Conservation Commission
of Western Australia

Forest Forum

Science and Forest Management

Murdoch University

Perth, Western Australia

26th March, 2002

PROGRAM AND SPEAKERS

Time	*Session*	*Presenter*
From 7:30 am	Registration, tea and coffee available	
8:50 am	**Introduction and welcome**	Dr John Bailey Ms Colma Keating
	Opening	Hon. Dr Judy Edwards, Minister for Environment and Heritage
	Process of development of the new Forest Management Plan.	Dr John Bailey
	Principles and objectives of ecologically sustainable forest management (ESFM) and how the new Forest Management Plan proposes to apply these principles.	Dr Joanna Young
9:50 am	**Maintaining biodiversity**	**Dr Libby Mattiske**
	Viewpoint one	Dr Neil Burrows
	Viewpoint two	Dr David Lindenmayer
	Discussion	
10:50 am	Morning tea	
11:20 am	**Maintaining ecosystem health and vitality**	**Professor Richard Hobbs**
	Viewpoint one	Dr Peter Attiwill and Professor Mark Adams
	Viewpoint two	Dr Mike Calver and Dr Grant Wardell-Johnson
	Discussion	
12:20 pm	Lunch	
1:20 pm	**Maintaining soil and water resources**	**Professor Jonathan Majer**
	Viewpoint one	Mr John Ruprecht, Dr Kerry Trayler and Dr Stuart Halse
	Viewpoint two	Dr John Raison
	Discussion	
2:20 pm	**Contributing to the new Forest Management Plan**	
	Briefing on concurrent sessions	Ms Colma Keating
2:30 pm	Concurrent breakout groups to identify where substantive agreement exists for strengths and weaknesses in the proposed mechanisms for maintaining the objectives, strategies and performance measures for: (i) biodiversity; (ii) ecosystem health and vitality; and (iii) soil and water resources.	Chairs and rapporteurs
	Key points from breakouts	Rapporteurs
3:50 pm	Afternoon tea	
4:10 pm	Concurrent breakout groups to address perceived weaknesses, and suggest mechanisms and research priorities to resolve issues of substantive scientific uncertainty in relation to the maintenance of best practice, the precautionary principle and scientific confidence in: (i) biodiversity; (ii) ecosystem health and vitality; and (iii) soil and water resources.	Chairs and rapporteurs
	Key points from breakouts	Rapporteurs
5:30 pm	Summary of afternoon sessions and general discussion including process for ongoing contributions and development of a communiqué from the forum.	
6:00 pm	Close and refreshments.	

Conservation Commission of Western Australia

SCIENCE FORUM

SCIENCE AND FOREST MANAGEMENT

Objective: To involve the scientific community in the development of the new management plan covering the south-west forests to ensure that the scientific and the wider community have confidence in its processes and outcomes.

Loneragan Lecture Theatre
Murdoch University
Tuesday 26th March, 2002

This Science Forum has been convened by a working group comprising Associate Professor Jenny Davis, Dr Geoff Stoneman, and Associate Professor Pierre Horwitz (representing the government agencies Conservation Commission of Western Australia, and the Department of Conservation and Land Management and the non-government organisation the Conservation Council of Western Australia, respectively).

OBJECTIVES OF THE SCIENCE FORUM

To facilitate a process that will:

- outline to participants procedural mechanisms that will allow their input in the development of the new management plan; and
- involve relevant sectors of the scientific community in the application of the principles of ecologically sustainable forest management.

To ensure that a range of scientific viewpoints is presented on the application of the principles and objectives of ecologically sustainable forest management (ESFM), with a focus on maintaining:

- biodiversity;
- ecosystem health and vitality; and
- soil and water.

For these three sustainability criteria, the forum will focus on:

- establishing appropriate objectives and strategies;
- establishing performance measures that will contribute to adaptive management,
- applying the precautionary principle;
- 'best practice' mechanisms for application to the south west region; and
- identifying areas of scientific confidence and uncertainty and areas requiring further research and development.

SPEAKER SESSION FORMAT AND PURPOSE

The discursive format will allow for two viewpoints to be presented to the audience for each topic, and then for the audience to engage in a process of identifying areas of agreement, areas in need of resolution, and strengths and weaknesses in proposed approaches. For each of the topics, biodiversity, ecosystem health and vitality, soil and water, speakers and the audience will be asked to address the following components:

- An evaluation of the proposed objectives and strategies for the new management plan;
- Comment of possible performance measures, noting they should be aimed to contribute to adaptive management and be cost effective?;
- Means to ensure the application of the precautionary principle;
- Do the objectives, strategies and performance measures constitute best practice, and what are areas of strengths and weaknesses?; and
- What further work is necessary?

Each topic will last for one hour, two-thirds of the time allocated to speakers for presentations and the remainder for questions from the floor.

Papers will be electronically circulated to registrants one week prior to the forum.

WORKSHOP FORMAT AND PURPOSE

Workshop sessions will be designed to identify perceived strengths and weaknesses in each of the three topics, particularly in light of the precautionary principle, and the choice of performance measures. Results of facilitated discussions will be reported to a plenary session.

The final session will use the same format to propose mechanisms to address areas of perceived weakness and scientific uncertainty.

Venue: Loneragan Lecture Theatre, Murdoch University

Date: Tuesday 26th March, 2002

- RSVP: By Tuesday 19th March, 2002 to
  Marie Hauxby,
  Public Involvement Coordinator,
  Conservation Commission of WA
- Registration: Please quote the name, organization, and email of attendees.
- Cost: $22 and $11 concessions, (incl GST) which includes morning and afternoon tea and lunch,
- Address: PO Box 3105 Broadway, Nedlands, WA 6009
- Phone (Metro): (08) 9389 7154,
- Phone (Country): 1300 65 7154 (local call charge)
- Fax: (08) 9389 8603
- Email: marieh@conservation.wa.gov.au

A Discussion Paper for the new FMP is now available: at www.conservation.wa.gov.au, under Forest Management; by collection at Department of Conservation and Land Management offices in the south-west; or upon request from Ms Hauxby.

Conservation Commission of Western Australia

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Conservation Commission of Western Australia

1 Forum Agenda

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2:20 pm	Contributing to the new Forest Management Plan	
	Briefing on concurrent sessions	Ms Colma Keating

2:30 pm	Concurrent breakout groups to identify where substantive agreement exists for strengths and weaknesses in the proposed approaches (objectives/strategies/performance indicators) for maintaining: biodiversity; ecosystem health and vitality; and soil and water resources.	Chairs and rapporteurs
	Key points from breakouts	Rapporteurs
3:50 pm	Afternoon tea	
4:10 pm	Concurrent breakout groups to address perceived weaknesses, and suggest approaches to address percieved weaknesses in relation to: Biodiversity; Ecosystem health and vitality; and soil and water resources.	Chairs and rapporteurs
	Key points from breakouts	Rapporteurs
5:30 pm	Summary of afternoon sessions and general discussion including process for ongoing contributions and development of a communiqué from the forum.	Professor Richard Hobbs and Dr Ray Wills
6:00 pm	Thanking of attendees	Dr John Bailey
6:00 pm	Close and refreshments.	

2 Process of Development of the New Forest Management Plan

Dr John Bailey

Chair, Conservation Commission of Western Australia

2.1 Abstract

This paper will outline the process being undertaken by the Conservation Commission of Western Australia in fulfilment of its legislative requirement to produce a management plan for the forest ecosystems in the southwest of Western Australia. It will detail the purposes for which the forest is to be managed, the Conservation Commission's relationship with other bodies in this regard and their respective roles in the process. It will give details of the public consultation being undertaken during the development of the Plan, the various independent reviews, and the approval process from now on.

2.2 Introduction

For the first time, the Conservation Commission of Western Australia (the Conservation Commission) will be the proponent of a Forest Management Plan. The Conservation Commission, which was established in November 2000 under the *Conservation and Land Management Act 1984* (the CLM Act), has vested in it the conservation estate and also State forest and timber reserves. The CLM Act provides for the Conservation Commission to prepare, conduct public consultation, and submit for approval by the Minister for the Environment and Heritage, management plans for the land vested in it. The CLM Act further provides for the Department of Conservation and Land Management (the Department) to manage these lands on behalf of the Conservation Commission according to those operations prescribed in management plans.

This change of responsibility has enabled the Conservation Commission to take a fresh approach to forest management for the forest ecosystems of the southwest of Western Australia. In developing the Forest Management Plan for the Conservation Commission, the Department acts jointly with the Forest Products Commission in respect of State forest and timber reserves and the Water and Rivers Commission and the Water Corporation in respect of public water catchment areas.

The new Forest Management Plan will be a regional management plan. It will apply within the geographic area of the Swan, South-West and Warren Regions of the Department other than marine waters. The boundaries of the proposed plan area differ from those of the Regional Forest Agreement because that process was focused on the tall forests whereas the new plan is intended to cover the Department's administrative regions.

The new plan will build on the Forest Management Plan 1993-2004 by giving effect to the Government's *Protecting our old-growth forests* policy.

Under the CLM Act principles for ecologically sustainable forest management are specified. After the expansion of the conservation estate within the forest ecosystems of the southwest, perhaps the most significant determinant of the new Forest Management Plan will be these principles. Dr Joanna Young will talk to these principles next. In brief, the application of these principles will lead to significant changes to forest management.

