DEFERRED FOREST ASSESSMENT FOR WESTERN AUSTRALIA

DRAFT REPORT
BY THE
GOVERNMENT OF WESTERN AUSTRALIA
FOR THE
COMMONWEALTH GOVERNMENT

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EXECUTIVE SUMMARY

This report provides an assessment of the existing conservation reserve system in the forests of south-west Western Australia. The reserves are evaluated in terms of their comprehensiveness, adequacy and representativeness (CAR) in accordance with criteria established by the Commonwealth. In this context, the conservation reserve system includes all statutory reserves, both existing and approved by Government, and non-statutory reserves that are excluded from timber harvesting.

The boundary of the study area for the Deferred Forest Assessment (DFA) is a boundary which includes all of CALM's three administrative regions in the forested portion of the south-west (Swan, Central Forest and Southern Forest Region).

Assessments are made in relation to protection of:

- biodiversity;
- old growth forest;
- wilderness;
- endangered and rare species.

BIODIVERSITY

For the biodiversity assessment, the Commonwealth set a target of 15 per cent of the 'pre-1750'distribution of each forest type to be protected in reserves. The State does not agree with this target, but accepts the JANIS target of a 10 per cent level of reservation of each biome. The JANIS recommendation is the only outcome referring to reserve criteria that is legitimate under the National Forest Policy Statement (NFPS).

The analysis showed that 19 per cent of the 'pre-1750' distribution of jarrah forest is protected in reserves. Thirty-five per cent of the 'pre-1750' distribution of karri forest is protected in reserves.

For jarrah forest, which occupies a broad geographic and environmental range, a 10 per cent target was applied by the Commonwealth for reservation within each of four sub-regions of the jarrah forest. This was used as a check on the distribution of reserves across the jarrah forest. The sub-regions were defined on the basis of rainfall, with the 1000 mm isohyet used as the boundary, and north-south distribution, with the Preston River used as the boundary. The sub-regional analysis of jarrah forest showed the levels of protection to be:

- 13 per cent for the high rainfall northern jarrah forest
- 24 per cent for the low rainfall northern jarrah forest
- 23 per cent for the high rainfall southern jarrah forest
- 16 per cent for the low rainfall southern jarrah forest

OLD GROWTH FOREST

For the assessment of old growth forest, the Commonwealth set a target which is dependent on the amount of old growth forest in the present distribution of each forest type. For karri forest, the Commonwealth target was for 60 per cent of the old growth forest to be protected. The Commonwealth target for the northern jarrah forest was for 90 per cent to be protected and for the southern jarrah forest the Commonwealth target was for 60 per cent to be protected. Western Australia does not accept the 60 per cent target for the southern jarrah forest, and believes a 50 per cent target should apply. This is based on the Commonwealth criteria to apply for the DFA, which states:

> *'In the case of a forest type that is still relatively widespread and retaining large contiguous areas of old growth, for example, a somewhat lesser amount than that calculated from strict application of the linear scale, may prove adequate.'*

The southern jarrah forest is still widespread and retains large contiguous areas of old growth forest, therefore a lower target should apply.

The analysis showed the following levels of protection of old growth;

- 66 per cent of old growth karri forest;
- 80 per cent of old growth in the northern jarrah forest;
- 55 per cent of old growth in the southern jarrah forest.

WILDERNESS

The Commonwealth target for wilderness was for protection of 90 per cent of areas of high quality wilderness that met agreed minimum area requirements. Agreement on the minimum size of wilderness areas was not reached, however analysis was applied on both the Commonwealth and State position.

The results showed that using either the Commonwealth or State positions the highest wilderness quality is protected in the reserve system. However, no areas of *wilderness* meeting either Commonwealth or State criteria were found.

ENDANGERED AND RARE SPECIES

The report details the procedures and strategies that CALM applies to the protection of endangered and rare species. The Commonwealth acknowledges that these processes are an effective means of ensuring the conservation of endangered and rare flora and fauna throughout the DFA region.

THE ISSUE OF NON-STATUTORY RESERVES

Both the NFPS and its implementation group (JANIS) state that non-statutory reserves contribute to the reserve system. The NFPS states:

> *'The nature conservation objectives are being pursued in three ways. First, parts of the public native forest estate will continue to be set aside in dedicated nature conservation reserve systems to protect native forest communities, based on the principles of*

comprehensiveness, adequacy and representativeness. The reserve system will safeguard endangered and vulnerable species and communities. Other areas of forest will also be protected to safeguard special areas and to provide links where possible between reserves or other protected areas. .... Second ....'

The Commonwealth has taken the view, in the case of Western Australia but no other State, that non-statutory reserves can contribute only to a limited extent in meeting the targets for reservation.

The Commonwealth's concern in relation primarily to edge effects has led to a deduction of the area of narrow linear reserves (60 metre wide 1st, 2nd and 3rd order riparian reserves and 200 metre wide road reserves) from the total area of formal and informal reserves. A deduction of 25 per cent of the area of 400 metes wide road reserves for internal edge effects has also been made. The resulting area has been termed the accredited reserve area.

The State strongly disagrees with the Commonwealth position, and argues that the non-statutory reserves make an essential contribution to the protection of biodiversity and old growth. All non-statutory reserves should thus be accredited in Western Australia, just as they have been in every other State. The Commonwealth's position is particularly untenable in relation to old growth in non-statutory reserves in the southern jarrah forest, as most of the narrow linear areas are currently surrounded by large areas of old growth. There is no justification for not accrediting these areas as most options for a reconfiguration of statutory and non-statutory reserves will still be available at the completion of the RFA.

Notwithstanding these different positions, this report presents the old growth data in the format the Commonwealth have requested, and interim protection arrangements are proposed below to satisfy the Commonwealth position.

The issue will be further considered during the public consultation phase and again in the RFA.

INTERIM PROTECTION ARRANGEMENTS

The assessments carried out for protection of biodiversity, old growth karri forest, wilderness and endangered and rare species, reveal that no forest areas need to be deferred from timber harvesting so as not to foreclose options for a CAR reserve system.

The only attribute where a difference was found against the Commonwealth criteria was for old growth jarrah forest. Interim protection of old growth jarrah forest will be undertaken in two sub-regions.

For the northern jarrah forest, the State proposes to defer 5760 hectares from timber harvesting, to give a protection level of 90 per cent. CALM will issue instructions to forest planners in the Swan and Central Forest Regions to exclude these areas of old growth jarrah forest from timber harvesting during 1996 and 1997 or until the Regional Forest Agreement (RFA) is completed, whichever is the soonest.

For the southern jarrah forest, Western Australia believes that a 50 per cent target level of protection should apply, in which case no areas would need to be deferred from timber harvesting so as not to foreclose options for a CAR reserve system. However, a difference of 26 170 hectares was identified between the Commonwealth 60 per cent target and the accredited reserve area for old growth forest. In this case, timber harvesting is proposed to be deferred during 1996 and 1997 or until the RFA is

completed, whichever is the soonest, from an area of 27 500 hectares of old growth forest within National Estate places in the southern jarrah forest.

Table 1: A summary of reserves in the forest of south-west Western Australia in relation to Commonwealth targets, for assessments of biodiversity, old growth, wilderness and endangered and rare species.

Assessment	*Commonwealth Target*	*In WA Reserves*	Result	
Biodiversity				
Pre-1750 jarrah forest	15%	19%		✓
Pre-1750 karri forest	15%	35%		✓
Sub-regional jarrah forest				
High rainfall north	10%	13%		✓
Low rainfall north	10%	24%		✓
High rainfall south	10%	23%		✓
Low rainfall south	10%	16%		✓
Old Growth				
Karri forest	60%	66%		✓
Northern jarrah forest	90%	80%	Balance protected by Code of Practice	✓
Southern jarrah forest	60%	55%	Balance protected in National Estate	✓
	50%*			✓*
Wilderness				
Highest wilderness quality is in reserves. No wilderness meeting Commonwealth criteria was found. Assessment accredited.				✓
Endangered and Rare Species				
The Commonwealth has accredited CALM's processes for ensuring the conservation of endangered and rare species as an effective means of achieving this objective.				✓

* The State argues that a 50 per cent target should apply in the southern jarrah forest because the forest is still widespread and containing large contiguous areas of old growth. In this case, no areas would need to be deferred from timber harvesting in the southern jarrah forest.

INTRODUCTION

Under the National Forest Policy Statement, the Federal, State and Territory Governments agreed to a framework and process for comprehensive regional assessments leading to Regional Forest Agreements (RFAs). The RFAs prescribe areas to be reserved, areas available for multiple use including wood production on a sustained yield basis and guidelines for the ecologically sustainable management of the forest estate. As a negotiated process, it is intended to meet the obligations and objectives of both the Commonwealth and Western Australian Governments.

It is recognised that it may take several years to complete a RFA and interim protection measures will be needed so as not to foreclose options for a comprehensive, adequate and representative (CAR) reserve system.

The interim protection measures are the subject of this report and are known as the Deferred Forest Assessment (DFA). The DFA will apply until RFAs are completed.

The Commonwealth's principal involvement in forest issues derives from the Commonwealth Export Control (Unprocessed Wood) Regulations made under the Export Control Act 1982 which regulates the export of unprocessed wood including woodchips. Exports of woodchips and unprocessed wood are regulated to ensure that a range of Commonwealth obligations are met. The DFA will take into account the statutory obligations and objectives of both the Commonwealth (e.g. *Environment Effects (Impact of Proposals) Act, Australian Heritage Commission Act* etc.) and Western Australia.

This DFA report provides an assessment of the existing Western Australian forest conservation reserve system and evaluates its comprehensiveness, adequacy and representativeness in accordance with criteria established by the Commonwealth.

In this context, the conservation reserve system includes all statutory reserves, both existing and approved by the Western Australian Government, and non statutory reserves that are excluded from timber harvesting.

A Commonwealth position paper 'Deferred Forest Assessments' was published in May 1995. This document outlined some possible approaches to the assessment and provided a basis for discussion between the Commonwealth and State governments.

In May 1995 the Premier of Western Australia invited the Commonwealth to commence the DFA, treating the south-west forests as a single region. A Steering Committee and a Technical Committee, comprising Commonwealth and Department of Conservation and Land Management (CALM) staff were established.

This process has involved considerable negotiation between State and Commonwealth officials.

This report represents the views of Western Australia on the DFA.

NATIONAL FOREST POLICY STATEMENT

The Federal, State and Territory Governments agreed to a National Forest Policy Statement (NFPS) in 1992. This Statement set out the measures to be undertaken to ensure the community obtains a balanced return from all forest uses by:

- providing for a comprehensive, adequate and representative reserve system which will protect old growth forest, wilderness and biodiversity;
- providing for a range of other forest values, including timber, water supply, tourism and recreation in an ecologically sustainable management framework;
- coordination of decision making between the Commonwealth and the States and Territories;
- development of an efficient, value adding, internationally competitive and ecologically sustainable wood products industry;
- the expansion of hardwood and softwood plantations;
- assistance to communities faced with structural adjustments as a result of the implementation of these measures.

