REPORT TO HON JIM MCGINTY, MLA, MINISTER FOR THE ENVIRONMENT

by Tos Barnett as Appeals Committee examining appeals submitted in relation to the Report and Recommendations of the Environmental Protection Authority on 'Proposals to amend the 1987 Forest Management Plans and Timber Strategy and proposals to meet Environmental Conditions on the Regional Plans and the WACAP ERMP'

December 1992

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Executive Summary

The report sets out the findings and recommendations of the Appeal Committee on 21 appeals against the Environmental Protection Authority (EPA) recommendations on the Department of Conservation and Land Management's (CALM) 1992 management proposals for the South-West Forests.

All 15 of the EPA recommendations were appealed directly or by implication by one or more of the appellants and my report takes the form of:

- narrative comment upon the EPA recommendations and CALM's proposals on matters raised by the appeals;
- comments in tabular form on the points raised in each appeal, with recommendations to the Minister on each appeal;
- recommendations to the Minister for consideration in imposing environmental conditions on CALM's proposals in accordance with s106(c) of the Environmental Protection Act; and
- recommendation on more general policy matters raised by the appeals.

The main thrust of the report is that, as a result of my consideration of the appeals I recommend:

- caution in the implementation of the proposals for harvesting and regeneration of the Jarrah-Marri forests;
- no increase in the level of cut beyond the rate approved in the 1987 Strategy;
- the creation of an extensive system of wildlife habitat corridors linking all streams across the saddles;
- a review of forest management policies to present and cost other options - including an option to gradually phase out large-scale timber operations from native forests and to base it on tree plantations on degraded farmlands with a long lead time and no loss of profit or jobs;
- approval of the EPA recommendations and CALM's proposal for the conservation estate with some modification;

- a public review of policy and practice regarding the effect and control of dieback;
- provision for undisturbed areas in high salt-risk areas;
- a public review of fire management;
- the establishment of an independent Forest Monitoring and Review Committee; and
- CALM's public accountability and relationship between the public, CALM and the EPA.

Recommendations of the Appeals Committee examining appeals submitted in relation to the Report and Recommendations of the Environmental Protection Authority on 'Proposals to amend the 1987 Forest Management Plans and Timber Strategy and proposals to meet Environmental Conditions on the Regional Plans and the WACAP ERMP'

I have examined CALM's approved 1987 timber strategies and its 1992 proposals and strategy documents, and the EPA Report and Recommendations and have considered the appeals and associated written and oral submissions on those appeals. I have also inspected a wide range of forest areas and timber processing locations in the company of representatives of CALM, the timber industry and the conservation movement.

In this process I have invited written and oral submissions from all appellants and the major interested parties and have received and considered the many responses to this invitation.

I am conscious of the need, and have endeavoured to maintain an appropriate balance between the competing interests and the different (and sometimes opposing) values concerned with forest management but am aware that, in the end, this must be a political decision.

In broad terms I am in general agreement with the approach taken by the EPA in the narrative and recommendations set out in its report as far as they go but in the light of some of the matters raised in the appeals I feel that in some respects the EPA report did not go far enough to maintain the appropriate balance required in CALM's management of the forests and in some other respects. In my view the EPA recommendations need to be modified or supplemented in the following ways:

A. EPA Recommendation 1 — Jarrah-Marri-Karri Silviculture

i) To strengthen the emphasis that CALM's proposals for the Jarrah-Marri forests be implemented cautiously and that the period to 2002 should be treated as a period of limited trial with emphasis being concentrated on getting the silvicultural system right in representative areas selected as being suitable for controlled scientific monitoring of the results. After 'in-house' and continuous review of the results by CALM and the proposed Monitoring and Research Committee the matter should be referred to the EPA for further independent assessment in 2002.

CALM's junior officers may need more training to design and supervise the logging coupes and there is a need for closer supervision by experienced officers in the next few

years to ensure that appropriate coupe design is correctly implemented by the logging contractors.

The regeneration will not be successful unless funds are made available year by year to carry out thinning and other required silvicultural practices. The present method of funding CALM's operations should be reviewed as soon as possible to ensure that a sufficient share of revenue raised by log sales and other charges is channelled into CALM's budget to ensure its capacity to carry out this work; and

ii) The EPA's approval of the methods for the proposed logging of the Jarrah-Marri and Karri forests (by means of gap creation, thinning or shelterwood management) should be modified to ensure that all streams are linked by forest habitat corridors across the saddles so that a network of wildlife habitat containing old growth forest is permanently maintained across the landscape. These corridors should be between at least 70 to 100m wide and be designed and managed primarily for the preservation of wildlife, both vertebrate and invertebrate, and for conservation of the soil micro-ecosystems. They should be managed for fire in a way consistent with habitat values. They should not be subjected to thinning, logging or other undue disturbance. The habitat trees recommended by the EPA in Recommendation 10 should be included in these habitat corridors.

The habitat corridors should be designed and mapped as soon as possible.

In the Karri forest these habitat corridors are intended to enhance CALM's proposed 3,200ha of linkage areas which can be included as part of the corridors linking the streams. The corridors once located should be left there as a permanent habitat for wildlife.

B. EPA Recommendation 2 — Conservation Estate

The EPA Recommendation 2 should be accepted with the result that CALM's original proposals should be accepted. In addition however the Minister should:

i) Give sympathetic consideration to allowing a five year breathing space for the wildflower industry to develop alternative supplies of the stock presently being obtained from the Mt Roe area. If a temporary licence system is to be granted it should be done with the maximum possible safeguards to ensure proper controls and automatic cessation at the end of the prescribed period; and

ii) Hester Block should be managed so as to preserve its public recreation and scenic values and so as to avoid contributing to a salinity problem in the area. This could be by transferring all or part of Hester Block to the reserve estate or by managing the block conservatively by way of a 200-300 year rotation.

C. EPA Recommendation 3 — Revised system of road, river and stream reserves

This recommendation should be accepted with the proviso that the correct interpretation of CALM's proposal is that the minimum width of the reserve on both banks combined will be 60m.

D. EPA Recommendation 4 —Protection of Diverse Ecotype Conservation Areas

This recommendation should be accepted for all areas of 5ha and over.

E. EPA Recommendation 5 — Identifying 3,200ha of outstanding old growth Karri forest

This recommendation should be approved. These areas should be included as part of the habitat corridors if possible. The corridors and old growth forest should be designed and mapped as soon as practicable.

F. EPA Recommendation 6 — Annual Sustainable Yield

The EPA concerns about possible increase in the allowable sustainable level of cut in State Forest should be made more specific by imposing a condition that there must be no increase in the level of cutting in the State Forest beyond the level approved in the 1987 Strategy. This limit should be maintained and follow the projections set out at page 32 of the EPA Report at least to the year 2002. This condition would not inhibit the utilisation of thinnings and wood residue which has been made possible by previously unavailable technology but the volume of chiplog and sawlog felled should not exceed the annual allowable volumes approved in 1987. The greater degree of flexibility which has been made possible by the additional resource disclosed in the Jarrah inventory should be accepted as an opportunity to build in greater safeguards for the protection of species of flora and fauna and to provide a comfortable surplus resource which will reduce pressures associated with honouring contracts to supply logs to industry. The availability of the resource should not be used as the justification to increase the level of cutting beyond that approved in the 1987 Strategy. It is noted that CALM

proposes a slight decrease in the Karri harvest in the 1992 proposals and this intention should be pursued.

G. EPA Recommendation 7 — Contractual Commitment of Logs

This recommendation should be approved but needs to be implemented so as to ensure that there is no hindrance to upgrading the classification of a class of log already included in a lower grade category.

H. EPA Recommendation 8 — Removal of Biomass

This recommendation should be approved.

I. EPA Recommendation 9 — Trial of Jarrah Silviculture

This recommendation should be approved with the Monitoring and Research Committee recommended below playing an active role in planning and overseeing the scientific monitoring of this trial period.

J. EPA Recommendation 10 — Undisturbed Areas in Catchments

The proposals contained in this recommendation should be modified as follows:

'In second order catchments in the intermediate and low rainfall areas in the Jarrah and Jarrah-Marri forests at least 30% of the catchment area must be permanently included in habitat corridors, stream reserves and diverse ecotype areas and not be subjected to logging, thinning or other forms of treatment other than fire management appropriate for wildlife habitat if this is necessary'.

K. EPA Recommendation 11 — Dieback

The proposals contained in this recommendation should be modified so that:

i) The habitat trees are to be located in the habitat corridors rather than as isolated trees in gaps;

ii) The population of B. grandis may be removed where it is necessary to prevent the spread of P. cinnamomi or whenever it is necessary to encourage regeneration;

iii) There should be a full review of all aspects of the dieback problem involving experts from within and outside CALM with emphasis on field assessment. (This matter should be set in motion by the Monitoring and Research Committee recommended below if that recommendation is accepted);

iv) Research funds should be made available for greatly increased research into the interaction between the proposed Jarrah-Marri silvicultural prescriptions and the spread of P. cinnamomi. The research should be field-orientated and inquire into such matters as:

- the effects of thinning and the health of the retained trees;
- the effect of P. cinnamomi on Jarrah regeneration;
- disease hazard rating systems; and
- maintenance of hygiene standards and the methods employed with particular reference to prescriptions for operations in summer moist soil conditions; and

v) Monitoring of the disease spread and impact in the intermediate and low rainfall zones is of particular importance. Monitoring should also be aimed at the maintenance of hygiene standards. Hygiene methods should be reviewed where necessary and with particular reference to prescriptions for operations in summer when soil conditions are moist.

L. EPA Recommendation 12 — Fire Management

EPA recommendation 12 should be augmented by a condition: 'that there be a public review of the Bush Fires Act, the question of wildfire threat analysis and the whole question of CALM's prescribed burning policy and practices. The Review should be carried out with close involvement of the Monitoring and Research Committee.'

M. EPA Recommendation 13 — High Salt-Risk Areas

This recommendation should be approved but the proposed condition should be modified so as to apply to all types of forest in all catchments where a high salt-risk has been identified.

N. **EPA Recommendation 14 — Forest Monitoring and Research Committee**

The concept is approved but should be modified to ensure that:

i) The Committee is autonomous (preferably created by Statute);

ii) It reports (publicly) to the Minister (or Ministers) responsible for CALM and for the Environment;

iii) The Committee's Executive Committee should include the heads (or representatives) of CALM, EPA, Forest Industries Federation of WA, Conservation Council, Water Authority and appropriate research institutions;

iv) The Committee should include working groups of 'hands-on' scientists such as soil scientists and silviculturalists, etc, to recommend on the advertising, funding and design of research projects; and

v) The former Dieback Foundation should be considered as a possible model.

O. Significantly more emphasis should be given to research into and monitoring of wildlife. To this end CALM should prepare and cost a research programme to identify the species, distribution and lifecycle of all species in the forest of the Darling Botanical District including vertebrates, vascular plants, snails, spiders and ants and report to the Minister.

P. **Public Accountability**

The Minister should direct a review of possible ways to provide public access to CALM's information and intentions and to ensure that CALM becomes more open and responsive to public input. More funds and energy should be given to the process of achieving accord between the major users, administrators and interest groups involved with the forests including accord between the Government organisations involved (CALM, EPA, WAWA, SECWA, etc).

Q. The Minister should establish a standing liaison committee of senior staff from EPA and CALM to keep the interaction between the two bodies under constant review, reporting to the Minister as well as to the executive heads of the two organisations.

R. The Minister should direct that CALM prepare and cost at least two additional sets of broad options for forestry policy and management. The options should include the possibility of

gradually phasing out large-scale commercial logging of the native forests and restructuring the timber industry to one based on plantations of trees suitable for sawlog and chiplogs grown on degraded farmlands. The options should consider ways to ensure there is no loss of jobs or interruption to domestic timber supplies. Options to ensure that industry is given sufficient lead time to restructure itself without loss of profits should also be canvassed. The options should be prepared in full consultation with all interested groups and public submissions should be called for and considered.

Costing the options should include an option of transferring the forestry operation from the Consolidated Revenue Fund to operate on a self-funding basis (see report on the Forestry Commission: Report No 52 December 1990 of the NSW Public Accounts Committee). The 'real' costs and benefits to the public of the various aspects of CALM's operations and of the activities of the timber industry and all other forest users should be taken into account.

1. Introduction

Establishment of Appeals Committee

The Committee was established under s106(c) of the Environmental Protection Act No 87 of 1986 ('the Act') to consider and report to the Minister for the Environment ('the Minister') on a total of 21 appeals lodged with the Minister under s100(2) of the Act. The appellants disagreed with the content and/or the recommendations in a report of the EPA which had reviewed and reported on forest management proposals by the Department of Conservation and Land management (CALM) for 1992 to 2002.

In 1992 CALM released four major proposals and strategy documents for public comment.

i) Proposals to amend the 1987 Forest Management Plans and Timber Strategy and proposals to meet Environmental Conditions on the Regional Plans and the WACAP ERMP. This document was subjected to formal assessment by the EPA under Part IV of the EP Act.

ii) Management Strategies for the South-West Forests of Western Australia A Review - Draft for Public Comment. This informative document provided detailed information about principles of forestry, the basic facts about WA forests, the legislative framework, CALM's guiding principles, objectives and strategies for forest management on the State Forest and conservation reserve estates.

iii) A Nature Conservation Strategy for Western Australia - a Draft for Public Comment.

iv) National Estate Values in the Southern Forest Region, South West Australia.

By agreement between CALM and the EPA the EPA made a combined review of all four documents and then made a report and recommendations to the Minister (which was published in EPA Bulletin 652, October 1992). The appeals being considered by this Appeals Committee are from appellants who disagree with the content and/or recommendations of that EPA Report.

Terms of Reference

The Committee was required to:

- Examine the appeals submitted in relation to the Report and Recommendations of the Environmental Protection Authority on 'Proposals to amend the 1987 Forest Management

Plans and Timber Strategy and proposals to meet Environmental Conditions on the Regional Plans and the WACAP ERMP';

- Examine the appeal reports submitted to the Minister in accordance with s106(b), by the Chief Executive Officer of the Environmental Protection Authority in relation to those appeals;

- make whatever enquiries the Committee considers appropriate; and

- provide the Minister with a report on the Committee's findings and recommendations in accordance with s109(3) no later than 23 December 1992.

Membership of Appeals Committee

The Appeals Committee consists of Mr Thomas Edwin Barnett, OBE BA, LLB.

Executive Officer: Mrs Coralie Faulkner.

EPA Recommendations

The EPA Recommendations are set out in their report 'Proposals to Amend the 1987 Forest Management Plans and Timber Strategy and Proposals to Meet Environmental Conditions on the Regional Plans and the WACAP ERMP' Bulletin 652, October 1992, Environmental Protection Authority.

The EPA Report provides introductory text to each of 15 recommendations and the recommendations need to be considered in the light of the introductory text. The recommendations are short but have created a lot of controversy and discussion. They are as follows:

Recommendation 1

The Environmental Protection Authority concludes that:

i) the proposals for the karri and karri-marri forest are environmentally acceptable; and could be implemented in accordance with the recommendations in this report and the application of a precautionary approach as outlined in this report; and

ii) the proposals in the jarrah and jarrah-marri forest are environmentally acceptable as a trial, since there are a number of uncertainties in predicting their long term environmental impacts. The Authority therefore recommends that they are implemented in accordance with the recommendations in this report and the application of the following general principles:

- a precautionary approach;
- adaptable and flexible management practices based on research and monitoring of operations;
- implementation as a trial with a reassessment by the Environmental Protection Authority after 10 years (the period of the Management Plans and the Timber Strategy); and
- no commitment of all of the wood resource in the long term.

Recommendation 2

The Environmental Protection Authority supports the amendments to the conservation reserve estate and recommends that they be implemented.

Recommendation 3

The Environmental Protection Authority recommends that the revised system of travel route (road), river and stream reserves should:

- be implemented, consistent with Recommendation 13 in relation to Intermediate and Low Rainfall Zones;
- have an effectiveness monitoring programme (see Recommendation 14); and
- remain unharvested in perpetuity, except for those portions of regrowth forest within road zones where thinning can be undertaken in a manner consistent with the enhancement of visual objectives.

Recommendation 4

The Environmental Protection Authority supports the protection of the Diverse Ecotype Conservation areas and recommends that they:

- be implemented and identified on publicly available maps; and

- remain protected from timber harvesting and associated impacts in perpetuity.

Recommendation 5

The Environmental Protection Authority recommends that the 3,200ha of outstanding old growth karri forest proposed by CALM for protection from logging should be identified on a regional basis and with the benefit of public involvement, and should include areas which are particularly valued by the community. These areas should:

- include those trees in Beavis, Carey and Giblett forest blocks protected from clearfelling by environmental conditions related to the Manjimup-Beenup power line proposal (EPA Bulletin 603);
- be identified publicly within three years from the adoption of the Management Plans;
- be managed to retain their social values and not be subject to harvesting in perpetuity; and
- should be subject to reporting by CALM on their implementation and management at the next Forest Management Plan review (see Recommendation 15).

CALM should retain sufficient contractural flexibility to ensure that the allocation of these reserves is not excessively constrained.

Recommendation 6

The Environmental Protection Authority has noted that CALM's silvicultural prescriptions for the jarrah forest have been developed with incomplete knowledge of their long term consequences; and therefore concludes that the proposals to amend the 1987 Timber Strategy should be implemented cautiously. The Authority recommends that the annual sustainable yield estimates in the Timber Strategy should only be applied for the life of the Strategy (ie, until 2002).

Recommendation 7

The Environmental Protection Authority recommends that the letting of wood supply contracts from the jarrah forest under the CALM Act:

- not commit all of the volumes in any class of log defined in the Timber Strategy for a term exceeding 10 years from 1992;

- not exceed the annual levels of supply in any class of log or wood (residue) nominated in the 1992 Timber Strategy; and

- recognise the possibility of the necessity to reduce wood supply beyond 2002 as a result of monitoring and adaptive management following the trial implementation of the jarrah silvicultural prescription.

Recommendation 8

CALM's inventory has identified classes of forest produce (other logs [jarrah] or forest residue [marri] in Tables 13 and 14 of the Timber Strategy) which had previously not been identified for commercial exploitation. There are uncertainties about the ecological implications of removing all of this biomass, so cautious, flexible management is warranted.

The Environmental Protection Authority recommends that no contract for a substantial portion of this newly identified resource should be entered into without prior referral of the proposal to the Environmental Protection Authority.

Recommendation 9

The Environmental Protection Authority recognises that the jarrah silvicultural prescription represents a significant change to former jarrah forest management and needs to be conservative. Therefore, the Environmental Protection Authority recommends that the jarrah silvicultural prescription should:

- be implemented as a trial, to provide a basis for future adaptability or management. Treated sites should be dispersed throughout the range of sites and localities in the forest (see Recommendation 14);

- include long term monitoring which quantifies the impacts of silvicultural practices on environmental elements and values in the forest and provides bases to adjust management; and

- provide for the first major report on outcomes and modifications to be part of the next review of Forest Regions Management Plans and Timber Strategy, by 2002.

Recommendation 10

The Environmental Protection Authority recommends that in the intermediate and low rainfall zones at least 30% of second order catchments in the multiple use jarrah forest should be left untreated (ie, undisturbed

from harvesting, thinning, etc) for a period of at least 15 years after harvesting or treatment of the remainder of the catchment. This untreated proportion should:

- include areas of multi-aged forest (including unlogged sites);
- be selected to emphasise wildlife, water resource and visual objectives;
- comprise sites with a minimum dimension of 100m; and
- be in addition to protected river and stream reserves and diverse ecotype conservation areas.

The status and effectiveness of this measure should be evaluated at the time of the next review of the Forest Regions Management Plans and Timber Strategy, by 2002 (see Recommendation 14).

Recommendation 11

The Environmental Protection Authority recommends that the jarrah silvicultural prescription be modified in the following ways:

- in providing for habitat trees CALM should ensure that sufficient selected trees are retained on sites subject to gap treatment which have the potential to provide this function throughout the lifecycle of the forest; and
- the reduction of the population of *Banksia grandis* be limited to specific areas with a high risk of *Phytophthora cinnamomi* impact, that a programme to identify and evaluate the environmental implications of the reduction be established as a priority, and that the results of that evaluation be subject to the next review of the Forest Regions Management Plans by 2002 (see Recommendation 14).

Recommendation 12

The Environmental Protection Authority recommends that the fire management objectives related to the jarrah silvicultural prescription should be modified to:

- include avoidance of air pollution in urban areas; and
- CALM should inform the public about its fire management (purposes of burns, areas burnt under different regimes of season and periodicity, escapes, etc) on a regional basis in its annual report each year.

Recommendation 13

In Recommendation 10 several constraints on logging in the jarrah forest are outlined for the protection of water resources, wildlife and visual amenity. There are some sites, mostly in the Intermediate and Low Rainfall Zones (ie, <1100mm per annum), where even with these constraints the risk of salt impacts following logging is still unacceptably high.

The Environmental Protection Authority recommends that the jarrah silvicultural prescription should be modified to provide for the identification by CALM, on advice from the Water Authority of Western Australia, of second order catchments with a high salt risk, within which:

- permanently protected stream buffers, at least 50m wide, should be left on both sides of all streams; and

- that part of the catchment which is to be left untreated as required by Recommendation 10 should be concentrated in the lower part of the catchment.

Recommendation 14

The Environmental Protection Authority recommends that a Forest Monitoring and Research Committee be established. The Committee should:

- have objectives which include the identification and approval of monitoring and research programmes and projects on environmental impacts of forestry management, granting of funds towards such research, receival of progress reports, reporting to the Environmental Protection Authority and publication of results;

- be established within 12 months;

- be funded from the proceeds of native forest product sales; and

- give brief annual progress reports to the Authority, with major reports in 1997 and 2002, at the time of the next review of Forest Management Plans and the Timber Strategy. The Authority shall report to the Minister for the Environment following the receipt of each major report.

Recommendation 15

The Environmental Protection Authority recommends that CALM provide brief annual progress reports to the Authority, and major public reports in 1997 and 2002, on compliance with the environmental conditions.

Appeals

After the recommendations were published on 9 October 1992, the public was given 14 days in which to lodge appeals. Appeals were lodged with the Minister for the Environment. In total there were 21 appeals, many of which were appeals from various representative organisations such as the Conservation Council of Western Australia and the Forest Industries Federation of Western Australia or from groups of individuals. The appellants were as follows:

EPA Appeal No	*Appellant*
187	Mary Frith, Bridgetown-Greenbushes Friends of the Forest
188	Peter Hird, Dennis Flockton, Kathleen Flockton, Beth Gwynne
189	Dr Beth Schultz, Conservation Council of WA
191	Dr Beth Schultz, South-West Forests Defence Foundation Inc
192	K Traylor, Dr J Davis, Murdoch University
193	Cam Kneen, Forest Industries Federation
194	Malcolm Hay
195	Dr Paul Wheatley
199	Alex Syme, Coalition for Denmark's Environment
201	Jeff McMahon
202	Forest Field Officers Association
203	David Swainston, Busselton Peace and Environment Group
204	Martin Taylor, Chamber of Commerce and Industry of WA
205	Andrew Thomson, Richard Chandler, Tony Poynton
206	F McKinnell, The Institute of Foresters of Australia (WA Division)
207	Christabel Chamarette, Senator for the Greens (WA)
209	Janet Pettigrew, Australian Conservation Foundation
210	Susan Hill
211	T Tranter, C Daly, L Hodson, M Davies, D Davies, H Parker, M Butcher,W Brown, R Lawrence, J Roberts, L Sutton, R Daglish, S Cullen (one appeal lodged)
212	Julia Boniface
213	Trish Townsend, Forest Protection Society Ltd

The contents of the appeals have been summarised by the EPA which then provided comments upon them for the Minister. In preparing this report I have adopted the EPA's summaries of the various appeals for the sake of convenience though each appeal has been studied in full and in detail. The EPA's summary of the points raised by each appellant, its comments, the Committee's comments and the Committee's recommendation on each appeal are set out in tabular form at Appendix I.

Methodology

In considering the appeals I have adopted a process of full and open consultation with all parties and relevant authorities as far as that has been possible. After an initial round of meetings with representatives of the main organisations involved to discuss the methodology of this appeal process I then set about conducting interviews with CALM, the EPA and appellant organisations with a representative of each main organisation invited to attend as an observer. These procedures worked well and led to an increase in each party's understanding of the other's position. Individual appellants were either interviewed separately face-to-face or by telephone or were invited to submit written submissions.

After those meetings there were three days of joint meetings involving representatives of the following organisations:

- Department of Conservation and Land Management
- Environmental Protection Authority
- Forest Industries Federation of WA
- Conservation Council of WA
- WA Forest Alliance
- Bridgetown-Greenbushes Friends of the Forest
- Coalition for Denmark's Environment

Dr Joanna Young (Tippett), former CALM research scientist and member of the EPA's Technical Advisory Panel also attended.

The purpose of those meetings was to discuss the background to the appeals and to discuss each recommendation of the EPA Report in turn. All groups and each person was given the opportunity to express their views and to reply to the views of others. No transcript was taken but summary notes were prepared.

To enable the Minister to give proper consideration to the appeals I have decided to report on each of the EPA's recommendations as each recommendation was appealed directly or impliedly by one

or other of the appellants. This report is made after considering the appeals and the subsequent submissions and discussions on the subject matter of the appeals. I have also had several interviews with the Chief Executive Officer of the EPA, the Executive Director of CALM and their senior officers and have read (selectively) from the vast quantity of written material submitted by those bodies and other persons and groups. A bibliography of this material is included in this report as it provides a useful source of reference material. Four days were spent inspecting forests, logging operations, regeneration plots and timber mills.

The task facing the Minister after he receives this report will be to consider CALM's 1992 proposals and the EPA recommendations in the light of my report. The result of that consideration will be the Minister's decision to allow or disallow each appeal. The Minister must also decide whether or not to impose environmental conditions on the implementation of CALM's proposals under section 45 of the Act (and will of course consider other policy aspects). Accordingly this report is directed towards that Ministerial task and will not discuss each individual appeal in detail. As stated above my recommendations and brief comment on each appeal are set out in Appendix I.

2. Background

The total area of public forest in Western Australia is approximately 2.4 million hectares. Of this area, approximately 1.7 million hectares is in production State Forest and a further 711,000 hectares is in national parks and reserves of various types. The amount of these areas which are covered by tall forest trees are set out in the table below.

TABLE 1

Tenure Categories by Forest Types

Forest	2.4m ha		
State Forest	1.7m ha		
National Park	328,000ha	]	
Nature Reserve	162,000ha	]	
Conservation Park	207,000ha	]	711,000ha
Other Reserve	14,000ha	]	

Total Forested (tall trees)

State Forest	1.5m ha		
National Park	148,000ha	]	
Nature Reserve	91,000ha	]	
Conservation Park	186,000ha	]	438,000ha
Other Reserve	14,000ha	]	

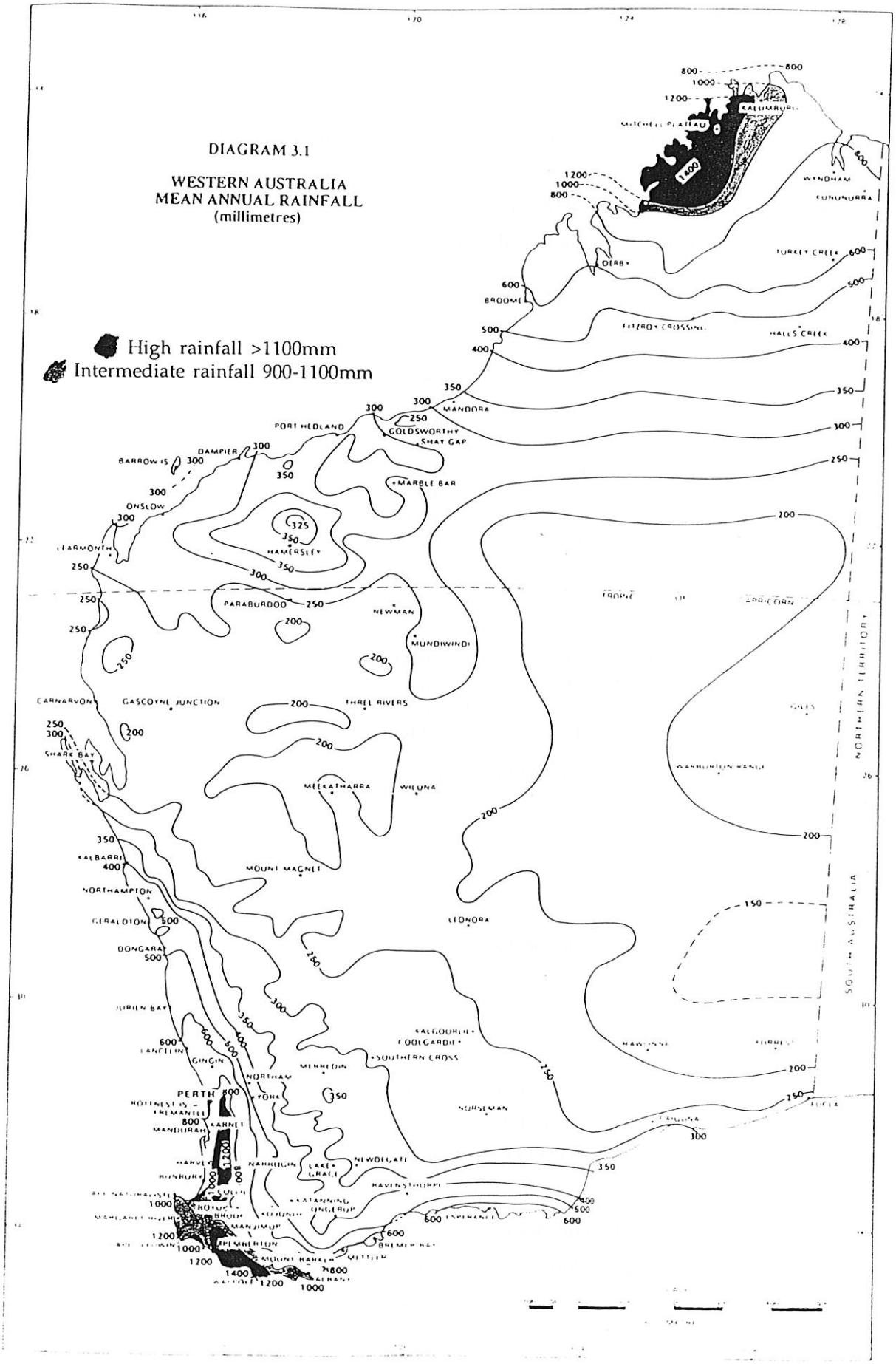
Source: Table 1 of CALM's Draft Management Strategies for the South-West Forests of Western Australia

The south-west forests are divided into the northern forests and the southern forests. The major natural division however is best expressed by means of rainfall and it is divided into areas of high, intermediate and low rainfall set out on the accompanying map overleaf.

Dieback

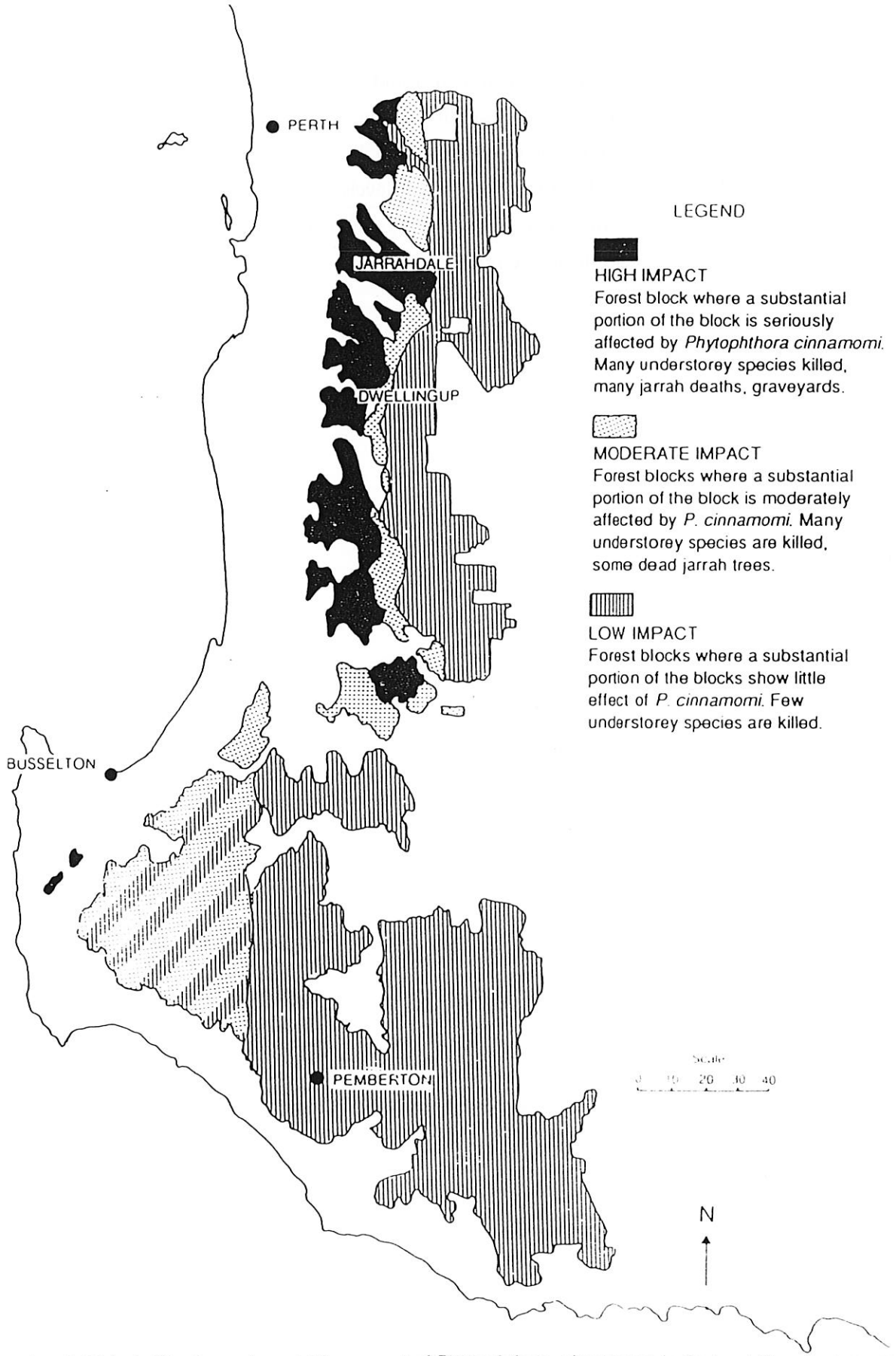
The forest is severely infected by *Phytophthora cinnamomi* (dieback), the northern forest being more affected than the south. The very useful map of the dieback-infected areas is set out at Figure 4 in the report by Shearer and Tippett CALM Research Bulletin No 3 overleaf.

