

# Towards a Regional Forest Agreement for the South-West Forest Region of Western Australia

**A PAPER TO ASSIST PUBLIC CONSULTATION**

**Prepared by officials to support the South-West Forest Region  
Regional Forest Agreement Process**

Published by the Joint Commonwealth and Western Australian Regional Forest Agreement (RFA) Steering Committee.

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# 1 Introduction

This paper has been prepared by the Joint Western Australian-Commonwealth Regional Forest Agreement (RFA) Steering Committee to assist stakeholders and the broader community to provide input to the development of the RFA for the South-West Forest Region of Western Australia. It builds on information contained in Comprehensive Regional Assessment reports released in late 1997 and in 1998, and on the results of extensive consultation conducted across the region with community and stakeholder groups. The Steering Committee regrets that the key conservation groups have declined to participate in the process.

The range of possible approaches to developing the RFA presented in this paper should not be seen as predetermining the outcomes of the RFA process, nor do they represent the full range of possibilities for meeting the RFA objectives. Rather, they have been designed to promote discussion and feedback as to the most appropriate ways to implement an RFA in the South-West Forest Region. The Commonwealth and Western Australian governments have not formally considered or expressed a preference for any of the approaches.

The RFA will operate for a period of twenty years and will be signed by the Prime Minister of Australia and the Premier of Western Australia. It will define the commitments made by both governments to forest conservation, forest use and the development of the region's forest-based industries. The RFA will be subject to five-yearly reviews of performance against the commitments that have been agreed.

## **The purpose of this paper**

The paper outlines the objectives for the RFA and describes its components. It also provides an overview of the results of the CRA. Importantly, it contains discussion of some approaches which could be employed to achieve the objectives of the RFA and how each of its components could be developed. This discussion serves to highlight that the RFA objectives can be achieved in numerous ways and consequently, the need for careful and balanced consideration of the concerns of all stakeholders.

## **How can you respond?**

The release of this paper marks the beginning of a six-week period of public consultation. To assist with this consultation, opportunities for discussion between the Steering Committee and interested parties will be made available throughout the South-West Forest Region to provide further information on the RFA process and the documents released to date. The locations of these will be advertised in *The West Australian* and major regional newspapers.

## **Written submissions on this paper are invited and should be forwarded to:**

**Mrs C Masters**  
**Forests Taskforce (WA)**  
**Department of Prime Minister and Cabinet**  
**3-5 National Circuit**  
**BARTON ACT 2600 or Fax No. 02-6271-5511**

Those presenting written submissions could consider the following:

- discussion on the issues raised in the paper, their implications and possible solutions;
- any matters of substance that have not been considered;
- other issues associated with the information presented.

These submissions will be taken into account in the development of the RFA.

The **closing date for submissions** will be **Friday 10 July 1998**.

### **Other opportunities for public comment**

Following release of this Public Consultation Paper and preceding the local discussion group phase of the social assessment (see Section 4.3.5), a series of open days will be held in Denmark, Manjimup, Pemberton, Nannup, Margaret River, Bunbury, Waroona, Mundaring and Perth. The open days will provide an opportunity for both general and technical questions to be answered. Maps from the CRA report will be available for examination and discussion. People will also be encouraged to record their comments.

## **1.1 THE REGION**

The South-West Forest Region is an area of 4.25 million hectares which extends from near Gingin in the north-west to near Denmark in the south-east (a map of the area is attached). The region has a Mediterranean climate with warm dry summers, mild wet winters and occasional frosts.

Jarrah-marri forest occurs uniformly on lateritic soils throughout the northern part of the region and also in the south where annual rainfall ranges from 900mm to 1100mm. The main belt of karri forest occurs in the extreme south-west of the region within the 1100mm rainfall isohyet south of a line from Nannup to Denmark. Areas of wandoo forest and woodlands occur generally on the clay soils in the north-eastern sector of the region where the rainfall is below 900mm.

The South-West Forest Region had an estimated population of 155,000 in the 1991 Census. More than 40,000 families and 70,000 (full and part-time) employees lived and worked in the region.

The Region has unique biodiversity values, including important habitat for a number of endangered species. The CRA documented over 3,200 plant species and about 400 vertebrate fauna species. Twenty seven forest ecosystems and 312 native vegetation complexes were mapped within the region. Areas of high species richness, endemism, disjunct flora populations and refugia have also been mapped.

The region supports a wide range of industries including agriculture, mining, mineral processing, manufacturing, native forest and plantation timber milling, wood processing, recreation and tourism, and other forest product industries such as fine wood craft, beekeeping and floriculture. The major industries contributed \$8,896 million to Western Australia's Gross State Product for 1995-96 compared to \$6,388 million in 1990-91.

## 1.2 THE REGIONAL FOREST AGREEMENT PROCESS

### 1.2.1 Background

The RFA process arose out of the National Forest Policy Statement (NFPS) agreed by the Commonwealth, State and Territory governments in 1992.

RFAs are agreements between individual States and the Commonwealth and recognise the range of economic and environmental obligations which each government has regarding the long-term management and protection of forest values in specific regions. RFAs are intended to provide stability through the establishment of a sustainable resource base for industry, while at the same time ensuring the protection of Australia's biodiversity, heritage, old-growth and wilderness through a comprehensive, adequate and representative (CAR) reserve system and complementary off-reserve management.

The RFA will:

- identify areas in the region that both governments believe are required for the establishment of a CAR forest reserve system, and provide for the conservation of those areas;
- provide for the ecologically sustainable management and use of forested areas in the region; and
- provide for the long-term stability of the forest and forest-based industries.

In developing the RFA, the full range of forest values, benefits and costs, need to be recognised and considered.

### 1.2.2 Characteristics of Regional Forest Agreements

RFAs have a number of important characteristics. They should:

- clearly describe the commitments of governments;
- clearly delineate responsibilities for implementing specific commitments and provide timetables and milestones; and
- provide for a review of governments' performance every five years.

Governments make commitments in RFAs to actions that include:

- agreement to the means by which the governments will pursue ecologically sustainable forest management systems and processes;
- defining and describing the means for conserving those areas needed to form a CAR reserve system;
- operational mechanisms for the Agreement; and
- guidance for implementation of the Agreement, including review mechanisms, monitoring and reporting provisions, funding agreements, data agreements and mechanisms for continuing public participation and consultation.



### 1.2.3 Legislative and policy framework for the Regional Forest Agreement process

There are a range of legislative obligations and policies at the Commonwealth and State levels that form the framework for the RFA process. RFAs are intended to recognise and fulfil these obligations and policies.

#### **The National Forest Policy Statement (NFPS)**

The NFPS defines the policies of State and Commonwealth governments in relation to the RFA process and its objectives. The NFPS sets out the vision of the Commonwealth and State governments for Australia's forests and forest industries based on the principles of ecologically sustainable forest management. The elements of that vision are described in the NFPS and comprise the following:

- forest conservation;
- wood production and industry development;
- integrated decision making and management;
- private native forests;
- plantations;
- water supply and catchment management;
- tourism and other economic and social opportunities;
- employment, workforce education and training;
- public awareness, education and involvement;
- research and development; and
- international responsibilities.

#### **National reserve criteria (JANIS)**

In accordance with the NFPS a set of *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia* was developed by an intergovernmental Technical Working Group on Reserve Criteria under the Joint Australian and New Zealand Environment and Conservation Council (ANZECC)/Ministerial Council on Forestry, Fisheries and Aquaculture (MCFFA) NFPS Implementation Sub-committee (JANIS).

These criteria (the JANIS criteria) were agreed by Ministers from ANZECC and MCFFA in 1997 and include provision for the protection of biodiversity, old-growth and wilderness, as well as recognising the role of off-reserve management in meeting conservation objectives. Further details of the JANIS criteria are provided in Box 1.1.

#### **Commonwealth legislation**

The Commonwealth's principal involvement in forest issues derives from the *Export Control Act 1982* which regulates the export of woodchips and unprocessed wood. In assessing applications for export licences under this Act, the relevant Minister is required to ensure that a range of Commonwealth legislative obligations are met. The major Commonwealth legislation includes:

- *Export Control Act 1982* and associated regulations;
- *Endangered Species Protection Act 1992*;
- *World Heritage Properties Conservation Act 1983*;

- *Australian Heritage Commission Act 1975*;
- *Environment Protection (Impact of Proposals) Act 1974*; and
- *Native Title Act 1993*.

### **Box 1.1 Summary of the JANIS reserve criteria**

The JANIS reserve criteria are nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia. The criteria were developed by the Joint ANZECC-MCFFA National Forest Policy Statement Implementation Subcommittee (JANIS).

#### **Regional conservation strategies**

Conservation objectives will be best achieved through the development of integrated regional conservation strategies that provide for the establishment and effective management of conservation reserves (the CAR reserve system) and complementary management of adjoining forest areas.

#### **Components of the comprehensive, adequate and representative reserve system**

All reasonable efforts should be made to provide for biodiversity, old-growth and wilderness conservation in a dedicated reserve system on public land. However, where it is demonstrated that this is not possible or practicable, other approaches will be required. The components of the CAR system are dedicated reserves, informal reserves and values protected by prescription on public land as well as conservation arrangements on private land.

#### **Biodiversity**

1. As a general criterion, 15% of the pre-1750 distribution of each forest ecosystem should be protected in the CAR reserve system, with flexibility applied according to regional circumstances and recognising that as far as possible and practicable the proportion of dedicated reserves should be maximised.
2. Where forest systems are recognised as vulnerable, at least 60% of their remaining extent should be reserved.
3. All remaining occurrences of rare and endangered forest ecosystems should be reserved or protected by other means, as far as is practicable.
4. Reserved areas should be replicated across the geographic range of the forest ecosystem.
5. The reserve system should seek to maximise the area of high-quality habitat for all known elements of biodiversity wherever practicable.
6. Reserves should be large enough to sustain the viability, quality and integrity of populations.
7. To ensure representativeness, the reserve system should, as far as possible, sample the full range of biological variation within each forest ecosystem.
8. In fragmented landscapes, remnants that contribute to sampling the full range of biodiversity are vital parts of a forest reserve system.

#### **Old-growth forest**

It is necessary to approach old-growth in a flexible manner according to regional circumstances. Wherever possible, areas of old-growth requiring protection should be included in the area identified to meet biodiversity criteria.

1. Where old-growth forest is rare or depleted (generally less than 10% of the extant distribution) within a forest ecosystem, all viable examples should be protected, wherever possible.
2. For other forest ecosystems, 60% of the old-growth forest identified at the time of assessment should be protected, consistent with a flexible approach where appropriate, increasing to the levels of protection necessary to achieve objectives for conservation and specific community needs for recreation and tourism.

#### **Wilderness**

Ninety per cent, or more if practicable, of the area of high-quality wilderness that meets minimum area requirements should be protected in reserves.

#### **Application of the criteria**

Flexibility in the application of reserve criteria is needed because of differing regional circumstances. The criteria are considered to be guidelines rather than mandatory targets. In some circumstances and for some criteria, lower levels of reservation may prove adequate. The extent of potential social and economic impact may limit the ability to meet reserve criteria (see Sections 5.2, 5.4 and 6.1.1 of the JANIS document). Where different configurations of reserves are identified as meeting the criteria, the option that imposes the least cost on the community should be adopted.

## Western Australian legislation

The NFPS recognises that State and Territory governments have constitutional responsibility for land use decisions and primary responsibility for forest management. To fulfill this responsibility the States and Territories have enacted legislation that allocates forest land tenures and specifies the administrative framework and policies within which public and private forests are managed. The major Western Australian legislation includes:

- *Conservation and Land Management Act 1984*;
- *Environmental Protection Act 1986*
- *Wildlife Conservation Act 1950*;
- *Mining Act 1978*;
- *Petroleum Act 1967*; and
- mineral-based Agreement Acts.

## Indigenous issues

The RFA process addresses Indigenous issues in two distinct ways: consultation on the outcomes and process in general (as part of the wider consultation process); and on Indigenous cultural heritage, through the national estate assessment.

As with all communities and stakeholder groups with an interest in the Western Australian RFA, Aboriginal communities in the region and appropriate representative bodies are already involved and will continue to be consulted throughout the RFA process.

The Commonwealth *Native Title Act 1993* recognises and protects native title rights and interests. In recognition of this Act:

- where any government action to implement an RFA could affect native title, the action will be taken in accordance with the *Native Title Act*; and
- an RFA is not intended to influence in any way native title claims that may arise.

## 1.2.4 Stages of the Regional Forest Agreement process completed to date

The major preparatory information gathering and assessment stages of the RFA process are now complete. These have included the analysis of available data, the filling in of major data deficiencies and the conduct of CRA projects. These projects have included the identification and assessment of:

- timber production and other forest products;
- tourism and recreation;
- water resources;
- mineral and petroleum resources;
- social values;
- biodiversity;
- old-growth forests;
- wilderness;
- endangered species;
- national estate values;

- world heritage values;
- indigenous heritage values; and
- ecologically sustainable forest management.

Details of the results of these projects are contained within the *Comprehensive Regional Assessment* report (February 1998), the *World Heritage Report: Record of the World Heritage Expert Panel meeting - Western Australia, New South Wales and Queensland* (January 1998), the *Assessment of Mineral Hydrocarbon Resources in the South-West Forest Region of Western Australia* (January 1998), the report on *Ecologically Sustainable Forest Management* (November 1997) and the forthcoming *National Estate Identification and Assessment in the South-West Forest Region* report.

Information gathered and generated through the CRA projects, together with information derived from public consultative processes, was brought together during the integration stage of the RFA to identify and analyse issues that need to be considered in the development of the RFA and assist in the preparation of this paper.

### 1.2.5 Stages of the Regional Forest Agreement process yet to be completed

The release of this public consultation paper constitutes an important stage in the RFA process. Following the conclusion of the six-week public comment period and consideration of submissions, the Commonwealth and Western Australian governments will develop and negotiate the RFA. The development of the RFA will also be informed by more detailed economic and social impact analyses of possible RFA approaches.

### 1.2.6 Consultative processes

A number of consultative mechanisms have been developed and implemented since the RFA process commenced in 1996. The aim of these has been to ensure that all groups and individuals interested in the RFA are kept informed of progress and developments, have ready access to information and have the opportunity to participate and contribute information as appropriate. Consultative processes have enabled the participation of a broad range of people including industry and community stakeholders, Indigenous people, scientists and members of the general public.

Materials developed to assist in community consultation have included CRA reports, information kits, an information line, a video and newsletters, fortnightly RFA updates published in *The West Australian* and local newspapers. A wide range of information on the RFA has also been made available on the internet (<http://www.rfa.gov.au> OR <http://www.calm.wa.gov.au>). This information includes technical reports, media releases and information updates.

#### **Public meetings**

Two series of public meetings have been conducted in towns to date throughout the region to enable members of the general public to be informed about the RFA process. At these meetings information has been presented by members of the joint Western Australian and Commonwealth RFA Steering Committee and by technical officers involved in CRA project work.

## Reference groups

Three consultative reference groups have been formed to enable stakeholders with particular needs and concerns to have ready access to information and the opportunity to provide input into the process. These groups have met periodically throughout the process.

- The *Stakeholder Reference Group* includes representatives from the tourism and timber industries, conservation groups, mining companies, shire councils, Western Australian Government agencies, Indigenous groups and forest product industries such as seed collection, beekeeping and wildflower picking.
- The *Noongar Action Group* comprises Noongar community members from across the region and representatives from agencies such as the Aboriginal Legal Service, Aboriginal Affairs Department and the Noongar Land Council.
- The *State Agreement Acts Committee* has involved representatives from mining companies operating in the South-West Forest Region whose leasehold areas are provided for under State Agreement Acts.

## Community heritage workshops

Participation in workshops conducted as part of CRA projects has enabled many people throughout the region the opportunity to contribute to the RFA process. A series of ten community heritage workshops was held as part of the identification and assessment of national estate social and aesthetic values. Seven Aboriginal community workshops were held as part of the identification and assessment of national estate Aboriginal heritage values and to gather community opinion regarding forest and heritage-related issues.

## Survey and interview

As part of the consultative processes for the CRA social assessment project, a range of survey and interview techniques were used to develop a regional social profile of stakeholder issues and to gather information from forest industry groups including timber, tourism, mining and other forest-based industries such as apiary, craft and specialty timber, firewood, wildflower picking and seed collecting. Sawmill industry employees were also interviewed.

## Scientific community consultation

Consultation with experts from a broad range of scientific fields contributed significantly to the development and implementation of CRA projects. This consultation included:

- the convening of workshops to advise governments on biodiversity assessment projects;
- consultation with independent experts and members of scientific organisations to assist in the development of CRA assessment methodologies and the validation of assessment results;
- the convening of a Panel of Independent Scientists and Experts (PoISE) to advise governments on the appropriate level of vegetation mapping to be used in the assessment of forest ecosystems;
- the assessment of World Heritage values by a Panel of Experts drawn from amongst Australia's foremost experts in disciplines relevant to the World Heritage natural and cultural criteria; and

- the Independent Expert Advisory Group on the assessment of ecologically sustainable forest management in the South-West Forest Region.

Many of the projects and assessments conducted for the CRA were also undertaken by scientists and experts from universities, the CSIRO and private consultancies under contract to the governments.

### **Issues raised during public consultations**

A summary of the issues raised by stakeholders and the general community during the range of public consultations outlined above are detailed at Appendix 1. These views will be considered in the development of the RFA.

## 2 Objectives for the Regional Forest Agreement

The Commonwealth and Western Australian governments believe that the long-term ecologically sustainable management of forests and the development of competitive and efficient forest industries are compatible objectives. They are committed to providing a framework for meeting these objectives in the RFA for the South-West Forest Region of Western Australia, thereby ensuring the protection of conservation values, the basis of an internationally competitive forest products industry and the effective use of economic and social resources in the region.

The Scoping Agreement signed by the Commonwealth and Western Australian governments in July 1996 commits both governments to negotiate an RFA that is consistent with a range of policies, legislative requirements and agreements, as set out in Chapters 1 and 4.

In meeting the requirements of these policies, agreements and legislation, the Commonwealth agreed to:

- apply to each state the same standards for forest management and environmental, heritage, social and economic targets, while allowing for regional variation between States, such as differences in the forest types in individual regions and in environmental, economic and social pressures and in the level of information available (clauses 1B(d) and 1B(e) of the Scoping Agreement);
- facilitate implementation of RFA outcomes through its Wood and Paper Industry Strategy and, where necessary, the Structural Adjustment Package (clause 16) and to provide assistance for conservation outcomes from the RFA (clause 14).

In addition, both governments agreed to:

- accredit jointly, to the maximum extent possible, data sets and processes for the purposes of the RFA and to satisfy requirements of associated Western Australian and Commonwealth statutory assessments (clause 19);
- make available derived data and derived information sets to inform stakeholders at agreed consultation stages during the course of negotiations on the RFA (clause 20).

Further guidance is provided under clause 4 of the Scoping Agreement, whereby Western Australia and the Commonwealth agreed to negotiate a RFA that meets the following requirements:

- defines and describes the means for conserving those forest areas needed to form a CAR reserve system;
- defines those forest areas available for securing sustainable commercial use of forests;
- accredits codes of forest practice, including the process for periodic review of these codes and other management arrangements for forests within the RFA boundary;
- identifies forest resource use and sustainable industry development options and examines any potential social and economic implications, including for communities, of these options;

- identifies the region's wood products, mining and other industry potential;
- addresses biodiversity and threatened species issues;
- addresses heritage issues; and
- identifies a mechanism to enable updating the agreement in the light of significant new information or exceptional circumstances.

In order to provide clear guidance on the goals governments wish to achieve through the RFA process the Steering Committee refined the objectives in the Scoping Agreement - see Box 2.1.

The Steering Committee recognises that difficulties will arise in seeking to meet a number of these objectives concurrently. It is also recognised that the objectives themselves do not identify the appropriate balance between environment, heritage, social and economic values. This report puts forward a range of possible approaches to meeting the various objectives. These approaches are not meant to represent the full range of options for addressing the RFA objectives, but rather have been designed to promote discussion and feedback as to the most appropriate way to implement a RFA in the South-West Forest Region.



## **BOX 2.1 REFINED OBJECTIVES FOR THE WESTERN AUSTRALIA RFA AGREED BY THE STEERING COMMITTEE**

### **Social and economic objectives**

Maintain or enhance the sustainable level of harvest for first and second grade jarrah and karri sawlogs from State native forests incorporated in the approved Western Australian Forest Management Plan.

Maximise a sustainable level of residue harvest to at least a level sufficient to facilitate the regeneration and tending of forest harvested for first and second grade sawlogs.

Promote timber industry development options based on a sustainable native and plantation timber resource.

Maintain and enhance the quality and quantity of water within and emanating from the forest estate and avoid impacting on sites with high potential for harnessing for both domestic and industrial water supplies.

Maintain access for mineral exploration and mining, particularly to areas covered by State Agreement Acts, exploration licences and mining leases and other identified areas of moderate to high mineral potential.

Maintain or enhance forest-based resource use options for other forest based industries, such as tourism, apiary, wildflower picking, fuelwood and seed collecting.

Enhance the potential growth in Gross State Product, value of exports and regional employment arising from forest industry development strategies that reflect market opportunities and the resource potential of the existing forest land base to promote the development of internationally competitive industries that maximise the value added to the resource from forested land.

For communities dependent on access to resources from forested land;

- maintain or enhance employment opportunities in forest-based industry sectors;

- maintain or enhance quality of life by increasing certainty for employment and access to social and physical infrastructure;

- ensure community viability; and

- maximise the benefits of the RFA on communities.

Seek to meet the needs and aspirations of south-west communities in relation to adequate access to, and use of, the forest estate, including for Indigenous cultural activities.

Maintain the forest structural goals identified for jarrah and karri forests in the approved Western Australia Forest Management Plan.

### **Environment and heritage objectives**

Protect forest biodiversity through a comprehensive, adequate and representative reserve system - consistent with the JANIS criteria.

Protect vulnerable, rare and endangered forest ecosystems - consistent with the JANIS criteria.

Protect old-growth forest - consistent with the JANIS criteria.

Protect high-quality wilderness - consistent with the JANIS criteria.

Maximise protection of conservation values through reserve design, taking into account the principles outlined in JANIS.

Protect areas of high-quality habitat for biodiversity - consistent with the JANIS criteria - in particular for:

- rare, vulnerable and endangered species;

- special groups of organisms; and

- areas of high diversity, refugia and endemism.

Adequately protect areas containing natural and cultural heritage (including World Heritage) and indigenous heritage values, in particular those of National Estate value.

Maintain the forest structural goals identified for jarrah and karri forests in the approved Western Australia Forest Management Plan.

### **Other objectives**

Ensure that Commonwealth and State legislative requirements are met.

Ensure that effective and appropriate management systems and processes exist to provide for ecologically sustainable forest management, drawing on the final recommendations of the ESFM Expert Advisory Group.

# 3 The current situation

## 3.1 INTRODUCTION

This chapter summarises the information assembled during the CRA of the South-West Forest Region. More detailed information is contained within the *Comprehensive Regional Assessment Report* (Western Australian-Commonwealth Joint Steering Committee 1998) and associated reports.