JANIS

Following signing of the NFPS an inter-governmental Technical Working Group on Reserve Criteria was established in 1993 to draft the national criteria required by the NFPS, 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). The Technical Working Group comprised representatives from state forest management and conservation agencies, and from CSIRO.

In August 1994, the Working Group produced a draft report containing a set of proposed criteria. This report was published as a draft report in July 1995 and is currently available for public comment.

Ideally, criteria for reserve selection that have been agreed nationally between the States and the Commonwealth will be applied to the assessments (Commonwealth of Australia, 1995). The National Forest Policy Statement requires that criteria must be agreed between the Commonwealth and the States. At the time of writing this report, **there are no nationally agreed criteria**.

THE COMMONWEALTH RESERVES CRITERIA

Pending finalisation of agreed national reserve criteria the Commonwealth prepared its own criteria as a basis for DFA./RFA discussions. These criteria are set out in the paper National Forest Conservation Reserves, Commonwealth Proposed Criteria (July 1995).

A key element of each RFA is the establishment of a comprehensive adequate and representative (CAR) forest reserve system which is managed for the primary purpose of nature conservation and

which is embedded in the wider forest estate. The criteria adopted by the Commonwealth Government for such a system include:

- a broad benchmark of 15 per cent of the 'pre-1750' distribution of each forest type to be protected within conservation reserves to protect biodiversity;
- retention in reserves of at least 60 per cent of existing old growth, increasing to 100 per cent in some cases for rare old growth and reducing in some cases where old growth is common;
- protection of 90 per cent or more wherever practicable of high quality wilderness;
- recognition of the role of off-reserve management in meeting conservation objectives, especially the protection of rare and threatened species.

In relation to the protection of old growth forests the Commonwealth's Reserves Criteria paper also states that:

> **The rarity of old growth may also need to be established in absolute terms, based on the remaining areal extent of the forest type as a whole. In the case of a forest type that is still relatively widespread and retaining large contiguous areas of old growth, for example, a somewhat lesser amount than that calculated from strict application of the proposed linear scale may prove adequate.**

MAXIMISATION OF THE NATIONAL ESTATE

The Commonwealth's CAR paper specifies that, when considering options for the interim protection of forests, the inclusion of national estate places should be maximised.

To maximise the consideration of national estate values within the DFA, the use of national estate was seen as a method for ensuring that any areas of potential 'deficit' against Commonwealth criteria could be located in areas where additional reservation formed meaningful additions to existing reserves.

The method used for maximising the inclusion of national estate are detailed in the section titled INTERIM PROTECTION OF FOREST AREAS.

REGION BOUNDARY

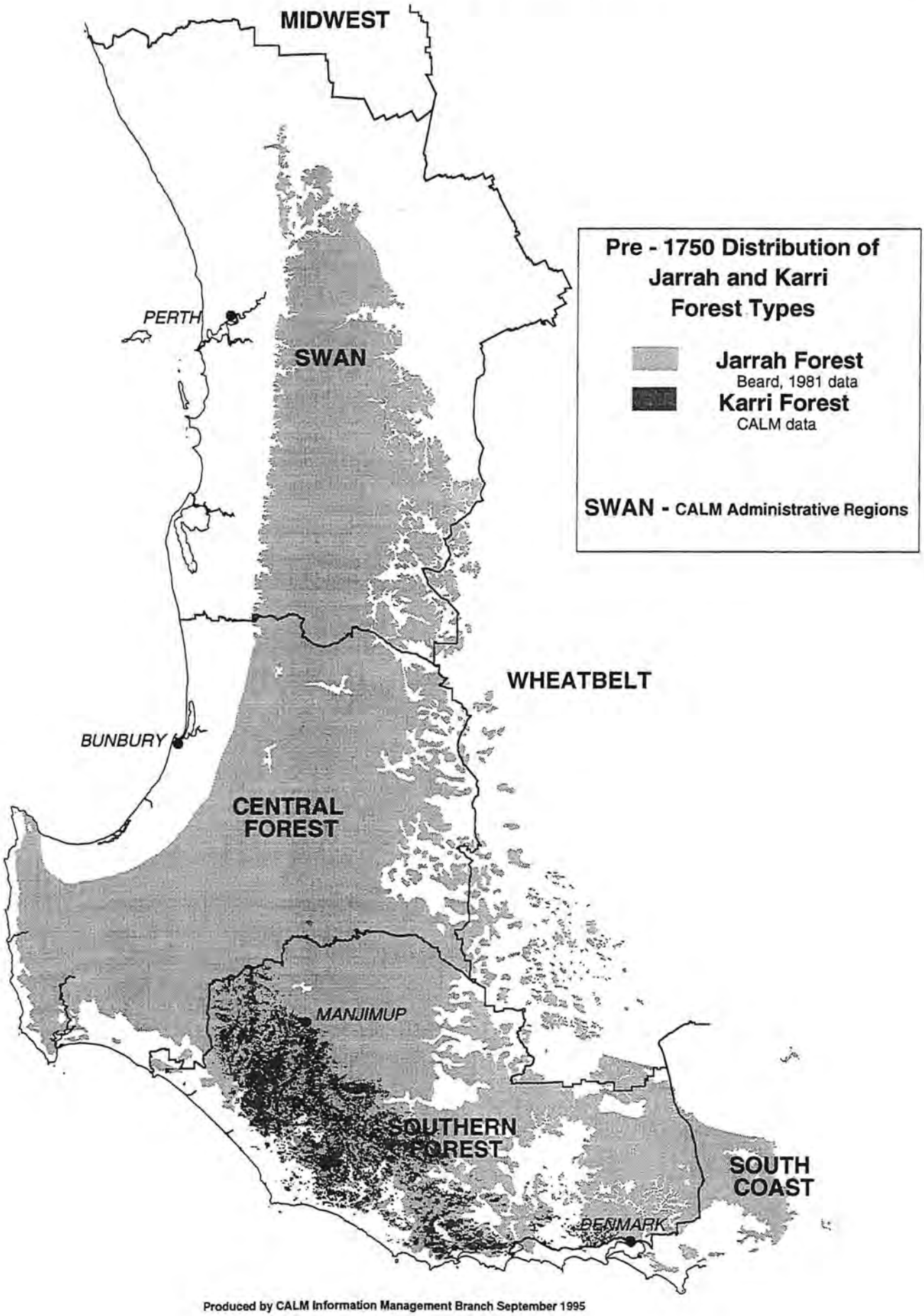
The boundary of the study area for the DFA is a boundary which includes all of CALM's three administrative regions (Swan, Central Forest and Southern Forest) in the south-west. This boundary encompasses 93 per cent of the jarrah forest (as mapped by Beard, 1981) and 98 per cent of the karri forest (as mapped by Bradshaw and Lush, 1981). The eastern outliers of the karri forest at the Porongorups and Mt Manypeaks are not included in the study area, however, all of the State forest available for timber production, is included.

The region is known as the 'south-west forest region' (see map 1).

The region boundary may be reviewed for the Regional Forest Agreement.

BOUNDARY OF "SOUTH-WEST REGION" FOR THE DEFERRED FOREST ASSESSMENT

Map 1



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VESTING, TENURE AND PURPOSE OF LAND MANAGED BY CALM

The system of classification, reservation and vesting which applies to lands, including forest lands, and waters managed by the Department of Conservation and Land Management is described in detail in Appendix 1.

CATEGORIES OF LAND MANAGED BY THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

The CALM Act as amended in 1991 lists seven categories of land to which the legislation applies. These are:

(i) State Forest
(ii) Timber Reserve
(iii) National Park
(iv) Conservation Park
(v) Nature Reserve
(vi) 5(g) Reserve
(vii) Miscellaneous Reserve

In addition, the Department also manages land held freehold in the name of the Executive Director.

MANAGEMENT PURPOSE OF LAND CATEGORIES

There are a variety of purposes for which forest lands are managed. Different categories of land have specific purposes as prescribed in management plans.

(a) **indigenous State forest or timber reserves**, to achieve the purpose, or combination of purposes, of conservation, recreation, timber production on a sustained-yield basis, water catchment protection, or another purpose prescribed in regulations;

(b) **State forest or timber reserves planted with exotic species**, to achieve the optimum yield in production consistent with the satisfaction of long-term social and economic needs;

(c) **national parks and conservation parks**, to fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest;

(d) **nature reserves**, to maintain and restore the natural environment, and to protect, care for, and promote the study of indigenous flora and fauna and to preserve any feature of archaeological, historic or scientific interest;

(e) **in the case of other land referred to in section 5(g)**, to achieve the purpose for which the land was vested in the controlling body.

Public participation in the management planning process is provided for, with a minimum two-month period during which written submissions will be considered.

RESERVE CLASSIFICATION AND IUCN MANAGEMENT CATEGORIES

The management regimes for dedicated reserves in Western Australia described above may be equated to protected area management categories defined by the IUCN Commission for National Parks and Protected Areas (1994).

The IUCN management categories relevant to the tenure and purpose of forest lands in Western Australia are Categories I, II, IV and VI defined as:

Category I Strict Nature Reserve/Wilderness Area: protected areas managed mainly for science or wilderness protection:

Areas of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological feature and/or species, available primarily for scientific research and/or environmental monitoring.

Large areas of unmodified land, or slightly modified land, or land and water, retaining their natural character influence, without permanent or significant habitation, which are protected and managed so as to preserve their natural condition.

Category II National Park: protected area managed mainly for ecosystem protection and recreation:

Natural area of land and/or sea, designated to:

(a) protected the ecological integrity of one or more ecosystems for this and future generations;
(b) exclude exploitation of occupation inimical to the purposes of designation of the area; and
(c) provide a foundation for spiritual, all of which must be environmentally and culturally compatible.

Category IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention:

Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species managed for the sustainable use of natural ecosystems.

Category VI Managed Resources Protected Areas: managed for the sustainable use of natural ecosystems

Table 1: - IUCN categorisation for forest lands in Western Australia

Land Category (CALM Act)	*IUCN Category*
State forest	VI
Timber reserve	VI
National park	II
Conservation park	II
Nature reserve	I
5g reserve	II and VI
Miscellaneous reserve	I, II and VI

NON-STATUTORY RESERVES

Non-statutory reserves (also known as administrative reserves or informal reserves) also form part of the nature conservation reserve system in Western Australia.

Both the NFPS and its implementation group (JANIS) state that non-statutory reserves contribute to the reserve system. The NFPS states:

> *'The nature conservation objectives are being pursued in three ways. First, parts of the public native forest estate will continue to be set aside in dedicated nature conservation reserve systems to protect native forest communities, based on the principles of comprehensiveness, adequacy and representativeness. The reserve system will safeguard endangered and vulnerable species and communities.* ***Other areas of forest will also be protected to safeguard special areas and to provide links where possible between reserves or other protected areas.*** *.... Second ....'*

For old growth forest protection the Commonwealth's Reserves Criteria paper states that at least 40 per cent of the protected old growth should be in **dedicated** conservation reserves, indicating that the balance (20-50 per cent) can be protected in non-statutory reserves.

The Commonwealth and the State could not agree on the extent to which non-statutory reserves would be accredited. It was agreed to refer the issue to the Commonwealth's Scientific Panel.

