patterns that first carry the smoke out to sea and then loop back over Perth. Complaints arise from the community about the effects of this smoke including concerns regarding a greater incidence of asthma. As a result, CALM has been increasingly constrained in the days on which it can carry out prescribed burning, to the point where it is only achieving one-third of its target. This nexus is a recipe for an impending disaster and demands urgent attention.

The problem will be exacerbated by the reduction of the karri sawlog supply to 50,000 cu m/yr after 2003. This will mean, in the long term, a reduction to about one third of the present logging force in the forest during summer. The change will be worse, in fact, because of a shift to different machinery for logging Karri Even-aged Regrowth Forest, as distinct from the large bulldozers commonly available in logging Karri Old Growth and Two-tiered Forest. These are of major importance in fire suppression in the heavy undergrowth that typifies the karri forest and its associates.

In attempting to compensate for these changes, three measures must be undertaken. The first is to increase the resources available to CALM for employment of fast-attack, trained crews in the karri forest in summer, including a much greater use, on standby, of helicopters (and possibly planes) with water-dropping capabilities. This will involve re-assessment of the suppression resources in the light of the changes in logging, and provision for a wider network of stand-by contractors, especially for bulldozers and similar equipment. The second is to make additional resources available for helicopter lighting and associated activities (firelines etc) for prescribed burning in the karri region. This will enable smaller burns to be undertaken, albeit at greater cost, with a lesser impact on the Perth pollution problem. The third is to educate the community on the need for prescribed burning and to recognise that it may be necessary to declare certain days as 'Protect the South-West' days for prescribed burning on which there is a possibility of smoke-haze. The need for prior education in relation to such a program and announcements will be obvious.

Prescribed burning requires careful planning, including the setting of priorities. The *Report of the Ecologically Sustainable Forest Management Panel for the Regional Forest Agreement* process drew attention to some matters needing review by CALM in relation to prescribed burning. External stakeholders perceive that CALM policy favours more frequent burning of some of the 'flats' and low woodlands in the Southern Region than may be desirable ecologically. Some stakeholders also assert CALM has had a bias towards protecting timber values rather than ecosystem values in this practice. Hence the recommendation (3.2) from the above report that CALM should:

> review the CALMfire process for setting priorities for the use of prescribed fire and change the weighting given to different values to better reflect the two over-arching and six specific principles of Ecologically Sustainable Forest Management and the current knowledge of the response and resilience to fire of ecosystems in the South-West Forest Region.

This was reinforced by a related recommendation (2.7) that CALM should:

> address the ecological basis for burning regimes in all forest ecosystems in planning for fire management. Annual District burning plans should be available for public access and medium-term (five to seven years) fire management plans should be published. Such plans should be prepared in conjunction with the medium-term integrated harvesting and regeneration plans specified within the 'Manual of Harvesting Specifications'.

The Group is strongly of the view that these recommendations need to be pursued as a matter of priority. Thorough review of research results and experience to date, community involvement, and transparency of process are essential in building confidence in CALM policies and practices in relation to contentious issues like prescribed burning. Once developed, continuing processes for public information, periodic review and research are essential.

One final issue relates to smaller-scale burning for regeneration. Normal practice in clearfelling is to burn in the autumn after completion of logging. This reduces the fuel load and competition by understorey with the planted karri, and creates an ashbed that stimulates growth.

Young karri must then be protected from fire until it is at least 20 to 25 years old, to avoid damage, after which prescribed burning may be carried out. However, the initial burning at age 20 to 25 years is demanding, because of the fuel load and types, and the need to burn lightly and again, in successive stages in the one season.

Regeneration burning is most unlikely to create smoke haze problems in Perth because the areas are small and the fires more intense than for prescribed burning. Nevertheless, it sometimes has to be carried out on the same days and is thus affected by the community objections. Greater resources for helicopter burning will be needed to facilitate this burning.

*Recommendation: Fire protection*
The Group recommends that:

2.2.1 The suppression resources available to CALM for employment of fast-attack crews in the Southern Forest Region in summer must be increased to allow much greater use of helicopters (and possibly planes) with water-dropping capabilities.

2.2.2 The suppression resources both within the forest region and in adjacent areas need to be re-assessed in the light of the changes in logging, and make provision for a wider network of stand-by contractors, especially for bulldozers and similar equipment.

2.2.3 Additional protection resources should be made available for helicopter lighting and associated activities (firelines etc) for prescribed burning in the karri region.

2.2.4 The community needs to be educated on the need for prescribed burning and to recognise that it may be necessary to declare special days for prescribed burning.

2.2.5 The recommendations of the Expert Panel on Ecologically Sustainable Forest Management concerning the burning of 'flats' and low woodlands need to be pursued as a matter of priority.

2.2.6 Further research is needed on alternative methods of site preparation and regeneration in concert with the move towards smaller coupes in Karri Even-aged Regrowth Forest after 2003.

***Aesthetic Impacts***

Government policy is to "end large scale clearfelling in karri forest" and the Terms of Reference required the Group to review aesthetic impacts.

Many of the issues related to the management of aesthetic impact have been dealt with in detail in Regional Forest Agreement reports for Western Australia. Although directed principally to maintaining aesthetic values associated with the National Estate, some of the issues raised are relevant for all areas of forest. The use of formal Visual Resource Management principles and practices brings a high degree of technical rigour to the protection of visual resources.

In relation to visual impacts, some members of the Northcliffe community considered their request for retention of roadside vegetation was not given adequate attention when logging proceeded in the vicinity of Hill Brook Road. Members of the Northcliffe Tourist Centre Inc. prepared a submission to the Minister for Tourism, Mr Norman Moore, listing roads and tracks on which they wished to see vegetation retained up to a maximum of 20m from the edge of any road reserve.

After 2003, reliance on regrowth forests for sawlogs will increase, initially within the relatively small areas of Big Brook and Treen Brook. Extensive logging and thinning in these areas could meet with adverse public reaction. Mechanical harvesting may allow selective logging, due to the smaller tree crowns of regrowth forest, and hence there is a need for trials of this system to be established in the near future. Early consideration also needs to be given to the location and scheduling of coupes to minimise the problems that may otherwise arise in relation to increasing tourism. There may be a role for mechanical

harvesting as a tourist feature, because viewing can often be carried out much more safely than is possible for logging of old growth forest.

What allowance should be made for roadside buffers and Visual Resource Management in scheduling future wood flows? The Group accepts that later implications for viable prescribed burning and logging require a minimum width of 100m if the retained strip is to be manageable in its own right. Logging contractors suggested another approach in stakeholder interviews - that of interspersing groups of mature trees along roads otherwise bordered by regrowth. In some places, patches of mature trees could be retained to advantage along roads rather than large linear strips, especially where the objective is to provide visual heterogeneity in ameliorating the impact of large stretches of young regeneration or regrowth. This approach has considerable merit.

Landscapes of potential importance in areas where ecotourism developments may occur should be assessed by personnel trained in Visual Resource Management. Views from rivers and established tourist routes are of obvious importance.

Private property owners should be afforded involvement in planning the logging of public forests immediately adjacent to their properties. Mechanisms for consultation exist but are not always pursued or concluded satisfactorily. Greater attention needs to be given to this aspect of coupe planning, especially if adjacent landowners have capital improvements or businesses, which could be devalued by logging. Visual buffer strips and the use of selection systems in regrowth forest offer possible solutions to these issues.

Minimising waste on logging coupes would also reduce one source of adverse reaction to clearfelling. Repeatedly, stakeholders have complained that the amount of felled wood actually utilised is not satisfactory in a visual and perhaps commercial sense. Broadcast regeneration burning also tends to convey the impression that no care has been taken to regenerate the site, whereas windrowing and burning the heaps looks tidier.

The successful application of Visual Resource Management will be dependent on exclusion or modification of logging in those areas of scenic importance in areas of tourism and recreation, and the management and monitoring of vegetation specifically retained or treated to ameliorate adverse visual impacts.

A landscape architect should be assigned responsibility for Visual Resource Management in the Southern Forest. This officer should guide those responsible for the demarcation of coupes and the supervision of contractors with respect to priorities. All logging plans should be assessed with respect to potential visual impacts. Other activities such as prescribed burning, road construction and maintenance should also be assessed and monitored to ensure adverse impacts are minimised.

*Recommendation: Aesthetic impacts*

2.3.1 A landscape architect should be assigned responsibility for Visual Resource Management in the Southern Forest Region.

2.3.2 All logging plans should be assessed with respect to potential visual impacts, and prescribed burning, road construction and similar activities should be assessed and monitored to ensure adverse impacts are minimised.

2.3.3 Greater attention needs to be given to the aesthetic impacts of logging on neighbouring landowners and communities.

***Nyungah People and Cultural Heritage***

The Nyungah community has stressed its concerns about the lack of employment and involvement of members of their community in forestry, and the forest industries, despite the evidence of an important relationship with these areas of forest prior to European settlement. The *Report of the Ecologically Sustainable Forest Management Panel* in the Regional Forest Agreement process gave some attention to this matter but it is appropriate to draw attention to it again here. The discovery of an extensive campsite in Dombakup Block highlights that it was not just the coastal strip that was utilised by the Nyungah. There is scope for greater employment and a need for greater involvement of the Nyungah people in the management of these forests. In relation to involvement, it is important to recognise the Nyungah as a special case for involvement, because some of the matters to be considered may involve spiritual associations and heritage sites.

Attachment 10 of the Regional Forest Agreement on Aboriginal Heritage and Consultation raised a number of points which the Group supports and is reproduced in Appendix 5 of this report.

In stakeholder consultations, the need for adequate pre-logging surveys for aboriginal sites (such as those found at Dombakup) was stressed. Contemporary concerns about employment opportunities within the timber industry for Aboriginal people were also expressed. Finally, the spiritual significance of some old-growth forests to the Aboriginal people was emphasised.

Systems for cultural heritage protection must be managed as part of Ecologically Sustainable Forest Management. Codes of practice need to be developed, perhaps structured on the basis of the environmental management system ISO14001. As suggested for south-east Queensland the "content and format of codes of practice need to be appropriate for use by field operators". The development of a "Field guide on the Code" similar to that in Queensland may be appropriate and encourage greater compliance.

*Recommendation: Nyungah people and cultural heritage*

2.4.1 Nyungah people should be involved in setting goals for the attainment of ecologically sustainable forest management and should be given adequate notice of any proposed roading or logging in areas of concern to them.

2.4.2 A Field guide on the Code of Practice concerning cultural heritage should be developed.

***Beekeeping***

Despite limited consultation with beekeepers our conclusions would reinforce points made by the RFA Social Assessment Unit in January 1999. Principal concerns relate to:

1. The maintenance of access to forest areas and the retention of old growth for the best honey flows.

2. The rate of clearfelling and mature forest harvesting does affect the industry.

The long term status of old-growth forest outside formal reserves may be important to the industry. Access to formal reserves is progressively being reduced and apiarists will want to maintain access to other areas for commercial honey production. The Government's decision to end logging of old growth forests after 2003 should assist this industry.

There is some debate and little definitive research about the impact of honey bees on native biological diversity. Given the special biodiversity values of tingle forest and associated communities, research on the effect of honey bees on the values is needed.

*Recommendation: Beekeeping*

2.5.1 Research should be undertaken on the effect of commercial honey bees on biological diversity values of tingle forest and associated communities.

***Location of Buffers***

The Terms of Reference also provide some important further constraints. While these bear more on the development of the logging plan with respect to karri logging, they are stated specifically in relation to the silvicultural prescription as follows:

> In recommending changes to silvicultural specifications, regard should be had to the Government's stated intention of meeting contractual commitments with regard to karri, maintaining the agreed 'step down' levels of supply of 1st and 2nd grade jarrah sawlogs, and delivering a non declining karri sawlog yield of 50,000 cubic metres per annum beyond 2003.

The reference to maintaining the levels of jarrah sawlogs imposes consequential constraints on the prescriptions for karri forest, in that any new and additional provisions for buffers, cannot impact on any adjacent jarrah forest. Thus any additional buffers introduced as a result of visual resource management have to be located in the karri, not the jarrah forest.

This also flags an issue readers need to recognise. The role of the Group under the Terms of Reference is specifically limited to karri and tingle forests, not jarrah forest. Thus consideration of the silvicultural prescription for jarrah forest has not been possible, nor has consideration of the location or extent of logging coupes in jarrah forest.

***Biodiversity Values***

Biodiversity is the variety of life and the processes that sustain it. The concept embraces all kinds of organisms from bacteria to plants and animals, the genes they contain, the communities which they form, and the living landscapes they occupy, as well as processes that ensure the continuation of life, such as reproduction, pollination, recruitment, feeding, coping with disturbances, pests and diseases, forming partnerships with other organisms, predator-prey relationships etc.

Biodiversity values of karri and tingle forests have received increasing attention in recent years, although much remains to be investigated. Useful reviews of current knowledge are available in Regional Forest Agreement documentation, as well as edited scientific symposium volumes[1].

There are some special attributes of biodiversity pertaining to old growth forest. In particular the presence of large mature trees provides habitat for animals requiring large hollows for nesting. The presence of large decaying logs and associated litter on the forest floor also create special habitats for a diversity of organisms from fungi to plants and animals.

The fact that the effects of disturbance are now negligible in such ecologically mature forests means it is likely that the relative abundances of many organisms and that some ecological processes will prevail at different levels to those seen in disturbed forest. For example, those organisms incapable of moving out of the way of machinery used in logging will have low survival rates in a clearfell coupe, and may be absent from subsequent regeneration until such time as seeds, spores or eggs are able to disperse back into the logged area.

An important consideration in the south-west Australian context is the unusually low powers of dispersability of many such organisms. South-western landscapes are globally unusual in the fact that major glaciation and significant mountain building have not occurred for more than 100 million years. This means that most south-western organisms have not adapted to natural disturbance factors closest in impact to mechanical disturbance associated with logging and bulldozing. Consequently, the ability to rapidly colonise large open areas of disturbed ground is evident in relatively few south-western organisms. Rather, natural selection has favoured ways of ensuring regeneration close to parental organisms. Of special importance to many species is the bank of seeds, spores or eggs buried in the uppermost topsoil. Management of this vital resource for regeneration is unusually critical in south-western Australia.

Those organisms of low dispersability lacking a significant soil store of propagules are especially vulnerable to mechanical disturbance. Indeed, the main forest trees of interest here fall into this category because their seed is stored in the canopy and is short-lived when dropped onto soil. The sophisticated regeneration systems developed for karri by foresters over many decades involve a combination of clear-felling, fire to stimulate germination and supplementary planting of seedlings brought into clear-felled coupes. Karri Old Growth Forest provides a classic example of a diversity of organisms in the forest that require special management due to low powers of dispersability to ensure successful regeneration. Restoration of such biodiversity elements in Karri Old Growth

[1] Withers, P.C. and Horwitz, P. (eds), (1996). Symposium on the Design of Reserves for Nature Conservation in South-western Australia. Journal of the Royal Society of Western Australia **79** (4).
Hopper, S.D., Harvey, M.S., Chappill, J.A., Main, A.R., and Main, B.Y. (1996). "The Western Australian biota as Gondwanan Heritage - a review." In S.D. Hopper, J.A. Chappill, M.S. Harvey and A.S. George (eds) "Gondwanan Heritage: Past, present and future of the Western Australian Biota". Pp 1-46 (Surrey Beatty & Sons, Chipping Norton, NSW).

Forest disturbed by logging would require considerable further investigation, active intervention and considerable time.

***Environmental Benefits and Costs***

Present logging prescriptions in karri forest involve a sequence of planning activities and operational disturbances:

- pre-logging planning, including inventory of the timber resource, wildfire threat analysis, dieback risk assessment, threatened species assessment, aboriginal heritage assessment, exclusion of ecologically diverse ecosystems (rock outcrops, peat swamps etc.), design of road river and stream informal reserves etc, road planning,
- no burning within three years prior to logging,
- road construction,
- scrub-rolling to provide access to trees,
- pre-logging of small trees,
- falling of the big trees in clear-felled coupes,
- snigging and removal of logs to landings and mills,
- bulldozing the edge of coupes for fire protection,
- ripping soil to alleviate compaction after wet soil logging,
- burning for regeneration,
- planting seedlings,
- direct seeding of log landings for regeneration of trees and understorey,
- subsequent burning of regrowth older than 25 years of age for a range of values including the maintenance of range of successional conditions.