## 3.2 MULTIPLE USE FORESTS

The forests of the south-west are used for a great variety of purposes. These include timber production, mining, nature-based tourism, recreation, apiculture, firewood collection, water production, catchment protection and the harvesting of a range of minor forest products. The Western Australian *Conservation and Land Management Act 1984* (the *CALM Act*) provides for multiple-use management of publicly-owned forested land. Other Acts supplement the *CALM Act* provisions for multiple use by providing for particular activities such as mining.

In 1994, following public consideration, the Department of Conservation and Land Management (CALM) published a ten-year plan for the south-west forests entitled *Forest Management Plan 1994-2003*. This plan was designed to provide for multiple use of the forests within the framework of ecological sustainability and was assessed under the Western Australian *Environmental Protection Act 1986*. The plan is likely to require change as a result of the RFA.

## 3.3 TIMBER PRODUCTION AND TIMBER INDUSTRY

Of the total area of approximately 2,450,000 hectares of public native forest managed by CALM, the area available for timber harvesting under the current forest management plan (CALM 1994) is :

- jarrah/marri forest - 1,111,000 hectares
- wandoo forest - 50,000 hectares
- karri/marri forest mixtures - 94,000 hectares.

In addition, Western Australia had 148,000 hectares of hardwood and softwood plantations in 1995 (National Forest Inventory, BRS 1997), the majority of which fall inside the RFA region.

In Western Australia, timber industry activity ranges from the production of tree seedlings, growing, tending and managing the forest estate, through to sawn timber conversion and secondary processing to provide a wide variety of wood-based products. The estimated annual gross value of production of the combined hardwood

and softwood sectors of timber and wood based products valued up to the point of first sale is estimated to be around \$400 million.

It is also estimated that there are more than 20,000 people employed directly or indirectly in timber production and timber using industries in Western Australia.

The native forest industry is the largest and more geographically dispersed component of the industry, with some 2,400 people directly employed by industry in logging, haulage, milling and timber dressing. Employment in this sector can be expected to have flow on effects on employment in other sectors which provide goods and services to these sectors such as transport, engineering, fuel and accountancy, and those engaged in the provision of services to the sector employees such as health and education services. The indirect flow on for the native forest timber industry is estimated to be some 2,900 people.

Approximately 400 people are directly employed by CALM in forest management. A further 500 CALM employees are funded from government revenue derived from timber industry royalties. The indirect employment effects of these CALM employees is estimated to be of the order of 1100 people.

Incomplete data is available on the direct employment in the value adding wood processing and manufacturing sectors of the native forest industry, but it is estimated that up to 6,000 are directly employed in manufacturing industries which utilise native timbers to some extent. In addition to the direct employees in these industries, there are indirect effects on employment in other sectors.

Over the past two decades, employment in the native forest sawmilling sector has been in decline while employment in the plantation establishment sector has increased. However, in the last decade, value adding of native forest timber has increased, leading to the enhancement of employment in the timber processing and manufacturing sectors. Employment in the plantation sector is predicted to increase over the lifetime of the RFA. The RFA process considers the timber industry as a whole and not just the native forest sector.

Interest in the availability of both native forest and plantation timber for local processing is currently strong in Western Australia. CALM and the Western Australian Department of Resources Development report that both local and overseas companies are actively investigating the feasibility of extending existing plants or establishing new plants involving a wide range of solid wood, engineered and reconstituted wood products.

### **Native forest timber production**

The annual allowable harvest under the current Forest Management Plan was determined by the Western Australian Minister for the Environment on 16 August 1993, and applies from January 1994 until 31 December 2003. The annual sawlog harvest for the period of this plan was set at:

- karri - 214,000 cubic metres per year of first grade sawlog and 203,000 of other logs.
- jarrah - 490,000 cubic metres per year of first and second grade sawlogs, with a substantial quantity of lower grade material also being available.

A review of the data and methods used to calculate these sustainable yields was conducted as part of the CRA assessment. This included examination of CALM's timber scheduling program (FORSCHEd) for the determination of long-term sustainable yield. As noted in the Meagher Report (1993), under current log specifications, harvesting practices and conversion technologies, the long-term non-declining level of first and second grade jarrah sawlogs is approximately 300,000m<sup>3</sup> per annum.

The level of harvest set by the Western Australian Minister for the Environment represented an allowable harvest which took into consideration the need to maintain industry and social stability and provide for reinvestment for value adding while adjusting for the reduced area available for timber harvesting arising from the creation of new reserves.

FORSCHEd simulations indicate that while the level of first and second grade jarrah sawlog harvest could be maintained at higher than 300,000m<sup>3</sup> per annum from the year 2004, this would lead to a substantial decline in these sawlogs by the year 2030.

It is anticipated, however, that the forecast decline in availability of first and second grade jarrah sawlogs may be partially offset by an increase in the uptake of lower grade jarrah logs and the future adoption of whole tree-bole logging methods, together with the further refinement of sawing technologies to enable lower grade logs to be sawn.

In Chapter 4 the impacts on the sawlog yield reported for the various approaches provide an approximation of the change in the long-term sustainable yield. For example, a reduction in first and second grade jarrah sawlog resource of 40,000m<sup>3</sup> per annum corresponds to reductions over the RFA period of 490,000m<sup>3</sup> to 450,000m<sup>3</sup> (to 2003) and 300,000m<sup>3</sup> to 260,000m<sup>3</sup> (from 2004 to 2017).

The future availability of log supply from native forests will reflect both the forecast levels under the current management plan and any other resource changes resulting from the RFA.

## **Plantations**

According to the National Forest Inventory (BRS 1997), Western Australia had 148,000 hectares of plantations in 1995 and there is currently considerable interest in developing new hardwood and softwood plantations. Within the RFA region there are 1,450,000 hectares potentially available for tree planting and approximately one third of this area (about 500,000 hectares) could conceivably grow *Eucalyptus globulus* at returns that are competitive with agriculture. Plantations not only provide wood, but help lower watertables and ease the problems of salinity.

Over the next 20 years, the sawlog from softwood plantations within the RFA region is estimated to increase from around 300,000 cubic metres per annum to around 700,000 cubic metres per annum, while chiplog supply from these plantations will remain at about 300,000 cubic metres per annum. The hardwood chiplog production from plantations within the broader south-west may expand from around 200,000 to three million cubic metres per annum. This would create employment in some

industry sectors. These wood flow forecasts were provided by growers in early 1996 and are based on their assumptions concerning existing and perceived markets, wood prices and the silvicultural management of their plantations.

According to Meagher (CALM 1993), Western Australia does have substantial capability to produce commercial quantities of hardwood chiplog from plantations. Sawlog production from hardwood plantations is, however, unlikely to replace Western Australia's native forest timber within the next 20 years, irrespective of market changes or technological improvements in the short term. Most of the hardwood plantations are being grown to produce high quality pulpwood and, although the potential to on-grow a portion of plantation hardwoods for sawlog does exist, current trials suggest that the lead time for research, development and cultivation is likely to be more than twenty years.

Sawlogs from hardwood plantations may begin to supplement the native forest timber harvest in about 25 years.

### **3.4 TOURISM AND RECREATION**

Tourism and recreation are important uses of forest areas. A wide range of tourism operators are licensed by CALM to operate in State forests and national parks in the region. An estimated average of 2.38 million visitor trips each year were made to the RFA region during 1995 and 1996. Total expenditure by tourists visiting the south-west region in that period has been estimated at \$250 million a year. Day trippers alone are estimated to spend \$70 million a year in the area.

Private investment in forest-related private tourism projects completed or under construction in the RFA and adjacent coastal regions during 1997 is estimated to exceed \$100 million. Excluding self-employed people, tourism in the Central and Southern forest regions is estimated to contribute to the direct employment of between 4,000 and 6,000 people in these areas.

### **3.5 MINING AND MINERAL PROCESSING**

Mining is the largest industry sector in the RFA region. A range of commodities is currently being mined from a number of sites from about 10 major mining centres in the RFA region, including bauxite, gold, coal, mineral sands (titanium minerals), lithium, tin and tantalum. These mining operations make significant contributions in terms of revenue and employment to the regional, State and national economies. In 1995-96, the industry in the RFA region generated revenue of \$2.68 billion and employed 8,118 people directly. In 1995-96 the Region produced \$1,920 million of alumina, \$270 million of coal, \$235 million of gold, \$198 million of mineral sands and \$58 million of tin, tantalum and lithium. Through demand for services the industry also contributes to the development of engineering, transport and communications infrastructure and service industries plus attendant employment in the region.

Over the past decade there has been significant expansion in production by all these operations in the RFA area. With world class resources in bauxite, gold, tantalum, spodumene and mineral sands, it is likely that production will continue to increase to meet expanding market demand. Bauxite from the South-West Forest Region currently provides approximately 20% of world alumina production and the Greenbushes pegmatite is the world's largest producer of lithium and tantalum, and contains the majority of the world's identified resource of tantalum. The Collie coalfield is the only producer of coal in Western Australia and in 1996-97 Collie coal generated 45% of Western Australia's electricity.

A total of 83 exploration tenements existed in the RFA region at the end of 1997, along with 279 mining titles. A further 107 tenement applications were under consideration. As the Western Australian *Mining Act* requires a minimum of \$20,000 be spent on exploration licences in the first year, rising in subsequent years, investment in exploration represents a significant element in the regional economy. Assessment of mineral resources within the forest region based on current knowledge of the geology has shown there is potential for thirteen types of metalliferous deposits, five industrial commodities and coal and oil/gas. About half the region is estimated to have moderate and high mineral potential for mineral deposits of significant economic benefit. Ongoing exploration is required to maintain a competitive industry in the region.

## 3.6 OTHER FOREST PRODUCTS

### 3.6.1 Apiculture

In 1995-96 there were 1,025 registered beekeepers operating in Western Australia, using approximately 2,500 apiary sites. A further 72 beekeepers operated solely on private property. During 1996 the total farm gate value of the beekeeping industry in Western Australia was \$7.03 million.

CALM registers all apiary sites on public land and co-ordinates site selection to minimise such factors as dieback spread. Beekeeping is allowed in National Parks and Nature Reserves under existing licences, however, a moratorium currently exists preventing the establishment of any new apiary sites in these areas. Extension of this moratorium is currently being reviewed.

### 3.6.2 Floriculture

The native forests are an important source of wildflowers for the floriculture industry. About 260 species of native flora are exploited by the industry in Western Australia. During 1992-3, there were approximately 700 registered pickers operating in public native forest. The farm gate value of Western Australian wildflower production in this period was more than \$7 million, which included a bush harvested component valued at \$3.7 million. Bush picked produce accounted for approximately 35% of the total Western Australian wildflower market and contributed \$5.5 million to the value of exports during 1992-3.

CALM regulates the floriculture industry and issues licences to ensure harvesting does

not pose a threat to flora conservation. Conditions apply to all licences specifying quotas, area, timeframe, allowed access and the need to provide a monthly statement of the amount harvested. As a general rule wildflower picking is not permitted in national parks, conservation parks and nature reserves.

## 3.7 BIODIVERSITY

The South-West Forest Region biodiversity assessment was undertaken at the species and ecosystems levels and included reviews of the responses of these elements to disturbance. The region is the major forested area of Western Australia, and supports a range of forest ecosystems and plant and animal communities that are restricted to this corner of the Australian continent. The forests are generally dominated by jarrah (*E. marginata*) and/or karri (*E. diversicolor*) and marri (*E. calophylla*). Jarrah is the most widespread tree species in the region, occurring in a wide range of environments and ranging in form from tall closed forest in the high rainfall and high fertility soils of the southern part of the region to open dry woodland in the eastern part of the region. A detailed description of the region's biodiversity is contained in the CRA report.

### 3.7.1 Forest ecosystems

Twenty seven forest ecosystems were mapped throughout the region. In addition to forest and woodland types, the mapped ecosystems include some non-forest areas such as rock outcrops, swamps and heathlands, which are of particular importance for some elements of biodiversity. Four forest ecosystems in the region are recognised under the JANIS criteria as rare and therefore have a target of protection of all remaining examples. These ecosystems are protected to varying extents in existing reserves, reserves proposed in the Forest Management Plan 1994-2003 and in informal reserves.

Details of the current reservation levels of forest ecosystems are provided in Appendix 6.

### 3.7.2 Flora

Over 3,200 taxa of native vascular plants have been recorded for the RFA region, including 462 species of particular conservation significance. The CRA identified areas of high species richness and areas important as centres of endemism, relictual flora and flora with disjunct distributions:

- species richness was highest in areas such as the Blackwood Plateau; the Coastal Plain south of Busselton and the forests north-east of Walpole, between the Frankland and Kent Rivers, and to a lesser extent the Darling Scarp east of Perth;
- areas particularly important as centres of endemism include larger areas on the Coastal Plain south of Busselton; the Scott River plain; between the Frankland River and Denmark; between the Canning and Helena Rivers; west of York and between Bindoon and the Moore River;
- larger areas important for relictual flora species include areas between Waroona and Stirling Dams; on the Scott River plain north-west to the Blackwood River; north-east of Point D'Entrecasteaux and around Lake Surprise between the Frankland and Kent Rivers;
- larger areas identified as important for disjunct flora species, occur between the Canning and Helena Rivers; south-west of Northam, around Collie; on the Scott River Plain; around Lake Surprise between the Frankland and Kent Rivers and in smaller patches near Dwellingup.

Seventy two scheduled threatened (declared rare flora) and 390 priority flora species are found in the region. These include 52 taxa also listed under Schedule 1 of the



Commonwealth *Endangered Species Protection Act 1992*. Declared rare flora (DRF) are considered in the planning process for both fire management and timber harvesting. The Western Australian *Wildlife Conservation Act 1950* provides mechanisms for the protection of rare and endangered plants.

Interim recovery plans are published, or in preparation, for those threatened plants listed as both critically endangered in Western Australia and on Schedule 1 of the Commonwealth *Endangered Species Protection Act 1992*. Altogether, 36 taxa which are listed as endangered or vulnerable on Schedule 1 of the Commonwealth *Endangered Species Protection Act 1992*, but not listed as critically endangered in Western Australia, required the preparation of conservation statements to clarify their current status and necessary management actions. These taxa are currently addressed in regional rare flora management programs and the preparation of interim recovery plans will be addressed as part of the RFA implementation process.

### 3.7.3 Fauna

The landscape of the South-West Forest Region is relatively uniform in comparison to the deeply incised and varied landscapes of eastern Australia. Many species of the south-west forests, especially mammals and birds, tend to occur broadly across the landscape, although some groups, particularly the invertebrates, can be quite restricted in occurrence. The distribution of these species is influenced by factors such as the diversity of understorey flora, soil moisture, rainfall, variations in relief and the frequency, intensity and seasonality of fires.

A number of mammal species unique to Western Australia, such as the Quokka, occur in the region. The south-west forests and woodlands are also refugia for a number of critical weight-range species such as the Numbat and Chuditch which were once widespread in the arid and semi-arid regions of Australia but have contracted in distribution south-westwards into the forest environment. These species are among a group of mammals ranging in weight from 500 grams to 5 kilograms, which have been identified as particularly vulnerable to changing land use, feral predators and competition from introduced species. Many critical weight range mammals have become extinct in Australia. Perup Nature Reserve and similar areas have been particularly important refugia in historical times for critical weight range species, and have allowed the survival of species which have now been reintroduced in other areas following the decline in feral predators as a result of a successful baiting program.

The geological history of this region has greatly influenced the development of the fauna, supporting endemic species unique to the south-west such as the Sunset Frog (*Spicospina flammocaerulea*), and allowing the persistence of elements of Gondwanan invertebrates, such as the mygalomorph spiders, in small refugia where favourable environmental conditions have been maintained. Although fire is one of the most defining elements of the south-west forest landscape, relictual species have persisted in small, infrequently burned refugia such as occur within the mixed karri/tingle and jarrah/tingle wet sclerophyll forests.

An important achievement of the CRA has been the amalgamation of available datasets into the first comparatively comprehensive fauna database in Western Australia, held at the Western Australian Museum. This database includes

approximately 64,000 records of birds, mammals, reptiles, frogs, and freshwater fish, and an additional 381 records for 89 highly endemic, relictual or restricted invertebrate species.

The CRA identified 123 fauna taxa as being of conservation significance. Nine of these species are currently listed in Schedules 1 and 2 of the Commonwealth *Endangered Species Protection Act 1992*. Six of these have recovery plans for their protection and a recovery plan is in preparation for the Western Ringtail Possum. Recovery Plans for the remaining species will be addressed in the implementation of the RFA.

There are currently 18 listed vertebrate species and 11 invertebrate taxa occurring within the RFA region which are declared under the Western Australian *Wildlife Conservation Act 1950*, and their protection is considered in forest management planning and practices. Additional mechanisms for the conservation of fauna species of conservation significance will be considered by governments in developing the Regional Forest Agreement.

### 3.8 OLD-GROWTH

The nationally agreed JANIS criteria were designed to provide for the protection of the range of biological, aesthetic and cultural values attributed to old-growth forest. Although in the south-west forests there are no documented examples of plants or animals dependent on old-growth forests, the targets specified in JANIS are designed to provide for adequate protection of elements of biodiversity even when these are poorly known.

The cultural and aesthetic values of old-growth are based on community and individual values. The JANIS criteria propose that to meet community expectations, old-growth forest should be protected in areas which optimise those values, and that in some cases additional reservation of old-growth may be required other than for biodiversity purposes.

The JANIS criteria provide the basis for identifying and mapping old-growth. Because of their ecological differences, the methodology used to map old-growth in Western Australia differs for wet sclerophyll forest (karri and its mixtures) and the dry sclerophyll forests (jarrah and its mixtures and wandoo). A summary of old-growth within 20 forest ecosystems shows that seven ecosystems have a current area of old-growth exceeding 10,000 hectares (five jarrah ecosystems, one karri, one wandoo). The most extensive areas of old-growth occur in the Jarrah South forest ecosystem (160,500 hectares), the Karri Main Belt forest ecosystem (53,300 hectares) and the Jarrah Blackwood forest ecosystem (48,500 hectares). Another seven forest ecosystems contain old-growth between 1,000 and 10,000 hectares in extent. The CRA report identified old-growth as rare or depleted in 10 out of 20 forest ecosystems.

Details of the current reservation levels for old-growth forest are provided in Appendix 6.

### 3.9 WILDERNESS

The assessment of wilderness in the South-West Forest Region identified no areas that

met the nationally agreed size threshold. Areas identified through the study, below the wilderness size threshold but with high values of remoteness and naturalness, were considered in the assessment of national estate values. All these areas occur within the “natural landscapes” identified through the assessment of national estate values.

Roads are the primary limitation on the size of areas of high wilderness quality in the region through their effect on the National Wilderness Inventory indicators of remoteness from access and apparent naturalness. Depending on management constraints, particularly for fire control, opportunities may therefore exist within some reserves to enhance wilderness quality through road closure or restriction of access.

### 3.10 NATIONAL ESTATE

The assessment of national estate values for the CRA of the South-West Forest Region has resulted in the identification of areas of indicative national estate significance for a wide range of values. These include extensive natural values such as natural landscapes and old-growth forest, localised values such as sites supporting populations of rare and endangered species and centres of endemism, disjuncture or unusual richness of species or communities. A large number of places of indicative national estate cultural value (both Indigenous and non-Indigenous) were also identified throughout the region. The larger areas of indicative national estate significance for natural values occur within the less disturbed forests in the south of the region, although several areas of substantial size, with aggregations of national estate natural values, have also been identified in the northern forests. Details of the national estate assessment are provided in the separate report *National Estate Identification and Assessment in the South-West Forest Region of Western Australia*.

### 3.11 WORLD HERITAGE

A World Heritage Expert Panel was convened and has identified places in Western Australia that warrant further investigation to assess their potential world heritage values. Themes identified by the Panel as possibly being expressed in places in Western Australia are palaeoplains, Eucalyptus-dominated vegetation and Aboriginal Dreaming sites. Details are in the World Heritage Report (1997).

The identification of possible world heritage themes was carried out to enable consideration of the full range of forest issues in the development of the RFA. The identification of potential places by the Expert Panel forum constitutes only a portion of the methodology used to determine those places of outstanding universal value. Those places listed above do not constitute ‘identified properties’ under the Commonwealth *World Heritage Properties Conservation Act 1983*.

## 3.12 ECOLOGICALLY SUSTAINABLE FOREST MANAGEMENT

Six principles underline an ecologically sustainable forest management system. These are:

1. conservation of biological diversity;
2. maintenance of productive capacity of forest ecosystems;
3. maintenance of forest ecosystem health and vitality;
4. conservation and maintenance of soil and water resources;
5. maintenance of global carbon cycles; and
6. maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies.

Assessment of the maintenance of the full range of natural and cultural heritage values identified under the Commonwealth *Australian Heritage Commission Act 1975* is included in these principles.

An independent panel of experts examined the process operating in the South-West Forest Region and found that:

“The current environment management system for the South-West Forest Region meets many of the requirements of a system to pursue ecologically sustainable forest management. Strengths of the forest management system in place in the South-West Forest Region include a well developed system for integrated planning and implementation on a regional basis, supplemented by individual management plans for specific areas. The predominantly top-down approach uses modern technology, research, specialist skills and professional judgment to advantage.

Deficiencies include overlapping and sometimes inconsistent Commonwealth and State legislation; duplication of processes due to the provisions of two overlapping pieces of State legislation and associated administrative arrangements; insufficient monitoring of outcomes of forest management to provide for continuing improvement, and gaps in legislation, policy formulation, planning and implementation concerning specific areas - notably flora and fauna legislation, biodiversity, heritage management and private forests.” *Assessment of Ecologically Sustainable Forest Management in the South-West Forest Region of Western Australia report* (Independent Expert Advisory Group 1997).

A summary of the panel’s recommendations is at Appendix 10.

# Map 1



# Appendix 1

## ISSUES RAISED DURING PUBLIC CONSULTATION

A summary of the issues raised by members of the Stakeholder Reference Group and the general community during the wide range of public consultations for the RFA outlined in section 1.2.6.

### Forest resources

- Native forest resources ought to be utilised.
- Concern that changes in reserve systems will compound current difficulties in resource availability and management and will be at the expense of industry.
- Security of tenure and/or resource is required by the timber, mining and other forest-based industries such as tourism, bee keeping, wildflower collecting and seed collecting, for a range of reasons including exploration, investment planning and industry viability.
- Concern about social and economic impacts that resource uncertainty causes.
- Need to balance old-growth conservation with timber demands.
- Opposition to the use of jarrah for the manufacture of silicon and charcoal.
- Opposition to clearfelling and woodchipping.
- Governments should recognise Noongar intellectual property rights in respect of Noongar traditional knowledge of forest flora, fauna and other resources.
- Noongar people require unrestricted access to all areas of the forest, including national parks and nature reserves, for spiritual, cultural and recreational purposes, including hunting.
- Protection of Noongar heritage places from destruction or damage caused by clearing, logging, development, mining and any other activity in the South-West Forest Region including compensation for damage.
- The use of Australia's publicly owned native forests should be based on comprehensive and co-ordinated land use planning.
- Opposition to logging or mining in national parks, and to their privatisation.
- Criticism that some areas have been given national park status (for example, Shannon National Park) when better areas exist, and that conferring national park status creates a negative public attitude towards mining.
- Community concern over mining leases in native forests.
- Security of access to economically mineable mineral resources is a fundamental determinant of mining companies' willingness to invest in mining operations, particularly in existing leases and tenements.
- Access to land for mining exploration is essential to maintain and expand the mining sector's significant contribution to the state's economy.

