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.

The views expressed in this paper are those of the authors and not necessarily those of the Commonwealth or Western Australian governments. The Commonwealth and Western Australia do not accept responsibility for any advice or information in relation to this material.

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Contents

MAP

APPENDICES

BOXES

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:

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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^3 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^3 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^3 per annum corresponds to reductions over the RFA period of 490,000m^3 to 450,000m^3 (to 2003) and 300,000m^3 to 260,000m^3 (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.

4 Securing outcomes for the Regional Forest Agreement

4.1 INTRODUCTION

The broad objectives of the RFA are to:

- provide certainty in relation to access to forest resources and environment and heritage conservation;
- establish a world class CAR reserve system;
- develop efficient, sustainable and internationally competitive forest-based industries; and
- ensure ecologically sustainable forest management practices.

This chapter seeks to elaborate and develop these major themes, including the more detailed objectives outlined in Chapter 2, and to demonstrate a range of approaches that could be used to achieve these objectives in an RFA.

4.2 CERTAINTY

The 20 year RFA will form the basis for the long-term ecologically sustainable management of the south-west forests, promoting competitive and efficient forest-based industries and protection of environment and heritage values. It will provide long-term certainty for conservation and industry activities and seek to ensure that independent action on the part of either the Commonwealth or the Western Australian governments will not lead to the Agreement being terminated.

Both governments will pursue options for complementary legislation to enhance the certainty of the RFA. The Commonwealth is committed to introducing legislation into the Parliament in 1998. The proposed legislation will include provisions that remove the application of existing Commonwealth legislation to timber harvesting and associated operations in a region subject to an RFA and specify the limited circumstances for termination of an RFA by the Commonwealth.

The Western Australian Government provides security and certainty for public land and resource access for forest based industries through the *Conservation and Land Management Act 1984, Mining Act 1978, Petroleum Act 1967* and the mineral-based State Agreement Acts. Within the scope of this legislation, new wood supply proposals that arise during the currency of the RFA will not require assessment unless they are beyond the scope of the Agreement.

Where existing legislation and management plans require changes under the RFA to ensure certainty, this will be pursued by both governments

4.3 COMPREHENSIVE, ADEQUATE AND REPRESENTATIVE (CAR) RESERVE SYSTEM

The development of a CAR reserve system will be guided by nationally agreed criteria developed by the Joint Australian and New Zealand Environment and Conservation Council (ANZECC)/Ministerial Council on Forestry, Fisheries and Aquaculture (MCFFA) NFPS Implementation Sub-committee (JANIS). JANIS and the National Forest Policy Statement define comprehensiveness, adequacy and representativeness as:

> *Comprehensiveness: includes the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels;*
>
> *Adequacy: the maintenance of ecological viability and integrity of populations, species and communities;*
>
> *Representativeness: those sample areas of the forest that are selected for inclusion in reserves should reasonably reflect the biotic diversity of the communities).*

The JANIS reserve criteria are summarised in Box 1.1. JANIS also includes specific reserve design criteria which are summarised in Box 4.1. The data obtained from the CRA process, the results of which were summarised in the CRA report released on 6 February 1998, will form the basis for any new reserve design.

Box 4.1 JANIS reserve design criteria

Reserve design can influence not only the protection of conservation values but the efficiency and effectiveness of subsequent management for conservation within the reserve. Criteria which should influence reserve design include:

- boundaries should be set in a landscape context with strong ecological integrity, such as catchments.
- large areas are preferable to small areas, though a range of reserve sizes may be appropriate to adequately sample conservation values.
- boundary-area ratios should be minimised and linear areas should be avoided where possible except for riverine systems and corridors identified as having significant value for nature conservation.
- reserves should be developed across the major environmental gradients if feasible, but only if these gradients incorporate key conservation attributes which should be incorporated in the CAR system.
- each reserve should contribute to satisfying as many reserve criteria as possible.
- reserve design should aim to minimise the impact of threatening processes, particularly from adjoining areas.
- reserves should be linked through a variety of mechanisms, wherever practicable, across the landscape.

The JANIS principles state that all reasonable effort should be made to provide for biodiversity and old-growth forest conservation in the dedicated reserve system on public land. Where this is demonstrated not to be possible or practicable. However, other approaches will be required, for example, conservation zones in approved forest management plans and voluntary arrangements such as covenants on private land. The elements of a CAR reserve system include dedicated reserves, informal reserves, values protected by prescription and private land where they meet the principles outlined in JANIS (Section 4.1).

The strategy for conserving biodiversity relies not just on a CAR reserve system, but also on the application of ecologically sustainable forest management across all tenures. In relation to this, specific management actions in the areas of policy, planning, implementation, monitoring and review for the RFA region will be considered by the Commonwealth and Western Australian governments in developing the RFA.

To assist members of the community to participate in and provide input to the RFA process, Commonwealth and Western Australian officials have developed three possible approaches to the development of a CAR reserve system. Within each of these approaches there are a range of outcomes resulting from differing ways of approaching the reserve design. These approaches, outlined in the remainder of this section, seek to protect biodiversity and old-growth forest values through reservation on public land. Other protection mechanisms such as those discussed in the *Assessment of Ecologically Sustainable Forest Management* (1997) report will be considered in the development of the RFA.

4.3.1 Formal reserves

In accordance with the JANIS criteria, the governments have agreed that, in addition to the existing dedicated reserves, reserves proposed in the 1994-2003 Forest Management Plan will, for the purposes of achieving the JANIS conservation targets, also be counted as formal reserves when included in the approaches. These proposed reserves are currently being managed as if they were a dedicated reserve even though most have yet to go through the consultation and approval process prior to being officially gazetted as formal reserves. Gazetted and proposed reserves are shown separately in the benchmark data.

In exploring approaches to the development of a CAR reserve system, and taking into account the CRA environment and heritage data and economic and social considerations, the opportunity has been taken to increase reserve design flexibility through a limited revision of new reserves proposed in the 1994-2003 Forest Management Plan. This revision has taken the form of some exchanges of areas containing ecosystems that are already well represented in the current reserve system for alternative areas which will increase the reservation of ecosystems and old-growth that are underepresented in relation to the JANIS targets, with reduced resource impacts.

4.3.2 Informal reserves

Western Australia's current informal reserve system, identified in the 1994-2003 Forest Management Plan, was designed to protect a range of values, including nature conservation, water and aesthetic values.

Informal reserves are protected areas within State forest designated in the Forest Management Plan and consist of:

- river and stream reserves - reserves varying in width from 60 m to 400 m depending on stream order;
- travel route reserves - reserves 400 m wide on Level 1 travel routes (including the Bibbulmun Track) and 200 m wide on Level 2 travel routes;
- diverse ecotype zones - reserves around rock outcrops, wetlands, heath, sedge, herb and woodland communities.

The total area of informal reserves designated in the 1994-2003 Forest Management Plan within the RFA region is 314,900 hectares.

In this paper the following informal reserves have been accredited towards achieving the JANIS conservation criteria, in addition to the existing dedicated and proposed reserves:

- 5th order and higher stream reserves;
- 4th order stream reserves;*
- those informal reserves and adjoining areas of land that were accredited by the Commonwealth Scientific Advisory Group for the Deferred Forest Agreement, on the basis that the RFA would contain a clause specifying that the Western Australian Government will redesignate said adjoining areas of land as informal reserves;
- diverse ecotype zones of an area equal to or greater than 40 hectares; and
- the Bibbulmun Track travel route reserve (400 metres wide).

*These informal reserves were accredited on the basis that the width of these reserves would be increased from 150 metres to 200 metres. This would be achieved through changes to the 1994-2003 Forest Management Plan.

Accreditation of these reserves was on the basis that:

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

The total area of informal reserves accredited in this paper is 170,800 hectares, including 113,900 hectares in diverse ecotype zones. This includes 3,530 hectares of State forest which have been accredited towards the JANIS targets but which are not informal reserves under the Forest Management Plan. The area of non-accredited informal reserves is 147,600 hectares.

4.3.3 Reserve design and natural resources

In the development of the RFA the governments will, in seeking to protect environment and heritage values, seek to minimise the impacts on resources (timber, minerals, water, etc) using the data compiled under the CRA process. Data layers showing areas of importance for timber values, mineral values, dam sites and other commodities will be considered in conjunction with the environment and heritage data layers. Consideration will also need to be given to the relevant legislative requirements pertaining to mining leases and other tenements.

State Agreement Act leases

WA has entered into agreements with several mining companies holding leases within the RFA Region - Alcoa Australia, Worsley Alumina, Griffin Coal and Wesfarmers Coal. These agreements have been given legal force through the enactment of individual State Agreement Acts. The Acts impose legally binding obligations between the companies and the State and guarantee the companies access to specified mineral resources within their leases. Proposals by the State for conservation reserves to be established within these leases have therefore been progressed, and only can progress, with the agreement of the respective companies.

In recognition of the importance of conserving viable areas representative of the forest ecosystems within their leases, State Agreement Act companies have, in the past, agreed to some areas within their leases becoming conservation reserves or to the excision of areas from their leases for conservation purposes. The primary mechanisms for achieving this reservation have been through the Conservation Through Reserves (System 6) process and CALM's forest management planning processes. Agreement Act companies are actively participating in the RFA with a view to contributing to JANIS outcomes.

An important consideration for the companies in the design of reserves within their leases is the availability of access to all mineral deposits within the lease. In order to ensure ongoing access it will be necessary to avoid creating a barrier between current mining infrastructure and future mining activity beyond any reserves created in the RFA. These factors will be considered, along with the JANIS reserve design criteria, in the development of the RFA. Access routes would need to be carefully selected to minimise environmental impacts, as has been the case under previous reserve design processes.

Other mineral and petroleum tenements

In other approved mineral and petroleum tenements, or where applications are under consideration, there is an obligation on governments not to change the statutory property rights of the tenement holders without consultation. New reserves in these areas have the potential to conflict with these rights. Consequently, where the creation of new reserves in these tenements is unavoidable because it would lead to significant limitations in achieving the JANIS criteria, discussions will be held with affected companies to ensure that any changes to their statutory property rights will only proceed with their agreement. Governments aim to reduce uncertainty over access to mineral resources as part of the RFA.

4.3.4 Economic analysis

At this stage in the RFA process only indicative economic impacts are available. As such, the impacts shown against the approaches in this paper should be viewed as a general guide. Detailed economic analysis for the development of the final RFA will be undertaken during the public consultation period and a description of the model to be used is provided at Appendix 2.

There was a need, however, to provide initial indicative measures of the possible impact of the various reserve approaches in terms of forgone wood production. Therefore for each approach estimates were made of the annual gross value of production of timber and wood products based on the estimated annual sustainable log yield for that approach. These estimates were then measured against the estimated annual gross value of production in the absence of any changes to conservation reserves.

The gross value of production estimates are based on existing log recovery rates and assumed splits between rough sawn and dressed timber for jarrah and karri and existing product recovery rates for woodchips and conversion rates from jarrah to charcoal production. These estimates are short-term indicators and assume a continuation of existing milling practices and market outlets.

Timber industry employment impacts

Broad estimates of the possible employment impacts in the timber sector that may arise from the RFA were developed to assist in the indicative economic analysis. More detailed analysis will be undertaken during the RFA development phase. The timing of any employment impacts is uncertain and will depend on when changes in contract volumes are passed onto mills, and how each sector would react to any variation in log volumes.

Industry employment

The impacts on direct private sector employment of that portion of the timber industry dependent on logs sourced from public native forests were calculated as follows. The industry was defined as covering employment from the forest to the point of first of sale of the wood. Four industry groupings were chosen: logging and haulage; sawmilling, resawing and dressing; woodchipping and charcoal manufacturing. Estimates were made of the current number of people directly employed in each of these categories. It was estimated that there were 2,440 employed in these categories which were dependent on hardwood log supply from Crown land.

Relationships were then established for the average volume of logs handled per employee for each category, based on the number of employees per category. Using estimates of the possible loss of log resource from each approach, employment losses were calculated for each of the employee categories.

The relationships developed assume that there is straight line association between log volumes and the number employed. In practice, the relationship can be quite uneven. For example, a sawmill may maintain employee numbers at a given level in the face of variable log flow, by adjusting shift lengths or overtime provisions. However, once log throughput declines below some critical level, individual operations may cease altogether.

The RFA impacts on employment will be in addition to the underlying adjustments which may occur in some sectors of the industry. For example, existing log supply projections indicate that the long-term supply of first and second grade jarrah logs will decline from current levels of 490,000 cubic metres to 300,000 cubic metres per annum due in part to the creation of reserves in the Forest Management Plan in response to the National Forest Policy Statement 1992. Although the introduction of improved milling technology may allow for greater utilisation and recovery from lower grade jarrah logs, a decline in supplies of first and second grade logs of such magnitude would be expected to lead to some significant adjustment in the jarrah sawmilling sector of the industry.

The estimated industry impacts against the approaches in this paper are shown in Appendices 7, 8 and 9.

Public Sector employment

The Western Australian Government has indicated that CALM operates under a net appropriation budget. In addition, hardwood timber production activity within CALM operates within a semi-autonomous Business Unit.

Additions to the reserve system arising from the RFA may result in a reduction in CALM's royalty revenue from the native forest sector. Such reductions may potentially result in CALM employment loss.

Subject to budgetary and policy decisions, the Western Australian Government has estimated that the potential public sector employment impacts are as follows:

Box 4.2 Public sector employment

Direct public sector employment impact of the approaches in Section 4.4 *

Benchmark	Approach A	Approach B	Approach C
0 to -8#	-81 to -69	-62 to -25	-3

* These estimates are indicative only and have been derived by dividing potential royalty revenue impacts used to meet staff costs by the average wage, salary and associated operating costs of all CALM employees. There has been no job-specific analysis of potential impacts. Based on these figures the likely indirect impacts from CALM employment impacts could be in the range of 0 to -10 (benchmark), -97 to -83 (approach A), -74 to -30 (approach B) and -4(approach C).