There are clear environmental benefits and costs associated with this prescription. Important areas such as ecologically diverse ecosystems (rock outcrops, peat swamps etc.) and road, river and stream edges are protected from any major direct impacts of logging and associated mechanical disturbance. Karri itself and associated species present as seeds, spores or eggs in soil are regenerated and protected from fire until the karri regrowth reaches 25 years of age.

The primary environmental impacts of logging karri forest are:

- increased access to people (which may be good for some values), feral animals and disease by the creation of a permanent road network,
- removal of much of the above-ground biomass by mechanical means and fire,
- mechanical soil disturbance and compaction,
- the introduction of plants or seeds from outside the coupe during regeneration, and
- the creation of low fuel buffers in flats and low woodlands through recurrent prescribed burning.

The proposed silvicultural prescription aims to reduce environmental impacts within the context of the Group's Terms of Reference, including adherence to Ecologically Sustainable Forest Management principles.

***Silvicultural Prescriptions***

*1. Karri Tingle Old Growth Forest and Karri Tingle Two-tiered Forest*

In the view of the Group, old growth and two tiered forests containing tingle (i.e Karri Tingle Old Growth and Karri Tingle Two-tiered Forest) have special values in relation to biodiversity. The Group therefore proposes to recommend that no logging be permitted in these forest types.

Although not as diverse in species richness as adjacent communities such as on granite outcrops, in peat swamps, or mixed woodlands on marginal sites, it is clear that tingle forests, in particular, are vitally important as refugia where organisms derived from the vast south-western rainforests of the Cretaceous and Tertiary persist. Wardell-Johnson and Williams[1] provide data indicating significant differentiation of plant communities beneath tingle trees and rapid change in species composition across the landscape within the narrow geographical distribution of tingles. Recent studies by Wardell-Johnson (personal communication) of changes across the landscape where tingles occur have shown that as the understorey changes, so too does the biomass of timber, the structural diversity of the forest and its species richness.

Yellow tingle also displays significant genetic variation among stands across its distribution, accounting for 16% of that detectable using biochemical isozyme markers[2]. The thick bark of large tingle trees also provides habitat for invertebrates such as certain spiders with ancient ancestries. Much remains to be documented about these relicts of Gondwanan times, when all the southern continents were joined together, and rainforest prevailed as the dominant vegetation.

*Recommendation: Karri Tingle Old Growth Forest and Karri Tingle Two-tiered Forest*
2.6.1 The Group recommends that **no** logging be permitted in these forest types.

*2. Karri Old Growth Forest and Two-tiered Karri Forest*

The basic choice for these forest types is between selection systems, in which individual or small groups of trees are removed, and clear-felling, in which almost all standing trees are removed, other than those required for aesthetic, structural, habitat or biodiversity reasons. As noted earlier, the Group concluded that in Old Growth and Two-tiered Karri Forest, clear felling should be maintained, principally because of the safety concerns that relate to trying to fell large crowned trees.

The Group canvassed two substantially different forms of clear-felling with stakeholders: one involving small coupes (average 10ha) and involving the more widespread use of

[1] Wardell-Johnson, G. and Williams, M. (1996). "A Floristic Survey of the Tingle Mosaic, South-western Australia: Applications in Land Use Planning and Management". Journal of the Royal Society of Western Australia **79** (4): 249-276.

[2] Wardell-Johnson, G. and Coates, D.J. (1996). "Links to the Past: Local Endemism in Four Species of Forest Eucalypts in South-western Australia". In S.D. Hopper, J.A. Chapill, M.S. Harvey and A.S. George (eds) "Gondwanan Heritage: Past, present and future of the Western Australian Biota". Pp 137-154. Surrey Beatty & Sons: Chipping Norton, NSW.

visual resource buffers (100m wide) on all permanent roads; the other involving larger coupes (not exceeding 40ha), with only limited recognition visual resource properties in relation to neighbouring landowners and communities. The choice between these bears crucially on the balance to be struck between the extent of clear felling of remaining Old Growth Karri Forest in the transition period (see 'Scheduling the logging' below) versus the provision to be made for aesthetic purposes. A very clear majority of stakeholders favoured the larger coupe option.

Karri forest is less diverse than tingle forest, but 13 floristic community types[1] have been identified, each differing in its productivity as measured by age-standardised top-height. Such data indicate the need for silvicultural prescriptions that take account of local variation in ecological features, productivity and forest structure. For example, karri on prime fertile alluvial sites will have much greater biomass (bigger trees at greater density) and fewer understorey species than karri on marginal infertile upland sites. To meet Ecologically Sustainable Forest Management objectives, logging and regeneration operations need to be better matched to such ecological variation.

On this basis, the Group recommends adoption of the large coupe option but with modifications at the margins to improve aesthetic, structural and biodiversity properties.

*Recommendation: Silvicultural prescriptions for Karri Old Growth Forest and Karri Two-tiered Forest*

2.7.1 Clearfelling systems should be maintained.

2.7.2 Coupe size should not exceed 40ha.

2.7.3 A rotation of 100 years is recommended, together with the use visual resource buffers of at least 100m in width, and stream and wildlife buffers as presently prescribed.

2.7.4 Marginally more trees and some clumps should be retained for feathering the coupe boundary, and for structural (eg. clumps of advanced regrowth), habitat (eg. hollow bearing trees) and biodiversity (eg. marri and understorey tree species) purposes.

2.7.5 The aim of regeneration should continue to be to achieve the species mix of the former old growth on that site.

2.7.6 In small coupes where broadcast burning is not feasible, windrowing, heaping and burning, should be carried out, followed by site preparation, fertilising and planting. Further research is needed on the impacts of windrowing, planting and fertilising.

2.7.7 As far as possible, seed stock of trees and understorey should be drawn from the same zone. Research to delineate these zones should be updated using DNA markers.

2.7.8 Trials of 'understorey islands' with minimal disturbance in clearfelled coupes should be completed within two years.

2.7.9 Studies of regeneration and biodiversity on mixed species sites should be established by CALM research as soon as possible to enable biodiversity impacts to be gauged.

[1] Inions, G., Wardell-Johnson, G. and Annels, A. (1990). "Classification and Evaluation of Sites in Karri (*Eucalyptus diversicolor*) regeneration. II Floristic attributes". For. Ecol. Manage. **32:** 135-54.

Our recommendation on ending large scale clearfelling in the karri forest by placing a 40ha maximum size limit on coupes avoids a number of environmental costs associated with reducing the average coupe size below the present average of approximately 20ha. Smaller coupes require proportionally longer road networks, and would disperse the impacts of logging across a greater area of the landscape.

The need to windrow, heap, burn, fertilise and plant seedlings in small coupes has a number of environmental difficulties. Mechanical disturbance to soil may be increased, seed stores can be sterilised by intense temperatures created when burning windrows, uneven distribution of nutrients from ash occurs, the use of fertiliser needs to be matched to site fertility to avoid adverse impacts on understorey species (eg. of Proteaceae). Direct seeding, where successful, overcomes some of these issues. Further research is needed to understand the impacts of windrowing and planting.

Trials on the retention of understorey islands within clearfell coupes have the potential to significantly improve survival of those organisms incapable of moving from the path of machinery used in logging. Research on understorey islands in Victoria's mountain ash (*Eucalyptus regnans*) forests has established dramatic improvement in the survival of resprouting understorey species with no loss of timber logged when mechanical disturbance is avoided in understorey islands up to 20m x 40m in logged coupes. The urgent investigation of this strategy in logged karri forest is recommended, with immediate application through prescription should its environmental benefits be established. We would recommend resolution of the matter within two years.

*3. Karri Even-aged Regrowth Forest*

Mechanical harvesting is feasible in Karri Even-aged Regrowth Forest and enables the individual regrowth tree, with its smaller crown and bole, to be felled safely. Trials of this system are needed to verify this approach but selection or group selection techniques represent a useful addition in certain areas where adjacent visual resources or the sites are sensitive to exposure. However, clear felling will probably be the preferred method for the greater part of the Karri Even-aged Regrowth Forest for economic and supply reasons, at least to 2025 (see 'Scheduling the logging' below). Hence the following prescriptions are recommended for Karri Even-aged Regrowth Forest.

*Recommendation: Silvicultural prescriptions for Karri Even-aged Regrowth Forest*

2.8.1 Clear-felling systems generally be maintained, at least until 2025, but selection systems are preferred in areas where adjacent visual resources or the sites are sensitive to exposure.

2.8.2 Coupe size should not exceed 20ha until a further review of operations has been undertaken.

2.8.3 A rotation of 100 years is recommended, together with the use of visual resource buffers of at least 100m in width and stream and wildlife buffers as presently prescribed.

2.8.4 Marginally more trees and clumps should be retained for aesthetic, structural, habitat, and biodiversity purposes. Precise prescription is not possible because this

process must be opportunistic in character, taking advantage of suitably located habitat trees, clumps of regrowth or understorey trees.

2.8.5 The aim of regeneration should continue to be to achieve the species mix of the former forest on that site. This does not equate to the same mix of regeneration, the relative proportion of species will change over time according to site and the influence of competition and fire.

2.8.6 Where broadcast regeneration burning cannot be effectively carried out in small coupes, windrowing, heaping and burning should be carried out, followed by site preparation, fertilising and planting.

2.8.7 As far as possible, seed stock should be drawn from the same zone.

2.8.8 If successful in trials in Karri Old Growth and Two-tiered Forest, 'understorey islands' should be instituted in clearfelled coupes.

2.8.9 Formal trials of selection systems should be established by CALM research as soon as possible.

## 3. SCHEDULING THE LOGGING

### *Introduction*

Scheduling the logging is a complex process carried out by detailed and technical computer programs, drawing on the comprehensive data available to CALM from aerial photography interpretation of forest types, field assessment, and recent logging operations and yields. The detail involved would defeat all but experts in the field and hence the need to rely on independent audit by experts in relation to the accuracy and appropriateness of the scheduling. The detail reflects:

- the complexity of a varied mix and location of forest types,
- the need to take account of proposed regulatory controls on the sawlog cut,
- the prediction of growth and mortality for each stand (an area of a particular forest type),
- the simulation of the cut and characteristics of the resulting stand,
- the requirements of strategic prescribed burning and of regeneration burning,
- visual resource and biodiversity management, wildlife habitat retention, and water quality protection,
- many different wood products to be supplied to different processors at different locations, and
- roading and logging requirements, including soil compaction and dieback issues.

### *Sustainable Yield*

The Terms of Reference of the Group state:

> In recommending changes to silvicultural specifications, regard should be had to the Government's stated intention of meeting contractual commitments with regard to karri, maintaining the agreed 'step down' levels of supply of 1st and 2nd grade jarrah sawlogs, and delivering a non-declining karri sawlog yield of 50,000 cubic metres per annum beyond 2003.

Despite the complexity of the process, the principles underpinning the determination of sustainable (ie. non-declining) yield are simple. The first is to determine whether the forest can sustain the level of supply stipulated by the Government: in this case 149,000 cu m/yr of Grade 1 and 2 karri sawlogs to 2003, and 50,000 cu m/yr thereafter in order to comply with the sustainable yield provisions. This involves an initial simulation by computer according to sets of rules that prescribe the details pertaining to the above silvicultural and related conditions, but without specific consideration of the detailed sequencing of logging coupes in time, especially in relation to roading or burning constraints.

In drawing up the conditions for this simulation, the Group was mindful not only of the need to minimise the extent of Karri Old Growth Forest logged, but also to try to exclude logging from sensitive areas of Karri Old Growth Forest in the following Blocks which had been the focus of community concerns and protests:

Table 2. Blocks containing sensitive areas of Karri Old Growth Forest

| Name of Block | Name of Block |
|---|---|
| Beavis | Keystone |
| Burnett | Northcliffe |
| Carey | Ordnance |
| Dawson | Sharpe |
| Deep | Swarbrick |
| Gardner | Thomson |
| Giblett | Wattle |
| Jane | Wye |

These exclusions apply **only** to Karri Old Growth Forest in these blocks. The Group has also recommended that logging be excluded from Karri Tingle Old Growth Forest and Karri Tingle Two-tiered Forest. Thus within the above blocks, areas of Jarrah Forest and areas of Karri Two-tiered Forest were still considered for logging.

The Karri Two-tiered Forest represents an especially important resource for karri sawlog supply. In addition to major contributions to supply in the transition period, it provides a very important part (about 66%) of sawlog supply from 2004 to 2025. Thus it bridges the hiatus that would otherwise occur until sufficiently large areas of Karri Even-aged Regrowth Forest reach their rotation age (100 years, under current Ministerial conditions).

Using the silvicultural prescriptions and constraints described above, the sustainable yield was simulated by CALM computer-based models designed to predict karri growth and yield. The results showed that the prescribed supply levels to 2003 can be met and that 50,000 cu m/yr can be sustained thereafter on a non-declining basis. (See Figure 3).

***Logging Plans***

The second simulation then imposes further a detailed level of sequencing and location:

- on the actual logging coupes for the period 2000, and then
- for the look-ahead candidate coupes for 2001 to 2003, and
- by trial and error through a CALM committee of local experts (especially regarding fire protection), produce a workable look-ahead logging plan of proposed coupes for 2001-2003.

*1. Year 2000 Coupes*

The locations of all proposed Year 2000 coupes in the karri forest region are shown in Maps 1-6 attached to this report.

Because of the various prior surveys (endangered species and threatened ecological communities, cultural heritage, National Estate, dieback etc), and operations (roading, landings) required prior to a coupe actually being opened for logging, little flexibility was available in the choices for the year 2000. Nevertheless, for this year and subsequent years, suggestions and concerns from stakeholder workshops were incorporated wherever possible. While concerns relating to proposed Karri Old Growth coupes in Wheatley and

Crowea East were able to be addressed by excluding the coupes concerned from logging, others in Boorara East and Crowea had to stand as they were critical to the supply of karri sawlogs in the year 2000. Time and inflexibility in the processes did not permit the development of alternatives.

*2. Year 2001-2003 Coupes*

The tentative status of the look-ahead candidate areas for coupes for 2001 to 2003 must be stressed. Due process in terms of the various surveys and controls has not been carried out. Some will prove to be infeasible because

- burning within the last three years prevents dieback symptoms being expressed and surveys being carried out, or
- arterial roading has not been completed to enable feeder roads to be developed into the coupe, or
- adjacent young regeneration under 25 years of age would be put at risk by a regeneration burn, or
- any of a number of other environmental or community reasons.

To cater for these uncertainties, the total areas of candidate coupes in the Karri forest types for 2001-2003 must be increased by about 50% over the accessed areas shown in the following table, to cater for subsequent exclusions. Should the exclusions reduce the areas to below the target figure, trade-offs will have to be found between the areas under consideration for exclusion and those available for logging, but not presently included in the candidate coupes.

*Recommendation 3.1.1: Indicative Logging plan 2001-2003*

| **Forest Type** | Indicative areas (ha) | Accessed areas (ha) |
|---|---|---|
| **Year 2000 Coupes** | | |
| Karri Old growth | 900 | Up to 1200 |
| Karri Two-tiered | 1200 | Up to 1700 |
| Karri Even-aged Regrowth | Negligible | Negligible |
| **Years 2001-2003 Coupes** | | |
| Karri Old growth | 1600 | 2100 |
| Karri Two-tiered | 2400 | 3400 |
| Karri Even-aged Regrowth | 3300 | 3600 |

The above table can only be broadly indicative because due process has to be followed with respect to existing CALM guidelines for finalising the logging plan (see Regional

Forest Agreement *Report of the Expert Panel on Ecologically Sustainable Forest Management* for details), to the existing provisions of the *Conservation and Land Management Act 1984* and to the existing Ministerial Conditions as set under Section 45 of the *Environmental Protection Act 1986* for the *Forest Management Plan.* Furthermore, the coupes in the karri forest types also have to be integrated with the locations of the coupes in the jarrah forest, which need to be revised in the light of the Regional Forest Agreement outcomes.