It is said that the map is not quite accurate as it was taken from black and white aerial photography and the resulting reflection has slightly over-emphasised the spread of the infection but it is sufficient for general purposes such as this report (no other map is available).



Source: Australian Bureau of Statistics Western Australian Year Book 1990, page 29

IMPACT OF *PHYTOPHTHORA CINNAMOMI* IN SOUTH-WESTERN AUSTRALIA (DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT MAPPING SECTION).



Source: Jarrah Dieback: The Dynamics and Management of Phytophthera cinnamomi *in the Jarrah* (Eucalyptus marginata) *Forest of South-western Australia by B L Shearer and J T Tippett, CALM Research Bulletin No 3, November 1989*

Salinity

Within the south-west region large areas of State Forest and woodlands occur where stored soil salts are at high levels. In the Jarrah forest soil salinity is generally low in the high rainfall zone but increases significantly in the intermediate and low rainfall zones. In the southern forest the trends are more complex with more local variation in salt levels. When high levels of stored salt are combined with high or rising soil water tables there is potential for salinisation of land and streams. Removal of vegetation exacerbates the processes.

3. The Appropriate Balance

A major theme underlying most of the EPA recommendations and most of the appeals against those recommendations is the endeavour to strike an appropriate balance between the basic need of the timber industry to fell trees and remove logs and wood residue from the forests and the need to preserve a healthy forest environment satisfying requirements of conservation and preservation of species of fauna and flora, of climate, of soil and water qualities and the requirements for human recreation and development.

The theme surfaces directly when considering proposals to declare national parks and reserves, to increase or decrease the size of buffer strips, to extend the areas to be harvested or treated, to intensify thinning or clearing procedures and proposals to protect catchments. The theme also intrudes into discussions about cautious and adaptive management of the forests and into considerations about the control of diseases - particularly in relation to the attempt to arrest or at least to slow down the rate at which P. cinnamomi is spreading. It arises yet again when considering the obvious need to obtain information on the pattern of the biota in forest areas and to protect species-rich areas for vertebrates and invertebrates and for native flora.

The recommendations and appeals which relate to this underlying theme are discussed together in this section under the heading 'The Appropriate Balance'.

It needs to be remembered that the attempt to find the appropriate balance does not always involve conflict between the interested parties as there is a large area of consensus on goals such as the need to control disease, to preserve endangered species, and to prevent salinity. The conflict usually occurs over the measures and restrictions which are required to achieve these goals.

The appeals relating to the following recommendations will be dealt with in this section:

1. Karri and Jarrah harvesting;
2. Conservation reserve estate;
3. Road, river and stream reserves;
4. Protection of diverse ecotype conservation areas;
5. Identification of Karri old growth forests;
6. Cautious implementation;
7. Constraint on overcommitting classes of log;
8. Caution in removing biomass;
9. The 10 year 'trial' approach to implementation;
10. Staggered harvesting in second order catchments; and
11. Restricted harvesting in salt-risk areas.

In an ideal world the appropriate balance between industrial forestry, and conservation and 'multiple use' values would perhaps be determined as a matter of public policy before the forests are subjected to human disturbance in any way. This of course is now impossible because human disturbance commenced thousands of years ago and was greatly increased after European colonisation. Large areas of the forests were heavily logged at the end of the last century and again in the 1930s. A timber industry now exists which creates employment, profit and Government revenue.

Until recently the timber mills were fairly small scale, but labour-intensive operations and some mills of this type are still operating. It is Government policy now and for the foreseeable future that a timber industry shall continue to operate in the State Forest. The Government's management policy requires CALM to organise the felling operations by means of logging contractors and to supply logs to private enterprise mills. CALM's silvicultural and management procedures, in turn, are based upon the requirement of the logging companies to do appropriate harvesting operations under CALM's supervision and control and upon the willingness and capacity of the mills to accept and process the logs and wood residue which is harvested.

CALM and the timber industry are now locked in a mutually dependent symbiotic relationship which is driven on industry's side by profit, without which it cannot exist. In expectation of guaranteed future wood supplies industry has invested and is still investing in mills and other plants which require the supply of a calculated volume of logs in order to make sufficient profits in the varying market conditions. CALM has been the supplier of logs from State Forest to the mills since 1988. If the supply of logs (or the anticipated sale prices of the product) falls too low the mills will have to reduce output or close. Without the mills CALM will not produce for the Government the revenue required to (amongst other things) manage the State Forest and national parks. These existing factors must be taken into account as constraints when assessing the appropriate balance between the requirements of industry and other values.

When the 1987 timber strategy was approved and published the level of annual allowable sustainable cut was fixed as the limit within which CALM and the timber industry were obliged to work in their various roles as forest manager, log supplier, logging contractors and timber millers and processors. The strategy was put in place for 10 years to 1997 and would have been taken into account in all decisions made by all parties in relation to timber supply and demand and in relation to the other non-commercial 'multiple use' values.

Based on the 1987 Strategy and upon industry's expectations of log supplies and market demand to 1997 and beyond, the major mills, particularly Bunnings Forest Products and Whittakers have

embarked on extensive capital development programmes. As a result they will be geared up to process the full range of products expected to result from the new 1991 Jarrah Forest Inventory and CALM's 1992 proposals if approved. Both companies are developing potentially lucrative overseas markets for the sale of high grade Jarrah and Karri products in addition to their existing and expanding markets in the eastern states of Australia.

In mills at Manjimup and Greenbushes these companies are processing large quantities of first grade Karri and Jarrah logs as well as a small quantity of high grade Marri logs. Large quantities of lesser quality Marri logs are being harvested in operations in Jarrah-Marri forests and processed at Bunnings Diamond chip mill together with large volumes of lesser grade Karri logs and Karri and Marri sawlog residue.

These large companies are making substantial investments in such things as timber drying facilities and a sawmill for small-sized logs (Whittakers). They are successfully striving to improve efficiency and reduce waste. They have also centralised their operations by closing smaller mills (with the loss of many jobs in the local areas) and have moved towards computerised automation and less labour-intensive operations. They are working double shifts. Other companies are investing in charcoal and activated carbon plants to try and profitably utilise the vast quantities of Jarrah waste being left in the forest after operations. The waste is left because Jarrah is not a preferred wood for paper production.

Meanwhile the small sawmillers and contractors struggle on with labour-intensive operations cutting primarily second and third grade logs (because they claim that first grade is rarely made available to them at a competitive price). They are not very profitable but are very labour-intensive and so do create jobs as well as providing the various advantages that small sawmills provide for local communities such as sawdust and firewood supplies.

In drawing up its 1992 proposals CALM has, naturally, been fully aware of the needs and present and potential capacity of the timber industry. To ignore those needs and capacities could cause the collapse or complete restructuring of the timber industry with profound consequences for all sectors of the economy dependent on timber supplies and for employment in those sectors. It could also have consequences for CALM's continued ability to manage the forests.

CALM has of course also been aware of its duties to manage the forest estate to cater for the non-commercial values spelt out in the Conservation and Land Management Act. CALM's concern to promote those environmental values is apparent from examining its 1987 strategy documents and the 1992 proposals. Obvious manifestations of this concern include the proposals to significantly extend the reserved estate, to retain river and stream buffer zones, to delay harvesting of 30% of forest in

some second order catchments, and to put more emphasis on visual amenity management. CALM's concern for wildlife preservation is further shown by its proposals to create Temporary Exclusion Areas in Jarrah-Marri coupes and compartments to provide some fauna habitat as well as lessening the visual impact caused by gap creation. The proposed retention of three habitat trees per hectare in the Jarrah gaps is a further example of manifested concern for wildlife preservation. In Karri forests CALM's current policy already provides for temporary retention of forested zones until the Karri gaps have regenerated and grown sufficiently to have some habitat value.

By and large the EPA Report has approved CALM's 1992 proposals but has made major recommendations to delay harvesting of further areas of undisturbed vegetation in some second order catchments and to provide for 50m stream buffers on each side of streams in high salt-risk areas. The EPA Report also includes several recommendations urging a more cautious approach on a trial basis with greater emphasis on monitoring and adaptive management practices.

Although there are some appeals against the EPA recommendations which express genuine professional concern about professional silvicultural processes (most notably from the Institute of Foresters), most of the appeals are concerned that the EPA's recommendations would inappropriately tilt the balance towards conservation at the expense of industry or that the recommendations do not sufficiently tilt the balance away from industry towards wildlife, environmental and social values which are also required by forestry policy.

No appellant has challenged the EPA's implied acceptance of CALM's proposals to continue to provide logs from State Forest for the timber industry. There are however many appellants who object that the EPA has accepted what is perceived as proposals by CALM to increase the level and intensity of the proposed cut in the Jarrah and Karri and Jarrah-Karri-Marri forests. There are other appellants who object that the EPA's recommendations for a precautionary approach and for reduction of cut in catchment areas are an unwarranted interference with the profitability of commercial timber operations. Some go so far as to claim that it could even render the industry non-viable. There is also a 'professional' view put by some foresters that the EPA recommendations, by reducing the level of thinning or removal of Banksia grandis, gap creation, would serious hinder CALM's ability to provide appropriate silviculture and post logging regeneration treatment, with the result that the commercial development of the forest and even its biological health will suffer.

There is some dispute about the extent and the consequences of CALM's 1992 proposals. One reason for this is that CALM's 1987 allowable cut strategies (which are the current approved rules within which CALM should still be operating) were expressed in terms of volume in cubic metres per annum in Tables 14 to 17 in the 1987 'Timber Production in Western Australia' (December 1987, CALM) document, pages 39 to 49. The 1992 proposals however were expressed in the form of the allowable

sustainable volume of wood which could be removed from the forest in terms of gross bole volume. The two sets of figures are not directly comparable and CALM did not clearly comment on whether or not the 1992 proposals would result in a greater annual allowable level of cut or cutting over a wider area than previously approved, for the remainder of the current planning period 1987-97.

A bar chart was prepared by the WA Conservation Council based on figures presented in the EPA report at page 32. It compared the sustainable annual cut, allowed for in the 1987 strategies for years 1992 to 1997, with the allowable sustainable annual cut proposed for the same years in CALM's 1992 proposals. This appeared to show a significant increase in annual allowable cut under the 1992 proposals. (Charts overleaf).

CALM's response was to amend the table to take into account an additional volume of 98 million m^3 which was not, but could have been, shown as 'residue' in the 1987 Strategy.

The essence of CALM's argument on this issue is that:

i) The new Jarrah inventory has accurately identified and located approximately 37,000,000m^3 of Jarrah (including residue) which was not included in the more roughly estimated inventory on which the 1987 strategies were based;

ii) A considerable portion of this timber is residue material which would previously have been uncut or cut and left on the ground pursuant to the 1987 Strategy;

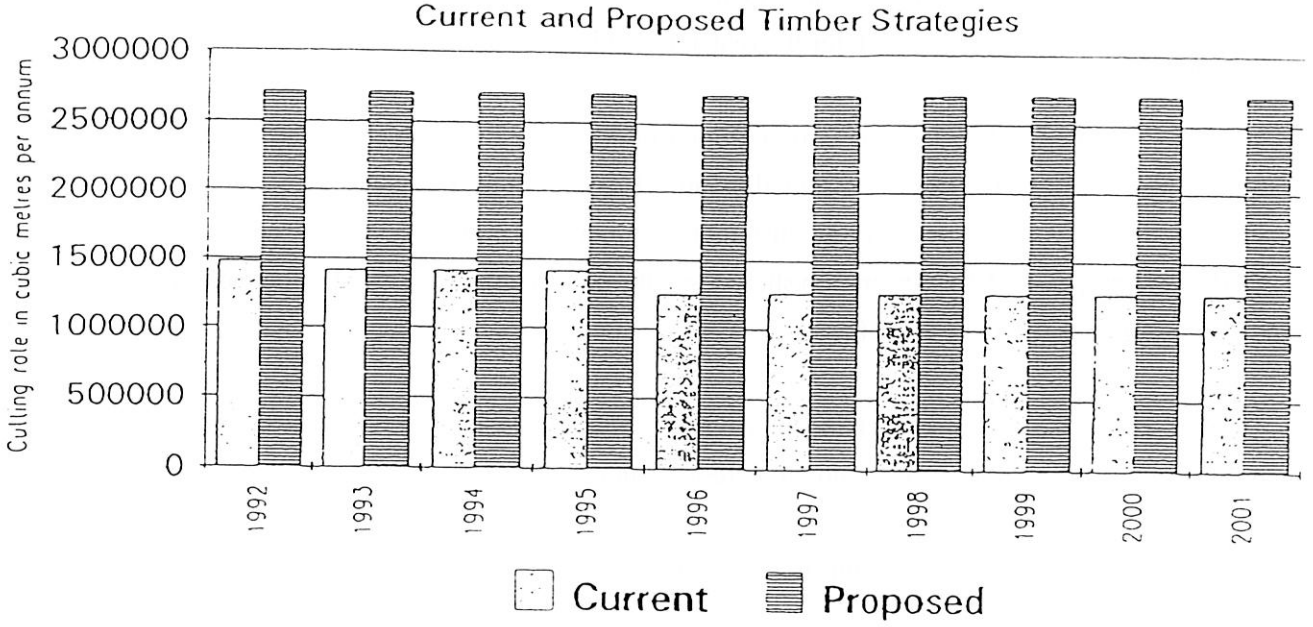
iii) By proposing to create additional parks and reserves totalling 125,000ha. Within this area there is a considerable volume of timber reserved from harvesting;

iv) In 1992 CALM is proposing to harvest an additional volume timber as follows:

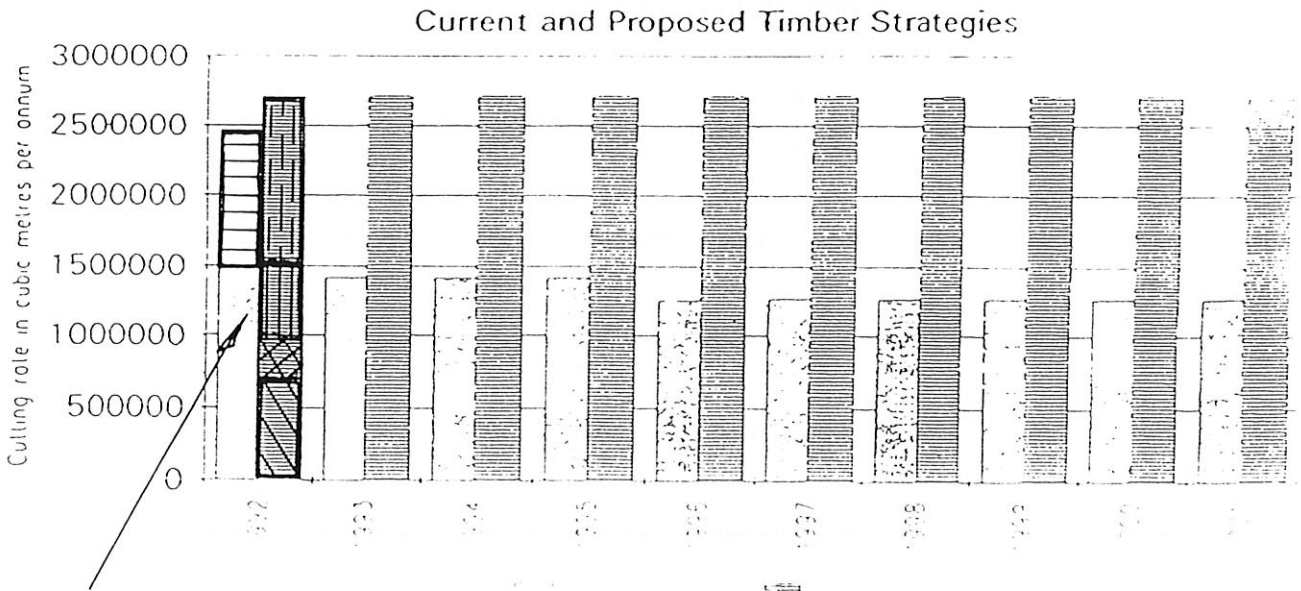
Jarrah - an additional 778,000m^3 per annum of which approximately 685,000m^3 is residue.
Karri - an additional 92,000m^3 per annum (all sawlog).
Marri - an additional 365,000m^3 per annum (all residue); and

v) CALM calculates that the 1992 proposals do not involve cutting more trees than allowed in the 1987 Strategy but they do involve removing and utilising a much greater volume of wood because new technology and markets are now available which will allow previously unutilised thinning and branch wood and sawdust to be commercially processed as small sawlogs, carbon blocks, activated carbon, etc.

TOTAL TIMBER



TOTAL TIMBER



(MOST OF THIS WAS NOT MEASURED IN 1987)

* THIS FIGURE TAKEN FROM THE EPA'S TABLE A·13 IS INCORRECT IT IGNORES THE 98·9 MILLION M³ OF J+M IDENTIFIED IN 1987 (TABLE B) THIS WOULD EQUATE TO APPROXIMATELY 1 MILLION M³ PER ANNUM BASED ON 100 YEAR ROTATION

(These figures were provided by EPA as CALM was unable to provide figures because 'it is not possible to provide figures to fit exactly within the clauses'.)

The EPA maintains its position that CALM is proposing to harvest a greater number of trees and this position is supported by the various 'conservationist' appellants.

In the time available I have been unable to resolve this conflict and the two authorities should be directed to provide the Minister with an agreed statement on the respective allowable cutting levels comparing the 1987 approvals with the 1992 proposals in some comprehensive fashion. Meanwhile I make the following comments:

i) Under the 1987 Strateg it was anticipated that there would be a reduced allowable cut in each year progressively from 1991 to 1997 and that woodchipping would be gradually phased out of the State Forest from some (contested) date around the year 2000.

ii) Many appellants representing the conservation movement believed that the approved 1987 timber strategy put too much pressure on the forests (particularly the Jarrah forest) and they had greeted the proposed reduction as a sign that the pressure for commercial exploitation would not be allowed to overtax the forests beyond the sustainable level of cut.

iii) There is concern that identification of unrealised additional resources in the 1991 Jarrah forest inventory has not resulted in a greater willingness to reduce the level of cut in catchment areas or to protect old growth forest from disturbance. The result has, rather, been to propose an intensification of thinning and gap creation in the Jarrah-Marri forests and to proceed to harvest Marri for chip and Jarrah for first and second grade sawlogs even though vast quantities of other (presently) unmarketable Jarrah wood is being left on the ground.

iv) There is concern that the proposed more intensive Jarrah silvicultural prescription involving: shelterwood, thinning and gap creation as appropriate, is being applied over very extensive areas. There is doubt about its viability as it will create very large areas where forest ecology is being drastically disturbed and the effectiveness of the procedures for producing regeneration is not yet proven in well-controlled trials over a sufficient area or period.

CALM officers however point to past history where vast areas of Jarrah-Marri forests were said to have been very heavily logged in operations which virtually amounted to clearfelling. The regeneration in many of these areas appears to have been very vigorous and although the diverse structure of the forest was drastically altered it has continued as commercially valuable hardwood forest areas with many forest values retained in terms of flora, fauna and social/recreational

potential. CALM also points out that its 1992 proposals are far less drastic than the operations of the 1930s as it proposes to set aside an extensive system of undisturbed stream and road reserves, Temporary Exclusion Areas to separate the gaps to be created in the Jarrah forests and 3,200ha of mature aged Karri forest to be retained in areas yet to be identified. It is apparent however that the 1930 operations did not amount to clearfell as there are mature aged trees still standing amongst the regenerated forests and these are extensively used as habitat by wildlife.

In addition CALM has proposed that a total of 30% of the area in second order catchment areas in the Jarrah-Marri forests in the intermediate and low rainfall zones should be left undisturbed for 15 years after adjacent forest in the catchment area has been harvested to reduce the chances of increased salinity, sedimentation or turbidity in the streams and as habitat for wildlife. CALM intended that the 30% would include the proposed river and stream reserves, and the diverse ecosystem reserves (all of which would be left undisturbed in perpetuity) and such additional area as necessary to make up the required 30% and that this additional area would be available to be thinned during the 15 year period if silviculturally appropriate.

CALM argues that its 1992 proposals are intended to augment an already extensive system of national parks and conservation areas, where all remaining species of fauna and flora are adequately protected and by ensuring that all streams and rivers and many major roads contain buffer strips of forest vegetation which will not be logged or thinned. These buffers are intended to provide permanent habitat for native wildlife and to be interconnected where possible by Temporary Exclusion Areas of native vegetation to provide corridors between large areas of mature forest and the reserved estate.

Having set aside these undisturbed areas CALM argues that the State Forest should be available for intensive commercial harvesting. Even in the areas of harvestable State Forest however CALM is obliged by its Act to ensure that the forest's diverse ecosystems are sustained. It claims to be doing this by identifying small special areas such as rock outcrops, endangered species habitat, etc, for special management and protection. It has also proposed rotation of Karri harvesting to ensure that a proportion of regrowth Karri forest in the State Forest will be managed so as to achieve full maturity and that a given percentage of Karri in each generation group will be managed so as to achieve maturity in a 250-350 year rotation cycle. This is set out in Table 4.9 at page 23 of the EPA Report.

TABLE 2

- National estate criteria will be used to identify areas of high value old growth forest.
- These areas will be nominated for Register of the National Estate.
- A secure and representative conservation reserve system, with no harvesting, will be enhanced.
- Old growth forest within river and stream and Level 1/2 road zones will not be logged.
- An additional 3,200ha of old growth forest will be retained, unharvested, as linkage areas or areas having special value.
- Logging and regeneration prescriptions which protect national estate values on a regional basis will apply to areas of State Forest on the Register of the National Estate outside of protected zones.
- These new management prescriptions are detailed under Jarrah and Karri silviculture.
- Multi-aged structure of Jarrah forest will be maintained, with mature trees being retained on all harvested areas.
- In regrowth Karri, the following areas will be grown until they develop old growth characteristics (>250 years):

When last cut	*Proportion retained to >250 years*	*Area*
pre-1940	25%	1,400ha
1940-75	all coupes < 200ha	2,000ha
1975-90	10%	2,650ha
post-1990	50%	

- Approximately 40% of the Karri forest will always contain old growth characteristics.

Source: CALM 1992c reproduced in Table 4.9 of Proposals to amend the 1987 Forest Management Plans and Timber Strategy and proposals to meet Environmental Conditions on the Regional Plans and the WACAP ERMP, EPA Bulletin 652, October 1992

It is not intended to retain existing stands of old growth Karri forest in the State Forest except that which occurs in the river and stream and (possibly) road reserves (except for 3,200ha to be identified and mapped as required by EPA Recommendation 5).

CALM claims to be confident that its silvicultural techniques in all types of forest are well tried and tested and that it has the ability, the will and the financial and technical resources to regenerate and manage the State Forest so that it can be harvested in ways which will promote timber growth and supply a technologically advanced timber industry increasingly capable of utilising all the wood produced. It claims that its ability to manage the forests has been greatly

enhanced by the completion of the new Jarrah forest inventory which has been linked with geographic co-ordinates stored in a Geographic Information System and used for strategic forest management to enable growth predictions and resource availability and demand to be estimated with far more accuracy than in previous years.

Some appellants however have challenged the ability of CALM to guarantee that sufficient funds can always be made available to ensure that the thinning and other silvicultural techniques can be carried out to ensure regeneration is successful. Senior CALM officers have agreed that funding is a serious problem and limits CALM's ability to carry out desirable silvicultural practices necessary to ensure satisfactory regeneration. There is a sense of frustration that the revenue earned by log sales goes into general revenue and that CALM is required to borrow to finance its essential operations.

There is also considerable concern that there is insufficient knowledge of the effect of disease (particularly P. cinnamomi) on Jarrah regeneration and the health of the Jarrah forest generally and that research on these matters is inadequate.

There is also a major area of concern by several appellants that the EPA did not sufficiently address bias they perceive in CALM's management strategies towards production forestry at the expense of the whole area of wildlife sciences and preservation. Although all existing species of vertebrate fauna have probably been identified, there are serious gaps in our knowledge of many species. Not everything is known accurately about the pattern of distribution. Even less is known about the invertebrates such as spiders and ants, some of which are unique relics of the Gondwanaland era.

The work to produce the Jarrah inventory has been a major scientific achievement which will be a great tool in the management of production forestry. It does not however contain the basic data concerning the range of scales of the biota - the vertebrates, vascular plants, snails, spiders and ants. A biogeographic survey to encompass that data to be added to the inventory would enable CALM to not only understand how Karri, Marri and Jarrah grows but also to anticipate how various management options at the local level will affect the pattern of the biota. It would also enable CALM to define the explicit basis for establishing a reserve network to protect these lifeforms.

At present CALM has the ability to answer most questions and to make estimates on most matters directly connected with production forestry and the growth of timber. It is noticeable however that the same ability does not exist regarding matters directly affecting wildlife and other plant species. There is also far less emphasis on scientific research in those areas. (See Forest Wildlife and Habitat Management in Southwestern Australia: Knowledge, Research and Direction by G Wardell-Johnson and O Nicholls.

At the coupe level silvicultural techniques have been put in place primarily to promote regeneration but also several concessions to favour the preservation of species have been made by the 1987 Strategy and the 1992 proposals. The exclusion of stream and road buffers is a major step in the direction but to the conservationist appellants the concessions do not adequately ensure the preservation of species at the local level and the reservation of further forest corridors crossing the saddle between each stream reserve has been proposed.

By and large the EPA review of the 1992 proposals has accepted CALM's estimate of the forest resources, the sustainable level of harvesting, the proposed silvicultural techniques for the Karri forest and the proposals for augmenting the system of reserves. It perceives that an increased level of cutting is being proposed for Jarrah and Marri and that extensive areas will be disturbed by more intensive harvesting and silvicultural techniques. The EPA has not paid much attention to the adequacy of CALM's proposals for the biota generally or for wildlife in particular. In its recommendations, the EPA has however endeavoured to instil a more precautionary approach with the first 10 years being treated as a trial period with adequate monitoring being carried out in scientifically selected areas and that CALM should follow adaptive management principles. In addition the EPA has recommended specific significant modifications to timber harvesting in the following areas:

i) Second order catchment areas (Recommendation 10) - Wildlife Habitat

CALM's proposals accepted that in the intermediate and low rainfall areas at least 30% of the multiple use Jarrah forest in second order catchments (including the river and stream reserves) would be left undisturbed for at least 15 years after harvesting or treatment of the rest of the catchment area. In Recommendation 10 the EPA recommended that this 30% should 'be in addition to protected river and stream reserves and diverse ecotype conservation areas". The aim of this recommendation was mainly to provide more wildlife habitat adjacent to stream reserves and also to protect against salinity and other disturbance to the aqua systems. If accepted this recommendation could temporarily exclude quite a large additional quantity of harvestable timber which CALM had intended to include in its logging programmes.

CALM and the timber industry representatives claim that this would oblige CALM to log more intensively in other areas and to extend operations into additional areas (with consequent additional road-making costs and an increased risk of spreading dieback disease into unaffected areas). Alternatively the exclusion of these harvesting areas for 15 years could require the level of cut to be reduced with the result that a reduced supply of resources will be available to industry. CALM's 1992 proposals seek approval for the level of

allowable sustainable cut to be held at the current 1992 level until 2002 as opposed to the approved 1987 Strategy which envisaged a progressive decline annually from 1992 onwards.

The controversy over EPA Recommendation 10 really focuses attention on the general adequacy of CALM's strategies for the protection of wildlife habitat discussed previously at page ii of this report. This raises serious concern about the appropriate balance between the requirements of commercial timber harvesting and the requirement to preserve wildlife species in the State Forest, particularly rare and endangered species. It is true that conservation estates have been set aside in which some of these species can exist in a relatively undisturbed state but many are locality specific and in any event CALM has a duty to manage the State Forest also so as to preserve wildlife values.

On the evidence of wildlife research specialists (both oral evidence and from publications) there is a huge gap in our knowledge about the lifestyles and habitat requirements of the larger vertebrates and a near dearth of knowledge about the invertebrates and the soil micro-organisms. Expert opinion favours the maintenance of permanent habitat corridors linking the stream reserves as the best way to protect these lifeforms while research is carried out into their existence, lifestyles and habitat requirements.

I have accordingly recommended the establishment of such permanent habitat corridors approximately 70-100m in width to cross the saddles in order to link streams and other habitat reserves. A network of such corridors, if carefully designed as wildlife habitats would also give rise to other possibilities:

a) They would do away with the need to retain 30% of second order catchments in the low to medium rainfall areas of the Jarrah forest (exclusive of stream reserves and diverse ecosystem areas) as recommended in EPA Recommendation 10. As the proposed wildlife habitat corridors would be designed to link with the stream reserves in such catchments those two areas combined would in most cases total up to 30% of the catchment as a permanent reserve which would be adequate for both habitat and salinity protection purposes. This would make it unnecessary to stagger harvesting as proposed in EPA Recommendation 10.

Should the Committee's recommendation about the establishment of the habitat corridors not be accepted however then I consider and recommend that EPA Recommendation 10 should be accepted by the Minister and implemented by the imposition of an appropriate condition.

b) The corridors would solve the dilemma of specifying the number of habitat trees to be retained as these would simply exist within the habitat corridors hopefully in far greater numbers than three per hectare.

c) Both CALM and the industry representatives have expressed concerns that tying up such a volume of timber as undisturbed forest will oblige CALM to log for timber more intensively and over a wider area than would otherwise be the case in order to sustain proposed timber supply levels. They argue that this will increase roading and logging costs and will contribute to the spread of dieback. These concerns should be considered alongside my recommendations that the level of cutting should not be allowed to remain at the higher 1992 levels of estimated sustainable yield but should progressively be reduced as approved in the 1987 Strategy.

It will also be possible for industry to extract higher volumes of small logs and residue material than had been anticipated in 1987 (owing to investment in new technology).

The effect of my recommendations will be to hold the level of harvesting through to the year 2002 at the levels approved in 1987. Any additional resource which could possibly be available for harvesting commercially should be held in reserve to provide a safeguard against overcommitment of the forest and to enable CALM to design a more effective safety net for the preservation of wildlife. The recommendations are intended to take the pressure off the forests which are inherent in the 1992 proposals.

ii) High salt-risk areas (Recommendation 13)

Recommendation 13 is intended to provide additional protection against salinity in catchments identified by CALM and the Water Authority as having a high salt-risk following logging operations. In these areas the EPA recommended 50m wide buffers on both sides of all streams. It also recommended that the 30% undisturbed area required by Recommendation 10 should be concentrated in the lower end of the catchment.

Although it believes that the salinity problem caused by logging has not been significant and is well under control CALM agrees in principle with Recommendation 13 in such high salt-risk areas. The industry would presumably also accept Recommendation 13 if such high salt-risk areas are identified. Clearly research and monitoring should be given high priority in such identified areas but also, research and monitoring programmes should take advantage of unplanned research opportunities which might arise (eg, a large wildfire defoliating and destroying vegetation over a wide area down to stream banks). Several appellants are

concerned that CALM is not vigorously monitoring salinity and that it should not merely rely on work carried out by the Water Authority which is basically monitoring for potability for human consumption and is not concerned with other aquatic values essential for the aquatic environment. These matters will be considered by the independent FMRC.