### Forest management

- Concern regarding the process for identification, management and care of forest values outside of the RFA study area.
- Concern about long term sustainability of current forest management regimes and the long-term sustainability of the native forest timber industry.
- Concern that forests are managed for timber production rather than for ecological sustainability.
- Concerns relating to a range of issues including forest hygiene, dieback, pests, weeds, forest residues, salinity, prescribed burning practices, regeneration practices, water quality, the loss of carbon to the atmosphere, forest recreation, the size of clear-felling coupes, retention of larger numbers of habitat trees and timber wastage rates.
- Concerns relating to water-related forest management issues raised, including the protection of divertible water resources, the need for the protection of catchment areas for dams and water quality in general.
- Need to keep the understorey in natural condition for the benefits of other industry groups. Clearfelling and prescribed burning regimes severely impact upon apiarists.
- Need to improve knowledge about sustained timber yield.
- Native forest outside conservation reserves should be managed for multiple use.
- Noongar people consider that their traditional knowledge of the natural environment has much to contribute to appropriate forest management and that it is their right to do so under either Native Title legislation or the principles of natural justice.
- Noongar joint-management arrangements with CALM should be developed for the South-West Forest Region.
- CALM has an excellent forest management policy and should not be hindered in implementing its timber strategies

## Industry adjustment

- Concern about the social impacts of timber industry rationalisation and increased automation.
- Need for enhanced value-adding processing to create more jobs. Assistance should be provided to enable local communities to develop broader value-adding opportunities.
- Need for industry improvement in areas such as timber recovery rates.
- Recent and upcoming industry adjustment is due not only to changes in resource availability, but also to broader social, economic and technological change.
- The RFA needs to provide certainty to industry.

## Consultation and transparency

- Public want greater opportunity to participate in the forest decision-making process and community effort and input should be recognised and utilised.
- Consultation is an important component of the care of cultural heritage places.
- CALM's management plans do not reflect changing community needs and CALM seems unaware of the impact of its decisions on local communities.
- Political decisions are made without industry or community consultation.



- A formal process needs to be negotiated and established for Noongar people to be involved in land management and planning decisions in the RFA region, both now and in the future, and where necessary governments to undertake any legislative reform required to implement this.
- Forest management processes and the RFA process need to be transparent.

## Old-growth

- The definition of old-growth forest needs to be clearly understood in the public arena.
- Old-growth forest should not be harvested but instead be preserved for a range of social and environmental reasons.
- Some tourism operators are opposed to future logging of old-growth forests based on their assessment that old-growth forest attracts international, interstate and intrastate visitors.
- Need for adequate management of the relationship between tourism and old-growth forest.

## Cultural heritage

- Concern was expressed regarding the level of protection afforded to cultural heritage places by the Australian Heritage Commission. It is unclear who is responsible for the care of places of cultural heritage significance.
- A greater level of community input should be incorporated into cultural heritage identification and management processes.
- Concern that identification of cultural heritage places would result in the locking up of land.
- Noongar people wish to be involved fully in the identification, assessment and development of protective mechanisms and guidelines for Noongar cultural and spiritual places, values and interests in the RFA region.
- Noongar people wish to have Aboriginal heritage issues addressed prior to the commencement of forest disturbance activities.
- Access to places of Aboriginal heritage value in forests is a matter of cultural survival to Noongar people.

## Economic

- The Commonwealth Government's tariff policies restrict the international competitiveness of the timber industry.
- Concern regarding royalty structures.
- Non-competitive pricing structure between native timbers and imported timber discourages greater expansion of plantation timber production.
- Government and industry need to provide funding and employment and training opportunities for Noongar people to be involved actively and employed in culturally appropriate land management and interpretation.
- Mechanisms for the sharing of economic gains from forest-based industries with the Noongar communities should be developed.
- Need for better recognition of the economic value of tourism.

## Education

- The Western Australian Government should support, facilitate and resource the Noongar community to inform and educate the wider community about Noongar values, places of Aboriginal heritage value and interests in the South-West Forest Region.
- Initiation of programs of cross-cultural training for all CALM personnel in order to increase their awareness of issues of Noongar identity and culture.
- There is a need for a greater knowledge of forest management practices within the wider community.

## Plantations

- Not all timber requirements can be sourced from plantations and it is not necessary to rely on plantations if the native forests of Western Australia are managed by sustainable forest management.
- Need to review success of job creation as a result of increased bluegum plantations.
- Concern at loss of employment and decreased social structure in rural communities as a result of large timber plantations.
- Concern regarding the aesthetic impact of plantations.
- Mixed views about hardwood farm forestry plantations due to perceived social impacts.
- Plantations should play a role in the Western Australian RFA process at a very broad level when economies of scale in future industries are being considered.

## Reserve design

- Potential dam sites should not be included in reserves.
- Representative areas encompassing the natural variation in each major native forest type should be reserved in secure tenure to be managed as closely as possible to the way in which they would develop naturally.
- Wilderness is an anthropocentric concept and should not be used to justify the creation of new reserves or other protected areas.
- Road reserve trees, although only a thin veneer, are not only a tourism attraction but are also important culturally and socially to the region. As such, road reserves should be excluded from the RFA reserve requirement and should not be logged at all.
- Blanket exclusion zones are highly unsatisfactory to the mining industry.
- Any changes to the existing reserve system should be made with the least possible impact on access to other forest resources, particularly mineral resources.
- A balance needs to be struck between forest conservation and mineral development.

## RFA process and outcomes

- There has not been enough publicity or media coverage to make the general public aware of the RFA process.
- Timeframe for the RFA process is inadequate and the process as a whole is flawed. This is particularly of note in relation to the short time allowed for CRA projects.

- Concern about composition of the Steering Committee as a government only body and the delineation of the study area.
- Social and economic assessments need to be given equal weighting to scientific evaluation and modelling.
- Governments should ensure that implementation of the Western Australian RFA will not adversely affect Native Title rights and interests.
- The tourism industry is an important user of the forest and must be an equal partner with the timber industry in the development of forest policy and the RFA.
- The need for local government, local community and Noongar participation in developing and reviewing the RFA.
- The necessary trigger for an industry growth strategy will need to be the enactment of complementary federal and state legislation to underpin the value of the RFA.
- Incorporation in the RFA of a plan for the management of Noongar heritage places.
- New reserves created as part of the RFA process should operate as “multiple use” reserves which do not seek to constrain or prohibit mineral exploration and mining under appropriate environmental conditions.
- The arbitrary selection of 15% as a reservation target for the RFAs gives rise to concern that a future review of the RFA might determine, for reasons of expediency rather than scientific justification, that a higher reservation target should be set, thus imposing further constraints on access to mineral resources.
- Minimal additional planning and approval requirements should be imposed for mining operations outside the agreed CAR reserve system as existing requirements are already very complex.
- The RFA or subsequent legislation should provide security from further reservation initiatives during the term of the RFA, bearing in mind that the 20 year duration of the RFA is inadequate for major resource development projects.
- The biodiversity criteria of 15% should be used as a maximum figure rather than a minimum figure.

# Appendix 2

## Economic analysis model for timber production sector

Outlined below are the assumptions to be used in the economic analysis model of the timber industry in the development of the RFA.

The model is based on:

- the current area of public land of wood production (excluding the proposed new reserve areas identified in the 1994-2003 Forest Management Plan) being available for harvest over the life of the RFA;
- log supply over the life of the current management plan being at the maximum sustainable yields, as outlined in that plan;
- estimates of available log supply and utilisation beyond the expiration of the current management plan in 2003; and
- forecasts of the log supply available from both hardwood and softwood plantations.

The analysis is based on a continuation of current access and management arrangements for mineral exploration and mining, tourism, recreation and other forest uses.

The utilisation of the available log supply is based on the estimates of industry development outlined in the BIS Shrapnel study(1997) . Not all of the proposed developments were incorporated in the baseline. The introduction of a paper mill is not expected to be commissioned by the end of the RFA period, and it was considered that further analysis would be required prior to an activated charcoal plant being introduced. Similarly the expansion of charcoal production has not been considered because of uncertainty over the availability of a sufficient supply of logs within an economic haulage distance of the current plant.

The analysis was undertaken up to the point of first sale of wood products. Thus for timber, valuing of secondary processing of wood beyond the dressed timber stage was not undertaken.

On current estimates, the expiration of the 1994-2003 Forest Management Plan indicates substantial reductions in the quantities of existing first and second grade quality jarrah sawlogs. At the same time, the availability of softwood sawlogs and plantation chiplog production (both hardwood and softwood) is forecast to increase over the life of the RFA. The BIS Shrapnel study assumes that there is increased utilisation of lower grade native forest timber sawlogs and increased investment in new milling technologies.

A spreadsheet-based model was developed to enable estimates to be made of the annual value of production based on the allocation of logs among the various end uses identified by the BIS Shrapnel study. A key assumption was that Western Australian

producers were price takers for their products which would be set at the equivalent export (defined as interstate or overseas) parity price. The RFA period was broken up into four five-year periods and it was assumed that performance in each year of a five-year period was the same.

The capacities of the expanded medium density fibreboard (MDF), particleboard and new timber value adding and pulp plants are fixed and it is assumed that these plants operate at full capacity. Various decision rules were adopted for the allocation of logs among end uses. First grade quality sawlogs were initially allocated to the production of the higher value-added end uses of veneer, laminated veneer lumber (LVL) and plywood up to the maximum throughput of these plants. Remaining sawlogs were then used for timber production with the percentage of timber being processed into appearance grade timbers increasing from current levels of around 55% for jarrah and 15% for karri to 85% for both species, over the life of the RFA. It is assumed that any variation in the sawlog availabilities would be reflected in timber production rather than the high value added products.

It is envisaged that a substantial increase in the harvest and milling of lower grade jarrah logs is assumed beyond 2002 to replace the expected reduction in first and second grade jarrah logs. As was outlined in the BIS Shrapnel study, a significant level of investment would be required to accommodate these changes in log quality and for mills to process a greater proportion of logs beyond the rough sawn stage. As a result, the adjustment process that has been a continual feature of the sawmilling industry over the years will continue through the RFA period. The number of sawmills is expected to decline with the overall average mill throughput expected to increase.

It is expected that the domestic demand for native forest chiplog will increase with an expansion in the production of particleboard and MDF. It is also assumed that a bleached hardwood kraft pulp (BHKP) plant will be a viable venture by around the last quarter of the RFA period. The export of native forest timber chips was regarded as a residual market after meeting domestic demands. It is assumed that any variation in marri/karri chiplog availabilities will be reflected first in the woodchip market, then the pulp sector and finally the MDF and particleboard industries.

The model enables estimates to be made of the annual gross value of production and the net value of production for the current period and for each of the four five-year periods of the RFA for all sectors of the industry which were then able to be allocated between hardwood and softwood production. Costs of production have been derived from a number of sources including the BIS Shrapnel report, results from a survey ABARE undertook of sawmills, CALM databases and discussions with industry personnel. Costs are based on an average cost of production and do not take into account any potential savings associated with the scale of production.

Where the proposed options result in the area available for logging declining, this will have an impact on the available annual log supply. As outlined in the CRA, CALM has systems and procedures in place for estimating the contribution that each area of the forest estate contributes towards the annual sustainable yield for the various forest species. Thus, once an area of forest to be removed from log production has been

identified, estimates then can be made of changes in the volume of log production. These new log supply estimates then can be entered into the model and revised estimates of the value of production made. As stated above, changes in the value of production will be reflected principally in the value of native forest timber production and in the value of woodchip exports.

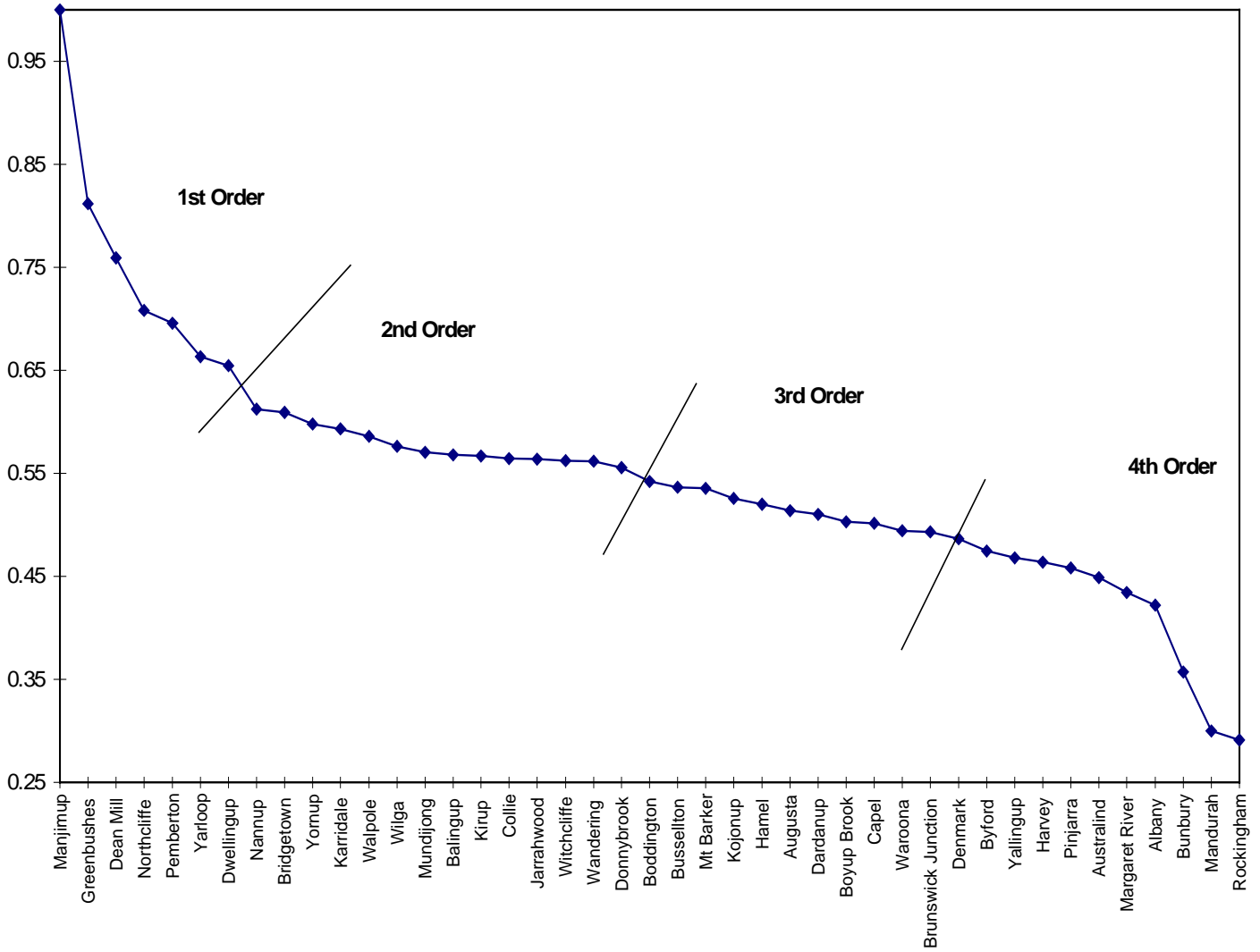
# Appendix 3

## BIS Shrapnel Summary of Potential Industry Development

	2001-2010	2011-2020
<b>Hardwood sawmilling</b> Turnover \$145 million Direct Employment 1,039 <i>Estimates from available information</i>	<b>Hardwood sawmilling</b> Turnover \$170 million Direct Employment 909	<b>Hardwood sawmilling</b> Turnover \$228 million Direct Employment 779
	<b>Hardwood processing and manufacturing</b> Increase in turnover from 1997 \$157 million Increase in employment from 1997 350	<b>Hardwood processing and manufacturing</b> Increase in turnover from 1997 \$207 million Increase in employment from 1997 495
<b>Plywood and other veneer products</b> Very little current production apart from some sliced veneer	<b>Plywood and other veneer products</b> Turnover \$134 million Direct Employment 360	<b>Plywood and other veneer products</b> Turnover \$144 million Direct Employment 360
<b>Reconstituted panels</b> Current output based almost exclusively on softwood	<b>Reconstituted panels</b> Turnover \$107 million Direct Employment 180	<b>Reconstituted panels</b> Turnover \$136 million Direct Employment 180
<b>Pulp</b>		<b>Pulp</b> Turnover \$308 million Direct Employment 730
<b>Paper</b>		<b>Paper</b> Turnover \$480 million Direct Employment 58
<b>Activated carbon</b>	<b>Activated carbon</b> Turnover \$60 million Direct Employment 20	<b>Activated carbon</b> Turnover \$60 million Direct Employment 20
<b>Woodchips</b> Turnover \$46 million Direct Employment 70	<b>Woodchips</b> Turnover \$110 million Direct Employment 120	<b>Woodchips</b> Turnover \$102 million Direct Employment 120

# Appendix 4

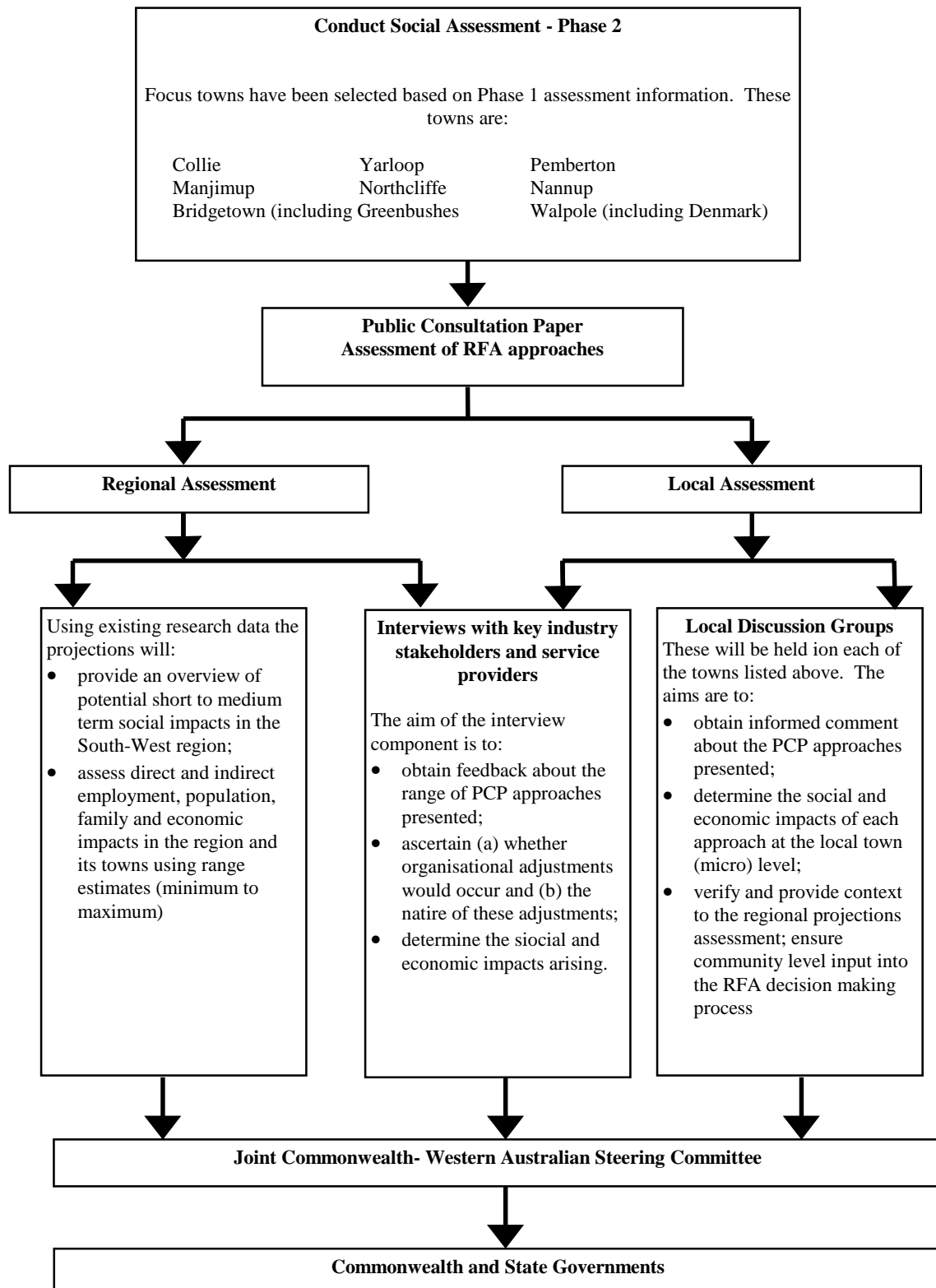
## Community Sensitivity Index





# Appendix 5

## Overview of Phase 2 of the Social Assessment Process



# Appendix 6

## BENCHMARK - TABLES

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Shows the estimated outcomes of fully implementing the Forest Management Plan 1994-2003. The contribution of informal reserves towards the JANIS targets are shown in two ways in the benchmark: 1) those informal reserves which have received up-front accreditation by governments, and 2) all existing informal reserves.