Descriptively, what we can say on the basis of the above recommendation and Figure 3 is that:

- Between 2000 and the end of 2003, virtually all the Karri Old Growth Forest available for logging **outside** of those sensitive areas in the blocks listed in Table 2 will be logged or accessed (some buffer zones being needed between 40ha coupes).
- Between 2000 and the end of 2003 virtually one fifth of the area of Karri Two-tiered Forest available for logging will be logged, and the remainder (four-fifths) between 2004 and 2025. Thus by 2025, little or none of this forest type will remain other than buffers and other informal reserves (streams, visual buffers, wildlife buffers etc).
- Between 2000 and 2005, virtually all of the Karri Even-aged Regrowth Forest in Big Brook and Treen Brook, other than buffers and informal reserves, will be logged.
- Logging of jarrah forest throughout the karri region will continue at rates consistent with the Government's agreed levels of commitment for the entire Jarrah Forest.

On the other hand, the logging plan excludes logging from some 9,850ha of Karri and Karri Tingle Old Growth Forest which previously would have been logged under the Regional Forest Agreement.

In developing this plan, no account has been taken of the change to an 80 year rotation length for Karri Even-aged Regrowth Forest recommended by the Regional Forest Agreement *Report on Ecologically Sustainable Forest Management.* This rotation length was examined by the Group and the earlier predictions confirmed. Such change would have little or no immediate effect on the karri sawlog supply for 2003. After that time, it would provide a greater degree of flexibility in meeting 50,000 cu m/yr supply level during the periods when the present level in Figure 3 is close to that limit, but would not otherwise materially affect the outcome. Nevertheless the Group does endorse the proposed use of an 80 year rotation in order to provide greater flexibility.

***Environmental Care***

The present system of exclusion of diverse ecosystems from logging operations, assessment of threatened flora and fauna populations, and creation of informal reserves along roads, rivers and streams is working well but will need ongoing review and refinement to ensure contemporary best practice. For example, as noted earlier, planning of roading and use of diverse ecosystems as low fuel buffers to protect even-age karri regeneration coupes needs careful review and research to minimise the impact on biodiversity in the context of operational objectives.

Special emphasis should be given to protection of the surface seed store and associated biodiversity. In particular, surface soil should be heaped dry on log landings earmarked

for restoration and spread for regeneration as soon as logs are removed, preferably in the same season as heaping. Every effort should be made to avoid stockpiling of surface soil for any length of time. Ideally the soil should be respread immediately on an adjacent operation or alternatively only stockpiled for a very brief period.

Logging operations should be mainly undertaken in the dry season to minimise roading requirements, soil compaction and erosion, manage disease risk and improve protection of the soil seed store and associated biodiversity. This move to seasonal logging from October to June (approximately) is one that has to be made progressively. The Group believes it should be commenced in some areas in 2001 and completed by 2003, to become the norm for subsequent logging from 2004 onwards.

Greater use should also be made of temporary roading, with restoration to forest and local understorey as an essential completion criterion. Careful management of the soil seed store should be undertaken, including utilisation of direct surface soil replacement or minimising the time between heaping and redistributing topsoil, and concentrating such activity in the dry season. Research on temporary road restoration should be undertaken.

Hydrocarbon management should be reviewed to reduce the risks of oil spills from machinery and other potential sources of pollution.

In concert with the development of a Code of Forest Practices covering public and private land, a formal Environmental Management System based on the ISO 14001 process should be implemented for forest practices with a view to achieving independent certification in the next three years. As with forest practices, the involvement and sense of ownership of all parties, especially forest operators, contractors, landowners, industry and CALM are essential to the success of this move.

*Recommendation: Environmental care*

3.2.1 Special emphasis should be given to protection of the surface seed store and associated biodiversity by heaping dry surface soil on log landings to be restored and spreading for regeneration as soon as logs are removed, preferably in the same season as heaping.

3.2.2 Seasonal logging (from October to June approximately) should be introduced in some areas in 2001 and throughout the Karri forest types by 2003, in order to minimise roading requirements, soil compaction and erosion, manage disease risk and improve protection of the soil seed store and associated biodiversity.

3.2.3 Greater use should also be made of temporary roading in logging, with restoration to forest and local understorey as an essential completion criterion. The time between heaping and redistributing topsoil should be minimised. Research on temporary road restoration should be undertaken.

3.2.4 Hydrocarbon management should be reviewed to reduce the risks of oil spills from machinery and other potential sources of pollution.

3.2.5 In concert with the development of a Code of Forest Practices covering public and private forests, a formal Environmental Management System based on the ISO 14001 process should be implemented with a view to achieving independent certification in the next three years.

***Community Involvement***

To secure greater community acceptance, the existing processes for determining logging plans should be changed, in the view of the Group, towards greater public involvement in planning. The very existence of the Group is evidence of this need for change. The history of community concern, protest and disputation developed to the point where the Government had to resort to circuit-breaking decisions. There is an urgent general need for rebuilding community trust, to which we shall refer again later.

In relation to sustainable yields and logging plans, however, we would urge consideration of a major change in policy to make the data and processes more transparent. It is important to recognise that the community at large already has access to quite sophisticated tools and has personnel to apply them, as can be seen in the use of remote sensing imagery by some community groups. The supply of maps is now possible on CDs or the web, as is the supply of large data sets, although copyright provisions would need to be made clear. Some charge may also need to be made to recoup immediate production costs and preclude frivolous requests. The supply of mainframe computer programs by this means is probably neither sensible nor necessary but again, subject to copyright provisions, listings of CALM programs might be supplied at immediate production cost to interested parties. There may be some data concerning commercial proposals that are confidential, at least until contracts are signed, but the general principle should be to make everything available provided it does not damage other parties commercially.

Improved transparency of data is just the first step. The processes used to develop sustainable yields, and those in the preparation of three year logging plans, have already been identified as needing greater provision for community involvement and some changes have been made towards that goal.

Before roading proceeds there must be some degree of community agreement. CALM should be encouraged to expand community consultative mechanisms at the District level. The key towns affected by karri logging are Walpole, Northcliffe, Quinninup, Pemberton and Manjimup. For the purpose of getting a degree of community "ownership" of plans, stakeholders must be identified and databases with lists of all relevant interest groups developed. Names and contact information for office bearers or individuals with a stake in outcomes should be collated. All local industries, which may be affected by the plans, should be represented.

Community input as to the location of special plant or animal communities, and significant areas free from dieback, should continue to be welcomed. Local knowledge of special trees or stands should also be collated. District CALM field staff have considerable knowledge in this respect and must also have opportunities to contribute. As a result of recent conflicts, some CALM staff tend to have been alienated from the community, to the further detriment of their role and morale.

*Recommendation: Community involvement*

3.3.1 Processes for community involvement need to be improved, developed and fostered.

3.3.2 CALM data and processes need to be made more transparent.

***Mediation***

Hopefully the processes described above will greatly curtail the number of protests but it may not eliminate them. Forest issues have the capacity to raise passions that are seldom seen in other areas. Once continuing protests arise, they have the capacity to explode to the detriment of community relationships, as well as economic and other values. The introduction of a mediation process, even if seldom used, seems a desirable mechanism to avoid the flashpoint of wider community conflict being reached.

Details of the mediation process require further study but some of the fabric is already available through the services of mediators established in other fields. The process needs to provide a low cost localised system for resolving otherwise irreconcilable differences between local communities and CALM as the administering agency. Criteria need to be developed for such a process because mediation, like judicial processes, cannot be all things to all people. We know of no existing scheme in forestry that might be used as a model, but there are many outside of forestry.

*Recommendation: Mediation*

3.4.1 A mediation process should be established using the services of mediators established in other fields.

# 4. IMPLEMENTATION AND FUTURE ISSUES

## *Coupe Management*

The Terms of Reference require the Group to review contractor coupe management. This form of management arose when CALM was assigned the principal role in managing logging, subject to out-sourcing the work to contractors. In pursuing this role, CALM subsequently formed a separate Business Unit for the purpose of managing these contract operations.

The rationale for CALM's role in contractor management was to enable it to market to different purchasers the many different wood products that often arise from one coupe. The previous system linked the coupe with the concessionaire's needs and interests and the rest was sometimes wasted or burnt, unless salvage could be organised after the concessionaire had completed operations. Nevertheless, several features relating to the letting of contracts have caused unfavourable comment by stakeholders.

Historically, Bunnings was and still is the largest contractor, having invested heavily in this area when the entire responsibility for logging rested with the concession holder. In their current role, contractors are responsible for initial log preparation at the landings and arranging transport to the various purchasers to whom CALM specify the various amounts and log grades to be supplied. CALM officers undertake a weekly inspection of the log grading and may require some further preparation and re-grading if they believe the standards have not been applied appropriately. However, this process inevitably leads to allegations by other purchasers of logs, of favouritism to Bunnings mills and discrimination against other purchasers. These complaints reverberate to the wider community who then also tend to believe CALM is complicit, or not doing its job.

One of the stakeholders pointed out that the only effective way of laying these allegations to rest is to have periodic independent audits of delivered log grades conducted at regular intervals. In addition the Group believes that CALM should explore more regular inspections of grading on a cost-benefit basis – more frequent inspection being justified if the revenues of upgrading exceed the costs of the additional services.

Another related issue concerns the responsibility for managing logging contractors, which is currently vested in the State Forest Resources Business Unit, a quasi commercial entity within CALM. This division of labour and responsibilities within CALM has blurred previously clear responsibilities for integration in field management of CALM-managed native forests. The Regional Forest Agreement *Report on Ecologically Sustainable Forest Management* argued that integration should be the paramount consideration if Western Australia is to maintain its progress in the pursuit of Ecologically Sustainable Forest Management and recommended accordingly (Recommendation 3.1). The Group strongly endorses this recommendation and suggests that it be considered carefully in any restructuring of CALM.

*Recommendation: Coupe management*

4.1.1 Independent audits of delivered log grades and sawn recoveries need to be instituted, and the results published.

4.1.2 CALM should explore more regular inspections of grading on a cost-benefit basis.

4.1.3 The Government should take note of the need to integrate field management in any restructure of CALM, such that field management of logging contractors does not become separated from management of other operations.

***Jarrah Sawlog Supply***

Jarrah grows in association with both marri and karri in the south. As noted earlier, these mixed species stands are named according to the relative abundance of the major tree species – jarrah/karri implying that over 20% of the trees over 15 cm diameter are karri. One consequence is that logging in jarrah forest adjacent to karri forest types will yield significant volumes of karri sawlogs. These were taken account in preparing the estimates of the karri sustainable yield, based on strategic plans developed as a result of the Regional Forest Agreement for the logging of the Jarrah Forest.

On the other hand, as outlined in CALM *Silvicultural Guidelines 2/95*, mixed karri/jarrah stands occur as "transition zones between karri and jarrah types where soil types change... and as substantial stands in their own right where the site types favours neither the full development of karri nor jarrah types." These karri/jarrah mixtures contribute to the sustained yield figures for jarrah. If any sizeable areas are withdrawn from logging, there could be significant impacts on the sustainable yield for jarrah.

Based on the simulations of the recommended silvicultural prescriptions and logging plan for the karri forest types, it seems that the impact on the jarrah will not be so large as to seriously endanger the capacity to meet jarrah sawlog commitments. However, there is very little margin for error and the implication of any impact would be one of a greater pressure on utilisation of lower grade jarrah logs (eg. Grade 3 sawlogs) and the pursuit of greater recovery of sawn timber from all log grades. This aspect of scheduling warrants more detailed work and confirmation.

Until relatively recently little consideration was given to the consequence of spreading dieback while carrying out karri logging operations. Karri roading often passes through jarrah forest vulnerable to the disease. Roading procedures for karri must therefore ensure that the dieback fungus (*Phytophthora cinnamomi*) is not spread to other vulnerable vegetation. The proposed progression to adopt seasonal logging will lessen the risks of soil movement and hence lessen the risks of spreading the fungus. It will also reduce soil disturbance under wet conditions on duplex soils that are often associated with the karri/jarrah and jarrah/karri mixtures.

*Recommendations: Jarrah sawlog supply*

4.2.1 Implementation of the karri silvicultural prescriptions have to be located in karri rather than jarrah forest types, if the supply of jarrah sawlogs is to meet the Government's commitments.

4.2.2 Roading and logging procedures in the karri forest types must aim to reduce the risk of dieback spread to adjacent jarrah forest and associated communities, by moving progressively to seasonal logging and avoiding soil movement especially under wet soil conditions.

***Marri Sawlog Supply***

Recent developments and value adding in the marri sawn timber industry should be encouraged. In some areas of the Southern Jarrah Forest, which were selectively cut in the past, marri predominates. There will be some restriction to supply of marri with the cessation of logging in Karri Tingle Old Growth and Two-tiered, and in Karri Old Growth from 2004. Nevertheless, an adequate supply of sawlogs seems likely to be provided, even acknowledging that less than one in ten of marri trees felled may be of sawlog quality, because of the high incidence of kino venation and water shakes. According to the *Sustained Yield Expert Panel Report* produced as part of the RFA, for the period 1999–2003, 23,000 cu m/yr of marri sawlog would be available from the karri forest whereas up to 55,000 cubic metres/year of marri sawlog could come from the jarrah forest. However, in 1996-1997 only 7000 cubic metres of marri sawlog was sold despite the estimated 70,000 cubic metres available at the time, indicating that there is ample scope for marri sawlog usage increase despite reductions in supply after 2003.

Consequently it is essential that ongoing markets exist for marri residues. Large quantities of marri residues are an inevitable consequence of a marri sawn timber industry. For the period 1992-1996, an average of about 376,000 cubic metres of large marri chiplogs was sold annually.

Further work is required to verify the sustainable marri sawlog supply. Considering marri's increasing importance for sawn timber, more growth data on marri need to be collected. As stated by Turner and Wood[1] "almost no information is available on the growth of marri which constitutes a substantial component of many stands and is now considered utilisable for some products. The assumption that other species have the same growth rates as jarrah is highly contestable". Further work is also required to evaluate the percentage of standing marri, which may be considered as sawlogs. Error may be understandably high but assumptions should be based on research and ongoing monitoring. The greater use of marri sawlogs will become even more important if the market for marri chips declines.

Much of the marri sawlog presently sold is identified at the Diamond Chipmill and returned to Bunnings Pemberton Mill on the log train otherwise used by tourists.

[1] Turner, B. and Wood, G. (1993). "Review of the New Jarrah Inventory System and Associated Timber Estimation Procedures". In "A Report to the Hon. Kevin J. Minson, MLA Minister for Environment, by the Scientific and Administrative Committee Chaired by T. Meagher".

Sawmillers close to the Diamond Chipmill can personally select sawlogs on a buyers' choice basis. If stain can be prevented by spray or end treatment, it may be possible to establish a sawlog dump at Pemberton for sale and supply to interested sawmillers. Elsewhere, greater effort may have to be placed on log selection at forest landings particularly in the jarrah forest. Similar consideration should be given to improving access to minor species such as she-oak.

The method of measure for calculating payment for marri sawlogs should be reviewed. The convenience of payment by weight has been acknowledged but some checking should be carried out to determine the variation in density for logs from different areas, sites, mixtures and size classes. Periodic review of conversion factors used should continue to be undertaken.

The proposed move to seasonal logging may impact on supply of marri logs to sawmills. Marri is prone to stain and storing during periods when logging is suspended may present some difficulties. However, during this period, logs might be accessed from drier jarrah forest away from high rainfall zones and thus less prone to adverse environmental effects of winter logging.

*Recommendation: Marri Sawlog Supply*

4.3.1 Recent developments and value adding in the marri sawn timber industry should be encouraged.

4.3.2 Further work is required to verify the sustainable marri sawlog supply but there is scope for an increase in supply.