The Conservation Estate

Since the establishment of CALM in 1985 there has been a major shift in policy which has resulted in the establishment of a significant network of national parks and conservation reserves with secure 'conservation status' tenure.

CALM's proposals regarding alterations to the conservation estate are set out at Tables 14 and 15 of pages 140 and 145 of its proposals.

Background

The realisation (see page 66 of draft Strategies) of the need to create conservation reserves first found expression in the 1970s when the Forests Department (as it then was) set about creating a system of nature conservation priority areas in order to include representative vegetation types in protected areas and this led to the creation of small, scattered protected areas. The EPA Systems Committee adopted the Forests Department proposals and promoted some larger areas for conservation reservation. Out of this process came the proposals for the Shannon National Park. In 1982 a Forests Department general working plan was prepared and the final version released for public comment at the end of the planning process. The general working plan included the Forests Department's nature conservation proposals.

Following the creation of CALM in 1985 however, new forest management plans were drafted in 1987 and the first conservation reserves with security of tenure and purpose were proposed. At that stage there was no public input into the initiation of the proposals. There was subsequent public consultation however in that the draft documents were released for three months before final approval. In some cases only the core area of the former Forests Department's nature conservation priority area was proposed for reservation as it was expected that buffer zones would be left in State Forest to be managed in a way consistent with protection of the reserved core areas. The 1987 proposals were based on the Forests Department proposals which in turn had been based on the Academy of Science Report of 1975 which published the following criteria for selection:

Special - areas may be considered special because:

- they provide ecosystem types or habitat for species or communities in special need of protection;
- they are vulnerable to unnatural perturbations;
- they contain a wide diversity of physical and biological forms;
- they contain outstanding geomorphological, physical or aesthetic features;
- they contain important scientific reference sites;
- they are held in high community esteem;
- they are little modified by human activity.

Representative - reserves should be created to:

- represent environmental gradients;
- represent biogeographic units;
- represent communities at the regional level based on systematic analysis of maps and datasets of physical and biological patterning;
- replicate ecotypes if possible.

Viable - reserves should be large enough to:

- support viable populations and genetic diversity of indigenous plants and animals;
- sustain biological and physical processes.

Managed:

- reserves should be vested in an agency which has the capacity to manage the area in a way which will sustain its inherent values;
- reserves should be declared under legislation which provides clear security of tenure and purpose.

Community Involvement - the process of reserve selection should include the involvement of community interst groups and individuals.

The major achievement of the 1987 plans was to give security of purpose by making the areas national parks, nature reserves or conservation parks.

When the 1987 Strategy proposals were approved and published they included a considerable increase in the number of conservation reserves of one or other type. During 1990 and 1991 CALM officers combined with the Australian Heritage Commission in a joint study and included AHC values in its database and identified heritage values which had not been adequately included in

existing reserves. AHC staff speak highly of CALM's approach to the preservation of heritage values in reserves.

In preparation of the 1992 nature conservation strategy CALM gave further consideration to the criteria for selection of reserved areas and, using those principles, reassessed the 1987 proposals and prepared further proposals intended to increase the representativeness of the 1987 reserves. This time far more attention was paid to public participation. The matter was advertised widely and seminars were held and a wide cross-section of the public attended. It resulted in several new areas being proposed for conservation particularly the Mt Roe area proposed for a national park which is representative of a wide range of diverse ecosystems including wilderness areas.

After the 1992 draft proposals were released there was more public consultation as submissions were invited after advertising in the local press. Most of the submissions received concerned requests for the allocation of specific areas (including Hester Block) and are said to be still under consideration by CALM.

The appeals against EPA recommendation No 2 are:

i) from the wildflower industry group (see appeal no 201 J McMahon) who object that the declaration of Mt Roe as a national park will seriously affect their multi-million dollar industry as it is the last expansive area of public land available to them in the State Forest. They wish to be able to continue picking wildflowers in Mt Roe for a few more years to enable their growing stock to be established on private lands and plantations. In view of the level of employment provided by the industry (141 living in the Mt Roe area) the Minister should consider whether to postpone the creation of the park for a few years or to declare the park but to make it subject to the condition that picking could continue under close supervision for a period of five years.

   It seems that wildflower picking for the industry presently occurs on a very large scale and can severely disturb the native flora (eg, reducing by pruning the height of Banksia to stimulate the growth of flower stems and to assist the picking process). Such activity is clearly inappropriate in a national park and any continuation of picking in Mt Roe should be unequivocably temporary and subject to strict supervision. The licences should be made area-specific and picking should be limited to nominated licensees confined to defined areas in the park which have previously been picked over. The period of the extension of licence to pick in Mt Roe National Park should be limited to five years without the possibility of further extension. Pickers should be subject to dieback control procedures.

ii) The Forest Field Officers Association object to the Monadnocks area and Gibbs Block being declared as national park and conservation area respectively - on the grounds that they lack areas of high conservation value or that they have been degraded. There has been no time to make an independent assessment of these two areas but CALM's reasons for their declaration are that the Monadnocks area contains unique rock outcrops and associated flora and that the Gibbs area contains special vegetation types poorly represented elsewhere in the reserve system. These reasons appear eminently satisfactory and no sufficient reason is given by the appellant why the public would not benefit from their declaration.

iii) Hester Block - several appellants are seeking that all or part of Hester Block near Bridgetown be protected from logging in order not to further contribute to a severe salinity problem in the district (caused mainly by agricultural clearing) and in order to preserve some of the remaining remnants of the area's forests for the recreation and scenic benefit of nearby residents and tourists. This request is receiving a sympathetic response from CALM and I also consider that the appeal has merit and have recommended accordingly.

I have therefore recommend that the Minister accepts Recommendation 2 of the EPA Report with the result that CALM's original proposals should be accepted. In addition however the Minister should give sympathetic consideration to allowing a five year breathing space for the wildflower industry to develop alternative supplies of the flowers presently being obtained from the Mt Roe area. If a temporary licence system is to be granted it should be done with the maximum possible safeguards to ensure proper controls and cessation at the end of the prescribed period. I have recommended that the Minister should allow the appeals regarding Hester Block and that it be protected from heavy logging either by inclusion as part of the block in the reserve estate or by managing the block conservatively by way of a 200-300 year rotation.

4. Disease Control

Many appellants have appealed against the brief and inadequate way the EPA recommendations have dealt with disease control - particularly P. cinnamomi. It should be noted however that the EPA Report gives much fuller coverage in the narrative section and that this largely follows the TAP report.

After interviews with the Executive Director of CALM and with other eminent research scientists who have specialised in the phenomenon of the apparently unstoppable spread of dieback throughout the forest areas (and in heathlands and elsewhere) it seems clear that Western Australia is presently under siege from a complex and destructive plant disease affecting thousands of species and that the problem is of cataclysmic proportions. The effect on the forest's understorey and on the dependent wildlife species is extremely severe and the problem is spreading. Although Karri trees are resistant to the disease the effect on Jarrah trees has been far more severe; resulting at some sites and under certain climate and soil conditions in the apparently unexpected sudden death of whole sections of the forest.

It has been established that a certain type of concreted laterite is likely to be associated with high disease impact. It is believed by some that most of these types of sites have already been diseased and therefore losses in the future will be less than in the past. This view does not take into account the possible gradual decline and reduced growth of trees on sites considered to be of more moderate impact.

It is difficult to identify in the field sites with the potential for greatest disease expression. It is not certain that the disease will not continue to be expressed as Jarrah deaths in the intermediate rainfall zone of the forest. In any event several scientists believe that high and moderate impact can be associated with soil profiles which don't include concreted laterite. There can be other reasons for perching of water. Little is known about the sequence of climatic conditions which can culminate in the death of Jarrah. Further work is required before a satisfactory field system for prediction disease hazard can be developed.

Incomplete research into the effect of thinning and gap creation has indicated that it may create conditions favourable for the growth and spread of the P. cinnamomi fungus. These types of treatment are known to increase soil temperatures and moisture levels. It is vital for growth prediction and future planning to know whether there is likely to be infection of lignotubers, young saplings and even more mature trees in those conditions. A great deal depends upon the success of regeneration after Jarrah harvesting.

Research into the presence of P. cinnamomi fungus in the roots of apparently healthy Jarrah trees in dieback-infected areas has given grounds for concern and it is vital to know how such trees, with heavy infestation of the root systems, will react under various forms of extended severe climatic stress.

It is known that dieback is spread by soil disturbance and that although animals and birds may spread it to some extent, humans are by far the biggest cause of its spread, particularly when they are utilising machinery such as motorcars, bulldozers, log trucks and sniggers. In this context it is a cause of great concern that our forest strategies require multiple incursions into infected and uninfected areas of the forest.

Dieback control measures have been imposed in recent years with areas being quarantined. It is now claimed that the purpose of quarantine was not simply to stop humans entering an area and inadvertently spreading the disease. Another purpose was to allow the disease to express itself so as to allow opportunity for mapping the extent of dieback infection. In certain areas logging in wet conditions was prohibited if the moist soil would adhere to wheel treads and tracks. Regulations prescribe how to log and remove timber across dieback infection boundaries in an endeavour to minimise cross-boundary incursions by vehicles and washing down to remove infected soil before departure. Provisions have also been made to encourage industry to stockpile logs for use during periods when climatic conditions might prevent logging operations.

It is agreed that these measures, if strictly enforced can be successful in partly slowing down the spread of the disease but for obvious reasons cannot be completely successful. It was observed in 1992, at a time when logging restrictions caused by wet summer weather were threatening to dry up the supply of logs to industry the prescriptions were altered by CALM to enable an additional 30% of the restricted forest to be logged. It is not clear whether this was a direct consequence of the pressure facing the timber industry but I consider that the question of dieback controls and provisions for supplying industry during dieback risk periods should be urgently reviewed.

Appellants have raised many aspects of the problem of dieback and I have recommended that the best way to address these appeals is to recommend the establishment of an appropriate body to carry out a public review of the dieback problem and hygiene procedures. Such a review should not of course be limited to the effects of logging operations on dieback controls but should examine the position of shires, the Main Roads Department, the public and their activities in national parks, mining companies and any other parties with potential to spread the fungus, the effects of dieback in relation to the health of retained trees and Jarrah regeneration. The review should be under the auspices of the proposed independent FMRC.

5. Research and Monitoring

Several appeals raise the question of gaps or lack of balance in the direction of CALM's research efforts and of inadequate monitoring of the effect of logging operations, of prescribed burning, of salinity levels and of the interaction between dieback and CALM's various types of operations. It seems clear that CALM is underfunded for its monitoring and research tasks and that when allocating the available resources it has favoured research efforts into matters immediately relevant for production forestry rather than on matters merely relevant to conservation and non-commercial environmental concern.

I have agreed with the EPA's recommendation that an independent Forest Monitoring and Research Committee (FMRC) should be established and have proposed the former Dieback Foundation (funded largely by ALCOA) as a possible model.

The FMRC should preferably be established under Statute so that it can control and allocate funds as well as establish research priorities and approve and supervise projects. Its upper levels should include representation of the major interested parties including CALM, EPA, Forest Industries Federation and the Conservation Council. It should also include representatives of appropriate research institutions. At the lower level there should be working groups of research scientists and the research should be field-orientated.

Funding should be from a percentage of royalties (and not by additional charge on industry).

The approved management strategies allow production forestry in salt-risk areas, amongst wildlife habitat and in disease infected forests. This will occur in advance of the gaining of adequate scientific knowledge to enable us to foresee the results with confidence. In these circumstances there is an *obligation* to carry out an active programme of research into the existence and preservation of the lifeforms and environmental values which may be affected. There is also an *obligation* to constantly and effectively monitor the effects of our activities in the forests. It is in the light of these factors that the recommendations on Research and Monitoring are made as an essential ingredient of the total package of recommendations I have made.

6. Fire Management

CALM's policy and practices on prescribed burning and the management of fire arose frequently as grounds for appeal.

At the meetings between representatives of the various groups this was one of the most contested issues and there is merit on many sides of many arguments. It affects wildlife, the success of regeneration, the spread of dieback, the safety of life and property and many other values.

I have recommended that this whole issue of fire management should be subjected to public review in the near future. The review could be established under the auspices of the FMRC.

7. Public Accountability

Several appellants complained that they were frustrated in their endeavours to obtain factual information from CALM in order to understand and possibly to comment on CALM's proposals and operations. At meetings and in interviews the view was expressed that these difficulties were deliberately manufactured by CALM officers to prevent them from assessing CALM's activities. There were many complaints from appellants who thought that CALM (and the EPA) had ignored their submissions and that documents put out for public comment were unnecessarily complex and confusing. There were particular concerns at the difficulties in obtaining information about or from the inventory database.

From the other side CALM officers complained that some members of the public (particularly those from the conservation movement) sought and then misquoted information only in order to aim it back at CALM by way of hostile and unreasonable criticism.

There is a very high level of suspicion and mistrust between CALM and some sections of the 'forest-minded' public and also, unfortunately between CALM and the EPA.

On the other hand there have been excellent examples of public consultation between CALM and various interest groups by way of published materials and workshops. There has also been extremely effective and willing co-operation between various individual officers of CALM and EPA at middle and senior staff level.

The level of suspicion, mistrust and hostility however is, I believe, beyond reasonable proportions and is quite counter-productive. I have therefore recommended that there be an inquiry into CALM's public accountability to see what can be done to make CALM's vast reservoir of knowledge more open to the public. I have further recommended that the process of achieving a greater degree of accord between all parties interested in forest management be given greater emphasis. I consider that there is much residual goodwill and valuable knowledge and experience amongst the groups and organisations involved and that the management of the forests would greatly benefit from more co-operation and less hostility. A professional facilitator should be employed in order to build up a level of well-founded trust.

8. Policy Options

Present management strategies are based on controlled commercial harvesting of the State Forest by means of a working relationship between CALM and the timber industry. Conservation values have also been addressed, and addressed quite effectively, by the creation of a series of conservation reserves and national parks. To some extent these values are also being addressed in the management of the production forests but to a much lesser extent than in the reserves.

There is genuine public concern that Western Australia's comparatively small fringe of forests is already under, or is in the process of coming under, unsustainable pressure from sawlog and chip mill companies and that our forest heritage is endangered.

There is also genuine concern from those engaged in the timber industry and their dependents that conservationists may one day persuade some future Government to ban logging in native forests or to impose such restrictions that the industry will become unprofitable and close down.

There is a real possibility of building up a system of hardwood tree plantations to supplement and eventually to replace the supply of logs from the native forests. This possiblity is supported on all sides of the forest debate as it would not only relieve the pressure on the State Forest but could play a major role in reviving degraded farmland and providing employment. It would be a cost-effective method of growing and utilising timber.

At present these possibilities are being bandied about without much of the factual basis required for enlightened debate. Consequently fear and hostility is being created; possibly unnecessarily.

I have recommended that the Minister should direct CALM to prepare and cost, in consultation with the public, alternative broad options for the development of forestry policy and management strategies. There should be a proviso that any move towards a plantation-based industry and away from large-scale forest logging should be planned for with sufficient lead time to enable industry to restructure itself so that there be no loss of profits and no loss of jobs.

Appendix I - Recommendations to Individual Appeal Points

Overleaf.

Ground	EPA Response	Consideration by Appeals Committee	Recommend

Appeal No 187
Appellant: Bridgetown-Greenbushes Friends of the Forest
PO Box 461, Bridgetown WA 6255

1.1 The karri forest cut is to be increased by one third, from 1500ha to 2000ha.	The EPA assessed a management strategy for the karri forest which provided for smaller coupes, expanded conservation and other protected areas, commitment to a range of rotation lengths and a total saw log yield consistent with present levels.	There is some merit in the concerns of this appellant, and they deserve careful consideration. My recommendations for establishing habitat corridors, for not allowing any increase in allowable sustainable cut in addition to the EPA's recommendations will satisfy the appellant's concerns to some extent.	Take into account
1.2 This will give a rotation length of 45 years.	Presumably the appellant has derived this figure by dividing the cut of 2000ha/year into the area of the karri forest. The actual rotation length is not determined solely by the present annual cutting rate, and depends on long term management objectives. There is no blanket prescription proposed with regard to rotation length. CALM explains on p19 of the proposals document that most of the karri forest will be managed to a rotation length of 100 years. Under the conditions set on any approval of the proposal CALM will be required to implement the proposed rotation lengths.		Take into account
1.3 The proposals will dramatically increase timber extraction from a forest ecosystem already under threat from clearing, mining, logging, dieback and insect attack.	In the past large quantities of 'waste' were left on the forest floor because of a lack of markets. CALM's previous inventory took no account of these 'waste' timber products. The proposals dramatically increase the inventory account of the amount which could be removed, subject to markets. The Authority has recommended caution in implementation of the proposals. Mining, logging, dieback and insect attack impact on the forest.		Take into account
1.4 CALM assumes that "regrowth will occur quickly enough to prevent significant long term increases in salinity"	Yes they do. They cite the conclusions of the Land and Water Research Steering Committee (proposals document pages 16,17). The Authority has recommended ongoing monitoring and adaptive management, and specific, more stringent, management procedures for catchments with a high risk of salinity.	The EPA recommendations and my proposals for monitoring salinity will tend to alleviate this concern.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.5 CALM has carried out no monitoring of salinity effects, nor does it propose it in the future.	The research referred to above included monitoring of the salinity impacts of logging practices similar to those proposed by CALM. It was carried out in consultation with the Water Authority of Western Australia. The Authority has made recommendations regarding the need for ongoing monitoring of salinity impacts.		Take into account
1.6 The risk of spread of dieback has not decreased but areas previously quarantined are to be logged year round.	The Authority considers that CALM should not be free to relax its dieback hygiene procedures for its own operations unilaterally. Any change to these procedures should involve public scrutiny in view of the risks involved and the substantial constraints that those procedures have imposed on other users of the forest and the public. The Authority considers that CALM's management of the forest should explicitly build in contingencies to avoid the need for logging and other dieback threatening activities under wet conditions. CALM should be required to ensure that i) the same rules regarding dieback hygiene procedures are applied to all operations in the forest occurring under moist soil conditions, and ii) any change to its dieback hygiene procedures is subject to public scrutiny.	This concern is justifiable and my proposals for a review of dieback procedures arise partly from this and similar appeals.	Take into account
1.7 CALM's jarrah inventory has not been available to the EPA, the TAP or the public.	CALM has produced publications describing the methodology of its inventory. Consultant Dr Ken Shepherd advised the EPA (Appendix 4 page 28) that "we must accept the calculation of allowable cut as it would be impossible, without very considerable resources, to check this figure."	There is widespread concern about the fact that the public does not have ready access to the data in the Jarrah Inventory. The check on the inventory model commissioned by the Appeals Committee may help to allay this public concern. The recommendations for a review of CALM's public accountability and openness to the public at Recommendation O arise partly from appeals of this nature.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.8 The EPA seems blind to the likely environmental effects of CALM's 1992 proposals on the 'production forests'.	The Authority has given detailed consideration to the environmental effects of CALM's proposals and made a general recommendation of the precautionary approach as well as specific recommendations regarding possible salinity impacts, dieback control measures, habitat tree provisions, fire management and independently supervised ongoing monitoring and research.	In my opinion the EPA and CALM are both making genuine efforts to take environmental effects into account. My recommendations are a further attempt to strike the 'appropriate balance'.	Dismiss
1.9 The proposals should be reassessed in five years, not ten.	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years.	I agree with the EPA response.	Dismiss
2. The 'improved protection of conservation values'(p iv) is to be restricted to conservation reserves.	This is not so. The provision of stream reserves throughout the forest, the phased logging proposals and the Authority's recommendations on habitat tree provision and salinity will ensure 'improved protection of conservation values' throughout the forest.	I agree with the EPA response.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3. The proposed stream reserve minimum widths are too narrow; the minimum should be 50m as recommended by CALM's scientists.	Stream reserves serve two primary functions - water quality protection/aquatic ecosystem maintenance and the provision of wildlife habitat/corridors. With regard to the first, in addition to these stream zones CALM has proposed a form of phased logging. In high salt risk catchments the EPA on advice from the Water Authority of WA has recommended wider stream zones (50m minimum) and the concentration of the area retained under phased logging in the lower part of the catchment. The Authority is satisfied that these constraints are likely to be adequate to protect water quality, but has also recommended monitoring and adaptive management. In association with CALM's proposals for phased logging, and the EPA's recommended minimum dimensions of the areas retained, protection of these areas from thinning and better provision for habitat trees the proposed widths, with the adoption of ecological boundaries, are adequate. The Authority has also recommended that the effectiveness of these zones be monitored. The appropriate minimum width will depend on the ecological objectives for these zones. As these have not yet been defined by CALM on a regional basis it is not possible to determine the adequacy of the proposed minima. The Authority has recommended the application of the proposed prescription as a trial with monitoring and adaptive management. It would be possible to further require that CALM identify the faunal/floral conservation objectives of the stream reserves on a regional basis and use these to determine the appropriate minimum stream reserve widths. Many of these reserves will be significantly wider than the 20m minimum. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries as proposed by CALM.	CALM's proposals are to be interpreted as requiring a minimum stream reserve on both banks combined of 60m with a minimum of 20m on any one bank. (Thus if the reserve on one bank dropped to 20m at any place the reserve on the opposite bank would need to be a minimum of 40m). If these untreated stream reserves are to be linked to the proposed habitat corridors then (in view of matters raised in the EPA comments) it is considered to be adequate.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5. The provision for the protection of areas "important to people for many different reasons" should apply for the jarrah forest too (e.g. Hester block).	Recommendation 5 addresses a similar concern with regard to the karri forest. The Authority recognises the parallels between that requirement and the appellant's request for some provision for the protection of special areas of jarrah forest.	This is a valid concern and has been addressed in part in Recommendation A(ii) which proposes that 70-100m habitat corridors designed so as to contain old growth forest be permanently reserved in the Jarrah-Marri forests. (In Recommendation B a specific recommendation is made about Hester Block).	Take into account
6.1 "drastic increases in wood extraction"..."ease the pressure on the already overcut forest"	See response to 1.3 above.	This concern is addressed in part by Recommendation F which requires a progressive reduction in the annual level of cut in accordance with the approved 1987 management strategy. It is also reflected in Recommendation Q which makes proposals for the development of a policy option to phase out large-scale commercial logging from State Forests while developing a plantation-based timber industry.	Take into account
6.2 All remaining unlogged forest and all old growth forest of high conservation value should be retained.	The response to this depends on one's value system. Some conservation values can only be protected in reserves. To protect these values requires an adequate representation in the reserve conservation estate. The EPA endorses CALM's proposed additions to the conservation estate. In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendations with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest.	Although there is merit in this suggestion at this stage it is not consistent with the policy of continuing to allow the timber to operate at the level of cutting accepted in the approval of the 1987 strategy. The concern can be addressed however by designing the proposed habitat corridors to include areas of old growth and unlogged forest wherever possible as these will also be the areas having greater habitat values [and this is intended by Recommendation A ii)]. The concern will be considered in preparing the policy options proposed in Recommendation Q if accepted. The committee agrees with the EPA's comments on this concern.	

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6.3 CALM should take account of local concerns about loss of mature and mixed aged forest.	See answer to 5. above.	See previous answers.	
7.1 EPA writes off all old growth forest outside present conservation reserves.	To the extent that 'old growth' implies 'minimal disturbance by man' this is true by definition in 'multiple use forest', however the Authority considers that significant old growth values can also be represented in old regrowth stands in the multiple use forest. The complex of attributes which make up 'old growth forest' include some which can only be represented in undisturbed forest and some which can be represented in old regrowth forest. CALM's proposals include allowing some areas of multiple use forest to grow on to ecological maturity (i.e. with old growth values) and have sufficient flexibility to allow this provision to be increased in the future if required.(See also response to 6.2 above)	This concern has been addressed by proposals for habitat corridors, and development of policy options.	Take into account
7.2 In view of the uncertainties about removing all the biomass, the proposals are environmentally unsound.	Decisions about any ecosystem are necessarily taken without absolute certainty because of the complex, dynamic nature of the systems involved. The EPA has made the judgement that the levels of uncertainty regarding the ecological implications of CALM's proposals are such as to justify cautious implementation with monitoring and adaptive management, and that decisions are based on the best, rigorous scientific advice, appraised by the proposed independent committee.	The committee agrees with the EPA's comments and with the requirement that a proposal to remove substantial amounts of biomass must be referred to the EPA for approval.	Take into account
9. The trial implementation should be reported on after five years, not 10.	See response to 1.9 above.	The committee agrees with EPA's comments and the proposals in Recommendation N to strengthen and broaden the Forest Monitoring and Research Committee should allay this concern to some extent.	Dismiss
10. Recommendations 10 and 11 need to be strengthened.	The grounds for this assertion are not stated, so it is impossible to say how the recommendations might be strengthened to meet the appellant's objectives.		Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
12.1 Research which shows adverse effects of frequent burning on numbers of individuals and species of both plants and invertebrate fauna has been ignored.	The EPA and the TAP considered the research referred to and concluded that there was a need for further research of the ecological effects of CALM's fire management practices. The appeal should be dismissed, but the Forest Monitoring and Research Committee should be required to give priority to a few key subject areas of which fire ecology should be one. The Committee should report on results in these key areas within five years.	The committee has recommended a public review of CALM's fire management policies and practices.	Take into account
12.2 There should be a big reduction in the area of forest subjected to prescribed fuel reduction burning and in the frequency of burns, especially in the spring.	The EPA was aware of an apparent difference between the public perception and CALM's actual practice of prescribed burning. It therefore recommended that CALM be required to report on such factors as the area burnt, frequency, intensity and season on a regional basis, each year in its annual report. This information is currently not publicly available. On the basis of the information provided by CALM on the area, frequency and intensity of burns the Authority did not consider that a recommendation of a lesser frequency/intensity could be justified. However, the EPA and the TAP considered the available research and concluded that there was a need for further research of the ecological effects of CALM's fire management practices. The Forest Monitoring and Research Committee should be required to give priority to this research.	The committee has recommended a public review of CALM's fire management policies and practices.	Take into account
13. Recommendation 13 should be applied to all the salt risk areas.	The Authority was advised by the Water Authority of WA that the constraints outlined in Recommendation 10 were adequate for the control of salinity impacts in all but the highest risk catchments. The constraints proposed in Recommendation 13 were those which the Water Authority considered necessary, on the basis of research, to provide adequate protection in these high risk catchments.	The committee considers that its proposals on Recommendation 10 will be adequate to control salinity but it has also strengthened the proposals for the FMRC which would be expected to ensure that the effect of operations in the catchment will be scientifically monitored on a continuing basis.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
14.1 The Forest Monitoring and Research Committee should include a Representative of the Conservation Council	The Authority's intention was that the FMRC be a body of expert scientists, but that the Committee "should actively promote the participation of and draw expertise from other government agencies, tertiary institutions, public organisations and individuals."	The committee agrees with the appellant and has so recommended.	Take into account
14.2 The FMRC should report directly to the Minister	The Authority considers that the FMRC should be appointed by and report to the Authority, and that its reports should be publicly available. This is because the Authority's processes always involve a high degree of public exposure which may not be the case with reports to the Minister. However, the Authority would subsequently report to the Minister on the matters raised in the Committee's report. This report should also be made public. It would also be helpful for the Minister to receive advice (which is subsequently made public) on the practical implications of the Committee's report from the Lands and Forests Commission.	The committee agrees with the appellant and has so recommended.	Take into account

Appeal No 188
Appellant: **Peter Hird, Dennis Flockton, Kathleen Flockton & Beth Gwynne**
21 Loftie Street, Bridgetown WA 6255

1. Catchment areas and water courses should be planted for permanent not temporary reasons thus ensuring a safer future for wildlife, drinking water and biodiversity.	This appears to relate to the rehabilitation of cleared land.(see below)	To the extent that this concern relates to the forests it is addressed by CALM's proposals for the river and stream reserves and the proposed permanent habitat corridors designed to link with those reserves.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2. The risks to salinity levels increasing after the proposed clearfelling of jarrah is very real, and not enough knowledge is available to safely insure against it.	The Authority has made recommendations based on research and monitoring by the Water Authority of WA in co-operation with CALM. This research indicates that salinity is likely to be an environmental problem in certain high risk catchments, and the Authority has recommended special constraints on logging in these catchments to ensure that there are no significant environmental salinity impacts.	The committee agrees with the EPA comments with the further comment that the proposed habitat corridors will assist in the control of salinity as they will be retained permanently in catchment areas.	Take into account
3. In the Bridgetown area salinity is getting worse, yet CALM proposes felling regrowth all around in the next 10 years.	Where salinity is a problem in substantially cleared catchments a total catchment approach is needed to address the issue. To simply constrain the activities on the forested areas and not the agricultural areas is inadequate. A range of measures is needed, and the approach must be community based to be successful. Obviously CALM should be one of the participants in this process. CALM has proposed a community consultation programme for the management of forest around Bridgetown.	The committee shares the concern about salinity in the Bridgetown area and has made recommendations about Hester Block in partial answer to this concern.	Take into account
4. Why is there no mention of jarrah plantations? Why is there no link with Landcare? Why aren't marginal farms replanted? This report lacks the scope of a holistic approach.	This assessment of CALM's proposals relates to the management of the State forests in the Swan, Central and Southern Regions. It does not relate to plantations or cleared farming land.	These questions will be addressed in the policy options proposed in Recommendation Q.	Take into account
5. Why are dieback areas now open to logging but not open to general use? Are timber companies treated preferentially? If so, why?	The Authority expressed concern about relaxation of dieback hygiene in wet seasons.	The committee agrees with the EPA comments and has recommended a public review of the dieback problem.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6. Poisoning non-timber trees is unacceptable. It creates a plantation effect, destroying the balances between components of the forest which is detrimental to forest health for many years to come.	The Authority agrees that the thinning operations carried out as part of the jarrah silviculture will produce a forest in which the ages of trees and tree forms are more uniform within treated areas. The available evidence does not indicate that this structural change will be "detrimental to the health of the forest", but the Authority has acknowledged that the question of the long term community acceptance of the restructured forest remains to be answered. It is partly for this reason that the Authority has recommended implementation as a trial only, with monitoring and adaptive management.	The committee agrees with the EPA's comments. It considers that the proposed Jarrah silvicultural methods are an appropriate method for harvesting and regenerating Jarrah. Its proposals for an extensive system of permanent habitat corridors in Jarrah (and Marri) forests will alleviate the 'plantation effect' complained of.	Take into account
7. CALM should prepare an economic statement of the costs and benefits of logging.	This issue, while important, is not an environmental issue.	The committee agrees with this statement and it is covered in the Recommendation R on policy options.	Take into account
8. Large areas of undisturbed forests are needed for real conservation. Corridors 100m wide will not.	The Authority agrees with the need for large areas of undisturbed forest and this is provided for in the reserve system including CALM's substantial proposed additions. The Authority examined the issue of corridor width in detail and concluded that the appropriate width for a corridor will depend on the objectives - the width of a corridor for invertebrates could be quite narrow, but the width needed for a highly mobile mammal would be much wider. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries. The conditions should reflect this.	The committee agrees with this comment and it is catered for in Recommendation A regarding habitat corridors where a minimum width is provided, but they can be wider if this is required for the particular wildlife intended to be preserved.	Take into account
9. Public participation is essential. Forests are worth more to tourism (unlogged) than if logged for timber.	The Authority agrees with the need for public participation. Submissions conveyed the perception that CALM could do this better. With regard to CALM's fire management activities the Authority has recommended more effective public reporting by CALM. The forests are managed for multiple uses. The balance between those uses is a matter for the Government to decide.	The comment about public participation is agreed by the committee and is dealt with in the proposals for public accountability in Recommendation P.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
10. Logging of Hester block is inappropriate.	As noted above, CALM has proposed a community consultation programme for the management of forest around Bridgetown, including Hester block.	The committee agrees that Hester Block should be managed so as to preserve its public recreation and scenic values and has recommended accordingly.	Take into account

Appeal No 189
Appellant: Conservation Council of Western Australia Inc
79 Stirling Street, Perth WA 6000