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**Table 6.1**  
**Biodiversity Values**  
**Reservation Analysis**

**Benchmark**

Forest ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	Area Reserved						
			% of pre 1750 area reserved <sup>1</sup>				Total (including only accredited informal reserves)		
			Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	ha	% <sup>2</sup>	Deficit/ Excess <sup>3</sup> ha
Bullich and Yate	2,800	2,440	53.5%	24.3%	0.0%	0.0%	2,176	89.2%	-264
Darling Scarp <sup>++</sup>	29,000	9,938	4.3%	0.0%	0.6%	1.3%	1,433	4.9%	-2,917
Jarrah Blackwood <sup>++</sup>	347,200	281,805	1.9%	6.5%	2.5%	7.8%	37,806	10.9%	-14,274
Jarrah Leeuwin <sup>++</sup>	56,400	19,552	4.5%	0.1%	0.9%	1.4%	3,036	5.4%	-5,424
Jarrah Mt Lindesay <sup>++</sup>	126,600	44,597	1.5%	6.9%	0.3%	0.5%	11,102	8.8%	-7,888
Jarrah North East <sup>++</sup>	717,100	350,239	4.4%	8.0%	1.0%	2.2%	95,646	13.3%	-11,919
Jarrah North West <sup>++</sup>	670,600	499,598	7.2%	2.5%	2.3%	5.6%	80,142	12.0%	-20,448
Jarrah Rate's Tingle	1,500	1,246	62.7%	2.1%	0.0%	0.2%	970	77.8%	-276
Jarrah Red Tingle	350	269	29.4%	32.0%	0.0%	0.1%	215	79.9%	-54
Jarrah Sandy <sup>++</sup>	107,900	71,092	8.3%	12.9%	1.4%	3.6%	24,400	22.6%	8,215
Jarrah South <sup>++</sup>	557,300	438,912	8.0%	13.9%	2.6%	6.7%	136,602	24.5%	53,007
Jarrah Unicup <sup>++</sup>	81,000	29,459	6.1%	11.7%	0.1%	0.2%	14,501	17.9%	2,351
Jarrah Woodland	106,374	67,221	10.9%	7.7%	15.8%	31.8%	36,531	34.3%	20,575
Jarrah Yellow Tingle <sup>++</sup>	11,600	9,669	14.1%	0.7%	10.1%	13.9%	2,890	24.9%	1,150
Karri Main Belt <sup>++</sup>	193,000	163,905	19.5%	1.8%	6.6%	14.8%	53,744	27.8%	24,794
Karri Rate's Tingle	1,100	860	66.9%	0.0%	0.0%	0.0%	736	85.6%	-124
Karri Red Tingle	7,200	5,860	38.1%	31.5%	0.0%	0.1%	5,013	69.6%	3,933
Karri West Coast <sup>++</sup>	14,500	6,274	26.9%	2.4%	0.1%	0.5%	4,254	29.3%	2,079
Karri Yellow Tingle <sup>++</sup>	15,800	13,264	14.2%	0.6%	7.7%	13.5%	3,558	22.5%	1,188
Peppermint & coastal heath	80,100	70,826	66.6%	5.2%	0.2%	0.2%	57,699	72.0%	45,684
Rocky outcrops	26,400	12,444	16.4%	7.1%	8.7%	19.6%	8,487	32.1%	4,527
Sand dunes	10,300	10,342	95.5%	1.8%	0.1%	0.1%	10,030	97.4%	8,485
Shrub, herb & sedgelands	429,900	296,950	19.5%	12.8%	19.0%	24.6%	220,397	51.3%	155,912
Swamps	15,300	8,069	33.4%	2.4%	4.1%	6.3%	6,105	39.9%	3,810
West'n Wandoo forest <sup>++</sup>	363,200	146,597	6.9%	7.1%	0.6%	1.8%	53,122	14.6%	-1,358
West'n Wandoo woodland <sup>++</sup>	163,000	72,078	8.2%	7.1%	0.7%	2.0%	26,023	16.0%	1,573
<b>TOTAL</b>	<b>4,135,524</b>	<b>2,633,506</b>					<b>896,618</b>		<b>272,337</b>

\* Rare forest ecosystem with 100% reservation target. All other ecosystems have a 15% target.

++ Ecosystems currently significant for commercial timber yield.

1 For a discussion of lands contained within these categories please see Sections 4.3.1, 4.3.2 and 4.4.1.

2 Represents the percentage of total reserves measured against 'Present area on all lands' for ecosystems with a 100% target and against 'Estimated pre 1750 area' for all other ecosystems.

3 As measured against the quantitative JANIS targets without taking into account the scientific, economic and social flexibility provisions.

4 Crown lands vested in Commonwealth and Western Australian Governments plus non-accredited informal reserves (see section 4.3.2).

5 Crown lands vested in Commonwealth and Western Australian Governments.

6 Privately owned land, including freehold land owned by Government agencies.

**Table 6.1 (cont.)  
Biodiversity Values  
Reservation Analysis**

**Benchmark**

Area Reserved <sup>1</sup>			Area Outside Reserves		
Total (including all informal reserves)			Public Land		Freehold land <sup>6</sup> ha
ha	% <sup>2</sup>	Deficit/ Excess <sup>3</sup> ha	Outside accredited reserves <sup>4</sup> ha	If all informal reserves were included <sup>5</sup> ha	
2,177	89.2%	-263	3	2	261
1,646	5.7%	-2,704	2,038	1,825	6,468
56,315	16.2%	4,235	230,983	212,474	13,016
3,331	5.9%	-5,129	7,279	6,984	9,237
11,419	9.0%	-7,571	19,189	18,873	14,306
104,510	14.6%	-3,055	170,531	161,667	84,062
102,598	15.3%	2,008	368,845	346,388	50,611
973	78.1%	-273	98	96	177
216	80.2%	-53	14	13	40
26,745	24.8%	10,560	41,353	39,008	5,339
159,385	28.6%	75,790	283,259	260,475	19,052
14,535	17.9%	2,385	2,864	2,830	12,093
53,552	50.3%	37,596	20,130	3,109	10,559
3,325	28.7%	1,585	5,560	5,125	1,219
69,624	36.1%	40,674	100,161	84,281	10,000
736	85.6%	-124	0	0	124
5,017	69.7%	3,937	93	89	755
4,315	29.8%	2,140	520	458	1,500
4,482	28.4%	2,112	8,283	7,359	1,423
57,701	72.0%	45,686	2,681	2,678	10,447
11,379	43.1%	7,419	3,957	1,066	0
10,034	97.4%	8,489	311	307	0
244,741	56.9%	180,256	40,363	16,018	36,191
6,446	42.1%	4,151	549	208	1,415
57,339	15.8%	2,859	52,071	47,853	41,404
28,110	17.2%	3,660	25,105	23,018	20,950
1,040,651		416,370	1,386,239	1,242,206	350,649

**Note:** Comparisons between the benchmark and the approaches are made against those figures that include only the accredited informal reserves.

**Table 6.2**  
**Old-growth**  
**Reservation Analysis**

**Benchmark**

Old-growth by forest ecosystem	Present area on all lands ha	Area Reserved <sup>1</sup>						
		% of present area on all lands reserved				Total (including only accredited informal reserves)		
		Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	ha	% <sup>2</sup>	Deficit / Excess <sup>3</sup> ha
Jarrah Blackwood <sup>++</sup>	48,496	9.7%	13.4%	4.4%	9.6%	13,324	27.5%	-15,773
* Jarrah Leeuwin <sup>++</sup>	477	75.0%	0.0%	0.0%	1.3%	358	75.0%	-119
Jarrah Mt Lindesay <sup>++</sup>	14,005	4.7%	42.2%	1.8%	2.7%	6,827	48.8%	-1,575
* Jarrah North East <sup>++</sup>	11,595	16.9%	20.1%	4.4%	8.3%	4,794	41.3%	-6,801
* Jarrah North West <sup>++</sup>	7,923	68.8%	11.1%	3.8%	4.7%	6,628	83.7%	-1,295
* Jarrah Rate's Tingle	1,021	87.6%	3.0%	0.0%	0.2%	924	90.5%	-97
* Jarrah Red Tingle	214	48.2%	47.7%	0.0%	0.2%	205	95.9%	-9
* Jarrah Sandy <sup>++</sup>	2,171	96.7%	2.2%	0.0%	0.0%	2,149	99.0%	-23
Jarrah South <sup>++</sup>	160,667	23.3%	25.9%	3.6%	7.1%	84,719	52.7%	-11,681
Jarrah Unicap <sup>++</sup>	4,739	21.6%	57.8%	1.4%	1.6%	3,828	80.8%	985
Jarrah Woodland	13,235	32.2%	14.5%	32.0%	51.1%	10,414	78.7%	2,473
Jarrah Yellow Tingle <sup>++</sup>	7,249	21.2%	0.9%	14.1%	18.6%	2,626	36.2%	-1,724
Karri Main Belt <sup>++</sup>	53,576	47.0%	3.9%	8.8%	21.3%	32,020	59.8%	-125
* Karri Rate's Tingle	674	100.0%	0.0%	0.0%	0.0%	674	100.0%	0
Karri Red Tingle	3,283	71.1%	26.4%	0.0%	0.1%	3,202	97.5%	1,233
* Karri West Coast <sup>++</sup>	492	90.2%	9.6%	0.0%	0.0%	491	99.8%	-1
Karri Yellow Tingle <sup>++</sup>	6,969	27.7%	0.6%	11.7%	20.0%	2,788	40.0%	-1,394
* West'n Wandoo forest <sup>++</sup>	7,865	19.5%	53.8%	3.6%	6.5%	6,053	77.0%	-1,812
* West'n Wandoo woodland <sup>++</sup>	3,013	26.6%	22.1%	6.8%	11.6%	1,673	55.5%	-1,340
<b>TOTAL</b>	<b>347,663</b>					<b>183,696</b>		<b>-39,079</b>

\* Forest ecosystem within which old-growth is rare or depleted with a 100% reservation target. All other ecosystems have a 60% target.

++ Ecosystems currently significant for commercial timber yield.

1 For a discussion of lands contained within these categories please see Sections 4.3.1, 4.3.2 and 4.4.1.

2 Represents the percentage of total reserves measured against 'Present area on all lands'.

3 As measured against the quantitative JANIS targets without taking into account the scientific, economic and social flexibility provisions.

4 Crown lands vested in Commonwealth and Western Australian Governments plus non-accredited informal reserves (see section 4.3.2).

5 Crown lands vested in Commonwealth and Western Australian Governments.

6 Privately owned land, including freehold land owned by Government agencies.

**Note:**

**Comparisons between the benchmark and the approaches are made against those figures that include only the accredited informal reserves.**

**Table 6.2 (cont.)**

**Old-growth**

**Benchmark**

**Reservation Analysis**

Area Reserved <sup>1</sup>			Area Outside CAR Reserve		
Total (including all informal reserves)			Public Land		Freehold land <sup>6</sup> ha
ha	% <sup>2</sup>	Deficit / Excess <sup>3</sup> ha	Outside accredited reserves <sup>4</sup> ha	If all informal reserves were included <sup>5</sup> ha	
15,830	32.6%	-13,268	35,172	32,666	0
364	76.3%	-113	119	113	0
6,953	49.6%	-1,450	7,177	7,052	0
5,241	45.2%	-6,354	6,768	6,320	33
6,700	84.6%	-1,222	1,295	1,222	0
927	90.8%	-94	97	94	0
205	96.1%	-8	9	8	0
2,149	99.0%	-23	23	23	0
90,308	56.2%	-6,093	75,948	70,360	0
3,839	81.0%	996	636	625	275
12,932	97.7%	4,992	2,807	288	14
2,951	40.7%	-1,398	4,623	4,298	0
38,712	72.3%	6,566	21,555	14,864	0
674	100.0%	0	0	0	0
3,206	97.7%	1,236	81	77	0
491	99.8%	-1	1	1	0
3,367	48.3%	-815	4,181	3,602	0
6,275	79.8%	-1,590	1,803	1,581	9
1,818	60.3%	-1,195	1,314	1,169	26
202,943		-19,832	163,609	144,361	358

**Table 6.3**

**Reservation Analysis of Indicative Areas of National Estate Values**

**Benchmark**

National Estate Value <sup>1</sup>	Present area on all lands ha	Area reserved <sup>2</sup>								Area Outside Reserves	
		% of present area on all lands reserved <sup>3</sup>				Total (including only accredited informal reserves)		Total (including all informal reserves)		Public Land	
		Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	ha	% <sup>3</sup>	ha	% <sup>3</sup>	Outside accredited reserves <sup>4</sup> ha	If all informal reserves were accredited <sup>5</sup> ha
<b>Criterion A.1</b>											
Refugia	71,138	55.5%	12.1%	20.7%	22.9%	62,786	88.3%	64,396	90.5%	8345	6,734
Centres of relictual flora	84,558	48.3%	18.8%	18.1%	19.9%	72,025	85.2%	73,583	87.0%	12533	10,975
Centres of flora endemism	101,137	20.2%	30.3%	21.8%	24.1%	73,132	72.3%	75,430	74.6%	28005	25,707
Centres of disjunct flora	42,730	22.8%	30.3%	28.6%	30.3%	34,889	81.7%	35,619	83.4%	7841	7,112
<b>Criterion A.2</b>											
Wetlands of national significance	48,146	60.2%	2.5%	2.6%	1.6%	31,453	65.3%	32,159	66.8%	1803	1,097
Aggregations of old-growth forest	178,977	31.7%	23.2%	5.6%	9.4%	108,265	60.5%	115,164	64.3%	70712	63,813
Contemporary fauna refuges	13	61.6%	19.2%	11.6%	15.4%	12	92.3%	12	96.2%	1	0
<b>Criterion A.3</b>											
Vegetation community diversity	6,982	14.7%	21.5%	20.6%	22.5%	3,969	56.8%	4,102	58.8%	3012	2,879
Flora species richness	123,102	18.5%	33.7%	16.7%	19.6%	84,799	68.9%	88,359	71.8%	38235	34,675
<b>Criterion B.1</b>											
Natural landscapes	559,970	44.5%	21.3%	11.5%	14.1%	432,915	77.3%	447,566	79.9%	122565	107,913

1 Some national estate values presented in this table, such as refugia and centres of flora endemism, are derived from similarly named biodiversity values listed in Table 6.4. Such national estate values represent subsets of the total areas which have been identified through the application of thresholds for condition and integrity. In most instances the application of thresholds for indicative national estate significance has involved the identification of these values within natural landscapes of 40 hectares or larger. For a detailed Explanation of thresholds for indicative national estate values, see the separate report "National Estate Identification and Assessment in the South-West Forest Region of Western Australia".

2 For a discussion of lands contained within these categories please see Sections 4.3.1, 4.3.2 and 4.4.1.

3 Represents the percentage of this reserve type as measured against 'Present area on all lands'.

4 Crown lands vested in Commonwealth and Western Australian Governments plus non-accredited informal reserves (see section 4.3.2).

5 Crown lands vested in Commonwealth and Western Australian Governments.

**Table 6.4**

**Biodiversity Reservation Analysis - Flora Values**

**Benchmark**

Flora Value	Present area on all lands ha	% of present area on all lands reserved <sup>1</sup>				Total (accounting for accredited informal reserves only) ha % <sup>2</sup>	Total (including all informal reserves) ha % <sup>2</sup>	Area Outside CAR Reserve		
		Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %			Public Land		Freehold land <sup>5</sup> ha
								Outside accredited reserves <sup>3</sup> ha	If all informal reserves were included <sup>4</sup> ha	
<b>Flora Disjunctiveness</b> Areas with concentrations of disjunct species (those with populations separated by a substantial geographic distance from other populations, such that they are unlikely to interbreed) two standard deviations or more above the mean for the region.	116,283	12.5%	13.6%	13.0%	16.6%	45,331 39.0%	49,539 42.6%	47,999	43,790	22,954
<b>Flora Endemism</b> Areas where the level of endemism is two or more standard deviations above the mean for the region.	221,879	11.9%	18.7%	11.7%	15.1%	93,863 42.3%	101,465 45.7%	110,711	77,155	43,259
<b>Relictual Flora</b> Areas with concentrations of relictual species (those of phylogenetic interest for primitive or relictual characteristics) two standard deviations or more above the mean for the region.	151,981	29.5%	12.5%	11.5%	16.0%	81,315 53.5%	88,119 58.0%	73,895	49,566	14,296
<b>Flora Species Richness</b> Areas of flora species richness (from a richness prediction map generated from site records and the distribution maps from species habitat models) two or more standard deviations above the mean for the region.	211,437	11.7%	23.1%	11.7%	16.8%	98,424 46.6%	109,227 51.7%	102,648	92,989	9,220

- 1 For a discussion of lands contained within these categories please see Sections 4.3, 4.3.2 and 4.4.1.
- 2 Represents the percentage of total reserves measured against 'Present area on all lands'.
- 3 Crown lands vested in Commonwealth and Western Australian Governments, including the non-accredited informal reserves.
- 4 Crown lands vested in Commonwealth and Western Australian Governments.
- 5 Privately owned land, including freehold land owned by Government agencies.



**Table 6.5**

**Indicative Impact Analysis – Native Forest Timber Industry**

**Benchmark**

For each Region	Area available for timber production ha	TIMBER YIELD			Gross Value of wood products at Mill Gate \$/yr
		Karri Sawlog Grade 1+2 m <sup>3</sup> /yr	Jarrah Sawlog Grade 1+2 <sup>4</sup> m <sup>3</sup> /yr	Chiplog and charlog m <sup>3</sup> /yr	
<b>Swan</b>					
Current available <sup>1</sup>	312,247	0	202,000	27,997	\$56,508,766
Less Stream order 4 extension <sup>2</sup>	-636	0	-397	-55	-\$111,068
Benchmark <sup>3</sup>	311,611	0	201,603	27,942	\$56,397,698
<b>Central Forest</b>					
Current available <sup>1</sup>	500,771	0	226,000	68,998	\$65,795,830
Less Stream order 4 extension <sup>2</sup>	-1,007	0	-430	-131	-\$125,074
Benchmark <sup>3</sup>	499,764	0	225,570	68,867	\$65,670,756
<b>Southern Forest</b>					
Current available <sup>1</sup>	337,014	214,000	62,000	637,000	\$117,282,740
Less Stream order 4 extension <sup>2</sup>	-1,688	-2,859	-446	-8,510	-\$1,463,567
Benchmark <sup>3</sup>	335,326	211,141	61,554	628,490	\$115,819,173
<b>TOTAL</b>					
Current available <sup>1</sup>	1,150,032	214,000	490,000	733,995	\$239,587,336
Less Stream order 4 extension <sup>2</sup>	-3,331	-2,859	-1,273	-8,696	-\$1,699,708
Benchmark <sup>3</sup>	1,146,701	211,141	488,727	725,299	\$237,887,628

1 Reflects the outcomes of the Forest Management Plan 1994-2003.

2 The increase in width of fourth order stream reserves by 50 metres to 200 metres and other areas deemed to be informal reserves for accreditation purposes results in a decrease in the area of forest available for timber production - see section 4.3.2.

3 Reflects the Forest Management Plan 1994-2003 less the increase in width of fourth order stream reserves and other areas deemed to be informal reserves for accreditation purposes.

4 The level of cut for jarrah is currently 490,000 m3 pa for the next 6 years - to the year 2004. The analysis uses the forecast drop in resource of 38% to 300,000m3 for jarrah sawlogs using the resource base of the current management plan. From 2004 the % of current' applies to 300,000m3 per yr.

**Table 6.6**  
**Indicative Impact Analysis**  
**Private Sector Native Forest Timber Industry**  
**Related Employment**

**Benchmark**

	Private Sector	
	Indicative Direct Employment <sup>1</sup>	Indicative Indirect Employment <sup>2</sup>
Current situation <sup>3</sup>	2,440	2,928
Less Stream order 4 extension <sup>4</sup>	-17	-20
Benchmark <sup>5</sup>	2,423	2,908

1 Direct employment in this analysis covers employment from the forest to the first point of sale. It includes private sector employment in logging and haulage, sawmilling, resawing and dressing, woodchip milling and charcoal manufacturing.

2 In the absence of any multiplier directly mirroring the industry, a multiplier of 2.2 was used to calculate indirect employment impacts. That is, for every 10 direct jobs lost because of reserve changes, an additional 12 jobs are lost in the wider community.

3 Reflects the outcomes of the Forest Management Plan 1994-2003.

4 The increase in width of fourth order stream reserves by 50 metres to 200 metres and other areas deemed to be informal reserves for accreditation purposes results in a decrease in the area of forest available for timber production - see section 4.3.2.

5 Reflects the Forest Management Plan 1994-2003 less the increase in width of fourth order stream reserves and other areas deemed to be informal reserves for accreditation purposes.

**Table 6.7****Reservation Analysis - Significance for Native Forest Timber Values  
on CALM Managed Land****Benchmark**

Significance for timber values <sup>2</sup>	Total area on CALM managed land ha	Existing Reserved Areas <sup>1&amp;3</sup>				Total (accounting for accredited informal reserves only) ha	Total (accounting for all informal reserves) ha	State Forest area available for production ha
		Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %			
High	283,031	25.8%	9.4%	4.4%	8.7%	112,081	124,087	158,944
Medium High	555,760	16.5%	16.9%	3.2%	7.2%	203,656	226,048	329,712
Moderate	233,306	2.7%	9.5%	2.3%	6.0%	33,833	42,437	190,870
Medium Low	176,574	7.9%	24.2%	2.0%	5.5%	60,403	66,483	110,091
Low	577,505	10.0%	10.5%	6.3%	16.4%	155,408	213,758	363,747

1 For a discussion of lands contained within these categories please see Sections 4.3.1 and 4.3.2.

2 Relates to sustained yield over the next 40 years. These values should not be interpreted as depicting current standing gross bole timber value. The values (high to low) depict the potential contribution of the areas to the scheduled woodflow and were derived on the basis of species, Site potential, silvicultural history, timber inventory and disease status.

3 Represents the percentage of this reserve type measured against 'Total area on CALM managed land'.

**Table 6.8****Reservation Analysis – Mineral Values****Benchmark**

<b>Areas covered by:</b>	<b>Proposed reserves<sup>1</sup> Ha</b>
<i>Agreement Act Leases</i>	51,154
<i>Mining Act tenements<sup>1</sup></i>	
Pending	16,338
Granted	30,976

<sup>1</sup> Proposed reserves as per the 1994-2003 Forest Management Plan

<b>Mineral Potential<sup>2</sup></b>	<b>Proposed reserves<sup>1</sup> Ha</b>
<b>High</b> Areas with a WMP score greater than 90 having moderate to high potential for major deposits eg gold, bauxite.	148,727
<b>Medium</b> Areas with a WMP score of 72-90 having moderate to high potential for significant deposits eg Greenbushes rare metal deposits.	14,786
<b>Low</b> areas with a WMP score of less than 72 having low to moderate potential for deposits of lesser economic significance eg industrial minerals.	159,457

<sup>1</sup> Proposed reserves as per the 1994-2003 Forest Management Plan

<sup>2</sup> Weighted mineral potential (WMP) is an estimate of mineral potential which makes some allowance for relative economic significance.

	<b>Proposed reserves<sup>1</sup> Ha</b>
<b>Identified mineral resources<sup>2</sup></b>	3,991

<sup>1</sup> Proposed reserves as per the 1994-2003 Forest Management Plan

<sup>2</sup> Mineral resources in the ground, identified, demonstrated and often quantified on the basis of past exploration and mining activities. This data is drawn on to develop further exploration and mining proposals.

# Appendix 7

## APPROACH A-TABLES

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Aims to meet JANIS quantitative targets and optimise the non-quantitative criteria while minimising resource impacts degree.