The Scientific Panel concluded that non-statutory reserves makes a definite, though non-quantifiable contribution to the protection of conservation values in the south-west forests. However, as a precautionary measure the majority of the Panel recommended that a buffer be added to the outer margin of all linear reserves considered for inclusion of CAR reservation targets for the DFA.

The Commonwealth has taken the view, in the case of Western Australia but no other State, that non-statutory reserves can contribute only to a limited extent in meeting the targets for reservation.

The Commonwealth's concern in relation primarily to edge effects has led to a deduction of the area of narrow linear reserves (60 metre wide 1st, 2nd and 3rd order riparian reserves and 200 metre wide road reserves) from the total area of formal and informal reserves. A deduction of 25 per cent of the

area of 400 metes wide road reserves for internal edge effects has also been made. The resulting area has been termed the accredited reserve area.

The State strongly disagrees with the Commonwealth position, and argues that the non-statutory reserves make an essential contribution to the protection of biodiversity and old growth. All non-statutory reserves should thus be accredited in Western Australia, just as they have been in every other State. The Commonwealth's position is particularly untenable in relation to old growth in non-statutory reserves in the southern jarrah forest, as most of the narrow linear areas are currently surrounded by large areas of old growth. There is no justification for not accrediting these areas as most options for a reconfiguration of statutory and non-statutory reserves will still be available at the completion of the RFA.

Notwithstanding the different positions of Western Australia and the Commonwealth this report presents the old growth data in the format the Commonwealth have requested, and interim protection arrangements are proposed below to satisfy the Commonwealth position.

FOREST TYPES

The dominant forest types in the south-west forest region are the wet sclerophyll karri (*Eucalyptus diversicolor*) and dry sclerophyll jarrah (*E. marginata*). Other forest and woodland types also occur in the region. These include tuart (*E. gomphocephala*) and wandoo (*E. wandoo*).

Other eucalypts occur in mixture as codominants with those listed above, or occasionally in pure form. These include marri (*E. calophylla*), yarri (*E. patens*), red tingle (*E. jacksonii*) and yellow tingle (*E. guilfoylei*), which associate with both jarrah and karri and powderbark wandoo (*E. accedens*) which associates with wandoo and jarrah at the drier end of its range. *E. rudis* (flooded gum) lines the banks of major creeks and rivers.

KARRI FOREST

Karri forest occurs in the extreme south-west of the area south of a line from Nannup in the north-west through Manjimup to the Frankland River in the south-east. It extends further eastwards to Denmark, Torbay and Albany, but in this area it is confined to within 15 to 20 km of the coast. Two main outliers occur, one on soils derived from coastal limestone at Karridale, the other on soils derived from weathered granite on the Porongurup Range north of Albany. Smaller outliers occur at Yallingup, Margaret River, Black Point, Rocky Gully and near the south coast adjacent to Mt Manypeaks. Karri is largely confined within the 1100 mm isohyet (Christensen, 1992).

The Porongurup Range and Mt Manypeaks outliers occur outside the boundary of the study area.

JARRAH FOREST

Jarrah forest occurs in a band approximately 60 km wide from Gingin in the north to Albany in the south. The height and density of the jarrah forest declines from west to east as a consequence of diminishing rainfall. East of the 900 mm rainfall isohyet the vegetation of the broad valleys becomes an open forest of wandoo and flooded gum, with jarrah and marri on the ridges.

The early work of Diels (1906) recognised that, apart from the more obvious east-west trend, a north-south trend in species distribution is evident within the jarrah forest and is also reflected in the structure and composition of the forest.

OTHER FOREST TYPES

On the eastern edge of the jarrah forest, wandoo and powderbark wandoo form a woodland restricted to low rainfall areas (600-850 mm). Whilst extensive timber harvesting once occurred in the wandoo forest, only 600 cubic metres of wandoo sawlogs was harvested in 1993/94 (CALM Annual Report).

Tuart forms a woodland on the western coastal plain on soils derived from limestone. Nearly all of the tuart woodland on Crown land is within conservation reserves and no tuart timber is harvested.

Marri occurs in mixture with jarrah, karri and wandoo. Occasional pure stands are found within the main karri forest envelope. These pure marri stands are excluded from timber harvest where they are encountered.

It was agreed that for the DFA only two forest types - jarrah forest and karri forest would be assessed. These are the only two forest types where any significant wood production activity occurs. Other forest types will be assessed in the RFA.

METHODOLOGY USED TO ASSESS 'PRE-1750' DISTRIBUTION OF FOREST TYPES

Jarrah forest

The best source of information available is based on the work of Beard (1981) in compiling the vegetation survey of Western Australia. Beard or Smith (1972-74) mapped vegetation structure formations over all of the jarrah forest areas at a scale of 1:250 000. Smith mapped the Collie, Busselton-Augusta and Pemberton-Irwin Inlet mapsheets, and Beard mapped all other mapsheets. Smith's maps show the various vegetation structure formations on *uncleared* land and he makes no attempt to estimate the distribution of original vegetation structure formations at the 1:250 000 scale. In contrast, Beard's 1:250 000 maps are of the original natural vegetation structure formations.

Smith's 1:250 000 scale maps have been generalised by Beard (1981) to show the original vegetation at a scale of 1:1 000 000. Beard and Sprenger (1984) used the 1:1 000 000 scale maps of original natural vegetation and calculated areas of vegetation units by counting squares on an overlay grid in which each square represented an area of 200 hectares. The maps (both 1:250 000 and 1:1 000 000) are clearly of the *gross* forest area, and many non-forest areas are included in the area mapped as forest. Transparent overlays that showed alienated land, reserves and vacant Crown Land were used to estimate the area of each original natural vegetation unit that was cleared. They assumed reserves and vacant Crown Land were not cleared, and that all alienated land was cleared.

CALM has digitised the relevant Beard 1:250 000 mapsheets and Beards generalised 1:1 000 000 mapsheets of Smith's 1:250 000 maps.

These maps were used as the primary data to estimate the gross area of pre-European distribution of jarrah forest.

Karri forest

The best source of information available is that using aerial photographic interpretation (API) of the Forests Department of Western Australia 1:15840 scale photographs of the 1960s. This scale allows patches of about two hectares to be discriminated and thus gives a good estimate of the *net* area of karri forest. The interpretation of cleared karri forest was done in 1981, using the 1960s photos, as part of the study by Bradshaw and Lush (1981). Most of the karri forest that was cleared, was by ring-barking, and these trees were clearly visible on the photos. Therefore, most areas of cleared karri forest could be clearly identified by the presence of these dead trees. Additionally, for cleared areas where dead trees had been removed, interpretation of areas of cleared karri forest was done by assuming that the pattern of distribution of karri continued across the cleared boundary with the same relationship to landform as was present in the nearby forest.

The karri occurrence in relation to soil types and topographic position is also very predictable. For example, in the Donnelly River valley karri occurs only in valley bottoms and lower slopes. In the Walpole area and along the D'Entrecasteaux coast karri occurs prominently in the uplands, with a sharp ecotone to jarrah or heathland vegetation. This is described in Bradshaw and Lush (1981).

Karri forest occurs in three distinct areas:

(i) the west coast and a small number of outliers to the east as far as Lake Jasper,
(ii) the main karri belt, east of the Darling Scarp to Irwin Inlet, and
(iii) the south coast, which is a more patchy distribution of karri forest east of Irwin Inlet to Mt Manypeaks and north to the Porongurup range.

An alternative source of available information from which to estimate the pre-European distribution of karri forest is that based on the work of Beard and Smith in compiling the vegetation survey of Western Australia. Smith mapped vegetation structure formations over the entire karri forest areas at a scale of 1:250 000. These maps show the various vegetation structure formations on *uncleared* land. No attempt is made to estimate the distribution of original vegetation structure formations at the 1:250 000 scale.

The 1:250 000 scale maps have been generalised by Beard (1981) to show the original vegetation at a scale of 1:1 000 000. Beard and Sprenger (1984) used the 1:1 000 000 scale maps of original natural vegetation and calculated areas of vegetation units by counting squares on an overlay grid in which each square represented an area of 200 hectares. It should be noted that most occurrences of karri forest are in patches of 10 hectares or less. The 1:1 000 000 scale map is clearly of the *gross* forest area, and as well as karri forest there are many non-forest and jarrah-marri forest areas included in the area mapped as 'tall forest'. Beard attributes the 'tall forest' category to mainly karri, with some jarrah and marri. Transparent overlays which showed alienated land, reserves and vacant Crown Land were used to estimate the area of each original natural vegetation unit that was cleared. They assumed reserves and vacant Crown Land were not cleared, and that all alienated land was cleared. Beard and Sprenger (1984) estimate the current area and the original area of karri forest. However, they note in their text 'Our Karri figure ..... is inflated by generalisations at the 1:1 000 000 scale including areas of other forest and non-forest types'.

CALM's Aerial Photographic Interpretation of 1:15 840 scale aerial photographs was used to estimate the net area of pre-European distribution of karri forest.

CURRENT DISTRIBUTION OF FOREST COMMUNITIES

The most accurate source of forest community information available is that using aerial photographic interpretation (API) of the Forests Department of Western Australia 1:15 840 scale photographs taken in the 1960s. This scale allows patches of about two hectares to be discriminated. These API data have been incorporated into CALM's Forest Management Information System (FMIS) database.

Aerial Photo Interpretation (API) Maps

Aerial photo interpretation of Crown land hardwood forests in the south-west was completed in the period 1956-1966.

The classification is based on standard characteristics such as stand structure, crown cover and codominant height. The presence of tree species is recorded where it constitutes more than 20 per cent of the larger trees.

Additional classification of heathland (flats), non forest, thick scrub, fire damaged forests and senescent forest was also undertaken. This information was used to discriminate forest types from 'non forest' in the assessments.

Forest Management Information System (FMIS)

The Forest Management Information System (FMIS) is a grid-cell based computer system for storing thematic maps, overlaying them, and extracting area statements. The maps for each 'theme' (e.g. tenure, forest vegetation type, or river watershed) are stored independently. The thematic information for each one is stored as a one or two character code on each grid cell, and 256 different such codes are possible for each theme. Most basic maps in the system use only single character codes, but a few such as year of past cutting or regeneration require a two digit code on each cell.

The cell size is approximately 140 metres square, which gives it an area of about two hectares. All map information is input and stored in eight kilometre square blocks of grid-cells, based on the Australian Map Grid coordinate system. The map data for the south-west forest region covers an area of about two million hectares. Data entry is by digitising and manual coding, and extensive facilities exist for comparative checking, verification, correction and updating of the map data.

The main function performed by the system is map overlay and subsequent extraction of area statements and scale plots. Any number of maps may be overlaid simultaneously, with any required complexity of code combinations. FMIS is a computer graphics system. Data can be transferred to or from other systems.