The increase in width of fourth order stream reserves by 50 metres to 200 metres for accreditation purposes results in a decrease in the area of forest available for timber production and hence in a decrease in CALM employment of -8.

Indirect employment impacts

Employment changes in one sector can be expected to have flow-on effects in other sectors. These sectors can include those which service the affected sector, such as fuel suppliers; those which use the output from the affected sector, such as furniture makers using sawn timber; and other sectors, such as the commerce, health and

education sectors which provide services to industry employees. The indirect employment losses are not confined to the State boundary.

One method of measuring employment changes is through the use of input-output employment multipliers. An average multiplier of 2.2 was used, based on the input-output employment multipliers relevant to the timber industry sectors of the Western Australian economy (Clements and Qiang 1995). The resultant estimate is that for every 10 jobs directly lost because of reserve changes, an additional 12 jobs could be lost outside the industry.

Detailed economic analysis - next steps

The detailed economic analysis will examine changes in the economic costs and benefits associated with known and potential mineral resources, forest use patterns, wood production and other economic activities (see Chapter 10 of the CRA report). For the timber industry analysis, broader economy-wide effects will be measured through changes in state output and employment.

For the timber production sector , the economic assessments will be used to provide information on the economic costs and benefits of varying forest use and industry development (see Appendix 2). A computer model has been developed to simulate the interactions between regional timber resources, wood-based forest industries and final product markets. Two important measures used to assess the economic impacts for the timber sector are the value of production and employment opportunities. In order to estimate what impacts the RFA may have on the value of production and employment prospects in this sector, it is first necessary to establish a baseline of how the industry would develop in the absence of an RFA (see Appendix 3). Any potential RFA impacts are then analysed against this baseline.

This baseline is not necessarily a continuation of the existing industry structure and production - the structure of the industry can alter in response to changes in wood resource quality and availability, market opportunities and relative competitiveness of industries within the sector. To assist in establishing this baseline, a consultant was engaged to develop a feasible industry development plan for the native forest timber sector over the life of the RFA (see Section 4.6.1). This development plan also took into account the projected availability of plantation timber over the RFA period, examining markets where native and plantation timbers compete, such as structural timbers, and those where they can complement, such as in the production of panel products. Therefore, in developing the baseline, the profitability and employment opportunities in utilising both native forest and plantation timbers were taken into account.

Any direct economic impacts in the timber and wood products sectors will have linkages to other sectors of the economy, at the regional, state and national levels. To assess these effects a general equilibrium model is to be used to measure the flow-on effects of changes in output or income from timber-based industries to other sectors of the state or national economy. Spillover effects from one sector of the economy to another are captured through wage and price adjustments resulting from one sector's expansion or contraction in response to a policy change. The Centre of Policy Studies at Monash University was commissioned to provide a computable general equilibrium model of the Australian economy, capable of measuring state level impacts. The

model, which is based on the Centre's existing MONASH-MRF model requires the direct timber industry sector impacts to be entered to simulate the subsequent flow-on effects to other sectors at both the state and national levels.

4.3.5 Social analysis

The social analysis has focussed mainly on the potential impacts of the RFA on the native forest based timber industry as this industry sector is likely to feel any effects of the RFA directly and more immediately. Indicative social impacts available from preliminary (Phase 1) social analysis assessment are presented in this paper. More detailed social analysis will be undertaken during the public consultation period.

The native forest based timber industry is a significant employer in the RFA region. Towns such as Manjimup, Pemberton, Nannup, Greenbushes, Northcliffe and Yarloop have a strong association with the industry. In the past 40 years, the timber industry has undergone significant modernisation, increasing centralisation of economic activity and, consequently, has changed in size and structure. In addition, increasing emphasis is being placed on value adding and manufacturing and, thereby, providing greater job skilling opportunities. A major industry issue is the requirement to manage a changing resource, primarily an increasing reliance on timber from native regrowth forests. Many timber industry representatives contend that any further changes would compound the challenges already faced.

Timber industry adjustments are still occurring. Due to recent major mill or shift closures towns including Walpole, Nannup, Northcliffe and Jarrahdale have undergone, or are undergoing, a period of adjustment and some uncertainty. Nannup and Northcliffe do, however, continue to have a significant timber industry presence and many Northcliffe residents now commute to the mill in Pemberton.

From an historical perspective, the last 40 years have seen numerous mill centres in the lower south-west either reduce greatly in size or cease to exist. Since 1961, the Northcliffe urban centre has gone from a population of well over 500 (ABS, 1961) to 239 currently; Nannup had nearly 400 more residents in 1961 than the current population of 521 and Yarloop's population has decreased by about 150 (ABS, 1996) over the same period. However, it should also be noted that these three towns have experienced modest population growth or minimal decline over the last 15 years. Other trends within this period show that the population in coastal towns (eg Denmark, Busselton, Margaret River) has more than doubled, while in the core RFA shires (eg Manjimup, Bridgetown-Greenbushes) the population has not grown substantially.

Mill closures and the downward trend in native forest-based timber industry employment have occurred over a reasonably long period and have been accompanied by consolidation of activities in larger centres such as Manjimup, where new investment in drying and processing of timber has occurred. This information can help to separate possible impacts stemming from the RFA from other events that are likely to occur, given current trends or no change. These events also highlight the potential for impacts to be cumulative, particularly in smaller communities such as Northcliffe and Nannup, and attention needs to be given to the interrelated effects of events in a region over time, as the combination of these is likely to be higher than

those considered separately. A community that has experienced a succession of impacts may possess a different adaptive capacity compared with one that has remained relatively undisturbed.

Today, the region is dominated by several major centres that act as focal points for economic and employment activity (eg Collie, Manjimup, Bridgetown). Coupled with timber industry adjustment and increasing economic diversity (eg mining, tourism, manufacturing, viticulture), many regional economies are less dependent on the timber industry. Key factors in adapting to these changes have been a community's ability to diversify and manage change.

It is also noteworthy that many existing towns - Denmark, Balingup, Bridgetown and Northcliffe to name a few - have all suffered economic and social hardships over the course of this century. Their endurance has depended upon the ability to broaden economic bases.

However, some towns still remain largely dependent on the timber industry for employment (eg Nannup, Manjimup). Other towns, including Collie and Greenbushes have an historical mix of timber and mining industry employment and there is a trend of increasing employment in the tourism industry in towns such as Pemberton.

Sawmill industry employees profile

An analysis of sawmill worker survey data conducted by Environment and Behaviour Consultants in 1997 for the RFA indicates that these families tend to consist of young to middle-age couples who are likely to have primary school aged children. Reliance on community infrastructure services such as education, health and recreation is therefore apparent. As such, changes in a town's population or employment levels have the potential to affect - to varying degrees - the level of provision of these and other services. These data also show the strength of workers attachment to rural communities and type of employment. This is demonstrated by the length of employment and residence in a particular community. Industry and place attachment are influential in the decision to remain in a community as is the perception of greater opportunity for re-employment.

Some of the more notable characteristics of sawmill industry workers within the RFA region are shown in Box 4.3.

Box 4.3 Sawmill industry employees profile

Indicator	Results
Age	Average age of 39 years
Gender	86% male
Marital status	59% married
Family size	Average of 2.9 persons
Home ownership	31% owned, 34% rented and 35% paying off a mortgage
Length of employment in current business	Average of 10.5 years
Length of employment in the industry	Average of 14 years
Employment relocation (no. of moves)	16% moved for employment, average of 2 moves
Partner's employment status	63% of partners currently employed
Length of residence in the area	Average of 19 years

Interviews, survey data and previous case studies suggest that any loss of timber or other industry employment does not automatically signify a corresponding loss of local population.

Community sensitivity and community consultation

The RFA social assessment investigated the resources a community has at its disposal and its degree of sensitivity to respond to change. From previous research (CRA Report 1998) more than 20 indicators were identified and analysed for each of 44 towns in the South-West Forest Region. The indicators were combined to form a Community Sensitivity Index (CSI). Using 1991 and 1996 ABS Census data, measures for the CSI include: distance from major centres, ratio of dependents, occupancy rates, median age and median family income. Also included are the percentage of a town's population employed in agriculture/timber production, bought homes, housing authority rentals and occupied dwellings.

The research indicated that those communities most sensitive to change exhibit many of the following characteristics:

- small populations;
- limited economic diversity;
- limited population growth;
- low mobility;
- low levels of home ownership;
- limited service provision;
- lower median income;
- a high percentage employed in the timber industry.

The CSI compares the sensitivity of each town against the other towns in the region and provides a score between zero and one, with one indicating towns with a higher sensitivity to change. Initial data analysis indicated that towns fall into four categories, ranging from those with a high sensitivity to change to those with a low sensitivity to change. Results are shown in Appendix 4.

As the CSI diagram shows, Manjimup, Deanmill, Greenbushes, Northcliffe, Pemberton and Yarloop appear as first order towns with relatively high sensitivity to change. Although a relatively large town, Manjimup has had strong historical links with the timber industry since it was established in 1912 and continues to be identified as a timber and service town. It is the centre for a number of forest-related industries, including a large timber processing centre, a woodchip mill, smaller sawmills and several harvesting and haulage contractors and engineering services. Most Manjimup businesses rely heavily on the forest industry sector.

Another first order town is Northcliffe with an urban centre population of 239 and an unemployment rate around 22%. Approximately 38% of Northcliffe's workforce is employed in the timber industry. While the town's population has risen from below 200 in 1981 to the present level, Northcliffe is experiencing some uncertainty over its future.

Bridgetown has been identified as a second order town. It has been in a state of growth since the 1970s and has a diverse industry base, including logging contractors,

sawmilling, livestock grazing, horticulture, tourism and tree farming. Timber industry employment accounts for approximately 10% of the workforce.

Summary

Broad conclusions can be drawn about the RFA region. Post impact analysis work suggests that towns adjacent to a major regional centre are likely to grow with that centre. The future of other towns is less certain.

As a general assessment, changes related to the timber industry and traditional timber towns are indicative of a host of changes being experienced by rural communities across Western Australia and many other parts of Australia. Business closures, loss of social infrastructure, comparatively high youth and average unemployment and uncertainty are common elements of such change. Uncertainty, particularly in communities with high dependence on forest-based industries, clearly has the potential to affect community cohesion and vitality negatively.

While this is the case, mining has the major economic presence of any industry in the region and has contributed to stability in towns such as Collie, Waroona, Yarloop, Dwellingup, Boddington and Jarrahdale. Forest-based tourism is also growing. Timber, however, remains an important industry of numerous RFA towns.

It is unlikely that the native forest-based timber industry will provide any additional employment in milling and forest management. Given incentives, including business investment, and the influence of strategic policy direction, however, employment growth (and related skilling and retraining) is likely in the value adding and manufacturing sectors (CRA Report, 1998).

Social assessment Phase 2 - The next step

Phase 2 of the social assessment process will be undertaken following the release of this consultation paper. This phase outlined in Appendix 5 will gather quantitative and qualitative information concerning the possible regional and local effects from the RFA. In particular, Phase 2 will inform the RFA decision-making process in relation to:

- the social and economic implications of these actions at regional and local levels;
- the nature and extent of effects and responses anticipated by local and regional businesses, service providers and community service groups; and
- local and regional community feedback about the RFA.

Social systems within townships are complex, interrelated and often cumulative. Effects on one group may have reverberating effects on other groups within that community and on the overall vitality of that township. Further, townships vary considerably in their ability to respond to impacts, whether positive or negative. Impact analyses are likely to be inaccurate if they discount people's values, social dynamics and beliefs about events.

Three approaches will be used to assess local and regional effects, utilising information obtained from:

- industry and community surveys, stakeholder interviews and ABS census data collected during Phase 1;

- detailed interviews with key stakeholders from industry, service providers and local, state and federal government agencies; and
- local discussion groups in towns throughout the South-West Forest Region.

1. Industry and community surveys, stakeholder interviews and Australian Bureau of Statistics data

During the first phase of the social assessment process, surveys and personal interviews were used to develop a profile of local and regional issues relating to forest use. Additionally, ABS data were used to extract demographic details such as urban centre populations, employment information and labour force characteristics. Information was also obtained from local, state and federal government authorities regarding community infrastructure and services in regional towns. Data derived from the above sources will be used to make local and regional impact projections.

2. Interviews with key stakeholders from industry, service providers and local, state and federal government agencies

To reflect more accurately the implications for townships as a result of changes in forest resource access, it is necessary to obtain input from local businesses and organisations. To this end, detailed personal interviews will be held with key people at local and regional levels. This includes those from timber, mining, tourism, local, state and federal authorities, (shire, health, education, social services etc), chambers of commerce, wildflower pickers, apiarists, fine wood manufacturing and Members of Parliament. Interviewees will be selected on the basis that they are able to provide specific information about the most probable effects on their organisation and community in relation to the possible impacts of an RFA.

3. Local discussion groups

Using information extracted from social profiles and industry surveys, local discussion groups will be held in Manjimup, Pemberton, Yarloop, Northcliffe, Collie, Nannup, Bridgetown (including Greenbushes) and Walpole (including Denmark).

Local discussion groups will comprise a mix of key people associated with each of the above towns and include local government, shire councillors, local businesses proprietors, tourist bureaux, chambers of commerce, mill managers, hospital boards, school principals, telecentre coordinators, service clubs (Apex, Lions etc) and community service groups (eg bush fire brigades, CWA). Group participants will comment on the desk top analysis and the perceived positive and negative outcomes of the RFA at local town level.

Phase 2 information will be collected and prepared by the Forest Community Co-ordinators who will present a social assessment report to the Steering Committee for consideration in the development of the RFA.