To explore the implications of ecologically sustainable forest management the Conservation Commission intends to explore a range of options within the draft Forest Management Plan. The Commission is keen to encourage public and scientific discussion on the philosophy or paradigm that should underpin the objectives and strategies for forest management. That is for example, given the imprecision inherent in a concept such as ecologically sustainable forest management how precautionary should forest management be when placed alongside the existing and proposed conservation estate. This is a crucial question since different responses will lead to different sustained yields for timber.

From the outset, the Conservation Commission has sought to involve the general community in the planning process, through public meetings and disseminating information and inputs via its web page.

The Minister for Environment and Heritage has established a Round Table of key stakeholders, who meet regularly and are briefed on the development of the plan.

The key steps in the planning process for the development of the new Forest Management Plan are outlined below:

In January the Conservation Commission released a Discussion Paper (Conservation Commission 2002) for public comment for a period of two months, which had been developed through the agency of the Department with input from other Government agencies, including the FPC, and considering community input provided at forums, the Round Table and individual submissions.

Public comment on the Discussion Paper will be considered in developing the Draft Forest Management Plan which will be distributed to relevant Ministers, local government and released for community comment in July 2002.

Comments will be assessed by the Conservation Commission, considering the interests of the FPC and water agencies for incorporation in the Final Forest Management Plan.

The Environmental Protection Authority (EPA) will then assess the Final Forest Management Plan (based in part on the public comments received by the Conservation Commission and shared with the EPA) and advise the Minister for Environment and Heritage.

Under the *Environmental Protection Act 1986*; there will then be a period during which appeals can be lodged with the Minister.

Once any appeals have been determined the Minister then approves the plan in the context of EPA recommendations.

Details of content and stages are given below.

2.3 Scope and purpose

The plan will cover in detail the management of existing State forest and timber reserves vested in the Conservation Commission that will remain as such following full implementation of the conservation reserves proposed by Government. It will also cover freehold land held in the name of the Executive Director of the Department, that contains native vegetation, which while not vested in the Conservation Commission, will be taken into account because its productive capacity contributes to the sustained timber yield figures. The plan will not cover the management of existing or proposed nature reserves, national parks, conservation parks or other land that has a conservation purpose.

State forest and freehold land held in the name of the Executive Director that is planted with exotic species for commercial production are not covered in detail in the plan; nor are CLM Act marine conservation reserves, as these are not vested in the Conservation Commission.

The plan will not address the pricing and allocation of harvested timber, as these matters are the responsibility of the Forest Products Commission. Nevertheless, they are important to the plan because the pricing structure for forest products set by the Forest Products Commission is required to ensure the long-term viability of the forest products industry and cover the cost of management of the forest products located on public land.

The purpose of the plan is to outline the objectives, strategies and operational details for the management of State forest and timber reserves as required by the CLM Act. The plan will operate for 10 years from the date it is approved by the Minister for the Environment and Heritage. Once approved, the plan will revoke the Forest Management Plan 1994-2003 and those parts of the three 1987 Regional (Northern Forest, Central Forest and Southern Forest) Management Plans that were current during the life of the Forest Management Plan 1994-2003. The new plan will authorise existing contractual agreements for timber supply let under the Forest Management Plan 1994-2003 until 31 December 2003, as necessary.

The Conservation Commission is committed to the development of an adaptive management plan which will result in progressive refinement of the Plan's strategies in response to new information. The Commission is particularly keen to receive input from the Science Forum and individual scientists to help in putting this approach into effect. To achieve this goal will require the selection of management focussed performance measures and indicators and the development of response strategies.

2.4 Contributing processes/inputs

2.4.1 Technical input

Several formal technical reviews and decision-making processes have been set up specifically to provide input to the development of the plan but are not yet complete. In addition, a number of recent past reviews are available for input.

2.4.2 Specifically commissioned input

- The Independent Expert Panel review of the sustained yield of timber in the context of ESFM (Ferguson *et al.* 2001).
- The review by the Water and Rivers Commission of stream and river timber harvesting buffers to ensure their adequacy in protecting waterways from salinity, degradation and turbidity (Water and Rivers Commission 2001).
- The assessment of the scientific, economic and community values and the impact of timber harvesting on salinity of the proposed 25,000 hectare expansion of the Wellington National Park near Collie, Palmer and Leach blocks near Collie, and Helms block near Nannup (URS Australia 2001).
- The report of the review committee in relation to Ministerial Condition 11 (jarrah silviculture) on the implementation of the Forest Management Plan 1994-2003.
- The assessment of high conservation value forest.
- A review of data and map information used in the calculation of sustained timber yield for the new Forest Management Plan.
- A socio-economic impact study of the draft Forest management Plan.

2.4.3 Community input

In order to ensure the community is keep informed of the process and to allow for public input, the Conservation Commission has appointed a public involvement coordinator to manage this process, which began in mid 2001 with public displays in centres across the southwest.

The Conservation Commission held five public meetings in 2001 to assist the development of the draft plan. A Round Table group of stakeholders also meets regularly and provides input. Many issues have been raised at these meetings. They have been summarised and are available on the Conservation Commission website, together with other information about the development of the new Forest Management Plan.

Public comment has been sought on the Discussion Paper released in January, and further public forums will be held after the draft Forest Management Plan is released. It is likely that the public will comment on the proposed reserve system as well as forest management.

Today's Science Forum is being held to engage the scientific community in the development of the plan. The Forum's objectives are:

to outline the mechanisms that will allow participants today to provide input into the development of the new Forest Management Plan; and

to involve attendants in the application of the principles of ecologically sustainable forest management.

2.4.4 *Environmental Protection Authority involvement*

Where a proposal is likely to have a significant effect on the environment, such as a proposed forest management plan, Part IV of the *Environmental Protection Act 1986* (EP Act) provides for a decision by the EPA on whether the proposal should be assessed. Where the EPA assesses a proposal, the EP Act provides the mechanism for a decision by the Minister for the Environment and Heritage on whether, and under what conditions, the proposal may be implemented. The EPA will assess the final Forest Management Plan commencing around December. The public and agency comments received on the draft Forest Management Plan will be shared with the EPA thereby avoiding the need for a second round of public submissions.

Once the Minister has approved the plan, notice will be given in the *Government Gazette* and the plan is operative from that date or a later date specified in the plan.

2.5 Conclusions

The Conservation Commission is anticipating that input from this Forum will enhance the new Forest Management Plan by contributing to the development of appropriate objectives and strategies and the establishment of performance measures which in turn will contribute to adaptive management. It is hopeful that areas of scientific concurrence will be identified, as well as areas which require further research and the development of additional means to achieve ecologically sustainable forest management.

2.6 References

Conservation Commission of Western Australia, Forest Management : Scoping Document for the Preparation of the next Forest Management Plan.

Conservation Commission of Western Australia, A new forest management plan for Western Australia: Discussion Paper January 2002

3 Objectives and Strategies contained in "A new forest management plan for Western Australia - Discussion paper - January 2002"

The following extracts from the discussion paper cover the objectives and strategies in relation to maintenance of:

- Biological diversity;
- Ecosystem health and vitality; and
- Soil and water resources.

The discussion paper also includes objectives and strategies under the criteria:

- Productive capacity of ecosystems;
- Global carbon cycles;
- Natural and cultural heritage values; and
- Socio-economic benefits.

Some of these may also be related to the topics for discussion at the Forum, however, they are not reproduced here.

3.1 Biological diversity

Development of a system of areas for biodiversity conservation

3.1.1 Objective

To establish a system of reserved areas that meets the comprehensive, adequate and representative targets and provides protection for high value biodiversity elements.

3.1.2 Strategies

The Department will manage areas according to their proposed tenure until the formal tenure changes are effected.

The Department will undertake the consultation processes for clearing the tenure changes proposed in the approved forest management plan to establish the conservation reserve system

The Department will manage State forest and timber reserves excluded from disturbance by timber harvesting taking account of the principles of ESFM.

3.2 Biological diversity components

3.2.1 Objective

To understand the impacts of the sustainable use of natural resources on the components of biological diversity.

3.2.2 Strategies

The Department will, during the life of the new forest management plan, progressively identify key elements (such as species at the edge of their range) of biodiversity in State forest and timber reserves.

The Department is to continue the accumulation of knowledge on the ecological characteristics and requirements of identified elements.

The Department will apply new information to adapt management regimes designed to conserve biological diversity to the satisfaction of the Conservation Commission

The Department will monitor elements of biodiversity, as agreed by the Conservation Commission, to gauge the effects of disturbance.

3.3 Managing to sustain biological diversity at various scales

3.3.1 Objective

To manage State forest and timber reserves for the conservation of biological diversity at a range of scales.

3.3.2 Strategies

The Department will propose appropriate whole of forest and landscape scale units to manage for the conservation of biodiversity, within two years of the approval of the new forest management plan

The Department will draw up and test objectives for the management of biodiversity at each scale that clearly promote the conservation of biological diversity.

3.4 Biological diversity and structural diversity

3.4.1 Objective

To manage State forest and timber reserves so that they maintain the structural elements necessary for the conservation of biological diversity at the whole of forest, landscape and operational management scales.

3.4.2 Strategies

The Department will propose to the Conservation Commission strategies to achieve structural goals in the draft forest management plan following the current review of jarrah and karri silviculture.