CRITERIA FOR PROTECTION OF BIODIVERSITY

The criteria for biodiversity protection is outlined in the Commonwealth's Reserves Criteria paper. The paper states that:

> *'Reservation benchmarks should be varied for different forest communities according to extent, natural rarity, past depletion and the level of threat to their continued existence. As a broad benchmark, 15 per cent of the 'pre-1750' distribution of each forest community should be represented in the dedicated conservation reserve system, thus varying the proportion of the* **existing** *distributions of forest communities in reserves according to depletion from past clearing.'*

The JANIS Reserves Criteria Paper states that:

> **'Cognisance should be taken of the international goal of '10 per cent of each biome' as defined by the Caracas declaration in determining an appropriate baseline level of reservation for each ecosystem type.'**
>
> **'Though large reserves are a desirable management objective, a range of reserve sizes may be considered appropriate to adequately sample the range of forest ecosystem types and other biological communities. In addition, such reserves should be supported by sympathetic off-reserve management and by multiple-use reserves.'**
>
> **'Adequacy should be addressed on a case-by-case basis using a range of attributes, e.g. adequacy in terms of viable population, size, amount of habitat remaining and the special needs of rare and threatened ecosystems and species.'**

ANALYSIS OF 'PRE-1750' DISTRIBUTION OF FOREST TYPES

Table 2: Pre 1750 distribution - jarrah forest (data on a 'gross' basis)

Area of 'pre-1750' distribution (ha)	3 122 000
Area in formal reserves (ha)	481 700
% in formal reserves	15.4
Area in informal reserves (ha)	124 800
% in informal reserves	4.0
Area in all reserves (ha)	606 500
% in all reserves	19.4
Area required to meet JANIS target (ha)	312 200
Additional area required to meet JANIS target (ha)	Nil
Area required to meet Commonwealth target (ha)	468 300
Additional area required to meet Commonwealth target (ha)	Nil

Table 3: Pre 1750 distribution - karri forest (data on a net basis)

Area of 'pre-1750' distribution (ha)	231 400
Area in formal reserves (ha)	53 600
% in formal reserves	23.1
Area in informal reserves (ha)	27 200
% in informal reserves	11.7
Area in all reserves (ha)	80 800
% in all reserves	34.9
Area required to meet JANIS target (ha)	23 140
Additional area required to meet JANIS target (ha)	Nil
Area required to meet Commonwealth target (ha)	34 710
Additional area required to meet Commonwealth target (ha)	Nil

Summary of Analysis

This analysis shows that the area of jarrah and karri forest in the formal reserve system meets both the JANIS and Commonwealth benchmarks. In addition, there are large areas in the informal reserve system. There is, however, no need to consider informal reserves for the pre 1750 analysis. No forest areas need to be deferred from timber harvesting so as not to foreclose options for a future CAR reserve system.

SUB-REGIONAL ANALYSIS - JARRAH FOREST

Due to the broad geographic extent of the jarrah forest type it was considered desirable to undertake a sub-regional analysis to check whether the reserves in the jarrah forest adequately covered the geographic range and environmental gradients with the region.

Many authors have described the influence of climate, landforms and soils in determining the distribution of plant communities in the south-west forest area (Diels, 1960; Havel 1968; Christensen, 1992). Rainfall is the most obvious east-west climatic gradient to utilise for this purpose. The evaporation gradient which operates in a north-south context is another primary influence on forest vegetation.

The 1000 mm rainfall isohyet was used to segregate high and low rainfall strata. The Preston River, with an eastward extension, was used to segregate the north-south evaporation strata. (Map 2).

Table 4: Sub-regional analysis - jarrah forest

	Sub-region				
	Northern Jarrah <1000mm	*Northern Jarrah >1000mm*	*Southern Jarrah <1000mm*	*Southern Jarrah >1000mm*	*TOTAL*
Area of 'pre-1750' distribution (ha)	910 300	433 300	1 147 000	631 400	3 122 000
Area in formal reserves (ha)	192 300	34 600	142 500	112 300	481 700
% in formal reserves	21.1	8.0	12.4	17.8	15.4
Area in informal reserves (ha)	27 900	24 300	38 100	34 500	124 800
% in informal reserves	3.1	5.6	3.3	5.5	4.0
Area in all reserves (ha)	220 200	58 900	180 600	146 800	606 500
% in all reserves	24.2	13.6	15.7	23.2	19.4
Commonwealth target % to be reserved	10	10	10	10	15
Area required to meet Commonwealth target (ha)	91 030	43 330	114 700	63 140	468 300
Additional area required to meet Commonwealth target (ha)	Nil	Nil	Nil	Nil	Nil

Summary of Analysis

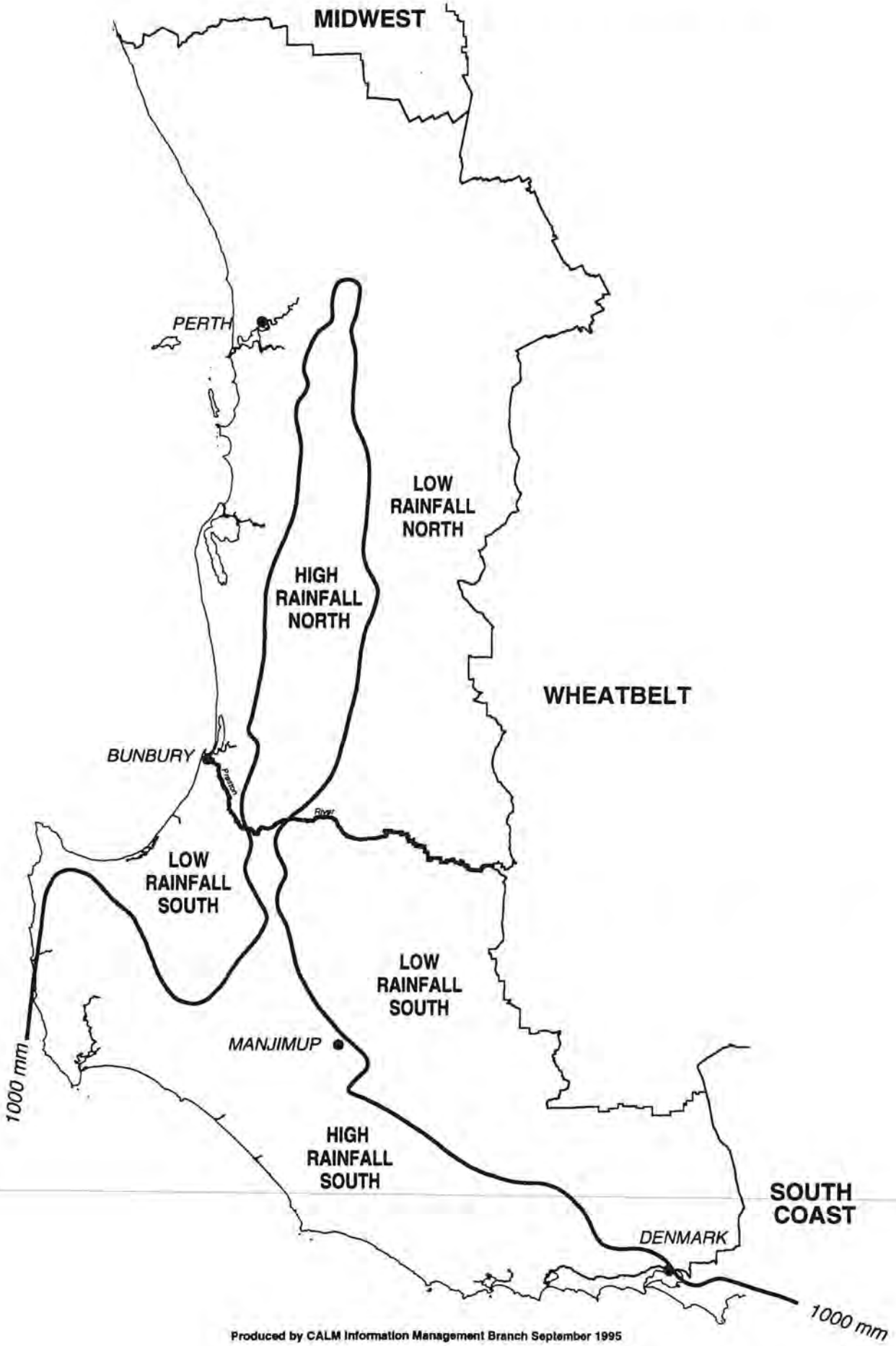
This analysis shows that the area of jarrah forest in the formal reserve system in each of the sub-regions of the jarrah forest, except the high rainfall northern jarrah sub-region, meets the Commonwealth benchmark of 10 per cent for a sub-regional analysis. There is, therefore, no need to consider informal reserves for those sub-regions.

For the high rainfall northern jarrah sub-region, the spread of formal reserves appears to cover the geographic range. Informal reserves provide a practicable method of protecting additional areas within this sub-region. Administrative (informal) reserves on 4th order and higher order streams (150-400m wide) are estimated to comprise at least 40 per cent of the total area of administrative reserves in this sub region (based on data for the Southern Forest Region).

The area of forest in formal reserves and the largest informal reserves in the high rainfall northern jarrah sub-region therefore exceeds 10 per cent. No forest areas need to be deferred from timber harvesting so as not to foreclose options for a future CAR reserve system.

BOUNDARY OF SUB - REGIONS USED FOR THE FOREST SUB - REGIONAL ANALYSIS

Map 2



Produced by CALM Information Management Branch September 1995

FOREST COMMUNITY ANALYSIS - SOUTHERN FOREST REGION

In order to check that particular forest communities are adequately distributed in reserves across the region, a forest community analysis was considered desirable. The FMIS dataset was used to define four forest community types: jarrah, mixed jarrah, karri and mixed karri. This analysis could only be conducted for the southern Forest Region. No equivalent data is available for the Central Forest and Swan Regions.

Table 5: Forest community analysis - Southern Forest Region

	FOREST TYPE			
	Karri		*Jarrah*	
	karri community type	*mixed karri community type*	*jarrah community type*	*mixed jarrah community type*
Area of current distribution (ha)	90 950	92 590	302 990	294 240
Area in formal reserves (ha)	26 860	22 540	102 770	71 840
% in formal reserves	29.5	24.3	33.9	24.4
Area in informal reserves (ha)	13 380	13 730	10 410	24 810
% in informal reserves	14.7	14.8	3.4	8.4
Area in all reserves (ha)	40 240	36 270	113 180	96 650
% in all reserves	44.2	39.2	37.4	32.8
% of forest type cleared	18	18	28	28
Commonwealth target % to be reserved (based on % cleared)	18	18	20	20
Area required to meet Commonwealth target (ha)	16 400	16 700	60 600	58 800
Additional area required to meet Commonwealt target (ha)	Nil	Nil	Nil	Nil

Summary of Analysis

This analysis of current distribution shows that each of the forest communities in the Southern Forest Region are very well represented in the formal reserve system. There are also very large areas within informal reserves. The area of each forest community in formal reserves exceeds the Commonwealth target. Therefore, no forest areas need to be deferred from timber harvesting so as not to foreclose options for a future CAR reserve system.

METHODOLOGY USED TO DEFINE OLD GROWTH FORESTS

The National Forest Policy Statement (1992) defines old growth forest as:

> 'Forest that is ecologically mature (the upper stratum or overstorey is in the late mature to over-mature growth phases) and has been subjected to negligible unnatural disturbance such as logging, roading and clearing.'