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**Table 7.1**  
**Biodiversity Values**  
**Reservation Analysis**

**Approach A**

Forest Ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>		
			Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha	Level of reservation under this approach <sup>2&amp;3</sup> %
* Bullich and Yate	2,800	2,440	0 to 1	2,176 to 2,177	89.2% to 89.2%
Darling Scarp <sup>++</sup>	29,000	9,938	1,271 to 1,880	2,694 to 3,168	9.3% to 10.9%
Jarrah Blackwood <sup>++</sup>	347,200	281,805	24,642 to 27,383	52,769 to 56,947	15.2% to 16.4%
Jarrah Leeuwin <sup>++</sup>	56,400	19,552	5,680 to 6,178	8,463 to 8,743	15.0% to 15.5%
Jarrah Mt Lindesay <sup>++</sup>	126,600	44,597	8,016 to 8,043	18,867 to 18,895	14.9% to 14.9%
Jarrah North East <sup>++</sup>	717,100	350,239	25,620 to 26,031	107,668 to 107,774	15.0% to 15.0%
Jarrah North West <sup>++</sup>	670,600	499,598	20,998 to 22,424	100,178 to 100,583	14.9% to 15.0%
* Jarrah Rate's Tingle	1,500	1,246	98 to 98	1,069 to 1,069	85.8% to 85.8%
* Jarrah Red Tingle	350	269	0 to 0	215 to 215	80.0% to 80.0%
Jarrah Sandy <sup>++</sup>	107,900	71,091	545 to 1,121	24,904 to 25,424	23.1% to 23.6%
Jarrah South <sup>++</sup>	557,300	438,912	15,658 to 21,176	151,718 to 153,161	27.2% to 27.5%
Jarrah Unicap <sup>++</sup>	81,000	29,459	0 to 105	14,501 to 14,570	17.9% to 18.0%
Jarrah Woodland	106,374	67,221	5,044 to 6,903	39,101 to 39,601	36.8% to 37.2%
Jarrah Yellow Tingle <sup>++</sup>	11,600	9,669	2,636 to 2,841	5,011 to 5,016	43.2% to 43.2%
Karri Main Belt <sup>++</sup>	193,000	163,905	288 to 383	53,988 to 54,217	28.0% to 28.1%
* Karri Rate's Tingle	1,100	860	0 to 0	736 to 736	85.6% to 85.6%
Karri Red Tingle	7,200	5,860	0 to 0	5,013 to 5,013	69.6% to 69.6%
Karri West Coast <sup>++</sup>	14,500	6,274	132 to 222	4,384 to 4,472	30.2% to 30.8%
Karri Yellow Tingle <sup>++</sup>	15,800	13,264	2,987 to 3,626	5,984 to 6,401	37.9% to 40.5%
Peppermint/coastal heath	80,100	70,826	0 to 0	57,699 to 57,699	72.0% to 72.0%
Rocky outcrops	26,400	12,444	1,658 to 1,832	9,287 to 9,294	35.2% to 35.2%
Sand dunes	10,300	10,342	0 to 0	10,030 to 10,030	97.4% to 97.4%
Shrub/herb/sedgeland	429,900	296,950	30,995 to 45,052	227,579 to 229,862	52.9% to 53.5%
Swamps	15,300	8,069	316 to 406	6,111 to 6,113	39.9% to 40.0%
West'n Wandoo forest <sup>++</sup>	363,200	146,597	7,678 to 7,762	55,100 to 55,367	15.2% to 15.2%
West'n Wandoo woodland <sup>++</sup>	163,000	72,077	7,880 to 8,112	33,091 to 33,113	20.3% to 20.3%
<b>TOTAL<sup>8</sup></b>	<b>4,135,524</b>	<b>2,633,503</b>	<b>164,975 to 187,475</b>	<b>1,000,175 to 1,007,820</b>	<b>24.2% to 24.4%</b>

\* Rare forest ecosystem with a 100% reservation target. All other forest ecosystems have a reservation target of 15%.

++ Ecosystems currently significant for commercial timber yield

1 Expressed as a range reflecting variations in approach to reserve design.

2 Includes only accredited informal reserves.

3 Represents the percentage of this reserve type measured against 'Present area on all lands' for rare ecosystems and against 'Estimated pre-1750 area' for all other ecosystems.

4 As measured against the quantitative JANIS targets without taking into account the scientific, economic & social flexibility provisions.

5 For a discussion of lands contained within this category please

6 Crown lands vested in Commonwealth and Western Australian Governments.

7 Privately owned land, including freehold land owned by Government agencies.

8 Minimum and Maximum Total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 7.1 (cont.)**  
**Biodiversity Values**  
**Reservation Analysis**

**Approach A**

Deficit / Excess ha <sup>2&amp;4</sup>	Area Outside CAR Reserve <sup>1</sup>			
	Non-accredited informal reserves <sup>5</sup> ha		Other Public Land <sup>6</sup> ha	
-264 to -263	1 to 1	1 to 2	261 to 261	
-1,656 to -1,182	16 to 92	286 to 684	6,468 to 6,468	
689 to 4,867	17,307 to 17,941	194,536 to 198,079	13,016 to 13,016	
3 to 283	4 to 41	1,568 to 1,811	9,237 to 9,237	
-123 to -95	148 to 240	11,156 to 11,277	14,306 to 14,306	
103 to 209	8,587 to 8,705	152,802 to 154,894	78,971 to 81,077	
-412 to -7	21,767 to 22,009	326,637 to 326,800	50,611 to 50,611	
-177 to -177	0 to 0	0 to 0	177 to 177	
-54 to -54	0 to 0	13 to 13	40 to 40	
8,719 to 9,239	2,259 to 2,321	38,069 to 38,789	5,077 to 5,339	
68,123 to 69,566	23,122 to 23,367	243,332 to 245,020	19,052 to 19,052	
2,351 to 2,420	30 to 34	2,766 to 2,830	12,093 to 12,093	
23,145 to 23,645	15,965 to 16,252	1,265 to 1,344	10,390 to 10,524	
3,271 to 3,276	268 to 336	3,103 to 3,166	1,219 to 1,219	
25,038 to 25,267	16,401 to 16,450	83,288 to 83,468	10,000 to 10,000	
-124 to -124	0 to 0	0 to 0	124 to 124	
3,933 to 3,933	4 to 4	89 to 89	755 to 755	
2,209 to 2,297	29 to 33	273 to 358	1,500 to 1,500	
3,614 to 4,031	614 to 695	4,744 to 5,243	1,423 to 1,423	
45,684 to 45,684	2 to 2	2,678 to 2,678	10,447 to 10,447	
5,327 to 5,334	2,902 to 2,943	270 to 291	-63 to -35	
8,485 to 8,485	4 to 4	307 to 307	0 to 0	
163,094 to 165,377	21,455 to 22,062	9,490 to 11,156	36,143 to 36,154	
3,816 to 3,818	358 to 360	183 to 183	1,415 to 1,415	
620 to 887	4,525 to 4,582	46,031 to 46,297	40,351 to 40,942	
8,641 to 8,663	2,049 to 2,057	16,426 to 16,562	20,367 to 20,490	
375,895 to 383,540	138,724 to 139,624	1,143,579 to 1,147,075	343,379 to 346,633	

**Table 7.2**  
**Old-growth**  
**Reservation Analysis**

**Approach A**

Old-growth by forest ecosystem	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>			
		Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha	Level of reservation under this approach <sup>2&amp;3</sup> %	
Jarrah Blackwood <sup>++</sup>	48,496	16,416 to 16,816	29,027 to 29,092	59.9% to 60.0%	
* Jarrah Leeuwin <sup>++</sup>	477	64 to 103	422 to 460	88.4% to 96.6%	
Jarrah Mt Lindesay <sup>++</sup>	14,005	4,035 to 4,454	10,678 to 11,066	76.3% to 79.0%	
* Jarrah North East <sup>++</sup>	11,594	5,288 to 5,716	9,665 to 9,897	83.4% to 85.4%	
* Jarrah North West <sup>++</sup>	7,923	752 to 961	7,213 to 7,702	91.0% to 97.2%	
* Jarrah Rate's Tingle	1,021	97 to 97	1,021 to 1,021	100.0% to 100.0%	
* Jarrah Red Tingle	214	0 to 0	205 to 205	95.9% to 95.9%	
* Jarrah Sandy <sup>++</sup>	2,171	0 to 6	2,149 to 2,155	99.0% to 99.2%	
Jarrah South <sup>++</sup>	160,667	12,188 to 16,096	96,577 to 96,810	60.1% to 60.3%	
Jarrah Unicap <sup>++</sup>	4,739	0 to 105	3,828 to 3,897	80.8% to 82.2%	
Jarrah Woodland	13,235	1,956 to 2,123	10,929 to 10,976	82.6% to 82.9%	
Jarrah Yellow Tingle <sup>++</sup>	7,249	2,130 to 2,606	4,267 to 4,564	58.9% to 63.0%	
Karri Main Belt <sup>++</sup>	53,576	223 to 294	32,205 to 32,347	60.1% to 60.4%	
* Karri Rate's Tingle	674	0 to 0	674 to 674	100.0% to 100.0%	
Karri Red Tingle	3,283	0 to 0	3,202 to 3,202	97.5% to 97.5%	
* Karri West Coast <sup>++</sup>	492	1 to 1	492 to 492	100.0% to 100.0%	
Karri Yellow Tingle <sup>++</sup>	6,969	1,794 to 2,340	4,225 to 4,570	60.6% to 65.6%	
* West'n Wandoo forest <sup>++</sup>	7,865	1,239 to 1,263	6,746 to 6,973	85.8% to 88.7%	
* West'n Wandoo woodland <sup>++</sup>	3,012	1,046 to 1,094	2,616 to 2,798	86.8% to 92.9%	
<b>TOTAL<sup>8</sup></b>	<b>347,662</b>	<b>49,545 to 51,755</b>	<b>227,169 to 227,871</b>	<b>65.3% to 65.5%</b>	

\* Rare forest ecosystem with a 100% reservation target. All other forest ecosystems have a reservation target of 15%.

++ Ecosystems currently significant for commercial timber yield

1 Expressed as a range reflecting variations in approach to reserve design.

2 Includes only accredited informal reserves.

3 Represents the percentage of this reserve type measured against 'Present area on all lands' for rare ecosystems and against 'Estimated pre-1750 area' for all other ecosystems.

4 As measured against the quantitative JANIS targets without taking into account the scientific, economic & social flexibility provisions.

5 For a discussion of lands contained within this category please

6 Crown lands vested in Commonwealth and Western Australian Governments.

7 Privately owned land, including freehold land owned by Government agencies.

8 Minimum and Maximum Total figures shown are sums of complete approaches, rather than sums of the columns above.



**Table 7.2 (cont.)**

**Old-growth**

**Approach A**

**Reservation Analysis**

Deficit / Excess ha <sup>2&amp;4</sup>	Area Outside CAR Reserve <sup>1</sup>					
	Non-accredited informal reserves <sup>5</sup> ha		Other Public Land <sup>6</sup> ha		Freehold land <sup>7</sup> ha	
-71 to -6	1,432 to 1,550	17,920 to 17,973	0 to 0			
-55 to -16	0 to 0	16 to 55	0 to 0			
2,276 to 2,663	43 to 114	2,895 to 3,212	0 to 0			
-1,930 to -1,697	122 to 128	1,543 to 1,774	26 to 33			
-710 to -221	8 to 37	213 to 672	0 to 0			
0 to 0	0 to 0	0 to 0	0 to 0			
-9 to -9	0 to 0	8 to 8	0 to 0			
-22 to -17	0 to 0	17 to 22	0 to 0			
177 to 409	5,670 to 5,954	57,903 to 58,420	0 to 0			
985 to 1,054	6 to 11	560 to 625	275 to 275			
2,988 to 3,036	2,066 to 2,074	178 to 218	14 to 14			
-83 to 214	215 to 254	2,432 to 2,767	0 to 0			
60 to 202	6,840 to 6,881	14,389 to 14,489	0 to 0			
0 to 0	0 to 0	0 to 0	0 to 0			
1,233 to 1,233	4 to 4	77 to 77	0 to 0			
0 to 0	0 to 0	0 to 0	0 to 0			
43 to 388	375 to 412	1,988 to 2,369	0 to 0			
-1,119 to -892	138 to 155	746 to 956	8 to 8			
-397 to -214	33 to 53	159 to 321	23 to 23			
4,394 to 5,097	17,267 to 17,314	102,131 to 102,873	346.41 to 353.8			

**Table 7.3**

**Reservation Analysis of Indicative Areas of National Estate Values**

**Approach A**

National Estate Value <sup>1</sup>	Extant area ha	CAR Reserve System under this Approach <sup>2</sup>				Area Outside CAR Reserve <sup>2</sup>					
		Possible New Reserves ha		Total area reserved ha		Total area reserved %		Non-accredited informal reserves <sup>3</sup> ha		Other Public Land <sup>4</sup> ha	
<i>Criterion A.1</i>											
Centres of disjunct flora	42,730	14,575 to	16,568	40,306 to	40,952	94.3% to	95.8%	129 to	247	1,649 to	2,177
Centres of flora endemism	101,137	25,957 to	37,388	87,904 to	93,883	86.9% to	92.8%	670 to	1,170	6,584 to	12,064
Centres of relictual flora	84,558	17,009 to	18,107	79,692 to	79,913	94.2% to	94.5%	626 to	626	4,019 to	4,240
Refugia	71,138	7,309 to	8,537	65,673 to	66,284	92.3% to	93.2%	1,218 to	1,344	3,629 to	4,113
<i>Criterion A.2</i>											
Aggregations of old-growth forest	178,977	22,603 to	25,748	124,571 to	130,136	69.6% to	72.7%	5,768 to	6,168	43,073 to	48,237
Contemporary fauna refuges	13	0 to	0	11 to	11	88.5% to	88.5%	0 to	0	0 to	0
Wetlands of national significance	48,146	315 to	505	31,646 to	31,648	65.7% to	65.7%	580 to	590	1,019 to	1,027
<i>Criterion A.3</i>											
Flora species richness	123,102	34,216 to	36,207	107,745 to	108,040	87.5% to	87.8%	1,492 to	1,568	13,425 to	13,796
Vegetation community diversity	6,982	2,259 to	2,836	5,300 to	5,711	75.9% to	81.8%	65 to	111	1,206 to	1,571
<i>Criterion B.1</i>											
Natural landscapes	559,970	63,412 to	71,326	470,849 to	472,766	84.1% to	84.4%	11,812 to	11,894	70,819 to	72,819

1 Some national estate values presented in this table, such as refugia and centres of flora endemism, are derived from similarly named biodiversity values listed in Table 7.4.

In these cases national estate values represent subsets of the total areas which have been identified through the application of thresholds for condition and integrity

In most instances the application of thresholds for indicative national estate significance has involved the identification of these values within natural landscapes

of 40 hectares or larger. For a detailed explanation of thresholds for indicative national estate values, see the separate report National Estate Identification and Assessment in the South-West Forest Region of Western Australia.

2 Expressed as a range reflecting variations in approach to reserve design.

3 For a discussion of lands contained within this category please see Section 4.3.2.

4 Crown lands vested in Commonwealth and Western Australian Governments.

**Table 7.4**

**Biodiversity Reservation Analysis - Flora Values**

**Approach A**

Flora Value	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>		Area Outside CAR Reserve <sup>1</sup>					
		Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha & % <sup>3</sup>	Non-accredited informal reserves <sup>4</sup> ha	Other Public Land <sup>5</sup> ha	Freehold land <sup>6</sup> ha			
<p><b>Flora Disjunctiveness</b> Areas with concentrations of disjunct species (those with populations separated by a substantial geographic distance from other populations, such that they are unlikely to interbreed) two standard deviations or more above the mean for the region.</p>	116,283	22,082 to 33,312	57,690 to 67,245 49.6% to 57.8%	2,22 to 3,406	23,663 to 32,234	22,954 to 22,954			
<p><b>Flora Endemism</b> Areas where the level of endemism is two or more standard deviations above the mean for the region.</p>	221,879	38,533 to 58,427	119,201 to 133,727 53.7% to 60.3%	4,610 to 5,750	40,283 to 53,669	43,259 to 43,259			
<p><b>Relictual Flora</b> Areas with concentrations of relictual species (those of phylogenetic interest for primitive or relictual characteristics) two standard deviations or more above the mean for the region.</p>	151,981	22,372 to 23,778	93,764 to 94,250 61.7% to 62.0%	5,558 to 5,603	37,877 to 38,318	14,296 to 14,296			
<p><b>Flora Species Richness</b> Areas of flora species richness (from a richness prediction map generated from site records and the distribution maps from species habitat models) two or more standard deviations above the mean for the region.</p>	211,437	46,714 to 48,398	130,594 to 130,753 61.8% to 61.8%	7,950 to 8,055	63,513 to 63,568	9,220 to 9,220			

1 Expressed as a range reflecting variations in approach to reserve design

2 Includes only accredited informal reserves

3 Represents total area reserved as a percentage of "present area on all lands"

4 For a discussion of lands contained within this category please see Section 4.3.2

5 Crown lands vested in Commonwealth and Western Australian Governments

6 Privately owned land, including freehold land owned by Government agencies

**Table 7.5**  
**Indicative Impact Analysis – Native Forest Timber Industry**

**Approach A**

For each Region	Area available for timber production ha	TIMBER YIELD			Gross Value of wood products at Mill Gate \$/yr
		Karri Sawlog Grade 1&2 m <sup>3</sup> /yr	Jarrah Sawlog Grade 1&2 <sup>1</sup> m <sup>3</sup> /yr	Chiplog and charlog m <sup>3</sup> /yr	
<b>Swan</b>					
Range under this approach	320,034 to 321,133	0 to 0	195,057 to 199,945	27,035 to 27,712	\$54,566,447 to \$55,933,760
% of current	102.3% to 102.6%	0.0% to 0.0%	96.6% to 99.0%	96.6% to 99.0%	96.6% to 99.0%
Deficit/Addition	7,151 to 8,250	0 to 0	-6,943 to -2,055	-962 to -285	-\$1,942,319 to -\$575,006
<b>Central Forest</b>					
Range under this approach	466,232 to 475,187	0 to 0	197,315 to 205,289	60,240 to 62,675	\$57,444,583 to \$59,766,186
% of current	92.9% to 94.7%	0.0% to 0.0%	87.3% to 90.8%	87.3% to 90.8%	87.3% to 90.8%
Deficit/Addition	-35,546 to -26,591	0 to 0	-28,685 to -20,711	-8,758 to -6,323	-\$8,351,247 to -\$6,029,644
<b>Southern Forest</b>					
Range under this approach	326,849 to 336,819	193,525 to 196,760	56,159 to 57,365	576,054 to 585,683	\$106,086,149 to \$107,931,527
% of current	96.5% to 99.4%	90.4% to 91.9%	90.6% to 92.5%	90.4% to 91.9%	90.5% to 92.0%
Deficit/Addition	-11,853 to -1,883	-20,475 to -17,240	-5,841 to -4,635	-60,946 to -51,317	-\$11,196,591 to -\$9,351,213
<b>TOTAL<sup>2</sup></b>					
Range under this approach	1,123,085 to 1,123,169	193,525 to 196,760	453,418 to 457,711	664,007 to 675,392	\$219,464,492 to \$222,264,159
% of current	97.9% to 98.2%	90.4% to 91.9%	92.3% to 93.3%	92.2% to 93.1%	92.2% to 93.1%
Deficit/Addition	-30,278 to -30,194	-20,475 to -17,240	-36,582 to -32,289	-69,988 to -58,603	-\$20,122,844 to -\$17,323,177

1 The level of cut for jarrah is currently 490,000 m<sup>3</sup> pa for the next 6 years - to the year 2004. The analysis uses the forecast drop in resource of 38% to 300,000m<sup>3</sup> for jarrah sawlogs using the resource base of the current management plan. From 2004 the % of current<sup>1</sup> applies to 300,000m<sup>3</sup> per annum.

2 Minimum and maximum total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 7.6**  
**Indicative Impact Analysis**  
**Private Sector Native Forest Timber Industry**  
**Related Employment**

**Approach A**

	Private Sector					
	Indicative Direct Employment <sup>1</sup>			Indicative Indirect Employment <sup>2</sup>		
Current situation	2,440			2,928		
Range under this approach	2,236	to	2,264	2,683	to	2,717
Range of Indicative Impacts**	-204	to	-176	-245	to	-211

\*\* The increase in width of fourth order stream reserves from 150 metres to 200 metres and other areas deemed to be informal reserves for accreditation purposes results in a decrease in the area of forest available for native forest timber production and reflects a reduction against the current situation of 17 direct jobs and 20 indirect jobs. This reduction is included in the employment impacts outlined above.

1 Direct employment in this analysis covers employment from the forest to the first point of sale. It includes private sector employment in logging and haulage, sawmilling, resawing and dressing, woodchip milling and charcoal manufacturing. Public sector employment impacts are shown at Box 4.2.

2 In the absence of any multiplier directly mirroring the industry, a multiplier of 2.2 was used to calculate indirect employment impacts. That is, for every 10 direct jobs lost because of reserve changes, an additional 12 jobs are lost in the wider community.

**Table 7.7**

**Reservation Analysis - Significance for Native Forest Timber Values on CALM Managed Land**

**Approach A**

Significance for timber values <sup>3</sup>	Total area on CALM managed land ha	CAR Reserve System under this Approach					Non-accredited Informal <sup>4</sup> Reserves Ha	Range of State forest area available for production <sup>4&amp;6</sup> ha
		Existing Reserved Areas <sup>1&amp;2</sup>			Possible New Reserves <sup>4</sup> ha	Total <sup>4&amp;5</sup> ha		
		Formal (gazetted) %	Formal (proposed) <sup>4</sup> %	Informal <sup>4</sup> (accredited) %				
High	283,031	25.8%	8.8% to 8.8%	3.7% to 4.3%	21,082 to 27,744	131,095 to 136,278	11,260 to 11,416	135,493 to 140,519
Medium High	555,760	16.5%	14.5% to 15.0%	3.0% to 3.2%	33,506 to 34,291	224,034 to 225,414	22,490 to 22,867	307,856 to 308,857
Moderate	233,305	2.7%	9.0% to 9.0%	2.1% to 2.1%	14,357 to 14,731	46,505 to 46,951	8,395 to 8,409	177,959 to 178,391
Medium Low	176,574	7.9%	21.9% to 22.1%	1.8% to 2.0%	6,411 to 8,151	62,544 to 64,353	6,004 to 6,090	106,216 to 107,940
Low	577,500	10.0%	8.6% to 8.7%	5.5% to 5.7%	21,572 to 24,904	162,371 to 164,999	56,264 to 57,265	356,232 to 357,864

1 Represents the percentage of this reserve type measured against 'Total area on CALM managed lands'

2 For a discussion of lands contained within this category please see Section 4.3.2

3 Relates to sustained yield over the next 40 years. These values should not be interpreted as depicting current standing gross bole timber value. The values (high to low) depict the potential contribution of the areas to the scheduled woodflow and were derived on the basis of species, site potential, silvicultural history, timber inventory and disease status.

4 Expressed as a range reflecting variations in approach to reserve design

5 Includes only accredited informal reserves.

6 Excludes non-accredited informal reserves

**Table 7.8**

**Reservation Analysis – Mineral Values**

**Approach A**

Areas covered by:	Total new reserves under this approach <sup>1</sup> ha	
<i>Agreement Act Leases</i> <sup>2</sup>	66,922	to 73,109
<i>Mining tenements, leases and licences</i> <sup>3</sup>		
Pending	20,526	to 22,001
Granted	53,026	to 61,507

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Where the creation of new reserves in these tenements is to be avoided, discussions will be held with affected Companies to ensure that any changes to their statutory property rights will only proceed with their agreement. to ensure that any changes to their statutory property rights will only proceed with their agreement.

Mineral Potential <sup>2</sup>	Total new reserves under this approach <sup>1</sup> ha	
<b>High</b> areas with a WMP score greater than 90 having moderate to high potential for major deposits. eg gold, bauxite	211,805	to 218,979
<b>Medium</b> areas with a WMP score of 72-90 having moderate to high potential for significant deposits. eg Greenbushes rare metal deposits	27,880	to 29,106
<b>Low</b> areas with a WMP score of less than 72 having low to moderate potential for deposits of lesser economic significance eg industrial minerals.	222,981	to 238,037

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Weighted mineral potential (WMP) is an estimate of mineral potential which makes some Allowance for relative economic significance:

	Total new reserves under this approach <sup>1</sup> ha	
<b>Identified mineral resources</b> <sup>2</sup>	3,496	to 3,593

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Mineral resources in the ground, identified, demonstrated and often quantified on the basis of past exploration and mining activities. This data is drawn on to develop further exploration and mining proposals.