1.1 No notice was taken of submissions	This is not so. All submissions were read in detail several times during the assessment. Issues raised in submissions were summarised by the EPA and referred to CALM. CALM responded, and the EPA & TAP considered both the submissions and CALM's responses. The Report necessarily highlights only the major issues, but all others were considered.	The committee agrees with the EPA response. The committee has also recommended that a public review should be carried out into the ways that the public can gain access to CALM information and provide public input.	Take into account
1.2 There will be no old growth karri left outside reserves	To the extent that 'old growth' implies 'minimal disturbance by man' this is true by definition in 'multiple use forest'. The complex of attributes which make up 'old growth forest' include some which can only be represented in undisturbed forest and some which can be represented in old regrowth forest. The importance of this depends on one's value system.	There is merit in this comment but 3,200ha of old growth Karri are to be identified and retained and the committee's proposals for habitat corridors are intended to preserve areas of old growth Karri as part of the habitat corridors.	Take into account
2. The 10 year trial period for the jarrah silviculture is too long and there is sufficient evidence of risk and damage (from dieback, salinity and removal of old trees) for the proposals to be rejected outright. CALM has a poor record for monitoring and meeting conditions.	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years.	The committee has some sympathy with this view and has accordingly strengthened the proposals for continuous monitoring and reporting and for this to be done on a scientific basis. The proposals for the Forest Monitoring and Research Committee are intended to ensure that it is an autonomous body directly involved in monitoring CALM's activities and directing and assessing and monitoring the type of research which will be necessary to ensure that the 10 years is a genuine trial period.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3. There is insufficient public information to determine whether the proposed conservation reserves are adequate.	The Authority is satisfied that CALM's proposals meet the Authority's requirements for reservation of forest expressed through the work of the Conservation Through Reserves Committee and subsequent assessments of CALM Forest Management Proposals. The criteria-based CALM/AHC proposals increase the reservation of old growth forest significantly beyond that originally envisaged by the EPA. The criteria should ensure that only areas with the appropriate values will be reserved. CALM has advised that all the supporting mapping will be publicly available.	There is merit in this comment and it has been taken into account when recommending that CALM's data bank and that CALM information should be made more available to the public. A review of this aspect of public information has been recommended in Recommendation P.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4. Stream reserves should be 50m either side of first, second and third order streams as recommended by CALM's scientists.	Stream reserves serve two primary functions - water quality protection/aquatic ecosystem maintenance and the provision of wildlife habitat/corridors. With regard to the first, in addition to these stream zones CALM has proposed a form of phased logging. In high salt risk catchments the EPA on advice from the Water Authority of WA has recommended wider stream zones (50m minimum) and the concentration of the area retained under phased logging in the lower part of the catchment. The Authority is satisfied that these constraints are likely to be adequate to protect water quality, but has also recommended monitoring and adaptive management. In association with CALM's proposals for phased logging, and the EPA's recommended minimum dimensions of the areas retained, protection of these areas from thinning and better provision for habitat trees the proposed widths, with the adoption of ecological boundaries, are adequate. The Authority has also recommended that the effectiveness of these zones be monitored. The appropriate minimum width will depend on the ecological objectives for these zones. As these have not yet been defined by CALM on a regional basis it is not possible to determine the adequacy of the proposed minima. The Authority has recommended the application of the proposed prescription as a trial with monitoring and adaptive management. It would be possible to further require that CALM identify the faunal/floral conservation objectives of the stream reserves on a regional basis and use these to determine the appropriate minimum stream reserve widths. Many of these reserves will be significantly wider than the 20m minimum. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries as proposed by CALM.	The committee agrees with the EPA comments on the width of stream reserves (interpreted to mean a minimum of 60m covering both sides of the streams). It believes that its recommendation for the proposed permanent habitat corridors to link with the stream reserves and for the combination of habitat corridor and stream reserves to be permanently retained in 30% of the area in the second order catchments referred to in EPA Recommendation 10 will provide reasonable protection for habitat and water qualities subject to the monitoring which is being proposed.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6.1 Recommendation 5 does not satisfy WACAP condition 4. CALM should be required to meet this condition in full.	The Authority considers that the Minister should set a condition based on Recommendation 5 (in EPA Bulletin 652), and that this condition should supersede WACAP condition 4. (This may require an amendment of the WACAP conditions under Section 46 of the Environmental Protection Act)	The committee notes the comments of the EPA and considers that its recommendation for the habitat corridors to include areas of old growth Karri forest will provide for this concern.	Take into account
6.2 There has been no public input into deciding which areas are protected	Agree, however, Recommendation 5 states that the areas should be identified "with the benefit of public involvement"	The committee agrees with the EPA comments and has recommended a review of the public input into CALM management decisions.	Take into account
6.3 CALM proposes to clearfell these areas	CALM proposes that these areas "will be excluded from harvesting and regeneration and from yield calculations"(proposals document p19)	The committee agrees with the EPA comments and has also proposed that old growth Karri will be included in the habitat corridors permanently.	Take into account
6.4 All unlogged forest and other old growth should be protected in conservation reserves	The response to this depends on one's value system. Some conservation values can only be protected in reserves. To protect these values requires an adequate representation in the reserve conservation estate. The EPA endorses CALM's proposed additions to the conservation estate. In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendations with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest.	In the confines of existing forest policy which allows the timber industry to maintain the cutting level based on the 1987 strategy approvals, the committee is unable to agree with this proposal. By providing for the extensive system of habitat corridors and by recommending that policy options be prepared including an option to phase down commercial logging in the State Forests and to gradually restructure the timber industry to be plantation-based, the committee has taken account of this concern.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
7. The increased volume of timber proposed to be extracted from the jarrah forest is environmentally unacceptable.	The environmental impacts of CALM's jarrah forest management proposals are not solely related to the quantity of wood removed from any given area. The Authority has addressed itself to the impacts, rather than the quantity of wood, nevertheless, the Authority expressed its caution over the proposed increase in the removal of biomass by recommending that any major proposal for the removal of 'other jarrah logs' (not presently utilised) should be referred to the Authority for further consideration of its environmental impacts.	The committee is sympathetic to this concern and has recommended that the volume of cutting not be increased beyond the volume allowed under the 1987 strategies and has recommended a policy review to determine the future direction of forestry management including the management of the Jarrah forests. The committee agrees with the EPA requirement that major proposals to remove biomass will require EPA approval.	Take into account
8.1 The public has not had an opportunity to comment on CALM's proposal to clearfell jarrah. (EPA questions whether the community will accept a 'significantly restructured forest')	CALM's proposals have been publicly reviewed. CALM has not described them as clearfelling presumably because they include the retention of habitat trees, the coupes are smaller than in normal clearfelling, and the regeneration is from lignotubers rather than a fired seedbed. This is one of the reasons why the EPA has recommended the implementation of the proposals as a trial, with the results available for public information.	The committee notes the EPA comments on this comment and although the Jarrah silvicultural proposals do not involve extensive clearfelling, the committee agrees that it involves an extensive amount of logging and disturbance. Its recommendations regarding the retention of habitat corridors and to contain the level of cutting to the 1987 strategies are intended to take some of the pressure off the Jarrah forests.	Take into account
8.2 There is widespread evidence that cutover jarrah is not regrowing. To reduce it to 10 or even 15 m^3/ha will push the ecosystem beyond the limits of recovery and survival	EPA is not aware of this 'widespread evidence'. The proposed thinning minima of 10 and 15 m^3/ha are based on CALM's research results. EPA recommends (Rec 9) that their implementation be subject to monitoring and adaptive management.	The committee agrees with the EPA comments on this matter and has proposed that the monitoring capacity be strengthened under the control of an independent and broadly representative FMRC.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
9. The additional safeguards in Rec 10 are insufficient. The risk of increased salinity is too high.	The provisions of Rec 10 are based on research by the Water Authority of WA in conjunction with CALM over a number of years, and are consistent with the Water Authority's advice.	High salt-risk catchments are dealt with specifically in Recommendation 13. The committee considers that its proposed reservation of habitat corridors and the agreed river and stream reserves in normal catchment areas will be sufficient, subject to a boosted up monitoring system. In low to intermediate rainfall second order catchments in the Jarrah forests the permanently retained habitat corridors and stream reserves must cover at least 30% of the catchment area and it is believed this is sufficient.	Take into account
10. It is unacceptable for CALM to judge how many habitat trees are sufficient.	The Authority considered the available evidence was insufficient to clearly indicate the number of habitat trees which would be required, but that it tended to indicate that three trees per hectare were insufficient.	The committee's view on habitat trees is that they should be included within generous wildlife habitat corridors and this has been proposed.	Take into account
11. The public has not had an opportunity to comment on the relaxation of CALM's hygiene prescriptions.	CALM should not be free to relax its dieback hygiene procedures for its own operations unilaterally. Any change to these procedures should involve public scrutiny in view of the risks involved and the substantial constraints that those procedures have imposed on other users of the forest and the public. CALM's management of the forest should explicitly build in contingencies to avoid the need for logging and other dieback threatening activities under wet conditions.	The committee agrees with this comment and has recommended a complete public review of all matters connected with dieback hygiene.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
12. CALM burns too much, too often and at the worst possible time of year (spring), with unacceptable ecological consequences.	The EPA was aware of an apparent difference between the public perception and CALM's actual practice of prescribed burning. It therefore recommended that CALM be required to report on such factors as the area burnt, frequency, intensity and season on a regional basis, each year in its annual report. This information is currently not publicly available. The EPA and the TAP considered the available research and concluded that there was a need for further research on the ecological effects of CALM's fire management practices. The Forest Monitoring and Research Committee should be required to give priority to this research.	The committee also has some concern about CALM's fire management policy and has recommended that the Bush Fires Act and the wildfire threat analysis should be publicly reviewed.	Take into account
13. The additional safeguards in Rec 13 are insufficient. The risk of increased salinity is too high.	The provisions of Rec 13 are based on detailed research by the Water Authority of WA in conjunction with CALM over a number of years, and are consistent with the Water Authority's advice.	The committee considers that EPA's Recommendation 13 is reasonable subject to intensive monitoring under the auspices of the proposed representative Forest Monitoring and Research Committee.	Take into account
14.1 The Forest Monitoring and Research Committee should include a Representative of the Conservation Council	The Authority's intention was that the FMRC be a body of expert scientists, but that the Committee "should actively promote the participation of and draw expertise from other government agencies, tertiary institutions, public organisations and individuals."	The committee agrees with this proposal and has so recommended.	Take into account
14.2 The FMRC should report directly to the Minister	The Authority considers that the FMRC should be appointed by and report to the Authority, and that its reports should be publicly available. This is because the Authority's processes always involve a high degree of public exposure which may not be the case with reports to the Minister. However, the Authority would subsequently report to the Minister on the matters raised in the Committee's report. This report should also be made public. It would also be helpful for the Minister to receive advice (which is subsequently made public) on the practical implications of the Committee's report from the Lands and Forests Commission.	The committee agrees with this proposal and has so recommended.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
15.1 CALM should make regular public reports as required by condition 6 of the 1987 Management Plans	The conditions set on this proposal will not necessarily supplant those set on the 1987 Management Plans. Condition 6 will still apply.	The committee has proposed a review of CALM's public accountability and methods of reporting to the public.	Take into account
15.2 These plans should not extend beyond 1997	Disagree. The ten year implementation period until 2002 is appropriate - see 2 above.	The committee agrees with the EPA comments regarding this concern and believes that the plan as modified by its recommendations and subject to the more stringent monitoring requirements should continue to 2002.	Take into account

Appeal No 191
Appellant: **South-West Forests Defence Foundation Inc**
PO Box 203, Nedlands WA 6009

1.1 CALM proposes a massive increase in the volume of wood available for extraction	There is no 'massive increase in the volume of wood available for extraction'. The change is a change in accounting which has led to a much more complete assessment of the total amount which can be extracted. In the past large quantities of 'waste' were left on the forest floor because of a lack of markets. CALM's previous inventory took no account of these 'waste' timber products. The proposals dramatically increase the inventory account of the amount which could be removed, subject to markets. Nevertheless, the Authority has recommended caution in implementation of the proposals, and has made a number of recommendations to ensure the acceptability of CALM's proposals.	The committee shares some of the concerns of this appellant and has agreed with the EPA's proposal that an EPA referral is required before a substantial amount of additional biomass can be removed from the forest. The committee has also recommended that there be no increase in the cutting rate above the 1987 approvals and that this matter should be included in a policy review.	Take into account
1.2 The cut should be reduced to take account of local concern about loss of forest.	Recommendation 5 addresses this concern with regard to the karri forest. The Authority recognises the parallels between that requirement and the possible need for some similar provision for the protection of special areas of jarrah forest.		

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.3 All unlogged forest and other old growth should be protected in conservation reserves	The response to this depends on one's value system. Some conservation values can only be protected in reserves. To protect these values requires an adequate representation in the reserve conservation estate. The EPA endorses CALM's proposed additions to the conservation estate. In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendations with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest.	In the confines of existing forest policy which allows the timber industry to maintain the cutting level based on the 1987 strategy approvals, the committee is unable to agree with this proposal. By providing for the extensive system of habitat corridors and by recommending that policy options be prepared including an option to phase down commercial logging in the State Forests and restructuring the timber industry as plantation-based, the committee has taken account of this concern. AMEND	Take into account
1.4 The Jarrah forest inventory must be made public.	CALM has produced publications describing the methodology of its inventory and has indicated to the Authority that the information in the inventory would be made publicly available, subject to resources.	The committee agrees with the EPA's comments and notes that the inventory techniques were fully explained in CALM Occasional Paper 1/92 January 1992. It is very difficult to make the inventory database easily accessible to the public but the committee has commissioned a check on the computer modelling used in the inventory project by an independent consultant. The public review of CALM's public accountability recommended by the committee should include a study as to how the interested sections of the public can be assisted to gain access to CALM's databank on the inventory as well as on other matters.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2. Winter logging should be discontinued (in disease-free and disease-risk areas of all forest types). Strict hygiene control measures must be introduced and enforced.	The Authority expressed concern about relaxation of CALM's dieback hygiene procedures in wet seasons.	The committee agrees with EPA comments on this matter and has recommended a public review of all matters concerned with dieback and the hygiene procedures.	Take into account
3. The Authority has ignored the risk of increased salinity following logging. There should be no intensification of logging in the high salt-risk areas.	The Authority has made recommendations based on research and monitoring by the Water Authority of WA in cooperation with CALM. This research indicates that salinity is only likely to be an environmental problem in certain high risk catchments, and the Authority has recommended special constraints on logging in these catchments to ensure that there are no significant environmental salinity impacts.	The committee agrees with the EPA comments on this point.	Take into account
4. The EPA has paid insufficient attention to the need for habitat trees. To maintain habitat trees and prevent the extinction of hollow-dependent species, intensified logging of the jarrah forest must not be permitted.	The Authority considered the available evidence was insufficient to clearly indicate the number of habitat trees which would be required, but that it tended to indicate that three trees per hectare were insufficient. For the longer term, the FMRC should give priority to research into this matter.	The committee agrees with the first part of this comment and has recommended the retention of permanent wildlife habitat corridors in both the Karri and Jarrah forests.	Take into account
5.1 EPA has approved a one third increase in the area of karri forest felled annually.	The EPA assessed a management strategy for the karri forest which provided for smaller coupes, expanded conservation and other protected areas, commitment to a range of rotation lengths and a total saw log yield consistent with present levels.	The committee is also concerned about the area of Karri and Jarrah forests being felled and has recommended the retention of permanent habitat corridors and that the level of cutting be contained to the 1987 approvals.	Take into account
5.2 The cut should be reduced to take account of local concern about loss of forest.	See response to 1.2 above.		

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5.3 All unlogged forest and other old growth should be protected in conservation reserves	See response to 1.3 above.	See response to 1.3 above.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6.1 Stream reserves should be at least 50m on either side of all first, second and third order streams.	Stream reserves serve two primary functions - water quality protection/aquatic ecosystem maintenance and the provision of wildlife habitat/corridors. With regard to the first, in addition to these stream zones CALM has proposed a form of phased logging. In high salt risk catchments the EPA on advice from the Water Authority of WA has recommended wider stream zones (50m minimum) and the concentration of the area retained under phased logging in the lower part of the catchment. The Authority is satisfied that these constraints are likely to be adequate to protect water quality, but has also recommended monitoring and adaptive management. In association with CALM's proposals for phased logging, and the EPA's recommended minimum dimensions of the areas retained, protection of these areas from thinning and better provision for habitat trees the proposed widths, with the adoption of ecological boundaries, are adequate. The Authority has also recommended that the effectiveness of these zones be monitored. The appropriate minimum width will depend on the ecological objectives for these zones. As these have not yet been defined by CALM on a regional basis it is not possible to determine the adequacy of the proposed minima. The Authority has recommended the application of the proposed prescription as a trial with monitoring and adaptive management. It would be possible to further require that CALM identify the faunal/floral conservation objectives of the stream reserves on a regional basis and use these to determine the appropriate minimum stream reserve widths. Many of these reserves will be significantly wider than the 20m minimum. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries as proposed by CALM.	The committee agrees with the EPA comments on the width of stream reserves (interpreted to mean a minimum of 60m covering both sides of the streams). It believes that its recommendation for the permanent habitat corridors to link with the stream reserves and for the combination of habitat corridor and stream reserves to be permanently retained in 30% of the area in the second order catchments referred to in EPA Recommendation 10 will provide reasonable protection for habitat and water qualities subject to the monitoring which is being proposed.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6.2 Road reserves should not be reduced until they have been fully assessed for their ecological values.	The principal management objective for road reserves is visual resource management, and that essential ecological functions which they may perform are in addition to those adequately provided by other means.	Granted the fact that existing approved policy requires a given amount of timber to be available for the timber industry in each year the committee considers that CALM's proposal to remove some road reserves in favour of creating more areas of reserved estate and providing reserves on the banks of all streams and rivers is appropriate. We are in endeavouring to maintain an appropriate balance between the requirements of industry and conservation within these policy constraints. The committee favours retention of these old growth qualities in the recommended habitat corridors. It is envisaged however that the requirements of the tourist industry, recreation and public opinion generally will be taken into account so that outstanding areas of old growth forest presently in the road reserves will be retained.	Take into account
6.3 All remaining unlogged forest and old-growth forest of high conservation value within existing road reserves should be protected in secure reserves.	See answer to 1.3 above.		Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
7 There should be a big reduction in the area of forest subjected to prescribed fuel reduction burning and in the frequency of burns, especially spring burns.	The EPA was aware of an apparent difference between the public perception and CALM's actual practice of prescribed burning. It therefore recommended that CALM be required to report on such factors as the area burnt, frequency, intensity and season on a regional basis, each year in its annual report. This information is currently not publicly available. On the basis of the information provided by CALM on the area, frequency and intensity of burns the Authority did not consider that a recommendation of a lesser frequency/intensity could be justified. However, the EPA and the TAP considered the available research and concluded that there was a need for further research of the ecological effects of CALM's fire management practices. The Forest Monitoring and Research Committee should be required to give priority to this research.	The committee notes the EPA comments on this point and has recommended a complete review of the Bush Fires Act and the wildfire threat analysis as part of a review of CALM's fire management policy and practices.	Take into account
8.1 The Forest Monitoring and Research Committee should include a Representative of the Conservation Council	The Authority's intention was that the FMRC be a body of expert scientists, but that the Committee "should actively promote the participation of and draw expertise from other government agencies, tertiary institutions, public organisations and individuals."	The committee agrees with the appellant's proposal and has so recommended.	Take into account
8.2 The FMRC should report directly to the Minister	The Authority considers that the FMRC should be appointed by and report to the Authority, and that its reports should be publicly available. This is because the Authority's processes always involve a high degree of public exposure which may not be the case with reports to the Minister. However, the Authority would subsequently report to the Minister on the matters raised in the Committee's report. This report should also be made public. It would also be helpful for the Minister to receive advice (which is subsequently made public) on the practical implications of the Committee's report from the Lands and Forests Commission.	The committee agrees with the appellant's proposal and has so recommended.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
9. The proposals should be reassessed in five years, not ten.	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years.	I agree with the EPA response.	Dismiss

Appeal No 192
Appellant: **K M Trayler and Dr J M Davis**
School of Biological and Environmental Sciences
Murdoch University, Murdoch WA 6150

1. CALM's stream zone widths are too narrow to control sedimentation - Clinnick's research is misquoted as relating to Australian streams.	The Authority acknowledged that the proposal was based on limited research and therefore recommended monitoring and adaptive management. However, on the basis of advice from the TAP (p4) it was concluded that the widths were likely to be adequate for the control of sedimentation.	The committee agrees with the EPA comments.	Dismiss
2., 3. CALM's report did not take into account the data of Growns and Davis 1991 which found 100m wide buffers ameliorated clearfelling impacts on water quality and macroinvertebrates. Recher et al (1980) concluded that 40m buffer zones either side of a stream was a minimum requirement for forest avifauna.	Submissions drew the Authority's attention to the work of Growns and Davis. The TAP advised (p5) that macroinvertebrate impacts were only likely to be short term and localised.Species were adapted to seasonal dessication and would be likely to rapidly recolonise from adjacent areas following temporary localised impacts. The 40m width referred to by Recher et al is of a similar magnitude to the widths proposed by CALM. However, the Authority has also recommended that the effectiveness of these zones be monitored, and that in high salt risk catchments the zones be at least 50m wide on either side of the stream. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries, as proposed by CALM.	The committee agrees with the comments of the EPA.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4. The precautionary approach for the karri forest needs definition.	Agree. CALM has suggested in discussions following the release of the EPA's report that the definitions spelled out for the jarrah forest could also be applied to the karri forest (with the exception to the reference to a trial). The EPA agrees that this would be acceptable. This would mean that the karri and karri marri forest too should be implemented "in accordance with the recommendations in this (the EPA's) report and the application of the following general principles: i) a precautionary approach; ii) adaptive and flexible management practices based on research and monitoring of operations; and iii) no commitment of all the wood resource in the long term."	The committee agrees with this proposal and intends that it should be taken into account in the monitoring activities of the proposed Forest Monitoring and Research Committee.	Take into account
5. The 30m wide strips should be implemented as an interim approach pending the results of experimental investigation comparing the effectiveness of buffer zones of different widths on WA streams.	The Authority has recommended that the proposal be implemented as a trial, and has listed a number of areas of research which the FMRC could pursue.	The committee agrees with this proposal and the EPA comments.	Take into account

Appeal No 193
Appellant: **Forest Industries Federation of Western Australia**
103 Colin Street, West Perth WA 6005

1.1 Recommending a precautionary approach is superfluous. CALM detailed such an approach in its proposals.	The Authority acknowledges that CALM has been undertaking its operations with some level of research and monitoring, however, in view of the major changes and ecological uncertainties in the proposed jarrah silviculture, the Authority considers that research and monitoring in some areas needs to be more closely linked with operations and the principles of adaptive management applied.	The committee agrees with the comments of the EPA. There are large gaps in our knowledge about the total biota in the forests and the effects of timber operations. There are also gaps in our knowledge about the effects of timber operations on such things as dieback and salinity. Timber operations involve extensive disturbance over wide areas and there is a clear need to carry out research and to monitor the effects.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.2.1 Calling the implementation of the proposals for the jarrah and jarrah-marri forest a "trial" is superfluous as they will be reassessed in ten years time anyway, ie, at the time proposed by EPA.	The Authority disagrees, the implementation is being treated as research in view of the uncertainties mentioned above. It is important that the proposals be applied over a representative range of sites and that the intensity of monitoring be appropriate to a trial implementation. Also, it is important that the proposed levels of timber extraction should not be seen as indicative of the amounts likely to be available in the longer term.		Take into account
1.2.2 Monitoring should consider the economic impact of the proposals on wood production and whether any additional cost that may be revealed is justified by the environmental gain.	Economic monitoring is not an environmental issue. However, the Authority agrees that decisions by Government about trade-offs between economic and environmental benefits should be adequately informed.	The economic effects of monitoring and research programmes are being taken into account by CALM and the EPA when they attempt to set the appropriate balance between industry and conservation.	Take into account
1.3 There is no reason not to commit the sustainable volume of wood resource from production forest.	The major problem is the uncertainty in the predictions of environmentally sustainable yield. If the jarrah silviculture is to be implemented as a trial, using adaptive management which takes account of the results of monitoring and research, the Authority considers it inappropriate to commit all of the estimated volume when management changes in response to monitoring and research results of the trial may subsequently reduce the volume available. Also, timber production from the natural forest is subject to natural variability through time from many diverse factors (weather, disease, insects, past management etc.). Further, under CALM's proposals the forest is to be managed for multiple uses, not solely for timber production. For all these reasons it is important that there should be no commitment of all the wood resource in the long term.	The committee agrees with the EPA's comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5.1,2,3 CALM's proposal refers to 'mature karri', not 'outstanding old growth karri', and their purpose is as 'patches of mature habitat'. The EPA recommendation is imposing rigidity on CALM's flexible approach. We understand the proposed 3200ha retention is a contingency allowance.	The reference to 'outstanding old growth karri' relates to WACAP (1987) environmental condition 4(1), which CALM is seeking to satisfy by its proposals.	The committee agrees with the EPA's comments.	Take into account
5.4 Old growth forest social values include the production of timber.	The Authority acknowledges that timber production is one of the values of multiple use forest. The Recommendation refers to the whole range of social values other than timber production and could be appropriately qualified.	The committee agrees with the EPA's comments.	Take into account
6. Recommendation 6 is meaningless because the proposals can only be applied for the life of the management plans (10 years).	The Recommendation appears to have been misunderstood. It was intended to ensure that any long term planning (beyond ten years) did not assume that the sustainable yield estimates in the amended Timber Strategy would necessarily be available in the longer term, particularly as the available information suggests that present cutting rates are relatively high in terms of the averages implied by the proposed rotation lengths. For this reason, timber supply contracts which can have a life of up to 15 years (i.e. beyond the life of the present plans) need to be appropriately constrained.	The committee agrees with the EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
7.1,2 There is no environmental reason to place controls on the volumes of each log class. Restrictions to current classes will inhibit efficient use of the wood resource.	Agree. The intent was to ensure that commercial commitments were consistent with the precautionary approach recommended by the Authority and that the total resource is not overcommitted nor committed for an excessively long time as either of these would reduce needed flexibility to respond to unforseen circumstances given the level of uncertainty in the management of this natural resource. It was not the intention of the EPA to discourage improved utilisation and value adding of the individual components of the resource. However, in recognition of the precautionary approach (see 1.3) the Authority considers that CALM should not be free to exchange timber from one class to another and thereby exceed the estimated class volumes without being required to demonstrate that sufficient flexibility is being maintained. This is consistent with the requirement to implement the project 'as proposed'. In that context it should be clear from any conditions set that the amounts of timber indicated by CALM for extraction are maxima, and that the conditions in no way require CALM to extract any or all of the timber proposed.	The committee agrees with the EPA comments.	Dismiss
7.3 The possibility of increased supply or changes to make wood production more economically efficient should also be recognised.	It is true that further refinement of CALM's timber inventory could identify a greater volume of timber available for harvesting in the future. The Authority was concerned that the social dislocation and economic implications to industry of unplanned adaption to a possible reduction in wood supply could lead to an unwillingness to respond to genuine environmental concerns. The adjustments implied by an increase in wood supply are likely to be more readily accommodated with less social and economic disruption.	The committee agrees with EPA comments.	Take into account
7.4	See 1.2.1 above	The committee agrees with EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
8.1 The classes of logs were not identified by the inventory but were arbitrarily set to reflect current economic and technological capabilities.	See 7.1,2 above.	The committee agrees with EPA comments.	Dismiss
8.2 Residues were previously identified for commercial exploitation in the 1987 Timber Strategy.	The residues were identified, but commercial exploitation was not proposed. Indeed, the text referred to the lack of a market.	The committee agrees with EPA comments.	Dismiss
8.3 The production of these logs is part of the proposals found environmentally acceptable in Rec 1.	Rec 1 refers to the proposals being environmentally acceptable, subject to the recommendations in this report - of which Rec 8 is one.	The committee agrees with EPA comments.	Dismiss
8.4 The requirement to refer is a substantial disincentive to industry attempting to utilise these resources.	The requirement to refer does not imply that the referral will be formally assessed. If the environmental impacts of the proposal can be shown to be insignificant, no assessment may be required. The advice of the Forest Monitoring and Research Committee will guide the Authority in determining the need for assessment.	The committee agrees with EPA comments.	Dismiss
9. Reject recommendation 9 on the grounds given for 1, 6 and 7 above.	Disagree. (see responses to 1, 6 & 7)	The committee agrees with EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
10.1 Recommendation 10 would increase the untreated portion of second order catchments to 40 to 50% compared to CALM's recommendation of 30%.	This appears to be an appeal against the recommendation that the 30% of catchment to be retained be in addition to stream reserves and diverse ecotype areas. The Authority based this part of the recommendation on its understanding that this was consistent with CALM's proposal. In the proposals document (p14, Table 7) CALM refers to 30% of forest to be "retained uncut" for at least 10 years, implying that it was forest that would ultimately be cut. This clearly excludes the stream zones and diverse ecotype areas which CALM has committed not to cut.	The committee has recommended a different approach to the second order catchment areas concerned which should partly allay the concerns of this appellant. It has recommended that for these catchments a minimum of 30% of the catchment area must be left permanently undisturbed in a combination of streams, river reserves, habitat corridors and diverse ecotype areas.	Take into account
10.2 The harvesting cost would increase dramatically.	This is not an environmental ground for rejecting the Authority's recommendation.	The committee agrees with EPA comments but has nevertheless considered this as one of the factors taken into account in maintaining an appropriate balance between commercial and conservation values.	Dismiss
10.3 The EPA has not provided any justification for modifying CALM's recommendations.	See 10.1 above	The committee agrees with EPA comments.	Dismiss
14.1 The existing institutional arrangements can be managed to achieve the objectives listed.	The Forest Monitoring and Research Committee would be and be publicly perceived to be independent of CALM.	Agree with EPA comments.	Take into account
14.2 The proposal is an unnecessary cost burden on the industry.	The Authority considers the listed research is essential to answering key questions about the ongoing environmental acceptability of the timber harvesting proposals. Their costs should be borne by the users of the timber (consistent with the 'user pays' principle). CALM is already undertaking much of the relevant research.	The committee agrees with EPA comments.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend

Appeal No 194
Appellant: Dr Malcolm C Hay
37 Colin Street, West Perth WA 6005

1. Two weeks is inadequate for the community to respond on such an important issue.	CALM's proposals were released initially for public comment for eight weeks earlier this year. The Minister subsequently extended this period by a further four weeks. This report is the EPA's advice to the Minister about those proposals, and takes into account many issues raised by the public in submissions. The two week appeal period on the EPA's report is specified in the Environmental Protection Act and in view of the previous opportunity for submissions on CALM's proposals, it is adequate.	The committee agrees that two weeks is a very short time for the public to respond. This matter could be raised in the review of public accountability recommended by the committee.	Take into account
2. The TAP report pleads caution. Why isn't the scientific evidence being acknowledged in the decision making process.	The Authority has acknowledged the need for caution by recommending the application of a 'precautionary approach' (involving adaptive and flexible management practices based on research and monitoring, trial implementation of the proposals for the jarrah forest and no long term commitment of all the wood resource). In addition the Authority has recommended a number of specific constraints on CALM's operations and recommended the establishment of an independent committee to oversee and report on the research and monitoring of the environmental impacts of CALM's proposals.	The committee agrees with the EPA comments that precaution has been recommended and the committee has added further strength to that precautionary approach.	Take into account
3. The amount of timber being harvested is to be doubled. Taking more timber that is actually maturing is like mining the forest and denies the rights of our descendants.	It is the amount of harvested timber identified as potentially useable which has doubled, not the amount harvested. That is, CALM now proposes to sell smaller logs and 'waste' previously left on the forest floor. This is not mining, and this improved utilisation is consistent with the principles of ESD.	The committee agrees with the EPA comment but in any event has recommended a lower rate of harvesting.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4.1 What is the justification for clearfelling the jarrah forest?	CALM advises that the substantial removal of the overstorey is necessary to ensure adequate regeneration of the forest following harvesting. The EPA has recommended that its cautious implementation as a trial could be environmentally acceptable, with monitoring and research and the retention of sufficient flexibility to reduce the intensity of operations during or after the trial period if environmental monitoring results showed this to be appropriate.	The committee accepts that the proposed Jarrah silvicultural technique is an appropriate method to ensure regeneration and that it in fact does not include clearfelling on a large scale. There are nevertheless problems and uncertainties related to the proposals for the Jarrah-Marri forests. The recommendations for tighter monitoring by the Forest Monitoring and Research Committee will partly satisfy this concern.	Take into account
4.2 To claim that there has been a public review of CALM's proposals is completely false.	CALM's proposals document included as an appendix the proposed new jarrah silviculture with its 'gap creation' - a process which the EPA described in its report as 'not unlike clearfelling'. As noted above, the proposals document was available for public review for twelve weeks. However, it is clear from submissions and appeals that the public had considerable difficulty understanding the environmental implications of CALM's proposals, based on CALM's documentation.	The committee understands some of the concerns of the appellant in this matter and has recommended a review of CALM's public accountability including its method of communicating with the public.	Take into account
4.3 The massive increase in the extent and intensity of logging will lead to salinity, dieback, loss of species, a complete immature forest and loss of all old growth forest outside conservation reserves.	There is no 'massive increase in the volume of wood available for extraction'. The change is a change in accounting which has led to a much more complete assessment of the total amount which can be extracted. In the past large quantities of 'waste' were left on the forest floor because of a lack of markets. CALM's previous inventory took no account of these 'waste' timber products. The proposals dramatically increase the inventory account of the amount which could be removed, subject to markets. Nevertheless, the Authority has recommended caution in implementation of the proposals, and has made a number of recommendations to ensure the acceptability of CALM's proposals.	The committee agrees with the EPA comments with some reservations. The committee has recommended the creation of habitat corridors which will reserve a considerable amount of old growth forest outside conservation reserves and also has recommended containment of the level of cutting.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4.4 CALM and the EPA have ignored virtually every recommendation made by the public. The public review process is a sham.	This is not so, indeed the EPA takes the strongest exception to this attack on the public review process. Issues raised in submissions were summarised by the EPA and referred to CALM. CALM responded, and the EPA & TAP considered both the submissions and CALM's responses. The Report necessarily highlights only the major issues, but all others were considered. The Western Australian public environmental review process, which is at the world forefront, is intended to inform the public about proposals, to enable them to raise issues of concern and to see the responses which the EPA and the proponent make to those issues. It is not intended to be a public decisionmaking process, the decision rests with the Minister, based on the EPA's independent advice.	The committee agrees with the EPA comments but has nevertheless recommended a review of CALM's public accountability and the whole process of consulting the public by CALM and the EPA could be considered during that review.	Take into account.