3.5 Protecting key habitat elements

3.6 Protecting threatened species and ecosystems

3.7 Controlling threatening processes

3.7.1 Objective

To manage State forest and timber reserves in a way that contributes to the maintenance of biological diversity.

3.7.2 Strategies

The Department will continue to develop and implement programs based on risk assessments that seek to protect threatened species and ecological communities

The Department and the Forest Products Commission will manage selected habitat elements according to codes of practice that provide standards for their protection. The Conservation Commission will audit the implementation of the codes of practice.

The Department and the Forest Products Commission will provide training and advice to their staff, and the staff of other Government agencies and industry on the application of codes and standards.

3.8 Using fire regimes for conservation

3.8.1 Objective

To use fire on State forest and timber reserves to promote the conservation of biological diversity and provide adequate protection to societal assets.

3.8.2 Strategies

The Department, using the best available knowledge and within likely resource constraints, will develop and maintain plans of proposed fire regimes designed to promote biological diversity. Wildfire occurrence will be incorporated into the plans

The Department and the Forest Products Commission will undertake regular risk assessments that evaluate wildfire threats to biodiversity and to fire-sensitive assets.

The Department will undertake an annual prescribed burning program that implements the fire management plan and treats unacceptable risks to assets.

The Department will, where possible, retain protectable, manageable and representative long-unburnt scientific reference areas.

3.9 Forest ecosystem health and vitality

Disease caused by *Phytophthora cinnamomi*

3.9.1 Objective

Seek to protect ecosystem health and vitality from the disease caused by *Phytophthora.*

3.9.2 Strategies

The Conservation Commission and the Department will develop a policy on the management of *Phytophthora* taking into account the results of the use of the protocol in the trial area.

Where appropriate, the Department will incorporate the strategies in the Dieback Threat Abatement Plan into its plans.

The Department will progressively identify uninfested 'protectable' areas and manage human access to them.

The Department will manage already infested areas to sustain an appropriate level of environmental and social benefits

Where assessment demonstrates it is likely to be effective and cost efficient, the Department will apply chemical phosphite treatments to protect threatened flora, threatened ecological communities and the habitats of threatened fauna at risk from Phytophthora.

The Department will rehabilitate areas degraded by the disease only where there is a strong environmental, social or economic reason determined by the Department or the Conservation Commission.

3.10 Weeds

3.10.1 Objective

To achieve the safe, effective and coordinated management of weeds in State forest and timber reserves.

3.10.2 Strategies

The Department will develop an annual weed control program based on the risk weed infestations pose to environmental and production values, and available resources.

The Department will, wherever possible, eradicate localised weed infestations before they are securely established

The Department will encourage the coordinated involvement of industry, the community and other land managers in addressing weed management

3.11 Pest animals

3.11.1 Objective

To achieve safe, effective and coordinated management of pest animals in State forest and timber reserves.

3.11.2 Strategies

The Department will seek to identify pest animal species, and their extent and impact.

The Department will prepare and implement pest animal management plans designed to control the occurrences of pest animal infestations where they have the highest impact on biodiversity

The Department will encourage the coordinated involvement of the community and other land managers in addressing pest animal management

3.12 Soil and water resources

3.12.1 Water - Objectives

To manage catchments on State forest and timber reserves to protect water resources.

3.12.2 Water - Strategies

The Department and the Forest Products Commission will, with the input of water agencies, maintain and periodically review codes of practice and silvicultural guidelines that incorporate operational controls and standards for the protection of water quality.

The Forest Products Commission will establish, and protect during their operations, buffers on all streams to standards consistent with the code of practice.

Only activities formally approved by the Department will be allowed in stream buffers.

The Forest Products Commission will implement silvicultural prescriptions in salt-sensitive areas as agreed by the Department and Water and Rivers Commission.

The Department will collaborate with water agencies on the impacts of forest thinning on water yield and water quality responses.

The Department will collaborate with State Agreement Act mining companies so that rehabilitation completion criteria include water production considerations.

3.12.3 Soil - Objective

To sustain soil values.

3.12.4 Soil - Strategies

The Department will further develop guidelines to sustain soil values, which will replace protection measures in existing guidelines.

The Department will investigate the development of a soil hazard assessment system to help sustain soil values.

4 The 'precautionary principle'

As much of the discussion at the Forum is focussed on an appropriate precautionary approach, the following text may assist participants during the breakout groups.

Incorporation of the 'precautionary principle' in decision making has been endorsed by State and Commonwealth Governments. It is defined thus:

> 'where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
>
> In the application of the precautionary principle, public and private decisions should be guided by
>
> I. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment;
>
> II. an assessment of the risk-weighted consequences of various options.' (Commonwealth of Australia 1992, p. 49)

5 Maintaining Biodiversity – Viewpoint One

Forum on Science & Forest Management: Biological Diversity

N.D. Burrows

Director, Science Division, Dept of Conservation & Land Management

5.1 General Comments

Ecologically Sustainable Forest Management is a laudable forest management concept, but lacks definition. The new forest management plan provides an opportunity for discussing values and for developing a new conceptual framework for forest management in Western Australia based on ecological principles. A framework of values and ecological principles could then guide lower order objectives and strategies and guide definition of ESFM with respect to biodiversity trade-offs. I propose the concept of e*cological forestry*, which focuses on maintaining the ecological integrity of the forest by emulating, as far as practical, disturbance regimes under which forest ecosystems have evolved. This approach also embodies the precautionary principle with respect to human-induced disturbances such as logging.

Many of the objectives and strategies of the Biological Diversity section of the discussion paper are commendable, but vague, so will be difficult to implement. There is insufficient detail in the discussion paper to critically evaluate how, or if, objectives will be achieved. The nature, quality and extent of on-ground forest operations will ultimately determine the extent to which biodiversity is maintained.

A systematic biological survey of the forest region and ongoing scientific study are critical to the conservation of forest biodiversity, including the establishment of a CAR reserve system and the embracement of the e*cological forestry* model.

5.2 Biological Diversity (Section 4.2 of the discussion paper)

While there were many positive elements about the content of this section of the discussion paper, I found it lacked structure and detail - what will actually be done? It is probably not within the scope of the discussion paper to include detail, but it the forest management plan should link with documents that describe how, in a practical, operational sense, these objectives are to be achieved. There may be general agreement on broad objectives or goals, which are often panaceas, but disagreement about how to get there in a practical sense.

5.2.1 Proposed structure

1. Conceptual/philosophical framework as discussed above (principles, values)
2. Whole-of-Forest (broad) Biodiversity Conservation Objective
3. Whole-of-Forest (broad) Biodiversity Conservation Strategies
   - 3.1. CAR reserve system
     - 3.1.1. Objectives, strategies, performance indicators
   - 3.2. Biodiversity conservation at the landscape scale
     - 3.2.1. Objectives, strategies, performance indicators
   - 3.3. Biodiversity conservation at the management unit (forest block, sub-catchment?) scale
     - 3.3.1. Objectives, strategies, performance indicators
   - 3.4. Biodiversity conservation at the disturbance patch (coupe?) scale
     - 3.4.1. Objectives, strategies, performance indicators

5.3 Section 4.2.1 - A CAR reserve system

Discussion paper objective

"*To establish a system of reserved areas that meets the CAR targets and provides protection for high value biodiversity elements*".

Comment on objective

No problem with the objective, but the basis for the CAR reserve system (targets) needs some examination.

The definition of a CAR reserve system proposed is based on the National Reserve System principles "*that will preserve Australia's native biodiversity*". The guideline is for it to contain samples of all *ecosystems* identified at an appropriate scale.

The discussion paper adopts the JANIS criteria for a CAR reserve system in forests. The problem, as recognised in the discussion paper, is with defining *forest ecosystems*. This is fundamental to the notion of a CAR reserve system . After assessing the options, the discussion paper adopts the forest ecosystems defined by sub-dividing broad forest associations into finer units with similar floristic assemblages, resulting in 27 forest ecosystems being identified, and a number of other non-forest ecosystems embedded in the forest matrix.

In the absence of better information, this is appropriate. However, there are some pitfalls.

A reserve system based on floristic assemblages alone may or may not be truly CAR. For example, an essential element of "Representative" is that species and genotypes are adequately reserved within this framework. In the absence of information on species distributions and genetic variations, we cannot be confident that this is indeed the case.

This problem can be partially overcome by systematic regional biological survey of a broader range of taxonomic groups (McKenzie *et al.* 2001). While there have been a number of local surveys, a systematic biological survey of the forest region has not been carried out. In addition to providing an objective basis for a reserve system, another outcome could be that more or less forest is available for timber production. The community can be better informed about the basis of the reserve system and the conservation importance of various forests.

5.3.1 Comment on strategies

A key strategy with respect to achieving a CAR reserve system should be to undertake a systematic biological survey of the forest region.

5.4 Section 4.2.2 – Biological diversity components

5.4.1 Discussion paper objective

"*To understand the impacts of the sustainable use of natural resources on the components of biological diversity".*

5.4.2 Comment on objective

This objective should reflect the need to understand impacts on ecosystem function, including biodiversity and productive capacity (intrinsically linked), and to understanding spatial and temporal patterns of structure, species assemblages and population dynamics.

5.4.3 Comment on strategies

Ongoing scientific study and monitoring are fundamental to achieving ESFM. The discussion paper statement should make a strong commitment to biological survey, research and to carefully designed and monitored operational trials. Management can only be as good as the science on which it is based.