4.3.3 If stain can be prevented by spray or end treatment, a marri (and other minor species) sawlog dump at Pemberton should be established for sale and supply to interested sawmillers.

4.3.4 Periodic review of conversion factors used for calculating stumpage payments should continue to be undertaken.

***Regrowth Karri Management***

A number of factors affect the growth rates of regrowth karri, most of which are incorporated into the computer-based simulation models on the basis of data from well distributed growth plots. Nevertheless, changes to silvicultural prescriptions from those used at time of growth plot establishment should be factored in to projected wood supply in due course. These have been taken into account to some extent in the present work, but further refinement is needed, especially in relation to the possible use of selection systems in the Karri Even-age Regrowth Forest. In particular, allowances for possible sources of defects in regrowth karri sawlogs need to be refined.

The grading of regrowth karri sawlogs is affected by a number of recognised agents. Adequate allowance in any modelling of future sawlog supplies should take into account:

1 Honey fungus
2 Borer and brown wood
3 Basal drysiding or fire damage to boles

As an increasing proportion of sawlogs is to be obtained from the Karri Even-aged Regrowth Forest, log quality will become increasingly important. Internal defect can cause sawn timber recoveries from small logs to drop dramatically and render sawmilling uneconomic.

As discussed by Florence (personal communication), some agents may not significantly affect growth or sustainability on good soils but in areas originally supporting mixed species stands may take on greater significance. Some marginal areas may produce few first grade sawlogs. The smaller the log, the greater the impact of the incidence of internal defects. Different agents may come into play on different soil types.

1. Honey fungus.

Allowance is already made in simulation modelling for areas of known Armillaria-induced mortality. Surveys of incidence are ongoing. Mortality has been observed in regrowth stands on a range of soils including some of the better soils. What is unknown is whether this root disease will be exacerbated by thinning, leading to increasing mortality of retained stems with significant impact on future sawlog volumes. Management strategies such as stump pulling by mechanical harvester may have to be adopted on some soils to minimise losses.

In areas of non-lethal infections, the fungus can be present in root systems but trees survive. However, log degrade may occur due to bole damage. Ongoing monitoring is essential as in most areas of intensive forestry losses do occur in the presence of Armillaria, and some allowance for increasing incidence with successive thinning is to be expected. Periodic assessment of the problem is needed so that data are available on which to make management decisions about stump pulling and other management strategies.

2. Borer and brown wood.

A number of CALM reports are available on the incidence of bullseye bore (*Tryphocaria acanthocera* or *Phorocantha*). CALM's Wood Utilisation Centre has also reported on incidence of borer and other causes of defect in small logs[1]. The most recent report[2] concluded that brown wood and borer were significant forms of degrade in regrowth karri requiring further work. Cossid moth (*Xyleutes* sp.) was also recognised along with the bullseye bore.

In 1991, Abbott *et al.*[3] reported that there was evidence to suggest that stress and proximity of karri to mature marri stands predisposed karri regrowth to bullseye borer attack. The recent report by Farr *et al.* (personal communication) tends to confirm these

[1] Siemon, G.R. (1995). "Review of WURC Stockpiling and Sawmilling Studies". CALM Science **2**(1), 101-110.

[2] Brennan, G.K., Smith, E.L., Stratico, S.C. and Pitcher, J.A. (1999). "Assessing Wood Quality of 30-year-old Regrowth Karri from Nairn Block, Pemberton." CALM Science **3**(1), 1-19.

[3] Abbott, I., Smith, R.. Williams, M. and Voutier, R. (1991). "Infestation of Regenerated Stands of Karri (*Eucalyptus diversicolor*) by Bullseye Borer (*Tryphocarya acanthocera, Cerambycidae*) in Western Australia. Aust. For. **54**(1 and 2), 66-74.

findings. The incidence of borer infestation ranged from 78% to 24% of trees sampled from the regrowth estate over different rainfall zones. Larger trees, those likely to be selected as future crop trees, had a higher incidence of internal defect than smaller trees.

Discussions with stakeholders associated with the karri sawn timber industry also highlighted their concerns as to the magnitude of the problem. Suggestions for control ranged from the need for research into ways of controlling the borer to reducing stress in younger regrowth stands. Early thinning should be tried, even if form of retained trees was affected. Such a strategy would be costly as the thinning operations may be non-commercial.

The problem does not seem confined to the intermediate rainfall or marginal karri areas where the original composition of the forest was mixed species. This means that the impact may be felt as soon as logging of Karri Even-aged Regrowth Forest commences on a substantial scale, after 2003.

3. Fire damage

Fire damage in regrowth stands after thinning represents another largely uncharted source of risk. Some allowance is made for losses from wildfire in the simulation models used to predict future growth and yield. However, the area of regrowth is increasing relative to the areas of mature forest for which fire can be more easily prescribed. As the fuel loads increase in the unthinned karri regrowth estate, so do the risks of fire. Where fuels are vertically distributed due to understorey growth, two successive burns may be required to reduce fuel loads to reasonable and manageable levels – a demanding task.

While current research aims at guiding the development of fire prescriptions for the management of the regrowth estate, additional allowance for some dry-siding and consequent decay of retained trees in thinned stands needs to be made.

*Recommendation: Regrowth karri management*

4.4.1 Further research is needed to refine the data. Pending the results of this research a sufficient allowance for internal defect and fire damage should be made.

***Regrowth Karri Utilisation***

The utilisation of regrowth karri sawlogs will become a major feature after 2003, because some 33% of the 50,000 cu m/yr supply thereafter will be in the smallest log sizes (less than 20cm top diameter). Beyond 2025 (approximately), almost the entire supply will be from regrowth sawlogs.

The goal of the Government and CALM is to encourage further processing and value adding in the utilisation of karri. Differing views have been presented to the Group with respect to prospects for value-adding regrowth or smaller diameter karri logs. Some representatives of industry felt research and development could quite rapidly develop satisfactory methods of drying boards cut from regrowth karri, minimising problems such as checking. Other representatives were less confident and felt that small log

characteristics and the incidence of defects from agents such as the bullseye borer would present significant problems.

Different sawing technology is needed to cope with growth stresses in the smaller logs, either by simultaneous twin sawing of flitches on either side of the log, or line bar carriages which allow compensation for the growth stresses. Drying of the resulting material tends to be more difficult. Machining of faster-grown wider-grained timber may also be more difficult. None of this is unusual, nor is it beyond realm of technological development to provide solutions. But it does require investment in equipment and technology that is different to that used in sawing old growth logs and that investment requires a larger scale of operation, if it is to be economic. It seems most unlikely the amounts available (about 16,000 cu m/yr) from 2004 to 2025 could support more than one suitable sawmill of economic scale for regrowth sawing and further processing to produce appearance and specialty products. This raises real dilemmas for the Government because Bunnings has an existing sawmill (No 2 mill at Pemberton) that is suitable and other sawmillers do not. It signals that careful thought and transparency in the sale of the resource beyond 2004 will be critical for all concerned.

The Group also received information from a stakeholder regarding new technologies which may make it possible to utilise very young regrowth for production of value added products such as flooring and furniture. Lamination techniques may provide one of best options for adding value to very small logs. Such a development, if economic, is to be applauded but further research is needed if the Government is to achieve its goal of greater value-adding, especially to small diameter regrowth logs. Financial contributions to this research by the Western Australian Government would potentially be eligible for matching funding from the Forests and Wood Products Research and Development Corporation.

*Recommendation: Regrowth karri utilisation.*

4.5.1 The sale of the regrowth karri resource after 2003 needs to recognise that the characteristics of regrowth are different from those of the old growth resource and the arrangements for sale of this resource need to take account of this and be transparent to all.

### *Value Adding*

Beyond 2003, an additional 34,000 cu m/yr will be available from Karri Two-tiered Forest with a wider array of size classes and log grades than has been true during the old growth era. This array will be suitable for existing or any new small or large sawmillers and for further processing and value adding. Any limitations on the utilisation of this material relate to price and the scale of further processing facilities, not to the sawmilling itself.

At present, the greatest hope with respect to value adding in karri is the "flooring market". Karri has some cost advantages over jarrah and recoveries from karri tend to be better than from jarrah. However, it must be acknowledged that there will be difficulty in finding value adding niches for karri. It is not durable to outdoor use and is an acid wood.

Some stakeholders have drawn attention to the needs of small sawmillers specialising in the supply of timber to craftwood products. They argued that some of these millers would welcome the opportunity to salvage logs from trees that have died and fallen in the Karri Old Growth Forest **outside** of National Parks and formal reserves. The latter qualifier is essential as removal from National Parks and formal reserves would run contrary to the principle of allowing natural ecosystem processes to proceed undisturbed, as far as possible. The notion of salvaging logs from trees that have died and fallen in the Karri Old Growth Forest (outside of the National Parks and formal reserves) is worthy of trial. It presumes that the logs can be cut into sufficiently short lengths to be snigged by dozer or harvester to a road without substantial disturbance to the old growth forest.

*Recommendation: Value adding*

4.6.1 A limited trial of salvaging logs from trees that have died and fallen in the Karri Old Growth Forest **outside** of the National Parks and formal reserve should be pursued.

***Forest Practices***

The Expert Panel on Ecologically Sustainable Forest Management, in its report for the Regional Forest Agreement, dealt with some matters of process including the Code of Practice and associated Manual. We endorse those recommendations and stress that the Code and Manual need to be revised and rewritten in a user-friendly manner.

Retention of National Estate values such as "Natural landscapes" and "Aggregations of old growth forest" are dependent on the implementation of the current Management Plan. The relevant Code of Practice, manuals, guidelines and area management plans also aim to protect these values where possible. The further development of formal environmental management systems associated with Ecologically Sustainable Forest Management and associated audit systems will lessen the risks to these and other values.

However, the present enquiry has also highlighted concerns of stakeholders that the present Code of Practice is by and for CALM. Forest management would benefit by independent regulation, and by extension of the processes involved to deal with forest practices on private land, especially in the light of the expansion of the plantation estate and the interest now being shown on the admittedly small areas of privately owned native forest.

Forest Practices processes can be regulated solely by Government agencies on a command and control basis, but this does not engender a sense of ownership of the process by the industry and community. A sense of ownership is important if good forest practices are to be instilled into daily work. Clearly, such a system needs to be independent of CALM, transparent, externally audited, periodically reviewed, and include representation of landowners, industry and the Conservation Commission on the governing body, as well as provision for input from all stakeholders and a proper appeal process. The system established under the Tasmanian Forest Practices Act has much to commend it as a model.

Such a system would also need to address training and accreditation of officers to administer issues relating to compliance, and research needs and priorities. It would require funding from Government on behalf of the publicly owned forests and small landowners, and from large private growers and processors. Again, the Tasmanian experience provides a useful model.

The Group has been alerted to the broad nature of the changes to structures currently proposed for CALM and its associated bodies. It would seem that a Forest Practices Board could be established as an independent statutory committee reporting to the proposed Forest Resources Commission and with membership drawn from landowners, industry and the Conservation Commission.

The argument has been advanced that this transgresses the principle of separation of regulator and manager and may be unacceptable. That argument is scarcely tenable, however. It presumes that the command and control model is the most efficient and effective in relation to matter of practice, whereas experience elsewhere is that is neither. There are no incentives for the government regulator to be more efficient, or industry to be more effective in applying better practice in the field. Indeed, the incentives work the other way - leading to more complex regulations, bigger regulatory agencies, and disenchanted and disinterested industries. In any event, the key policy matters concerning the balance between forest uses, the levels of sustainable yield, and the conditions laid down in the Forest Management Plan are still subject to the joint control of the Conservation Commission and the Forest Resources Commission and the provisions of the CALM and Environment Protection Acts.

*Recommendation: Forest Practices*

4.7.1 An independent body, similar to the Tasmanian Forest Practices Board with representation of landowners, industry and the Conservation Commission, should be established to develop and administer the Code of Forest Practices on public and private forests. The system needs to be transparent, externally audited, periodically reviewed; and with provision for stakeholder input, a proper appeal process, training and accreditation of officers, developing research needs and priorities, and funding from Government (on behalf of publicly owned forests and small landowners), and from large private growers and processors.

***Structural Adjustment***

The Group is charged to review these matters in relation to economic values. This matter is dealt with in a more direct way in relation to the relative cost of the proposed changes. However, the indirect costs of structural change that are implicit, if not explicit, in the Government's changes need to be addressed. The Group was made acutely aware of the distress and concern that stakeholders in the timber industry that are or will be displaced by the changes feel. That concern extends to businesses and service companies in Manjimup, Pemberton, Greenbushes and elsewhere, who's livelihoods depended on that economic activity. Banks and finance houses are already curtailing lending in the light of the changes and this simply exacerbates the problems.

Assistance to those individuals, households and businesses affected is essential but will only provide transient relief. It needs to be accompanied by a vigorous program of support and assistance for development projects generated by those communities, be they value adding in timber, craftwood, tourism or otherwise, in order to lift community morale by focussing on achievable and positive economic outcomes and employment.

*Recommendation: Structural adjustment*

4.8.1 Structural adjustment assistance is essential to those individuals, households and businesses affected, and needs to be accompanied by a vigorous program of support and assistance for development projects generated by the communities concerned.

***Relative Costs***

The estimation of relative costs is difficult - all the more so for a Group that is not directly involved in the day-to-day operations involved. The Group therefore urges that its estimates of relative costs be refined by relevant agencies and independent consultants.

The estimates given in Table 4 refer to the additional aggregate costs for the annual program. The period 2004-2015 involves a reduction in logging to one third of the former figure but a major increase in cost due to smaller coupe size and mechanical harvesting of thinnings and final crop regrowth trees.

Table 4. Estimates of percentage increases in aggregate annual costs for new karri prescription and plan

| Operation | 2000 | 2001-2003 | 2004-2025 |
|---|---|---|---|
| Scheduling | 0% – largely complete | 100% – rework from scratch | 0%-Similar to present, less volume, greater complexity |
| Pre-logging surveys | 20% - minor new surveys | 100% - rework from scratch – two years only | 0% - similar to present, smaller coupes, higher cost offsets reduction in cut |
| Roading | 60% - major roading for following years | 50% - more dispersed coupes | 0% - cost increases balanced by fewer coupes |
| Logging | 10% - greater dispersion of coupes | 20%-greater dispersion and seasonal logging | 0% - fewer but smaller coupes |
| Regeneration burning and planting | 10% - greater dispersion of coupes | 20% - smaller average coupe plus some windrowing and burning | 0% - large cost increases offset by reduced area |
| Prescribed burning | 0% - largely committed | 40% - catch up on backlog and small area helicopter burning | 30% - more small area helicopter burning |

| | | | |
|---|---|---|---|
| Fire suppression | 0% - little change | 10% - progressively more standby crews, resources and helicopters as logging winds down | 40% - substitute standby crews, resources and helicopters for wind-down of logging force |

***Incomplete Logging within Sensitive Areas.***

Logging has been interrupted by protest, and regeneration works remain incomplete or have not been commenced, in 9 coupes and 2 blocks in sensitive areas of Karri Old Growth Forest. These include Swarbrick 3, Gardner 5 and 8, Sharpe 6, Thomson 4, Northcliffe 7 and 9, Jane Block, Giblett Block and Wattle 1 and 2. Various stakeholders were concerned about the wastage of logs and the failure to regenerate these areas was raised. The meeting of stakeholders at Walpole agreed that leaving these areas in this condition (eg. Swarbrick) was unsatisfactory and that further action would be needed to salvage the logs and complete the regeneration.

There are three main operations required:
- The removal of logs on landings, or on the ground as a result road construction.
- The consolidation of cells within the coupes to enable workable fireline construction and perimeter cleanup prior to burning and regeneration.
- The burning and planting of the resulting cells.

Logs have been stacked on landings at Gardner 5 coupe for some time. Logs are on the ground in Northcliffe 9, Jane and Giblett blocks where haul roads have been constructed or partially made. Regeneration should be undertaken in Wattle 1 and 2 coupes. Gravel pit rehabilitation is required in Northcliffe 7. In Sharpe, Swarbrick and Thomson the full range of works summarised above are required.