Appeal No 195
Appellant: **Dr Paul Wheatley**
24 Nelson Street, Bridgetown WA 6255

1.1 Overlooking available scientific evidence that levels of cut are ecologically unsustainable.	The Authority studied the available scientific evidence with the assistance of the TAP and concluded that the proposals could be ecologically sustainable, subject to the Authority's recommendations, including the need for flexibility referred to by the appellant.	The committee has recommended a lower level of cutting than was proposed and the reservation of major areas and habitat corridors.	Take into account
1.2 The 10 year trial period for the jarrah silviculture is too long	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years. In view of this and in the context of a forest much of which is to be managed on a rotation length of over 100 years, the ten year trial period is appropriate.	I agree with the EPA response.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.3 The consideration of wood production levels should be part of this review.	The wood production levels proposed in the revised Timber Strategy were reviewed by the Authority.	The committee agrees with the EPA comments and has made recommendations on the level of cut.	Take into account
2.1 CALM states in Appendix 1 page 40 that the pristine nature of forests (i.e. undisturbed by man) "is not of ecological significance".	This is not an appeal against the Authority's report and recommendations but against a claim made by CALM.	Agree with the EPA comments.	Dismiss
2.2 CALM states in Appendix 3 page 3 that "It is not the intention of the CALM/AHC agreement to 'protect' old growth values outside reserves".	The Authority agrees with the appellant that this statement is incorrect. It is also not the view of the AHC. In a letter to the Authority the AHC's Executive Director stated "that part of the agreement included the development of guidelines for the protection of national estate guidelines outside the nature conservation reserves". The purpose of managing some of the multiple use forest to a rotation length of 120-240 years is clearly to protect some old growth values on an ongoing basis, as acknowledged by CALM later in the response quoted by the appellant. This is not an appeal against the Authority's report and recommendations.	The committee was informed by staff of the AHC that the agreement extended to the listing of areas of heritage values but that it is left to CALM to decide which of the areas listed should be retained in accordance with its own management plans and policies. Not all areas listed were necessarily scarce or unique.	Take into account
2.3 Jarrah and karri clearfelling requiring subsequent thinning etc. is no longer natural forest; it is more like a plantation.	This is a statement of values, it is not a ground for appeal against the Authority's report and recommendations.	Agree with EPA comments.	Dismiss
2.4 The Summary page iv discussion of road river and stream zones makes no mention of wilderness values as having a priority.	Many values relevant to wilderness are referred to by CALM in its discussion of defining scenic quality (DMS p 151), however, the provision for the protection of wilderness values rests primarily in the conservation estate rather than the road, river and stream zones.	Agree with EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3.1 Grave concerns about proposed logging in Hester block.	CALM's response " CALM acknowledges the value of Hester and will consult with Bridgetown community about its management, particularly logging." is considered adequate.	The committee agrees with this concern and has made recommendations to manage Hester Block in a way which will preserve recreation and scenic values.	Take into account

Appeal No 199
Appellant: **Coalition for Denmark's Environment**
PO Box 77, Denmark WA 6333

1. The EPA has dismissed almost all the expert independent advice of its TAP in favour of CALM's explanations.	This unsupported claim is refuted. The Authority considered the TAP's advice in all areas. On nutrients and Old growth forest the TAP did not raise any major concerns. In regard to dieback the Authority endorsed the need for CALM to develop an alternative strategy to avoid logging in wet summers. With regard to salinity, stream reserves and habitat trees the Authority's recommendations were based on the TAP's advice, and the Authority recommended more research into fire management. The Authority also followed the TAP's general recommendation of a cautious approach.	The committee agrees with the EPA comments and did itself interview the TAP. The subject of several of the committee's recommendations were previously discussed with TAP.	Dismiss
2. There is sufficient evidence for the EPA to have rejected CALM's proposals as environmentally unacceptable.	The Authority considered the substantial information provided in public submissions and studied the available scientific evidence with the assistance of the TAP and concluded that, although there was reason for caution, the proposals could be implemented, subject to the Authority's recommendations.	The committee agrees with EPA comments but has added several recommendations to further protect the environment.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3. The EPA has confirmed that 'multiple use' forest is in fact for the single use of wood production. This is a new management policy and, as such the EPA should have required CALM to resubmit its proposals to the public, with this policy clearly spelled out.	In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a small proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendation with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest. CALM does not propose to manage the forest only for wood production, and the EPA has explicitly recognised other management objectives in its recommendations.	The committee agrees that the purpose of timber production has been given more emphasis in the State Forests than other non-commercial values and has made several recommendations to redress the imbalance including the creation of the habitat corridors and a recommendation to contain the level of cutting to the 1987 approvals.	Take into account
4. The EPA does not address CALM's breaches of environmental conditions.	This report is of CALM's proposals for its management of the forest. Matters of compliance with environmental conditions are dealt with through another process under Section 48 of the Environmental Protection Act.	Agree with the EPA comments.	Dismiss
5. CALM's claim that only 60-80% of an area is burnt during a prescribed burn is misleading. Invariably 100% of some different vegetation/habitat types are burnt. EPA's recommendation on prescribed burning is unacceptable.	The Authority acknowledges that the principle of mosaic burning may not adequately ensure the protection of fire-prone vegetation/habitat types. For this reason it is important that "different burn regimes may be applied over time on the same area" as CALM claims, but the application of these different regimes needs to be directed by research. It is for this reason that fire management is one of the priority research areas for attention by the Forest Monitoring and Research Committee.	The committee shares some of the concerns of the appellant and has recommended a public review of CALM's fire management practices and policy.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6. Historically the jarrah forest has not been treated conservatively, CALM states that only 15% of the jarrah forest remains unlogged. So the conclusion that the jarrah forest can withstand a 10 year trial is wrong.	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years. In view of this and in the context of a forest much of which is to be managed on a rotation length of over 100 years, the ten year trial period is appropriate.	The committee agrees with the EPA's comments and the committee has recommended a strengthening of the monitoring process to be done under the auspices of a revised FMRC which includes a representative of the conservation movement and is recommended to have statutory autonomy.	Take into account

Appeal No 201
Appellant: Mr J McMahon
56 Stock Road, Attadale WA 6156

1. Proposed Mt Roe National Park should not be 'locked up'. There is no evidence given that the conservation values sought cannot be achieved in a reserve managed for multiple purposes.	The Authority has recommended that CALM's proposal for the creation of the Mt Roe National Park be implemented. Some 'multiple' uses are compatible with the conservation objectives of the national park. CALM should determine and manage such activities.	The committee considers that Mt Roe National Park will be an important addition to the national park system but has recommended that consideration be given to the temporary extension of the right to harvest wildflowers.	Take into account
2. The proposed 'diverse ecosystem areas' do not need 'protection from physical disturbance'.	CALM proposes that these areas be protected from physical disturbance associated with logging and other forest operations. These areas generally do not have timber production values.	The committee disagrees with this comment. In particular the gathering of wildflowers on a commercial basis is a considerable disturbance to the area and should not be permitted beyond a brief temporary extension period.	Take into account
3. There is no programme for implementation.	CALM can be expected to develop the programme for implementation once its proposals have been endorsed by Government.	Agree with EPA comments.	Dismiss
4. The CALM/AHC agreement is not relevant to Bulletin 652.	Disagree.	Agree with EPA proposal.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5. The diverse ecosystem areas have not been identified.	Recommendation 4 covers this.	Agree with EPA comments.	Dismiss
6. The new reserves and protected areas will have a substantial negative impact on rural communities and the WA economy by preventing renewable resource industries access to these large areas which are already under CALM's management.	These reserves are part of a total forest management package, and their economic impact should not be assessed in isolation from the rest of the package.	The committee understands that the declaration of Mt Roe as a national park will have an effect on the wildflower industry but has recommended an extension of time to enable that industry to obtain its stock from areas outside the national park.	Take into account

Appeal No 202
Appellant: **Forest Field Officers Association**
C/- Dept of CALM, Jarrahdale WA 6203

1. Monadnocks Conservation Park should not become a national park because it lacks high conservation value.	High conservation value is not the only, or even a necessary prerequisite for a National Park. For example, two of the State's most used national parks, Yanchep and John Forest, have areas which have been substantially modified for recreation. Nevertheless, an area should not become a national park unless it has the appropriate values, which would usually include conservation value. CALM's proposals go beyond the Authority's System 6 recommendation. The Authority endorsed in general CALM's proposals for additional reservation, but did not determine its position with regard to each area proposed, accepting that any adjustments could be made in the final management plans approved by the Minister. The decision whether or not this area should be a national park is one for the Government to take, on appropriate advice. The EPA supports its implementation.	The committee agrees with the comments of the EPA.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2. Gibbs block should not become a conservation park as its conservation value has been substantially degraded by logging and the vegetation complex it is proposed to secure no longer exists.	The Authority took CALM's proposal for Gibbs block on face value as being worthy for conservation. Accordingly, Gibbs block should be set aside for conservation unless, in the process of normal review the claims by the appellant are proven, in which case an equivalent area of land elsewhere should be set aside to protect the relevant conservation values.	The committee agrees with the comments of the EPA.	Take into account

Appeal No 203
Appellant: **Busselton Peace and Environment Group**
89 Kent Street, Busselton WA 6280

1. The EPA has failed to take account of the findings of researchers, including its own Technical Advisory Panel.	The Authority considered the substantial information provided in public submissions and studied the available scientific evidence with the assistance of the TAP and concluded that the proposals could be ecologically sustainable, subject to the Authority's recommendations. Specifically, the Authority considered the TAP's advice in all areas. On nutrients and Old growth forest the TAP did not raise any major concerns. In regard to dieback the Authority endorsed the need for CALM to develop an alternative strategy to avoid logging in wet summers. With regard to salinity, stream reserves and habitat trees the Authority's recommendations were based on the TAP's advice, and the Authority recommended more research into fire management. The Authority also followed the TAP's general recommendation of a cautious approach.	Agree with EPA comments. The committee did interview the TAP. The subject of several of its own recommendations were previously discussed with TAP.	Dismiss
2. EPA has failed to consider that CALM's response to issues is often inadequate and contradictory.	The Authority considered CALM's responses very carefully.	Agree with EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3.The EPA has failed to take into account the concerns raised in our submission.	This is not so. Issues raised in submissions were summarised by the EPA and referred to CALM. CALM responded, and the EPA & TAP considered both the submissions and CALM's responses. The EPA and the TAP also met with representatives of the conservation movement to discuss a range of issues including those raised in submissions. The EPA's Report necessarily highlights only the major issues, but all others were considered.	Agree with EPA comments.	Dismiss
4. The report makes a mockery of the public participation process.	This statement is of great concern. The Authority champions the public's right to know and to be heard, but accepts that the decisionmaking role should rest with the Minister, informed by a range of inputs, including the Authority's public, independent advice.	Agree with EPA comments. Nevertheless the committee has recommended a review of CALM's public accountability and the question of public input to CALM and the EPA could be discussed during that review.	Take into account

Appeal No 204
Appellant: **Chamber of Commerce and Industry of Western Australia**
190 Hay Street, East Perth WA 6004

1. Social impact issues should not be part of an environmental impact assessment.	The Authority disagrees. The Environmental Protection Act defines the environment to include "living things, their physical, biological and social surroundings, and interactions between all of these". This proposal clearly impacts on some of the social values people derive from the forest and consideration of these is essential to the assessment. Nevertheless, the Authority is aware that some social impact issues are not covered by the above definition, and determines on a case by case basis those issues which must be addressed, and those which can be left for other processes (e.g. Aboriginal heritage)	The committee agrees with the comments of the EPA.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2. Recommendation 7 should not place limitations on the individual classes of timber products. It works against efficient resource use, and has no environmental justification.	Agree. The intent was to ensure that commercial commitments were consistent with the precautionary approach recommended by the Authority and that the total resource is not overcommitted nor committed for an excessively long time as either of these would reduce needed flexibility to respond to unforseen circumstances given the level of uncertainty in the management of this natural resource. It was not the intention of the EPA to discourage improved utilisation and value adding of the individual components of the resource. However, in recognition of the precautionary approach (see 1.3) the Authority considers that CALM should not be free to exchange timber from one class to another and thereby exceed the estimated class volumes without being required to demonstrate that sufficient flexibility is being maintained. This is consistent with the requirement to implement the project 'as proposed'. In that context it should be clear from any conditions set that the amounts of timber indicated by CALM for extraction are maxima, and that the conditions in no way require CALM to extract any or all of the timber proposed.	The committee agrees with the EPA comments.	Dismiss
3 Recommendation 12, second dot point requiring CALM to better inform the public on its fire management should not be part of environmental conditions. (see 1 above)	The highly public nature of the environmental assessment process gives a clear focus to the principle of the public's right to know which underlies the whole of the Environmental Protection Act. Where the public is justifiably concerned about an environmental issue, it is the clear role of the Authority to make recommendations about both the management of the issue, and the informing of the public, so they may know what is being done to manage the issue. This recommendation was partly in response to concerns expressed in submissions.	The committee has recommended a complete public review of CALM's fire management policies and practices.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend

Appeal No 205
Appellant: **Andrew George Thomson, Richard Chandler and Tony Paynton**
28 Tralee Way, Waterford WA 6152

This appears to be an earlier draft of Appeal No 191 except for the additional handwritten page signed by Andrew George Thomson, Richard Chandler and Tony Paynton regarding Recommendation 12 which is addressed below.

1. CALM's fire management practice leaves a lot to be desired. There are too many hot fires damaging trees. CALM should be required to keep accurate records of the fires they light, including date and time of fire, maximum temperature, humidity, wind speed and direction, fire forecast for that day, previous weather conditions and previous burn.	These basic parameters should be part of CALM's fire management record. However, they are at a level of detail inappropriate for an environmental condition of approval. They should be conveyed to CALM as part of the compliance audit procedures.	The committee has recommended a complete review of CALM's fire management policies and practices and these concerns can be addressed at that review.	Take into account

Appeal No 206
Appellant: Institute of Foresters of Australia (WA Division)
PO Box 187, Como WA 6152

1. It is wrong to imply (Page ii para 3)that the eastern and central jarrah forest had less logging in the past because of environmental concerns.	The logging in these areas was constrained by dieback and salinity concerns. However, this does not have a direct bearing on any of the EPA's recommendations.	Agree with EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2. It is wrong to imply (Page ii para 4) that selection cutting of the jarrah forest is the only harvesting treatment used since the 1930s.	The statement does not exclude the possibility that there was some use of other treatments, but correctly identifies selection cutting as the principal method of timber harvesting. It is true that some relatively small (marketable) trees were extracted as part of the selection cutting process.	Agree with EPA comments.	Dismiss
3.It is wrong to imply (Page ii para 4) that clearfelling was not used before the last 20 years.	The statement does not imply that clearfelling was not used prior to the last 20 years.	Agree with EPA comments.	Dismiss
4. It is wrong to imply (Page ii para 4) that the decision not to clearfell jarrah was based on a fear of not being able to subsequently thin the stand.	The statement does not imply this.	Agree with EPA comments.	Dismiss
5.1 It is wrong to say (Page ii para 4) that gap creation is similar to clearfelling.	The appellant obviously does not appreciate the community's perceptions with regard to this matter (as demonstrated in submissions). To the community the fact that both treatments result in the removal of the great majority of the overstorey from a significant area of the forest means that their gross physical effects look similar at the human scale. The fact that the area in question may be no larger that 10 hectares and has some habitat trees retained does not appear to change this perception significantly. There is a continuum of possible treatments from light selection cutting to large scale clearfelling. The public perception is clearly that in terms of gross visual impact, gap creation is closer to clearfelling that selection cutting. The EPA has not redefined the accepted meaning of clearfelling but identified that the definition accepted by the public is different from the definition applied by foresters.	The committee agrees with the gist (but not the tenor) of the EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5.2 It is wrong to say (Page ii para 4) that gap creation imposes a long term requirement for ongoing thinning. It provides the opportunity to thin regrowth which a silviculture which does not ensure regeneration would not provide.	Gap creation introduces thinning into the management regime. Whether it is seen as a requirement or as an opportunity is a matter of perception.	Agree with EPA comments.	Dismiss
6. It is wrong to infer (Page ii para 6) that quarantine was set up to protect the forest from logging. It was set up to provide time to allow disease expression and accurate mapping and thus enable better managed logging.	The quarantine system excluded logging.	Agree with EPA comments.	Dismiss
7. It is wrong to say (Page iii para 2) that application of the proposed silviculture will lead to a 'radical restructure' of the forest.	Application of the proposed silviculture will lead to a change in the age structure of the multiple use forest. The mean age of the forest will be younger and there will be fewer age groups represented (especially the older age groups). The forest will look different, with trees of more uniform size and fewer misshapen trees in treated areas. There will also be a change in the pattern of logging impacts relative to selection cut. Areas of up to ten hectares will now be impacted by the removal of virtually all the overstorey whereas with selection cutting this was not the case. In all these respects the changes are significant and appropriately described as 'radical'.	Agree with EPA comments with the further comment that this method of silviculture appears to have been in practice for several years prior to the 1992 proposals.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
8. It is not possible to use an operation to 'enhance' an 'objective'. Recommendation 3 should be reworded to allow thinning 'in a manner consistent with visual quality objectives'.	This raises two issues. Firstly, the intent of the Recommendation was to ensure that thinning was consistent with the enhancement of visual amenity, which is the primary management objective of these road zones ('To provide vistas of undisturbed forest for tourists travelling on major roads.') Secondly, the implications of the use of the word 'thinning' need to be understood. CALM has proposed 'thinning' in these zones. In the glossary of the proposals document CALM defines thinning as "a felling made in an immature stand for the purpose of improving the growth of trees that remain without permanently breaking the canopy and encouraging regeneration." It is possible to conceive of a need to thin in these zones with the objective of enhancing the visual amenity (because bigger trees look nicer). If the recommendation were worded as suggested by the appellant it would imply that the trees were not being removed to enhance the visual amenity of the road zones. One may then ask why they are being removed, since CALM states that 'no logging of mature forests will take place' in these areas so there is no silvicultural need to thin them to produce bigger trees for later logging. If CALM were simply wishing to remove the trees and not thereby enhance the visual amenity of the zones, that removal should not be referred to as thinning but as selection cutting. Since CALM has proposed thinning, the Authority accepts that the only objective of the thinning can be the enhancement of the visual amenity of the zones.	The committee notes the interchange between the appellant and the EPA about the terminology used by the EPA.	Take into account
9.1 Recommendation 5 should not require these areas to be identified within three years but progressively as public concerns become apparent.	Disagree. Rec 5 follows from WACAP condition 4 which has yet to be met. It is important that a defined timetable be placed on the identification of these areas. CALM has the tools and the expertise, and the Authority is sure the three year time period is adequate.	The committee has recommended that these areas of 3,200ha of old growth Karri should be included in the habitat corridors if possible and that these should be defined as soon as practicable.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
9.2 Recommendation 5 should not imply that timber production is not a social value.	The Authority acknowledges that timber production is one of the values of multiple use forest. The Recommendation refers to the whole range of social values other than timber production and could be appropriately qualified.	Agree with the EPA comments.	Uphold
10. Recommendation 7 should not inhibit the State's efforts to add value to log products by upgrading them to higher value categories. There is no different environmental impact.	Agree. The intent was to ensure that commercial commitments were consistent with the precautionary approach recommended by the Authority and that the total resource is not overcommitted nor committed for an excessively long time as either of these would reduce needed flexibility to respond to unforseen circumstances given the level of uncertainty in the management of this natural resource. It was not the intention of the EPA to discourage improved utilisation and value adding of the individual components of the resource. However, in recognition of the precautionary approach (see 1.3) the Authority considers that CALM should not be free to exchange timber from one class to another and thereby exceed the estimated class volumes without being required to demonstrate that sufficient flexibility is being maintained. This is consistent with the requirement to implement the project 'as proposed'. In that context it should be clear from any conditions set that the amounts of timber indicated by CALM for extraction are maxima, and that the conditions in no way require CALM to extract any or all of the timber proposed.	Agree with the EPA comments.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
11.1 The negative connotations implied by the Authority (Page 46 para 6) are inappropriate. The proposals are consistent with ESD and intergenerational equity.	The words used do not have a negative connotation, they are merely descriptive, identifying that the proposed silviculture is more intensive than the selection cut practices previously used. This increased intensity is not necessarily 'bad', but it does imply a different range of impacts. About some of these the Authority concluded on the advice of the TAP and other sources that there was sufficient uncertainty to justify the implementation of the proposal as a trial. This response to uncertainty is environmentally, socially and economically responsible, and entirely consistent with the concepts of ESD and intergenerational equity.	The committee notes the interchange between the appellant and the EPA.	Take into account
11.2 The treatment will not generate more wood per hectare. Due to more markets more may be removed from the forest.	The treatment is intended to result in the removal of more biomass per hectare, and this has environmental implications. Also, there is a silvicultural objective to encourage more growth per hectare as part of the treatment.	Agree with the EPA comments.	Take into account
12.1 Recommendation 11 should specify how many habitat trees are 'sufficient'.	The Authority considered the available evidence was insufficient to clearly indicate the number of habitat trees which would be required, but that it tended to indicate that three trees per hectare were insufficient. In the interim, the Minister should determine the appropriate number of habitat trees on the advice of the EPA and CALM. For the longer term, the FMRC should give priority to research into this matter.	The committee has recommended the habitat trees be included in the habitat corridors proposed.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
12.2 Recommendation 11 requires that the original habitat trees retain their function throughout the lifecycle of the forest. This is impractical and unnecessary.	This was not the intention of the recommendation. The intention is that some of the selected trees are not now habitat trees but that they are selected to provide that function at some time in the future. The Authority recognised that trees selected for their habitat value may not survive the perhaps 100 years until the appropriate habitat characteristics are developed within the regrowth forest. For example, the habitat trees will be mature, possibly damaged and more vulnerable to basal attrition, fire, disease and windthrow. It is necessary, therefore to ensure that trees are retained in addition to those presently with habitat values to ensure the ongoing provision of these values in the forest. (Refer to TAP report)	The committee has recommended the habitat trees be included in the habitat corridors proposed.	Take into account
13. Recommendation 11 should not restrict the reduction of *Banksia grandis* population densities to high dieback risk sites as this would constrain the 'shelterwood' treatment on areas with inadequate lignotubers.	In addition to the proposals for dieback, CALM's silvicultural prescription for the jarrah forest specifically targets *B grandis* for removal under thinning, shelterwood and gap creation. The Authority is not aware of any research that has demonstrated the environmental implications of this deliberate *B grandis* population reduction programme and has therefore, as part of its precautionary approach, recommended that the programme be constrained and the implications further assessed. The Authority's recommendation may well constrain the application of the shelterwood programme.	The committee agrees with the appellant and has recommended that Banksia grandis may be removed for the control of dieback or to assist in regeneration.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
14. There is no need at all for old growth forest outside the conservation reserves and other protected areas. To suggest that there should be shows EPA has not understood CALM's proposal. EPA clearly does not appreciate that it is necessary to plan forest management holistically.	The EPA disagrees. Significant old growth values can be and are represented in multiple use forest and indeed that is the intent of the CALM/AHC agreement. In a letter to the Authority the AHC's Executive Director stated "that part of the agreement included the development of guidelines for the protection of national estate values outside the nature conservation reserves". This recognises that the protection of these values (including old growth) outside reserves is a fundamental principle of the agreement. Also, CALM's proposals to manage a significant proportion of the karri forest on a 250 year rotation length have the clear objective of allowing old growth values to be represented in the multiple use forest.	The committee agrees with the EPA comments and the proposed habitat corridors should be one of the methods of retaining old growth forest values.	Take into account

Appeal No 207
Appellant: **Senator Christabel Chamarette**
Suite 1, 111 Colin Street, West Perth WA 6005

1. Disagree with the EPA's approval for a massive increase in the volume of wood available for extraction. The allowable cut for jarrah as proposed in the 1987 Timber Strategy must not be exceeded.	There is no 'massive increase in the volume of wood available for extraction'. The change is a change in accounting which has led to a much more complete assessment of the total amount which can be extracted. In the past large quantities of 'waste' were left on the forest floor because of a lack of markets. CALM's previous inventory took no account of these 'waste' timber products. The proposals dramatically increase the inventory account of the amount which could be removed, subject to markets. Nevertheless, the Authority has recommended caution in implementation of the proposals, and has made a number of recommendations to ensure the acceptability of CALM's proposals.	The committee agrees with this appellant and has recommended that the 1987 quotas not be exceeded.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2. The cut should be reduced to take account of local concern about loss of forest.	Recommendation 5 addresses this concern with regard to the karri forest. The Authority recognises the parallels between that requirement and the possible need for some similar provision for the protection of special areas of jarrah forest.	The committee agrees with this appellant and has recommended that the 1987 quotas not be exceeded. The committee has also proposed the retention of extensive habitat corridors to cater in part for this concern.	Take into account
3. All remaining unlogged forest and all old growth forest of high conservation value should be protected in conservation reserves	The response to this depends on one's value system. Some conservation values can only be protected in reserves. To protect these values requires an adequate representation in the reserve conservation estate. The EPA endorses CALM's proposed additions to the conservation estate. In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendations with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest.	Although there is merit in this suggestion at this stage it is not consistent with the policy of continuing to allow the timber to operate at the level of cutting accepted in the approval of the 1987 strategy. The concern can be addressed however by designing the proposed habitat corridors to include areas of old growth and unlogged forest wherever possible as these will also be the areas having greater habitat values [and this is intended by Recommendation A ii)]. The concern will be considered in preparing the policy options proposed in Recommendation Q if accepted. The committee agrees with the EPA's comments on this concern.	Take into account
4. The EPA has paid insufficient attention to the need for habitat trees. The number of habitat trees to be maintained should be based on the full range of bird, mammal and other species which go to make up the ecosystem of a forest.	The EPA agreed that the provision of habitat trees should be adequate to meet the needs of the whole forest ecosystem, jointly with the system of reserves, stream zones etc. which also provide habitat. The Authority considered the available evidence was insufficient to clearly indicate the number of habitat trees which would be required, but that it tended to indicate that three trees per hectare were insufficient. In the interim, the Minister should determine the appropriate number of habitat trees on the advice of the EPA and CALM. For the longer term, the FMRC should give priority to research into this matter.	The committee agrees with this comment and has recommended the whole question of habitat be dealt with by way of permanent habitat corridors.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5. Concern about a perceived dichotomy between the reports and EPA's recommendations.	The appellant does not indicate which 'reports' are referred to. It may be that the reports referred to are those of the TAP and Dr Ken Shepherd. The Authority has given detailed consideration to these reports and is not aware of any dichotomy.	The committee is unable to comment as the reports referred to are not identified.	Dismiss
6. CALM and the EPA appear to have totally ignored the public submissions.	This is not so. Issues raised in submissions were summarised by the EPA and referred to CALM. CALM responded, and the EPA & TAP considered both the submissions and CALM's responses. CALM's responses represent one of the most detailed responses to public submissions ever published by the EPA. The Report necessarily highlights only the major issues, but all others were considered.	The committee agrees with the EPA comments but nevertheless has recommended a public review of CALM's accountability to the public and the methods by which public input should be obtained and considered. This whole question could be raised at that review.	Take into account

Appeal No 209
Appellant: **Australian Conservation Foundation**
79 Stirling Street, Perth WA 6000

1.1 CALM has presented inadequate scientific evidence in its documents which the EPA has not challenged in any depth.	In addition to the information supplied by CALM, the Authority examined a range of scientific and technical information relating to the CALM proposals. It was neither appropriate or practical for this information to be reproduced in the CALM documents or the Authority's report. Nevertheless, the Authority acknowledged uncertainties and the need for further information when it recommended the establishment of the FMRC and listed areas needing further research.	The committee notes the comments by the EPA and has approached this matter in its recommendations by strengthening the proposals for an independent Forest Monitoring and Research Committee to plan, fund and assess CALM's research programmes and it is recommended that the conservation movement be represented on that committee.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.2 There is a dichotomy between the TAP report and EPA's recommendations.	This is not true. The Authority considered the TAP's advice in all areas. On nutrients and Old growth forest the TAP did not raise any major concerns. In regard to dieback the Authority endorsed the need for CALM to develop an alternative strategy to avoid logging in wet summers. With regard to salinity, stream reserves and habitat trees the Authority's recommendations were based on the TAP's advice, and the Authority recommended more research into fire management. The Authority also followed the TAP's general recommendation of a cautious approach.	The committee agrees that on the surface of the EPA recommendations there does seem to be a dichotomy with the TAP report but after interviewing the TAP and examining carefully the narrative of the EPA report this matter is no longer a matter of concern to the committee.	Take into account
2.1 The allowable cut for jarrah in the 1987 Timber Strategy must not be exceeded.	The environmental impacts of CALM's jarrah forest management proposals are not solely related to the volume of wood removed from any given area. The Authority has addressed itself to the impacts, rather than the quantity of wood, and concluded that the proposals could be implemented as a trial for the next ten years. In the past large quantities of 'waste' were left on the forest floor because of a lack of markets. CALM's previous inventory took no account of these 'waste' timber products. The proposals dramatically increase the inventory account of the amount which could be removed, subject to markets. Nevertheless, the Authority expressed its caution over the proposed increase in the removal of biomass by recommending that any major proposal for the removal of 'other jarrah logs' (not presently utilised) should be referred to the Authority for further consideration of its environmental impacts.	The committee agrees with the appellant on this point and has so recommended.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
2.2 The jarrah cut should be reduced to retain all remaining unlogged native forest of high conservation value and all old growth forest.	The response to this depends on one's value system. Some conservation values can only be protected in reserves. To protect these values requires an adequate representation in the reserve conservation estate. The EPA endorses CALM's proposed additions to the conservation estate. In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendations with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest.	This concern has been addressed by proposals for habitat corridors, and development of policy options.	Dismiss

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3.1 No logging should be permitted in disease risk areas in winter months.	The Authority does not agree. There are some situations where winter logging can be safely undertaken, for example where the extent of the disease is accurately mapped and effective hygiene procedures are in place. The Authority considers that CALM should not be free to relax its dieback hygiene procedures for its own operations unilaterally. Any change to these procedures should involve public scrutiny in view of the risks involved and the substantial constraints that those procedures have imposed on other users of the forest and the public. The Authority considers that CALM's management of the forest should explicitly build in contingencies to avoid the need for logging and other dieback threatening activities under wet conditions. CALM should be required to ensure that i) the same rules regarding dieback hygiene procedures are applied to all operations in the forest occurring under moist soil conditions, and ii) any change to its dieback hygiene procedures is subject to public scrutiny.	The committee shares the appellant's concern about logging in dieback-infected areas and has recommended a complete public review of CALM's dieback policies and practices with particular attention to be given to the question of hygiene control.	Take into account
3.2 There should be further research on canopy reduction and litter layer removal and its relationship to the spread and virility of *P. cinnamomi.*	This is one of the issues listed for the attention of the FMRC on p52 of the Authority's report.	The committee shares the view of the appellant and has made specific recommendations about dieback research to be discussed at a public review of dieback control.	Take into account
3.3 There should be more research on the reduction of *B grandis* in dieback areas before any reduction proceeds.	This is one of the issues listed for the attention of the FMRC on p52 of the Authority's report. However, the Authority does not consider it necessary that this research should precede a limited implementation of the proposed reduction in *B grandis* populations in disease risk areas because of its large population and competitive nature.	The committee notes the appellant's concerns for the Banksia grandis but considers that the attempt to remove the species will be confined to logging areas and areas where regeneration is being encouraged and does not see it as a threat to the survival of the species or of species dependent on it.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4. There should not be any intensification of logging in high salt risk areas.	The Authority has made recommendations based on research and monitoring by the Water Authority of WA in cooperation with CALM. This research indicates that salinity is likely to be an environmental problem in certain high risk catchments. The Authority has recommended special constraints on logging in these catchments to ensure that there are no significant environmental salinity impacts and monitoring and adaptive management of all logging in these areas.	The committee agrees with the comments of the EPA on this matter and has recommended a greatly strengthened and representative Forest Monitoring Committee which would be expected to monitor salinity with great scientific attention.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
5. Buffers at least 50m should be retained on all first, second and third order streams.	Stream reserves serve two primary functions - water quality protection/aquatic ecosystem maintenance and the provision of wildlife habitat/corridors. With regard to the first, in addition to these stream zones CALM has proposed a form of phased logging. In high salt risk catchments the EPA on advice from the Water Authority of WA has recommended wider stream zones (50m minimum) and the concentration of the area retained under phased logging in the lower part of the catchment. The Authority is satisfied that these constraints are likely to be adequate to protect water quality, but has also recommended monitoring and adaptive management. In association with CALM's proposals for phased logging, and the EPA's recommended minimum dimensions of the areas retained, protection of these areas from thinning and better provision for habitat trees the proposed widths, with the adoption of ecological boundaries, are adequate. The Authority has also recommended that the effectiveness of these zones be monitored. The appropriate minimum width will depend on the ecological objectives for these zones. As these have not yet been defined by CALM on a regional basis it is not possible to determine the adequacy of the proposed minima. The Authority has recommended the application of the proposed prescription as a trial with monitoring and adaptive management. It would be possible to further require that CALM identify the faunal/floral conservation objectives of the stream reserves on a regional basis and use these to determine the appropriate minimum stream reserve widths. Many of these reserves will be significantly wider than the 20m minimum. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries as proposed by CALM.	The committee agrees with the EPA's comments and believes that this matter will also be subjected to very careful monitoring and adjustment if necessary. The committee has also recommended the development of alternative policy options which will consider the future of large-scale commercial timber operations in the forests over the coming years.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
6.1 There should be a reduction in the area, intensity and frequency of burns (especially spring burns).	The EPA was aware of an apparent difference between the public perception and CALM's actual practice of prescribed burning. It therefore recommended that CALM be required to report on such factors as the area burnt, frequency, intensity and season on a regional basis, each year in its annual report. This information is currently not publicly available. On the basis of the information provided by CALM on the area, frequency and intensity of burns the Authority did not consider that a recommendation of a lesser frequency/intensity could be justified. However, the EPA and the TAP considered the available research and concluded that there was a need for further research of the ecological effects of CALM's fire management practices. The Forest Monitoring and Research Committee should be required to give priority to this research.	The committee shares the concern of the appellant regarding fire management and has recommended a public review of CALM's policies and practices regarding fire management.	Take into account
6.2 An independent fire management committee should be set up to assess the impact of CALM's fire management practices on forest ecology and wood production. The committee should report directly to the Minister, and have representation from the voluntary conservation movement.	The EPA and the TAP considered the available research and concluded that there was a need for further research of the ecological effects of CALM's fire management practices. The Forest Monitoring and Research Committee should be required to give priority to a few key subject areas of which fire ecology should be one.	This matter should be considered during the fire management review process referred to above.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
7. The allowable cut for karri should not exceed the 1987 Timber Strategy. All remaining unlogged forest of high conservation value and all old growth forest must be retained free from logging.	See response to 2.2	The committee agrees with this proposal and has so recommended.	Take into account
8.1 The FMRC should have representatives from the Conservation Council and the ACF.	The Authority's intention was that the FMRC be a body of eminent scientists, but that the Committee "should actively promote the participation of and draw expertise from other government agencies, tertiary institutions, public organisations and individuals." The Authority considers that this adequately takes into account the desire for participation by the voluntary conservation movement.	The committee agrees that representatives of the conservation movement should be included on the FMRC and that it should report directly to the Minister and has so recommended.	Take into account
8.2 The FMRC should report directly to the Minister.	The Authority considers that the FMRC should be appointed by and report to the Authority, and that its reports should be publicly available. This is because the Authority's processes always involve a high degree of public exposure which may not be the case with reports to the Minister. However, the Authority would subsequently report to the Minister on the matters raised in the Committee's report. This report should also be made public. It would also be helpful for the Minister to receive advice (which is subsequently made public) on the practical implications of the Committee's report from the Lands and Forests Commission.		