5.5 Section 4.2.3 Managing to sustain biological diversity at various scales

5.5.1 Discussion paper objective

"*To manage State forest and timber reserves for the conservation of biological diversity at a range of scales*".

5.5.2 Comment on objective

In disturbance-driven ecosystems, the issue of spatial and temporal scales is critical but complex. The discussion paper adopts a nested approach to spatial scale. I believe this is a sound approach as it recognises the linkages and interactions between various scales. Temporal scales need to be addressed and, consistent with the conceptual framework above, ecosystem functions and habitat legacies must be maintained through time as well as spatially. This is also consistent with the notion of intergenerational equity.

5.5.3 Discussion paper strategy

The strategy is to be developed within 2 years of the approval of the forest management plan.

5.5.4 Possible Performance Measures

Species richness, composition and abundance at various scales and through time. Measuring this is problematic – see FORESTCHECK below.

5.6 Section 4.2.4: Biological Diversity and Structural Diversity

5.6.1 Discussion paper objective

"*To manage State forest and timber reserves so that they maintain the structural elements necessary for the conservation of biological diversity at the whole of forest. landscape and operational management scales*

5.6.2 Comments on objective

Forests are dynamic mosaics driven by disturbances, abiotic and biotic processes. Maintenance of temporal and spatial heterogeneity in landscapes can help to conserve biodiversity. These concepts are recognised in the discussion paper and are reflected in the objective. The concept of setting conservation objectives at various scales is a good one. The specific objectives set at each scale is a good starting place.

5.6.3 Strategies

To be proposed.

5.6.4 Comment on strategies

This is the critical issue – how will the objective be met? At some point there will need to be some definition of the range of desirable age/structural classes, of patch size and distribution and of what trade-offs with timber production. A set of guiding principles, or a conceptual framework, such as the ecological forestry model described above, will guide this.

5.7 Section 4.2.5. Protecting key habitat elements

5.7.1 Comment

I support the intent, but there are no objectives or strategies to evaluate.

5.8 Section 4.2.6 Protecting threatened species and ecosystems.

5.8.1 Comment

As above.

5.9 Section 4.2.7 Controlling threatening processes.

5.9.1 Discussion paper objective

"*To manage State forest and timber reserves in a way that contributes to the maintenance of biological diversity*".

5.9.2 Comment on objective

This is repetitious/redundant - it says essentially the same thing as objectives above – hence the need for a better framework. Controlling threatening processes should not be a high order objective, but a strategy to achieve biodiversity conservation at various levels.

5.10 Summary of FORESTCHECK

FORESTCHECK is a framework devised to quantify, record, interpret and report on the status of key forest organisms, communities, and processes in response to both forest management activities and natural variation. The most desirable attributes have been identified as simplicity, integrated sampling, efficient sampling, reliability, feasibility, credibility and affordability. It is recognized that it is not possible to optimise all of these traits simultaneously.

Monitoring is treated as a form of quality control. FORESTCHECK is not a substitute for audit, compliance, survey or research.

FORESTCHECK has been designed to mesh with the Montreal Process Criteria and Indicators (agreed to jointly by the Commonwealth and State Governments in 1998).

FORESTCHECK will sample various silvicultural treatments, and unlogged or lightly logged forests, across a representative range of jarrah forest landscapes. At each grid, all birds, mammals, reptiles and vascular plants will be sampled and a selection of 'indicator' species of invertebrates, fungi and cryptogams. After a year of operation, and following data analysis, a decision will be made as to whether only 'indicator' species need be sampled, allowing a greater number of sites to be monitored. Each site will be assessed in spring and autumn every 3-5 years.

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6 Maintaining Biodiversity – Viewpoint Two

Biodiversity and A New Forest Management Plan for Western Australia

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6.1 Introduction

A New Forest Management Plan for Western Australia is a commendable effort at re-shaping the direction of ecologically sustainable forest management in the state and despite its deficiencies the draft document should be applauded for the process that has been instigated. Other Australian states could benefit through efforts to re-position the stance on forest management. Part of the brief given for this talk (and associated spoken presentation) was to identify "strengths and weaknesses in proposed approaches to ecologically sustainable forest management". The brief also included whether.... "the objectives and strategies constitute best practice, and what are areas of strengths and weaknesses" ? This paper will address some issues – but it is not possible in the short space available to address all of them, nor to address any single issue in detail. The focus of this brief paper is largely on perceived deficiencies as they are points which can either be refuted at the meeting and/or discussion about them may perhaps help strengthen the draft document.

6.2 A definition of Ecologically Sustainable Forest Management (ESFM)

It could be argued that one of the first deficiencies of the Discussion Paper is that the definition of ESFM (given on page 17 and extracted from CLM Act) is not really a practical working definition for on-ground application. ESFM has been variously defined by many different workers. Lindenmayer and Recher (1998) spent considerable time examining various definitions of ESFM and what is should encompass from an ecological perspective. They proposed the following definition:-

'Ecologically sustainable forest management perpetuates ecosystem integrity while continuing to provide wood and non-wood values; where ecosystem integrity means the maintenance of forest structure, species composition, and the rate of ecological processes and functions with the bounds of normal disturbance regimes'.

Lindenmayer and Recher (1998) believed this definition was a useful one because it nominated specific ecological entities that are essential to maintain as part of attempting to achieve the goal of ESFM – stand structure, plant and animal species composition, and key ecological processes (for example, seed dispersal, pollination, nutrient cycling etc), The importance of considering natural disturbance regimes and its congruence (or lack thereof) with human disturbance regimes was also recognised as critical (see Attiwill, 1994; Seymour and Hunter, 1999). These entities and ecological are open for monitoring and assessment as part of a true adaptive management regimes (*sensu* Walters, 1986; Taylor *et al.*, 1997; see below).

The issue of what constitutes ESFM and what does not, may seem a semantic one, but the definition given above is considered important relative to the needs of forest biodiversity conservation – and hence are highly relevant to the biodiversity conservation issues canvassed in the Discussion Paper.

6.3 Emphasis on reserves, lack of emphasis on the management of production forests

A major emphasis in the Discussion Paper is on additions to the reserve system – this is perhaps understandable in the political context of debates over the forest estate not only in Western Australia, but elsewhere around Australia. However, many authors have recognised that a sole reliance on the reserve

system will be insufficient and careful management of the entire forest estate, including lands outside the reserve system will be critical for the conservation of much of the nation's forest biodiversity. While reserves are a fundamental part of all conservation strategies (Margules and Pressey, 2000), a comprehensive approach to the conservation of forest biodiversity needs to be multi-scaled, spanning considerations at the stand, patch, landscape and regional levels. This is the primary argument of a new text on conserving forest biodiversity (Lindenmayer and Franklin, 2002). While the Discussion Paper does recognise the issues of multi-scaled forest management (on Page 23 and 24) and refers readers to other supporting documents (Appendices 5.11 and 5.12), the fact that the Discussion Paper is concerned with a new forest management plan for Western Australia, indicates that much more information should be provided on how the production component of the forest estate will be managed at, for example, the stand and landscape levels. This is a non-trivial issue as much of the validity of the plan and its effectiveness (or otherwise) will lie in the detail of its on-ground implementation (the FEMAT [1993] documents in the Pacific Northwest of the U.S.A. are a useful example of a successful and comprehensive plan for forest biodiversity conservation). In the case of Western Australian forests, important issues need to be further explored in the Discussion Paper such as (among others):- (1) stand level retention of structural attributes in relation to species' habitat requirements (is one log per ha of cutover forest sufficient?), (2) landscape-level impacts of roading systems on ecological integrity, and, (3) the dispersion of cutover areas in space and time. Landscape-level management of prescribed burning regimes (the frequencies of which are likely to be well outside the bounds of natural disturbance regimes) are among other issues which need to be addressed.

6.4 True Adaptive Management

Adaptive management and monitoring is mentioned in a number of places in the Discussion Paper. This is not unlike numerous other forest management documents in all other Australian states. In the case of adaptive management, many agencies discuss the term without fully understanding what it really entails. Walters (1986), Taylor *et al.* (1997) and several other authors (e.g. Walters and Holling, 1990), discuss the nature of what constitutes real adaptive management. They propose a highly integrated approach involving research, monitoring and management designed to assess (test) and improve the effectiveness of resource management prescriptions, which obviously includes programs and projects designed to maintain biodiversity in forest landscapes. Experimentation is a core element and essential to an improved understanding of a system that will make improved management possible. In these experiments with the system, the goal is to learn as much as possible from both successes and mistakes (Taylor *et al.,* 1997). The method is a rigorous process and not a 'trial and error' approach (Walters, 1986). Trial-and-error management is problematic because policy alternatives are not properly specified. Formalized adaptive management has strict requirements for the documentation of objectives, assumptions, policy options and outcomes. It is based on clear hypotheses stemming from real policy options informed by previous experience and understanding; however, these hypotheses are not constrained by a requirement that the approaches being tested in the field must work (Walters, 1997). The formalized approach to adaptive management increases the likelihood that new knowledge will be generated and subsequently embraced in on-the-ground management (Taylor *et al.,* 1997). In implementing a true adaptive management program, there are a series of logically linked steps:-

Step 1 All available information about a system is gathered. Based on that information, alternative models are created regarding management of that system and policies clarified on approaches that will meet management goals, possibly using simulation models (Walters, 1986).