Several written submissions, one to the group and one to the Minister's office referred to Swarbrick. Swarbrick's strategic location with respect to Walpole and private property was mentioned, in particular the need for a "coherent conclusion to fire and silviculture management" in the area. It was argued that local purchasers should be given the opportunity to purchase the small number of yellow tingle logs of reasonable quality, which are on the ground.

When the issue was raised in stakeholder meetings, different stakeholders took different positions. The consolidation of cells may necessitate occasional felling of individual trees. Some conservationists were apprehensive about additional falling in these sensitive areas, although supportive of the need to clean up and regenerate these cells.

*Recommendation Incomplete logging*

4.9.1 The Group recommends that CALM negotiate with community groups associated with protests on coupes in sensitive areas, and put in train log salvage and regeneration works. Any additional felling should involve these groups in the selection of the trees and delineation of the cells.

## 5. COMMUNITY TRUST AND INVOLVEMENT

The support of the community is vital for the future of Western Australia's forest industry. Consultation with stakeholders by the Group established a broad though far from general consensus on two issues - commitment to an ecologically sustainable forest industry, and a willingness to seek a way through the long-standing conflicts over forest policy issues.

The Group was impressed by the quality of debate and input from stakeholders during discussions and workshops. People were prepared to sit around the table, hear and respect each other's point of view irrespective of whether they agreed or not, and offer suggestions on options for logging plans and silvicultural prescriptions placed before them.

It was made very clear to the Group that such community involvement, if it was to continue in the future, depended upon:

- the availability of high quality technical data to the public,
- improved transparency of and community involvement in decision-making processes,
- trust and respect among stakeholders, and
- a clear dispute resolution process where complaints could be aired and mediation delivered in a fair and equitable forum.

While several elements towards meeting these objectives are already in place, the level of recent community concern and protest from both sides of the forest policy debate signal the need for significant change in some areas. The following strategy is recommended as a way forward.

*Recommendation: Community Trust and Involvement*

5.1.1 In preparation for the review of the Forest Management Plan, the proposed Conservation Commission should institute a transparent audit of data, models and other technical information used to set logging plans and silvicultural prescriptions.

5.1.2 The proposed Conservation Commission should appoint a panel of experts to review the implementation of each Forest Management Plan prior to its expiration. The panel should make recommendations for improvements in line with contemporary best practice.

A range of other issues relating to community trust and involvement have been covered elsewhere in the report and in the Regional Forest Agreement, including the critically important one of transparency. Some of these are restated below and most relate to the application of principles for Ecologically Sustainable Forest Management.

- An independent body should be established with wide representation from industry, community groups, regulatory agencies, technical experts and local government to establish a code of forest practice for both public and private forests, and deliberate and mediate on disputes and complaints. This body could be modelled on the Tasmanian Forest Practices Board. The code of forest practice should be regularly

examined and revised through a publicly transparent process and wide comment sought on a draft before final adoption.

- Improvements in community involvement and participation in decision-making on logging plans and silvicultural prescriptions should be actively sought by CALM or successor agencies. Lists of current stakeholders should be improved, and community advisory committees and focus groups should be used to help develop three year rolling logging plans at the local level and ten-yearly forest management plans at the regional or State level. Representation in such committees should be balanced and wide. Ongoing special attention to Aboriginal community interests is needed. Opinions of landholders and communities should continue to be sought on clearfelling proposals in their local area. Wherever possible, requests to retain unlogged visual buffers on boundaries should be adopted.

- The Government agencies involved in forest management should maintain or improve implementation of their customer service charters across the full gamut of operational activities. They should also undertake regular surveys of relevant community opinions on Ecologically Sustainable Forest Management issues, publish the results and publish their response statements.

- Audits of operational performance conducted by the proposed Conservation Commission should be published, including the listing of achievement of planned objectives against success indicators. The Conservation Commission and CALM should seek public involvement in the development of success indicators.

- Scientific research conducted by CALM, the Conservation Commission and the Forest Resources Commission on matters to do with Ecologically Sustainable Forest Management should place greater emphasis on publication in external peer-reviewed journals, greater emphasis on external collaboration, encouragement and funding where appropriate research by external scientists, and a five-yearly independent expert review of the Ecologically Sustainable Forest Management research programs. Special efforts should be made to develop suitable programs of involvement for schools and volunteers in research.

- CALM, the Forest Resources Commission and the Conservation Commission should enhance working with industry and relevant community groups and organisations to promote Ecologically Sustainable Forest Management. Initiatives could include use of demonstration forests, forest heritage centres that celebrate and promote the history of forest use and conservation, active education and interpretation programs etc.

- Environmental management systems and related certification in line with Ecologically Sustainable Forest Management principles should be developed with industry as a matter of urgency.

The timing of initiation of many of these activities is important not only in terms of due process but also in terms of community involvement that is thorough, measured and without undue haste. Hence the commencement of the review of the Forest Management Plan should not be delayed.

*Recommendation: Ministerial conditions and the EP Act.*

5.2.1 The review of the present Forest Management Plan should be initiated as soon as possible to ensure Ecologically Sustainable Forest Management principles and the processes of community involvement are given ample opportunity and are examined through due process under the Environment Protection Act.

If one reviews and synthesises these points, the very clear direction is towards a process consistent with Ecologically Sustainable Forest Management. That is not to brush aside a host of legitimate objections to detail, ambiguities and idealism. However, we do not know of a better process, or even of one that offers a comparable possibility of progressive (albeit not revolutionary) improvement.

Four aspects remain to be canvassed.

The first is the community itself and what has been the growing division concerning forest values and ends, combined with growing cynicism about institutions (including experts) and governments. There is nothing unique about forestry in these trends but the capriciousness of the public concerns in an area driven by long-term policies and strategies tends to be unsettling to those who work in the forests, or depend on it for their livelihood.

We have no panacea for this - only the plea that the community itself has to more actively engage in the decisions and to recognise that balances need to be struck between sometimes conflicting but often complementary values. Needless to say, this implies greater community involvement at all levels of policy and planning - local community, local government, state and national levels. The processes now (or hopefully will) exist for these to be pursued – the challenge is to make the processes work better and to integrate them across the various levels. The latter step represents a major challenge because inevitably some local concerns will be lost or local strategies overturned in the progression up the levels. Time is probably the key element in this. The sequence up or down will never be neatly ordered or scheduled but, given sufficient time, the transfer of information and understanding (albeit without agreement) may assist in resolving these concerns and developing local variants broadly consistent with higher level strategies.

The second aspect is the administering agency and its staff. Not surprisingly, morale in some sections of CALM is low. The general aura of mistrust or loss of faith has affected many dedicated and knowledgable staff members deeply. While changes in approach are, in the view of the Group, essential to changing that aura, the staff themselves need to be given encouragement and recognition by the community for the many skills and knowledge they possess, and the dedication they give to their work. Some will see the work of this Group as a repudiation of their own expertise. Not so, for we have a profound respect for that knowledge, expertise and research and applaud it. Our invited task was to build on that foundation in charting a new course – the implementation and details of which will rest largely on CALM staff and associates. It is time to erase the prevailing aura and to set that new course, recognising the mutual dependence of community goals on the expertise and dedication of the staff of the administering agency.

Thirdly, it is fashionable to dwell on the need for scientific expertise and rational planning and the Group would be no exception to this trend. But having a passion for forests and the people who work in, recreate in, and utilise them in many different ways is also important. Urban dwellers especially need to recognise that their weekend or vacation travel through or other use of the forests is the pleasant, easy part of forest use. There are many other aspects which are challenging and far from pleasant. We need people who know and are prepared to face those challenges, including the many dedicated scientists, conservationists and industry people who do so.

Finally, the workers displaced from the wood products industry deserve special consideration. We have sought to identify some areas in which greater employment might be forthcoming through further processing but with less success than we would wish. These should be pursued with vigour but it would be misleading to assert that these will cure the problem. Structural adjustment is a major issue that has to be addressed.

## APPENDIX 1: COMMUNITY CONSULTATION

Following is a list of organisations and representatives who provided written submissions, attended individual meetings, participated in community workshops and/or provided input to the Ministerial Advisory Group:

| Organisation | Representative |
|---|---|
| Allwood Milling, Institute of Wood Science | • Des Donnelly |
| BL and BF de Russett Sawmill | • Brian de Russet |
| Bridgetown Greenbushes Friends of Jane | • Jim Frith<br>• Mary Frith |
| Bunnings | • Warren Murphy<br>• Ian Telfer<br>• Stephanie Parry<br>• Max Evans<br>• Keith Kessell<br>• Ron Adams<br>• Ewald Valom |
| Bush Fires Brigade, Northcliffe | • Cr. Paul Owens |
| Bush Fires Brigade, Walpole | • John Mayger |
| Bush Fires | • John Evans |
| Campaigners for Ancient Forest | • Patrick Weir<br>• Maggie Burke |
| Chamber of Minerals and Energy | • Ian Satchwell |
| Conservation Council of Western Australia Inc. | • Dr Beth Schultz<br>• Sue Graham Taylor |
| Conservation Society | • Alex Syme |
| Denmark Shire Council | • Cr. Colleen Donnelly |
| Environment Group | • Mark Sheehan |
| Fine Woodcraft Gallery | • Murray Johnson |
| Forest Industries Federation | • Bob Pearce |
| Forest Protection Society | • Trish Townsend<br>• Trevor Richardson<br>• Margaret Pearce |
| Forest Protection Society, Northcliffe | • Anne O'Donnell<br>• Bev de Russett |
| Forest Protection Society, Pemberton | • Ric Evans<br>• Mario Parolin |
| Forest Protection Society, Walpole | • Kevin Anderson |
| Forest Protection Society, Manjimup | • Peter Gunson<br>• Robert Orr |
| Friends of Giblet | • Leith Maddock |
| Friends of Jane | • Helen Nixon |
| Greater Beedelup National Park Society | • Roger Cheeseman |
| Institute of Foresters | • Don Spriggins<br>• Roger Underwood |

| Organisation | Representative |
|---|---|
| | • Steve Quain |
| Manjimup Aboriginal Corporation | • Glen Kelly |
| Manjimup Bushfires Advisory Committee | • Tom Muir<br>• Jim Muir<br>• Kelvin Wren |
| Manjimup Local Shire | • Cr. Dave Tapely |
| Manjimup Local Shire (bushfires) | • Max Conner |
| Manjimup Tourist Bureau | • Lyn Ward |
| Middlesex Sawmill | • Tony Drake<br>• Shane Rudd |
| Nyungah Action Group | • Mike Hill |
| Nyungah Land Council | • Peter Rattigan<br>• John Hoare |
| Northcliffe Environment Centre | • Jim Lamb<br>• Diana Circosta |
| Northcliffe for Future Generations | • Peta Sargison |
| Northcliffe Historical Society | • Ian Crawford |
| Northcliffe Tourist Centre | • Geoff Milne |
| Pemberton Community Centre | • John Evans |
| Pemberton Community Group | • Arthur Mills |
| Pemberton Tourist Bureau | • Jane Barnett |
| Quinninup Community Association | • Nandi Chinna<br>• Sylvia Swallow |
| Quinninup Friends of Jane | • John Austin |
| Quinninup North Body Corporate | • Sharon Keilor |
| Quinninup South Body Corporate | • John Austin |
| Quinninup Tavern | • Jim Anderson<br>• Jenny Anderson |
| Rose and Bending Contractors | • Paul Rose<br>• Mark Bending |
| Royal Society of Western Australia | • Dr Harry Recher |
| Saw Miller, Northcliffe | • Felix Detri |
| Shire of Manjimup | • Cr. Peter Mackenzie<br>• Cr. Keith Liddlelow<br>• Jeremy Huddle<br>• Anne Sutton |
| Shire of Nannup | • Dean Freeman |
| Smithbrook Milling | • John Mitchell |
| South Coast Environment Group | • Donna Selby<br>• Rob Versluis |
| South-West Development Commission | • Don Punch |
| The Australian Workers Union, Western Australian Branch | • Tim Daly<br>• Nick Oaks |
| The National Trust of Australia (WA) | • Tom Perrigo<br>• Jane Blake |

| Organisation | Representative |
|---|---|
| The Wilderness Society | • David Mackenzie |
| Tourism South-West | • Kerry Clarke<br>• John Suckling |
| Valuwood International Pty Ltd | • Phil Shedley<br>• Kevin Bentley |
| Walpole and Nornalup National Parks Association | • Geoff Fernie |
| Walpole/ Tingledale Land Conservation District Committee | • Ivan Edmonds |
| Walpole Tourist Bureau | • Ross Muir |
| Warren Environment Society | • Andy Russell |
| Waugh's Forest Services | • Gavin Hanrahan |
| Western Australian Beekeepers Association | • Peter Detchon |
| Western Australian Farmers Federation (Beekeepers) | • Stephen Fewster<br>• Micheal Spurge<br>• Doug Parker |
| Western Australian Forest Alliance | • Peter Robertson |
| Western Australian Municipal Association | • Jamie Edwards<br>• Tim Shanahan |

## APPENDIX 2: SUMMARY OF ISSUES RAISED IN WRITTEN SUBMISSIONS TO THE GROUP

- Coupes should be described as 'micro' and 'small' rather than 'small' and 'large'
- Concern over government's ability to honour its commitment to the jarrah sawlog volume
- Seasonal logging constraints
- Cost impacts of the Ministerial Advisory Group's recommendations
- Karri supply after 2003
- Regrowth forest in Shannon National Park to be considered for production purposes in the future
- Management of risks associated with fire in relation to forest management (particularly regeneration) and protection
- Dieback hygiene constraints
- Coupe size and dispersal
- Description of coupes
- Post-harvest management
- Impact on jarrah sawlog production
- Economic impacts
- Role of government in forest management
- Accountability
- Visual buffers
- Aesthetic impacts
- Relative costs of recommended changes
- Fire protection strategies
- Consideration to overall impact of the proposed changes on government costs and revenues
- Mechanism for ongoing stakeholder input
- Transitional process must not be driven by the purported need to meet contracts but by ecological considerations
- Status of Wesfarmers Bunnings and Worsley contracts to be clarified publicly before volumes required and extent of forest to be logged are considered
- Royalties
- Need for independent review of volumes and grades of logs available from all potential coupes to ensure that the true volume of sawlogs is assessed and accounted for (and recovered from) any given area
- Incomplete logging in sensitive areas
- All existing stockpiles of logs should be recovered from landings
- Transparency
- Sawn timber recoveries
- End uses of timber
- Fate of two-tiered forest of high conservation value
- Old growth reservation and tenure
- Old growth jarrah and wandoo logging
- Need for a sustainable timber industry
- Proposed logging in Muirillup and old growth karri in Charley block is not acceptable
- Concern over changes to map definitions

- Request for clarification as to whether maps were compiled from data consistent with the JANIS definition of old growth forest or that provided by the Department of CALM
- Blackbutt
- Reviews of jarrah forest management and logging
- The mixed forest types in Giblet and Jane forests
- Swarbrick block
- The role of the Conservation Commission, the Department of CALM in integrated land management and the role of the EPA
- Incomplete operations
- Concerns over proposed clearfelling in the North East section of Crowea State Forest near Northcliffe
- Historical Value and scenic beauty of Moons Crossing, Blackberry Pool and the River Road Bridge
- Reviews of jarrah forest management and logging
- The Greater Beedelup National Park Proposal
- Northcliffe 9 and Boggy Creek should not be logged
- Concern over lack of aboriginal studies conducted in some areas
- Retention of older trees to provide visual and structural diversity in the regrowth forest
- Visual resource management
- Impacts on the fire protection strategies for the karri, jarrah and tingle forests
- Reduction in harvesting in karri and tingle forests will further reduce the personnel available to control hazard reduction and suppress wildfires
- Fire management
- Factors affecting increased risks of fire
- Costs of fire management
- Focus must remain on utilising controlled burning as an essential fire management tool
- Membership and Terms of Reference of the Ministerial Advisory Group
- Factors affecting workers
- Occupational Health and Safety
- Widths of buffer strips
- Continuation of logging in old growth in Thomson, Lochart, Wye, Boorara, Crowea, Dombakup, Sharpe, Beavis, Carey and Deep blocks
- Jarrah resources in Jane and Giblett blocks
- Economic impacts
- Sutton State forest coupes PSU01 and PSU02 should be added to list of sensitive forest blocks
- Impacts on community if Sutton block east of Wheatley Coast Road is clearfelled
- Community access and responsibility for maintaining the Quinninup Eco Module
- Impact of buffer strips on fire management
- Reliability of data provided by Department of CALM
- Request for data regarding the conclusions that clearfelling is the desirable silvicultural prescription for safety reasons
- Mill recover rates
- Need to look at jarrah along with karri and tingle
- Wood chipping