The approach taken by Woodgate *et al.* (1994) in East Gippsland, Victoria was examined to determine its suitability for application in the south west forests. The identification of old growth in that study relied on combining datasets for 'forest growth stage' and 'disturbance'.

There is no broadscale mapping of forest growth stages in Western Australian forests and no mapped datasets which could be used as a surrogate for growth stage. The only types of disturbance for which mapped datasets exist are agricultural clearing, timber harvesting and roading. Anecdotal and qualitative information exists for past grazing and mining. The methods employed for this assessment are consistent with, and build on, the previous joint work carried out by CALM and the AHC (CALM/AHC 1992).

The area of old growth forest is dynamic. As the effects of past disturbance diminishes and as trees reach the mature and senescent growth stages, new areas of old growth will be recruited. Other areas will cease to be old growth forest due to wildfires, windstorms, timber harvest or other disturbances.

DEFINITION OF OLD GROWTH

Jarrah Forest

Several options for defining jarrah old growth were considered. However, given limitations in disturbance data and difficulties in verification, options other than virgin forest were discounted. Virgin forest provides the best available surrogate for old growth forest, according to the NFPS definition, for the DFA.

Karri Forest

Due to the absence of mapped data pertaining to tree age and the nature of past disturbance, especially timber harvest, in the karri forest, virgin is the only suitable surrogate for old growth forest for the DFA.

The definition of old growth may be reviewed during the RFA.

CRITERIA FOR PROTECTION OF OLD GROWTH

The Commonwealth has proposed interim arrangements for setting aside old growth on public land (Commonwealth of Australia, 1995).

- Where forest types have been extensively cleared, little old growth remains, forest types represent refugia and forest types are vulnerable to further loss.
  - Ninety per cent of old growth should be reserved (at least 40 per cent in dedicated conservation reserves).
- Where forest types have 10-25 per cent old growth remaining.
  - Ninety per cent to 60 per cent of old growth should be reserved (at least 40 per cent in dedicated conservation reserves)
- Where forest types have more than 25 per cent old growth remaining.
  - Sixty per cent of old growth should be reserved (at least 40 per cent in dedicated conservation reserves)

The Commonwealth also recognises that the rarity or abundance of old growth may also need to be established in absolute terms, based on the remaining area of the forest type as a whole.

> 'In the case of a forest type that is relatively widespread and retaining large contiguous areas of old growth, for example, a somewhat lesser amount than that calculated from strict application of the linear scale, may prove adequate.'

The criteria in the JANIS paper states:

> 'Using the definition given in the National Forest Policy Statement (and with particular regard to the pre-European level of disturbance), old growth should be adequately sampled by the application of the CAR process in planning forest reserve systems with particular emphasis on providing sufficient protection to old growth for the maintenance of biodiversity. Ideally old growth should be adequately conserved for all forest types.'

The JANIS criteria are clearly more flexible than the Commonwealth criteria.

Western Australia's position is that jarrah old growth should be protected at the percentage levels prescribed in the Commonwealth Reserves Criteria Paper less 10 per cent. The Commonwealth referred this issue to a Scientific Panel which concluded as follows:

> 'The Panel accepts that Jarrah is a widespread species and is the dominant or co-dominant canopy species in the old growth areas under consideration. The Panel agrees that the extensive nature of Jarrah would warrant consideration under the flexibility criteria for old growth reservation benchmarks. However, the Panel agreed that it would need to be satisfied either that the broad Jarrah forest type is relatively homogenous in terms of structural and floristic diversity or, if the forest type is heterogenous, that this heterogeneity is well sampled in the existing reserve system. The Panel considered that the information available was insufficient to disaggregate sub-units that might better reflect the biodiversity of the Jarrah forest. The issue could be fully assessed in the RFA.'

The Scientific Panel also concluded that not all of the linear administrative reserves could be accredited as contributing to CAR reserve values for the DFA. This was not a unanimous opinion of the Panel. The Commonwealth's concern in relation primarily to edge effects has led to a precautionary deduction of the area of narrow linear reserves (1st, 2nd and 3rd order riparian reserves and level two road reserves) from the total area of formal and informal reserves. A deduction of 25 per cent of the area of wide (level one) road reserves for 'internal edge effects' has also been made as a precautionary measure for the DFA.

CALM does not agree with the findings of the Scientific Panel and this issue will be further considered during the public consultation phase and again in the RFA.

ANALYSIS TO ASSESS PROTECTION OF OLD GROWTH KARRI FOREST

Table 6:- Old growth analysis - karri forest

Area of old growth in all tenures (ha)	83 500
% of extant old growth in all reserves	66
Extant distribution of karri forest (ha)	190 000
Old growth as a % of extant distribution	44
Commonwealth target % to be protected	60
Area required to meet Commonwealth target (ha)	50 100
Area in all formal and informal reserves (ha)	55 400
Deduction for narrow riparian reserves	3 860
Deduction for narrow road reserves	360
Deduction for internal edge effects on wide road reserves	660
Area of reserves accredited	50 520
Additional area required to meet Commonwealth target (ha)	Nil

Data as at December, 1993

Summary of Analysis

This analysis shows that the area of old growth karri forest in reserves exceeds the Commonwealth target. The Commonwealth has expressed some concern over edge effects on linear reserves. However, CALM has undertaken to ensure that timber harvest will not foreclose options for wider informal reserves during the period of development of the Regional Forest Agreement. Therefore, no forest areas need to be deferred from timber harvesting so as not to foreclose options for a future CAR reserve system.

ANALYSIS TO ASSESS PROTECTION OF OLD GROWTH JARRAH FOREST

Table 7: Old growth Analysis - jarrah forest

	Northern	*Southern*
Area of old growth in all tenures (ha)	41 190	281 890
% of extant old growth in all reserves	80	55
Extant distribution of jarrah forest	773 700	940 500
Old growth as % of extant distribution	5.3	30
Commonwealth target % to be protected	90	60
Area required to meet Commonwealth target (ha)	37 070	169 130
Area in formal and informal reserves (ha)	32 840	153 960
Deduction for narrow riparian reserves	1 530	8 920
Deduction for narrow road reserves	-	1 040
Deduction for internal edge effects on wide road reserves	-	1 040
Area of reserves accredited	31 310	142 960
Additional area required to meet Commonwealth target (ha)	5 760	26 170
Commonwealth target % to be protected less 10%	80	50
Area required to meet Commonwealth target less 10% (ha)	32 950	140 950
Additional area required to meet Commonwealth target less 10%	1 640	Nil

Data as at December, 1993

Summary of Analysis

This analysis shows that with a 10 per cent reduction in the Commonwealth benchmark, the area of old growth jarrah forest in reserves meets the Commonwealth target for the southern jarrah forest but there is a difference of 1640 hectares for the northern jarrah forest.

Without a reduction in the Commonwealth benchmark, there is a difference between the Commonwealth's benchmark and the area accredited in reserves of 5760 hectares of old growth jarrah in the northern forest and 26 170 hectares of old growth jarrah in the southern forest. The arrangement for interim protection of this area is described in a later section of this report. Interim protection will need to take account of the fact that distribution of jarrah old growth is significantly different in the northern jarrah forest compared to the southern jarrah forest due to the historical pattern and progression of timber harvest.

The Commonwealth has expressed some concern over edge effects on linear informal reserves. CALM has undertaken to ensure that timber harvest will not foreclose options for wider informal reserves during the RFA period.

WILDERNESS ASSESSMENT

The Commonwealth's Deferred Forest Assessment position paper states that 'Ideally, criteria that have been agreed nationally between the States and the Commonwealth will be applied to the assessments'. In relation to data sets for assessment of wilderness the paper stated:

> 'For consistency, the National Wilderness Inventory (NWI) database will provide the framework for wilderness assessments in all States. Updating of the database will be undertaken where necessary and where feasible within the timeframe. State assessment of wilderness may augment the extent of areas defined by the NWI method.'

The Commonwealth's Proposed Reserves Criteria position paper proposes the following interim arrangement for wilderness reservation:

> 'Ninety per cent, or more wherever practicable, of the areas of high quality wilderness (NWI equal to or greater than 12) that meet minimum area requirements be protected, and no activity undertaken inside or adjacent to that area that would reduce the NWI rating of the wilderness areas.'

Western Australia does not accept the Commonwealth's criteria for wilderness reservation. Western Australia prefers the JANIS criteria which states:

> 'Using existing definitions and the National Wilderness Inventory, wilderness quality should form a sequential overlay criterion in the selection process for a forest reserve system that meets both the objectives of protecting biodiversity and wilderness values. It is not envisaged that wilderness values will be protected on a representative basis for each forest type.'

CALM applied the NWI model to the south-west forest region using CALM datasets for themes such as roads and disturbances. AHC officers checked the application of the model and coding of data.

Two processes for the assessment of wilderness quality were undertaken. The Commonwealth's preferred method was to apply a size threshold across all areas which were identified as having an NWI rating of 12 or more. CALM's preferred method was to apply a size threshold across areas which were identified using separate ratings thresholds for each of the four NWI components. This method was used to assess wilderness quality in East Gippsland and Central Highlands in Victoria in the joint studies undertaken by The Australian Heritage Commission and the Victorian Department of Conservation and Natural Resources. (AHC/CNR, 1994).

Initially, maps of NWI were produced using a one kilometre grid cell size. While this scale of data provided an overall view of the distribution of NWI 12 or greater wilderness, it was felt that a finer resolution was required in order to accurately identify wilderness areas. Further investigations using a grid size of 500 metres were therefore undertaken which enable wilderness areas to be assessed.

CALM's preferred size threshold was 10 000 hectares, while the Commonwealth preferred 8000 hectares. In undertaking the assessment of wilderness, both size thresholds were investigated. In addition, the separate NWI component threshold methodology preferred by CALM was also investigated. A sensitivity analysis using a range of thresholds for each indicator was undertaken to determine the effects of the thresholds on wilderness quality.

Applying the different methodologies allowed the separate analyses to inform the overall assessment of wilderness quality in the three regions. The result of the applications of both CALM and the Commonwealth's preferred methodologies is that no wilderness areas were identified.

It was agreed that the final determination of thresholds will be undertaken in the RFA.

CONSERVATION OF DECLARED RARE (THREATENED) FLORA AS APPLICABLE TO THE CONSERVATION OF FEDERAL ESP ACT SCHEDULE TAXA IN DEFERRED FOREST ASSESSMENT AREAS

CALM Policy Statement No. 9 'Conservation of Threatened Flora in the Wild' and the associated Administrative Instruction No. 24 'Protection of Endangered Flora in Departmental Operations on CALM Managed Public Land' provide the framework for CALM's management of threatened flora. These statements are augmented by the Forest Management Plan 1994-2003 in relation to CALM's forest management operations. Management Programs (defined as including Recovery Plans) for Threatened Flora are also prepared pursuant to Policy No. 44 'Wildlife Management Programs'.

Priorities for threatened flora research and other operations are considered pursuant to CALM Policy No. 50 'Setting priorities for the conservation of Western Australia's threatened flora and fauna'.