4.4 POSSIBLE APPROACHES TO A COMPREHENSIVE, ADEQUATE AND REPRESENTATIVE RESERVE SYSTEM

To assist members of the community to participate in, and provide input into the RFA process, Commonwealth and Western Australian government officials have

developed three possible approaches to the development of a CAR reserve system, for convenience named approaches A, B and C. The approaches are not designed to predetermine the likely outcomes of the RFA but, rather, are intended to promote discussion and feedback to the two governments on the development of a balanced RFA that addresses the needs of the community, industry and governments. There are many other approaches that would be equally appropriate. The final RFA may lead to results which are a mixture of the different approaches or which lie outside the ranges explored in this document.

All three approaches have been developed from, and are compared to, a benchmark developed from the Forest Management Plan 1994-2003. In all of the approaches, existing dedicated reserves remain unchanged, but consideration has been given to some revision of the new reserves proposed in the Forest Management Plan 1994-2003, where this could assist in better achieving the objectives of the RFA.

It should be noted that in the Benchmark most ecosystems meet or exceed the 15% biodiversity targets. Additional reservation to meet the target for old-growth will, in some cases, result in the 15% biodiversity target being exceeded for the same ecosystem. Similarly, additional reservation to meet the target for forest ecosystems may, in some cases, result in the 60% target for old-growth being exceeded.

The approaches vary in their relative emphasis on conservation, resource and employment values, with approach A having greater emphasis on conservation values and approach C having the greater emphasis on economic and employment values.

All approaches:

- increase the areas of reservation above the benchmark in relation to the JANIS quantitative targets, with the highest level of reservation in approach A;
- aim to optimise the achievement of the non-quantitative JANIS criteria in reserve choices; and
- aim to minimise adverse impacts on economic and social outcomes.

In summary the approaches can be characterised as follows:

Approach A aims to meet the JANIS quantitative targets and optimise the non-quantitative targets while minimising resource impacts.

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

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

Within each of these broad approaches there are many ways of configuring reserves. Variations inherent in reserve choice means a range of outcomes are possible for each approach. Thus, outcomes such as areas reserved and the employment and resource impacts, are presented as a range.

The contribution of informal reserves which have received up-front accreditation by governments towards the achievement of the JANIS criteria is considered in all of the

approaches. A parallel assessment of outcomes in relation to the JANIS criteria when all existing informal reserves are considered is also presented in the benchmark. Private forested land has generally not been considered in the development of these approaches. However, freehold land outside State forests, which is privately owned by Western Australian Government agencies, has been taken into consideration.

4.4.1 Benchmark

In order to provide a baseline against which the three approaches can be compared a benchmark has been established which shows the estimated outcomes of implementing the Forest Management Plan 1994-2003, including the level of reservation in relation to the JANIS targets and resource impacts.

The contribution of informal reserves towards the JANIS targets are shown in two ways in the benchmark tables at Appendix 6:

1. those informal reserves which have received up-front accreditation by governments; and
2. all existing informal reserves.

Comparisons in the approaches text are made against the benchmark (other than for the timber industry indicative impact analysis) where only those informal reserves which have received up-front accreditation by governments contribute towards meeting the JANIS targets. The timber industry indicative impact analysis is compared against the 1994-2003 Forest Management Plan.

The increase in width of fourth order stream reserves by 50 metres to 200 metres, and the inclusion of other additional areas deemed to be informal reserves for accreditation purposes, results in a decrease in the area of forest available for timber production. The benchmark therefore incorporates change against the current situation. These changes, which include an estimated reduction in employment, are outlined in Tables 6.5 and 6.6 at Appendix 6 and in Box 4.2, Section 4.3.4.

Outcomes against Regional Forest Agreement objectives

The benchmark addresses the environment and heritage and social and economic objectives for the RFA in the ways described below - detailed information regarding the benchmark is contained within the tables at Appendix 6.

Environment and heritage objectives

- The benchmark contains a total area of around 896,700 hectares in accredited reserves, comprising 408,700 hectares of gazetted reserves, 319,700 hectares of proposed reserves and 168,300 hectares in informal reserves. The benchmark would contain a total reserve area of 1,040,700 hectares, comprising 408,700 hectares of gazetted reserves, 319,700 hectares of proposed reserves and 312,300 hectares in informal reserves if all informal reserves were included.
- The JANIS biodiversity reservation target of 15% of the pre-1750 distribution would be met or exceeded in accredited reserves for 15 of the 22 forest ecosystems which are not vulnerable, rare or endangered in accredited reserves. The outcome would be 18 out of 22 if all informal reserves were included.

- The JANIS biodiversity reservation level of 100% would not be achieved for the four forest ecosystems which are vulnerable, rare or endangered.
- The level of protection for other forest biodiversity values would include 39% for areas important as centres of disjunct flora; 54% for areas important as centres of relictual flora; 47% for areas important as centres of flora species richness; and 42% for areas important as centres of flora endemism in accredited reserves. The level of protection for other forest biodiversity values would be 43% for areas important as centres of disjunct flora; 58% for areas important as centres of relictual flora; 52% for areas important as centres of flora species richness; and 46% for areas important as centres of flora endemism if all informal reserves were included.
- The existing and proposed reserves in the benchmark would result in the reservation of 183,700 hectares of old-growth forest in accredited reserves or 202,900 hectares if all informal reserves were accredited. The JANIS target of a reservation level of 60% of the extant distribution would be met or exceeded for four of the nine forest ecosystems in which old-growth is not rare or depleted. Shortfalls in accredited reserves would occur for old-growth in the Jarrah Blackwood (28% reserved), Jarrah Mt Lindesay (49% reserved), Jarrah South (53% reserved), Jarrah Yellow Tingle (36% reserved) and Karri Yellow Tingle (40% reserved) forest ecosystems. Shortfalls would occur for old-growth in the Jarrah Blackwood (33% reserved), Jarrah Mt Lindesay (50% reserved), Jarrah South (56% reserved), Jarrah Yellow Tingle (41% reserved) and Karri Yellow Tingle (48% reserved) forest ecosystems if all informal reserves were included.
- For old-growth forest which is rare or depleted, a 100% level of protection of all examples considered viable would be achieved for four out of ten forest ecosystems. Shortfalls occur for old-growth in accredited reserves in the Jarrah Leeuwin (75% reserved), Jarrah North-East (41% reserved), Jarrah North-West (84% reserved), Western Wandoo forest (77% reserved), and Western Wandoo woodland (56% reserved) forest ecosystems. The protection of all examples considered viable would be achieved for five out of ten forest ecosystems if all informal reserves were included. Significant shortfalls occur for old-growth in the Jarrah North-East, Jarrah North-West, Western Wandoo forest, and Western Wandoo woodland forest ecosystems. For rare or depleted old-growth in some forest ecosystems the target is not achievable on public lands, as the remaining old-growth outside reserves exists as small examples. Protection of small viable patches of old-growth may be best achieved through informal reservation or management prescription.
- Overall, the existing and proposed reserves in the benchmark are generally consistent with the JANIS reserve design principles (such as the setting of boundaries within a landscape context with strong ecological integrity; the reservation of larger rather than smaller areas; the development of reserves across environmental gradients; minimising the impact of threatening processes; and the establishment of links between reserves).
- The reserves in the benchmark would result in a protection level for areas of indicative national estate significance in accredited reserves of more than 90% for contemporary fauna refuges; more than 80% for refugia and centres of relictual flora and disjunct flora; more than 70% for natural landscapes and centres of

endemism; more than 60% for aggregations of old-growth forest, flora species richness and wetlands of national significance; and more than 50% for vegetation community diversity. Protection levels for areas of indicative national estate significance would be more than 90% for refugia and contemporary fauna refuges; more than 80% for centres of relictual flora and centres of disjunct flora; more than 70% for centres of flora endemism, flora species richness and natural landscapes; and more than 60% for aggregations of old-growth forest and wetlands of national significance; and more than 50% for vegetation community diversity if all informal reserves were included.

Social and economic objectives

- The area available for timber production in native forest would be some 1,146,700 hectares or some 1,150,000 hectares if the fourth order stream reserves and other areas deemed informal reserves are not varied for accreditation purposes as outlined in Section 4.3.2.
- The level of harvest of first and second grade jarrah and karri sawlogs from State forests would be around 489,000 and 211,000 cubic metres per year, respectively or 490,000 and 214,000 if the fourth order stream reserves and other areas deemed informal reserves are not varied for accreditation purposes as outlined in Section 4.3.2.
- The level of chiplog and charlog harvest would be around 725,300 cubic metres per year or 734,000 cubic metres per year if the fourth order stream reserves are not varied for accreditation purposes as outlined in Section 4.3.2.
- The gross value of wood products at the mill gate would be $237.9 million per year or $239.6 million per year if the fourth order stream reserves and other areas deemed informal reserves are not varied for accreditation purposes as outlined in Section 4.3.2.
- Realisation of development opportunities for the extension of existing plants or the establishment of new plants involving a wide range of solid wood, engineered and reconstituted wood products, could be expected.
- Employment opportunities, quality of life, access to social and physical infrastructure and community viability will be maintained for communities with significant dependencies on native forest industries.
- Access to the forest estate for community activities, including Indigenous cultural activities, would be maintained.
- Current opportunities for tourism, apiary, wildflower picking, fuelwood and seed collecting would be maintained.
- The proposed reserves include 51,200 hectares in State Agreement Act areas, 47,300 hectares in mining tenements and leases (these may overlap Agreement Act leases), 4,000 hectares in areas of identified mineral resources and 163,500 hectares in areas of high and medium mineral potential.

4.4.2 Approach A

Approach A aims to meet the JANIS quantitative targets and optimise the non-quantitative targets while minimising resource impacts.

Under this approach between 165,000 and 187,500 hectares of new reserves would be added to the CAR reserve system. Major additions to the CAR reserve system would be concentrated in the Jarrah Blackwood, Jarrah North East, Jarrah North west and Jarrah South forest ecosystems.

This approach would involve some 29,000 to 32,000 hectares of areas proposed for reservation in the Forest Management Plan remaining as State forest. These areas would be concentrated in the Jarrah North East, Jarrah North West, Western Wandoo forest, Western Wandoo woodland, Jarrah Blackwood and Jarrah South ecosystems.

Outcomes against Regional Forest Agreement objectives

Approach A addresses the social and economic and environment and heritage objectives for the Regional Forest Agreement in the ways described below. The outcomes are shown in terms of only those informal reserves which have received up-front accreditation by governments contributing towards meeting the JANIS targets. An indication is also provided of how this compares against the benchmark. For more detailed information, refer to the tables presented in Appendix 6.

Environment and heritage objectives

- The protection of forest biodiversity would be enhanced through the additional reservation of between 165,000 and 187,500 hectares of new reserves, (with between 29,000 and 32,000 hectares of proposed reserves remaining as State forest, resulting in a net increase against the benchmark of between 145,000 and 155,500 hectares) contributing to a total area of CAR reserves of between 1,000,200 and 1,007,800 hectares.
- The JANIS biodiversity reservation target of 15% of the pre-1750 distribution would be met or exceeded for 21 of the 22 forest ecosystems which are not vulnerable, rare or endangered. The 15% level of CAR reservation would not be met only for the Darling Scarp forest ecosystem, where opportunities for additional reservation on public land are extremely limited, as the areas outside reserves are largely confined to private lands.
- The JANIS biodiversity reservation level would be increased for one of the four forest ecosystems which are rare or endangered (Jarrah Rates Tingle from 78% to 86%). Opportunities for increased reservation of the remaining three rare or endangered forest ecosystems (Bullich and Yate, Jarrah Red Tingle and Karri Rates Tingle) on public lands are extremely limited, as the areas remaining outside reserves are relatively small and are largely confined to private lands.
- The level of protection for other forest biodiversity would be further enhanced by increased CAR reservation of areas important for disjunct flora (from 39% up to 58%), relictual flora (from 54% up to 62%), flora species richness (from 47% up to 62%), or as centres of flora endemism (from 42% up to 60%).

- The protection of old-growth forest would be enhanced through the additional CAR reservation of 49,500 to 51,800 hectares of old-growth. All of the nine forest ecosystems in which old-growth is not rare or depleted would meet or exceed the JANIS reservation level of 60% of the extant distribution.
- The JANIS target for old-growth forest in six of the ten forest ecosystems in which old-growth is rare or depleted would be met as far as is practical and feasible in this approach. The CAR reservation level would be increased for the four remaining ecosystems (Jarrah North East, Jarrah North West, Western Wandoo forest and Western Wandoo woodland).
- The increases to the CAR reserve system in this approach would allow increased opportunities for applying the JANIS reserve design principles.
- The CAR reserves in this approach would result in a protection level for areas of indicative national estate significance of more than 90% for centres of disjunct flora, refugia and centres of relictual flora; up to more than 90% for centres of flora endemism; more than 80% for contemporary fauna refuges, flora species richness and natural landscapes; up to more than 80% for vegetation community diversity; up to 70% or more for aggregations of old-growth forest, and more than 60% for and wetlands of national significance

Social and economic objectives

- The area available for timber production would be some 1,087,100 to 1,090,200 hectares which represents a reduction of up to 66,200 hectares (about a 5% reduction in comparison to the Forest Management Plan 1994-2003).
- The level of harvest of first and second grade jarrah and karri sawlogs from State forests would be 453,400 to 457,700, and 193,500 to 196,800 cubic metres per year, respectively. This represents a reduction of between 49,500 and 57,100 cubic metres per year (between a 7% to 10% reduction in comparison to the current situation).
- The level of chiplog and charlog harvest would be 664,000 to 675,400 cubic metres per year. This represents a reduction of between 58,600 and 70,000 cubic metres per year (between a 7% to 8% reduction in comparison to the current situation).
- The gross value of wood products at the mill gate would be $219 million to $222 million per year, representing a reduction of between $17 million and $20 million per year, which is between a 7% to 8% reduction in comparison to the benchmark.
- The ability of the native forest timber industry to take up additional development opportunities would be constrained by this approach because of the reduction in timber resources.
- The estimated reduction in employment (see Appendix 7, Table 7.6 and Box 4.2) which could occur under this approach has the potential to impact on a number of communities across the region with significant dependencies on the native forest timber industry and may contribute to a reduction in quality of life, access to social and physical infrastructure and community viability.
- Access to the forest estate for community activities, including Indigenous cultural activities, would in general be maintained for most activities.