Ground	EPA Response	Consideration by Appeals Committee	Recommend
9. EPA has not heeded the opinions and concerns of the public in their submissions.	This is not so. Issues raised in submissions were summarised by the EPA and referred to CALM. CALM responded, and the EPA & TAP considered both the submissions and CALM's responses. The EPA and the TAP also met with representatives of the conservation movement to discuss a range of issues including those raised in submissions. The EPA's Report necessarily highlights only the major issues, but all others were considered.	The committee agrees with the comments of the EPA but has nevertheless recommended that there be a review of CALM's public accountability during which the methods of obtaining and considering public input would be considered.	Take into account

Appeal No 210
Appellant: **Susan Hill**
27 Frankel Street, Bunbury WA 6230

1.1 The jarrah cut should be reduced to take account of local concern about loss of forest.	Recommendation 5 addresses a similar concern with regard to the karri forest. The Authority recognises the parallels between that requirement and the appellant's request for some provision for the protection of special areas of jarrah forest.	The committee has recommended that the proposals for the Jarrah cut should be constrained to the 1987 approvals.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
1.2 All remaining unlogged forest and all old growth forest of high conservation value should be protected in conservation reserves	The response to this depends on one's value system. Some conservation values can only be protected in reserves. To protect these values requires an adequate representation in the reserve conservation estate. The EPA endorses CALM's proposed additions to the conservation estate. In the multiple use forest under CALM's proposed management, timber is the primary objective and it takes precedence when areas are harvested. Although some conservation values can be sustained across the multiple use forest while a proportion is subjected to logging in any one year, the fact that it is all eventually to be logged determines that it will be different in some important environmental respects from unlogged forest. To protect these values requires that there are adequate controls on forest management activities. The Authority has made several recommendations with regard to the protection of conservation values in multiple use forest, in addition to the CALM/AHC understanding on the protection of heritage values in multiple use forest.	The committee has addressed this concern by proposals for habitat corridors, and development of policy options.	Take into account
2. CALM's dieback containment policy should be adhered to and the TAP warnings should be noted and winter logging discontinued in disease risk areas of all forest types.	CALM should not be free to relax its dieback hygiene procedures for its own operations unilaterally. Any change to these procedures should involve public scrutiny in view of the risks involved and the substantial constraints that those procedures have imposed on other users of the forest and the public. Management of the forest should explicitly build in contingencies to avoid the need for logging and other dieback threatening activities under wet conditions.	The committee shares the concern of the appellant with regard to dieback and has recommended a complete public review of CALM's dieback policies and practices.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
3. Stream reserves should be at least 50m on either side of all first, second and third order streams.	Stream reserves serve two primary functions - water quality protection/aquatic ecosystem maintenance and the provision of wildlife habitat/corridors. With regard to the first, in addition to these stream zones CALM has proposed a form of phased logging. In high salt risk catchments the EPA on advice from the Water Authority of WA has recommended wider stream zones (50m minimum) and the concentration of the area retained under phased logging in the lower part of the catchment. The Authority is satisfied that these constraints are likely to be adequate to protect water quality, but has also recommended monitoring and adaptive management. In association with CALM's proposals for phased logging, and the EPA's recommended minimum dimensions of the areas retained, protection of these areas from thinning and better provision for habitat trees the proposed widths, with the adoption of ecological boundaries, are adequate. The Authority has also recommended that the effectiveness of these zones be monitored. The appropriate minimum width will depend on the ecological objectives for these zones. As these have not yet been defined by CALM on a regional basis it is not possible to determine the adequacy of the proposed minima. The Authority has recommended the application of the proposed prescription as a trial with monitoring and adaptive management. It would be possible to further require that CALM identify the faunal/floral conservation objectives of the stream reserves on a regional basis and use these to determine the appropriate minimum stream reserve widths. Many of these reserves will be significantly wider than the 20m minimum. The actual width of corridors should be adjusted according to specific sites, functional objectives and ecological boundaries as proposed by CALM.	Agree with the EPA comments.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4. There should be a big reduction in the area of forest subjected to prescribed fuel reduction burning and in the frequency of burns, especially spring burns.	The EPA was aware of an apparent difference between the public perception and CALM's actual practice of prescribed burning. It therefore recommended that CALM be required to report on such factors as the area burnt, frequency, intensity and season on a regional basis, each year in its annual report. This information is currently not publicly available. On the basis of the information provided by CALM on the area, frequency and intensity of burns the Authority did not consider that a recommendation of a lesser frequency/intensity could be justified. However, the EPA and the TAP considered the available research and concluded that there was a need for further research of the ecological effects of CALM's fire management practices. The Forest Monitoring and Research Committee should be required to give priority to this research.	The committee shares the appellant's concern regarding burning and has recommended a public review of CALM's policies and practices for fire management.	Take into account
5. There should be a further review of CALM's forest management and timber strategy in 1997 (not 2002).	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years.	The committee agrees with the EPA comments but has also strengthened the provisions for continuing scientific monitoring.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend

Appeal No 211
Appellants: **Trudy Tranter, Cameron Daly, Linton Hodsdon, Marina Davies, Donna Davies, Helen Parker, Mandy Butcher, Wendy Brown, Ruth Lawrence, Jane Roberts, Leanne Sutton, Ross Daglish and Shelley Cullen**
C/- 280 Railway Terrace, Margaret River WA 6285

1. To accept the proposals brings unacceptable risks of salinity, land degradation, spread of Phytophthora dieback, species/habitat loss, extinction and the survival of diverse local ecosystems into perpetuity.	The Authority has considered all of these issues in detail and concluded that there are uncertainties associated with them. The Authority has therefore recommended caution in the implementation of the proposals, including trial implementation of the jarrah silviculture, monitoring and adaptive management and no long term commitment of the whole resource. Special precautions have been recommended for high salt risk areas. The Authority has concluded that the proposals would be environmentally acceptable subject to these recommendations.	The committee shares the appellant's concerns about some of the subject matters referred to and has made several recommendations in order to try to place safeguards on those matters.	Take into account
2. The proposals do not adequately address the needs of users other than the silvicultural industries.	The proposals are for the management of the multiple use forest and the reserve system for a wide range of uses. However, the Authority has not addressed itself to the adequacy of the provisions for forest uses other than environmental/conservation. The balance between forest uses is a matter for the Government to determine, on the advice of a range of inputs including CALM and the EPA.	The committee shares the appellants' concern on this matter and has discussed the question of the appropriate balance in the narrative of this report. It has also recommended that alternative policy options should be developed to take into account, amongst other things, these non-commercial values.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend

Appeal No 212
Appellant: Julia Boniface
PO Box 10, Nannup WA 6275

1. CALM has supplied insufficient information. EPA is right to recommend caution, but CALM should supply the information before approval of the proposals is given.	Some of the information can only be supplied by that trial, and the Authority has recommended sufficient constraints and precautions to ensure the proposed implementation.	The committee shares some of the concerns of this appellant regarding the provision of information to the public by CALM and has made recommendations for a public review of CALM's public accountability in this regard. In considering the appeals against the EPA recommendations however the committee sought and obtained a great deal of information from CALM with CALM's co-operation.	Take into account
2. The ten year trial period is too long - the Forest Management Strategy should be reassessed after five years. A lot of irreversible environmental damage can occur in ten years.	The Authority has recommended monitoring and adaptive management which means that CALM would be expected to review its implementation of the strategy on an on-going basis and adapt it in response to monitoring results. The Authority has further recommended that the FMRC should report on the results of monitoring and research after five years.	The committee agrees with the comments of the EPA and has recommended proposals to further strengthen the FMRC and to ensure that there will be a continuation of scientific monitoring of the effects of these proposals.	Take into account
3.1 The Forest Monitoring and Research Committee should be set up immediately.	The FMRC should be set up as soon as possible. The wording "within 12 months" was intended to convey this urgency, and does not preclude its immediate establishment.	The committee agrees with the EPA's comments.	Take into account
3.2 The FMRC should provide EPA with detailed assessments concerning the impact of the Forest Management Strategy every year rather than every five years.	The assessment of longer term trends will not be possible over such a short term.	The committee expects that if its recommendations regarding the FMRC are accepted there will be a continuing monitoring process with regular reports to the Minister as well as to CALM and the EPA, not merely on a periodical basis.	Take into account
3.3 The FMRC's reports to EPA should be made available to the public.	The Authority agreed. Recommendation 14 provides for this.	The committee agrees with the appellant and the EPA on this matter and has so recommended.	Take into account

Ground	EPA Response	Consideration by Appeals Committee	Recommend
4. The apparent inconsistencies in CALM's estimates of the amounts of timber to be harvested are disturbing.	In the past large quantities of 'waste' were left on the forest floor because of a lack of markets. CALM's previous inventory took no account of these 'waste' timber products. The proposals dramatically increase the inventory account of the amount which could be removed, subject to markets. Nevertheless, the Authority has recommended caution in implementation of the proposals, and has made a number of recommendations to constrain the removal of additional material and to ensure the acceptability of CALM's proposals. Also, the Authority is concerned at the evident difficulty the public had in understanding CALM's proposals.	The committee shares the appellant's concern about the difficulty of reconciling the figures for wood production provided by CALM and the EPA and has recommended that the Minister direct these two authorities to present him with an agreed statement on these statistics.	Take into account

Appeal No 213
Appellant: Forest Protection Society Limited
PO Box 254, West Perth WA 6005

1. Recommendation 5 should not imply that timber production is not a social value.	The Authority acknowledged that timber production is one of the values of multiple use forest. The Recommendation refers to the whole range of social values other than timber production and could be appropriately qualified.	The committee agrees with the appellant and with the EPA's comments on this matter.	Take into account
2. The social and cultural significance of old growth forest to forest communities in terms of timber production has not been adequately considered.	CALM in reaching its agreement with the AHC took consideration of these values. The Authority has observed (Bulletin 652, p vi) that "In most of the multiple use forest, timber production is the primary objective."	The committee agrees with the comments of the EPA on this matter and has discussed the problem of achieving the appropriate balance between the timber production and conservation values in the narrative of this report. The committee has proposed the development of alternative policy options including an option togradually restructure the timber industry so that it becomes plantation-based rather than continuing to obtain resources from the native forests. Such a policy would provide future resources for the industry and job security for its employees without sudden, painful restructuring.	Take into account

Appendix II - Bibliography

Overleaf.

Annual Reports

Department of Conservation and Land Management Annual Report 1985
Department of Conservation and Land Management Annual Report 1986
Department of Conservation and Land Management Annual Report 1987
Department of Conservation and Land Management Annual Report 1987/88
Department of Conservation and Land Management Annual Report 1988/89
Department of Conservation and Land Management Annual Report 1989/90
Department of Conservation and Land Management Annual Report 1990/91
Department of Conservation and Land Management Annual Report 1991/92

Commercial Activities

Agricultural Systems & Information Technology Newsletter, Vol 3 No 3, 1991
Agroforestry, an Alternative Approach to Farming
Agroforestry, the Integration of Trees and Farming
Brennan, G K and Doust, B R, 1988, Moisture Content of Jarrah Logging Residues Report No 3
Brennan, G K, 1988, Economic Utilisation of Thinnings from the Jarrah Forest CALM Report No 1
Brennan, G K, Glossop, B R and Hanks, W R, 1990, Drying Regrowth Eucalypts Using a Low Temperature Batch Kiln Report No 20
Brennan, G K, Glossop, B R and Mathews, L R, 1988, Stockpiling of Regrowth Jarrah and Karri Logs Using Different Watering Schedules Report No 16
Brennan, G K, 1988, Penetration of Copper-Chrome-Arsenic Preservative into Regrowth Jarrah Posts Report No 6
Brennan, G K, 1988, Splitting of WA Sheoak Logs Stored under Water Spray or Dry Stockpiled CALM Report No 5
Code of Logging Practice, CALM, 1990
Developing New Techniques and Equipment for Processing Small Eucalypt Regrowth Logs
Donnelly, D J, Mathews, L R and Hanks, W R, 1989, Wood Utilisation Research Centre - High Temperature Drying of Green Jarrah Blocks Prior to Charcoal Production CALM WURC Technical Report
Glass, J and Shedley, P, A Survey of Timber Used in Timber Manufacturing Western Australia 1983 Forests Department of WA Technical Paper No 11
Glossop, B R, 1989, Wood Utilisation Research Centre - Assessment of 'Viva 20' Capacitance-Type Moisture Meter CALM WURC Technical Report
Grow Trees for Profit
Hingston, F J, O'Connell, A M and Grove, T S, 1989, Nutrient Cycling in the Jarrah Forest
Jarrah - the Beauty and Elegance of a Western Australian Mahogany
Kealley, Ian G, 1991, The Management of Sandalwood CALM Wildlife Management Programme No 8
Malajczuk, G, Morrison, D, Havel, J, Anderson, G and Moore, R, An Economic Study of Agroforestry in the Manjimup Region, Western Australia Forests Department of WA Technical Paper No 10
Manual of Logging Specifications, 3rd Edition, CALM, 1990
Moore, R, Edminston, Roger, Brown, Paul and Beatty, Peter, Pine Trees for Timber under WA Conditions CALM Information Sheet No 2-87
Newby, P and Brennan, G K, 1990, Moisture Content Fluctuations of Regrowth Jarrah and Karri under Different Environmental Conditions CALM Report No 18
Newby, P and Siemon, G R, 1989, Adhesives for Manufacture of Furniture Blanks CALM Report No 12
Pulp and Paper Manufacture in the South West of Western Australia, Department of State Development, 1992
Siamos, L and Siemon, G R, 1989, Effect of Pencilling and Furnace Oil Treatment on Strength Properties of Jarrah CALM Report No 10
Siemon, G R and Donnelly, D J, 1989, Wood Utilisation Research Centre - Graded Recoveries of Timber Milled from Radiata Pine Logs from Different Thinning Treatments CALM WURC Technical Report
Small Jarrah Sawlog and Residue Log Harvesting Trials Near Harvey, WA, CALM Report No 4, 1988
Softwood Sharefarming, Investment Opportunity

The Wood Utilisation Research Centre, Harvey Western Australia, CALM, 1986
Thomson, A B, 1989, Shrinkage, Collapse and Dimensional Recovery of Regrowth Jarrah CALM Report No 13
Tree Crops for Profit
Tree Trust
Tree Trust, Restoring Nature's Balance, A Proposal for a Private Enterprise Funded Hardwood Afforestation Programme for South-Western Australia Trees: an Investment for the Future - Proceedings of a seminar on commercial tree growing in the Albany and Mt Barker area, CALM, 1991
Valwood
Valwood New Wood, Furniture from Forests
Van Doornum, M and Shedley, P, Wood Residue Combustion and Gasification in a Fluidized Bed CALM Technical Report No 10, 1986
Vegetation and Tree Planting Advisory Service
White, K J, 1989, Wood Utilisation Research Centre - Regrowth Jarrah Stockpile and Sawing Trial CALM WURC Technical Report
White, K J, 1989, Wood Utilisation Research Centre - Sawmilling of Regrowth Karri Logs CALM WURC Technical Report

Dieback Fungus and Other Fungi

Batini, F E and Cameron, J N, 1975, The Effects of Temperature on the Infection of New Zealand Blue Lupins by *Phytophthora Cinnamomi* Forests Department of WA Research Paper No 25
Brandis, A J, Introduction to the Detection and Interpretation of the Symptoms of Jarrah Dieback Disease in Western Australia Forests Department of WA Technical Paper No 3
Butcher, T B, Stukely, M J C and Chester, G W, Genetic Variation in Resistance of *Pinus Radiata* to *Phytophthora Cinnamomi* reprinted from Forest Ecology and Management, Amsterdam
Chevis, H W and Stukely, M J C, Mortalities of Young Established *Radiata Pine* Associated with *Phytophthora* spp in the Donnybrook Sunkland Plantations in Western Australia reprinted from Australian Forestry Vol 45, No 3
Controlling Dieback in WA's National Parks and Forests, Resource Notes, CALM No 12, 1990
Davison, E M and Tay, C S, Twig, Branch, and Upper Trunk Cankers of *Eucalyptus Marginata*
de Bragança, Luisa and Havel, J J, 1987, Potential of *Pinus Pinaster, P Radiata* and *P Elliottii* to Rehabilitate Dieback Sites CALM Research Paper No 2
Dieback Disease, Hygiene Manual, CALM, 1992
Edminston, Roger, Plants Resistant to Dieback CALM Information Sheet No 1-89
Fight Dieback - Give Our Plants a Chance, Speakers Kit
Havel, J, Identification of Vulnerable Communities and Prediction of Disease Spread Forests Department of WA Reprint No 23
Maljckuk, N, Trappe, J M and Molina, R, 1976, Interrelationships Among Some Ectomycorrhizal Trees, Hypogeous Fungi and Small Malls: Western Australian and Northwestern American Parallels Australian Journal of Ecology
McKinnell, F H, Review of the Dieback Disease Situation 1981 Forests Department of WA Technical Paper No 2
Noake, G L and Shearer, B L, 1985, Quarternary Ammonium Compounds Were More Effective Than A Phenotic Compound Or Sodium Hypochlorite in Inhibiting Growth of *Phytophthera Cinnamomi* (Rands) reprinted from Australasian Plant Pathology Vol 14 No 2
Pearce, M H, Malajckuk and Kile, G A, 1986, The Occurrence and Effects of *Armillaria Luteobubalina* in the Karri (*Eucalyptus Diversicolor* F Muell) Forests of Western Australia Australian Forestry Research, 16
Shea, S R and Dell, B, Structure of the Surface Root System of *Eucalyptus Marginata* Sm and its Infection by *Phytophthora Cinnamomi* Rands Forests Department of WA
Shea, S R and Dillon, M J, 1980, Rate of Spread of *Phytophthora Cinnamomi* Rands Infections in the Jarrah (*Eucalyptus Marginata* Sm) Forest Forests Department of WA Research Paper 65
Shea, S R and Malajczuk, N, Potential for Control of *Eucalypt* Dieback in Western Australia Forests Department of WA Reprint No 3
Shea, S R, 1979, Forest Management and *Phytophthora Cinnamomi* in Australia Forests Department of WA Reprint No 22

Shea, S R, Gillen, K J and Kitt, R J, Variation in Sporangial Production of *Phytophthora Cinnamomi* Rands on Jarrah (*E Marginata* Sm) Forest Sites with Different Understorey Compositions Forests Department of WA, Reprint No 15

Shea, S R, Gillen, K J and Leppard, W I, Seasonal Variation in Population Levels of *Phytophthora Cinnamomi* Rands in Soil in Diseased, Freely-Drained *Eucalyptus Marginata* Sm Sites in the Northern Jarrah Forest of South-Western Australia Forests Department of WA Reprint No 21

Shea, S R, 1982, *Phytophthora Cinnamomi* (Rands) - A Collar Rot Pathogen of Banksia Grandis Willd Forests Department of WA Reprint No 27

Shea, S R, Shearer, B and Tippett, J, Recovery of *Phytophthora Cinnamomi* Rands from Vertical Roots of Jarrah (*Eucalyptus Marginata* Sm) Forests Department of WA Research Notes

Shea, S R, Shearer, Tippett, J T, and Deegan, P M, Distribution, Reproduction, and Movement of *Phytophthora Cinnamomi* on Sites Highly Conducive to Jarrah Dieback in South Western Australia Forests Department of WA

Shearer, B L, 1992, The Problem of Plant Diseases The Jarrah Book, Blackwood Environment Society and Bridgetown-Greenbushes Friends of the Forest

Shearer, B L and Shea, S R, Variation in Seasonal Population Fluctuations of *Phytophthora Cinnamomi* Within and Between Infected *Eucalyptus Marginata* Sites of Southwestern Australia reprinted from Forest Ecology and Management, Amsterdam

Shearer, B L and Tippett, J T, Distribution and Impact of *Armillaria Luteobubalina* in the *Eucalyptus Marginata* Forest of South-Western Australia

Shearer, B L and Tippett, J T, 1989, Jarrah Dieback: The Dynamics and management of *Phytophthora Cinnamomi* in the Jarrah (*Eucalyptus Marginata*) Forest of South-western Australia CALM Research Bulletin No 3

Shearer, B L, Michaelsen, B J and Somerford, P J, Effects of Isolate and Time of Inoculation on Invasion of Secondary Phloem of *Eucalyptus* spp and *Banksia Grandis* by *Phytophthora* spp CALM

Shearer, B L, Michaelsen, B J and Warren, H J, Comparative Behaviour of Phytophthora Species in the Secondary Phloem of Stems and Excised Roots of Banksia Grandis and Eucalyptus Marginata

Shearer, B L, Shea, S R and Deegan, P M, Temperature-Growth Relationships of *Phytophthora Cinnamomi* in the Secondary Phloem of Roots of *Banksia Grandis* and *Eucalyptus Marginata* CALM

Shearer, B L, Shea, S R and Fairman, R G, Infection of the Stem and Large Roots of *Eucalyptus Marginata* by *Phytophthora Cinnamomi* Forests Department of WA Reprint No 26

Stuart Crombie, D, and Tippett, J T, A Comparison of Water Relations, Visual Symptoms, and Changes in Stem Girth for Evaluating Impact of *Phytophthora Cinnamomi* Dieback on *Eucalyptus Marginata*

Syme, K, 1992, Survey of the Larger Fungi of the Two Peoples Bay Nature Reserve Australian Heritage Commission, Heritage Council of WA, Denmark Environment Centre (Inc)

Tippett, Joanna T and Barclay, Joanne, L, 1987, Detection of Bark Lesions Caused by *Phytophthora Cinnamomi* in *Eucalyptus Marginata* with the Plant Impedance Ratio Meter and the Shigometer Canadian Journal of Forest Research Vol 17 No 10

Tippett, Joanna T and Hill, T C, Role of Periderm in Resistance of *Eucalyptus Marginata* Roots against *Phytophthora Cinnamomi* reprinted from European Journal of Forest Pathology

Tippett, Joanna T and Hill, T C, The Relationship Between Bark Moisture and Invasion of *Eucalyptus Marginata* by *Phytophthora Cinnamomi* Forests Department of WA Reprint No 36

Tippett, Joanna T, Crombie, D S and Hill, T C, Effect of Phloem Water Relations on the Growth of *Phytophthora Cinnamomi* in *Eucalyptus Marginata* Reprint No 80

Tippett, Joanna T, Formation and Fate of Kino Veins in Eucalyptus L'Herit CALM Reprint No 71, IAWA Bulletin New Series

Tippett, Joanna T, Hill, T C and Shearer, B L, Resistance of *Eucalyptus* spp to Invasion by *Phytophthora Cinnamomi* CALM Reprint No 62

Tippett, Joanna T, Shea, S R, Hill, T C and Shearer, B L, Development of Lesions caused by *Phytophthora Cinnamomi* in the Secondary Phloem of *Eucalyptus Marginata* Forests Department of WA Reprint No 31

Tree Killer

What is Dieback? Resource Notes, CALM No 11, 1990

Ecological Theory

Saunders, Denis, A and Burbidge, Andrew, A, Ecological Theory and Biological Management of Ecosystems CALM Occasional Paper No 1/88

Fire

Abbott, I, van Heurck, P and Wong, L, Responses to Long-Term Fire Exclusion: Physical, Chemical and Fauna Features of Litter and Soil in a Western Australian Forest CALM Reprint No 55

Abbott, Ian and Loneragan, Owen, Influence of Fire on Growth Rate, Mortality, and Butt Damage in Mediterranean Forest of Western Australia Forests Department of WA Reprint No 32

Abbott, Ian, Changes in the Abundance and Activity of Certain Soil and Litter Fauna in the Jarrah Forest of Western Australia after a Moderate Intensity Fire Forests Department of WA Reprint No 51

Bradshaw, J, 1987, Treemarking and Silviculture in the Jarrah Forest, a Training Brief for Operational Staff CALM

Bradstock, R A and Myerscough, P J, 1988, The Survival and Population Response to Frequent Fires of Two Woody Resprouters *Banksia Serrata* and *Isopogon Anemonifolius* Australian Journal of Botany, 36

Burrows, N D, 1987, Fire Caused Bole Damage to Jarrah (*Eucalyptus Marginata*) and Marri (*Eucalyptus Calophylla*) Research Paper No 3, CALM

Christensen, P and Maisey, K, The Use of Fire as a Management Tool in Fauna Conservation Reserves

Christensen, P E and Kimber, P C, Effect of Prescribed Burning on the Flora and Fauna of South-West Australian Forests

Christensen, P E S, Wardell-Johnson, G and Kimber, P, Birds and Fire in Southwestern Forests

Christensen, Per and Abbott, I, Impact of Fire in the Eucalypt Forest Ecosystem of Southern Western Australia: A Critical Review reprinted from Australian Forestry Vol 52, No 2

Fire Management on Nature Conservation Lands, CALM Occasional Paper 1/89

Hopkins, A J M and Griffin, E A, 1989, Fire in the Banksia Woodlands of the Swan Coastal Plain Journal of the Royal Society of Western Australia, 71(4)

Kimber, P C, Some Effects of Prescribed Burning on Jarrah Forest Birds Forests Department of Western Australia

Lamont, B B and Downes, S, 1979, The Longevity, Flowering and Fire History of the Grasstrees *Xanthorrhoea Preissii* and *Kingia Australis* Journal of Applied Ecology, 16

Malcolm Gill, A, 1986, Research for the Fire Management of Western Australian State Forests and Conservation Reserves

McCaw, W L and Burrows, N D, Fire Management

McCaw, W L, 1986, Behaviour and Short Term Effects of Two Fires in Regenerated Karri (*Eucalyptus Diversicolor*) Forest CALM Technical Report No 9

McCaw, W L, Regeneration of Acacia and Kennedia from Soil Stored Seed Following an Autumn Fire in Jarrah (*Eucalyptus Marginata*) Forest CALM Reprint No 99

McCaw, W L, Wood Defect Associated with Fire Scars on Jarrah (*Eucalyptus Marginata* Sm) Forests Department of WA Reprint No 45

McCormick, J, Assessing Maritime Pine Fuel Quantity Forests Department of WA Reprint No 7, 1973

McCormick, J, 1976, Recovery of Maritime Pine (*Pinus Pinaster*) After Severe Crown Scorch Forests Department of WA Reprint No 20

Peet, G B and McCormick, J, 1971, Short-Term Responses from Controlled Burning and Intense Fires in the Forests of Western Australia

Shea, S R, McCormick, J and Portlock, C C, 1979, The Effect of Fires on Regeneration of Leguminous Species in the Northern Jarrah (*Eucalyptus Marginata* Sm) Forest of Western Australia Australian Journal of Ecology 4

Shea, S R, Peet, G B and Cheney, N P, The Role of Fire in Forest Management

Sneeuwjagt, R J and Peet, G B, 1985, Forest Fire Behaviour Tables for Western Australia CALM

Sneeuwjagt, Richard, J, 1992, Fire Suppression on CALM Lands, A Paper for National Parks and Nature Conservation Authority

Springett, J, 1976, The Effect of Prescribed Burning on the Soil Fauna and on Litter Decomposition in Western Australian Forests Australian Journal of Ecology

Strelein, G J, Site Classification in the Southern Jarrah Forest of Western Australia CALM Research Bulletin 2

The Shape of Mild Fires in Jarrah Forest, Forests Department of WA

Underwood, R J, Research for Forest fire Operations in Australia CALM Reprint No 69

Underwood, R J, Sneeuwjagt, R J and Styles, H G, 1985, The Contribution of Prescribed Burning to Forest Fire Control in Western Australia: Case Studies Symposium on 'Fire Ecology and Management in Western Australian Ecosystems'

Ward, S C, Koch, J M and Ainsworth, G L, 1991, The Effect of Controlled Burns on Nitrogen and Phosphorus in Rehabilitated Bauxite Mines ALCOA of Australia Limited, Perth (unpublished report)

Wooller, R D and Calver, M C, Changes in an Assemblage of Small Birds in the Understorey of Dry Sclerophyll Forest in South-western Australia after Fire a reprint from the Australian Journals of Scientific Research

Flora and Fauna

Abbott, Ian and Van Heurck, Paul, 1985, Comparison of Insects and Vertebrates as Removers of Seed and Fruit in a Western Australian Forest Australian Journal of Ecology 10

Abbott, Ian and Van Heurck, Paul, Response of Bird Populations in Jarrah and Yarri Forest in Western Australia Following Removal of Half the Canopy of the Jarrah Forest CALM Reprint No 74

Abbott, Ian and Van Heurck, Paul, Tree Species Preferences of Foraging Birds in Jarrah Forest in Western Australia CALM Reprint No 65

Abbott, Ian and Van Heurck, Paul, Widespread Regeneration Failure of Persoonia Elliptica (Proteaceae) in the northern Jarrah forest of Western Australia CALM Reprint No 100

Abbott, Ian Emergence, Early Survival, and Growth of Seedlings of Six Tree Species in Mediterranean Forest of Western Australia reprinted from Forest Ecology and Management, Amsterdam

Abbott, Ian, 1985, ecruitment and Mortality in Populations of Banksia Grandis Willd in Western Australian Forest Australian Journal of Botany 33

Abbott, Ian, 1985, Rate of Growth of *Banksia Grandis* Willd (Protaeceae) in Western Australian Forest Australian Journal of Botany 33

Abbott, Ian, Reproductive Ecology of Banksia Grandis (Proteaceae) Forests Department of Western Australia Reprint No 53