In addition to its legal and policy obligations CALM also maintains a priority flora list which includes plant taxa, listed according to priority codes:

- that have recently been removed from the schedule of Threatened Flora; or,
- that have been adequately surveyed and are considered to be naturally uncommon but under no apparent threat through identifiable factors; or
- that are poorly known and hence there is insufficient information for reasonable assessment to be made of their status, in terms of possible inclusion on the Threatened Flora list.

The priority flora are also specially considered in terms of CALM's operations planning and preparation of management prescriptions and programs. Special efforts are made, involving surveys and research, in relation to the poorly known flora to determine if they should be added to the Threatened Flora list.

It is important to recognise that because of the comparatively uniform habitats of commercially harvested forest areas in relation to heathlands and other areas of the southwest, comparatively very few threatened plant taxa occur in those areas. Indeed, the vast majority of DRF taxa that are known to occur in the overall forest regions, actually occur in the vicinity of streams, heaths, rock outcrops etc., and not in the open tall forest areas.

The major actions undertaken by CALM for threatened flora conservation and protection in relation to the Deferred Forest Assessment are:

- the identification of taxa that are threatened with extinction;
- the listing of threatened taxa as Declared Rare Flora under the WC Act;
- field location and marking of populations of threatened flora;
- surveys for populations of threatened flora;
- maintenance of a computerised Declared Rare (Threatened) Flora Database, comprising information on location and size of all known populations of DRF;
- maintenance of rare flora population locations on operations mapping and planning systems;
- nominated Threatened Flora Officers whose duties include ensuring that Policy 9 and AI 24 are complied with in operations;

- operation of Threatened Flora Recovery Teams, that have been formed for the Southern Forest Region, Central Forest Region and Swan Region, with the task of preparing and implementing threatened flora management programs (Recovery Plans) for the management of all threatened flora within those regions.
- identification, reservation and management of conservation reserves to protect areas of high nature conservation value, including populations of threatened flora; and
- protection, under the Forest Management Plan, of areas of special biological value as either River and Stream (Riparian) Zones or Diverse Ecotype Zones. Travel route zones also afford special protection.

As mentioned above CALM has formed Threatened Flora Recovery Teams for each of the three forest regions and also has individual threatened flora officers nominated within the forest regions and districts.

The strategies outlined above are seen as effective means of ensuring the conservation of threatened flora taxa throughout the Deferred Forest Assessment region.

CONSERVATION OF THREATENED FAUNA AS APPLICABLE TO CONSERVATION OF FEDERAL ESP ACT SCHEDULE TAXA IN DEFERRED FOREST ASSESSMENT AREAS

CALM Policy Statement No. 33 'Conservation of threatened and specially protected fauna in the wild' and Administrative Instruction No. 44 'Protection of endangered fauna in Departmental Operations' provide the framework for CALM's management of threatened fauna. These statements are also augmented by the Forest Management Plan 1994-2003 in relation to CALM's forest management operations. Management Programs (Recovery Plans) for Threatened Fauna are also prepared pursuant to Policy No. 44 'Wildlife Management Programs'.

Priorities for threatened fauna research and other operations are considered pursuant to CALM Policy No. 50 'Setting priorities for the conservation of Western Australia's threatened flora and fauna'.

The major actions undertaken by CALM for threatened fauna conservation and protection in relation to the Deferred Forest Assessment are:

- the identification of taxa that are threatened with extinction;
- the listing of threatened taxa as specially protected fauna under the WC Act;
- surveys for populations of threatened fauna;
- maintenance and development of a central computerised threatened fauna locational database;
- maintenance of information on known populations of threatened fauna on operations, mapping and planning systems;
- nominated threatened fauna officers whose duties include ensuring that Policy 33 and AI 44 are complied with in operations;
- establishment and operation of recovery teams for development and implementation of recovery plans;
- protection of critical habitat elements, such as den logs and tree hollows, in timber harvest prescriptions;
- establishment and management of conservation reserves to protect habitats of threatened fauna;
- protection of areas of special biological significance from significant disturbance as either River and Stream (Riparian) Zones or Diverse Ecotype Zones. Travel route zones also afford special protection.

CALM has established 12 recovery teams for threatened fauna, each with CALM as well as non-CALM representatives. These teams have prepared, or are preparing recovery plans for the identified taxa, in most cases in association with the ANCA, covering each of the ESP Act endangered fauna taxa dependent to some extent on the major forest areas.. It is the duty of the teams to ensure that the recovery plans are implemented and that the taxa nominated are recovered from their threatened status. In order to achieve this, recovery plans identify key habitat areas, survey requirements and management actions necessary to assist recovery.

In the process of planning for forest management operations CALM routinely consults maintained records on known populations of threatened fauna, obtained from targeted forest fauna surveys. Extensive forest fauna surveys have been completed over key habitat areas. The strategy followed, encompassing reference to the results of past targeted surveys, ongoing targeted surveys and operations of threatened fauna recovery teams and threatened fauna officers, combined with the other actions outlined previously and detailed below, is seen as an efficient means of conserving threatened fauna.

A key threatened fauna conservation action is the ongoing development of a conservation reserve system which is representative of vegetation types occurring throughout the forest and thus covering the habitat elements for the fauna. Where endangered or vulnerable (i.e. threatened) taxa populations are known to occur, special reservation is made for them. This is relevant for the Numbat and Woylie for which the Perup Nature Reserve was principally established. In the Forest Management Plan 1994-2003 reservation has been proposed for a portion of Witchcliffe Forest Block to enhance protection of the White-bellied Frog. Other land management options to protect threatened fauna habitat include creation of Diverse Ecotype Zones and River and Stream (Riparian Zones) described in the Forest Management Plan, 1994-2003. Riparian zones are known to be important foraging habitat of the Chuditch. Furthermore, critical habitat elements, such as tree hollows and den logs, are protected under timber harvest prescriptions. The jarrah harvesting prescription provides for the retention of habitat trees and den logs for the Chuditch where these may be limiting (see Attachment for criteria for selection of habitat trees and den logs).

The strategies outlined above are seen as effective means of ensuring the conservation of threatened fauna taxa throughout the Deferred Forest Assessment region.

INTERIM PROTECTION OF FOREST AREAS REQUIRED TO MEET COMMONWEALTH CRITERIA AND FOREST HARVESTING IN RELATION TO WOODCHIP EXPORT LICENCES FOR 1996 AND 1997

The assessments carried out for protection of biodiversity and wilderness values revealed that no forest areas need to be deferred from forest harvesting so as not to foreclose options for a CAR reserve system. Similarly, the assessment of old growth karri forest indicated that no options would be foreclosed during the preparation of a RFA.

The only attribute where a difference was found against the Commonwealth's criteria was for old growth jarrah forest. The interim protection of old growth jarrah will be undertaken in two sub-regions due to the variation between the northern and southern jarrah forest.

NORTHERN JARRAH FOREST

A difference of 5760 hectares was identified for the 90 per cent reservation benchmark in the northern jarrah forest.

As an interim protection arrangement the State proposes to defer this area of jarrah old growth forest north of the Preston River from timber harvest during the RFA preparation.

CALM will issue instructions to forest planners in the Swan Region and Central Forest Region to exclude these areas of jarrah old growth forest from coupes planned for timber harvest during 1996 and 1997 or until the RFA is completed, whichever is the soonest.

SOUTHERN JARRAH FOREST SUB-REGION

The Commonwealth criteria recognises that the rarity of abundance of old growth may also need to be established in absolute terms, based on the remaining area of the forest type as a whole.

> **'In the case of a forest type that is relatively widespread and retaining large contiguous areas of old growth, for example, a somewhat lesser amount than that calculated from strict application of the linear scale, may prove adequate.'**

CALM believes that a lower benchmark of 50 per cent should be applied to the southern forest. In this case, no areas would need to be deferred from timber harvesting so as not to foreclose options for a CAR reserve system.

A difference of 26 170 hectares was identified between the Commonwealth 60 per cent benchmark and the accredited reserve area for the old growth in the southern jarrah forest.

As an interim protection arrangement the State proposes that 27 500 hectares of old growth jarrah forest will be deferred from timber harvesting within national estate places in the southern jarrah forest.

It has been established that additional large contiguous areas of old growth jarrah, representative of the geographic range, can be found in the following national estate places and sub areas:

National Estate Place	*Sub Area*
Boorara	--
Bow River	Irwin
Deep	South Weld
Deep	Walpole River
Denbarker	Hay
Denbarker	Lindesay
Denbarker	Mitchell
Denmark	Kent
Denmark	Clearillup
D'Entrecasteaux	Andrews
D'Entrecasteaux	Boggy Creek
D'Entrecasteaux	Malimup
D'Entrecasteaux	Meerup
D'Entrecasteaux	Naenup
Frankland	Collis
Frankland	E. Frankland
Giblett-Hawke	Lower Donnelly
Giblett-Hawke	S.W. Carey Brook
Giblett-Hawke	Warren
Roe	Long
Roe	Spring
Shannon	Fish Creek
Shannon	Middle Shannon
Warrup	--
Willmott	--

CALM will instruct the planning officer for the Southern Forest Region to exclude areas of jarrah old growth forest in these twenty-five national estate places from timber harvest during 1996 and 1997 or until the RFA is completed, whichever is the soonest.

Minor clearing of old growth jarrah forest may be necessary in these national estate places, during the RFA period, associated with infrastructure development and fire protection.

ISSUES TO BE RESOLVED DURING THE PREPARATION OF A REGIONAL FOREST AGREEMENT

There are a number of issues which arose during the Deferred Forest Assessment, which will need to be addressed by the governments during the preparation of a Regional Forest Agreement. These issues include:

- Region boundary and utilisation of IBRA regions
- Definition of forest (as opposed to woodland)
- Definition of old growth forest
- Assessment of forest types, other than jarrah and karri
- Contribution of administrative reserves to CAR values
- Methodology for wilderness assessment, including thresholds for individual wilderness indicators
- Reserves criteria to be used

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APPENDIX 1

VESTING, TENURE AND PURPOSE OF LAND MANAGED BY CALM

The following describes the system of classification, reservation and vesting which applies to lands, including forest lands, and waters managed by the Department of Conservation and Land Management.

THE CONTROLLING BODIES AND THE DEPARTMENT

The proclamation of the Conservation and Land Management Act in 1985 established two controlling bodies (the National Parks and Nature Conservation Authority and the Lands and Forest Commission) in which land is vested. The Act also established the Department of Conservation and Land Management which is responsible for management of the land vested in the controlling bodies.

The membership of the controlling bodies is representative of the many community interests associated with the lands vested in them.

VESTING AND MANAGEMENT

State forests and timber reserves are vested in the Lands and Forest Commission (LFC). National parks, conservation parks and nature reserves are vested in the National Parks and Nature Conservation Authority (NPNCA). 5(g) Reserves and miscellaneous reserves may be vested in either body.

The Department is responsible for management of lands vested in the Authority and the Commission. Management is carried out according to government policies, and as specified in management plans submitted by the controlling bodies and approved by the Minister for the Environment.