- The 2000 -2003 logging plans
- The swapping of areas of logging
- Opposition to further forest regeneration
- Salvage of logs on the ground
- Management of forests in natural estate lists
- Time constraints and the Ministerial Advisory Group process
- Court block
- The two tiered forests
- Independent assessment of logging plans
- Transparency
- Crowea and Collins forest blocks
- Details of contractual obligations
- Alternatives to old growth logging
- Efficiency and recovery rates of different types of mills
- The fine wood industry
- Export of timber in the square
- Initiatives for the Manjimup Shire
- Community, business, industry and worker incentives
- Tourism, and development of tourism icons
- Decentralisation of services by government and commercial sectors
- A call for a Royal Commission
- Logging in the vicinity of Quinninup
- Consideration of values other than scientific, including aesthetic, social, historic, indigenous and educational.
- Crowea
- National Estate
- Quinninup

## APPENDIX 3A: Summary of Community Workshop on Logging Plans For Karri and Karri-Tingle Forests, WALPOLE

27 September 1999 Walpole Recreation Centre

### QUESTIONS AND ISSUES DISCUSSED

(Not necessarily in order presented)

**1. Questions and issues raised in relation to Background Material on:**
**Forest types, distribution and reservation**
**Tingle**
**Silvicultural prescriptions**
**Karri sawlog supply schedule 1993-2025**
**Implications for old growth and two-tiered forest.**

- The accuracy of data bases and maps were queried and discussed.
- Area of karri in Thomson thought to be underestimated.
- The relationship between old growth distribution on the maps presented and the RFA maps queried.
- Major flaws in the RFA (mapping and data bases).
- Clarification was sought on what wood supply commitments were binding. The question of chipwood contracts raised. Government commitments to supply 149,000 cubic metres of karri sawlogs 2000-2004, declining to 50,000 cubic metres thereafter reiterated.
- Definition of forest types discussed at some length. Group wished to clarify if jarrah forest could have up to 20% tingle before being classified as jarrah-tingle.
- Management of jarrah forest with small percentage of karri, within group's terms of reference as forest contains karri.
- Jarrah supply has to be considered as significant volumes come out of karri forest types.
- Great variation in structure of two tiered forests. Valley of the Giants not classified as "old-growth".
- Some areas of two-tiered forest considered as old-growth by communities. eg. Area south of Quinninup.
- Removal of jarrah forest from MAG's review makes for difficulties in conceptually planning future logging in areas of mixed forests.

**2. Development of silvicultural prescriptions for karri based on the reducing the scale of logging coupes.**

Points on the options presented included:

- Selective logging not best forest practice.
- Operational costs associated with roading and logging of smaller coupes would be increased.
- Fire management of dispersed coupes would be impossible.
- The greater area of forest disturbed in logging restricted to coupes separated by 100m wide buffers acknowledged.
- It was suggested that smaller coupes may be appropriate for old growth forest but larger coupes could be maintained in two-tiered stands.
- Greater flexibility for burning in coupes if debris heaped and burnt.

**3. Silvicultural options and management of regrowth karri.**

- Concern expressed about fuel loads in regrowth karri close to town (60-80 tonnes/ha).

- Industry and departmental commitment to management of regrowth estate needed.
- R and D and policy development for regrowth stand management.
- Older regrowth littered with marri logs. Presents difficulties for mechanical harvesting.
- Need for burn buffers for protection.

**4. General comments on current forest management practices, log grading, supervision.**

- A request was made of the MAG to determine what percentage of 2nd grade karri sawlogs are supplied to Bunnings. (With reference to a recent memo to field staff to leave trees with 2nd grade material standing).
- General wish to see timber recoveries maximised and in-forest waste minimised.
- A call for a royalty review was made.
- Costs to communities for fire protection will increase.
- Could recovery rates be improved. ie more marri to be sawn?
- Question of salvaging logs on the ground raised.
- Practice of replanting predominantly jarrah areas to karri questioned. Need for prescription development with respect to some soil and forest types raised.
- It was stated that there are unavoidable expenses in repairing past mistakes.

**5. The karri sawlog supply schedule 1999-2025**

- Productivity of areas cut now and in the future not critical to supply as will only mature in period when plenty of regrowth available. If there is plenty of regrowth to supply 50,000cubic metres of karri sawlogs after 2020 then there should be greater flexibility in the regeneration strategies used from now on.
- Drastic review required as less resource available.
- Structural variation in 2-tiered forest needs elucidation.
- Concerns about lack of allowance for all risks associated with future supply, eg. frost, disease, insects etc.
- Demand could be decreased by increasing royalties.
- Increased royalties could 'kill' industry in some communities.
- Industry need to retool for greater efficiency.
- Problem of low recovery from automated mills.
- There may be greater flexibility if there is actually karri in forest mapped as jarrah.

**6. Sensitive areas of karri old growth**

***Beavis, Burnett, Carey, Dawson, Deep, Gardner, Giblett, Jane, Keystone, Northcliffe, Ordnance, Sharpe, Swarbrick, Thomson, Wattle, Wye.***

- Include part of Burnside on list.

**7. Logging of old growth 2001-2003**

- Logging should be consolidated in areas where roads already in place and prescriptions in place.
- Crowea old-growth karri could be controversial.
- Need for some compromise.

**8. General principles which should be used in trading-off future locations for old-growth logging.** (Facilitated discussion with Paddi Brown).

- Biodiversity.
- Tourism.
- Need to supply industry or people affected.
- Proximity to towns and houses.

**9. Location of the year 2000 logging coupes**

- Stakeholder request that jarrah plans for Rocky block be made available (outside MAG brief but will relay on).
- Contingency logging in areas where roading already in place. eg. Thomson, Wattle, Wye, (Ordnance close to Beardmore Rd. but avoid Deep River if possible).
- Fate of unfinished coupes such as in Swarbrick and Wattle. Walpole stakeholders felt as long as there was no more logging no problem with cleaning-up, regeneration burning and log salvage.

**10. The Ministerial Advisory Group Process**

- Many aspects of the rushed process criticised.
- Dismay and frustration expressed. Short notice of meeting. Timing on a public holiday.
- Impossible task of commenting on maps and liaising with constituents.
- Separation of karri from jarrah difficult if we are to protect integrated harvesting.
- Request for urgent delivery of maps to groups.

**11. Ways to progress ongoing community involvement**

- Increased involvement of CALM district staff.
- Participation of CALM staff in community workshops.
- Trust and transparency vital.
- Access to accurate data.
- Broadened scope of timber advisory group to include fire management and land management.
- Set minimum time frames for community consultation.
- Increase availability of data.
- Advertise for stakeholder nominations to a database.
- Get true representation of key stakeholders. Identify through active groups and/or through local authority.
- Distribute maps through local authorities and other key groups.
- Consider Tasmanian model of independent audit of forest management plans.
- Need for new management plan by 2004.
- Need interim management plan with agenda to protect sensitive areas.
- Need for compromise.
- Avoid mistakes of the flawed RFA process.

## APPENDIX 3B: Summary of Community Workshop on Logging Plans For Karri and Karri-Tingle Forests, PEMBERTON

27 September 1999 Gloucester Motel

### QUESTIONS AND ISSUES DISCUSSED

(Not necessarily in order presented)

1. **Questions and issues raised in relation to Background Material presented by Prof. Ian Ferguson, Chairman of the Group. Topics initially covered included:**
   **Forest types, distribution and reservation**
   **Tingle**
   **Silvicultural prescriptions**
   **Karri sawlog supply schedule 1999-2025**
   **Implications for old growth and two-tiered forest**
   - Reasons for restricting logging in karri-tingle sought.
   - Definition of various forest types questioned. eg. jarrah forest and mixed species stands.
   - Definition of karri-tingle. How much tingle has to be present for it to be called karri/tingle?

2. **Development of silvicultural prescriptions for karri based on reducing the scale of logging coupes.**
   - Increased costs.
   - Extra roads would mean less forest area regenerated.
   - Fire control more difficult.
   - Need for clear definition as to how coupe size is to be measured. Are areas of rock outcrop and stream zones etc included? Net area of logging vs gross area of coupe as defined by outer boundary of felling.
   - Any retention of trees such as in feathered edges considered to increase risks especially with respect to fire management.
   - Need to be clear whether strips of vegetation or retained trees are for aesthetics or for protecting wildlife.
   - Concern about increased risks to life and property from any reduction in areas of logging and greater retention of strips of forest and habitat trees.
   - Adequacy of stream and roadside buffers. Up to kilometre wide buffers suggested for rivers. In general more protection for streams and rivers.
   - Regeneration burns in small coupes more difficult.
   - If strips to be left along roads, how should roads be classified? CALM roads, haul roads, public roads.
   - Larger area disrupted by smaller coupes. (Impact on available camping areas.)

3. **Silvicultural options and management of regrowth karri.**
   - Big Brook area an example of a regrowth area becoming a tourist attraction. Need to have flexibility in land use planning to allow for change.
   - Extent of planned karri regrowth thinning vs clearfelling.

4. **General comments on current forest management practices, log grading supervision.**
   - Concurrence between policy and practice non-existent.
   - Lack of trust in CALM to do all pre-logging surveys adequately.
   - A request was made for current membership of the committee which advises on endangered species.
   - Distress in community in part related to clearfelling and woodchipping.
   - Within CALM some confusion as to what constitutes a stream.
   - Too many non-industry people using roads in State forest. No controls over them spreading dieback etc.

5. **The karri sawlog supply schedule 1999-2025.**
   - How will supply of 3rd grade logs be affected by levels set for 1st and 2nd grades?
   - Access to windfalls and logs on ground should be allowed in State forest, not National Parks. Considerable resource for milling.
   - Role and importance of craft wood reserves , mostly an issue for jarrah.
   - Considerable quantities of logs have been burnt in the past.
   - Pressure to take all old growth karri outside sensitive areas to meet government commitments.
   - One option is to re-negotiate contracts.
   - Money needed to break contracts, but government not going to break them.

6. **Sensitive areas of karri old growth**
   - Areas considered sensitive to individuals at the workshop included Crowea along the river, knobs of karri to the south of Northcliffe e.g. Dombakup (important to Aboriginal people).
   - Quinninup. Forest around town.
   - Charley Block.
   - Northcliffe. Forest close to town.

7. **Logging of old growth 2001-2003**
   - Need to separate logging areas from tourism when logging progressing. It was stated that increasingly there will be tourism in areas of logging and regeneration.
   - Better to log remote areas (30-40km) away than special areas along local rivers.
   - No further logging of ancient forests.

8. **General principles which could be used in trading off future locations for old growth logging. (Result of group discussion).**
   - Focus should be on conserving large areas even if it meant less strips and road reserves in other areas. There should be links of retained forest between large areas of forests.
   - If resource from SW restricted will more timber be imported from countries where silvicultural practice very poor.
   - Idea put forward for protection of a "great forest belt" between Nannup and Walpole.
   - Some areas of old-growth could be managed for craft wood and feature wood. Finewood industry dependent on old-growth timber.

**List collated from all workshops. Points added to list at Pemberton ***

- Proximity of forest to towns and houses.
- Biodiversity.
- Tourism.
- Resource for people working in the industry
- The economy. 50year outlook important.*
- Future focus or perspectives. How well future generations look back.*
- Aesthetic values.*
- Aboriginal values.*
- Social values across the board.

**9. Location of the year 2000 logging coupes.**

- Question of carryover logging areas from 1999. Where are they and how much wood volume do they account for?

**10. The MAG process**

- Not enough time given to considering impacts on timber workers and their livelihoods.
- Terms of reference too narrow. Processes should not be rushed. At least a week should be allowed for stakeholders to consult with their members or associates before feeding back reactions to groups such as MAG.

**11. Ways to progress ongoing community involvement and participation.**

- Increased involvement of CALM staff.
- Transparency.
- Increased availability of data relating to issue. More on different species.
- Access to accurate data.
- Broadened scope of timber advisory group to include fire and land managemant.
- Have forums and workshops but have adequate notice of meetings and issues.
- Develop data base of stakeholders. May have to advertise for people to nominate to be placed on list. Key stakeholders must be identified.
- Focus on the future.
- Explore use of community accord approach.
- Relative efficiencies of small mills vs large automated mills should be reviewed.
- Greenhouse and carbon credits, need plantation and native forest data.
- Need for secret ballots in areas like Northcliffe when local opinions being suppressed.
- How will issues be progressed once committee reports?
- Need a community accord approach.

**12 Audit, ESFM, research and future developments.**

- Greater transparency and independent audit necessary.
- Need for more research into tourism.
- Could tourism be better integrated with logging? Relate tourism to timber industry more closely.
- Impacts of fertilising in native forest systems.
- Site viability should be assessed prior to logging.
- Impact of nutrient depletion on 2$^{nd}$ rotation karri.

- Pre 1850's Aboriginal burning methods, need research.
- Could the tallest karri in Lindsay block east of Manjimup have tourism potential.
- Issue of royalty levels raised.

**13 CALM's involvement.**

- CALM not trusted by some but trusted by others.
- Excellent professional staff in CALM eg. Local chief ranger Rod Annear.
- Co-operation and input from CALM essential.
- CALM staff's involvement at an operational level should be increased.

## APPENDIX 3C: Summary of Community Workshop on Logging Plans For Karri and Karri-Tingle Forests, MANJIMUP

28 September 1999 Manjimup Library

### QUESTIONS AND ISSUES DISCUSSED

(Not necessarily in order presented)

1. **Questions and issues raised in relation to Background Material presented by Prof. Ian Ferguson, Chairman of the Group. Topics initially covered included**
   - **Forest types, distribution and reservation**
   - **Tingle**
   - **Silvicultural prescriptions**
   - **Karri sawlog supply schedule 1999-2025**
   - **Implications for old growth and two-tiered forest**

- Considerable concern expressed about group position on importance to conserve karri-tingle forests.
- Clarification of karri/tingle mixes needed by ground truthing. Greater detail on distribution of tingle within the karri matrix.
- Areas of tingle could be left without restricting karri logging.
- Was decision based on science or politics?
- Tingle not endangered.
- Why is tingle in regrowth not as important for conservation as tingle in old-growth or two-tiered stands?
- Tingle has limited distribution.
- Accurate, verified data important.

2. **Development of silvicultural prescriptions for karri based on reducing the scale of logging coupes.**

- Many problems with retaining 100m strips along roads stated.
- Safety an issue in working smaller clearfell areas.
- Forest productivity decreases with small regeneration gaps in forest.
- Many issues relating to roads and roading. Need for permanent roads for future fire management. If strips of forest retained problems if road alignments change as with highways.
- Larger coupes. Less problems for fire management. Less risks of escapes and less cost.
- Retained forest buffers between coupes should be for biodiversity not aesthetics.
- Bigger coupes definitely preferred.
- More roading for dispersed coupes. Who would pay for all the roading? Timber industry?
- Small and dispersed coupes present many problems for fire management.
- Many costs associated with going to smaller coupes. Increased supervision. Machinery and personnel dispersed.
- Managing small coupes requires greater skills. Boundaries of informal reserves and temporary exclusions areas have to be precise e.g. GPS.
- Drive for smaller scale clearfelling not from professional foresters, rather political.
- Skills loss in particular in relation to fire management.
- Equipment used in mechanical harvesting of regrowth not useful in fire control.