Attiwell, P, 1982, Karri Forest Conservation Bulletin, 123, Department of Conservation and Environment

Burrows, N D, Reducing the Abundance of Banksia Grandis in the Jarrah Forest by the Use of Controlled Fire CALM Reprint No 61

Christensen, P E, Guide to Research Findings on Biology and Ecology of the Karri Forest CALM Landnote

Christensen, P E S, 1988, Clearfelling in the Karri Forest and Hollow Trees for Wildlife CALM (unpublished report)

Christensen, P E S, 1980, The Biology of *Bettongia Penicillata* Gray, 1837, and *Macropus Eugenii* (Desmarest, 1817) in Relation to Fire Forests Department of WA Bulletin 91

Christensen, P, Annels, A, Liddelow, G and Skinner, P, 1985, Vertebrate Fauna in the Southern Forests of Western Australia A Survey Forests Department of WA Bulletin 94

Davies, S J J F, 1979, The Breeding Seasons for Birds in South-Western Australia Journal of the Royal Society of Western Australia, Vol 62 Parts 1-4

Forest and Woodland Fauna Research in South-Western Australia Compiled by Forest Fauna Research Working Group, Forests Department of WA Technical Paper No 13

Garnett, S G, 1992, Threatened and Extinct Birds of Australia RAOU and APWS, RAOU Report 82

Glossop, B L, Bell, D T and Shea, S R, Changes in the Nitrogen and Phosphorus Levels in Foliage and Connecting Branches of Jarrah (*Eucalyptus Marginata* Donn ex Sm) after Intense Fire Forests Department of WA

Growns, I O and Davis, J A, 1991, Comparison of the Macroinvertebrate Communities in Streams in Logged and Undisturbed Catchments Eight Years After Harvesting Australian Journal of Marine Freshwater Research, 42

Hilliard, R W, 1989, Aspects of Stream Degradation Influencing the Distribution of Native and Introduced Fishes - A Southwest Australian Perspective Conference Paper for Issues for Water Management No 2, The State of Our Rivers, Australian National University

Inions, Gary, 1981, A Comparison of Possum Trees in the Perup River Fauna Priority Area Forests Department of WA

Inions, Gary, 1981, Nesting Trees of the Brushtail (Trichosurus Vulpecula) and Ringtail (Pseudoceirus Peregrinus) Possums and the Effect of Autumn Fire on these Sites Forests Department of WA

Inions, Gary, 1982, Recolonization of Wildfire Area (Wildfire 9, 1981) by Brushtailed Possums (*Trichosurus Vulpecula*)

Kimber, P and Christensen, P, Birds of Western Australian Forests Forests Department of WA Information Sheet 12

Muir, B G, 1987, Time Between Germination and First Flowering of Some Perennial Species Kingia 1(1)

Saunders, D A, 1985, The Effects of Clearing for Agriculture on the Distribution of Cockatoos in the Southwest of Western Australia RAOU and Surrey Beatty and Sons

Serena, Melody, Soderquist, Todd R and Morris, Keith, 1991, The Chuditch (Dasyurus Geoffroii) CALM Wildlife Management Programme No 7

Sources of Information on the Vegetation and Flora of Western Australia Flora Information Service, Western Australian Herbarium, CALM

Wardell-Johnson, G W, 1985, The Composition and Foraging Ecology of a Bird Community in Karri Forest in South Western Australia

Wardell-Johnson, Grant and Nicholas, Owen, Forest Wildlife and Habitat Management in Southwestern Australia: Knowledge, Research and Direction

Wardell-Johnson, Grant, Use of Nest Boxes by Mardos, Antechinus Flavipes Leucogaster, in Regenerating Karri Forest in South Western Australia CALM Reprint No 70

Forest Inquiries

A Survey of Australia's Forest Resource Resource Assessment Commission, 1992

Australia's Forest and Timber Resources Resource Assessment Commission Background Paper, 1990

Ecologically Sustainable Development A Commonwealth Discussion Paper, 1990

Ecologically Sustainable Development Working Groups Final Report - Forest Use, 1991

Forest and Timber Inquiry Draft Report Vol 1 Resource Assessment Commission

Forest and Timber Inquiry Draft Report Vol 2 Resource Assessment Commission

Forest and Timber Inquiry Final Report Vol 1 Resource Assessment Commission, 1992

Forest and Timber Inquiry Final Report Vol 2A Resource Assessment Commission, 1992

Forest and Timber Inquiry Final Report Vol 2B Resource Assessment Commission, 1992

Four Corners: The Expose´ Exposed CALM's Reply to the ABC Four Corners Attack ('The Wood for the Trees'), 1990

Four Corners: The Expose´ Exposed CALM's Reply to the ABC Four Corners Attack ('The Wood for the Trees'), Summary Version, 1990

Integrating Forestry and Farming Commercial Wood Production on Cleared Agricultural Land, Report of the National Plantations Advisory Committee

Resource Assessment Commission Forest and Timber Inquiry Draft Report Critique for CALM, 1991

Select Committee into Land Conservation Final Report, 1991

Submission to Resource Assessment Commission Inquiry into Forest and Timber Resources by the Government of Western Australia, 1990

Williams, Daryl R AM QC, Allegations of Illegal Logging and the Accountability Procedures of the Department of Conservation and Land Management in relation to Logging in South-West Forests Report to the Honourable R J Pearce MLA the Minister for the Environment

Hydrology

Batini, F E, Forest and Catchment Management in Western Australia CALM Reprint No 68

Borg, H and Stoneman, G L, 1991, Long-Term Implications for Streamflow of Changes in Vegetation Cover and Stand Height in Regenerating Karri Stands in South-West Western Australia Forest Ecology and Management Vol 40

Borg, H, Hordacre, A and Batini, F , Effects of Logging in Stream and River Buffers on Watercourses and Water Quality in the Southern Forest of Western Australia reprinted from Australian Forestry Vol 51, No 2

Borg, H, King, P D and Loh, I C, 1987, Stream and Ground Water Response to Logging and Subsequent Regeneration in the Southern Forest of Western Australia Interim Results from Paired Catchment Studies Water Authority of WA Report No WH 34

Borg, H, Stoneman, G L and Ward, C G, 1987, Stream and Groundwater Response to Logging and Subsequent Regeneration in the Southern Forest of Western Australia Results from Four Catchments CALM Technical Report No 16

Forest Management to Increase Water Yield from the Northern Jarrah Forest A Report by the Steering Committee for Research on Land Use and Water Supply, Water Authority of WA, 1987

Hatch, A B, 1976, The Relationship Between Electrical Conductivity of Soil: Water Suspensions and Soluble Salts in Some Western Australian Forest Soils Forests Department of WA Research Paper No 19

Hatch, A B, Wong, Yoke Lin and Stone, Colleen, 1976, A Comparison of Several Techniques for the Microestimation of Sulphate in Water Samples Forests Department of WA Research Paper No 27

Herbert, E J and Ritson, P, 1976, Small Streamflow Measurements in the Northern Jarrah Forest, Western Australia Forests Department of WA Research Paper No 28

Martin, M W, Review of the Effect of Logging on Groundwater in the Southern Forest of Western Australia Project 2, paired Catchment Study Geological Survey of Western Australia

McKinnell, F H, 1976, Water Quality in the Donnybrook Sunkland (Blackwood Plateau) Forests Department of WA Research Paper No 24

Research into the Effects of the Woodchip Industry on Water Resources in South Western Australia Report by the Steering Committee, Department of Conservation and Environment, 1978

Research into the Effects of the Woodchip Industry on Water Resources in South Western Australia Report by the Steering Committee, Department of Conservation and Environment, Bulletin No 81, 1980

Ritson, P and Shea, S R, 1980, Water and Salt Cycles Across a Forested Catchment Forests Department of WA Reprint No 25

Ruprecht, J K, Schofield, N J, Crombie, D S, Vertessy, R A and Stoneman, G L, 1991, Early Hydrological Response to Intense Forest Thinning in Southwestern Australia Journal of Hydrology Vol 127

Schofield, N J, Stoneman, G L and Loh, I C, Hydrology of the Jarrah Forest CALM Reprint No 94

Shea, S R and Hatch, A B, 1976, Stream and Groundwater Salinity Levels in the South Dandalup Catchment of Western Australia Forests Department of WA Research Paper No 22

Stoneman, G L and Schofield, N J, 1989, Silviculture for Water Production in Jarrah Forest of Western Australia: an Evaluation Forest Ecology and Management Vol 27

Stoneman, G L, Thinning a Small Jarrah Forest Catchment: Steamflow and Groundwater Response After Two Years The Institution of Engineers, Australia, CALM Reprint No 73

Stream Salinity and its Reclamation in South-West Western Australia Steering Committee for Research on Land Use and Water Supply

The Impact of Logging on the Water Resources of the Southern Forests, Western Australia A Report by the Steering Committee for Research on Land Use and Water Supply, Water Authority of WA, 1987

Vegetation Strategies to Reduce Stream Salinities of Water Resource Catchments in South-West Western Australia, Water Authority of WA Report No WS 33, 1989

Invertebrates

Abbott, Dr I, 1985, Forest Entomology Research in Western Australia CALM Technical Report No 2

Abbott, I, Burbidge, T, Williams, M and Van Heurck, P, 1992, Arthropod Fauna of Jarrah (*Eucalyptus Marginata*) Foliage in Mediterranean Forest of Western Australia: Spatial and Temporal Variation in Abundance, Biomass, Guild Structure and Species Composition Australian Journal of Ecology Vol 17

Abbott, I, Majer, J D, and Mazanec, Z, 1986, Annotated Bibliography of Forest Entomology in Western Australia to 1985 CALM Technical Report No 14

Abbott, I, Smith, R, Williams, M and Voutier, R, 1991, Infestation of Regenerated Stands of Karri (*Eucalyptus Diversicolor*) by Bullseye Borer (*Tryphocaria Acanthocera, Cerambycidae*) in Western Australia Australian Forestry Vol 54

Abbott, Ian, Distribution of Introduced Earthworms in the Northern Jarrah Forest of Western Australia Institute of Forest Research

Abbott, Ian, Influence of Some Environmental Factors on Indigenous Earthworms in the Northern Jarrah Forest of Western Australia Institute of Forest Research

Abbott, Ian, Insect Outbreaks in Forests of Western Australia Population Dynamics of Forest Insects

Abbott, Ian, 1992, Records of Outbreaks of Defoliating Insects in Jarrah Forest, South-West Western Australia, from 1960 to 1990 CALM Technical Report No 28

Brennan, G K, 1990, Powder Post Borer (Lyctus spp) Attack on Dry Timber - A Review CALM Report No 19

Influence of Jarrah Leaf Miner on the Growth of Jarrah reprinted from Australian Forestry Vol 37, No 1, 1974

Majer, J D and Abbott, I, Invertebrates of the Jarrah Forest

Majer, J D, 1981, The Role of Invertebrates in Bauxite Mine Rehabilitation Forests Department of WA Bulletin 93

Mazanec, Z, A Sampling Scheme for Estimating Population Density of the Jarrah Leaf Miner, *Perthida Glyphopa* (*Lepidoptera: Incurv Ariidae*) CSIRO

Mazanec, Z, Natural Enemies of *Perthida Glyphopa* Common (*Lepidoptera: Incurv Ariidae*) CSIRO

Mazanec, Z, Oviposition Behaviour and Dispersal of *Perthida Glyphopa* Common (*Lepidoptera: Incurv Ariidae*) CSIRO

Mazanec, Z, Resistance of *Eucalyptus Marginata* to *Perthida Glyphopa* (*Lepidoptera: Incurv Ariidae*) CSIRO

Mazanec, Z, The Immature Stages and Life History of the Jarrah Leafminer, *Perthida Glyphopa* Common (*Lepidoptera: Incurv Ariidae*) CSIRO

Postle, A and Abbott, I, Termites of Economic Significance in Suburban Perth, Western Australia: A Preliminary Study of their Distribution and Association with Types of Wood (Isoptera) CALM

Springett, J A, The Enchytraeidae (Oligochaeta) of South Western Australia: the Genus Fridericia Micaelsen 1889 Forests Department of WA Reprint No 10

Strelein, G J, 1988, Gum Leaf Skeletoniser Moth, *Uraba Lugens*, in the Forests of Western Australia reprinted from Australian Forestry Vol 51, No 3

Williams, M R and Abbott, I, Quantifying Average Defoliation Using Leaf-Level Measurements Ecology, Vol 72, No 4

Landscope - Promotional Material

'Multiple Use' Management on State Forest Proceedings of a Workshop Lands and Forest Commission, 1991

A Review of Road, River and Stream Zones in South West Forests Proceedings of a Seminar Lands and Forest Commission, 1991

Aplin, T E H, Edminston, R J, Abbott, I, 1986, A *Eucalyptus* Study Tour of South-Western Australia CALM Technical Report No 3

Batini, F E, Quarantine in Native Forests by Information Sheet 35

Christensen, P, Pentony, K, Schmidt, K, 1981, The Blackwood: A Valley in Transition Forests Department of WA Special Focus No 2

Discover Wild Places, Quiet Places A Guide to the Natural Highlights of the South-West, CALM

Dwellingup and Lane Poole Reserve CALM

Future Forest Management in Western Australia CALM Briefing Paper 3/91

Land Management Requirements in the Manjimup Land Conservation District A Report prepared for the Manjimup Land Conservation District

Landscope Autumn 1989

Landscope Autumn 1991

Landscope Autumn 1992

Landscope Autumn Edition 1987

Landscope Autumn Edition 1988

Landscope Spring 1989

Landscope Spring 1990

Landscope Spring 1991
Landscope Spring Edition 1987
Landscope Summer 1988/89
Landscope Summer 1989/90
Landscope Summer 1990/91
Landscope Summer 1991/92
Landscope Summer Edition 1987
Landscope Summer Edition, 1986/87
Landscope Vol 1, 1985
Landscope Vol 1, No 2, 1985
Landscope Vol 1, No 3, 1985
Landscope Vol 1, No 4, 1986
Landscope Vol 2, No 1, 1985
Landscope Winter 1989
Landscope Winter 1990
Landscope Winter 1991
Landscope Winter Edition 1987
Landscope Winter Edition 1988
Landscope Winter Edition 1988
Manjimup Pemberton National Parks and Forest, CALM
Media Statement by the Minister for the Environment, 5 February 1992
Nature Conservation and Recreation Reserves in the Jarrah Forest CALM Briefing Paper 1/91
Out of the Woods - Concluding Report on the Small Eucalypt Processing Study Wood Utilisation Research Centre, CALM
Rebuilding the Cathedral
Research on the Impact of Forest Management in Western Australia CALM Occasional Paper 2/92
Restoring Nature's Balance reprinted from CALM Landscope Vol 3, No 3
Shannon National Park, CALM
Shea, Syd and Underwood, Roger, 1990, Forests for the Future reprinted from CALM Landscope Vol 6, No 1, Spring Edition
Tree Felling in the Shannon River National Park CALM Briefing Paper 1/90
Vesting and Management of Conservation Areas in Western Australia A Response from CALM to a Policy Proposal by the WA Conservation Council
Western Australia's National Parks and Forests Recreation Guide
Where Are You Taking Those Trees?
White, Barney and Underwood, Roger, Conservation in the Karri Forest reprinted from CALM Landscope

National Policies, Strategies, Management Plans

A Nature Conservation Strategy for Western Australia, A Draft for Public Comment, CALM, 1992
A New Focus for Australia's Forests Draft National Forest Policy Statement, 1992
Burrows, N D, McCaw, W L and Maisey, K G, Planning for Fire Management in Dryandra Forest
Central Forest Region Regional Management Plan 1987-1997, CALM, 1987
Conservation of the Karri Forest Forests Department of WA, 1981
Forests for Australia Goals and Strategies for the Management of Australian Forests, Standing Committee of the Australian Forestry Council, 1992
Forests for Tomorrow Your Decisions A Summary of the management Plans for the Northern, Central and Southern Forest Regions and the Timber, Recreation and Conservation Strategies
Future Directions for Nature Conservation Summary of the Draft 'A Nature Conservation Strategy for Western Australia', CALM, 1992
Implementing the Timber Strategy CALM, 1988
John Forrest National Park Draft Management Plan, CALM, National Parks and Nature Conservation Authority, 1992
Kelly, Anne, E, Coates, D J, Herford, I, Hopper, S D, O'Donoghue, M and Robson, L, 1990, Declared Rare Flora and Other Plants in Need of Special Protection in the Northern Forest Region CALM Wildlife Management Program No 5
Land Managed by CALM, CALM

Lane Poole Reserve Management Plan 1990-2000, Management Plan No 5, CALM, National Parks and Nature Conservation Authority
Leeuwin-Naturaliste National Park Management Plan 1989-1999, Management Plan No 13, CALM
Logue Brook Reservoir and Catchment Area Management Plan 1990-2000, Management Plan No 20, CALM/Water Authority of WA
Management Strategies for the South-West Forests of Western Australia A Review Draft for Public Comment, CALM, 1992
McKinnell, F H, Forestry Terminology in Western Australia Forests Department of WA Technical Paper No 1
Moore, R, 1986, The Integration of Trees and Farming in New Zealand CALM Technical Report No 6
National Estate Values in the Southern Forest Region of South-West Western Australia Vol 1, Draft Report, Australian Heritage Commission/CALM
National Estate Values in the Southern Forest Region of South-West Western Australia Vol 3, Australian Heritage Commission/CALM
National Estate Values in the Southern Forest Region of South-West Western Australia Vol 4, Australian Heritage Commission/CALM
National Estate Values in the Southern Forest Region of South-West Western Australia Vol 5, Australian Heritage Commission/CALM
Nature Conservation Strategy A Submission by the Environmental Protection Authority on the Draft Document Released for Review by the Department of Conservation and Land management, Bulletin 634, 1992
Northern Forest Region Regional Management Plan 1987-1997, CALM, 1987
Pearce, Bob, MLA, Hon Minister for the Environment, 1991, Future Forest Management in Western Australia A Paper to the 27th Australian Forestry Council, Coffs Harbour
Proposals to Amend the 1987 Forest Management Plans and Timber Strategy and Proposals to Meet Ministerial Conditions on the Regional Plans and WACAP ERMP Formal Assessment Under Part IV of the Environmental Protection Act, CALM, 1992
Shea, S R, 1991, Adding Value to Timber Products A Western Australian Perspective CALM
Shea, S R, 1992, Integration: The Key to the Future of the Hardwood Forest Industries CALM
Shea, S R, Multiple Use Management in a Mediterranean Ecosystem - the Jarrah Forest, A Case Study by Forests Department of WA Reprint No 35
Shea, S R, 1990, The Need for a National Forest Strategy OR Why Can't Our Forest Strategy Become Australia's Magic Pudding 13th All Australia Timber Congress
Southern Forest Region Regional Management Plan 1987-1997, CALM, 1987
Strategies for Conservation and Recreation on CALM Lands in Western Australia, CALM, 1987
Submissions on Management Plans for Northern, Central and Southern Forest Regions, Supporting Papers, Timber Production in Western Australia Summary of Public Submissions, CALM, 1987
The Road, River and Stream Zone System in the Southern Forest of Western Australia A Review, CALM, 1988
Timber Production in Western Australia A Strategy to take WA's South-West Forests into the 21st Century, CALM, 1987
Underwood, R J and Murch, J H, Hygienic Logging in the Northern Jarrah Forest Forests Department of WA Reprint No 52
Walpole-Nornalup National Park Draft Management Plan 1990, CALM
What Future for our Forests? You Choose Management Plans

Official Records of Inquiries

Bellamy, D Videos Information and Publicity, Audio Visuals, Video Films and Photography, Vol 1, CALM, 1991
Correspondence with ABC Following Four Corners Program Information and Publicity, Media Publicity, Vol 1, CALM, 1991
Correspondence with ABC Following Four Corners Program Information and Publicity, Media Publicity, Vol 2, CALM, 1991
Crown Law and Ombudsman Opinions on Four Corners Program Administration, Legal Rulings and Opinions, Vol 1, CALM, 1991
Ecologically Sustainable Development Working Group on Coastal Zone Management Committees and Conferences, Vol 1, CALM, 1992

Land Use Planning Management Plans, General Information Ecologically Sustainable Development, Vol 1, CALM, 1992
Land Use Planning Management Plans, General Information Ecologically Sustainable Development, Vol 2, CALM, 1992
Land Use Planning Management Plans, General Information Ecologically Sustainable Development, Vol 3, CALM, 1992
National Plantations Advisory Committee Committees and Conferences, Vol 1, CALM, 1991
Resource Assessment Commission Administration, Government Departments and Shire Councils, Vol 1, CALM, 1989
Resource Assessment Commission Administration, Government Departments and Shire Councils, Vol 2, CALM, 1990
Resource Assessment Commission Administration, Government Departments and Shire Councils, Vol 3, CALM, 1992
Resource Assessment Commission Administration, Government Departments and Shire Councils, Vol 4, CALM, 1992.
Resource Assessment Commission Administration, Government Departments and Shire Councils, Vol 5, CALM, 1992
Resource Assessment Commission Coastal Zone Inquiry Administration, Government Departments and Shire Councils, Vol 1, CALM, 1991
Response to Four Corners Program Information and Publicity, Media Publicity, Vol 1, CALM, 1990
Response to Four Corners Program Information and Publicity, Media Publicity, Vol 2, CALM, 1991

Rehabilitation

Bartle, J R and Riches, J R H, Rehabilitation after Mining in the Collie Coalfield Forests Department of WA Reprint No 4
Bartle, J R and Shea, S R, Development of the Ecosystem after Mining Forests Department of WA Reprint No 19

Silvics, Silviculture, Forest Inventory

Kimber, P C, 1976, Aerial Application of Urea Fertilizer to Jarrah Pole Stands Forests Department of WA Research Paper No 26
Biggs, P H, 1991, Aerial Tree Volume Functions for Eucalypts in Western Australia CALM
Rayner, M E, 1992, Application of Dendrochronology, Stem Analysis and Inventory Data in the Estimation of Tree and Stand Ages in Karri Forest CALM Technical Report No 27
Spencer, R D, 1992, Application of Modern Inventory Techniques in the Forests of Western Australia CALM Occasional Paper No 1/92
Abbott, Ian, Comparisons of Spatial Pattern, Structure, and Tree Composition Between Virgin and Cut-Over Jarrah Forest in Western Australia Forests Department of WA Reprint No 49
Butcher, T B, Competitive Effect of Pine Regrowth and Woody Weeds on the Growth of Pinus Pinaster Forests Department of WA Reprint No 24
Stoneman, Geoff and Dell, Bernie, 1991, Constraints on the Productivity of Regenerating Jarrah (*Eucalyptus Marginata* Donn ex Sm) Stands in the Northern Jarrah Forest of Western Australia Third Australian Forest Soils and Nutrition Conference
Crombie, D S, Tippett, J T and Hill, T C, Dawn Water Potential and Root Depth of Trees and Understorey Species in South-Western Australia A Reprint from the Australian Journals of Scientific Research
Abbott, Ian, Ecological Features of an Outlying Stand of Jarrah (*Eucalyptus Marginata*) at Jilakin Rock, Western Australia Forests Department of WA Reprint No 41
Abbott, Ian and Loneragan, Owen, Ecology of Jarrah (*Eucalyptus Marginata*) in the Northern Jarrah Forest of Western Australia CALM Bulletin No 1
Effect of Nitrogen and Phosphorus Supply on the Response of Seedlings of *Pinus Radiata*, D Don to Applied Zinc CALM Reprint No 57
Rayner, M E, 1991, Estimation of True Height from Karri (*Eucalyptus Diversicolor*) Stem Analysis Data Australian Forestry Vol 54
Rayner, M E, 1992, Evaluation of Six Site Classifications for Modelling Timber Yield of Regrowth Karri (*Eucalyptus Diversicolor* F Muell) Forest Ecology and Management, Amsterdam
Biggs, P H, Pearce, C J and Westcott, T J, 1989, GPS Navigation for Large-Scale Photography CALM

Fremlin, R R A, Kruger, J W, Hingston, R A, Growth and Potential of Coniferous Species in the South-West of Western Australia A Report on the Progress of Three Arboreta Forests Department of WA Technical Paper No 14

Rayner, M E and Turner, B J, 1990, Growth and Yield Modelling of Australian Eucalypt Forests I Historical Development Australian Forestry Vol 53

Rayner, M E and B J, Turner, 1990, Growth and Yield Modelling of Australian Eucalypt Forests II Future Trends Australian Forestry Vol 53

Abbott, Ian and Loneragan, Owen, Growth Rate and Long-Term Population Dynamics of Jarrah (*Eucalyptus Marginata* Donn ex Sm) Regeneration in Western Australian Forest Institute of Forest Research

Abbott, Ian and Loneragan, Owen, Growth Rate of Jarrah (*Eucalyptus Marginata*) Coppice Forests Department of WA Reprint No 39

Growth Rate of Jarrah (*Eucalyptus Marginata*) in Relation to Site Quality in Cut-Over Forest, Western Australia Forests Department of WA Reprint No 34

Loneragan, O W, 1990, Historical Review of Sandalwood (Santalum Spicatum) Research in Western Australia CALM Research Bulletin No 4

Loneragan, O W, 1979, Karri (*Eucalyptus Diversicolor* F Muell) Phenological Studies in Relation to Reforestation Forests Department of WA Bulletin 90

Clarke, John, Log Faults A Glossary of Defects and Other Characteristics of Trees and Logs in the South-West of Western Australia CALM

McKinnell, F H, Low Pruning Radiata Pine Forests Department of WA Reprint No 11

Biggs, P H, Spencer, R D, 1990, New Approaches to Extensive Forest Inventory in Western Australia Using Large-Scale Aerial Photography reprinted from Australian Forestry Vol 53, No 3

Shea, S R, Bartle, J R and Richmond, P C, Preliminary Studies of Water Relations of Some Tree Species at Yeelirrie Forests Department of WA Reprint No 6

Bradshaw, F J, 1991, Quantifying Edge Effect and Patch Size for Multiple-Use Silviculture - A Discussion Paper CALM

Stoneman, G L, Rose, P W and H Borg, 1988, Recovery of Forest Density After Intensive Logging in the Southern Forest of Western Australia CALM Technical Report No 19

B J White, 1974, Regeneration Methods in Mixed Marri-Karri Stands Forests Department of WA Research Paper No 4

Ian Abbott and Owen Loneragan, Response of Jarrah (*Eucalyptus Marginata*) Regrowth to Thinning Institute of Forest Research

B Dell, J R Bartle and W H Tacey, Root Occupation and Root Channels of Jarrah Forest Subsoils Forests Department of WA Reprint No 38

F H McKinnell, Sawlog Silviculture in Western Australian Pine Plantations Forests Department of WA Reprint No 18

F J Bradshaw, 1985, Silvicultural Guidelines for the Treatment of Even-Aged Regrowth and Two-Tiered Karri Forests CALM Technical Report No 1

F J Bradshaw, 1986, Silvicultural Guidelines for Virgin Southern Jarrah Forest CALM Technical Report No 4

Silviculture Specifications, CALM

M E Rayner, 1991, Site Index and Dominant Height Growth Curves for Regrowth Karri (*Eucalyptus Diversicolor* F Muell) in South-Western Australia Forest Ecology and Management, Amsterdam

I Rotheram, Suppression of Growth of Surrounding Regeneration by Veteran Trees of Karri (*Eucalyptus Diversicolor*) Forests Department of WA Reprint No 33

The Distribution of Zinc and the Diagnosis of Zinc Deficiency in Seedlings of *Pinus Radiata*, D Don, CALM Reprint No 56

J F McGrath and A D Robson, The Influence of Zinc Supply to Seedlings of *Pinus Radiata* D Don on the Internal Transport of Recently Absorbed Zinc CALM Reprint No 50

I Abbott, B Dell and O Loneragan, The Jarrah Plant CALM Reprint No 97

J F McGrath and A D Robson, 1984, The Movement of Zinc Through Excised Stems of Seedlings of *Pinus Radiata* D Don Annals of Botany 54

M E Rayner, 1992, Timber Yield of Regrowth Karri (*E Diversicolor*) Forest Ecology and Management, Amsterdam

D Stuart Crombie, J T Tippett and D J Gorddard, Water Relations of Root-Pruned Jarrah (*Eucalyptus Marginata* Donn ex Smith) Saplings CALM

Appendix III - Timber Consumption Forecasts for Western Australia by the Department of Conservation and Land Management - a review by Dr David Pannell, 11 December 1992 (and comments by Dr George Malajczuk).

Overleaf.

Timber Consumption Forecasts for Western Australia by the Department of Conservation and Land Management

Dr David Pannell

Senior Lecturer, Agricultural Economics, School of Agriculture,
University of Western Australia

11 December 1992

These comments relate to CALM's statistical model of timber consumption and to predictions made with it for the purposes of CALM's Draft Forest Strategy. In the following sections I express my views on the quality and reliability of the statistical model and the forecasts made with it.

These views are based on
(a) information about data, procedures and the resulting model provided to me by Dr George Malajczuk of CALM and
(b) my reading of "Timber Production in Western Australia; A Strategy to take WA's South-West Forests into the 21st Century" (CALM, 1987).

I have not had access to the Draft of the 1992 Forest Strategy. I am informed by Dr Malajczuk that the forecasts included in the Draft Forest Strategy are the same as those in the 1987 Timber Strategy.

1. The Statistical Model

1.1 Description of the model

The model includes three elements. The first element calculates per capita consumption of sawn timber, plywood and veneers. It does this for a given year based on the levels of the following factors in that year:
. the value of building commencements,
. timber usage per house, and
. the number of houses and flats commenced.
Per capita consumption is multiplied by state population to give total consumption for the state.

A number of other factors were tested but it was found that historical per capita wood consumption could best be predicted using these variables.

The second element relates the value of building commencements in a year to:
. the level of economic activity in Western Australia (the state's GDP),
. the change in state population, and
. the ratio of the housing interest rate to the inflation rate.

The third element relates timber usage per house to the ratio of timber prices to steel prices.

The second and third elements of the model are used to provide forecasts of building commencements and timber usage per house. These predictions are fed into the first element to calculate forecasts of wood consumption.

1.2 Comments on the model

It is my opinion that although the model is not perfect, it is likely to be a reasonable representation of the relationship between demographic and economic factors and timber consumption between 1960 and 1988. Although I might have approached the selection of model structure slightly differently, there is probably only a limited potential for improving the model's ability to explain the determinants of timber consumption between 1960 and 1988.

My specific suggestions of how the model might be improved are as follows:

. I suggest that CALM could investigate the possibility of substituting the equation which predicts wood per house into the equation for per capita consumption. The independent variables would then be PRDWFP, TU, TU x P and NH (with logs as appropriate) where P is the ratio of wood to steel prices. This approach would consider the impact of prices on consumption simultaneously with all the other variables. I would then like to see the price ratio added as a separate variable, acting independent of its impact on wood per house to try to capture impacts of price on factors other than housing.

. Logically I believe that the appropriate structure is for the model to be a function of wood per house **times** the number of houses. It is logically impossible for the current equation structure, with TU and NH as separate variable, to be correct.

. If all these suggestions were to be tested in a single model, it would have four independent variables: PRDWFP, TU x NH, TU x NH x P and P.

However let me reiterate that despite these comments, I expect the improvement in predictive power from a model revised along the lines I suggest would be small, and it may even be zero. That is, these are suggestions which *might* improve the model, but only in a marginal way.

2. Consumption Forecasts to 2040

I have no specific reason to question CALM's long range forecasts of timber consumption in Western Australia. The forecasts are plausible and conservative relative to other published forecasts. However I wish to make some general comments about the use of statistical models for long-range forecasting.

The potential for errors when forecasting 50 years ahead is substantial. The use of statistical models such as that discussed above may be interpreted as an attempt to take some of the guess-work out of forecasting. However I believe that such a model is unlikely to perform better than a thoughtful and well-informed individual making an "educated guess". The reason for this is that forecasting models do not remove the guess-work from forecasting; they simply change the variable about which one has to guess.

To illustrate, the CALM model represents the relationship between wood consumption and the value of new building commencements (amongst other things). To use this model to make predictions of wood consumption in the year 2040, one must first forecast the value of building commencements in 2040 and then use this forecast to calculate wood consumption. Clearly, the model only gives you a better prediction of wood consumption if you can

predict the value of building commencements better than you can directly predict wood consumption.

You could of course use another equation to predict building commencements (as CALM has done) but then you still have to predict the inputs to that equation.

Even if the model is perfect in its ability to explain wood consumption as a function of other variables, you still have to predict those other variables. In reality, the model is never perfect in this way, so for the model to be beneficial, your ability to predict the inputs to the model has to be so much better than your ability to predict wood consumption directly that you can more than compensate for this imperfection.

Use of the modelling approach does have the advantage that it makes explicit the exact basis on which the forecast is made. On the down side, use of a model may give the forecast a false image of objectivity or authority, especially amongst people who do not understand the modelling process.