- This approach may reduce the area accessible for the purposes of apiary, wildflower picking, fuelwood and seed collecting.
- The proposed reserves under this approach includes 66,900 to 73,100 hectares in State Agreement Act areas, 73,500 to 83,500 hectares in mining tenements and leases (these may overlap Agreement Act leases), 3,500 to 3,600 hectares in areas of identified mineral resources and 239,700 to 248,100 hectares in areas of high and medium mineral potential. New reserves established under this approach would be in accordance with the arrangements outlined in Section 4.3.3.

4.4.3 Approach B

Approach B explores the flexibility provisions in the application of the JANIS criteria with lower levels of reservation than Approach A.

Under this approach between 122,500 and 127,700 hectares of new reserves would be added to the reserve system. Major additions to the reserve system would be concentrated in the Jarrah Blackwood, Jarrah North East and Jarrah South forest ecosystems.

This approach would involve some 30,000 to 50,000 hectares of areas proposed for reservation in the Forest Management Plan remaining as State forest. These areas would be concentrated in the Jarrah North East, Jarrah North West, Western Wandoo forest, Western Wandoo woodland, Jarrah Blackwood and Jarrah South ecosystems.

Outcomes against Regional Forest Agreement objectives

Approach B addresses the social and economic and environment and heritage objectives for the Regional Forest Agreement in the ways described below and provides a comparison against the benchmark. The outcomes are shown in terms of only those informal reserves which have received up-front accreditation by governments contributing towards meeting the JANIS targets. For more detailed information, refer to the tables presented in Appendix 8.

Environment and heritage objectives

- The protection of forest biodiversity would be enhanced through the additional reservation of between 122,500 and 127,700 hectares of new reserves (with between 30,000 and 50,000 hectares of proposed reserves remaining as State forest, resulting in a net increase against the benchmark of between 92,500 and 77,700 hectares), contributing to a total area of CAR reserves of between 943,600 and 968,100 hectares.
- The JANIS biodiversity reservation target of 15% of the pre-1750 distribution would be met or exceeded for 16 of the 22 forest ecosystems which are not vulnerable, rare or endangered. The 15% level of CAR reservation would not be met for up to six forest ecosystems. In some of these, such as the Darling Scarp forest ecosystem, opportunities for additional reservation on public land are extremely limited, as the areas outside reserves are largely confined to private lands.

- The JANIS biodiversity reservation level would be increased for one of the four forest ecosystems which are rare or endangered (Jarrah Rates Tingle from 78% up to 86%). Opportunities for increased reservation of the remaining three rare or endangered forest ecosystems (Bullich and Yate, Jarrah Red Tingle and Karri Rates Tingle) on public lands are extremely limited as the areas remaining outside reserves are relatively small and largely confined to private lands.
- The level of protection for other forest biodiversity would be further enhanced by increased CAR reservation of areas important for disjunct flora (up to 46%), relictual flora (between 60% and 61%), flora species richness (between 59% and 61%), or as centres of flora endemism (between 49% and 51%).
- The protection of old-growth forest would be enhanced through the additional CAR reservation of 32,600 to 36,100 hectares of old-growth. Four of the nine forest ecosystems in which old-growth is not rare or depleted would meet or exceed the JANIS reservation level of 60% of the extant distribution.
- The JANIS target for old-growth forest in six out of the ten forest ecosystems in which old-growth is rare or depleted would be met as far as is practical and feasible. The reservation level would be increased for Jarrah Leeuwin, Jarrah North West, Jarrah Yellow Tingle, Western Wandoo forest and Western Wandoo woodland . For old-growth in the Jarrah North East, Western Wandoo forest and Western Wandoo woodland forest ecosystems, the 100% level of reservation is not feasible.
- The increases to the reserve system in this approach would allow for opportunities to apply the JANIS reserve design principles.
- The CAR reserves in this approach would result in a protection level for areas of indicative national estate significance of more than 90% for refugia and centres of disjunct flora or relictual flora, and up to 90% or more for contemporary fauna refuges; more than 80% for centres of flora endemism, flora species richness and natural landscapes; more than 70% for vegetation community diversity and, more than 60% for aggregations of old-growth forest and wetlands of national significance.

Social and economic objectives

- The area available for timber production would be some 1,123,100 to 1,123,200 hectares which represents a reduction of between 30,300 to 30,200 hectares (about a 2% reduction in comparison to the current situation).
- The level of harvest of first and second grade jarrah and karri sawlogs from State forests would be between 466,100 to 478,000, and 197,300 to 207,700 cubic metres per year, respectively. This represents a reduction of between 18,200 and 40,600 cubic metres per year (about a 3% to 8% reduction in comparison to the current situation).
- The level of chiplog and charlog harvest would be between 677,000 to 712,000 cubic metres per year. This represents a reduction of between 22,000 and 57,000 cubic metres per year (about a 3% to 6% reduction in comparison to the current situation).
- The gross value of wood products at the mill gate would be $224,800,000 to $233,200,000 pa, about a 3% to 6% reduction in comparison to the benchmark.

- This approach could limit opportunities for development in the native forest timber industry due to a reduction in timber resources.
- The estimated reduction in employment (see Appendix 8, Table 8.6 and Box 4.2) which could occur under this approach has the potential to impact on a number of communities across the region with significant dependencies on the native forest timber industry and may contribute to a reduction in quality of life, access to social and physical infrastructure and community viability.
- Access to the forest estate for community activities, including Indigenous cultural activities, would in general be maintained for most activities.
- This approach may reduce the area accessible for the purposes of apiary, wildflower picking, fuelwood and seed collecting.
- The proposed under this approach includes between 55,800 to 58,800 hectares in State Agreement Act areas, between 66,600 to 76,700 hectares in mining tenements and leases (these may overlap Agreement Act leases), between 3,500 to 3,600 hectares in areas of identified mineral resources and between 204,400 to 217, 100 hectares in areas of high and medium mineral potential. New reserves established under this approach would be in accordance with the arrangements outlined in Section 4.3.3.

4.4.4 Approach C

Approach C aims to enhance social and economic values by increasing sustained timber yield whilst also seeking to enhance protection of environment and heritage values. A variation of this approach is reported at the end of this section which provides a further enhancement of the resource outcomes.

Under this approach between 43,500 and 57,400 hectares of new reserves would be added to the reserve system. The main additions to the reserve system would be concentrated in the Jarrah Leeuwin, Jarrah North East, Jarrah South, Western Wandoo forest and Western Wandoo woodland forest ecosystems.

This approach would involve some 35,500 to 50,400 hectares of areas proposed for reservation in the Forest Management Plan remaining as State forest. These areas would be concentrated in the Jarrah North East, Jarrah North West, Western Wandoo forest, Western Wandoo woodland, Jarrah Blackwood, Jarrah South, Jarrah Unicup and Jarrah Sandy Basins ecosystems.

Outcomes against Regional Forest Agreement objectives

Approach C addresses the social and economic and environment and heritage objectives for the Regional Forest Agreement in the ways described below and provides a comparison against the benchmark. The outcomes are shown in terms of only those informal reserves which have received up-front accreditation by governments contributing towards meeting the JANIS targets. For more detailed information refer to the tables presented in Appendix .

Environment and heritage objectives

- The protection of forest biodiversity would be enhanced through the reservation of between 43,500 and 57,400 hectares of new CAR reserves (with between 35,500 and 50,400 hectares of proposed reserves remaining as State forest, resulting in a net increase against the benchmark of between 7,000 and 8,000 hectares), contributing to a total area of CAR reserves of between 905,700 to 911,200 hectares.
- The JANIS biodiversity reservation target of 15% of the pre-1750 distribution would be met or exceeded for 16 of the 22 forest ecosystems which are not vulnerable, rare or endangered. In the remaining four ecosystems opportunities for additional CAR reservation on public land are extremely limited as the areas outside reserves are largely confined to private lands.
- The JANIS reservation target of 100% would not be achieved for the four forest ecosystems which are rare or endangered (Bullich and Yate, Jarrah Rates Tingle, Jarrah Red Tingle and Karri Rates Tingle). Opportunities for increased reservation of three of the rare or endangered forest ecosystems (Bullich and Yate, Jarrah Rates Tingle, Jarrah Red Tingle and Karri Rates Tingle) on public lands are extremely limited as the areas remaining outside reserves are relatively small largely confined to private lands.
- The level of protection for other forest biodiversity would be further enhanced by increased CAR reservation of areas important for disjunct flora (between 41% and 42%), relictual flora (between 54% and 55%), flora species richness (between 52% and 53%), or as centres of flora endemism (between 46% and 47%).
- The JANIS reservation level of 60% of the extant distribution for old-growth would be met or exceeded for four of the ten forest ecosystems in which old-growth is not rare or depleted (Jarrah Unicup, Jarrah Woodland, Karri Red Tingle and Jarrah Mount Lindesay).
- The JANIS target for old-growth forest in five of the ten forest ecosystems in which old-growth is rare or depleted would be met as far as is practical and feasible in this approach without more detailed reserve design. For old-growth in the Jarrah North East, Western Wandoo forest and Western Wandoo woodland forest ecosystems, the 100% level of protection in CAR reserves is not feasible.
- The smaller area of new reserves in this approach may allow for fewer opportunities to apply the JANIS reserve design principles.
- The CAR reserves in this approach would result in a protection level for areas of indicative national estate significance of up to more than 90% for contemporary fauna refuges and refugia; more than 80% for centres of disjunct flora or relictual flora; up to more than 80% for centres of endemism; more than 70% for flora species richness, vegetation community diversity and natural landscapes; more than 60% for wetlands of national significance; and up to more than 60% for aggregations of old-growth forest.

Social and economic objectives

- The area available for timber production would be some 1,170,000 to 1,175,800 hectares which represents an increase of between 16,600 to 22,500 hectares (about a 2% increase in comparison to the current situation).

- The level of harvest of first and second grade jarrah and karri sawlogs from State forests would be 496,300 and 211,100 to 211,200 cubic metres per year, respectively representing an increase of between 3,400 to 3,500 cubic metres per year (up to a 2% increase in comparison to the current situation).
- The level of chiplog and charlog harvest would be 725,800 to 725,900 cubic metres per year representing a reduction of between 8,100 to 8,200 cubic metres per year (similar to the current situation).
- The gross value of wood products at the mill gate would be $240,000,000 representing an increase of up to $400,000 per year.
- This approach has the potential to provide for continuing development opportunities for the timber industry through an increase in sustained timber yield.
- The increase in sustained yield resulting from this approach is estimated to increase employment opportunities (see Appendix 9, Table 9.6 and Box 4.2). This would contribute to the quality of life and viability of local communities. This approach may enhance the quality of life and viability of local communities by increasing employment opportunities associated with projected industry developments. This would have a positive effect on the continued availability of community services and social and physical infrastructure in regional areas.
- Access to the forest estate for community activities, including Indigenous cultural activities, would in general be maintained for most activities.
- Current access to forest areas for the purposes of apiary, wildflower picking, fuelwood and seed collecting would be maintained.
- The CAR reserve system under this approach includes between 41,800 to 42,300 hectares in State Agreement Act areas, between 147,400 to 52,900 hectares in mining tenements and leases (these may overlap Agreement Act leases), 3,500 hectares in areas of identified mineral resources and between 181,500 to 184,000 hectares in areas of high and medium mineral potential. New reserves established under this approach would be in accordance with the arrangements outlined in Section 4.3.3.

Alternative approach C

The accreditation of fourth order stream reserves towards the JANIS targets is based on an increase in width from 150 metres to 200 metres and the inclusion of other additional areas deemed to be informal reserves (see Section 4.3.2), has a consequent loss of area available for timber harvesting. An alternative means of increasing timber yield under this approach would be not to proceed with these extensions to informal reserves. This would result in an increase over the existing approach C outcomes o approximately f:

- 3,300 hectares being retained for timber harvesting;
- 4,100 cubic metres per annum in the level of harvest of first and second grade jarrah and karri sawlogs;
- 8,700 cubic metres per annum in chiplog and charlog harvest; and
- $1.7 million in the gross value of wood products at the mill gate.

Employment impacts are shown at (see Appendix 9, Table 9.6 and Box 4.2). As this would result in the fourth order stream reserves no longer being accredited towards the JANIS targets in this paper, there would, however, be a consequent reduction in the level of reservation achieved for the range of forest ecosystems, old-growth and other environment and heritage values.

4.4.5 Comparison

A comparison of the major features of the approaches presented and the benchmark is presented in Box 4.4.

4.5 ECOLOGICALLY SUSTAINABLE FOREST MANAGEMENT

The need for ecologically sustainable forest management is recognised in the NFPS. It is specifically emphasised in the national goals relating to conservation, wood production and industry development, private native forests, tourism and other economic and social opportunities and public awareness, education and involvement.

The Commonwealth and Western Australian governments agreed to assess jointly the performance of the Western Australia's forest management systems and processes in achieving the objectives of ecologically sustainable forest management. An independent panel of experts was convened to carry out this task and its recommendations are at Appendix 10. Further details may be obtained from the report *Assessment of Ecologically Sustainable Forest Management in the South-West Forest Region of Western Australia report* (Independent Expert Advisory Group 1997).

The recommendations of this group will be assessed by the Commonwealth and Western Australian governments in the development of the RFA. Both governments recognise the importance of ecologically sustainable forest management

4.6 INDUSTRY DEVELOPMENT

In accordance with the objectives of the NFPS, a desired outcome for the RFA is the development of efficient, sustainable and internationally competitive forest-based industries.