3. **Silvicultural options and management of regrowth karri. Points made included:**
   - Will regrowth management be compromised by 50,000 supply requirement? Will management become inconsistent with RFA prescribed rotations for karri regrowth.
   - Form of regrowth better since high karri seedling planting rates adopted.

4. **General comments on current forest management practices, log grading supervision.**
   - Costs of roading should be shared with tourism.
   - When processes become political good forest management often lost in public debate.
   - Need flexibility to allow for local variation rather than broad prescriptions that rely on discretionary decision making.
   - ESFM important
   - Concerns expressed about broadscale use of artificial fertilizers.

5. **The karri sawlog supply schedule 1999-2025.**
   - Reduced cut means less in forest personnel and machinery.

6. **Sensitive areas of karri old growth**
   - Reference to RFA position. Areas kept being added.

7. **Logging of old growth 2001-2003**
   - No comments presented during group discussion. Maps considered at end of meeting.

8. **What set of general principles should be used in trading off future locations for old growth logging**

   **List collated from all workshops.**
   - Proximity of forest to towns and houses.
   - Biodiversity
   - Tourism
   - Resource for people working in the industry.
   - The economy. 50year outlook important.
   - Future focus or perspectives. How well future generations look back.
   - Aesthetic values
   - Aboriginal values
   - Social values across the board.

9. **The MAG process**
   - Time too short

10. **Ways to progress ongoing community involvement and participation.**
    - Accountability and ownership.
    - Endeavour to get realistic outcomes.
    - Feeling of "why bother to participate if no one listens"?

- Need mechanisms for input to be effective. Crowea Committee came to an agreement but outcome overruled by CALM.
- Last 10 years some issues raised time and again. RFA final debacle.
- Professional foresters should have the greatest say in developing options.
- Foresters should be paid greater respect.
- Regional policy too often over-rides local issues.
- Planning has to be long term.
- Indigenous people have concerns and should be involved in management, employment and planning.
- Indigenous people need 2-3 years lead time on logging plan to enable heritage issues to be properly addressed.
- Indigenous people want action, and want to work with CALM. RFA policy on Aboriginal people and forest management should now be implemented.

## APPENDIX 3D: Summary of Community Workshop on Logging Plans For Karri and Karri-Tingle Forests, PERTH

28 September 1999 Kings Park Board Room

### QUESTIONS AND ISSUES DISCUSSED

(Not necessarily in order presented)

1. **Questions and issues raised in relation to Background Material presented by Prof. Ian Ferguson. Topics covered included:**
   **Forest types, distribution and reservation.**
   **Tingle**
   **Silvicultural prescriptions**
   **Karri sawlog supply schedule 1999-2025**
   **Implications for old growth and two tiered forest.**
   - Definition used for mapping old-growth. (Not just virgin, may include some regrowth older than 100 years).
   - Why group aimed to produce schedule for 149,000 cubic metres of karri sawlogs explained.
   - Request for area of two-tiered forest being considered along with total area of old-growth.

2. **Development of silvicultural prescriptions based on reducing the scale of logging coupes.**
   - Roadside buffers unnecessary. Tourists are entitled to see the logging and regrowth.
   - Proposal put to abandon all buffers for VRM. ( One response was this may generate even less acceptance of clearfelling).
   - WA only State which had road reserves accredited as part of RFA.
   - Habitat trees are an option and should be selected for age, structural diversity and habitat values.
   - Ability to protect habitat trees questioned.
   - Protect habitat trees using methods developed for seed trees.
   - Stated that current average coupe size 18ha with a maximum of 80ha.
   - Industry supports regime of road, river and stream reserves.
   - Most people would prefer not to have to look at freshly logged coupes.

3. **Silvicultural options and management of regrowth karri. Points included.**
   - Karri regrowth should be subjected to early thinning.
   - Increase growth rates and reduce stress in regrowth by more thinning.

4. **General comments on forest management.**
   - Once an area is clearfelled need for ongoing commitment to intensive management.
   - CALM responsible for grading but only has supervisory role.
   - Jobs and old growth forests can be retained. Policy to "hide between the issues" spoken against.
   - Some agreement amongst stakeholders that group should be encouraged to recommend that a comparative assessment be made of recoveries from logs supplied to spot mills and big mils. (Assess on species, log grades. Volumes into mills and products out, suggested).

- Should beekeepers and other users be able to have sites in sensitive areas if timber industry can not utilise resource?

**5. The karri sawlog supply schedule 1999-2025**

- More data required on log utilisation and efficiency.
- Marri should be given greater status, not treated as waste.
- Amount of logging should be minimized.
- Greater recovery of material from logs may be way of minimizing impacts in forest.

**6. Sensitive areas of karri old growth**

BEAVIS, BURNETT, CARY, DAWSON, DEEP, GARDNER, GIBLETT, JANE, KEYSTONE, NORTHCLIFFE, ORDNANCE, SHARPE, SWARBRICK, THOMSON, WATTLE, WYE.

- Sensitive areas of old-growth may need special protection as not National Parks.

**7. Logging of old-growth 2001-2003**

- Most people involved in debate don't know where special areas are until roads put in.

**8. General principles for use in trading off future locations for old growth logging.**

- Intergenerational equity. Economic and social values
- Scientific
- Heritage
- Social
- Indigenous heritage

**9. MAG process**

- Time insufficient and not an ideal process. Wished to register strong protest to Minister regarding unreasonable haste imposed in MAG process, including short notice, meeting on public holidays.

**10. Ways to progress ongoing community involvement and ESFM**

- Something like the RFA run properly would be useful.
- Release of a new draft forest management plan.
- Drop jargon and make sure language is clearly understood.
- Need for agreed objectives amongst stakeholders.
- Transparency.
- Independent audit.
- The precautionary principle.
- Full range of heritage values, aesthetic, historic, aboriginal and social values should be protected for all native forest.
- Removal of bureaucrats with conflicts of interest from public processes.
- Commercial secrecy shouldn't have a place in management of public forest. (Comment; all contracts are in public domain.).
- Processes used in development of Forest Management Plans most important.

- Freely available information on alternatives to native timbers. Use of softwoods in housing etc.
- Need for independent regulators. Auditing agency should be properly funded.
- Tasmania Codes of Practice well developed for auditing.
- Codes of practice should be developed by range of groups and professionals.
- Freedom of speech for scientific community.
- Issue should be reviewed in broadest terms, not just to maintain status quo.

**In summary:**

The Advisory group felt that from all four workshop it was fair to say that communities were weary of division and felt the need for a better way.

## APPENDIX 4: ECOLOGICALLY SUSTAINABLE FOREST MANAGEMENT IN THE REGIONAL FOREST AGREEMENT PROCESS.

**Table 1 Management System and Criteria for Assessment of Ecologically Sustainable Forest Management.**

| ASSESSMENT CRITERIA | CRITERIA* DESCRIPTION |
|---|---|
| **System design to meet national principles of ecologically sustainable forest management** | The planning and management of native forests should:<br>1. Maintain the full suite of forest values for present and future generations.<br>2. Maintain and enhance long term multiple socio-economic benefits to meet the needs of societies.<br>3. Protect and maintain biodiversity.<br>4. Maintain the productive capacity and sustainability of forest ecosystems.<br>5. Maintain forest ecosystem health and vitality.<br>6. Protect soil and water resources.<br>7. Maintain forest contribution to global carbon cycles.<br>8. Maintain natural and cultural heritage values.<br>9. Utilise the precautionary principle for prevention of environmental degradation. |
| **Public transparency** | **Scrutiny:** Type and level of scrutiny - parliamentary, administrative.<br>**Consultation:** Opportunity for public comment, individual stakeholder and group submissions, advisory group involvement in the process, information exchange, provision for feedback in consultation process.<br>**Access to information:** Process for access to information.<br>**Public involvement**: Opportunity for individual stakeholder or community groups to be involved in the decision-making process.<br>**Reporting**: Mechanism for reporting of processes and outcomes for all system criteria. |
| **Monitoring** | **Trend measurements**: Process for assessment of change.<br>**Monitoring regimes**: Process for regular monitoring of indicators.<br>**Standards**: Process for designation of quantifiable measures against which the quality or performance of a characteristic or attribute is assessed.<br>**Performance targets**: Process for designation of specified goals. |

| | |
|---|---|
| | **Performance verification**: Process for ensuring achievement of standards and targets |
| **Compliance** | **Audit arrangements, penalties, incentives**: Processes that ensure compliance with stated goals or objectives. |
| **Scientific and technical basis** | **Mechanism** for assessing adequacy of information (eg scientific/peer review); **Process** for incorporation of information into decision making process. |
| **Review** | **Mechanism** for review, feedback and continual improvement, internal/external, periodicity. |

The nine principles described below were developed for national application from the Montreal Process, Forest Stewardship Council Principles and Australian Forestry Council Principles for Environmental Care in Native Hardwood Logging.

**Principle 1 Maintain the full suite of forest values for present and future generations.** This principle addresses the issue of intergenerational equity, that is, that forests be managed to meet present needs without compromising the ability of future generations to meet their own needs. It provides the context in which principles 2-9 must be considered.

**Principle 2 Maintain and enhance long-term multiple socio-economic benefits to meet the needs of societies.** The basis of this principle is the promotion of forest-related economic activity which is consistent with the maintenance of the environment and satisfaction of the socio-economic requirements for income, employment, goods and services. Implicit in this principle is the optimum use of the forest economy's capital stock (human, man-made and natural resource capital) through management so as to maximise the long-term welfare or benefit of society in terms of goods and services it requires. The forest economy covers timber and other forest products and uses, water supply, minerals, grazing, recreation and tourism.

**Principle 3 Protect and maintain biodiversity.** The maintenance of biodiversity is fundamental to achieving ecologically sustainable forest use. In the National Forest Policy Statement, biodiversity is defined as the variety of all life forms, the plants, animals and micro-organisms, the genes they constitute, and the ecosystems they inhabit. Incorporated into the concept of biodiversity is variation occurring at the ecosystem, species and genetic level.

**Principle 4 Maintain the productive capacity and sustainability of forest ecosystems.** The concepts of productive capacity and sustainability of forests underpin this principle. Productive capacity covers the ability of a forest to produce biomass. Sustained production of biomass by forest ecosystems, whatever its fate (whether utilised by man or as part of nutrient and energy cycles), is essential to the well-being of all living things. The productive capacity of a forest can be influenced through the silvicultural regime and other management activities. Implicit in the term sustainability is the

understanding that irreversible damage through resource use is not imposed on the capacity of the forest to supply goods or services to present and future generations.

**Principle 5 Maintain forest ecosystem health and vitality.** This principle reflects the concept of ecological integrity whereby the health and vitality of an ecosystem is maintained under changing environmental conditions. Structural and functional changes can occur in ecosystems as a result of threatening processes, such as land clearing, fire, pollution, pests and diseases. These can cause significant shifts in species composition, loss of key biological components such as decomposers, pollinators or food chain relationships, or the degradation of ecosystem processes. Consideration of ecological integrity means determining thresholds of environmental change whereby each threshold results in a reorganisation of the ecosystem to a different but appropriate level.

**Principle 6 Protect soil and water resources.** Forests contribute significantly to the maintenance and conservation of the soil resource; they afford water catchment protection, and maintain the quality and quantity of water.

**Principle 7 Maintain forest contribution to global carbon cycles.** Carbon is stored in Australian forests as living plant and animal biomass and dead organic matter in the form of forest debris. As a general rule, carbon is accumulated and stored in forests that are growing and which, as a consequence, contribute positively to carbon storage. Forests in which carbon is accumulated through photosynthesis but offset by the loss of carbon resulting from biomass, decomposition or death, are carbon neutral. Generally, forests that make a negative contribution to carbon storage are those that are regularly burnt, harvested on short rotations, or subject to heavy soil disturbance.

**Principle 8 Maintain natural and cultural heritage values.** Heritage encompasses archaeological sites, historic places and customs (cultural heritage), and natural values or objects (natural heritage) that are of aesthetic and social values and passed down to the present generation from past generations.

**Principle 9 Utilise the precautionary principle for prevention of environmental degradation.** The incorporation of the precautionary principle into decision making has been endorsed by State and Commonwealth Governments and is defined as 'where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.' In applying the precautionary principle, public and private decisions should be guided by:

- careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
- an assessment of the risk-weighted consequences of various options.

## APPENDIX 5: ABORIGINAL HERITAGE AND CONSULTATION

Within the South-West Forest Region:

1. The State will develop formal consultation processes with Aboriginal people about policy and procedures for the protection of Aboriginal heritage values on CALM-managed lands.

2. The State will consult with Aboriginal people on:
   - the establishment of mechanisms to enable more effective involvement of Aboriginal people in the protection of culturally significant sites; and
   - the provision of training and employment opportunities.

3. The State will protect identified Aboriginal sites in accordance with the requirements of *the Aboriginal Heritage Act 1972* (WA) and develop protocols for, and linking, the CALM geographic information system with information held by Aboriginal Affairs Department.

4. In consultation with the Aboriginal Affairs Department and Aboriginal people, CALM will establish procedures and protocols, and include relevant expertise in Aboriginal heritage in CALM, to enable the early identification of Aboriginal sites as defined in the *Aboriginal Heritage Act 1972* (WA) and afford them the protection that is provided through that Act.

5. The State will introduce into Parliament, amendments to the *Wildlife Conservation Act 1950* (WA) and the CALM Act to permit Aboriginal people to undertake traditional and cultural activities including hunting, gathering and ceremonies on Stet Forest and other public lands.

6. The State, in consultation with Aboriginal people, will ensure Aboriginal heritage values, especially those associated with protected old growth forests, are recognised and managed in culturally appropriate ways.

7. CALM will facilitate the access to and use of CALM-managed forests by Nyungahs for culturally important activities.

8. CALM will facilitate cross cultural awareness and interpretive activities to inform and educate the wider community about Nyungah values and links to the South-West Forest region.

9. The State recognises that the Commonwealth *Native Title Act 1993* protects native title rights and interests and will comply with the provisions of the Act.