Step 2 Next, a small set of testable hypotheses for different management options are created. It may be necessary to stipulate the degree of difference between the several options (Taylor *et al.,* 1997). Sometimes, this step involves consideration of entirely new management approaches (even paradigm shifts) that are outside existing procedures and policies.

Step 3 Development of an experimental design and monitoring program is the third step. The design must specify which system components are to be used as response variables (i.e. measured to assess the success of different management options). A pilot study may be required (Silsbee and Peterson, 1993). A robust experimental design is necessary to avoid the limitations of trial-and-error management.

Step 4 Management changes are implemented -- such as altered reserve designs or silvicultural systems in managed stands – based on the results of the experiments. Monitoring and continuing assessment of the data stream continue with regards to the modified management strategies. Thus, continued and iterative field research is coupled with result-driven management actions.

Step 5 The adaptive management program is carefully documented including detailed information on all the steps of the process (Taylor *et al.,* 1997).

The brief discussion above on adaptive management has some significant implications for the New Management Plan for Western Australian forests. It highlights the fact that simple statements like "management might be changed in the future if some new information becomes available" does not constitute adaptive management. However, a formalised approach to testing harvesting impacts and other related forms of disturbance offers an important opportunity to gather the critical data needed to better achieve ecologically sustainable forest management – the key guiding principle of the Discussion Paper. Indeed, one of the performance measures of the New Management Plan should be whether adaptive management has actually been embraced (see Lindenmayer *et al.*, 2000).

6.5 Monitoring

Rigorous monitoring is a fundamental requirement of adaptive management – something has rarely been accomplished in any form of forest management (including forest biodiversity conservation programs. Most fundamentally, monitoring is necessary to generate the empirical data that provide the definitive measure of the degree to which a management program is achieving its objectives. Therefore, monitoring is essential to assess the effectiveness of any resource management program. Despite the fundamental importance of monitoring, relatively few credible long-term forest monitoring programs have actually been implemented anywhere in the world (traditional continuous forest inventories, which have focused primarily on timber growth and wood volumes can not be considered true monitoring; Franklin *et al.*, 1999). It is important that the appalling record on forest monitoring in Australia is not continued in Western Australian forests. Therefore, to have real credibility, the New Forest Management Plan for Western Australia must outline some strategies on how it will maintain robust well designed forest monitoring programs over the forest estate (and then sustain them in the long-term). A stated (and actual) commitment to monitoring could, like the adoption of adaptive management, be embraced as a performance measure in the New Management Plan for Western Australian forests.

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7 Maintaining Ecosystem Health and Vitality – Viewpoint One

Comments on Ecosystem Health and Vitality - As outlined in the document: A new forest management plan for Western Australia Discussion Paper January 2002, Conservation Commission of Western Australia

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7.1 Ecosystem Health and Vitality

The key threats to ecosystem health and vitality in State forests and timber reserves that are identified in the new Management Plan are disease (and in particular, dieback caused by the fungus *Phytophthora cinnamomi*) and pest plants and animals. The objectives – seeking to protect ecosystem health and vitality by managing disease and by managing pest plants and animals – are straightforward and immediately apparent. Likewise, the strategies that are identified are general and more or less obvious.

Our first question might be why are ecosystem health and vitality limited to these dimensions? Ecosystem health, for example, is better defined within the context of ecosystem functions. That this is the case is made immediately obvious when we consider *Phytophthora cinnamomi.* For many years, researchers have focused on the roles of fire and hydrologic regimes in containing or encouraging the spread of *Phytophthora cinnamomi.* 'Healthy ecosystem' immediately implies that ecosystem functions, like carbon, nutrient and hydrological cycles are maintained. Indeed, it is arguable that diseases like jarrah dieback owe as much to changes in other ecosystem functions as they do to the autecology of any single organism. Studies in forests worldwide have shown that a great many insect pests and fungal pathogens *only* become problems when some other ecosystem function or component species is impaired in some way.

We could argue that by far the greater part of native forest research has concentrated on those forests that are used for timber production. Thus we can argue that we know rather more about management of native forests used for timber production than we do about native forests used for purposes other than timber production. The identified threats to ecosystem health and vitality are fungal disease and pest plants and animals, and these threats do not recognize boundaries drawn on a map, and are threats to the whole forest estate as much as they are to forests used for timber production.

It therefore seems short-sighted, if not quite out of step with strongly-emerging, global practices of managing at the level of landscapes, to set up schemes of monitoring, control and management at the restricted level of land-use units. We reject (as we hope the Management Plan rejects) the notion that, by placing forest ecosystems into reserves, there are no threats to ecosystem health and vitality, although elsewhere the Management Plan states that one of the ways to conserve biodiversity 'is to allocate land to national parks (and) other conservation reserves'. Ecosystem properties (such as health, vitality, biodiversity) are concerns for management and performance indicators over the entire range of forest uses.

The discussion document does not provide a clear definition of the 'ecosystems' to be managed. For the native forests of Western Australia, this is crucial owing to the long history of definition and counter-definition. This matter also highlights that unless a 'whole of forest' approach is adopted, forest management in Western Australia may move further out of step with world trends. For example, it has often been the case that the whole of the jarrah forest is defined as the 'jarrah ecosystem' and likewise the Karri forest. This is clearly an important matter since if we are to manage the 'jarrah ecosystem' (that is defined as the whole of the jarrah forest) then we are managing reserves as well as production areas. If we are managing only State Forests, then we are not managing the 'jarrah ecosystem'. Even if some

other means is used to subdivide the jarrah forest into smaller 'ecosystems', then the internationally accepted definition of the term 'ecosystem' will dictate that land tenure boundaries are not ecosystem boundaries and we should be managing for the whole, and not by land tenure.

Furthermore, sustainable forest management does not stand alone: it is embedded within a matrix of national and State legislation on forest policy and environmental, conservation and land-use strategies. These policies and strategies are the result of the inputs and wishes and aspirations of all of the stakeholders ('society'). Stand-level criteria and indicators must then be established within the context of on-going development of national and State strategies. Retention of 'old-growth' stands is a classic example. Using the principle of inter-generational equity, forest management today should put in place the strategies to ensure that there will be 'old-growth' stands in 100 or 200 or 1000 years from now. The young forest of today is tomorrow's 'old-growth'. Management plans can accommodate society's wish for old-growth forests provided they deal with the whole of the forest. Reserving areas of old forest now will not alone ensure 'old-growth' for the next generation owing to the combined effects of fires, droughts, pests and disease. While the 'precautionary principle' is often invoked to ensure that we 'do nothing' other than to place land within a reserve, it should also be used to ensure 'old growth' for the next generation.

The performance indicators presented in this new plan for forest management are themselves no more than indicative at this stage. Indeed, the development of criteria and indicators world-wide is currently in an experimental stage. Society sets criteria (goals), and science aims to define the indicators by which progress toward the goals can be assessed. The indicators provide the information to society that can be used to review the whole process through adaptive management, a process that 'seeks progressive improvement, by treating each management intervention as an experiment, monitoring its development and learning from the outcome'.

Indicators that are applicable to stands will vary between different forest types, different stages of the development of the national economy and forest management, and between different objectives for forest management. However, as with research, by far the greatest effort in the development of indicators at the stand-level has concentrated on forest that is managed for timber production. The development of criteria and indicators for conservation and the management of ecosystem health and vitality must address the whole forest estate, reserves and outside reserves. Some summary points follow:

- Indicators may be more or less specific to the landscapes and stands for which they are developed. Some indicators are applicable at the stand level (eg. compaction of soil after timber harvesting). Some indicators are applicable at the catchment level (eg. quality and quantity of run-off water). Some indicators are applicable at the landscape level (eg. biodiversity and, in our view, fungal diseases and pest plants and animals).
- Few indicators work in isolation. For example, the likely spread of a fungal disease may well depend on the hydrologic regime as well as on the number and viability of diaspores.
- Goals for sustainable management must be set across the range of forest uses in the landscape.
- It is not possible to optimise all goods and services in any stand at any one time. Different portions of the landscape are assigned to fulfil specific sets of management objectives, of which biodiversity and timber objectives are two examples.
- The contribution of natural and management-induced disturbances should approximate the ecological effects of characteristic natural disturbance regimes. The combined implications for the ecosystem of frequency, intensity and spatial scale of disturbance must be considered.
- Forest stands are dynamic systems; indicators and certification will undergo a continuous process of approximation, which will be refined on the basis of developing scientific knowledge.
- Adaptive management demands the construction of effective links between stakeholders, research, monitoring, management, and practice.
- Scientists do not make management decisions. Science provides information to managers on current conditions, risks, opportunities and consequences.

The new forest management plan for Western Australia is somewhat obscure on many of these points. In particular:

- Have criteria and indicators been drafted for forests not covered by this management plan?
- Will a multiplicity of performance indicators for different forest uses be inefficient and expensive?
- What strategies have been set up to ensure adaptive management for timber production, and adaptive management between forest uses? For example, it makes little sense to manage ecosystem properties (e.g. control of Phytophthora and pests) in isolation within the various land-uses.
- What magnitude of ecosystem change resulting from one land use can be incorporated across the range of land-uses?
- Fire, as both a natural and man-made disturbance, is not considered as broadly as it might. For example, pests and disease, carbon cycles, nutrient cycles and even hydrological cycles will be greatly affected by serious wildfire. That there has not been a serious fire in Western Australia since the Dwellingup fires of 1962 does not mean that the probability of serious fire has been reduced. Indeed, fuel-reduction burning has been reduced in many areas and the likelihood of serious wildfire has increased.