Having said all this, it is certainly true that CALM's forecasts for timber consumption are conservative compared to to those made by the Bureau of Agricultural Economics in 1982. They are also similar or slightly lower than a forecast by BIS Shrapnel up to the year 2000.

On the other hand, the extent to which the BAE's prediction made in 1982 differ from reality in 1990 highlights the difficulties of forecasting within a decade, let alone over 50 years. Their forecast for 1990 was 1.6 million cubic metres, compared with actual consumption of approximately 1.0 million cubic metres.

3. The Use of Consumption Forecasts for Forest Management

Although I have stressed the unreliability of long range forecasts, regardless of the statistical method used, I recognise that predictions have to be made to provide inputs to long-term planning decisions. The point is that such planning decisions need to recognise the high degree of uncertainty inherent in *any* long term forecast. In particular, irreversible decisions or decisions which substantially constrain land use for a long period should be made only with the utmost care, whatever future levels of consumption have been predicted. Preferably the maximum possible degree of future flexibility should be encompassed in any current decisions.

This does not mean that it can never be appropriate to trade off some future flexibility for a perceived economic gain. However in making a decision to do this, the very real possibility that consumption will be lower than has been forecast should be weighed up.

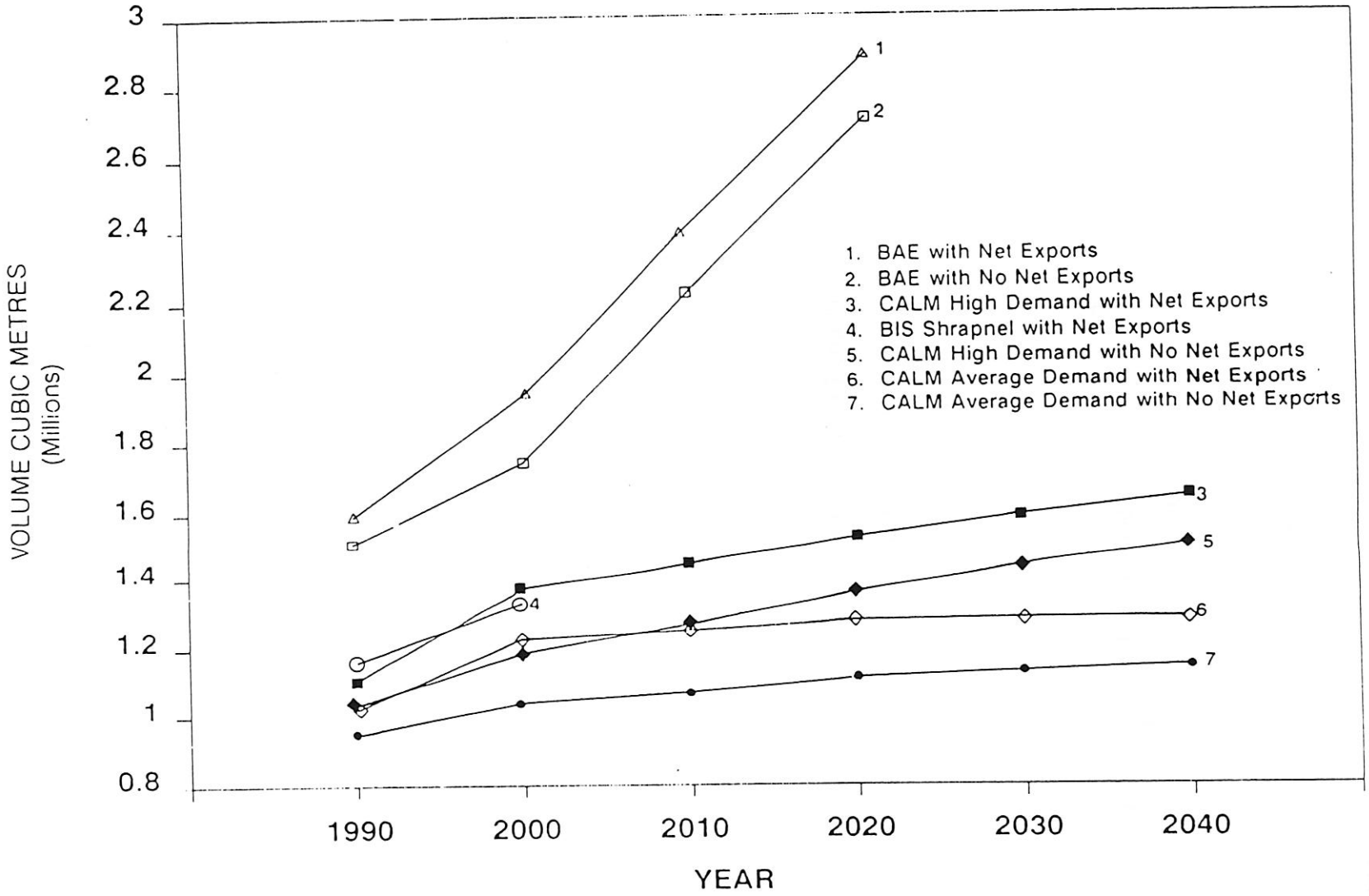
One concerning aspect of the CALM forecasts is that they include high and average scenarios for timber consumption, but not a low scenario. I am not saying that a low scenario is more or less likely than the others; just that the possibility of a low scenario needs to be considered in any planning. In my experience, it is normal practice for economists to consider in their analyses scenarios on either side of their expected or average scenario (i.e. high, medium and low, or optimistic, expected and pessimistic).

Finally, I wish to comment on the goal of timber self sufficiency. From the Timber Strategy, it appears that there is a goal of timber self-sufficiency in Western Australia (plus some level of exports). The fact that so much energy went into forecasting Western Australian timber consumption is a reflection of this goal. However in my view the goal of self sufficiency for its own sake is inappropriate. In my view, the appropriate approach is to forecast the world prices for different types of timber and to base forest management on those prices. For example, if timber prices are high enough, it will be economically optimal for the state to meet all domestic wood requirements and have wood available for export (subject to environmental constraints of course). However if timber prices are low enough, it will be unprofitable to export and economically efficient to import some of the domestic consumption (which will be stimulated by the low prices). This is true regardless of the fact that the imports would add to our foreign debt. Under this low price scenario, a decision to cut timber anyway to meet all local demands would mean that unnecessarily high financial and environmental costs were being borne to provide wood which could be imported cheaply. Constraints on imports of rainforest timbers could be included in this planning if it were thought appropriate.

It may well be true that timber prices are high enough for self sufficiency to be achieved efficiently. However we should not lock the state into this objective into the indefinite future.

Figure 1

EXTERNAL AND DOMESTIC DEMAND FOR SAWLOGS: WESTERN AUSTRALIA



DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

HEAD OFFICE
HACKETT DRIVE CRAWLEY
WESTERN AUSTRALIA
Phone (09) 3868811
Telex AA94585
Facsimile (09) 3861578

STATE OPERATIONS HEADQUARTERS
50 HAYMAN ROAD COMO
WESTERN AUSTRALIA
Phone (09) 367 0333
Telex AA 94616
Facsimile (09) 367 0466

Please address all correspondence to Executive Director, P.O. Box 104, COMO W.A. 6152

Your Ref:
Our Ref:
Enquiries: Dr George Malajczuk
Phone: (09) 367 0336

JUDGE T BARNETT
11th FLOOR, DUMAS HOUSE
2 HAVELOCK STREET
WEST PERTH WA 6005

Dear Sir

I wish to make a few comments on Dr Pannell's report (of the 11 December, 1992) on CALM's demand forecasts. My comments are attached.

Dr George Malajczuk
DIRECTOR ECONOMICS

18 December, 1992

TIMBER CONSUMPTION FORECASTS FOR WESTERN AUSTRALIA BY THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

I refer to Dr Pannell's report of the 11 December, 1992.

Dr Pannell has concluded that the sawn timber demand model is likely to be a "reasonable representation of the relationship between demographic and economic factors and timber consumption ... ". He has also stated that he has "... no specific reason to question CALM's long range forecasts of timber consumption in Western Australia". Naturally, I would agree with these statements.

However, I would like to make a few comments on some of his other statements (which in no way alter the fact that the model is valid).

Page 2, Paragraph 1

The model structure is only one aspect contributing to a perfect model. It is important also that the model be statistically significant in terms of such parameters as F, t, R squared and Durbin-Watson. Many alternative models and model structures were tried in the econometric work but were found to be statistically insignificant or illogical in such terms as the signs calculated for variables. Although the model developed may not be absolutely perfect, a perfect model may not exist based on statistical investigation of many alternative model forms.

Page 2, Paragraph 2

I am fairly certain that the substitution of the equation predicting wood per house into the equation predicting per capita consumption was tried (as many alternative models were investigated) but was rejected on statistical grounds. The data for P was somewhat unreliable, and the equation predicting wood per house was used as a guide.

Page 2, Paragraph 3

It is a matter of opinion as to which model structure is most appropriate. The structure has to be decided also on statistical and other grounds as discussed above.

Although it may not appear to be ideal, it is possible to have TU and NH in the same equation : Whereas NH, or the ratio of houses to houses plus flats, indicates a general change in timber consumption due to type of dwelling construction, there is a further dimension in the form of change in timber usage per house indicated by TU. The reason for using both variables was also influenced by statistical factors.

Page 3, Last Paragraph

A "low" forecast of consumption was made but was not included as it was considered to be unlikely (being somewhat pessimistic). The "average" and "high" forecasts were themselves considered conservative relative to the range of alternative forecasts derived from other sources. Dr Pannell has himself stated that the forecasts are conservative.

Page 4, Paragraph 1

Although timber self sufficiency is not a goal of the State, it is still important to make predictions of future domestic timber consumption. Such predictions are made in a number of countries (eg USA), and assist forest policy - making and planning.

Forest management needs to be based on a number of considerations (including possible prices) and not just world timber prices alone. It is extremely difficult to predict future world prices for different types of wood. These prices can fluctuate markedly over time and can vary from region to region. Exchange rate uncertainties also make predictions of future world prices in Australian dollars difficult.

Other

There are other comments that Dr Pannell has made but it would serve little purpose to comment on all of them. It is pleasing that he has found the CALM consumption forecasts plausible and that there may be little scope, if any, to improve the predictive power of the model. Note that a similar model was developed in 1982 and its validity was endorsed by Professor Peter Phillips of the Economics Department of Yale University (USA) when I was Visiting Fellow at the institution in 1984.

Dr George Malajczuk
DIRECTOR OF ECONOMICS

17 December, 1992

Appendix IV - Review of the New Jarrah Inventory System and Associated Timber Estimation Procedures by Dr Brian Turner and Dr Geoff Wood, 8 January 1993.

Overleaf.

SENT BY:AUST NAT UNIV CANB ; 8- 1-93 ; 2:04PM ; Forestry Department

Review of the New Jarrah Inventory System and Associated Timber Estimation Procedures

by

Dr Brian Turner and Dr Geoff Wood

Department of Forestry
Australian National University
Canberra, ACT

8 January, 1993

This report is submitted to the Environmental Protection Act Appeals Committee in response to a request for an independent review of the ability of the new jarrah inventory and associated systems to "provide policy makers, forest managers and informed members of the public with reliable estimates" (FAX from T. Barnett to Professor Bachelard, 11/12/1992) on such matters as gross bole and sawlog volumes, growth rates and allowable cuts.

We wish to emphasise that our check of the new jarrah inventory system (Spencer 1992)[1] and of the growth data base and of the procedures used for modelling growth and yield has, of necessity, been cursory. We have concentrated on matters likely to affect the validity of the estimates derived from both the inventory and the modelling processes.

Inventory Design

Examination of Spencer (1992) indicates that CALM Officers gave considerable thought to a range of options before adopting a sampling design and associated sampling and measurement procedures which would provide the resource data needed to manage efficiently the jarrah forest resource.

The rationales for choosing for inventory a two-phase (double) sampling design in a systematic layout without stratification, and for describing features of tree boles in detail in the 2nd-phase sample as a basis for determining product assortments (rather than relying on the expert knowledge of experienced assessors of timber products within a tree bole), are both sound and justifiable. We are pleased to note that the Department of CALM is conducting sawmill studies to try to develop stronger correlations between the external bole features and internal wood characteristics of trees in an attempt to improve the prediction of product assortments from the inventory.

The assumptions made about the coefficients of variation (CVs) of the estimates in the two phases of sampling, viz. of gross bole volume from the photo samples (70%) and of the ratios of ground estimates to photo estimates (50%) are also reasonable and acceptable. These CVs can now be refined given that the first inventory has been completed. However, it appears from Spencer (1992, p. 11-12) that the desirable size of sample in the two phases was derived using the formula for two-stage rather than two-phase sampling, namely:

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1 Spencer, R.D. (ed.). 1992. Application of modern inventory techniques in the forests of Western Australia. Occasional Paper 1/92, Department of Conservation and Land Management, West Australia. 85 pp.

$$E = \sqrt{[C_1^2 t_1^2 / n_1 + C_2^2 t_2^2 / n_2]}, \qquad \text{Formula 1}$$

$$\text{thus, } n_2 = C_2^2 t_2^2 n_1 / [E^2 n_1 - C_1^2 t_1^2], \qquad \text{Formula 2}$$

where E = desired precision of estimate (%) of sawlog volume for areas of 10 000 ha
C_1, C_2 = CVs (%) of the 1st- and 2nd-stage samples respectively
n_1, n_2 = size of sample in the 1st- and 2nd-stage respectively
t_1, t_2 = Student's t-statistic for the 1st- and 2nd-stage respectively.

Accepting that C_1 = 70%, C_2 = 50%, E = ±25%, and t_1, t_2 = 2, the computed sizes of the 2nd-stage sample, n_2, for nominated sizes of the 1st-stage sample, n_1, are:

n_1	n_2	n_2'
10000	16.1 (16)	17.7 (18)
500	17.1 (17)	18.6 (19)
300	17.9 (18)	19.2 (19)
200	19.0 (19)[2]	20.0 (20)
150	20.2 (20)	21.0 (21)
100	23.3 (23)	23.1 (23)

Theoretically, all of the listed combinations of n_1, n_2 in the table above would give a precision of estimate that meets the design criterion. To check the validity of these combinations when the correct formula for two-phase sampling with ratio estimation is used (see Cochran 1977[3]), we rearranged Cochrane's Formula 12.72' as follows:

$$n_2' = [S_y^2 - 2RS_{yx} + R^2 S_x^2] \,/\, \{[V(\bar{y}_R) - S_y^2 / N - [2RS_{yx} - R^2 S_x^2] / n_1\} \qquad \text{Formula 3}$$

where n_2' = number of ground plots in the 2nd-phase sample
n_1 = number of photo plots in the 1st-phase sample
N = number of sample units in the population
R = $\bar{y}_2 / \bar{x}_2$, where $\bar{y}_2$ and $\bar{x}_2$ are the means of y and x, the variables measured in the 2nd-phase sample
S_x^2 = variance of x in the 2nd-phase sample
S_y^2 = variance of y in the 2nd-phase sample
S_{yx} = covariance of y and x in the 2nd-phase sample
$V(\bar{y}_R)$ = variance of the ratio estimate of $\bar{y}$, the population estimate.

We then used real inventory data supplied by CALM (from 'the Ross Block') and substituted them into Formula 3. The results listed under n_2' in the table above indicate that the values have changed only marginally from the n_2 derived using the incorrect Formula 2.

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[2] The combination chosen by CALM was n_1 = 200, n_2 = 20. The exact values of t_1 and t_2 for this option are 1.97/199 dfs and 2.093/19 dfs respectively.

[3] Cochran, W.G. 1977. Sampling Techniques. 3rd ed. John Wiley & Sons Inc. 428 pp.

Thus, the combination of 200 1st-phase and 20 2nd-phase plots chosen by CALM as the basis of the new jarrah inventory is entirely appropriate.

We note that relative costs of the first and second phases of sampling were not known and were not considered in determining the desirable size of sample for the inventory. Although these costs now will be known, they are unlikely to be of consequence in determining the optimum size of sample as the table above demonstrates clearly that n_2 (the costly ground sampling phase) is relatively insensitive to changes in n_1. In any case, a minimum size for n_2 of about 20 ground plots is necessary to ensure that sufficient sample trees are available to provide the information required on product assortments. In any future consideration of improving the design of the jarrah inventory, it would be prudent for CALM staff to review some of the principles contained in the recently published paper of Oderwald and Jones (1992)[4].

It should be clearly understood that the precision of estimate of sawlog volume (±25%) attained by the inventory over a 10 000 ha block of forest will be much better than that attained for the estimates of the other component wood products/log assortments. If better precision is ever required in these latter estimates, n_2 should be increased (while possibly leaving n_1 unchanged) because, as indicated above, it is only from the 2nd-phase sample that volumes of the various wood products can be estimated.

Field Procedures

A key constraint determining the reliability of estimates derived from double sampling is the level of success achieved by field crews in locating accurately on the ground the centres of the 2nd-phase ground plots, matching them with the centres of the 1st-phase photo plots. We are confident that the field procedures described in Sections 3.4, 5.1 and 5.2 of Spencer (1992) meet this constraint. The rest of the procedures applied in the ground-measurement phase of the inventory and described in Section 5 of Spencer (1992) are sound.

A number of the procedures underpinning the new jarrah forest inventory, e.g. the aerial photographic and photo-measurement methods and the new technique developed to estimate product types, are innovative and practical, and will be of considerable interest and benefit to resource scientists. The combined system developed by CALM staff incorporating the forest inventory, GPS receivers, GIS integration of data, and the estimation technique for log products, is indeed a very powerful planning tool of which, justifiably, the Department can be proud.

Bole Volume Function and Basic Data Processing Algorithms

Bole volumes in the first phase of the new jarrah inventory are estimated from an exponential relationship previously established between bole volume and total tree height. The relationship is based on a small sample (data base) of 112 trees drawn from the Collie area (Spencer 1992, p. 8-9). These 1st-phase volumes are then corrected using the more accurate estimates derived from the 2nd-phase ground plots. The restricted sample underpinning the 1st-phase estimate is unlikely to bias this estimate but it will affect its precision. It is recommended that this data base be expanded over time to help improve the efficiency of the inventory.

[4] Oderwald, R.G. and Jones, E. 1992. Samples sizes for point, double sampling. Canadian Journal of Forest Research 22 (7): 980-983.

A matter of concern with any set of photo-measurement data is the possibility of bias on the part of one or more photo interpreters. This problem is well covered in the jarrah forest inventory by the procedures used to monitor the performance of the interpreters (refer Spencer 1992, Section 4.6).

Data Integration and Analysis

Section 6 of Spencer (1992) describes the procedures used to integrate and process the data derived from the jarrah inventory. Parts of this section are difficult to comprehend due to poor English expression and description, e.g. the last paragraph of Sub-Section 6.2.3. Despite this, we are able to follow the gist of the story and are satisfied that the procedures used to process the data are sound.

Area Estimation

Accurate estimation of total volumes in a forest depend as much on the precision of estimation of land areas as on that of current and future volumes per hectare. CALM is justifiably proud of its long involvement in GIS technology and is able to use it effectively to rapidly update areas available for timber production (e.g., Spencer 1992, p. 51-53). Since the inventory has a systematic design, plots which are subsequently designated in non-production areas can be eliminated and the statistics recalculated. Thus, our expectation is that the area statistics are accurate and up-to-date. We note the proposed amendment of the operable area of jarrah/marri to 1.239 million hectares (CALM 1992a[5], p. 27) from 1.324 million hectares (CALM 1987[6], p. 17). Presumably, this reflects recent conversions from state forest to conservation areas and exclusion of stream buffers from production status. However, proposed new silvicultural guide-lines mandate the preservation from logging of additional areas, such as Special Visual Resource Management Areas (permanently) or wildlife corridors (temporarily) (CALM 1992a, App. A, p. 3-5). It is also proposed that areas of very low timber productivity which will be too expensive to adequately regenerate should not be harvested (CALM 1992a, App. A, p. 7). It is not clear how much of these proposed reservations has been taken into account in the reduced operable area.

Growth Data

In order to estimate changes in the jarrah forest resource it is necessary to predict the growth of the forest. Future growth can be estimated from the patterns of past growth. As noted by Abbott and Loneragan (1983)[7], past growth can be measured by: (a) periodic measurement of individual trees over their life; (b) growth ring analysis from destructive sampling of sample trees; or (c) periodic measurement of trees or stands over long enough periods that the patterns of growth can be deduced. Most of the data available on jarrah that can be used for growth analysis come from source (c).

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5 CALM. 1992a. Proposals to amend the 1987 forest management plans and timber strategy and proposals to meet ministerial conditions on the regional plans and WACAP ERMP. Department of Conservation and Land Management, West Australia.

6 CALM. 1987. Timber production in Western Australia. Department of Conservation and Land Management, West Australia.

7 Abbott , I. and Loneragan , O. 1983. Growth rate of jarrah (*Eucalyptus marginata*) in relation to site quality in cut-over forest, Western Australia. Aust. For. 46: 91-102.

Abbott and Loneragan (1986)[8] give an extensive description of growth data (p. 33-51) and the factors which affect the rate of growth. Since the method used for yield regulation is based only on the rate of diameter growth, only this is considered here.

Estimates of diameter growth at breast height range up to about 1.5 cm/yr but " the most recent authoritative estimate for" fully stocked stands of high quality jarrah forest "is 0.17 cm/yr, with a range of 0.09-0.25 cm/yr" (Abbott and Loneragan 1986, p. 35). They point out that "there is a strong negative correlation between stand basal area and diameter growth" (citing Abbott and Loneragan 1983) for high quality stands, although not for low quality forest where the increment averaged 0.10 cm/yr. Standard errors on these means were 0.012 cm and 0.014 cm respectively.

The yield regulation method used by CALM assumes that the primary determinant of diameter increment is the current diameter at breast height (dbh) of the tree. Abbott and Loneragan (1986) developed regressions for estimating dbh under bark (ub) at a second measurement from dbhub at a first measurement for 21 stands scattered over the jarrah region. These stands were first measured in the 1950's or before and remeasured in the early 1980's, thus representing 30 or more years of growth. Correlations were high (r=0.88+ for plots containing from 19 to 65 trees). Average diameter growth for high quality forest as estimated from these models ranged from about 0.3 cm/yr for 10 cm trees to 0.03 cm/yr for 100 cm trees, "indicating that trees of smaller diameters (e.g. poles) grow slightly more rapidly than trees of larger diameter" (Abbott and Loneragan 1986, p. 37), a fact which they attribute "most likely" to the greater age of larger trees. However they assert that "in more or less even aged stands ... the larger diameter classes show faster growth".

Other factors which have been shown to affect diameter growth are *seeding* (production of flowers and seeds) which "reduces the diameter growth of pole-sized jarrah" (Abbott and Loneragan 1986, p. 38); *fire* (mild fires seem to have no effect but "moderate to high intensity fires in some cases accelerate d.u.b. growth" (p. 39)); and *intraspecific competition* which "curtails diameter growth" (p. 40). Thinning increases diameter growth in more or less even aged stands roughly in proportion to the thinning intensity. The pattern and magnitude of diameter growth over time in cut-over stands does not appear to differ from that in virgin stands (p. 41).

Growth Prediction

The growth data which have been used by CALM in their prediction process derive from the 22 stands mentioned above (see Growth Data). We presume that the choice was based on a number of factors including the long period over which measurements were made (30+ years), their geographic spread, and their range in site quality and initial diameters, all important considerations. They also seem representative in terms of diameter growth rates, as indicated above.

The average growth rates for these stands (for high and low productivity forests separately) were calculated for the range of diameter classes and used as a guide to derive the curves shown in Fig 19 of CALM (1992b)[9] (p. 172). The average relationships are linear, a result of the fitted simple linear regressions, but the increments of small trees have been reduced and those of the large trees have been increased somewhat, presumably to fit silvicultural expectations about the species. A curve for average productivity has been estimated between the high and low productivity curves and values are given in Table 1. These are the

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[8] Abbott , I. and Loneragan ,O. 1986. Ecology of jarrah (*Eucalyptus marginata*) in the northern jarrah forest of Western Australia. Bull. 1, Department of Conservation and Land Management, West Australia.

[9] CALM. 1992b. Management strategies for the south-west forests of Western Australia. Department of Conservation and Land Management, West Australia.

diameter growth data used to project the current diameter distribution into the future (Biggs, pers. comm)[10]. How this is done is covered under **Yield Regulation**.

Table 1. Average diameter growth rates (Di) for given Dbhubs, from Fig 19 of CALM (1992b).

Dbhub (cm)	15	25	35	45	55	65	75	85	95	105	115	125	135	145
Di (cm/yr)	0.22	0.21	0.20	0.18	0.15	0.12	0.10	0.08	0.07	0.06	0.06	0.06	0.05	0.05

We have tried to gain some understanding of how the curves of Fig 19 of CALM (1992b) have been derived from the linear regression models of Table 10 of Abbott and Loneragan (1986, p. 38). Estimates of annual diameter growth rates were calculated from the models for each of the 21 stands listed, for a range of initial dbhub classes. The unweighted averages of these (separately for the 15 high quality stands and the 6 low quality stands) were then calculated and are shown in Table 2.

Table 2. Average diameter growth rates (Di) for given Dbhubs, derived from Abbott and Loneragan (1986), Table 10.

Dbhub (cm) (limits of initial data)	15	25	35	45	55	65	75	85	95
Di (cm/yr) ---High quality forest	0.28	0.25	0.22	0.20	0.17	0.14	0.11	0.09	0.06
Di (cm/yr) ---Low quality forest	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09

When the two Tables are compared it can be seen that the values of Table 1 mostly fit within the upper and lower values of Table 2, but the curvilinear relationship evident in Table 1 is not derivable from Table 2 where the relationships are strictly linear.

Predictions are based on the assumption that conditions which affected the growth of individual trees in the past will continue to pertain in the future. Factors which may change and affect growth rates are:

- higher stocking densities may be retained in future for wildlife habitat
- weather patterns over the period of prediction may differ from those over the measurement period
- climate may change in the long term (but effects are difficult to predict)

Yield Regulation

Prediction of future wood yields from the jarrah forests is predicated on a policy decision that the desirable structure of the forest to be maintained in perpetuity is the current average structure of the forest (CALM 1992a, p. 14). This structure is defined by the frequency distribution of trees by diameter classes given in Table 22 of CALM 1992b, p. 172. The harvestable component of a stand is thus that which is in excess of this desirable distribution.

[10] Biggs, P. Department of Conservation and Land Management, West Australia.

Using the matrix method of Usher (1966)[11] (essentially a modernisation of the stand projection method but applied on an annual update basis), it is possible to determine the cutting pattern which will retain any desirable distribution (i.e., stand table) (Campbell, pers. comm[12]). The gross bole volumes of these harvestable trees by diameter classes are estimated and used to develop the total volumes of removable stems by diameter classes. These are calculated by forest units to allow for geographic variations in tree volumes. Finally the per hectare figures are expanded by the appropriate areas to give total harvestable gross volumes for any specified forest unit.

We were not supplied with information as to how gross bole volumes were ascribed to trees of particular diameters. Presumably, one-way tree volume tables are available to predict volumes from diameters within forest units.

A matrix of species and log product ratios allows the gross bole volume yield in each diameter class to be partitioned into species and log product components. "The ratios were derived from the jarrah inventory and were specific to the forest unit under consideration" (Campbell, pers. comm).

Items Needing Further Consideration or Action

In our review, we have identified a number of items which present current problems or difficulties or about which we had inadequate information but which might require reconsideration or at least, documentation. For convenience, these are gathered together in this section.

1. The formula used to estimate sample sizes for the two-phase sampling scheme should be corrected.

2. Improved precision in estimating product assortments or volumes on areas smaller than 10 000 ha will require a much higher 2nd-phase sampling rate.

3. The database used to relate bole volume to total tree height should be expanded over time so that the efficiency of 1st-phase sampling can be improved.

4. Any bias in photointerpretation has serious consequences and should be continually monitored.

5. Any change in the land base of forest available for timber production will affect inventory levels and thus sustainable yields. Many of the 1992 proposals involve changes in this production base. Care is essential to ensure that all of these changes are accounted for.

6. Most of the growth data have been collected for jarrah species only, presumably because in the past other species were considered non-merchantable. This is no longer the case. For example, 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.

7. The way in which the average diameter growth rates used in yield calculations have been derived from the empirical data needs clarification and documentation.

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11 Usher, M.B. 1966. A matrix approach to the management of renewable resources, with special reference to selection forests. J. Applied Ecology 3: 355-367.

12 Campbell, H. Department of Conservation and Land Management, West Australia.

8. The most desirable structure of the forest depends on the management objectives. For example, the optimum structure if timber production is to be maximised will differ from that which will maximise conservation objectives. It seems likely that maintaining the existing structure will offer a compromise between these extremes since the forest is currently a mixture of cut-over and virgin forest. Conservation objectives may be better served by maintaining the structure of virgin forests. It is not clear how different these are and some sensitivity analysis might be illuminating.

9. The practical implications of the proposed approach to yield regulation need careful consideration. For example, a stand table projection of the existing distribution of trees by diameter classes over the next ten years suggests that if the current distribution is to be retained, about 2/3 of the stems to be removed will be in the 20-30 cm dbh class. Although this analysis is not as rigorous as that using the Usher algorithm, it indicates the need for a market for this small material.

10. The critical nature of the new algorithm for defining product assortments from the inventory is evident. This defines what proportion of the sustainable yield is expected to be in sawlogs, by grades. Careful monitoring of this procedure is essential.

Concluding Remarks

We note that the proposed sustainable yield of gross bole volume is substantially higher than the previous accepted projected supply. The latter (CALM 1987, p. 42, 49) projected a generally decreasing supply of sawlogs from the jarrah forests, from 523 000 m^3 in 1992-1995 to 239 000 m^3 in about 2030. The proposed sustainable yield is a constant 1 360 000 m^3 of jarrah and 469 000 m^3 of marri (CALM 1992a, p. 29). These latter figures, however, include significant volumes of non-sawlog material. More comparable figures are 675 000 m^3 of jarrah and 57 000 m^3 of marri sawlogs (1992-2001). Further differences are due to somewhat different definitions of sawlogs and increased utilisation of bole volume resulting in significant increases in the quantity of lower grade logs. (We note that estimated supply of first grade logs for 1992-1995 was previously 400 000 m^3 and the proposed sustainable yield of first grade logs is 459 000 m^3.)

The differences noted above reflect the substantially higher sawlog volumes estimated in the recent inventory (57.2 million m^3) (CALM 1992a, p. 27) compared with the 18.25 million m^3 estimated in the previous inventory (CALM 1987, p. 17). The annual sawlog harvest for the 1992-1995 period would be 2.9% of the sawlog resource according to the 1987 Strategy as compared with 1.3% of the sawlog resource using the recent inventory and the proposed sustainable yield. Thus, the proposed increase in potential sawlog harvest would come from a significant increase in utilisation, not from an increase in proportion of the forest harvested.

In summary, we are very impressed with the care with which the jarrah inventory has been designed and, as indicated by the results, executed. We have suggested a correction to the sampling intensity calculation (which has negligible impact on the results) and possible increases in the 2nd-phase sampling intensity to improve precision if the inventory is to be used at the operational, as opposed to the strategic, level. The significant impact of product outturn estimates on the sustainable yield calculations is noted and this highlights the importance of gaining high precision in these estimates. The approach being used by CALM seems a much-needed advance, but is innovative and thus needs careful monitoring. Precise estimation of land areas is also important to the overall inventory. Frequent updating of the area statistics to account for changes in the production forest base is essential. Fortunately, CALM's extensive experience with GIS means that the ability to make these

rapid updates is available, but care is needed to ensure that all current and anticipated future changes are made.

Successful yield regulation depends on a precise inventory (which we believe now exists, at least at the strategic level) and good growth information. Existing growth information has been extensively reviewed, so we have no doubt that the best possible data set has been used for growth projections. However, this data set has some deficiencies which are not easy to overcome in the short term. For example, little information is available on species other than jarrah. The diameter growth data used in projections, although consistent with other evidence, seem to have been derived from sources (perhaps non-empirical) additional to the data set indicated as the source, and this should be carefully documented. The method of yield projection used by CALM is appropriate to the type of growth data available but more advanced tree growth models should be developed as better data are acquired. The concept of using a steady-state diameter distribution to define a desirable ecosystem structure is an interesting and useful advance in the definition of sustainability, and provides a useful platform for yield regulation. Our spot checks of these calculations indicate that the methodology has been applied correctly.

Assuming the acceptability of the assumptions underlying the sustainable yield approach, we believe that the methodology used by CALM is appropriate and essentially correct. The methodology specifies not only the volume to be removed to achieve sustainability but also the size distribution of removals. This has implications for utilisation, marketing and silviculture which have been mentioned in part but are beyond the scope of this report. However, the success of the yield regulation system depends on its correct implementation. Careful and continuous monitoring of the relationship between predicted and actual distributions and yields will be essential.

Signed: .....

Brian J. Turner
Reader, Dept. of Forestry, ANU

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Geoff B. Wood
Reader, Dept. of Forestry, ANU

8 January 1993