# Appendix 8

## APPROACH B-TABLES

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Explores the flexibility provisions in the application of the JANIS criteria with lower levels of reservation than approach A.

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**Table 8.1  
Biodiversity Values  
Reservation Analysis**

**Approach B**

Forest Ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>		
			Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha	Level of reservation under this approach <sup>2&amp;3</sup> %
* Bullich and Yate	2,800	2,440	0 to 0	2,176 to 2,176	89.2% to 89.2%
Darling Scarp <sup>++</sup>	29,000	9,938	1,271 to 1,880	2,694 to 3,168	9.3% to 10.9%
Jarrah Blackwood <sup>++</sup>	347,200	281,805	18,226 to 22,235	46,775 to 57,058	13.5% to 16.4%
Jarrah Leeuwin <sup>++</sup>	56,400	19,552	5,680 to 6,178	8,463 to 8,743	15.0% to 15.5%
Jarrah Mt Lindesay <sup>++</sup>	126,600	44,597	5,772 to 6,823	16,603 to 17,766	13.1% to 14.0%
Jarrah North East <sup>++</sup>	717,100	350,239	19,002 to 22,614	98,181 to 105,311	13.7% to 14.7%
Jarrah North West <sup>++</sup>	670,600	499,598	4,116 to 18,546	79,761 to 97,011	11.9% to 14.5%
* Jarrah Rate's Tingle	1,500	1,246	0 to 98	970 to 1,069	77.9% to 85.8%
* Jarrah Red Tingle	350	269	0 to 0	215 to 215	80.0% to 80.0%
Jarrah Sandy <sup>++</sup>	107,900	71,091	276 to 835	24,658 to 25,190	22.9% to 23.3%
Jarrah South <sup>++</sup>	557,300	438,912	10,599 to 12,982	135,906 to 145,490	24.4% to 26.1%
Jarrah Unicap <sup>++</sup>	81,000	29,459	0 to 0	12,097 to 14,501	14.9% to 17.9%
Jarrah Woodland	106,374	67,221	2,913 to 3,530	37,254 to 38,605	35.0% to 36.3%
Jarrah Yellow Tingle <sup>++</sup>	11,600	9,669	1,415 to 1,916	4,053 to 4,258	34.9% to 36.7%
Karri Main Belt <sup>++</sup>	193,000	163,905	65 to 193	53,762 to 53,912	27.9% to 27.9%
* Karri Rate's Tingle	1,100	860	0 to 0	736 to 736	85.6% to 85.6%
Karri Red Tingle	7,200	5,860	0 to 0	5,013 to 5,013	69.6% to 69.6%
Karri West Coast <sup>++</sup>	14,500	6,274	132 to 228	4,384 to 4,478	30.2% to 30.9%
Karri Yellow Tingle <sup>++</sup>	15,800	13,264	899 to 2,822	4,336 to 5,863	27.4% to 37.1%
Peppermint/coastal heath	80,100	70,826	0 to 0	57,699 to 57,699	72.0% to 72.0%
Rocky outcrops	26,400	12,444	1,407 to 1,538	9,075 to 9,110	34.4% to 34.5%
Sand dunes	10,300	10,342	0 to 0	10,030 to 10,030	97.4% to 97.4%
Shrub/herb/sedgeland	429,900	296,950	27,440 to 27,685	224,617 to 226,341	52.2% to 52.6%
Swamps	15,300	8,069	310 to 318	6,064 to 6,111	39.6% to 39.9%
West'n Wandoo forest <sup>++</sup>	363,200	146,597	3,574 to 7,728	50,483 to 55,403	13.9% to 15.3%
West'n Wandoo woodland <sup>++</sup>	163,000	72,077	2,565 to 7,660	27,533 to 32,898	16.9% to 20.2%
<b>TOTAL<sup>8</sup></b>	<b>4,135,524</b>	<b>2,633,503</b>	<b>122,526 to 127,674</b>	<b>943,575 to 968,118</b>	<b>22.8% to 23.4%</b>

\* Rare forest ecosystem with a 100% reservation target. All other forest ecosystems have a reservation target of 15%.

++ Ecosystems currently significant for commercial timber yield

1 Expressed as a range reflecting variations in approach to reserve design.

2 Includes only accredited informal reserves.

3 Represents the percentage of this reserve type measured against 'Present area on all lands' for rare ecosystems and against 'Estimated pre-1750 area' for all other ecosystems.

4 As measured against the quantitative JANIS targets without taking into account the scientific, economic & social flexibility provisions.

5 For a discussion of lands contained within this category please

6 Crown lands vested in Commonwealth and Western Australian Governments.

7 Privately owned land, including freehold land owned by Government agencies.

8 Minimum and Maximum Total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 8.1 (cont.)  
Biodiversity Values  
Reservation Analysis**

**Approach B**

Deficit / Excess ha <sup>2&amp;4</sup>	Area Outside CAR Reserve <sup>1</sup>			
	Non-accredited informal reserves <sup>5</sup> ha		Other Public Land <sup>6</sup> ha	
-264 to -264	1 to 1	2 to 2	261 to 261	
-1,656 to -1,182	16 to 92	286 to 684	6,468 to 6,468	
-5,305 to 4,978	17,365 to 18,460	194,366 to 203,554	13,016 to 13,016	
3 to 283	4 to 41	1,568 to 1,811	9,237 to 9,237	
-2,387 to -1,224	214 to 228	12,311 to 13,460	14,306 to 14,306	
-9,384 to -2,254	8,807 to 8,861	157,095 to 162,175	78,971 to 81,077	
-20,829 to -3,579	21,962 to 23,056	330,015 to 346,169	50,611 to 50,611	
-275 to -177	0 to 2	0 to 96	177 to 177	
-54 to -54	0 to 0	13 to 13	40 to 40	
8,473 to 9,005	2,307 to 2,361	38,256 to 38,994	5,077 to 5,339	
52,311 to 61,895	23,821 to 24,095	250,549 to 259,860	19,052 to 19,052	
-53 to 2,351	34 to 139	2,830 to 5,129	12,093 to 12,093	
21,297 to 22,649	16,712 to 17,076	1,514 to 2,368	10,390 to 10,524	
2,313 to 2,518	359 to 370	3,822 to 4,038	1,219 to 1,219	
24,812 to 24,962	16,455 to 16,482	83,538 to 83,661	10,000 to 10,000	
-124 to -124	0 to 0	0 to 0	124 to 124	
3,933 to 3,933	4 to 4	89 to 89	755 to 755	
2,209 to 2,303	27 to 33	269 to 358	1,500 to 1,500	
1,966 to 3,493	747 to 790	5,231 to 6,715	1,423 to 1,423	
45,684 to 45,684	2 to 2	2,678 to 2,678	10,447 to 10,447	
5,115 to 5,150	2,941 to 3,125	273 to 464	-63 to -35	
8,485 to 8,485	4 to 4	307 to 307	0 to 0	
160,132 to 161,856	22,523 to 23,457	11,944 to 12,723	36,143 to 36,154	
3,769 to 3,816	360 to 407	183 to 183	1,415 to 1,415	
-3,997 to 923	4,673 to 4,708	46,170 to 50,464	40,351 to 40,942	
3,083 to 8,448	2,151 to 2,155	16,657 to 21,904	20,367 to 20,490	
319,295 to 343,838	142,992 to 144,444	1,179,013 to 1,198,854	343,379 to 346,633	

**Table 8.2**  
**Old-growth**  
**Reservation Analysis**

**Approach B**

Old-growth by forest ecosystem	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>			
		Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha	Level of reservation under this approach <sup>2&amp;3</sup> %	
Jarrah Blackwood <sup>++</sup>	48,496	8,425 to 10,759	21,216 to 23,300	43.7% to 48.0%	
* Jarrah Leeuwin <sup>++</sup>	477	64 to 103	422 to 460	88.4% to 96.6%	
Jarrah Mt Lindesay <sup>++</sup>	14,005	3,012 to 4,183	9,698 to 10,798	69.3% to 77.1%	
* Jarrah North East <sup>++</sup>	11,594	5,311 to 5,718	9,660 to 9,902	83.3% to 85.4%	
* Jarrah North West <sup>++</sup>	7,923	742 to 843	7,209 to 7,689	91.0% to 97.0%	
* Jarrah Rate's Tingle	1,021	0 to 97	924 to 1,021	90.5% to 100.0%	
* Jarrah Red Tingle	214	0 to 0	205 to 205	95.9% to 95.9%	
* Jarrah Sandy <sup>++</sup>	2,171	0 to 6	2,149 to 2,155	99.0% to 99.2%	
Jarrah South <sup>++</sup>	160,667	7,477 to 9,608	88,605 to 90,580	55.1% to 56.4%	
Jarrah Unicap <sup>++</sup>	4,739	0 to 0	2,628 to 3,828	55.5% to 80.8%	
Jarrah Woodland	13,235	1,147 to 1,208	10,537 to 10,674	79.6% to 80.7%	
Jarrah Yellow Tingle <sup>++</sup>	7,249	1,126 to 1,757	3,507 to 3,871	48.4% to 53.4%	
Karri Main Belt <sup>++</sup>	53,576	47 to 141	32,034 to 32,141	59.8% to 60.0%	
* Karri Rate's Tingle	674	0 to 0	674 to 674	100.0% to 100.0%	
Karri Red Tingle	3,283	0 to 0	3,202 to 3,202	97.5% to 97.5%	
* Karri West Coast <sup>++</sup>	492	1 to 1	492 to 492	100.0% to 100.0%	
Karri Yellow Tingle <sup>++</sup>	6,969	634 to 1,704	3,307 to 4,119	47.4% to 59.1%	
* West'n Wandoo forest <sup>++</sup>	7,865	1,234 to 1,234	6,938 to 6,938	88.2% to 88.2%	
* West'n Wandoo woodland <sup>++</sup>	3,012	1,050 to 1,050	2,793 to 2,793	92.7% to 92.7%	
<b>TOTAL<sup>8</sup></b>	<b>347,662</b>	<b>32,644 to 36,085</b>	<b>210,174 to 210,376</b>	<b>60.5% to 60.5%</b>	

\* Rare forest ecosystem with a 100% reservation target. All other forest ecosystems have a reservation target of 15%.

++ Ecosystems currently significant for commercial timber yield

1 Expressed as a range reflecting variations in approach to reserve design.

2 Includes only accredited informal reserves.

3 Represents the percentage of this reserve type measured against 'Present area on all lands' for rare ecosystems and against 'Estimated pre-1750 area' for all other ecosystems.

4 As measured against the quantitative JANIS targets without taking into account the scientific, economic & social flexibility provisions.

5 For a discussion of lands contained within this category please

6 Crown lands vested in Commonwealth and Western Australian Governments.

7 Privately owned land, including freehold land owned by Government agencies.

8 Minimum and Maximum Total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 8.2 (cont.)**

**Old-growth**

**Approach B**

**Reservation Analysis**

Deficit / Excess ha <sup>2&amp;4</sup>	Area Outside CAR Reserve <sup>1</sup>					
	Non-accredited informal reserves <sup>5</sup> ha		Other Public Land <sup>6</sup> ha		Freehold land <sup>7</sup> ha	
-7,882 to -5,798	1,920 to	1,932	23,265 to	25,361	0 to	0
-55 to -16	0 to	0	16 to	55	0 to	0
1,296 to 2,395	49 to	92	3,157 to	4,214	0 to	0
-1,935 to -1,693	123 to	127	1,539 to	1,779	26 to	33
-714 to -234	11 to	38	223 to	676	0 to	0
-97 to 0	0 to	2	0 to	94	0 to	0
-9 to -9	0 to	0	8 to	8	0 to	0
-23 to -17	0 to	0	17 to	23	0 to	0
-7,795 to -5,820	6,237 to	6,258	63,829 to	65,826	0 to	0
-215 to 985	11 to	91	625 to	1,744	275 to	275
2,596 to 2,733	2,330 to	2,441	217 to	243	14 to	14
-842 to -478	266 to	280	3,098 to	3,475	0 to	0
-111 to -4	6,884 to	6,912	14,550 to	14,629	0 to	0
0 to 0	0 to	0	0 to	0	0 to	0
1,233 to 1,233	4 to	4	77 to	77	0 to	0
0 to 0	0 to	0	0 to	0	0 to	0
-875 to -63	454 to	493	2,397 to	3,169	0 to	0
-927 to 0	0 to	138	781 to	781	8 to	8
-220 to 0	0 to	33	164 to	164	23 to	23
-12,601 to -12,399	18,596 to	18,761	118344 to	118374	346.41 to	353.8

**Table 8.3****Reservation Analysis of Indicative Areas of National Estate Values****Approach B**

National Estate Value <sup>1</sup>	Extant area ha	CAR Reserve System under this Approach <sup>2</sup>				Area Outside CAR Reserve <sup>2</sup>					
		Possible New Reserves ha		Total area reserved ha		Total area reserved %		Non-accredited informal reserves <sup>3</sup> ha		Other Public Land <sup>4</sup> ha	
<i>Criterion A.1</i>											
Centres of disjunct flora	42,730	12,554 to	14,342	39,181 to	39,854	91.7% to	93.3%	136 to	346	2,740 to	3,203
Centres of flora endemism	101,137	21,091 to	21,721	82,958 to	84,211	82.0% to	83.3%	1,550 to	1,639	15,377 to	16,540
Centres of relictual flora	84,558	14,450 to	14,859	77,139 to	78,423	91.2% to	92.7%	763 to	860	5,373 to	6,559
Refugia	71,138	5,182 to	6,643	64,019 to	65,764	90.0% to	92.4%	1,359 to	1,510	4,008 to	5,601
<i>Criterion A.2</i>											
Aggregations of old-growth forest	178,977	16,790 to	18,470	119,328 to	120,771	66.7% to	67.5%	6,562 to	6,729	51,644 to	52,920
Contemporary fauna refuges	13	0 to	0	11 to	12	88.5% to	92.3%	0 to	0	0 to	0
Wetlands of national significance	48,146	195 to	510	31,463 to	31,637	65.3% to	65.7%	603 to	663	1,016 to	1,129
<i>Criterion A.3</i>											
Flora species richness	123,102	22,119 to	27,109	99,220 to	101,695	80.6% to	82.6%	2,009 to	2,376	19,330 to	21,437
Vegetation community diversity	6,982	1,921 to	2,166	5,160 to	5,261	73.9% to	75.4%	113 to	116	1,607 to	1,705
<i>Criterion B.1</i>											
Natural landscapes	559,970	45,986 to	49,438	456,557 to	458,227	81.5% to	81.8%	13,468 to	13,482	83,785 to	85,440

1 Some national estate values presented in this table, such as refugia and centres of flora endemism, are derived from similarly named biodiversity values listed in Table 7.4.

In these cases national estate values represent subsets of the total areas which have been identified through the application of thresholds for condition and integrity

In most instances the application of thresholds for indicative national estate significance has involved the identification of these values within natural landscapes

of 40 hectares or larger. For a detailed explanation of thresholds for indicative national estate values, see the separate report National Estate Identification and Assessment in the South-West Forest Region of Western Australia.

2 Expressed as a range reflecting variations in approach to reserve design.

3 For a discussion of lands contained within this category please see Section 4.3.2.

4 Crown lands vested in Commonwealth and Western Australian Governments.

**Table 8.4**

**Biodiversity Reservation Analysis - Flora Values**

**Approach B**

Flora Value	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>		Area Outside CAR Reserve <sup>1</sup>						
		Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha & % <sup>3</sup>	Non-accredited informal reserves <sup>4</sup> ha	Other Public Land <sup>5</sup> ha	Freehold land <sup>6</sup> ha				
<p><b>Flora Disjunctiveness</b> Areas with concentrations of disjunct species (those with populations separated by a substantial geographic distance from other populations, such that they are unlikely to interbreed) two standard deviations or more above the mean for the region.</p>	116,283	16,064 to 17,931	52,855 to 53,635 45.5% to 46.1%	3,454 to 3,728	36,241 to 36,747	22,954 to 22,954				
<p><b>Flora Endemism</b> Areas where the level of endemism is two or more standard deviations above the mean for the region.</p>	221,879	28,907 to 30,176	108,082 to 112,507 48.7% to 50.7%	6,196 to 6,626	59,918 to 63,913	43,259 to 43,259				
<p><b>Relictual Flora</b> Areas with concentrations of relictual species (those of phylogenetic interest for primitive or relictual characteristics) two standard deviations or more above the mean for the region.</p>	151,981	20,065 to 20,228	91,461 to 92,481 60.2% to 60.9%	5,525 to 5,648	39,556 to 40,698	14,296 to 14,296				
<p><b>Flora Species Richness</b> Areas of flora species richness (from a richness prediction map generated from site records and the distribution maps from species habitat models) two or more standard deviations above the mean for the region.</p>	211,437	39,412 to 40,563	124,108 to 128,334 58.7% to 60.7%	8,179 to 8,545	65,703 to 69,563	9,220 to 9,220				

1 Expressed as a range reflecting variations in approach to reserve design

2 Includes only accredited informal reserves

3 Represents total area reserved as a percentage of "present area on all lands"

4 For a discussion of lands contained within this category please see Section 4.3.2

5 Crown lands vested in Commonwealth and Western Australian Governments

6 Privately owned land, including freehold land owned by Government agencies

**Table 8.5**  
**Indicative Impact Analysis – Native Forest Timber Industry**

**Approach B**

For each Region	Area available for timber production ha	TIMBER YIELD			Gross Value of wood products at Mill Gate \$/yr
		Karri Sawlog Grade 1&2 m <sup>3</sup> /yr	Jarrah Sawlog Grade 1&2 <sup>1</sup> m <sup>3</sup> /yr	Chiplog and charlog m <sup>3</sup> /yr	
<b>Swan</b>					
Range under this approach	320,034 to 321,133	0 to 0	203,710 to 203,923	28,234 to 28,264	\$56,987,253 to \$57,046,657
% of current	102.3% to 102.6%	0.0% to 0.0%	100.8% to 101.0%	100.8% to 101.0%	100.8% to 101.0%
Deficit/Addition	7,151 to 8,250	0 to 0	1,710 to 1,923	237 to 267	\$478,487 to \$537,891
<b>Central Forest</b>					
Range under this approach	466,232 to 475,187	0 to 0	201,618 to 214,333	61,554 to 65,436	\$58,697,453 to \$62,399,229
% of current	92.9% to 94.7%	0.0% to 0.0%	89.2% to 94.8%	89.2% to 94.8%	89.2% to 94.8%
Deficit/Addition	-35,546 to -26,591	0 to 0	-24,382 to -11,667	-7,444 to -3,562	-\$7,098,377 to -\$3,396,601
<b>Southern Forest</b>					
Range under this approach	326,849 to 336,819	197,281 to 207,712	59,789 to 60,788	587,234 to 618,283	\$109,101,539 to \$113,731,456
% of current	96.5% to 99.4%	92.2% to 97.1%	96.4% to 98.0%	92.2% to 97.1%	93.0% to 97.0%
Deficit/Addition	-11,853 to -1,883	-16,719 to -6,288	-2,211 to -1,212	-49,766 to -18,717	-\$8,181,201 to -\$3,551,284
<b>TOTAL<sup>2</sup></b>					
Range under this approach	1,123,085 to 1,123,169	197,281 to 207,712	466,116 to 478,045	677,022 to 711,983	\$224,786,245 to \$233,177,342
% of current	97.9% to 98.2%	92.2% to 97.1%	96.0% to 97.4%	94.1% to 97.6%	94.4% to 97.6%
Deficit/Addition	-30,278 to -30,194	-16,719 to -6,288	-23,884 to -11,955	-56,973 to -22,012	-\$14,801,091 to -\$6,409,994

1 The level of cut for jarrah is currently 490,000 m<sup>3</sup> pa for the next 6 years - to the year 2004. The analysis uses the forecast drop in resource of 38% to 300,000m<sup>3</sup> for jarrah sawlogs using the resource base of the current management plan. From 2004 the % of current<sup>1</sup> applies to 300,000m<sup>3</sup> per annum.

2 Minimum and maximum total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 8.6**  
**Indicative Impact Analysis**  
**Private Sector Native Forest Timber Industry**  
**Related Employment**

**Approach B**

	Private Sector	
	Indicative Direct Employment <sup>1</sup>	Indicative Indirect Employment <sup>2</sup>
Current situation	2,440	2,928
Range under this approach	2,291 to 2,374	2,749 to 2,849
Range of Indicative Impacts**	-149 to -65	-179 to -78

\*\* The increase in width of fourth order stream reserves from 150 metres to 200 metres and other areas deemed to be informal reserves for accreditation purposes results in a decrease in the area of forest available for native forest timber production and reflects a reduction against the current situation of 17 direct jobs and 20 indirect jobs. This reduction is included in the employment impacts outlined above.

1 Direct employment in this analysis covers employment from the forest to the first point of sale. It includes private sector employment in logging and haulage, sawmilling, resawing and dressing, woodchip milling and charcoal manufacturing. Public sector employment impacts are shown at Box 4.2.

2 In the absence of any multiplier directly mirroring the industry, a multiplier of 2.2 was used to calculate indirect employment impacts. That is, for every 10 direct jobs lost because of reserve changes, an additional 12 jobs are lost in the wider community.



**Table 8.7**

**Reservation Analysis - Significance for Native Forest Timber Values on CALM Managed Land**

**Approach B**

Significance for timber values <sup>3</sup>	Total area on CALM managed land ha	CAR Reserve System under this Approach					Non-accredited Informal <sup>4</sup> Reserves Ha	Range of State forest area available for production <sup>4&amp;6</sup> ha
		Existing Reserved Areas <sup>1&amp;2</sup>			Possible New Reserves <sup>4</sup> ha	Total <sup>4&amp;5</sup> ha		
		Formal (gazetted) %	Formal (proposed) <sup>4</sup> %	Informal <sup>4</sup> (accredited) %				
High	283,031	25.8%	8.1% to 8.8%	4.0% to 4.5%	10,480 to 20,402	119,102 to 129,445	11,637 to 12,100	141,949 to 151,829
Medium High	555,760	16.5%	14.4% to 14.9%	3.1% to 3.1%	19,509 to 26,269	211,540 to 215,190	23,067 to 23,373	317,503 to 320,847
Moderate	233,305	2.7%	8.4% to 9.4%	2.1% to 2.2%	8,086 to 12,136	41,336 to 43,127	8,617 to 8,680	181,498 to 183,352
Medium Low	176,574	7.9%	17.9% to 21.9%	1.9% to 2.1%	5,908 to 7,438	55,168 to 63,482	6,017 to 6,372	107,074 to 115,035
Low	577,500	10.0%	7.8% to 8.8%	5.9% to 6.0%	14,927 to 16,373	152,114 to 159,637	57,794 to 58,287	360,067 to 367,099

1 Represents the percentage of this reserve type measured against 'Total area on CALM managed lands'

2 For a discussion of lands contained within this category please see Section 4.3.2

3 Relates to sustained yield over the next 40 years. These values should not be interpreted as depicting current standing gross bole timber value. The values (high to low) depict the potential contribution of the areas to the scheduled woodflow and were derived on the basis of species, site potential, silvicultural history, timber inventory and disease status.