4.6.1 Timber

An objective of the RFA is to promote timber industry development options based on a sustainable native and plantation timber resource. Western Australia's timber industry has undergone major structural adjustment over the past decade to enhance its competitiveness through improvements in silvicultural and harvesting practices, conversion technologies and the establishment of hardwood and softwood plantations.

A key factor influencing the future development of the native forest timber industry will be improved certainty in the continuity of log supply from a sustainably managed

Box 4.4 Summary of benchmark and approaches

		Benchmark	Approach A	Approach B	Approach C*
Reserved land area	New	319,700	165,000 to 187,500	122,500 to 127,700	43,500 to 57,400
	Total (hectares)	896,700	1,000,200 to 1,007,800	943,600 to 968,100	905,700 to 911,200
Ecosystems meeting or exceeding biodiversity targets	(number of ecosystems)	15	21	16	16
Ecosystems less than biodiversity targets	(number of ecosystems)	11	5	10	10
Old growth ecosystems meeting or exceeding target	(number of ecosystems)	8	15	10	9
Old growth ecosystems less than target	(number of ecosystems)	11	4	9	10
Reservation of flora values	Disjuncture	39	39-58	46-46	41-42
	Relictual	54	54-62	60-61	54-55
	Richness	47	47-62	59-61	52-53
	Endemism (%)	42	42-60	49-51	46-47
Reservation of National Estate indicative areas	Refugia	88	92-93	90-92	89-91
	Disjunct flora	82	94-96	92-93	83-85
	Relictual flora	85	94-95	91-93	85-87
	Flora endemism	72	87-93	82-83	78-81
	Fauna refuges	92	89-89	89-92	89-92
	Wetlands	65	66-66	65-66	65-66
	Old-growth	61	70-73	67-68	59-62
	Veg diversity	57	76-82	74-75	75-75
	Flora richness	69	88-88	81-83	76-77
	Natural landscapes (%)	77	84-84	82-82	78-79
Variation in Sustained yield	Jarrah	-1,300	-36,600 to -32,300	-23,900 to -12,000	6,300 to 6,300
	Karri (%)	-2,900	-20,500 to -17,200	-16,700 to -6,300	-2,900 to -2,800
Mineral Potential score > 90	(hectares)	148,700	211,800 to 219,000	181,200 to 181,500	167,700 to 168,100
Identified mineral resources	(hectares)	4,000	3,500 to 3,600	3,500 to 3,600	3,500 to 3,500
State Agreement Acts	(hectares)	51,200	66,900 to 73,100	55,800 to 58,800	41,800 to 42,300
Mining Act Tenements		47,300	73,500 to 83,500	66,600 to 76,700	47,400 to 52,900

* NOTE: An alternative approach to achieving the aims of approach C results in increases in timber yields, wood value and employment (see above - 'alternative approach C').

Employment impacts are outlined in Appendices 6 (Table 6.6), 7 (Table 7.6), 8 (Table 8.6) and 9 (Table 9.6) and in Box 4.2..

resource. These factors and opportunities are outlined in the BIS Shrapnel Forestry Group (1997) report.

BIS Shrapnel Forestry Group identified a range of possible industry expansion and investment opportunities. A summary of potential industry developments to 2020, prepared by the BIS Shrapnel Forestry Group is at Appendix 3. The commencement and viability of projects will be influenced by such factors as the security of supply of native forest timber into the future through the RFA process, government and community commitment to the commercial development of the native forest timber industry, international competitiveness, research and development of growing, product development and marketing and commercial considerations such as potential returns to shareholders.

Currently, the native forest timber industry is experiencing a major change towards value adding away from structural timber. Approximately 45% of sawn timber has undergone value adding in some form, the majority of this being jarrah. In some jarrah sawmills more than 80% of the sawn output is directed into value added products. The woodchip industry is currently based largely on native forest timber logs, although rapid expansion of plantation hardwood chip exports is forecast. Reconstituted panels are at present based almost exclusively on softwood mill and forest residues, but provide an opportunity for utilisation of some native forest timber as low cost supplementary fibre.

BIS Shrapnel identified potential for the industry to develop a veneer-based sector by 2010, generating $133 million per annum and 360 jobs (see Appendix 3). Eighty five percent of sawn timber could be further processed, increasing turnover by about $25 million per annum. Output of appearance grade timber may also provide the opportunity for considerable downstream processing. There is potential to utilise jarrah residues to produce activated carbon, generating $60 million per annum in turnover and the manufacture of high grade charcoal. Reconstituted panels are at present based almost exclusively on softwood chiplog and sawmill residue but there is the possibility of utilising both native forest timber and plantation hardwood as supplementary fibre in the manufacture of these panels with the potential, after 2005, to expand both medium density fibreboard (MDF) and particleboard operations.

By 2020, turnover from the native sawn timber industry could increase by $82 million to $228 million per annum through value adding and forecast real price increases. Direct employment in the native forest timber sawmilling sector is likely to decline somewhat but this could be more than compensated for by increased employment levels in further downstream processing which has the potential to add over $200 million to the Western Australian economy. There is expected to be increasing employment in the plantation sector, including the milling of softwood sawlogs. There should be sufficient resource to establish both a pulp and paper making facility which could contribute almost $800 million to the Western Australian economy and directly employ almost 300 people and expand the manufacturing of high grade charcoal. If current planting levels are maintained, there would be sufficient resource for a Bleached Kraft Pulp (BKP) mill to be built before 2010.

Western Australia, which has undergone significant structural adjustment in the timber industry over the past decade, is well placed to capitalise on this shift in emphasis from primarily a native forest-based industry with moderate value adding to an industry reliant on both native forests with high levels of value adding and hardwood and softwood plantations.

4.6.2 Mining

The mining industry is the largest economic sector in the region and there remains considerable room for expansion of mineral and related operations. One of the aims of the RFA process is to 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 and high mineral potential.

Under prevailing Western Australian Government policies, all areas of the state are open for exploration and consideration for mining. However, exploration companies consider the existence of conservation reserves a disincentive to exploration unless the prospectivity, based on remote sensing techniques, is perceived as particularly high.

The RFA area contains significant mineral resources and potential for locating new mineralisation, both under existing leases and tenements and in areas which are open for future exploration. Mineral and petroleum resources are targeted by industry based on perceived economic opportunities which in turn are influenced by world prices and markets for commodities. Australia has a technologically advanced and mature industrial base for locating and extracting mineral and petroleum resources and generating down-stream value adding processing. Hydrocarbon (natural gas) resources have been identified in the region and research is currently proceeding to determine if they can be extracted.

The mineral and petroleum sector underpins the state economy. As indicated in the CRA report, the mining sector in the RFA region alone generated considerable revenue and employment in both the state and national economies. The industry has been growing strongly for some years and on-going development is likely, given continuing high levels of investment in exploration, mining and mineral processing. In balancing these industry development prospects with the establishment of a CAR reserve system, certainty of access will need to be considered in the development of the RFA to dispel any concerns of sovereign risk.

4.6.3 Tourism

In Western Australia, the tourism industry is a major contributor to the state's economy and is predicted to become the state's fastest growing industry sector during the 1990s and into the next century (Western Australian Tourism Commission 1997). The RFA will provide certainty for predicted tourism investment to take advantage of the region's comparative advantages as both a general tourism location and with respect to nature-based tourism opportunities.

The RFA will provide the context in which future planning for tourism and recreation activities can be developed. A wide range of factors need to be considered when developing planning strategies for tourism development in forested areas, among them the need to ensure tourism development is both sustainable and compatible with other forest uses. While some recreation and tourism activities require broad areas of forest, it is worth noting that most high-use tourism facilities in forests involve site-based or corridor-based activities. Additionally, tourism can and does operate across tenures and through different forest types and age-structures.

The overall number of visitors to the RFA area is estimated to increase from 1.2 million in 1996 to between 1.8 and 1.9 million in 2018 (tourist bureaux figures indicate that this could be as high as 3 million by the year 2018). To support this growth considerable infrastructure development is required in providing facilities such as roads and accommodation and in developing a range of forest-based tourism attractions such as walking tracks, camping areas, picnic sites and information centres which provide an interpretive framework about forest industry activities to tourists and visitors to the area. The scope for the development of tourism attractions such as vineyards, restaurants and adventure experiences within the region is considerable.

Tourism in the region has been growing with an estimated annual growth rate of around 10% over the period 1994-96. With a growth rate of 20% per annum predicted for ecotourism in Western Australia generally, there would seem to be potential for a further increase in forest-based tourism activity in the region.

4.6.4 Other forest products

Future access for beekeeping in conservation reserves will depend in part on the results of on-going research into the impact of the European honeybee on native flora and fauna.

Wildflowers harvested from crown land add value to the industry in the form of product diversity, more so than contributing to the quantity of production. Restricting access to native forests could impact on the industry as it may preclude harvesting of a number of species.

4.7 COMMONWEALTH AND STATE LEGISLATIVE REQUIREMENTS

One of the objectives of the RFA process is to meet Commonwealth and State statutory and policy requirements through the development of the RFA. The satisfactory completion of these requirements is intended to provide for greater certainty of government decision-making in relation to forests during the period the RFA is in place.

Commonwealth statutory requirements exist in relation to environmental protection, the protection of world heritage and national estate values and the protection of endangered species. The Commonwealth also has obligations relating to the protection of native title rights and interests. The relevant Acts are listed in Section 1.2.3.

The range of Western Australian legislation relating to land management in the South-West Forest Region is also listed in Section 1.2.3.

It has been recognised by both governments that the terms of the RFA for Western Australia are to be consistent with the NFPS and other relevant agreements and policies including the National Strategy for Ecologically Sustainable Development and the Intergovernmental Agreement on the Environment.

4.7.1 Resource management

Security of tenure arrangements exist in mining leases covered by State Agreement Acts, and no new reserve proposals may be developed without the endorsement of those companies that have negotiated such agreements. The provisions of these Acts are of particular note in the development of the RFA for Western Australia.

Other forest-based resources within the region will be considered in addressing ecologically sustainable management in the RFA.

4.7.2 Environmental impacts

The Commonwealth Government's proposal to enter into an RFA with Western Australia will be referred to the Commonwealth Minister for the Environment in accordance with the administrative procedures of the Commonwealth *Environment Protection (Impact of Proposals) Act 1974*. These procedures require the Minister to determine whether preparation and public review of an environmental impact statement or a public environment report are required to satisfy the objectives of the Act. The Minister is required to provide this advice before the RFA is finalised. The public consultation process for the RFA has been designed to be consistent with the requirements of this Act.

Changes to the Forest Management Plan 1994 - 2003 (CALM 1994) made as a result of the RFA may require consideration as a proposal under the Western Australian *Environmental Protection Act 1986.*

4.7.3 The National Estate

In accordance with Section 30 of the Commonwealth *Australian Heritage Commission Act 1975*, the Commonwealth Government's proposal to enter into an RFA with Western Australia will be referred to the Australian Heritage Commission for comment. The Australian Heritage Commission has statutory responsibility for providing advice on proposed actions that might adversely affect National Estate places. In the context of the RFA, the Commission could make provision for delegating preparation of Section 30 advice for National Estate listed places under the Commonwealth *Australian Heritage Commission Act 1975* to an appropriate Western Australian body. The joint assessment of National Estate values in the South-West Forest Region is detailed in the forthcoming National Estate Report.

In relation to its statutory responsibilities for listing places on the Register of the National Estate, the Australian Heritage Commission will take into account the overall assessment of values and the levels of protection for these values embodied in the RFA. It is expected that the RFA will contain a jointly agreed process for delineating places for listing in the Register of the National Estate.

4.7.4 World Heritage

Australia has international obligations under the World Heritage Convention which include the identification, protection and presentation of places of outstanding

universal natural or cultural heritage value. The Commonwealth *World Heritage Properties Conservation Act 1983* provides the legal means by which the Commonwealth is able to protect and conserve the World Heritage places covered by the Act. While the values governments seek to protect for World Heritage are different to those they are seeking to protect under National Estate legislation and the criteria for a CAR reserve system, there will of necessity be some values that are common to all three.

The Commonwealth and the States have developed a methodology for assessing World Heritage in areas covered by an RFA. The methodology is structured in a series of five steps and is based on a thematic approach to assessing areas in terms of the extent to which they have 'outstanding universal value'. An expert panel carried out the first two steps in this methodology and has provided the Steering Committee with advice on themes of outstanding universal value relevant to Western Australia's forests and which require further investigation.

It is important to note that the places identified by the panel cannot be regarded as 'identified properties' under the *World Heritage Properties Conservation Act 1983*. Only places that are identified once all the steps in the methodology have been completed would be considered for World Heritage nomination. Nomination of places for World Heritage listing would be with the agreement of both governments and take into account social and economic considerations.

As part of the RFA, governments will be considering the next steps required in the process to identify places of potential World Heritage significance in the region.

4.7.5 Endangered species

The Commonwealth *Endangered Species Protection Act 1992* has schedules of nationally endangered, vulnerable and presumed extinct native species of flora and fauna, endangered ecological communities and key threatening processes. The Act requires that any effect on scheduled species and communities be taken into account in all Commonwealth actions and decisions. The Act is linked to the Commonwealth *Environment Protection (Impact of Proposals) Act 1974*, such that any action that could threaten with extinction or significantly impede the recovery of a listed species or community may be considered a matter of environmental significance in terms of the latter Act and may require environmental assessment.

The Commonwealth *Endangered Species Protection Act 1992* also requires that recovery plans be prepared for nationally listed species and that threat-abatement plans be prepared for key threatening processes. Many of these species are also listed under state legislation.

The objective of the Western Australian *Wildlife Conservation Act 1950* is the protection of indigenous flora and fauna. The Act allows the Minister for the Environment to declare flora or fauna as protected, including those likely to become extinct, rare, or otherwise in need of special protection. Such species cannot be taken (removed, interfered with, injured or destroyed) without the written consent of the Minister. Management plans are prepared for declared species. A large number of plans have been prepared for flora species and the writing of plans for fauna is in

progress. Endangered species issues will be considered in the development of the RFA (see Sections 3.7.2 and 3.7.3).