We are asked to comment on the quality of the objectives and strategies in managing ecosystem health and vitality. Again, we find that the new management plan is too brief to allow such a critical evaluation. We note, however, that practices in Western Australia relating to control of *Phytophthora*, control of foxes have been outstanding.

8 Maintaining Ecosystem Health and Vitality – Viewpoint Two

Assessing health and vitality in the forested ecosystems of south-western Australia

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8.1 Abstract

Complex interactions are inherent in the changes that accompanied prolonged, unsustainable timber-cutting in south-western Australia's hardwood forests. We ask: how might an assessment of ecosystem health be quantified to satisfy a skeptical public? Can health and vitality be assessed under a paradigm incorporating the precautionary principle and adaptive management? Assessment of ecosystem condition requires adequate data sets, a clear conceptual framework, and proper research and analysis techniques. The effective monitoring of forest health within an adaptive framework requires replication and repeated measures, and an indication of the ability to detect change through the measurement process. Regardless, an effective public participation process is required to allow effective application. Broad involvement in the forest management process will allow a collaborative, multidisciplinary and inter-institutional approach to scientific research and monitoring. Such a constructive approach to information collection and its publication and wide dissemination may allow a more general co-operative dialogue concerning public land management in south-western Australia. We provide guidelines for the formulation of prescriptions that account for ecosystem health, the precautionary principle and adaptive management in south-western Australia.

8.2 Acknowledgements

We thank the Conservation Commission for funding this forum and Angela Wardell-Johnson for sociological insight.

8.3 Introduction

A period of unrestrained exploitation followed European exploration of the hardwood forests of south-western Australia. By 1920 "...nearly one million acres of the jarrah forest were cut over for the removal of 750 million cubic feet of logs, causing a reduction of almost 50% in the forest canopy" (Wallace 1965, p.35). There were intense land-use conflicts between agricultural clearing and long-term forestry, bitter complaints of wastage in the timber industry and large-scale government inquiries. The timbers that Roe (1852) saw in 'inexhaustible quantity' proved finite and, as always, people argued bitterly over a finite resource.

In 1920 the Western Australian State parliament passed a Forests Act, designating large areas as State Forest for long-term sustainable timber production. However, figures for both the timber cut and contemporary estimates of the growth increment of timber for 1920, 1928, 1935, 1961, 1966, 1971, 1974 and 1993 showed that in all but one case, the timber cut exceeded the estimated growth increment, often by a considerable margin. A recent draft management plan (Conservation Commission 2002, p. 1) proposes a reduction in yield, 'largely as a consequence of the increase in the area of protected forest'. Thus, it is possible that overcutting will exceed the growth increment in those areas still available for logging (at least in areas of jarrah forest) for the foreseeable future.

Timber-cutting (the process of logging eucalypt forest for timber and timber derived products, and the suite of activities such as road building, prescribed fire and silvicultural prescriptions associated with the

process) includes the most extensive disturbances occurring within the forested ecosystems on State managed land in south-western Australia. Associated Impacts include local extinctions, increased activity of introduced predators, weed introductions, changed hydrological regimes or soil properties, pest outbreaks and massive spread of plant pathogens. However, attempts to determine a single cause for the dramatic and permanent changes in forest structure and processes that have accompanied this sustained overcutting will be unsuccessful. This is shown most clearly by the complex of interacting factors involved in the multifarious impacts of the plant pathogen Phytophthora cinnamomi, regarded by Wardell-Johnson & Nichols (1991) as second only to agricultural clearing as a conservation problem in the south-west. The impacts of timber cutting must also be seen in the context of the extensive clearing for agriculture and fragmentation of remaining native vegetation occurring within and surrounding the State managed lands. Many of the complex interactions can only be assessed with the benefit of hindsight.

The damage that has occurred in the south-western forests, has culminated in considerable public disquiet, and the current management plan process. Therefore, how might an assessment of ecosystem health be quantified that is satisfactory to a wider public than was thought necessary during the period of greater trust by society in professional management (Geno 2001)? Can health and vitality be assessed under a paradigm incorporating the precautionary principle and adaptive management?

8.4 Ecosystem health and sustained yield

Unsustainable management reduces ecosystem health. Yazvenko & Rapport (1996) suggest that healthy ecosystems must possess: resilience, freedom from Ecosystem Distress Syndrome, self-sustainability, management practices and ecosystem processes that don't impair adjacent ecosystems, economic viability, and the capacity to sustain healthy human communities. What of the south-western forests, whose health is the subject of considerable debate within the scientific community (e.g. Abbott & Christensen 1994, Calver et al. 1996, 1998)? It is clear that something better than superstitious learning (erroneous connections between cause and effect that increase as the scientific rigor of the learning mode is reduced – see Lee 1999) will be required to satisfy the broader community of the sustainability of forest management in Western Australia. It is our contention that, despite consensus that sustainable logging of eucalypt forests is possible, it has not yet been achieved within jarrah forest. This is because forestry professionals, who strove to regulate the cut to a sustainable level, were required to exceed it for social, economic and political reasons. The inherent low fertility and lack of resilience of jarrah forest ecosystems has prevented recovery. By contrast, the greater fertility, productivity and resilience of the ecosystems including a component of karri, along with the productivity of karri in managed even-aged regrowth stands provides hope for achieving sustainable timber yields.

However, the achievement of (maximum) sustained yield does not achieve ecologically sustainable forest management (ESFM) because the optimum solution for a single variable results in declining natural capital (Goodland 1995). Therefore, because ESFM includes all the natural services of the sustained resource, the yield must be held somewhat lower than that considered sustainable.

8.5 Towards prescriptions for sustainability

Recent research demonstrates that production forests can aid biodiversity conservation if timber-cutting practices mimic natural forest dynamics (Ehrlich 1996, Lindenmayer & Franklin 2000 Seydack 2000). Thus, there is a need for a shift away from highly interventionist systems towards more naturalistic systems. This will involve setting the cut to allow for sustained production from a given area in the long term while maintaining a diverse stand structure. This may involve the retention of more of the existing canopy within any forest coupe. Specific elements are:

In areas that are managed by gap-creation, reduce gap sizes to a safe minimum, and set rotation lengths that allow regrowth stands to attain most old growth characteristics prior to re-logging (at least 120 years).

Retention of critical habitat requirements including stags, large living trees, fallen timber and understorey thickets in logged stands. In jarrah stands this will involve the introduction of 'minimum canopy cover' requirements following logging.

Reservation from logging of remaining old-growth, and stands whose removal threatens soil salinity, leads to hydrological impacts or erosion hazards, or that are dieback susceptible.

Establishing a network of retained habitat throughout production forest using wildlife corridors and stream buffers (see Wardell-Johnson et al. 1991).

Ensuring that the species composition of regrowth mimics that of the naturally occurring stand.

Ensuring that return times in logging coupes depend on the regrowth stand mimicking the structural characteristics of the previous stand.

The implementation of these approaches may differ in areas of different community types or vegetation complexes and will have implications for the draft management plan. In areas including mixed species, ensure that logging and regeneration methods reflect natural stand characteristics. For example, in karri forest, set coupe sizes to the minimum required to safely remove timber given that karri is a light demanding species but usually occurs as a mixed age, mixed species stand (see Wardell-Johnson 2000). This may also involve the progressive return to mixed species, mixed aged stands of some stands clearfelled and regenerated as single species, single aged stands. Operations associated with logging should be consistent with ensuring a healthy forest system, and not impact on neighboring community types.

8.6 Measuring and monitoring the effectiveness of prescriptions

A successful assessment of ecosystem condition requires: adequate data, a clear conceptual framework, and proper research and analysis techniques (Yazvenko & Rapport 1996). Effective monitoring of forest health within an adaptive framework requires: systematic monitoring to detect the unexpected, careful design to enable explicit application of the precautionary principle as a learning experience (see Lee 1999), replication and repeated measures, and an indication of the magnitude of change detectable through the measurement process.

Adherence to prescriptions does not in itself fulfill the requirements of a precautionary approach because no measurable standards are set for response variables such as population viability of rare biota or patterns in the structure of assemblages. It is plausible that the standards could be followed and yet, for an unforeseen factor, a species could be lost, or a biotic community changed. Thus it is critical that research and monitoring accompany these prescriptions to ensure the viability of selected indicator species and assemblages, and that the prescriptions be modified if necessary. There have been several species proposed by various authors for detailed monitoring to assess ecosystem health. It will also be necessary to monitor vertebrate, vascular plant, and those selected invertebrate assemblages for which expertise is available to allow judgment on impacts of disturbance. Quantitative standards for monitoring in relation to precaution in such matters are given by Calver (in press) and Calver et al. (1999) and included references. Wardell-Johnson et al. (2002) provides a methodology for quantitative assessment of assemblage patterns. Moreover, the publication of yield forecasts and quantity removed at a local level will also be necessary to monitor sustained yield in a given area.

Environmental Management Systems (e.g. ISO 14001 guidelines) must focus on actual outcomes rather than simply be process-oriented. Otherwise it is possible to have an EMS, which faithfully captures unsustainable environmental management (see Geno 1999). Furthermore, evaluations of success will have to be sensitive to the actions taken.