4 Expressed as a range reflecting variations in approach to reserve design

5 Includes only accredited informal reserves.

6 Excludes non-accredited informal reserves

**Table 8.8**

**Reservation Analysis – Mineral Values**

**Approach B**

Areas covered by:	Total new reserves under this approach <sup>1</sup> ha	
<i>Agreement Act Leases</i> <sup>2</sup>	55,784	to 58,755
<i>Mining tenements, leases and licences</i> <sup>3</sup>		
Pending	12,738	to 20,210
Granted	53,816	to 56,525

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Where the creation of new reserves in these tenements is to be avoided, discussions will be held with affected Companies to ensure that any changes to their statutory property rights will only proceed with their agreement. to ensure that any changes to their statutory property rights will only proceed with their agreement.

Mineral Potential <sup>2</sup>	Total new reserves under this approach <sup>1</sup> ha	
<b>High</b> areas with a WMP score greater than 90 having moderate to high potential for major deposits. eg gold, bauxite	181,225	to 181,477
<b>Medium</b> areas with a WMP score of 72-90 having moderate to high potential for significant deposits. eg Greenbushes rare metal deposits	23,193	to 35,590
<b>Low</b> areas with a WMP score of less than 72 having low to moderate potential for deposits of lesser economic significance eg industrial minerals.	194,999	to 208,096

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Weighted mineral potential (WMP) is an estimate of mineral potential which makes some Allowance for relative economic significance:

	Total new reserves under this approach <sup>1</sup> ha	
<b>Identified mineral resources</b> <sup>2</sup>	3,496	to 3,598

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Mineral resources in the ground, identified, demonstrated and often quantified on the basis of past exploration and mining activities. This data is drawn on to develop further exploration and mining proposals.

# Appendix 9

## APPROACH C-TABLES

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Aims to enhance economic and social values by increasing sustained timber yield whilst also seeking to enhance protection of environment and heritage values.

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**Table 9.1**  
**Biodiversity Values**  
**Reservation Analysis**

**Approach C**

Forest Ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>		
			Possible New Reserves ha	Total area reserved under this approach <sup>2</sup> ha	Level of reservation under this approach <sup>2&amp;3</sup> %
* Bullich and Yate	2,800	2,440	0 to 0	2,176 to 2,176	89.2% to 89.2%
Darling Scarp <sup>++</sup>	29,000	9,938	1,841 to 1,851	3,129 to 3,139	10.8% to 10.8%
Jarrah Blackwood <sup>++</sup>	347,200	281,805	773 to 3,144	32,898 to 38,575	9.5% to 11.1%
Jarrah Leeuwin <sup>++</sup>	56,400	19,552	5,680 to 6,172	8,463 to 8,738	15.0% to 15.5%
Jarrah Mt Lindesay <sup>++</sup>	126,600	44,597	396 to 3,550	11,497 to 14,517	9.1% to 11.5%
Jarrah North East <sup>++</sup>	717,100	350,239	9,391 to 10,905	91,972 to 93,337	12.8% to 13.0%
Jarrah North West <sup>++</sup>	670,600	499,598	2,014 to 2,755	81,449 to 82,181	12.1% to 12.3%
* Jarrah Rate's Tingle	1,500	1,246	0 to 0	970 to 970	77.9% to 77.9%
* Jarrah Red Tingle	350	269	0 to 0	215 to 215	80.0% to 80.0%
Jarrah Sandy <sup>++</sup>	107,900	71,092	263 to 270	24,647 to 24,653	22.8% to 22.8%
Jarrah South <sup>++</sup>	557,300	438,912	6,768 to 6,780	132,626 to 133,073	23.8% to 23.9%
Jarrah Unicap <sup>++</sup>	81,000	29,459	0 to 0	12,097 to 14,501	14.9% to 17.9%
Jarrah Woodland	106,374	67,221	1,776 to 2,069	37,863 to 37,929	35.6% to 35.7%
Jarrah Yellow Tingle <sup>++</sup>	11,600	9,669	35 to 35	2,925 to 2,925	25.2% to 25.2%
Karri Main Belt <sup>++</sup>	193,000	163,905	6 to 6	53,736 to 53,750	27.8% to 27.8%
* Karri Rate's Tingle	1,100	860	0 to 0	736 to 736	85.6% to 85.6%
Karri Red Tingle	7,200	5,860	0 to 0	5,013 to 5,013	69.6% to 69.6%
Karri West Coast <sup>++</sup>	14,500	6,274	132 to 222	4,384 to 4,472	30.2% to 30.8%
Karri Yellow Tingle <sup>++</sup>	15,800	13,264	4 to 4	3,562 to 3,562	22.5% to 22.5%
Peppermint/coastal heath	80,100	70,826	0 to 0	57,699 to 57,699	72.0% to 72.0%
Rocky outcrops	26,400	12,444	837 to 873	8,875 to 8,964	33.6% to 34.0%
Sand dunes	10,300	10,342	0 to 0	10,030 to 10,030	97.4% to 97.4%
Shrub/herb/sedgeland	429,900	296,950	5,309 to 8,910	225,103 to 226,145	52.4% to 52.6%
Swamps	15,300	8,069	26 to 32	6,062 to 6,125	39.6% to 40.0%
West'n Wandoo forest <sup>++</sup>	363,200	146,597	4,194 to 4,362	51,654 to 52,000	14.2% to 14.3%
West'n Wandoo woodland <sup>++</sup>	163,000	72,078	5,156 to 6,239	30,359 to 31,357	18.6% to 19.2%
<b>TOTAL<sup>8</sup></b>	<b>4,135,524</b>	<b>2,633,506</b>	<b>43,543 to 57,385</b>	<b>905,731 to 911,191</b>	<b>21.9% to 22.0%</b>

\* Rare forest ecosystem with a 100% reservation target. All other forest ecosystems have a reservation target of 15%.

++ Ecosystems currently significant for commercial timber yield

1 Expressed as a range reflecting variations in approach to reserve design.

2 Includes only accredited informal reserves.

3 Represents the percentage of this reserve type measured against 'Present area on all lands' for rare ecosystems and against 'Estimated pre-1750 area' for all other ecosystems.

4 As measured against the quantitative JANIS targets without taking into account the scientific, economic & social flexibility provisions.

5 For a discussion of lands contained within this category please

6 Crown lands vested in Commonwealth and Western Australian Governments.

7 Privately owned land, including freehold land owned by Government agencies.

8 Minimum and Maximum Total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 9.1 (cont.)**  
**Biodiversity Values**  
**Reservation Analysis**

**Approach C**

Deficit / Excess ha <sup>2&amp;4</sup>	Area Outside CAR Reserve <sup>1</sup>		
	Non-accredited informal reserves <sup>5</sup> ha	Other Public Land <sup>6</sup> ha	Freehold land <sup>7</sup> ha
-264 to -264	1 to 1	2 to 2	261 to 261
-1,221 to -1,211	44 to 47	287 to 295	6,468 to 6,468
-19,182 to -13,505	19,062 to 19,594	211,152 to 216,297	13,016 to 13,016
3 to 278	4 to 41	1,573 to 1,811	9,237 to 9,237
-7,493 to -4,473	276 to 348	15,498 to 18,446	14,306 to 14,306
-15,593 to -14,228	9,633 to 9,650	168,298 to 169,646	78,971 to 78,971
-19,141 to -18,409	22,904 to 22,998	343,902 to 344,539	50,611 to 50,611
-275 to -275	2 to 2	96 to 96	177 to 177
-54 to -54	0 to 0	13 to 13	40 to 40
8,462 to 8,468	2,361 to 2,362	39,001 to 39,007	5,077 to 5,077
49,031 to 49,478	24,509 to 24,638	262,149 to 262,726	19,052 to 19,052
-53 to 2,351	34 to 139	2,830 to 5,129	12,093 to 12,093
21,907 to 21,973	17,392 to 17,514	1,388 to 1,576	10,390 to 10,390
1,185 to 1,185	458 to 458	5,067 to 5,067	1,219 to 1,219
24,786 to 24,800	16,491 to 16,492	83,664 to 83,677	10,000 to 10,000
-124 to -124	0 to 0	0 to 0	124 to 124
3,933 to 3,933	4 to 4	89 to 89	755 to 755
2,209 to 2,297	29 to 33	273 to 358	1,500 to 1,500
1,192 to 1,192	943 to 943	7,336 to 7,336	1,423 to 1,423
45,684 to 45,684	2 to 2	2,678 to 2,678	10,447 to 10,447
4,915 to 5,004	3,250 to 3,360	273 to 294	-63 to -63
8,485 to 8,485	4 to 4	307 to 307	0 to 0
160,618 to 161,660	24,686 to 24,831	9,832 to 11,018	36,143 to 36,143
3,767 to 3,830	346 to 409	183 to 183	1,415 to 1,415
-2,826 to -2,480	4,948 to 4,978	49,298 to 49,614	40,351 to 40,351
5,909 to 6,907	2,285 to 2,379	18,069 to 18,972	20,367 to 20,367
281,451 to 286,911	150,115 to 150,781	1,228,819 to 1,233,616	343,379 to 343,379

**Table 9.2**  
**Old-growth**  
**Reservation Analysis**

**Approach C**

Old-growth by forest ecosystem	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>					
		Possible New Reserves ha		Total area reserved under this approach <sup>2</sup> ha		Level of reservation under this approach <sup>2&amp;3</sup> %	
Jarrah Blackwood <sup>++</sup>	48,496	266 to	1,540	13,591 to	14,767	28.0% to	30.4%
* Jarrah Leeuwin <sup>++</sup>	477	64 to	103	422 to	460	88.4% to	96.6%
Jarrah Mt Lindesay <sup>++</sup>	14,005	389 to	2,863	7,216 to	9,579	51.5% to	68.4%
* Jarrah North East <sup>++</sup>	11,595	8 to	1,178	4,445 to	5,563	38.3% to	48.0%
* Jarrah North West <sup>++</sup>	7,923	6 to	6	6,631 to	6,631	83.7% to	83.7%
* Jarrah Rate's Tingle	1,021	0 to	0	924 to	924	90.5% to	90.5%
* Jarrah Red Tingle	214	0 to	0	205 to	205	95.9% to	95.9%
* Jarrah Sandy <sup>++</sup>	2,171	0 to	0	2,149 to	2,149	99.0% to	99.0%
Jarrah South <sup>++</sup>	160,667	5,701 to	5,703	83,609 to	87,102	52.0% to	54.2%
Jarrah Unicap <sup>++</sup>	4,739	0 to	0	2,628 to	3,828	55.5% to	80.8%
Jarrah Woodland	13,235	70 to	81	10,306 to	10,367	77.9% to	78.3%
Jarrah Yellow Tingle <sup>++</sup>	7,249	35 to	35	2,661 to	2,661	36.7% to	36.7%
Karri Main Belt <sup>++</sup>	53,576	6 to	6	32,026 to	32,026	59.8% to	59.8%
* Karri Rate's Tingle	674	0 to	0	674 to	674	100.0% to	100.0%
Karri Red Tingle	3,283	0 to	0	3,202 to	3,202	97.5% to	97.5%
* Karri West Coast <sup>++</sup>	492	1 to	1	492 to	492	100.0% to	100.0%
Karri Yellow Tingle <sup>++</sup>	6,969	4 to	4	2,792 to	2,792	40.1% to	40.1%
* West'n Wandoo forest <sup>++</sup>	7,865	1 to	92	5,695 to	5,712	72.4% to	72.6%
* West'n Wandoo woodland <sup>++</sup>	3,013	7 to	620	1,648 to	2,247	54.7% to	74.6%
<b>TOTAL<sup>8</sup></b>	<b>347,663</b>	<b>6,599 to</b>	<b>12,190</b>	<b>182,571 to</b>	<b>190,125</b>	<b>52.5% to</b>	<b>54.7%</b>

\* Rare forest ecosystem with a 100% reservation target. All other forest ecosystems have a reservation target of 15%.

++ Ecosystems currently significant for commercial timber yield

1 Expressed as a range reflecting variations in approach to reserve design.

2 Includes only accredited informal reserves.

3 Represents the percentage of this reserve type measured against 'Present area on all lands' for rare ecosystems and against 'Estimated pre-1750 area' for all other ecosystems.

4 As measured against the quantitative JANIS targets without taking into account the scientific, economic & social flexibility provisions.

5 For a discussion of lands contained within this category please

6 Crown lands vested in Commonwealth and Western Australian Governments.

7 Privately owned land, including freehold land owned by Government agencies.

8 Minimum and Maximum Total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 9.2 (cont.)**

**Old-growth**

**Approach C**

**Reservation Analysis**

Deficit / Excess ha <sup>2&amp;4</sup>	Area Outside CAR Reserve <sup>1</sup>		
	Non-accredited informal reserves <sup>5</sup> ha	Other Public Land <sup>6</sup> ha	Freehold land <sup>7</sup> ha
-15,507 to -14,331	2,547 to 2,589	31,183 to 32,317	0 to 0
-55 to -16	0 to 0	16 to 55	0 to 0
-1,187 to 1,176	82 to 144	4,344 to 6,644	0 to 0
-7,150 to -6,032	446 to 492	5,560 to 6,631	26 to 26
-1,292 to -1,292	76 to 76	1,216 to 1,216	0 to 0
-97 to -97	2 to 2	94 to 94	0 to 0
-9 to -9	0 to 0	8 to 8	0 to 0
-23 to -23	0 to 0	23 to 23	0 to 0
-12,791 to -9,299	6,453 to 6,702	67,112 to 70,356	0 to 0
-215 to 985	11 to 91	625 to 1,744	275 to 275
2,365 to 2,426	2,635 to 2,697	217 to 219	14 to 14
-1,689 to -1,689	347 to 347	4,241 to 4,241	0 to 0
-119 to -119	6,916 to 6,916	14,634 to 14,634	0 to 0
0 to 0	0 to 0	0 to 0	0 to 0
1,233 to 1,233	4 to 4	77 to 77	0 to 0
0 to 0	0 to 0	0 to 0	0 to 0
-1,390 to -1,390	592 to 592	3,585 to 3,585	0 to 0
-2,170 to -2,153	304 to 309	1,841 to 1,853	8 to 8
-1,364 to -766	125 to 182	618 to 1,159	23 to 23
-40,203 to -32,650	20,625 to 21,060	136567 to 143684	345.92 to 346.41

**Table 9.3**

**Reservation Analysis of Indicative Areas of National Estate Values**

**Approach C**

National Estate Value <sup>1</sup>	Extant area ha	CAR Reserve System under this Approach <sup>2</sup>				Area Outside CAR Reserve <sup>2</sup>					
		Possible New Reserves ha		Total area reserved ha		Total area reserved %		Non-accredited informal reserves <sup>3</sup> ha		Other Public Land <sup>4</sup> ha	
<i>Criterion A.1</i>											
Centres of disjunct flora	42,730	613 to	1,598	35,425 to	36,433	82.9% to	85.3%	738 to	741	5,559 to	6,564
Centres of flora endemism	101,137	7,539 to	9,959	78,893 to	81,520	78.0% to	80.6%	2,415 to	2,592	17,203 to	19,652
Centres of relictual flora	84,558	0 to	1,370	72,017 to	73,335	85.2% to	86.7%	1,569 to	1,579	9,655 to	10,963
Refugia	71,138	1,072 to	2,288	63,021 to	64,901	88.6% to	91.2%	1,660 to	1,806	4,570 to	6,303
<i>Criterion A.2</i>											
Aggregations of old-growth forest	178,977	2,550 to	5,173	105,300 to	110,060	58.8% to	61.5%	7,722 to	8,107	61,195 to	65,569
Contemporary fauna refuges	13	0 to	0	11 to	12	88.5% to	92.3%	0 to	0	0 to	0
Wetlands of national significance	48,146	73 to	94	31,326 to	31,547	65.1% to	65.5%	663 to	758	1,046 to	1,172
<i>Criterion A.3</i>											
Flora species richness	123,102	8,800 to	9,972	93,238 to	94,269	75.7% to	76.6%	3,493 to	3,581	25,272 to	26,214
Vegetation community diversity	6,982	1,278 to	1,278	5,247 to	5,247	75.2% to	75.2%	136 to	136	1,598 to	1,598
<i>Criterion B.1</i>											
Natural landscapes	559,970	8,386 to	16,274	434,689 to	442,978	77.6% to	79.1%	15,679 to	16,359	96,821 to	104,431

1 Some national estate values presented in this table, such as refugia and centres of flora endemism, are derived from similarly named biodiversity values listed in Table 7.4.

In these cases national estate values represent subsets of the total areas which have been identified through the application of thresholds for condition and integrity

In most instances the application of thresholds for indicative national estate significance has involved the identification of these values within natural landscapes

of 40 hectares or larger. For a detailed explanation of thresholds for indicative national estate values, see the separate report National Estate Identification and Assessment in the South-West Forest Region of Western Australia.

2 Expressed as a range reflecting variations in approach to reserve design.

3 For a discussion of lands contained within this category please see Section 4.3.2.

4 Crown lands vested in Commonwealth and Western Australian Governments.



**Table 9.4**

**Biodiversity Reservation Analysis - Flora Values**

**Approach C**

Flora Value	Present area on all lands ha	CAR Reserve System under this Approach <sup>1</sup>				Area Outside CAR Reserve <sup>1</sup>					
		Possible New Reserves ha		Total area reserved under this approach <sup>2</sup> ha & % <sup>3</sup>		Non-accredited informal reserves <sup>4</sup> ha		Other Public Land <sup>5</sup> ha		Freehold land <sup>6</sup> ha	
<p><b>Flora Disjunctiveness</b> Areas with concentrations of disjunct species (those with populations separated by a substantial geographic distance from other populations, such that they are unlikely to interbreed) two standard deviations or more above the mean for the region.</p>	116,283	1,860 to	2,988	47,080 to	48,260	4,245 to	4,249	40,820 to	42,004	22,954 to	22,954
<p><b>Flora Endemism</b> Areas where the level of endemism is two or more standard deviations above the mean for the region.</p>	221,879	11,058 to	14,629	100,937 to	103,922	7,897 to	8,094	66,801 to	69,589	43,259 to	43,259
<p><b>Relictual Flora</b> Areas with concentrations of relictual species (those of phylogenetic interest for primitive or relictual characteristics) two standard deviations or more above the mean for the region.</p>	151,981	245 to	2,406	81,320 to	83,440	6,905 to	6,930	47,340 to	49,435	14,296 to	14,296
<p><b>Flora Species Richness</b> Areas of flora species richness (from a richness prediction map generated from site records and the distribution maps from species habitat models) two or more standard deviations above the mean for the region.</p>	211,437	13,565 to	15,670	110,859 to	111,363	10,746 to	10,768	80,107 to	80,589	9,220 to	9,220

1 Expressed as a range reflecting variations in approach to reserve design

2 Includes only accredited informal reserves

3 Represents total area reserved as a percentage of "present area on all lands"

4 For a discussion of lands contained within this category please see Section 4.3.2

5 Crown lands vested in Commonwealth and Western Australian Governments

6 Privately owned land, including freehold land owned by Government agencies

**Table 9.5**  
**Indicative Impact Analysis - Native Forest Timber Industry**

**Approach C**

For each Region	Area available for timber production ha	TIMBER YIELD			Gross Value of wood products at Mill Gate \$/yr
		Karri Sawlog Grade 1&2 m <sup>3</sup> /yr	Jarrah Sawlog Grade 1&2 <sup>1</sup> m <sup>3</sup> /yr	Chiplog and charlog m <sup>3</sup> /yr	
<b>Swan</b>					
Range under this approach	328,003 to 328,535	0 to 0	208,675 to 208,704	28,922 to 28,926	\$58,376,013 to \$58,384,292
% of current	104.8% to 105.0%	0.0% to 0.0%	103.3% to 103.3%	103.3% to 103.3%	103.3% to 103.3%
Deficit/Addition	15,120 to 15,652	0 to 0	6,675 to 6,704	925 to 929	\$1,867,247 to \$1,875,526
<b>Central Forest</b>					
Range under this approach	495,450 to 499,256	0 to 0	223,565 to 223,969	68,254 to 68,378	\$65,086,966 to \$65,204,571
% of current	98.7% to 99.5%	0.0% to 0.0%	98.9% to 99.1%	98.9% to 99.1%	98.9% to 99.1%
Deficit/Addition	-6,328 to -2,522	0 to 0	-2,435 to -2,031	-744 to -620	-\$708,864 to -\$591,259
<b>Southern Forest</b>					
Range under this approach	346,011 to 348,587	211,141 to 211,212	63,624 to 64,015	628,490 to 628,700	\$116,378,890 to \$116,517,503
% of current	102.2% to 102.9%	98.7% to 98.7%	102.6% to 103.2%	98.7% to 98.7%	99.2% to 99.3%
Deficit/Addition	7,309 to 9,885	-2,859 to -2,788	1,624 to 2,015	-8,510 to -8,300	-\$903,850 to -\$765,237
<b>TOTAL<sup>2</sup></b>					
Range under this approach	1,169,996 to 1,175,846	211,141 to 211,212	496,255 to 496,298	725,795 to 725,877	\$239,967,753 to \$239,980,482
% of current	102.0% to 102.4%	98.7% to 98.7%	101.7% to 101.8%	100.3% to 100.4%	100.5% to 100.5%
Deficit/Addition	16,633 to 22,483	-2,859 to -2,788	6,255 to 6,298	-8,200 to -8,118	\$380,417 to \$393,146

1 The level of cut for jarrah is currently 490,000 m<sup>3</sup> pa for the next 6 years - to the year 2004. The analysis uses the forecast drop in resource of 38% to 300,000m<sup>3</sup> for jarrah sawlogs using the resource base of the current management plan. From 2004 the % of current<sup>1</sup> applies to 300,000m<sup>3</sup> per annum.

2 Minimum and maximum total figures shown are sums of complete approaches, rather than sums of the columns above.

**Table 9.6**  
**Indicative Impact Analysis**  
**Private Sector Native Forest Timber Industry**  
**Related Employment**

**Approach C**

	Private Sector	
	Indicative Direct Employment <sup>1</sup>	Indicative Indirect Employment <sup>2</sup>
Current situation	2,440	2,928
Range under this approach	2,445 to 2,446	2,934 to 2,935
Range of Indicative Impacts**	5 to 5	6 to 6

\*\* The increase in width of fourth order stream reserves from 150 metres to 200 metres and other areas deemed to be informal reserves for accreditation purposes results in a decrease in the area of forest available for native forest timber production and reflects a reduction against the current situation of 17 direct jobs and 20 indirect jobs. This reduction is included in the employment impacts outlined above.

1 Direct employment in this analysis covers employment from the forest to the first point of sale. It includes private sector employment in logging and haulage, sawmilling, resawing and dressing, woodchip milling and charcoal manufacturing. Public sector employment impacts are shown at Box 4.2.

2 In the absence of any multiplier directly mirroring the industry, a multiplier of 2.2 was used to calculate indirect employment impacts. That is, for every 10 direct jobs lost because of reserve changes, an additional 12 jobs are lost in the wider community.