Tenure

'Land tenure' is the term used to describe the form of right, or title to land. The two broad classes of land tenure are private land and Crown land. Crown lands which are managed by the Department fall into two broad categories: reserves and State forests.

SECURITY OF TENURE OF LAND

In Western Australia, the security of tenure of Crown land reserves varies, depending upon whether the reserve is Class A, B or C.

A Class reserve - tenure can be changed only by agreement of both Houses of the Western Australian Parliament.

B Class reserve - tenure can be changed by the Governor of Western Australia on the recommendation of the Minister, without approval by Parliament. However, the reasons for any change must be reported to Parliament by the Minister for Lands.

C Class reserve - tenure can be changed by the Governor, on the recommendation of the Minister. However, any changes must be published in the Government Gazette.

This system therefore determines the degree of difficulty involved in changing the tenure of Crown land.

Most national parks and nature reserves are A Class reserves. However, some national parks and nature reserves were given B or C Class status when they were created many years ago and this status has persisted.

The security of tenure of State forest is the same as that of an A Class reserve. State forest is not a 'reserve', and therefore is not classed A, B or C. However, any change to the tenure of a State forest requires the agreement of both Houses of Parliament.

Land for which no management plan exists is to be managed by the Department in accordance with the purpose of the land, as specified in section 56 of the Act. In the case of national parks, nature reserves and conservation parks which do not have a management plan, only necessary operations may be undertaken. These operations are defined as 'those that are necessary for the preservation or protection of persons, property, land, flora and fauna or for the preparation of a management plan'.

TENURE CATEGORIES

The categories used for the classification of tenure are described in detail here. The descriptions have been compiled from the CALM Act, the three Forest Regional Management Plans of December 1987, the Forest Management Plan 1994-2003 and various management plan documents.

In the following the terms ***Land Act (1933)*** reserve and **Crown reserve** are used interchangeably, and have the same meaning. Also the convention of capitalising the tenure categories has been adopted for emphasis and consistency and to avoid confusion with other interpretations, e.g. Timber Reserve under the CALM Act versus Land Act timber reserve (Crown reserve with purpose 'Timber').

(i) State Forest

Within the meaning of the CALM Act, land categorised as *State Forest* is Crown land reserved under the CALM Act which:

- immediately before the commencement of the CALM Act was dedicated as a *State Forest* under the *Forest Act 1918*. (On the proclamation of the CALM Act all of these lands were automatically vested in the Lands and Forest Commission.);
- After the commencement of the CALM Act is reserved or set aside and vested in the LFC for the purpose of *State Forest.;*

Vesting:	Lands and Forest Commission.
Security:	Identical to A Class Land Act (1933) reserves, in that the agreement of both Houses of Parliament is required before tenure can be changed.
Management Purpose:	Multiple use.
Identification:	*State Forest* Number.
Established by:	Forest Act (1918), superseded by CALM Act (1984).
Act Reference:	Sections 5(a), 6(1)(c).

(ii) Timber Reserve

Within the meaning of the CALM Act, land categorised as *Timber Reserve* is Crown land which:

- immediately before the commencement of the CALM Act was dedicated as a *Timber Reserve* under the Forest Act 1918. (On the proclamation of the CALM Act all of these lands were automatically vested in the Lands and Forest Commission);

- after the commencement of the CALM Act is reserved or set aside and vested in the LFC for the purpose of *Timber Reserve.*

Vesting:	Lands and Forest Commission.
Security:	Similar to C class.
Management Purpose:	Timber production.
Identification:	Forest Department (FD)/CALM timber reserve number.
Established by:	*Forest Act (1918)*, superseded by *CALM Act (1984).*
Act Reference:	Sections 5(b),.6(2)(c)
Comment:	*Land Act (1933)* land reserved for the purpose of 'Timber' and vested in the Executive Director is included under Miscellaneous Reserves.

(iii) National Park

Within the meaning of the CALM Act, land categorised as *National Park* is land reserved under the Land Act (1933), which:

- Immediately before the commencement of the CALM Act was a *National Park* under the *National Parks Authority Act 1976.* (On the proclamation of the CALM Act all of these reserves were automatically vested in the National Parks and Nature Conservation Authority (NPNCA).)

- After the commencement of the CALM Act is vested in the NPNCA for the purpose of *National Park.*

Vesting:	NPNCA.
Security:	A, B or C Class.
Management Purpose:	Wildlife and landscape conservation, scientific study, preservation of features of archaeological, historic or scientific interest, together with recreational enjoyment by the public.
Identification:	By name (whether named 'officially' or otherwise) or by individual Crown Reserve(s) forming the *National Park.*
Established by:	*Land Act (1933).*
Act Reference:	Sections 5(c), 6(3)(c).
Comment:	The inclusion of the phrase 'National Park' in the name of a reserve does not imply a tenure of *National Park* within the meaning of the CALM Act. Examples of this are Crown Reserve 20215 which has a purpose of 'National Park' and vested in the Shire of Albany, and Crown Reserve 32601 which has a purpose of 'National Park and Historic Building' and jointly vested in the National Trust and the Executive Director of CALM.

(iv) Conservation Park

Within the meaning of the CALM Act, land categorised as *Conservation Park* is land reserved under the *Land Act (1933)* which:

- Is vested in the NPNCA for the purpose of *Conservation Park.*

Vesting:	NPNCA.
Security:	A or C Class.
Management purposes:	Identical to *National Park.*
Identification:	By name (whether named 'officially' or otherwise) or by individual Crown Reserve(s) forming the *Conservation Park.*
Established by:	*Land Act (1933).*
Act Reference:	Sections 5(ca), 6(4).
Comment:	*Conservation Parks* differ from *National Parks* only in their significance, size or condition. They are managed as if they were *National Parks*. The difference is that these areas do not have major national or international significance, are relatively small, or the landscape or biota have been affected by past land use.

(v) Nature Reserve

Within the meaning of the CALM Act, land categorised as *Nature Reserve* is land reserved under the *Land Act (1933)* which:

- Immediately before the commencement of the CALM Act was a *Nature Reserve* under the *Western Australian Wildlife Authority Act 1950* and vested in the Western Australian Wildlife Authority, either solely or jointly.

  On the proclamation of the CALM Act all of these reserves were automatically vested, solely or jointly, in the National Parks and Nature Conservation Authority (NPNCA).

- After the commencement of the CALM Act is vested in the NPNCA for the purpose of *Conservation of Flora or Fauna,* or both *Flora and Fauna.*

- On the proclamation of the *CALM Amendment Act 1991* (amendment number 20 of 1991) was an unvested *Nature Reserve* under the *Western Australian Wildlife Authority Act 1950.* (These were automatically vested in the NPNCA.)

Vesting:	National Parks and Nature Conservation Authority.
Security:	A, B or C class.
Management Purpose:	Wildlife and landscape conservation, scientific study and preservation of features of archaeological, historic or scientific interest.
Identification:	By name (whether named 'officially' or otherwise) or by individual Crown Reserve(s) forming the *Nature Reserve.*
Established by:	*Land Act (1933).*
Act Reference:	Sections 5(d), 6(5)(c).
Comment:	

(vi) 5(g) Reserve

Within the meaning of the CALM Act, land categorised as *5(g) Reserve* is land reserved under the *Land Act (1933)* which:

- Is vested in the NPNCA or the Lands and Forest Commission (LFC) that is not a *National Park, Conservation Park, Nature Reserve, Marine Park or Marine Nature Reserve.*

- Immediately before the commencement of the CALM Act, was vested in, or under the control and management of, the National Parks Authority but not as a *National Park.* (On the proclamation of the CALM Act all of these reserves were automatically vested in the National Parks and Nature Conservation Authority (NPNCA).)

Vesting:	Lands and Forest Commission or National Parks and Nature Conservation Authority.
Security:	Normally B or C class.
Management Purposes:	These reserves have a wide variety of purposes, but normally are related to recreation, wildlife conservation and historical features. As with Timber Reserves, this classification is often transitional, and on further evaluation the classification can be changed to a more appropriate one.
Identification:	Crown Reserve number.
Established by:	*Land Act (1933).*
Act Reference:	Section 5(g).
Comment:	

(vii) Miscellaneous Reserve

Within the meaning of the CALM Act, land categorised as *Miscellaneous Reserve* is land reserved under the *Land Act (1933)* which:

- Immediately before the commencement of the CALM Act was vested in a former departmental head or authority and is not covered by any of the classifications (i) to (vii). (On the proclamation of the CALM Act all of these reserves were automatically vested in the Executive Director.)

- After the commencement of the CALM Act is vested in the Executive Director and is not a *5(g) Reserve.*

Vesting:	Executive Director.
Security:	A, B or C Class.
Management Purposes:	Various
Identification:	Crown Reserve number.
Established by:	*Land Act (1933).*
Act Reference:	Sections 36, 38.
Comment:	

PRINCIPLES FOR 'NON STATUTORY' RESERVES TO BE INCLUDED IN A CAR FOREST RESERVE SYSTEM

The Commonwealth Reserves Criteria Paper proposed a set of principles for the inclusion of forest reserves other than those in the 'dedicated' reserve system (IUCN categories I, II and IV).

The criteria required for inclusion are:

- they contain and are managed for conservation values which unequivocally contribute to the CAR system;
- they have a sound basis in legislation (for example, management plans required under legislation);
- there is the provision of opportunity for public comment on changes to reserve boundaries, and decisions on their establishment and alteration are politically accountable;
- they are able to be accurately identified (on maps);
- they are of sufficient area and adequate design to contribute to the continued viability of the values they seek to protect.

Some of these reserves could have flexible boundaries that might change over time to reflect forest dynamics and the effects of climate change but the conservation 'rules' that determine the area and vegetation type and structure required should remain constant. *(Commonwealth of Australia, 1995)*

The National Forest Policy Statement (1992) defined 'Nature Conservation Reserves' as areas of publicly owned land, including forested land, managed primarily for nature conservation and providing multiple benefits and uses such as recreation and water catchments but excluding wood production. The riparian, diverse ecotype and travel route zones designated in south-west forests meet the NFPS definition.

ANALYSIS OF HOW NON-STATUTORY RESERVES MEET THE COMMONWEALTH'S CAR RESERVES CRITERIA

The Forest Management Plan 1994-2003 identifies three types of 'non-statutory' reserves from which timber harvesting is excluded. Travel route zones, 200 metres to 400 metres wide along level 1 and level 2 travel routes; riparian zones 60 metres to 400 metres wide along all streams, valley headwaters and seepage areas; diverse ecotype zones around wetlands, heath, sedge, herb and woodland communities.

It is impractical for these zones to be included as part of the dedicated reserve system because of the huge cost and difficulty of surveying the boundary of these sites for the purpose of gazettal.

- **Conservation values which contribute to the CAR system**

  Riparian ecosystems (sites with high moisture and high nutrient status) have special importance for species richness and abundance in a range of vertebrate fauna (Wardell-Johnson *et al.*, 1991). These sites provide a critical source of diversity within a forest system.