8.7 Conclusion

As monitoring programs that are designed to detect the unexpected are expensive, broad involvement in the forest management process is necessary. This will require a collaborative, multidisciplinary and inter-institutional approach to scientific research and monitoring as recommended by Wardell-Johnson & Horwitz (2000). A constructive approach to information collection and its publication and wide dissemination is essential to ensure scientific rigor in research and monitoring for ecosystem health. In turn, a more general co-operative dialogue could be established between civil communities concerning

public land management in south-western Australia. Alternatively, continued over cutting of ever-decreasing areas available for logging will continue to exhaustion.

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9 Maintaining Soil and Water Resources – Viewpoint One

Forest management to maintain water resource values

John Ruprecht, Stuart Halse and Kerry Trayler

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9.1 Review of existing situation

Aquatic systems are referred to in the Discussion Paper (especially section 4.2 Biological diversity) as "niche" ecosystems (p. 24) or "key habitats" (p. 25) with policies and codes of practice brought forward from the 1994-2003 Forest Management Plan to protect them. It is arguable (though not necessarily correct) that in some cases the 1994-2003 prescriptions failed to protect aquatic systems and it would have been useful to see within the Discussion Paper a more explicit overall plan for the conservation and protection of aquatic systems in the forest. The lack of such provisions in the 1994-2003 Forest Management Plan was pointed out by WRC (2001, p. 10). Most of the explicit discussion of biodiversity protection in the Discussion Paper is focussed on terrestrial values.

We believe more explicit recognition of biodiversity values encompassing the structural, compositional and functional integrity of aquatic systems is needed in the next Forest Management Plan than appears in the Discussion Paper. However, it must be recognized that forest streams are the best preserved streams in the south-west (see Halse *et al.* 2001), partly because a large proportion of the forest estate is in national parks or nature reserves. These reserves provide a refuge for a large proportion of aquatic faunal elements (estimated to be 86% for Warren bioregion; Trayler et al., 1996). Another reason for the good condition of streams is that prudently managed forestry itself causes much less change to aquatic systems than agriculture, urbanisation and hobby farming. The major challenges facing aquatic conservation in the south-west lie in the Wheatbelt, on the coastal plain and in semi-rural areas. Diverting resources to forest areas will result in the problems of other areas receiving less attention than they should. Nevertheless, the aim of forestry management should be to retain the high conservation values of forest streams. and the river and stream zones provide an important role to achieve this.

The State forest and timber reserves provide a very good supply of water to the reservoirs for Perth and the south west region. The potential for forest management to augment or increase water yield for water supply is considered limited. However forest management can have major effects on water quality aspects, such as salinity, turbidity and sediment yields. The current prescriptions for salinity management, which include permanent 50 m buffer (each side) and phased logging are considered appropriate until further research is available from jarrah forest catchment studies.

9.2 Stream buffers

The linear nature of streams makes them difficult to protect in conventional reserves, which has lead to the widespread use of buffer zones. The rationale is that the water quality and ecology of a stream, even in a reserve, are likely to reflect any disturbances in the catchment, such as that caused by agriculture or forestry, unless the connection between disturbance and stream is broken by a buffer. We do not address the issue of stream buffers on freehold land in this paper, although the issue was discussed by WRC (2001) and it is widely accepted that they are required to protect streams in downstream reserves. Recent calls for a national river reserve system reflect, in part, an increasing recognition of the need to formalise the buffer system on rivers and streams.

Existing information suggests that current stream buffer prescriptions in the south-west forests are suitable for protecting water quality. Studies by Borg *et al.* (1988a and b) found that changes to mean annual sediment concentrations and turbidity in the southern forests were only significant with no stream buffer. The importance of buffers for protection of stream biota was reviewed by Halse and Blyth (1992) . All recent Western Australian observations on the adequacy of stream buffers for protecting biodiversity

have been restricted to karri forest where clear-felling occurs. Growns and Davis (1991) showed that logging without buffers may cause changes to the composition of the macroinvertebrate community of a stream for at least 8 years. However, no impact on richness or density were detected. Trayler and Davis (1998) undertook a more comprehensive investigation in relation to describing the invertebrate fauna and found substantial changes in the richness, density and composition of the invertebrate community of karri forest streams clear-felled without buffers 5 years after logging. The causes of changes communities are not well understood. The streams within clearfelled areas exhibited higher flow, salinity, depth and temperature. Salinities were elevated by only 100mg/L and it is unclear whether this was a causal factor. Similarly, low but elevated salinities were identified in the studies by Growns and Davis (1991). The current prescriptions in salt risk areas incorporate both buffers and phased logging which would avoid the level of salinity increase observed in these studies.

Even under current buffer prescriptions, logging can cause biological changes. In an unreplicated study, Growns and Davis (1994) found some evidence of small changes in the community of a stream logged with 30 m buffers but suggested the changes were probably the result of the buffers being breached (ie contractors did not adhere to prescriptions). Frequency of non-compliance with buffer prescriptions is difficult to assess, but Halse *et al.* (2001) also found evidence that macroinvertebrate communities in some streams were substantially altered as a result of roads passing too close to streams and regeneration burns escaping into buffers. Thus, evidence suggests better implementation of current prescriptions is required.

It has also been suggested that recommended buffer widths on first to third order streams (20 m minimum either side of stream, average of 30 m) may be too narrow and that some investigation into appropriate widths is required (see Growns and Davis 1994). Davies and Lane (1996) showed that during storm events significantly elevated amounts of nitrogen travelled in surface flow through buffers 20-50 m wide around Lake Clifton (the surrounding land is cleared for grazing and hobby farms, leading to high rates of runoff and nutrient export). The amount of surface flow was inversely related to buffer width.

Alongside the opinions offered in this paper, WRC (2001) undertook a substantial review of the adequacy of existing stream buffer widths. The WRC paper represents a very thorough desktop study and provides much useful background information on issues associated with setting buffer widths, as well as recommending alternative buffer systems. We are not in complete agreement with the WRC (2001) recommendations on buffer type and dimensions and the rationale for them but believe that some of the recommendations warrant consideration. In particular, we support the recommendations relating to the protection of water supply reservoirs and wetlands.

9.3 Recommended Changes

The objective in the Discussion Paper refers to managing catchments on State Forest and timber reserves to protect water resources. As we have stated above, this is considered ambiguous in that it is not explicit as to whether it is focused on specifically drinking water or includes water for the environment. It needs to be implicit that ecological integrity is critical to the resilience and value of the water resource. There is overlap with the biological diversity and forest ecosystem components of the Discussion Paper. Because for the importance of water quantity and quality on the riparian and aquatic ecosystems and the ambiguity in the current objective a refinement to the current objective is proposed.

Proposed Water Objective

To protect and enhance catchment conditions to provide the water quality and quantity necessary to support ecological integrity and intended beneficial water uses.

The strategies required to achieve this objective should encompass:

- Adequate stream buffers
- Maintain integrity of catchment and riparian areas with well designed roads, forest harvesting and management
- Forest management to meet salinity risk
- Water supply considerations

The current strategies are not focussed or specific enough. The strategies refer to codes of practice and prescriptions which are not independent of the resource user or easily available to review. The strategies need to be reworded to be more focused on achieving defined outcomes in relation to stream buffers, road and timber harvesting management, salinity risk and water supply considerations. The codes of practice and prescriptions should then be considered as tools to achieve the strategies.

9.4 Performance measures

Auditing compliance with prescriptions. Existing evidence from the south-west and elsewhere suggest that the current buffer prescriptions are likely to be adequate to protect the water quality and ecology of most forest streams. However, it should be acknowledged that this has not been thoroughly tested. Problems appear to be mostly the result of non-compliance with prescriptions, although data on the frequency of non-compliance are lacking. The extent of compliance with prescriptions should be monitored. The prescription may also need to be better defined to account for some of the confusion in definition of buffer extent.

Performance Indicator 1. Extent of compliance with buffer prescriptions (this indicator should be tied to remedial action in the case of non-compliance)

Water quality. Water quality should be monitored at selected gauging sites within and downstream from areas of forest subject to logging. Automated gauging could measure flow-weighted and event-related salinity, turbidity and nutrients. From a water supply viewpoint, water quality should remain within guidelines for potable water while, from an ecological viewpoint, criteria for salinity, turbidity and nutrients should be developed as recommended in the ANZEEC guidelines and account for known tolerance of local fauna. Monitoring water quality is a way of measuring the adequacy of logging and buffer prescriptions.

Performance Indicator 2. Extent of compliance with potable water guidelines and forest-based environmental water quality guidelines

Ecological health and biodiversity in streams. Biomonitoring has been shown to provide much more useful information about ecological condition of ecosystems than chemical monitoring. There are a range of methods for monitoring biological health of aquatic communities. The recent development of AusRivAS models, as the result of the national Monitoring River Health Initiative, provides a cost-effective method, with standardised methodology, for measuring the ecological health of streams. Monitoring ecological condition provides another measure of the adequacy of logging and buffer prescriptions.

Performance Indicator 3. Number of streams in logged areas where ecological health is impaired using the AusRivAS assessment or other agreed measure.

9.5 Precautionary Principle

The behaviour of an ecosystem almost always involves some level of uncertainty. Conversely, a forest harvesting system operates to minimise uncertainty so that the resource availability is known. There is almost always a gap in the level of precision or accuracy between the two approaches. A forest manager can easily predict the impacts of a 75 m versus 100 m stream-side buffer on the sustainable yield or allowable cut. However, researchers cannot easily predict the varying effects on biodiversity, or water quality between the same two buffers. Research can say with some certainty that buffers are important but large scale (temporal and spatial) and complex experimental investigations are required to distinguish the influence of 30 or 60 m widths.