**Table 9.7**  
**Reservation Analysis - Significance for Native Forest Timber Values**  
**on CALM Managed Land**

**Approach C**

Significance for timber values <sup>3</sup>	Total area on CALM managed land ha	CAR Reserve System under this Approach					Non-accredited Informal <sup>4</sup> Reserves Ha	Range of State forest area available for production <sup>4&amp;6</sup> ha
		Existing Reserved Areas <sup>1&amp;2</sup>			Possible New Reserves <sup>4</sup> ha	Total <sup>4&amp;5</sup> ha		
		Formal (gazetted) %	Formal (proposed) <sup>4</sup> %	Informal <sup>4</sup> (accredited) %				
High	283,031	25.8%	8.8% to 8.8%	4.5% to 4.5%	573 to 2,231	111,282 to 112,766	12,601 To 12,617	157,665 to 159,132
Medium High	555,760	16.5%	14.4% to 14.7%	3.4% to 3.4%	2,911 to 4,542	195,138 to 195,349	24,236 To 24,268	336,174 to 336,353
Moderate	233,305	2.7%	8.4% to 8.8%	2.4% to 2.4%	1,119 to 3,875	33,530 to 35,314	9,083 To 9,123	188,869 to 190,693
Medium Low	176,574	7.9%	17.9% to 21.9%	2.1% to 2.2%	1,863 to 2,333	51,706 to 58,219	6,412 To 6,573	111,942 to 118,294
Low	577,500	10.0%	7.8% to 8.5%	6.4% to 6.4%	1,358 to 2,807	142,545 to 145,715	59,911 To 60,114	371,876 to 374,844

1 Represents the percentage of this reserve type measured against 'Total area on CALM managed lands'

2 For a discussion of lands contained within this category please see Section 4.3.2

3 Relates to sustained yield over the next 40 years. These values should not be interpreted as depicting current standing gross bole timber value. The values (high to low) depict the potential contribution of the areas to the scheduled woodflow and were derived on the basis of species, site potential, silvicultural history, timber inventory and disease status.

4 Expressed as a range reflecting variations in approach to reserve design

5 Includes only accredited informal reserves.

6 Excludes non-accredited informal reserves

**Table 9.8**

**Reservation Analysis – Mineral Values**

**Approach C**

Areas covered by:	Total new reserves under this approach <sup>1</sup> ha	
<i>Agreement Act Leases</i> <sup>2</sup>	41,849	to 42,317
<i>Mining tenements, leases and licences</i> <sup>3</sup>		
Pending	15,500	to 18,982
Granted	31,875	to 33,963

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Where the creation of new reserves in these tenements is to be avoided, discussions will be held with affected Companies to ensure that any changes to their statutory property rights will only proceed with their agreement. to ensure that any changes to their statutory property rights will only proceed with their agreement.

Mineral Potential <sup>2</sup>	Total new reserves under this approach <sup>1</sup> ha	
<b>High</b> areas with a WMP score greater than 90 having moderate to high potential for major deposits. eg gold, bauxite	167,673	to 168,099
<b>Medium</b> areas with a WMP score of 72-90 having moderate to high potential for significant deposits. eg Greenbushes rare metal deposits	13,797	to 15,855
<b>Low</b> areas with a WMP score of less than 72 having low to moderate potential for deposits of lesser economic significance eg industrial minerals.	151,426	to 153,010

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Weighted mineral potential (WMP) is an estimate of mineral potential which makes some Allowance for relative economic significance:

	Total new reserves under this approach <sup>1</sup> ha	
<b>Identified mineral resources</b> <sup>2</sup>	3,456	to 3,487

1 Expressed as a range reflecting variations in approach to reserve design. Includes new reserves proposed under this approach and reserves proposed under the Forest management Plan 1994-2003, less those designated to remain as State forest under this approach.

2 Mineral resources in the ground, identified, demonstrated and often quantified on the basis of past exploration and mining activities. This data is drawn on to develop further exploration and mining proposals.

# Appendix 10

## RECOMMENDATIONS OF THE INDEPENDENT EXPERT ADVISORY GROUP ON THE ASSESSMENT OF ECOLOGICALLY SUSTAINABLE FOREST MANAGEMENT IN THE SOUTH-WEST FOREST REGION OF WESTERN AUSTRALIA

The Independent Expert Advisory Group on Ecologically Sustainable Forest Management submitted the following recommendations for consideration in developing the RFA for the South-West Forest Region:

### 1. The commitment and the policy framework

#### ***The Commonwealth and Western Australian governments should:***

- 1.1 Systematically and jointly review relevant Commonwealth and State Acts to achieve consistency and minimise duplication; develop standard heritage criteria and assessment processes, and create a clear delineation of responsibilities for each level of government.

#### ***The Government of Western Australia should:***

- 1.2 Amend the *Conservation and Land Management Act 1984*, *Mining Act 1978* and other relevant legislation for the South-West Forest Region to explicitly incorporate the two overarching principles and the six specific principles of ecologically sustainable forest management used in the RFA process.
- 1.3 Revise the *Wildlife Conservation Act 1950* to:
  - A. include explicit requirements to conserve genetic, species and ecosystem diversity;
  - B. include a requirement to prepare and regularly review a state-wide strategy for conservation of biodiversity;
  - C. establish an explicit system of categorising threatened species and communities, threatening processes and critical habitats; and
  - D. formalise the responsibility of CALM for the protection and maintenance of both flora and fauna on all tenures, including the preparation of recovery plans for rare and endangered species.
- 1.4 Change the *Conservation and Land Management Act* to ensure the Executive Director of CALM does not serve on either the Lands and Forest Commission or the National Parks and Nature Conservation Authority, in order to avoid perceptions of conflict of interest. The composition of the Lands and Forest Commission should include an independent Chair, a community representative and three experts with experience in relevant aspects of forest management including wood production and nature conservation.

- 1.5 Review and, where necessary, amend the review provisions of the *Environmental Protection Act 1986* and *Conservation and Land Management Act 1984* to:
- encompass a joint review of environment protection, management plan requirements, and environmental management systems; such that the strategic issues of balancing and integrating forest uses, including social, economic and environmental implications, can be considered together. The review process should include some expert representation from outside the State, and
  - enable periodic independent and transparent audits of compliance with forest management processes, including codes of practice, and for subsequent joint reviews of those processes and codes.
- 1.6 Review the *Conservation and Land Management Act 1984* to:
- enable licences for the sale of wood to extend beyond the period of the management plan;
  - make some or all long-term licences renewable as well as transferable, and
  - introduce a declining ratchet provision in the volumes to be sold beyond the initial ten years of any longer-term licence.

***CALM should:***

- 1.7 Revise the draft Nature Conservation Strategy for Western Australia in the light of public comment already received and approve and implement the strategy as soon as possible.
- 1.8 Develop policy statements:
- dealing with the productive capacity of former mine sites, and other principles underpinning ecologically sustainable forest management;
  - on the maintenance of carbon and hydrological cycles at the ecosystem level to assist integrated planning and implementation;
  - on water and revise these periodically to facilitate the preparation of the next Forest Management Plan, and
  - on natural and cultural heritage, including geoconservation and cultural values, in collaboration with other relevant agencies.

***The relevant land management agencies should:***

- 1.9 adopt a new Memorandum of Understanding for the protection of remnant vegetation on private land to clarify responsibility for the pursuit of ecologically sustainable forest management in private forests.

## 2. Planning

### ***The Government of Western Australia should:***

- 2.1 Facilitate an integrated approach by relevant agencies to assess:
  - areas of native forest and present and planned plantations on private land, and
  - impacts of plantation development on regional values such as water yields, social, roading/infrastructure issues and industry development.

### ***The Minister, controlling bodies and Executive Director of CALM should:***

- 2.2 Determine a schedule for concurrent development of strategies and a new Forest Management Plan spanning all State public tenures in the South-West Forest Region. Where previous ministerial conditions have been imposed, these conditions and references to other previous plans should be revoked and replaced by a complete set of conditions consistent with the terms of the currently gazetted plan.

### ***CALM should:***

- 2.3 Complete a set of official guidelines and manuals for assessment of flora and fauna, consistent with a revised Wildlife Conservation Act and a finalised Nature Conservation Strategy.
- 2.4 Develop a formal process to appraise and meet data requirements to support assessment of risk to biodiversity from forest management practices, including those associated with timber harvesting, protection from fire, and conservation.
- 2.5 With other relevant agencies, develop a cost-effective and appropriate set of performance indicators for effective monitoring of plans relating to biodiversity, as well as other values.
- 2.6 Address the ecological basis for burning regimes in all forest ecosystems in planning for fire management. Annual District burning plans should be available for public access and medium-term (five to seven years) fire management plans should be published. Such plans should be prepared in conjunction with the medium-term integrated harvesting and regeneration plans specified within the Manual of Harvesting Specifications.
- 2.7 Explicitly define water quality in the Code of Practice for Plantations, Manual of Harvesting Specifications and Code of Practice for Timber Harvesting in Western Australia.
- 2.8 Complete and use soil and landform assessment methods and develop manuals for using this information in planning in the southern forests.
- 2.9 In consultation with the mining industry, review the present strategies and operations to establish formal requirements for conservation or re-establishment of all forest values, including productive capacity, on former mining sites, consistent with incorporation of the principles of ecologically sustainable forest



management into the CALM and the Mining Acts (see also Recommendation 1.4).

- 2.10 Involve communities in planning for cultural heritage conservation.
- 2.11 Assess natural and cultural heritage resources through systematic surveys and the development of databases and integrate the conservation of natural and cultural heritage values into the management and planning process through training and more explicit processes and guidelines.
- 2.12 Extend the use of operational planning on a periodic (say five yearly) and integrated basis and introduce the opportunity for public comment on these 'look ahead' plans.

***The relevant land management agencies should:***

- 2.13 Adopt a new Memorandum of Understanding for the protection of remnant vegetation on private land to ensure that harvesting is carried out in a manner that will lead to adequate stocking after harvest of retained growing stock or new regeneration for all timber harvesting operations.

### 3. Implementation

***The Government of Western Australia and CALM should:***

- 3.1 Ensure that the management of CALM lands in the South-West Forest Region is placed under a single integrated management entity, either as a:
  - public service entity being an integral part of CALM, or
  - separate commercial entity with its own board of management, chief executive, and commercial objectives.

***CALM should:***

- 3.2 Review the CALM fire process for setting priorities for the use of prescribed fire and change the weighting given to different values to better reflect the two overarching and six specific principles of ecologically sustainable forest management and the current knowledge of the response and resilience to fire of ecosystems in the South-West Forest Region.
- 3.3 Implement a District-level forest health surveillance system (including private forests) to provide early warning of potential pest disease and weed problems, develop an associated action plan, and undertake risk analyses for likely incursions or outbreaks.
- 3.4 Give the Director of Regional Services explicit responsibilities for cultural and natural heritage management matters.
- 3.5 Revise the two existing Codes of Practice and accompanying manual to make them easier for field operators and field staff to understand.

- 3.6 Give increased attention to skill requirements, staff training and the contracting of external services to ensure timely access to the range of skills needed to implement ecologically sustainable forest management.
- 3.7 Release draft Policy Statements related to ecologically sustainable forest management for public comment prior to finalisation.
- 3.8 Develop appropriate processes to facilitate consultation with and involvement of Aboriginal communities in the development of policies and procedures for heritage conservation.

## 4. Monitoring and compliance

### ***The Lands and Forest Commission and the National Parks and Nature Conservation Authority should:***

- 4.1 Jointly report on compliance with all provisions of relevant management plans, including periodic reporting of progress with the structural goals prescribed within the Forest Management Plan.

### ***CALM should:***

- 4.2 Complete the revision of Policy Statement No. 28 to include the current objectives and a commitment to develop and regularly monitor a set of indicators of ecological sustainability in relation to all of the principles of ecologically sustainable forest management. The revised policy should be implemented as soon as possible.
- 4.3 Collate and maintain a database on forest soils (including soil nutrients) and carbon, using data from researchers within and outside CALM.
- 4.4 Employ Aboriginal heritage officers in the field monitoring of CALM activities and to maintain the indigenous places database, as well as communicate with Aboriginal communities on the protocols for data entry and retrieval; and:
  - link CALM heritage databases to the CALM geographic information system and to databases of other agencies;
  - commission experts to explore the feasibility of developing sensitivity indicators which might be applied to the location of prehistoric Aboriginal sites, and
  - sponsor research on the ability of prescribed buffer zones to conserve a representative sample of cultural heritage values.
- 4.5 Continue to operate the CALM Management Audit Branch as an internal audit of CALM planning and implementation priorities. In addition, there should be an external, independent audit of a sample of operational practices on an annual basis. Performance criteria and the results of the external audit should be published in the annual report of CALM.

## 5. Review and improvement

### ***CALM should:***

- 5.1 Implement frequent (about one to two yearly) internal review and periodic (about five yearly) external review of the Code of Harvesting Practice and Timber Harvesting Manual.
- 5.2 Encourage the implementation of the new processes for formal involvement of Regional and District staff in setting priorities for research and development, and planning implementation of research results in management. Strategic research should continue to be funded from the programs, but regions should also purchase research using funds under their control. CALM should periodically assess whether the processes are meeting the research needs of the Regions and Districts.
- 5.3 Retain the Forest Monitoring and Research Committee as a peak committee for advising on research priorities within CALM, but the committee should not have authority or responsibility for funding or the detail of the research program. CALM should ensure that the Forest Monitoring and Research Committee represents a wide range of stakeholder interests relevant to ecologically sustainable forest management.
- 5.4 Establish scientific advisory committees to facilitate input of external advice to research projects and to aid integration of CALM's strategic research planning with research priorities of other organisations, agencies and institutions.
- 5.5 In consultation with harvesting operators, develop mechanisms for fostering research and development and transferring new technology in harvesting operations.
- 5.6 Initiate a cross-agency cultural and natural heritage research program.
- 5.7 Develop further its social and economic research program.

### ***The Western Australian Museum, CALM and other relevant institutions should:***

- 5.8 Develop formal processes for jointly determining priorities for collection of fauna data and for maintaining a consolidated database.

### ***The relevant land management agencies should:***

- 5.9 Ensure that the requirements for restoration of former mine sites take account of the full range of values related to ecologically sustainable forest management and so guide research and development by the mining industry.

# Glossary

## **Accreditation**

Acceptance by one government or organisation of data and methods used by another government or organisation.

## **Biological diversity (biodiversity)**

The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain, and the ecosystems they form. Biological diversity is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity. It is sometimes considered at the level of landscape diversity.

## **Comprehensive, adequate and representative (CAR) reserve system**

A reserve system to conserve all native forest types as well as the plants and animals that depend on them. Comprehensive - the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels; Adequate - the maintenance of the ecological viability and integrity of populations, species and communities; Representative - those sample areas of the forest that are selected for inclusion in reserves which should reasonably reflect the biological diversity of the communities.

## **Comprehensive regional assessment (CRA)**

A joint Commonwealth-State assessment of all forest values - environmental, heritage, economic and social - leading to the establishment of a CAR reserve system, agreements on forest management, and the signing of a Regional Forest Agreement (RFA).

## **Conservation**

The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment.

## **Dedicated reserves**

Reserves where the management regime equates to specific protected area management categories defined by the IUCN Commission for National Parks and Protected Areas—categories I, II, III and IV. Security of tenure, as demonstrated if parliamentary action by Commonwealth, State or Territory governments is required for revocation of the reserve, is fundamental to the establishment and management of dedicated reserves.

## **Deferred Forest Agreement**

Agreement signed by the Commonwealth and Western Australian governments in July 1996, defining those wood-production areas to be set aside from logging until 30 December 1997 while a comprehensive assessment of their wood-production and conservation values was undertaken. At that stage, it was considered that the areas identified in the Agreement included those that might be required for inclusion in a CAR reserve system.

### ***Disjunct***

Individual flora or fauna populations which are physically separated from one another; that is, there is no or minimal gene flow between populations. They are formed over time as a result of the appearance of a barrier in a formerly continuous distribution. Disjunct populations often have features that are distinctive in an evolutionary sense from those of the “parent” population and in time may become separate species.

### ***Ecologically sustainable forest management (ESFM)***

The National Forest Policy Statement specifies three requirements for sustainable forest use:

- maintaining ecological processes within forests (the formation of soil, energy flows and the carbon, nutrient and water cycles);
- maintaining the biological diversity of forests; and
- increasing the net social benefit derived from the mixture of forest uses, within ecological constraints, whilst maintaining options for the future.

### ***Ecosystem***

The aggregate of plants, animals and other organisms and the non-living parts of the environment with which these organisms interact.

### ***Endangered forest community***

A forest community whose mapped distribution has contracted to less than 10% of its estimated former range or whose total area has contracted to less than 10% of its estimated former area or where more than 90% of the area of the community is in small patches that are unlikely to persist for more than 25 years.

### ***Endemic species***

Native species confined to a specific region or locality.

### ***Endangered species and biological communities***

Species which are in danger of extinction and whose survival is unlikely if the causal factors continue. Included are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that the species are deemed to be in danger of extinction. Also included are species that are possibly already extinct but have definitely not been seen in the wild in the past 50 years and have not been subject to thorough searching.

### ***Export woodchip licence***

A licence issued by the Commonwealth Government authorising the export of woodchips.

### ***Farm forestry (agroforestry)***

The growth and management of trees on farms as part of the farm enterprise for the purpose of producing wood and/or non-wood products.

### ***Genetic Diversity***

The variety of genetic information contained in all individual plants, animals and micro-organisms. It occurs within and between populations of species.

**Gross state product**

Is the total market value of goods and services produced in a State within a given period after deduction of the costs of goods and services used in the process of production but before deducting allowances for the consumption of fixed capital. Also referred to as Gross State Product at market prices. For a discussion of the sources and methods used to calculate Gross State Product, refer to the explanatory notes in the Australian National Accounts - State Accounts, Australian Bureau of Statistics catalogue number 5242.0.

**Habitat**

The place or environment where an organism naturally occurs.

**Hardwood**

Timber from broad-leaved, flowering trees, irrespective of physical hardness. Includes eucalypts, wattles and rainforest species.

**Hardwood plantation**

Plantations of hardwood species; in Western Australia, particularly eucalypts.

**JANIS**

A joint Commonwealth-State sub-committee responsible for preparing reports on the implementation of the National Forest Policy Statement for the information of the relevant Ministerial councils (the Australian and New Zealand Environment Conservation Council and the Ministerial Council on Forestry, Fisheries and Aquaculture).

**LVL**

laminated veneer lumber.

**MDF**

medium density fibreboard.

**Mill-door value**

Value of wood at the mill before processing.

**Mill-Gate Value**

Value of wood product after processing and before transport to market

**Multiple-use forest**

Multiple-use in forest, or in land management generally, means the management of a particular area for a variety of uses concurrently or sequentially. The uses may be permitted over the entire multiple use area or in defined parts or zones and priorities may be assigned particular uses. The range of uses permitted depends on the tenure category for the forest; for example, State reserve, State forest or private forest. Multiple-use management is designed to achieve optimum management results in areas where a range of values and potential uses overlap.

**National Estate**

Those places, being components of the natural environment of Australia, or the cultural environment of Australia which are listed on the Register of the National Estate as having aesthetic, historic, scientific or social significance or other special value for future generations as well as for the present community.

***National Estate areas and places***

Natural or cultural areas and places that have been entered on the Register of the National Estate or the Interim List by the Australian Heritage Commission for their aesthetic, historic, scientific or social significance or other special value.

***National Estate values***

Aesthetic, historic, scientific or social values attributed to places by the Australian Heritage Commission.

***Native forest***

Any locally indigenous forest community, the dominant species of which are trees. It includes forests that have been regenerated with human assistance following disturbance. It excludes plantations of species which are not locally endemic and previously logged native forest that has been regenerated with non-endemic native species.

***National Forest Policy Statement***

A joint Commonwealth, State and Territory government statement which outlines agreed objectives and policies for Australia's public and private forests. This statement is published in booklet form.

***National Wilderness Inventory***

An environmental database and set of modelling procedures which are designed to assist in the planning and management of remote and natural lands in Australia.

***Old-growth forest***

Ecologically mature forest where the effects of disturbance are now negligible. The definition focusses on forest in which the upper stratum or overstorey is in the late mature to over mature growth stages.

***Pulpwood***

Logs that are below sawlog quality but are suitable for manufacture of pulp, paper and panel products, including woodchips.

***Rare species***

Species with small world populations that are not at present endangered or vulnerable.

***Regional Forest Agreement (RFA)***

An agreement between the Commonwealth and a State government about the long-term management and use of forests in a particular region. Its purpose is to reduce uncertainty, duplication and fragmentation in government decision making by producing a durable agreement on the management and use of forests.

***Recovery plan***

A comprehensive plan that details, schedules and costs all actions deemed necessary to support the recovery of a threatened species or ecological community.

***Refugia***

Biological communities or geographic entities that, because of their moderating structural characteristics or physical isolation, or both, provide a sanctuary to which species or groups of species have retreated or have been confined in response to threatening processes, including climatic change.

***Regrowth forest***

Native forest containing a substantial proportion of trees that are in the younger growth phase. Regrowth forests may contain scattered individuals or small occurrences of ecologically mature, or old-growth trees.

***Reserves***

Areas such as national parks, conservation parks and nature reserves which are subject to an established degree of. *See* also dedicated reserves.

***Sawlogs***

Logs for processing into sawn timber, veneers, poles and sleepers.

***Sawmill residue:***

Material left following the processing of logs into sawn timber.

***Scoping Agreement***

Agreement signed by the Commonwealth and Western Australian governments in July 1996, establishing the broad parameters for undertaking a CRA and finalising a RFA for Western Australia.

***Softwood plantation***

Plantations of softwood trees, particularly radiata pine.

***Softwood***

Timber of coniferous trees, irrespective of physical hardness. Includes pines and cypresses.

***Species***

A group of organisms capable of interbreeding freely with each other.

***Species diversity***

The variety of living species.

***Sustainable yield***

The sustainable yield of a forest is the maximum level of commercial timber which can be maintained in perpetuity under a given management regime.

***Thinning***

The selective removal of some trees from a stand. Usually applied to relatively even-aged stands.



***Threatened species or community***

A species or community that is endangered, vulnerable or presumed extinct.

***Threatening process***

A process that threatens, or may threaten, the survival, abundance or evolutionary development of a species or ecological community.

***Value-adding***

The increase in value to the economy of a natural resource product by manufacturing within the economic area, as opposed to exporting the raw material to be manufactured elsewhere.

***Vulnerable species or ecosystems***

Species or ecosystems that are approaching a reduction in range of 70% or are subject to threatening processes that may cause their loss at the bioregional level.

***Wilderness***

Land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement or is capable of being restored to such a state; is of sufficient size to make its maintenance in such a state feasible; and is capable of providing opportunities for solitude and self-reliant recreation.

***Wilderness Quality***

A measure of differing levels of human impact on the natural environment, as part of a continuum of conditions varying from pristine to urban. Wilderness quality is measured in terms of four variables: remoteness from settlement, remoteness from access, apparent naturalness, and biophysical naturalness.

***Wildlife corridor***

A strip of forest of varying width reserved from harvesting to facilitate fauna movement including gene movement between patches of forest of varying ages and stages of development.

***World heritage***

Areas deemed to have universal value for humankind under an international convention to which Australia is a signatory.

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