4.7.6 Native title

Under the Commonwealth *Native Title Act 1993* the Commonwealth has obligations relating to the protection of native title rights and interests. It is not intended that the RFA will in any way influence any native title claims that may arise. If any government action to implement the Agreement could affect native title, that action will be taken in accordance with the Native Title Act.

4.8 MONITORING, REPORTING AND ACCREDITATION

For the RFA for the South-West Forest Region to satisfy the requirements of clauses 4(c), 4(h) and 22 of the Scoping Agreement, it must include, or provide for, the:

- identification of appropriate performance indicators to measure the RFA outcomes;
- development of monitoring arrangements;
- reporting on those indicators and the performance of the RFA every five years;
- identification of a mechanism for updating the Agreement in the light of significant new information or exceptional circumstances; and
- identification of exceptional circumstances which could influence the RFA outcomes significantly or which would require a reassessment and amendment of the RFA before its due expiry date.

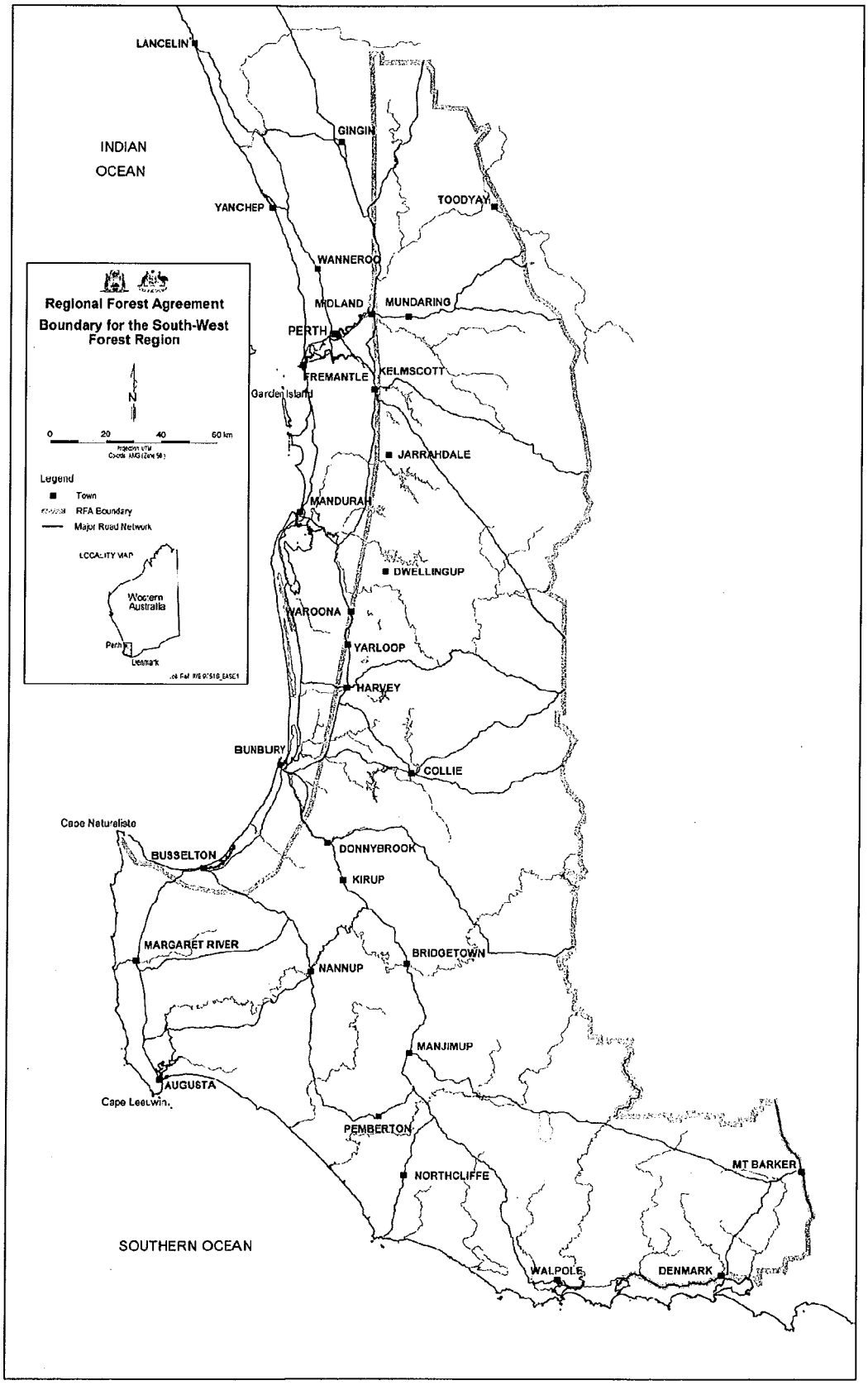
These requirements will be met through action agreed by both governments in the RFA, taking into account the recommendations of the Expert Advisory Group on ecologically sustainable forest management.

4.9 WOODCHIP EXPORT LICENCES

The Commonwealth 1996 Export Control (Wood Chips) Regulations provide that from 1 January 2000, woodchip exports will be permitted only from areas covered by a RFA.

Under amendments to the relevant regulations under the Commonwealth *Export Control Act 1982* no controls under that Act apply to the export of woodchips or unprocessed wood sourced from native forests in a region for which an RFA is in force.

Map 1


LANCELIN
INDIAN
OCEAN
GINGIN
YANCHEP
TOODYAY
WANNEROO
MIDLAND
MUNDARING
PERTH
FREMANTLE
KELMSCOTT
Garden Island
JARRAHDALE
MANDURAH
DWELLINGUP
WAROONA
YARLOOP
HARVEY
BUNBURY
COLLIE
Cape Naturaliste
BUSSELTON
DONNYBROOK
KIRUP
MARGARET RIVER
NANNUP
BRIDGETOWN
MANJIMUP
AUGUSTA
Cape Leeuwin
PEMBERTON
NORTHCLIFFE
MT BARKER
WALPOLE
DENMARK
SOUTHERN OCEAN
Regional Forest Agreement
Boundary for the South-West
Forest Region
N
0 20 40 60 km
Legend
Town
RFA Boundary
Major Road Network
LOCALITY MAP
Western
Australia
Perth
Denmark

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.

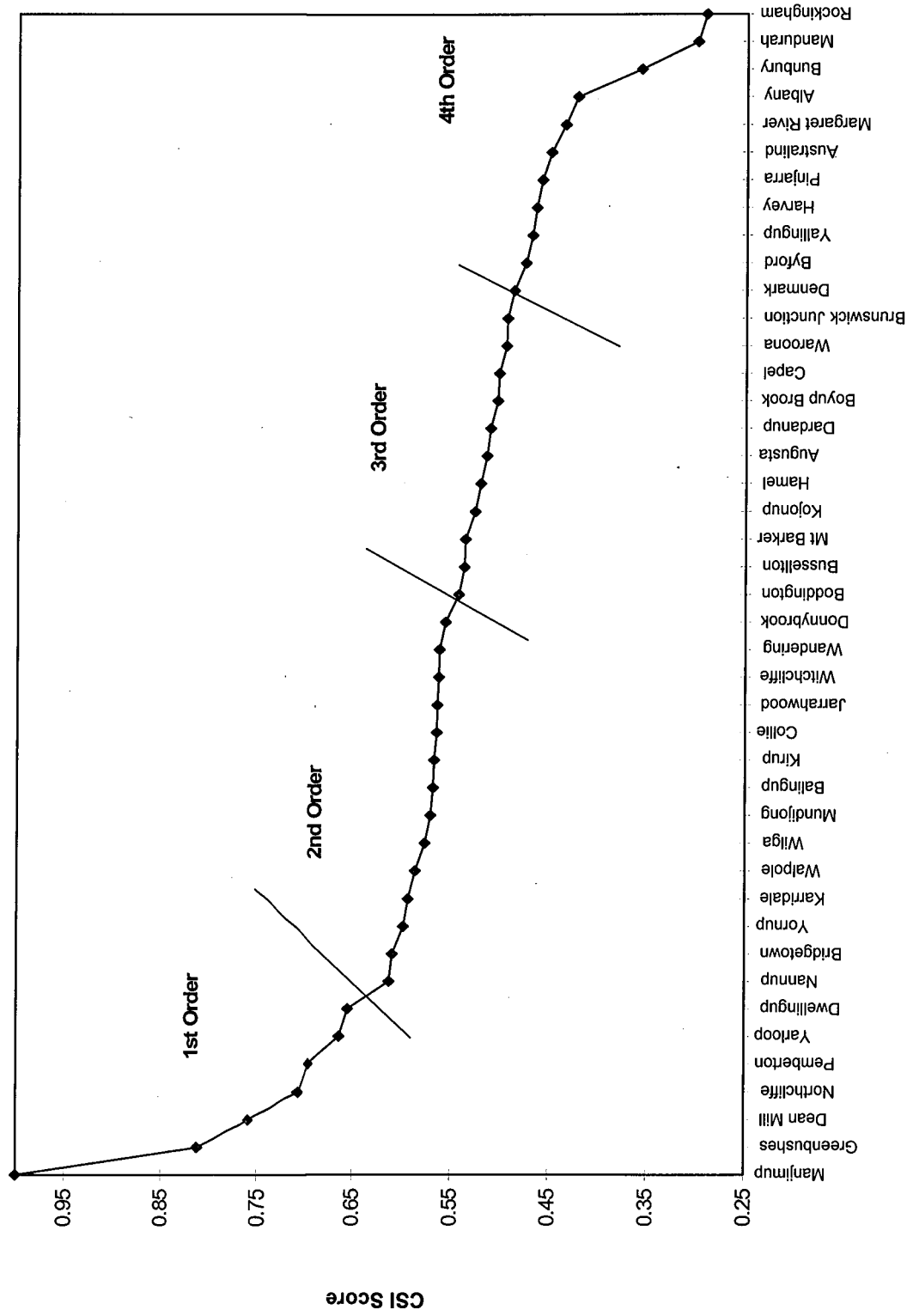
Appendix 3

BIS Shrapnel Summary of Potential Industry Development

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

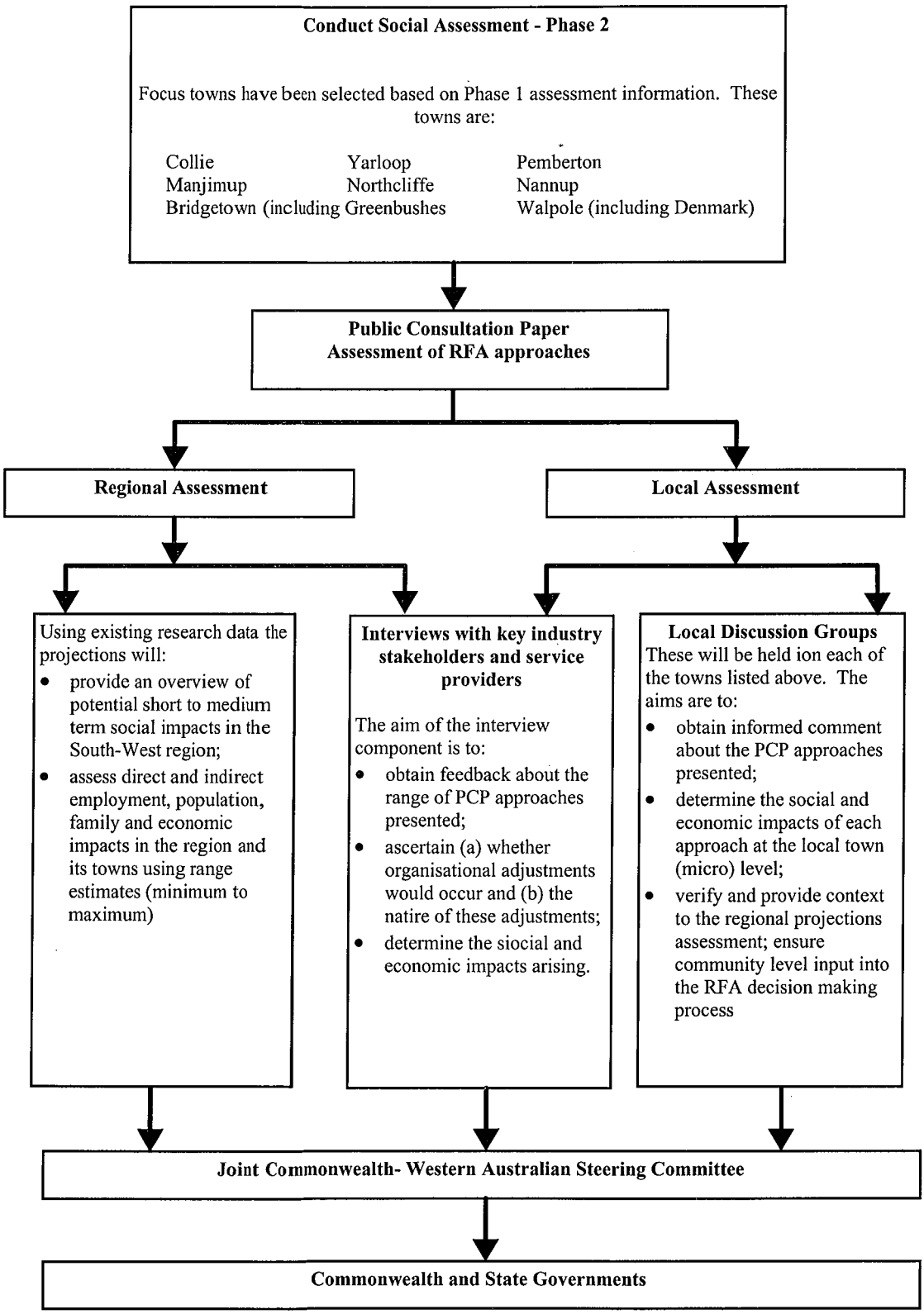
Appendix 4

Community Sensitivity Index



Appendix 5

Overview of Phase 2 of the Social Assessment Process



Appendix 6

BENCHMARK - TABLES

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.