This lack of balance in the level of uncertainty in aspects of forest management can be a source of misunderstanding and conflict. One of the solutions to this is to rely on best professional judgement and the precautionary principle. The precautionary principle simply implies that in an absence of sound information, it is the best policy to err on the side of caution and conservation. However in being conservative, both the probability and consequence of an action need to be taken into account. In addition, the alternatives and the associated implications need to be assessed.

An adaptive management approach is considered more appropriate for water resources and forest management. The adaptive management approach would involve modifying forest management practices as improved knowledge and understanding is obtained.

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10 Maintaining Soil and Water Resources – Viewpoint Two

Key issues in implementing adaptive forest management; with examples relating to the protection of soil and water values

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10.1 Abstract

Adaptive approaches to forest management are essential because of our incomplete knowledge of the long-term effects of forest use on environmental values, and because community expectations evolve over time Adaptive forest management involves a set of linked processes: planning, implementation, monitoring of outcomes, evaluation, responses (e.g. adaptation of plans or operational guidelines), and reports to stakeholders. Critical and challenging steps involve setting of targets for each management objective, specifying indicators and monitoring procedures, and defining evaluation steps. Stakeholders need to be involved in the development of each of these steps, with the objective of developing greater 'ownership' of the process and outcomes.

Whilst the discussion paper is forward looking in advocating an adaptive forest management framework, it provides little guidance on possible indicators or monitoring approaches. This must be a key activity leading up to the preparation of the draft management plan.

The stated objectives for the protection of soil and water values are at a very high (principles) level and need to be much more specific and measurable. Likewise, proposed strategies lack detail and are 'input' rather than 'outcome' focused.

Risk analysis based on available information and expert opinion should be used to identify those situations (practices, and parts of the landscape) where soil and water values are most threatened. Where management impacts may be subtle and long-term over large areas of the forest (e.g. impacts of repeated prescribed burning on microbial function and nutrient cycling) R&D should be strengthened.

Use of independent audit and reporting to the public is important for building community confidence that forests are well managed.

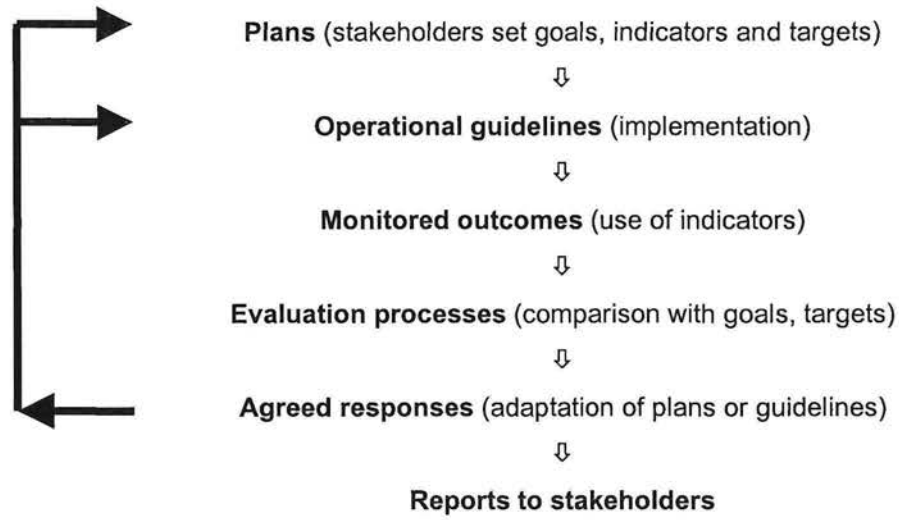
10.2 Adaptive forest management

Sustainable forest management (SFM) is an evolving concept, but is widely recognised to comprise social, economic and environmental components. The relative weighting given to these will vary from place to place, and will reflect the goals and outcomes negotiated between those having legitimate interests in or concerns about forest management. The goals and outcomes effectively become a working definition of SFM that takes into account local values and issues.

The environmental component of SFM covers the properties and processes occurring in the various parts of the forest ecosystem. These have been described in a series of sustainability criteria as part of internationally accepted sets of Criteria and Indicators (e.g. those developed under the Helsinki and Montreal Processes).

Criteria and Indicators can be used to help forest managers to meet growing community expectation that they should demonstrate SFM by quantifying progress against agreed goals and outcomes (targets). Monitoring of outcomes provides the foundation for continuing review and improvement, which are essential if there is to be progress towards SFM. While Criteria and Indicators have considerable potential for improvement of forest policy and management, the science underpinning them and their application to forestry is still immature. The elements required for adaptive forest management are shown below.

Adaptive Forest Management



The major challenge in implementing an adaptive forest management approach is the identification of targets for each management objective, specification of indicators and monitoring procedures for tracking progress against targets, and defining the evaluation steps. Stakeholders need to be involved in the development of each of these steps, with the objective of developing greater 'ownership' of the process and outcomes. For detailed discussion of these issues see Raison, Flinn and Brown (2001).

For building community confidence that forests are well managed, use of independent audit and reporting to the public is important. This is unlikely to be achieved in the near-term by forest certification processes in Australia.

10.3 Some comments on soil and water issues

Possible threats from forest management to soil and water values include:

- Compaction of soil by harvesting machines with consequences for infiltration, erosion, or regeneration success.
- Accelerated erosion following disturbance to vegetation or soil during timber harvesting or prescribed burning.
- Effects of too frequent burning on microbial diversity and function, with associated consequences for nutrient mineralization and uptake (Tommerup and Bougher, CSIRO *pers. comm.*)
- Effects of too frequent burning on site nitrogen balance and nitrogen availability (Raison *et. al.* 1992).
- Changes in water balance and increased risk of salinity.
- Reduction in streamflow, or quality of water for a range of uses.

Careful analyses of these threats in terms of their severity, spatial coverage and longevity (reversibility) of impact is needed. The more obvious and shorter-term impacts are addressed in planing and operational guidelines (particularly the Code of Practice). More subtle and longer-term effects (e.g. those due to repeated prescribed burning) are relatively poorly understood and addressed. For example, the 'principles of fire management' (p.118 of the Discussion Paper), whilst advocating a precautionary approach, make no specific reference to the conservation of soil and water values.

The broad issues relating to the development and application of indicators have recently been reviewed for soil (Raison and Rab 2001) and water (Roberts 2001) values in forests.

10.4 Approach taken in the discussion paper

The discussion paper provides valuable background information for development of the forest management plan, and importantly, is forward thinking in advocating an adaptive forest management framework. The paper provides little guidance on possible indicators and monitoring approaches for each sustainability Criterion (forest value) which is the core of an adaptive management system. This must be a key activity leading up to the preparation of the draft forest management plan. A major recent review for all forest sustainability Criteria, that can provide guidance, has recently been published (Raison, Brown and Flinn, 2001). Only a relatively simple approach to this will be possible initially, but this can be refined over time based on 'learning from doing'. It will be much better to do the most important (based on risk analysis) aspects well. On-going R&D can also be used to support monitoring programs.

10.5 Conclusions

1) An adaptive approach to forest management is desirable, but implementation poses many challenges. Stakeholder involvement is important at all stages.
2) Risk analysis is an important input to the development of forest management plans.
3) A strategic approach to monitoring can be more cost-effective by focusing on representative higher-risk situations, and assessing the effectiveness of practices used to mitigate risk.
4) Performance measures or targets are likely to initially be a mixture of management 'inputs' and sustainability 'outcomes'. The aim must be to progressively move to a more outcome-oriented approach.

10.6 References

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11 Science Forum: Communiqué Process

11.1 Objective

To ensure that outputs of the Science Forum:

- are developed by a representative group of scientists or their nominees
- are produced into a short coherent document with text suitable for feeding directly into the draft Forest Management Plan

11.2 Process

Products from Science Forum need to be collated during the day:

- papers presented by session speakers
- issues raised by audience from each session
- notes used by each rapporteur plus minuted record of their presentation

Science Forum agrees to core group to take the outputs of the day and produce from them a communiqué. Core group will be formed by a nominee from each breakout group plus the two scientists who summarise the day's events. Core group will appoint a spokesperson and a Chair as required/appropriate

Core group meets and finalises communiqué for feeding into Draft Forest Management Plan

Communiqué consists of two parts - an executive summary and a report from the forum. Executive summary produced containing synthesised products (including agreed recommendations and recommended actions, areas of uncertainty or disagreement, areas of agreement, strengths and weaknesses, suggested approaches to address weaknesses, KPIs).

Communiqué fed into draft Forest Management Plan

Core group reconvenes to consider Draft Forest Management Plan's treatment of Communiqué.

11.3 Important Timelines

25th January 2002	Release of Discussion paper - call for comments
25th March 2002	Comments on Discussion paper closes
26th March 2002	Science Forum. Core group formed to develop Communiqué
19th April 2002	Communiqué from Forum finalised and submitted to assist preparation of Draft Plan
July 2002 (approx)	Draft Forest Management Plan released
August 2002	Core group could reconvene and reiterate any comments that appear not to have been incorporated into the draft Plan
Mid 2003	Final Forest Management Plan prepared