11. CALM field activities will be monitored in relation to protection of Aboriginal sites.

*Attachment 10, Regional Forest Agreement*

## LIST OF FIGURES AND MAPS

Figures:



Maps:

Figure 1a

# Old Growth Karri Forest

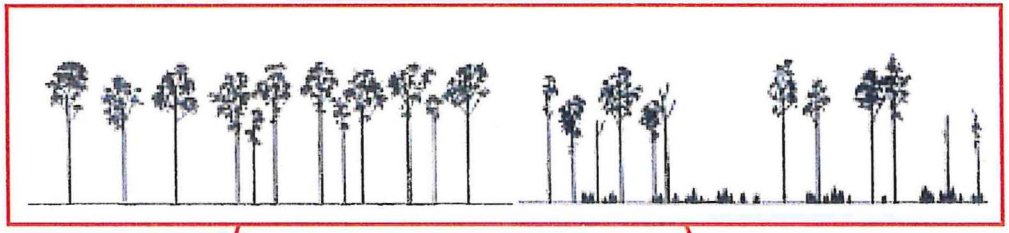
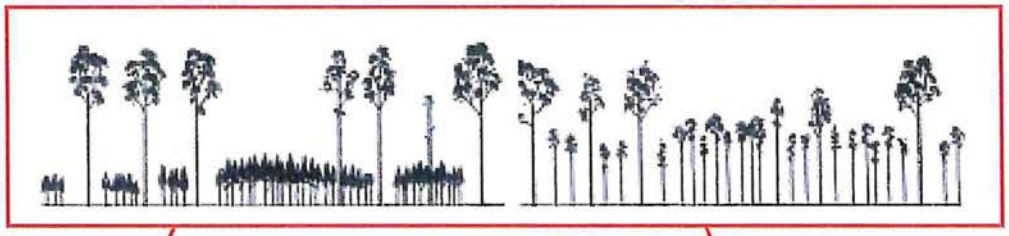


Figure 1b

# Two Tiered Karri Forest



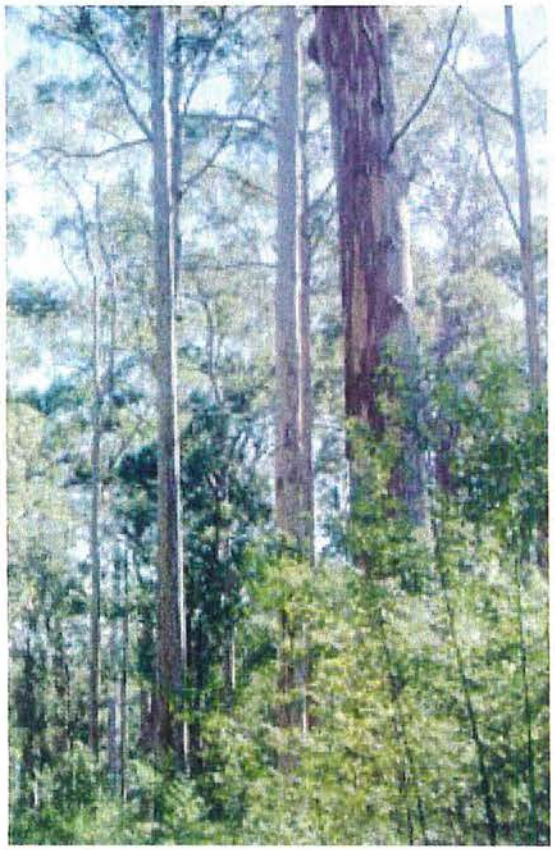


Figure 1c

# Regrowth Karri Forest

Courtesy of CALM

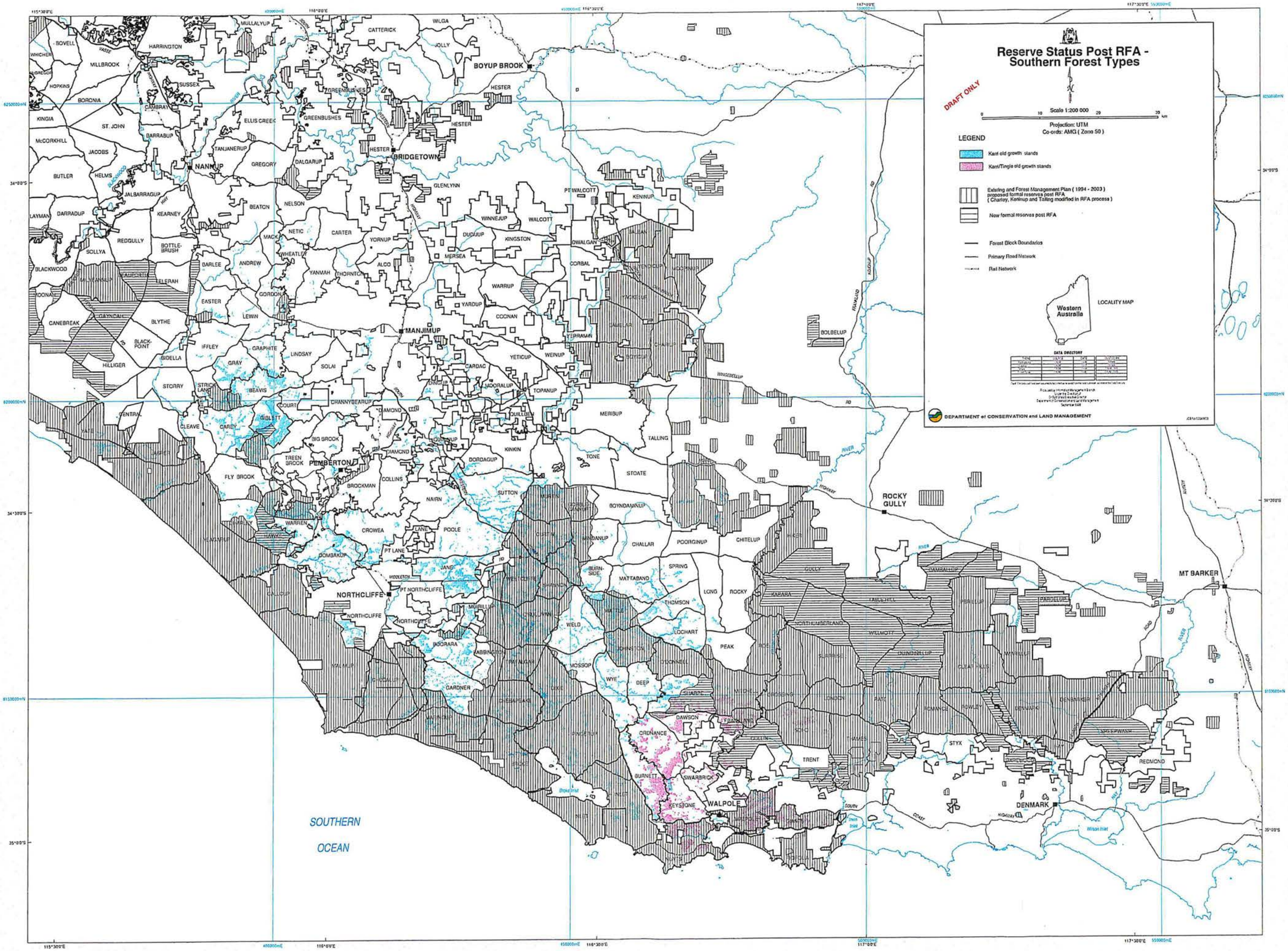



Figure 2: Distribution of Karri Old Growth and Karri Tingle Old Growth Forest and Reserve Status.

383000mE
6230000mN

410000mE
6230000mN

# Reserve Status Post RFA - Southern Forest Types Proposed Year 2000 Coupes Map 1

DRAFT ONLY

Scale 1:75 000

0 1.5 3 4.5 km

Projection: UTM
Co-ords: AMG ( Zone 50 )

## LEGEND

- Karri old growth stands
- Karri/Tingle old growth stands
- Karri two - tiered stands
- Karri/Tingle two - tiered stands
- Karri even - aged regrowth
- Jarrah
- Existing and Forest Management Plan ( 1994 - 2003 ) proposed formal reserves post RFA ( Charley, Keninup and Talling modified in RFA process )
- New formal reserves post RFA
- Proposed Year 2000 Coupes (as at Sept. 1999)
- Forest Block Boundaries
- Primary Road Network
- Rail Network

Produced by Information Management Branch
Under the Direction of
Dr Syd Shea Executive Director
Department of Conservation and Land Management
October 1999

DEPARTMENT of CONSERVATION and LAND MANAGEMENT

JOB No 00041103

BEATON
NETIC
MACK
CARTER
WHEATLEY
YANMAH
ANDREW
BARLEE
TELERAH
EASTER
GORDON
LEWIN
BLYTHE
IFFLEY
GRAPHITE

6210000mN
383000mE

6210000mN
410000mE

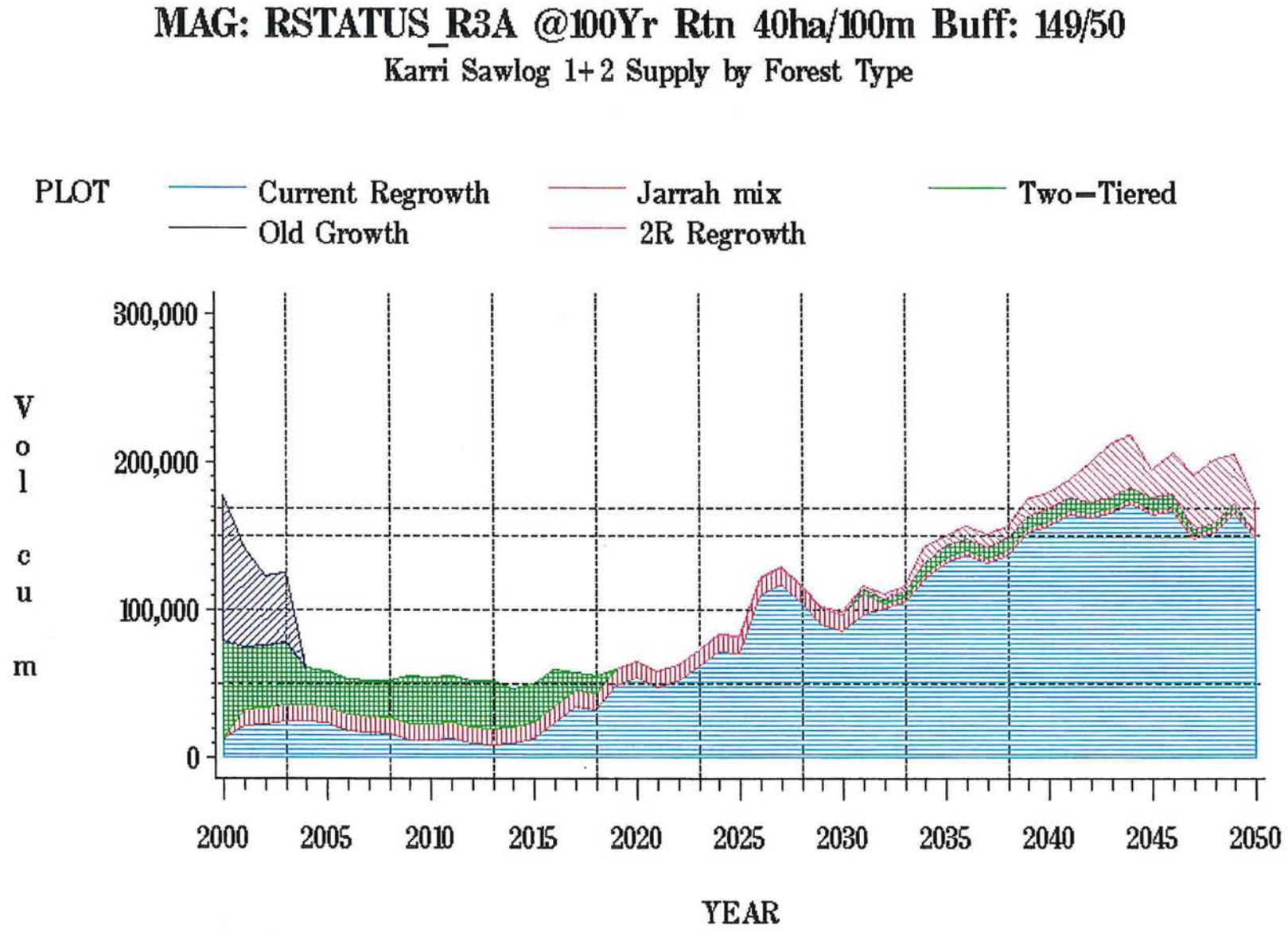



**Figure 3: Schedule of 1st and 2nd grade karri sawlogs**

394000mE
6214000mN

421000mE
6214000mN

# Reserve Status Post RFA - Southern Forest Types Proposed Year 2000 Coupes Map 2

DRAFT ONLY

Scale 1:75 000

0 1.5 3 4.5 km

Projection: UTM
Co-ords: AMG ( Zone 50 )

## LEGEND

- Karri old growth stands
- Karri/Tingle old growth stands
- Karri two - tiered stands
- Karri/Tingle two - tiered stands
- Karri even - aged regrowth
- Jarrah
- Existing and Forest Management Plan ( 1994 - 2003 ) proposed formal reserves post RFA ( Charley, Keninup and Talling modified in RFA process )
- New formal reserves post RFA
- Proposed Year 2000 Coupes (as at Sept. 1999)
- Forest Block Boundaries
- Primary Road Network
- Rail Network

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GRAPHITE

LINDSAY

SOLAI

GRAY

BEAVIS

CHANNYBEARUP

DIAMOND 1

COURT

GIBLETT

BIG BROOK

6194000mN
394000mE

6194000mN
421000mE

388000mE
6196000mN

415000mE
6196000mN

GIBLETT

CAREY

CLEAVE

BIG BROOK

TREEN
BROOK

FLY BROOK

BROCKMAN

CHARLEY

WARREN

CROWEA

HAWKE

DOMBAKUP

**Reserve Status Post RFA -**
**Southern Forest Types**
**Proposed Year 2000 Coupes**
**Map 3**

DRAFT ONLY

Scale 1:75 000

0 1.5 3 4.5 km

Projection: UTM
Co-ords: AMG ( Zone 50 )

LEGEND

- Karri old growth stands
- Karri/Tingle old growth stands
- Karri two - tiered stands
- Karri/Tingle two - tiered stands
- Karri even - aged regrowth
- Jarrah
- Existing and Forest Management Plan ( 1994 - 2003 ) proposed formal reserves post RFA ( Charley, Keninup and Talling modified in RFA process )
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6176000mN
388000mE

6176000mN
415000mE

401000mE
6196000mN

428000mE
6196000mN

# Reserve Status Post RFA - Southern Forest Types Proposed Year 2000 Coupes Map 4

DRAFT ONLY

Scale 1:75 000

0 1.5 3 4.5 km

Projection: UTM
Co-ords: AMG ( Zone 50 )

## LEGEND

- Karri old growth stands
- Karri/Tingle old growth stands
- Karri two - tiered stands
- Karri/Tingle two - tiered stands
- Karri even - aged regrowth
- Jarrah
- Existing and Forest Management Plan ( 1994 - 2003 ) proposed formal reserves post RFA ( Charley, Keninup and Talling modified in RFA process )
- New formal reserves post RFA
- Proposed Year 2000 Coupes (as at Sept. 1999)
- Forest Block Boundaries
- Primary Road Network
- Rail Network

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BIG BROOK

QUININUP

DIAMOND 2

COLLINS

TREEN BROOK

BROCKMAN

NAIRN

WARREN

CROWEA

LANE

HAWKE

DOMBAKUP

6176000mN
401000mE

6176000mN
428000mE

416000mE
6170000mN

443000mE
6170000mN

# Reserve Status Post RFA - Southern Forest Types Proposed Year 2000 Coupes Map 5

DRAFT ONLY

Scale 1:75 000

0 1.5 3 4.5 km

Projection: UTM
Co-ords: AMG ( Zone 50 )

## LEGEND

- Karri old growth stands
- Karri/Tingle old growth stands
- Karri two - tiered stands
- Karri/Tingle two - tiered stands
- Karri even - aged regrowth
- Jarrah
- Existing and Forest Management Plan ( 1994 - 2003 ) proposed formal reserves post RFA ( Charley, Keninup and Talling modified in RFA process )
- New formal reserves post RFA
- Proposed Year 2000 Coupes (as at Sept. 1999)
- Forest Block Boundaries
- Primary Road Network
- Rail Network

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JANE

WESTCLIFFE

NORTHCLIFFE

MUIRILLUP

O'SULLIVAN

BOORARA

TRAFALGAR

BABBINGTON

CHUDALUP

GARDNER

CHESAPEAKE

6150000mN
416000mE

6150000mN
443000mE

452000mE
6170000mN

479000mE
6170000mN

# Reserve Status Post RFA - Southern Forest Types Proposed Year 2000 Coupes Map 6

DRAFT ONLY

Scale 1:75 000

0 1.5 3 4.5 km

Projection: UTM
Co-ords: AMG ( Zone 50 )

## LEGEND

- Karri old growth stands
- Karri/Tingle old growth stands
- Karri two - tiered stands
- Karri/Tingle two - tiered stands
- Karri even - aged regrowth
- Jarrah
- Existing and Forest Management Plan ( 1994 - 2003 ) proposed formal reserves post RFA ( Charley, Keninup and Talling modified in RFA process )
- New formal reserves post RFA
- Proposed Year 2000 Coupes (as at Sept. 1999)
- Forest Block Boundaries
- Primary Road Network
- Rail Network

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SPRING
MATTABAND
WATTLE
THOMSON
LONG
ROCKY
LOCHART
WELD
PEAK
JOHNSTON
MOSSOP
O'DONNELL
WYE
DEEP
SHARPE
MITCHELL
DIXIE

6150000mN
452000mE

6150000mN
479000mE