Table 6.1
Biodiversity Values Reservation Analysis

Forest ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	Area Reserved: % of pre 1750 area reserved[1] Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	Total (including only accredited informal reserves) ha	% [2]	Deficit/ Excess[3] ha
* Bullich and Yate	2,800	2,440	53.5%	24.3%	0.0%	0.0%	2,176	89.2%	-264
Darling Scarp++	29,000	9,938	4.3%	0.0%	0.6%	1.3%	1,433	4.9%	-2,917
Jarrah Blackwood++	347,200	281,805	1.9%	6.5%	2.5%	7.8%	37,806	10.9%	-14,274
Jarrah Leeuwin++	56,400	19,552	4.5%	0.1%	0.9%	1.4%	3,036	5.4%	-5,424
Jarrah Mt Lindesay++	126,600	44,597	1.5%	6.9%	0.3%	0.5%	11,102	8.8%	-7,888
Jarrah North East++	717,100	350,239	4.4%	8.0%	1.0%	2.2%	95,646	13.3%	-11,919
Jarrah North West++	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++	107,900	71,092	8.3%	12.9%	1.4%	3.6%	24,400	22.6%	8,215
Jarrah South++	557,300	438,912	8.0%	13.9%	2.6%	6.7%	136,602	24.5%	53,007
Jarrah Unicup++	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++	11,600	9,669	14.1%	0.7%	10.1%	13.9%	2,890	24.9%	1,150
Karri Main Belt++	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++	14,500	6,274	26.9%	2.4%	0.1%	0.5%	4,254	29.3%	2,079
Karri Yellow Tingle++	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++	363,200	146,597	6.9%	7.1%	0.6%	1.8%	53,122	14.6%	-1,358
West'n Wandoo woodland++	163,000	72,078	8.2%	7.1%	0.7%	2.0%	26,023	16.0%	1,573
TOTAL	4,135,524	2,633,506					896,618		272,337

* 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.

Benchmark

Area Reserved[1]			Area Outside Reserves		
Total (including all informal reserves)			Public Land		
ha	%[2]	Deficit/ Excess[3] ha	Outside accredited reserves[4] ha	If all informal reserves were included[5] ha	Freehold land[6] 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

	Old-growth by forest ecosystem	Present area on all lands ha	Area Reserved[1]						
			% of present area on all lands reserved				Total (including only accredited informal reserves)		
			Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	ha	%[2]	Deficit / Excess[3] ha
	Jarrah Blackwood++	48,496	9.7%	13.4%	4.4%	9.6%	13,324	27.5%	-15,773
*	Jarrah Leeuwin++	477	75.0%	0.0%	0.0%	1.3%	358	75.0%	-119
	Jarrah Mt Lindesay++	14,005	4.7%	42.2%	1.8%	2.7%	6,827	48.8%	-1,575
*	Jarrah North East++	11,595	16.9%	20.1%	4.4%	8.3%	4,794	41.3%	-6,801
*	Jarrah North West++	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++	2,171	96.7%	2.2%	0.0%	0.0%	2,149	99.0%	-23
	Jarrah South++	160,667	23.3%	25.9%	3.6%	7.1%	84,719	52.7%	-11,681
	Jarrah Unicup++	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++	7,249	21.2%	0.9%	14.1%	18.6%	2,626	36.2%	-1,724
	Karri Main Belt++	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++	492	90.2%	9.6%	0.0%	0.0%	491	99.8%	-1
	Karri Yellow Tingle++	6,969	27.7%	0.6%	11.7%	20.0%	2,788	40.0%	-1,394
*	West'n Wandoo forest++	7,865	19.5%	53.8%	3.6%	6.5%	6,053	77.0%	-1,812
*	West'n Wandoo woodland++	3,013	26.6%	22.1%	6.8%	11.6%	1,673	55.5%	-1,340
	TOTAL	347,663					183,696		-39,079

* 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

Benchmark

Area Reserved[1]			Area Outside CAR Reserve		
Total (including all informal reserves)			Public Land		
ha	%[2]	Deficit / Excess[3] ha	Outside accredited reserves[4] ha	If all informal reserves were included[5] ha	Freehold land[6] 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[1]	Present area on all lands ha	Area reserved[2] % of present area on all lands reserved[3] Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	Total (including only accredited informal reserves) ha	%[3]	Total (including all informal reserves) ha	%[3]	Area Outside Reserves Public Land Outside accredited reserves[4] ha	If all informal reserves were accredited[5] ha
Criterion A.1											
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
Criterion A.2											
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
Criterion A.3											
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
Criterion B.1											
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 om 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[1]				Total (accounting for accredited informal reserves only)		Total (including all informal reserves)		Area Outside CAR Reserve		
										Public Land		
		Formal (gazetted) %	Formal (proposed) %	Informal (accredited) %	Informal (all) %	ha	%[2]	ha	%[2]	Outside accredited reserves[3] ha	If all informal reserves were included[4] ha	Freehold land[5] ha
Flora Disjunctiveness 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
Flora Endemism 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
Relictual Flora 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
Flora Species Richness 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^3/yr	Jarrah Sawlog Grade 1+2[4] m^3/yr	Chiplog and charlog m^3/yr	
Swan					
Current available[1]	312,247	0	202,000	27,997	$56,508,766
Less Stream order 4 extension[2]	-636	0	-397	-55	-$111,068
Benchmark[3]	311,611	0	201,603	27,942	$56,397,698
Central Forest					
Current available[1]	500,771	0	226,000	68,998	$65,795,830
Less Stream order 4 extension[2]	-1,007	0	-430	-131	-$125,074
Benchmark[3]	499,764	0	225,570	68,867	$65,670,756
Southern Forest					
Current available[1]	337,014	214,000	62,000	637,000	$117,282,740
Less Stream order 4 extension[2]	-1,688	-2,859	-446	-8,510	-$1,463,567
Benchmark[3]	335,326	211,141	61,554	628,490	$115,819,173
TOTAL					
Current available[1]	1,150,032	214,000	490,000	733,995	$239,587,336
Less Stream order 4 extension[2]	-3,331	-2,859	-1,273	-8,696	-$1,699,708
Benchmark[3]	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 annum.

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

	Private Sector	
	Indicative Direct Employment[1]	**Indicative Indirect Employment[2]**
Current situation[3]	2,440	2,928
Less Stream order 4 extension[4]	-17	-20
Benchmark[5]	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[2]	Total area on CALM managed land ha	Existing Reserved Areas[1&3]				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**

Areas covered by:	Proposed reserves[1] ha
Agreement Act Leases	51,154
Mining Act tenements [1]	
Pending	16,338
Granted	30,976

1 Proposed reserves as per the 1994-2003 Forest Management Plan

Mineral Potential[2]	Proposed reserves[1] ha
High areas with a WMP score greater than 90 having moderate to high potential for major deposits eg gold, bauxite.	148,727
Medium areas with a WMP score of 72-90 having moderate to high potential for significant deposits eg Greenbushes rare metal deposits.	14,786
Low 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

1 Proposed reserves as per the 1994-2003 Forest Management Plan
2 Weighted mineral potential (WMP) is an estimate of mineral potential which makes some allowance for relative economic significance.

	Proposed reserves[1] ha
Identified mineral resources[2]	3,991

1 Proposed reserves as per the 1994-2003 Forest Management Plan
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 7

APPROACH A-TABLES

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

Table 7.1
Biodiversity Values Reservation Analysis

Forest Ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	CAR Reserve System under this Approach[1]					
			Possible New Reserves ha		Total area reserved under this approach [2] ha		Level of reservation under this approach[2&3] %	
* Bullich and Yate	2,800	2,440	0	to 1	2,176	to 2,177	89.2%	to 89.2%
Darling Scarp++	29,000	9,938	1,271	to 1,880	2,694	to 3,168	9.3%	to 10.9%
Jarrah Blackwood++	347,200	281,805	24,642	to 27,383	52,769	to 56,947	15.2%	to 16.4%
Jarrah Leeuwin++	56,400	19,552	5,680	to 6,178	8,463	to 8,743	15.0%	to 15.5%
Jarrah Mt Lindesay++	126,600	44,597	8,016	to 8,043	18,867	to 18,895	14.9%	to 14.9%
Jarrah North East++	717,100	350,239	25,620	to 26,031	107,668	to 107,774	15.0%	to 15.0%
Jarrah North West++	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++	107,900	71,091	545	to 1,121	24,904	to 25,424	23.1%	to 23.6%
Jarrah South++	557,300	438,912	15,658	to 21,176	151,718	to 153,161	27.2%	to 27.5%
Jarrah Unicup++	81,000	29,459	0	to 105	14,501	to 14,570	17.9%	to 18.0%
Jarrah Woodland	106,374	67,220	5,044	to 6,903	39,101	to 39,601	36.8%	to 37.2%
Jarrah Yellow Tingle++	11,600	9,669	2,636	to 2,841	5,011	to 5,016	43.2%	to 43.2%
Karri Main Belt++	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++	14,500	6,274	132	to 222	4,384	to 4,472	30.2%	to 30.8%
Karri Yellow Tingle++	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/sedgelands	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++	363,200	146,597	7,678	to 7,762	55,100	to 55,367	15.2%	to 15.2%
West'n Wandoo woodland++	163,000	72,077	7,880	to 8,112	33,091	to 33,113	20.3%	to 20.3%
TOTAL[8]	4,135,524	2,633,503	164,975	to 187,475	1,000,175	to 1,007,820	24.2%	to 24.4%

* 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 see Section 4.3.2.

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.

Approach A

		Area Outside CAR Reserve[1]					
Deficit / Excess ha[2&4]		Non-accredited informal reserves[5] ha		Other Public Land[6] ha		Freehold land[7]	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

Old-growth by forest ecosystem	Present area on all lands ha	CAR Reserve System under this Approach[1]					
		Possible New Reserves ha		Total area reserved under this approach [2] ha		Level of reservation under this approach[2&3] %	
Jarrah Blackwood++	48,496	16,416 to	16,816	29,027 to	29,092	59.9% to	60.0%
* Jarrah Leeuwin++	477	64 to	103	422 to	460	88.4% to	96.6%
Jarrah Mt Lindesay++	14,005	4,035 to	4,454	10,678 to	11,066	76.3% to	79.0%
* Jarrah North East++	11,594	5,288 to	5,716	9,665 to	9,897	83.4% to	85.4%
* Jarrah North West++	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++	2,171	0 to	6	2,149 to	2,155	99.0% to	99.2%
Jarrah South++	160,667	12,188 to	16,096	96,577 to	96,810	60.1% to	60.3%
Jarrah Unicup++	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++	7,249	2,130 to	2,606	4,267 to	4,564	58.9% to	63.0%
Karri Main Belt++	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++	492	1 to	1	492 to	492	100.0% to	100.0%
Karri Yellow Tingle++	6,969	1,794 to	2,340	4,225 to	4,570	60.6% to	65.6%
* West'n Wandoo forest++	7,865	1,239 to	1,263	6,746 to	6,973	85.8% to	88.7%
* West'n Wandoo woodland++	3,012	1,046 to	1,094	2,616 to	2,798	86.8% to	92.9%
TOTAL[8]	347,662	49,545 to	51,755	227,169 to	227,871	65.3% to	65.5%

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

++ 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' .

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

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

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.

Approach A

		Area Outside CAR Reserve[1]					
Deficit / Excess ha[2&4]		Non-accredited informal reserves[5] ha		Other Public Land[6] ha		Freehold land[7] 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	102131 to	102873	346.41 to	353.8

Table 7.3
Reservation Analysis of Indicative Areas of National Estate Values

Approach A

National Estate Value[1]	Extant area ha	CAR Reserve System under this Approach[2]						Area Outside CAR Reserve[2]			
		Possible New Reserves ha		Total area reserved ha		Total area reserved %		Non-accredited informal reserves[3] ha		Other Public Land[4] ha	
Criterion A.1											
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
Criterion A.2											
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
Criterion A.3											
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
Criterion B.1											
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[1]		Area Outside CAR Reserve[1]		
		Possible New Reserves ha	Total area reserved under this approach[2] ha & %[3]	Non-accredited informal reserves[4] ha	Other Public Land[5] ha	Freehold land[6] ha
Flora Disjunctiveness 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	22,082 to 33,312	57,690 to 67,245 49.6% to 57.8%	2,422 to 3,406	23,663 to 32,234	22,954 to 22,954
Flora Endemism Areas where the level of endemism is two or more standard deviations above the mean for the region.	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
Relictual Flora 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	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
Flora Species Richness 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	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 Karri Sawlog Grade 1&2 m^3/yr		Jarrah Sawlog Grade 1&2[1] m^3/yr		Chiplog and charlog m^3/yr		Gross Value of wood products at Mill Gate $/yr	
Swan										
Range under this approach	305,921 to	310,982	0 to	0	195,057 to	199,945	27,035 to	27,712	$54,566,447 to	$55,933,760
% of benchmark	97.8% to	99.4%	0.0% to	0.0%	96.6% to	99.0%	96.6% to	99.0%	96.6% to	99.0%
Deficit/Addition	-6,962 to	-1,901	0 to	0	-6,943 to	-2,055	-962 to	-285	-$1,942,319 to	-$575,006
Central Forest										
Range under this approach	460,888 to	466,984	0 to	0	197,315 to	205,289	60,240 to	62,675	$57,444,583 to	$59,766,186
% of current	91.9% to	93.1%	0.0% to	0.0%	87.3% to	90.8%	87.3% to	90.8%	87.3% to	90.8%
Deficit/Addition	-40,890 to	-34,794	0 to	0	-28,685 to	-20,711	-8,758 to	-6,323	-$8,351,247 to	-$6,029,644
Southern Forest										
Range under this approach	315,243 to	317,310	193,525 to	196,760	56,159 to	57,365	576,054 to	585,683	$106,086,149 to	$107,931,527
% of current	93.1% to	93.7%	90.4% to	91.9%	90.6% to	92.5%	90.4% to	91.9%	90.5% to	92.0%
Deficit/Addition	-23,459 to	-21,392	-20,475 to	-17,240	-5,841 to	-4,635	-60,946 to	-51,317	-$11,196,591 to	-$9,351,213
TOTAL[2]										
Range under this approach	1,087,112 to	1,090,215	193,525 to	196,760	453,418 to	457,711	664,007 to	675,392	$219,464,492 to	$222,264,159
% of current	94.8% to	94.8%	90.4% to	91.9%	92.3% to	93.3%	92.2% to	93.1%	92.2% to	93.1%
Deficit/Addition	-66,251 to	-63,148	-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 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 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[1]			**Indicative Indirect Employment[2]**		
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[3]	Total area on CALM managed land ha	CAR Reserve System under this Approach					Non-accredited Informal[4] Reserves ha	Range of State forest area available for production[4&6] ha
		Existing Reserved Areas[1&2]			Possible New Reserves[4] ha	Total[4&5] ha		
		Formal (gazetted) %	Formal (proposed)[4] %	Informal[4] (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[1] ha		
Agreement Act Leases[2]	66,922	to	73,109
Mining Act tenements, leases and licences[2]			
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.