  Sites lowest in the topography are most valuable for the spectrum of bird species found in any particular forest type and include greater numbers of individuals than upland sites. Sites lowest in the landscape are also valuable for other vertebrate groups and for invertebrate conservation. Many known vulnerable species tend to be found only in lowland habitat and these sites need to be priority areas in wildlife conservation (CALM, 1992)

  In the karri forest, small mammals reach their highest numbers (species and individuals) in sites low in the topography (Christensen and Kimber, 1975). The water rate *(Hydromys chrysogaster)* and the quokka are most common in these sites.

Endangered and threatened fauna that favour riparian habitat include Orange-bellied Frog, Chuditch, Western Ringtail Possum and White-bellied Frog. Species on the Western Australian list that favour riparian habitat include Southern Brown Bandicoot, Tammar Wallaby, Karri Minnow, Short-nosed Snake, Red-eared Firetail.

Sites lowest in the profile are most valuable for the full spectrum of amphibians found in the karri forest including species restricted to these sites (e.g. the frog *Geocrinia lutea*; Wardell-Johnson and Roberts, 1991). All reptiles known in the karri forest also occur in stream zones including two that are most common there *(Chelodina oblonga* and *Egernia luctuosa)*.

The aquatic invertebrate fauna of the karri forest is imperfectly known, but research in the jarrah forest in the south-west of Western Australia (Bunn, 1986; Bunn *et al.*, 1986) suggest that 200-300 species of macro-invertebrate and a large number of smaller animals occur. Many of the species are endemic to Western Australia, and probably a considerable number including Gondwanan relicts are restricted to the karri forest.

Eight species of native fish occur in karri forest streams, seven of which are endemic to south-western Australia. Shelter is important to most species of fish, largely because it provides refuge from the current, and they tend to congregate where log jams or changes in stream contour provide this.

Non-statutory reserves make an essential contribution to the adequacy of the total reserve system, which is essential for a reserve system which aims at a reservation level of 10-20 per cent. Non-statutory reserves provide essential corridors and links between the dedicated reserve system areas. Historical evidence and observation indicates that non-statutory reserves remain viable in the short-term, and rapid regrowth of areas adjacent to the reserves ensures that long-term viability is maintained.

Retained linear strips of mature karri forest have been shown to provide very important nature conservation values. Wardell-Johnson and Williams (in press) showed a very slight and temporary reduction, attributable to timber harvesting, of the total detection of birds in narrow remnants versus sites near the edge of wide remnants. There was no significant impact on any individual species of bird. The retained mature forest had a strong positive effect on the bird community in the adjacent logged forest. The results demonstrated a slight and temporary negative edge effect on the bird community within the retained linear strip, which was more than balanced by a major positive edge effect on the bird community within the adjacent logged forest.

Research has indicated that to be effective in protecting water quality, stream buffers should protect both permanent and ephemeral streams, including headwater seepage areas and spring heads, and should extend along the entire stream length (Borg *et al.* 1987; Borg *et al.* 1988; CALM, 1992). CALM's stream reserves are much wider than necessary for the protection of water quality and are designed for broad nature conservation values (CALM, 1988).

Riparian zones also protect significant areas of old growth forest. Timber harvest prior to 1940 largely excluded stream zones because of the railway formation and extraction systems employed in logging. Riparian zones therefore contain a high proportion of their area as old growth forest.

The variable minimum width of riparian zones according to stream order is presented in the table below:

Stream Order	*Width either side (approx.) (m)*	*Total width (approx.) (m)*	*Minimum width either side (m)*
First	30	60	20
Second	30	60	20
Third	30	60	20
Fourth	75	150	50
Fifth upwards	200	400	100

The selection of the boundary of riparian zones requires field officers to identify and demarcate the distinctive riparian vegetation to be excluded from timber harvest. In many cases the width of the riparian zone is much (where it exists) wider than the minimum width prescribed according to stream order. Where stream terraces are identified, they are fully protected by the zone width.

In addition to riparian zones, there are a large number of sites of exceptional importance because of habitat diversity. For example, areas of heathland, sedge and herb vegetation, rock outcrops, swamps, lakes, wetlands and woodland formations can have outstanding species richness (Hopper *et al.*, 1992; Wardell-Johnson and Christensen, 1992).

These sites often represent ecotones between major landscape features. Ecotonal features are known to be significant and valuable sites for wildlife conservation (Wardell-Johnson *et al.*, 1991).

Travel route zones which are between 100 metres and 200 metres wide and often several kilometres in length also provide for important nature conservation values. They are often representative of upland sites because of the tendency for major roads to be located on ridgelines. They also contain old growth forest values and habitat components such as hollows for birds and mammals which require them. These zones also provide corridors which link catchments.

Non-statutory reserves are critical for the conservation of floral biodiversity. Most rare flora species occur in non-statutory reserves. Granite outcrops, diverse ecotypes and riparian areas are the prime habitats for these species (Kelly *et al.* 1990, Hopper *et al.* 1992). Three species of endangered flora and nine species of vulnerable flora occur in riparian areas within multiple use State forest. Riparian areas sample a very large range of both overstorey and understorey vegetation types and road reserves increase the representation of upland vegetation types (Havel 1975, Heddle *et al.* 1980, Strelein 1988).

Much more variation occurs in riparian vegetation communities than in upland areas. To be comprehensive and representative it is therefore important that the reserve system has some bias towards riparian areas.

Strips of retained forest are able to serve several roles which large blocks cannot (Taylor, 1990). By spreading the undisturbed forest over a wider area, more diverse types of habitat can be retained. A broader range of species can be catered for and their value in providing refuge will be maximised. This can be particularly important for invertebrate species with poor dispersal ability. Non-statutory reserves provide old growth forest characteristics throughout the landscape. Nest sites are then provided close to feeding sites, and these areas provide sites from which rapid recolinisation of regrowth areas can occur.

Harris and Scheck (1991) argue that a managed, interconnected system of protected areas that utilises movement corridors is better than a system of dispersed protected areas with no connected corridors.

The nature conservation value of the riparian, diverse ecotype and travel route zones is enhanced by the sympathetic management of adjoining forest which is subject to timber harvest, but is also managed to preserve the extent of flora and fauna (Christensen, 1992).

Nesting hollows are the principal nature conservation value of old growth forest. Recent studies have shown that logging of jarrah forest has had little impact on the availability of hollows. These studies have also shown that very few hollows are used, therefore, hollows are not a limiting factor for the fauna.

The non-statutory reserves require only minor variations to normal forest management to maintain the biological and old growth values that they protect. During timber harvest operations, entry of logging equipment is excluded from these zones, unless specifically authorised by a forest officer. Thinning and removal of dangerous trees is permitted in travel route zones. In most cases the riparian zones and diverse ecotype zones are kept free of fire when regeneration burning is carried out in adjacent coupes.

- **Basis of legislation**

The Conservation and Land Management Act as amended in 1991 requires that management plans will be prepared for indigenous State forests, specifying the purpose or combination of purposes to be one or more of the following:

(a) conservation;
(b) recreation;
(c) timber production on a sustained yield basis;
(d) water catchment protection; or
(e) other purpose prescribed by the regulations.

CALM's current Forest Management Plan (FMP) for south-west forests was approved by the Lands and Forest Commission and the Minister in accordance with the requirements of the Act. The security of purpose of the riparian zones, diverse ecotype zones and travel route zones which are specified in Chapter Two of the FMP has been addressed by Ministerial Conditions imposed by the Minister for the Environment under the requirements of the Environmental Protection Act (1986). The Minister has specified in Conditions 5 and 6 that these reserves **shall remain unharvested in perpetuity** and **shall remain protected from timber harvesting and associated activities in perpetuity**.

- **Opportunity for public comment and political accountability for changes to reserve boundaries**

The CALM Act specifies that draft management plans will be released for public comment for a minimum of two months. During the drafting of the FMP (1994-2003) a comprehensive program of seminars, public workshops and briefings to key stakeholders was implemented. The joint CALM/ AHC study of the national estate values in the Southern Forest Region, which was prepared concurrently with the FMP, was also released for public comment for a period of three months. The public submissions received on the Draft FMP were summarised, analysed and published. Many recommendations arising in public submissions were incorporated into the final FMP.

CALM's FMP is also subject to the requirements of the EPA Act. The EPA Act provides for proponents to make reports available for public review and requires that proponents respond to submissions made to the Environmental Protection Authority. Reports by the Authority are released to the public and decisions by the Authority are subject to appeal. The implementation of proposals is subject to published conditions and subsequent audit and monitoring. CALM must report publicly on compliance with Ministerial Conditions applied to the FMP in 1997 and 2002. The EPA Act prescribes penalities for non-compliance.

- **Identification on maps**

The system of riparian zones, diverse ecotype zones and travel route zones is currently being digitised in CALM's Geographic Information System (GIS). This work has been completed for the Southern Forest Region and is well progressed for the Central Forest and Swan Regions. These zones can be depicted on maps at a variety of scales upon request. The zones are not routinely depicted on 1:50 000 maps sold to the public.

The area of the non-statutory reserves is as follows:

Travel route zones	18 710 hectares
Riparian zones	152 175 hectares *
Diverse ecotype zones	200 000 hectares *

* Estimate only for Swan and Central Forest Regions *(CALM, 1994)*

- **Design and continued viability**

The issue of size and contribution to nature conservation values has been discussed in the first principle above. The viability of the reserves has been monitored during the past 20 years. A system of road, river and stream reserves has been implemented in a different configuration for the past two decades. Timber harvest, including broadscale clearfelling in karri forest has been completed in many forest blocks up to 2000 hectares in size, where the only mature forest remaining exists in the road, river, stream and diverse ecotype reserves. There is no evidence that these reserves have suffered damage or decline which will affect their long term viability and ability to protect the nature conservation, hydrologic and aesthetic values they were designed for. Blocks such as Sutton, Brockman, Gray and Poole provide illustration as to the long term efficacy of the system of reserves in the south-west forests.

The maintenance of the attributes for which the non-statutory reserves have been set aside will be monitored as described in Chapter 4 of the FMP 1994-2003.

- **Management protection through contracts, codes of practice and enforcement**

The protection of travel route zones, riparian zones and diverse ecotype zones is specified in CALM's logging contracts (Contracts to Supply), 'Code of Logging Practice' and 'Manual of Logging Specifications'. Penalties apply for non-compliance.

CALM has recently established a Management Audit Unit, which has a specific role to ensure that policies, procedures, prescriptions, and codes are applied as intended.

The system of riparian zones, diverse ecotype zones and travel route zones in the State forests of Western Australia clearly meet the five Commonwealth criteria and will be included in the evaluation of a CAR reserve system in south-west forests.

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WESTERN AUSTRALIA
DEFERRED FOREST ASSESSMENT

Officials of the Commonwealth and Western Australian Governments have had lengthy consultations on a Deferred Forest Assessment for Western Australia's south-west forests.

The Western Australian Government has released for public comment a draft report on a Deferred Forest Assessment for Western Australia.

The Commonwealth agrees to the release of CALM's draft report on a Deferred Forest Assessment as a means to involve interested groups and individuals in the process.

Comments on this draft report should be submitted by 20 October 1995 to:

Forests Taskforce
Department of Prime Minister and Cabinet
3-5 National Circuit
BARTON ACT 2600