Mineral Potential[2]	Total new reserves under this approach[1] ha		
High areas with a WMP score greater than 90 having moderate to high potential for major deposits. eg gold, bauxite	211,805	to	218,979
Medium 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
Low 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[1] ha		
Identified mineral resources[2]	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

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

Table 8.1
Biodiversity Values Reservation Analysis

Forest Ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	CAR Reserve System under this Approach[1]					
			Possible New Reserves ha		Total area reserved under this approach [2] ha		Level of reservation under this approach[2&3] %	
* Bullich and Yate	2,800	2,440	0 to	0	2,176 to	2,176	89.2% to	89.2%
Darling Scarp++	29,000	9,938	1,271 to	1,880	2,694 to	3,168	9.3% to	10.9%
Jarrah Blackwood++	347,200	281,805	18,226 to	22,235	46,775 to	57,058	13.5% to	16.4%
Jarrah Leeuwin++	56,400	19,552	5,680 to	6,178	8,463 to	8,743	15.0% to	15.5%
Jarrah Mt Lindesay++	126,600	44,597	5,772 to	6,823	16,603 to	17,766	13.1% to	14.0%
Jarrah North East++	717,100	350,239	19,002 to	22,614	98,181 to	105,311	13.7% to	14.7%
Jarrah North West++	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++	107,900	71,091	276 to	835	24,658 to	25,190	22.9% to	23.3%
Jarrah South++	557,300	438,912	10,599 to	12,982	135,906 to	145,490	24.4% to	26.1%
Jarrah Unicup++	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++	11,600	9,669	1,415 to	1,916	4,053 to	4,258	34.9% to	36.7%
Karri Main Belt++	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++	14,500	6,274	132 to	228	4,384 to	4,478	30.2% to	30.9%
Karri Yellow Tingle++	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/sedgelands	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++	363,200	146,597	3,574 to	7,728	50,483 to	55,403	13.9% to	15.3%
West'n Wandoo woodland++	163,000	72,077	2,565 to	7,660	27,533 to	32,898	16.9% to	20.2%
TOTAL[8]	4,135,524	2,633,503	122,526 to	127,674	943,575 to	968,118	22.8% to	23.4%

* 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 see Section 4.3.2.

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.

Approach B

		Area Outside CAR Reserve[1]					
Deficit / Excess ha[2&4]		Non-accredited informal reserves[5] ha		Other Public Land[6] ha		Freehold land[7]	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

Old-growth by forest ecosystem	Present area on all lands ha	CAR Reserve System under this Approach[1]					
		Possible New Reserves ha		Total area reserved under this approach [2] ha		Level of reservation under this approach[2&3] %	
Jarrah Blackwood++	48,496	8,425 to	10,759	21,216 to	23,300	43.7% to	48.0%
* Jarrah Leeuwin++	477	64 to	103	422 to	460	88.4% to	96.6%
Jarrah Mt Lindesay++	14,005	3,012 to	4,183	9,698 to	10,798	69.3% to	77.1%
* Jarrah North East++	11,594	5,311 to	5,718	9,660 to	9,902	83.3% to	85.4%
* Jarrah North West++	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++	2,171	0 to	6	2,149 to	2,155	99.0% to	99.2%
Jarrah South++	160,667	7,477 to	9,608	88,605 to	90,580	55.1% to	56.4%
Jarrah Unicup++	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++	7,249	1,126 to	1,757	3,507 to	3,871	48.4% to	53.4%
Karri Main Belt++	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++	492	1 to	1	492 to	492	100.0% to	100.0%
Karri Yellow Tingle++	6,969	634 to	1,704	3,307 to	4,119	47.4% to	59.1%
* West'n Wandoo forest++	7,865	1,234 to	1,234	6,938 to	6,938	88.2% to	88.2%
* West'n Wandoo woodland++	3,012	1,050 to	1,050	2,793 to	2,793	92.7% to	92.7%
TOTAL[8]	347,662	32,644 to	36,085	210,174 to	210,376	60.5% to	60.5%

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

++ 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'.

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

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

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.

Approach B

		Area Outside CAR Reserve[1]					
Deficit / Excess ha[2&4]		Non-accredited informal reserves[5] ha		Other Public Land[6] ha		Freehold land[7] 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[1]	Extant area ha	CAR Reserve System under this Approach[2]						Area Outside CAR Reserve[2]			
		Possible New Reserves ha		Total area reserved ha		Total area reserved %		Non-accredited informal reserves[3] ha		Other Public Land[4] ha	
Criterion A.1											
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
Criterion A.2											
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
Criterion A.3											
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
Criterion B.1											
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[1]		Area Outside CAR Reserve[1]		
		Possible New Reserves ha	Total area reserved under this approach[2] ha & %[3]	Non-accredited informal reserves[4] ha	Other Public Land[5] ha	Freehold land[6] ha
Flora Disjunctiveness 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	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
Flora Endemism Areas where the level of endemism is two or more standard deviations above the mean for the region.	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
Relictual Flora 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	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
Flora Species Richness 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	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: Karri Sawlog Grade 1&2 m^3/yr		TIMBER YIELD: Jarrah Sawlog Grade 1&2[1] m^3/yr		TIMBER YIELD: Chiplog and charlog m^3/yr		Gross Value of wood products at Mill Gate $/yr	
Swan										
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
Central Forest										
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
Southern Forest										
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
TOTAL[2]										
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 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 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[1]			**Indicative Indirect Employment[2]**		
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[3]	Total area on CALM managed land ha	CAR Reserve System under this Approach					Non-accredited Informal[4] Reserves ha	Range of State forest area available for production[4&6] ha
		Existing Reserved Areas[1&2]			Possible New Reserves[4] ha	Total[4&5] ha		
		Formal (gazetted) %	Formal (proposed)[4] %	Informal[4] (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[1] ha		
Agreement Act Leases[2]	55,784	to	58,755
Mining tenements, leases and licences[3]			
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[2]	Total new reserves under this approach[1] ha		
High areas with a WMP score greater than 90 having moderate to high potential for major deposits. eg gold, bauxite	181,225	to	181,477
Medium 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
Low 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[1] ha		
Identified mineral resources[2]	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

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

Table 9.1
Biodiversity Values Reservation Analysis

Forest Ecosystem	Estimated pre 1750 area ha	Present area on all lands ha	CAR Reserve System under this Approach[1]					
			Possible New Reserves ha		Total area reserved under this approach [2] ha		Level of reservation under this approach[2&3] %	
* Bullich and Yate	2,800	2,440	0 to	0	2,176 to	2,176	89.2% to	89.2%
Darling Scarp++	29,000	9,938	1,841 to	1,851	3,129 to	3,139	10.8% to	10.8%
Jarrah Blackwood++	347,200	281,805	773 to	3,144	32,898 to	38,575	9.5% to	11.1%
Jarrah Leeuwin++	56,400	19,552	5,680 to	6,172	8,463 to	8,738	15.0% to	15.5%
Jarrah Mt Lindesay++	126,600	44,597	396 to	3,550	11,497 to	14,517	9.1% to	11.5%
Jarrah North East++	717,100	350,239	9,391 to	10,905	91,972 to	93,337	12.8% to	13.0%
Jarrah North West++	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++	107,900	71,092	263 to	270	24,647 to	24,653	22.8% to	22.8%
Jarrah South++	557,300	438,912	6,768 to	6,780	132,626 to	133,073	23.8% to	23.9%
Jarrah Unicup++	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++	11,600	9,669	35 to	35	2,925 to	2,925	25.2% to	25.2%
Karri Main Belt++	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++	14,500	6,274	132 to	222	4,384 to	4,472	30.2% to	30.8%
Karri Yellow Tingle++	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/sedgelands	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++	363,200	146,597	4,194 to	4,362	51,654 to	52,000	14.2% to	14.3%
West'n Wandoo woodland++	163,000	72,078	5,156 to	6,239	30,359 to	31,357	18.6% to	19.2%
TOTAL[8]	4,135,524	2,633,506	43,543 to	57,385	905,731 to	911,191	21.9% to	22.0%

* 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 see Section 4.3.2.

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.

Approach C

		Area Outside CAR Reserve[1]					
Deficit / Excess ha[2&4]		Non-accredited informal reserves[5] ha		Other Public Land[6] ha		Freehold land[7]	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

Old-growth by forest ecosystem	Present area on all lands ha	CAR Reserve System under this Approach[1]					
		Possible New Reserves ha		Total area reserved under this approach [2] ha		Level of reservation under this approach[2&3] %	
Jarrah Blackwood++	48,496	266 to	1,540	13,591 to	14,767	28.0% to	30.4%
* Jarrah Leeuwin++	477	64 to	103	422 to	460	88.4% to	96.6%
Jarrah Mt Lindesay++	14,005	389 to	2,863	7,216 to	9,579	51.5% to	68.4%
* Jarrah North East++	11,595	8 to	1,178	4,445 to	5,563	38.3% to	48.0%
* Jarrah North West++	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++	2,171	0 to	0	2,149 to	2,149	99.0% to	99.0%
Jarrah South++	160,667	5,701 to	5,703	83,609 to	87,102	52.0% to	54.2%
Jarrah Unicup++	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++	7,249	35 to	35	2,661 to	2,661	36.7% to	36.7%
Karri Main Belt++	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++	492	1 to	1	492 to	492	100.0% to	100.0%
Karri Yellow Tingle++	6,969	4 to	4	2,792 to	2,792	40.1% to	40.1%
* West'n Wandoo forest++	7,865	1 to	92	5,695 to	5,712	72.4% to	72.6%
* West'n Wandoo woodland++	3,013	7 to	620	1,648 to	2,247	54.7% to	74.6%
TOTAL[8]	347,663	6,599 to	12,190	182,571 to	190,125	52.5% to	54.7%

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

++ 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'.

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

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

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.

Approach C

		Area Outside CAR Reserve[1]					
Deficit / Excess ha[2&4]		Non-accredited informal reserves[5] ha		Other Public Land[6] ha		Freehold land[7] 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[1]	Extant area ha	CAR Reserve System under this Approach[2]						Area Outside CAR Reserve[2]			
		Possible New Reserves ha		Total area reserved ha		Total area reserved %		Non-accredited informal reserves[3] ha		Other Public Land[4] ha	
Criterion A.1											
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
Criterion A.2											
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
Criterion A.3											
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
Criterion B.1											
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[1]		Area Outside CAR Reserve[1]		
		Possible New Reserves ha	Total area reserved under this approach[2] ha & %[3]	Non-accredited informal reserves[4] ha	Other Public Land[5] ha	Freehold land[6] ha
Flora Disjunctiveness 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	1,860 to 2,988	47,080 to 48,260 40.5% to 41.5%	4,245 to 4,249	40,820 to 42,004	22,954 to 22,954
Flora Endemism Areas where the level of endemism is two or more standard deviations above the mean for the region.	221,879	11,058 to 14,629	100,937 to 103,922 45.5% to 46.8%	7,897 to 8,094	66,801 to 69,589	43,259 to 43,259
Relictual Flora 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	245 to 2,406	81,320 to 83,440 53.5% to 54.9%	6,905 to 6,930	47,340 to 49,435	14,296 to 14,296
Flora Species Richness 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	13,565 to 15,670	110,859 to 111,363 52.4% to 52.7%	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 Karri Sawlog Grade 1&2 m^3/yr		Jarrah Sawlog Grade 1&2[1] m^3/yr		Chiplog and charlog m^3/yr		Gross Value of wood products at Mill Gate $/yr	
Swan										
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
Central Forest										
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
Southern Forest										
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
TOTAL[2]										
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 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 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[1]			Indicative Indirect Employment[2]		
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[3]	Total area on CALM managed land ha	CAR Reserve System under this Approach					Non-accredited Informal[4] Reserves ha	Range of State forest area available for production[4&6] ha
		Existing Reserved Areas[1&2]			Possible New Reserves[4] ha	Total[4&5] ha		
		Formal (gazetted) %	Formal (proposed)[4] %	Informal[4] (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[1] ha		
Agreement Act Leases[2]	41,849	to	42,317
Mining tenements, leases and licences[3]			
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[2]	Total new reserves under this approach[1] ha		
High areas with a WMP score greater than 90 having moderate to high potential for major deposits. eg gold, bauxite	167,673	to	168,099
Medium 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
Low 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[1] ha		
Identified mineral resources[2]	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 over-arching and six specific principles of ecologically sustainable forest management and the current knowledge of the response and resilience to fire of ecosystems in the South-West Forest Region.

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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