FOREST MANAGEMENT PLAN 1994-2003

DEPARTMENT OF PARKS AND WILDLIFE
Department of Conservation and Land Management

LANDS AND FOREST COMMISSION

FOREST MANAGEMENT PLAN

1994-2003

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VISION STATEMENT

The Government requires that the State's forests are managed so as to provide in perpetuity for biodiversity, fresh water, timber, recreation and tourism, heritage values and other products such as honey and wildflowers.

The Government's vision is based on the ecologically sustainable management of the State's publicly owned native forests for all forest values. In particular, the vision is for:

- a publicly owned native forest estate which is maintained in perpetuity,
- further development of an efficient, sustainable and competitive range of forest-based industries,
- forests which are managed in a holistic way for all the values recognised by society relevant to particular areas of the forest estate, recognising that the importance of any value will vary over the forest estate,
- progressive improvement in management techniques as new research results come forward,
- conservation of biodiversity both within formally gazetted reserves and in forest which is used for productive purposes,
- forests in which visual amenity values are maintained to enhance the tourism industry.

Furthermore, the Government intends to encourage expansion of, and better management in, the private forest estate, in line with the provisions of the National Forest Policy. Although the main emphasis will be an increased private investment in plantations, our vision is for the approximately 500 000 hectares of private native forest estate to be maintained and managed for both its production and conservation values, in a way which complements the publicly owned forests.

In accordance with section 60 of the *Conservation and Land Management Act 1984*, I hereby approve the Forest Management Plan 1994-2003.

K. J. Minson.

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Kevin Minson MLA
MINISTER FOR THE ENVIRONMENT

FOREWORD

The strategies for the management of the publicly owned native forests of the south west of Western Australia has been continually evolving since the introduction of scientific forest management into Western Australia in 1919. This evolution has been in response to changing community values and demands, increased knowledge about the forest ecosystem and improved technology. The most recent formal update of the strategy was in 1987 when three Forest Region Management Plans and a Timber Strategy were adopted by the Government after extensive public participation. The Plans and the Timber Strategy, which foreshadowed major changes to land tenure arrangements in the forest and the system of allocation, processing and pricing of wood products, were scheduled for review in 1997.

The review of forest management in 1992 and 1993 which lead to this Plan may appear premature, however, a number of factors have come together to make the timing opportune.

Firstly, as a result of the Environmental Protection Authority report on the 1987 Forest Region Management Plans and the WA Chip and Pulp Environmental Review and Management Program, a number of outstanding statutory requirements needed to be resolved.

These were:

- an evaluation of the effect of jarrah silviculture on water quality;
- a review of the road, river and stream zone system in the southern forests;
- the identification of areas of special significance in the old growth forest and their future management.

Secondly, there was a need to accommodate the results of a comprehensive inventory of the jarrah forest, which was foreshadowed in the 1987 Timber Strategy and which had been completed by mid 1991.

Thirdly, the successful implementation of the Timber Strategy has provided the opportunity for the introduction of a more sophisticated forest management system. For example, the large investments in new plant and equipment by the forest industry, which were made possible by the provision of resource security, have resulted in major improvements in log utilisation and increased value-adding to forest products.

Fourthly, new research information and new technologies have become readily available since 1987 which have markedly increased the potential for integrating forest management and potentially conflicting uses. For example, the development of geographic information systems and spatial data for forest areas means that alternative reserve and harvesting strategies can be evaluated in days rather than months.

Finally, the 1992 review provided the opportunity to incorporate an evaluation of national estate values into forest management strategies. Concurrently with the initiation of the review, CALM and the Australian Heritage Commission commenced a cooperative study of national estate values in the southern forests. In addition to providing the basis for dealing with the question of national estate areas in forests, the study also provided valuable information relative to the general review.

A Draft Forest Management Strategy was released in February 1992. This document summarised the current knowledge of Western Australia's forest ecosystems, analysed the community's requirements from the forests, developed forest management principles and

objectives which meet the requirements for ecologically sustainable development and proposed strategies which will result in the objectives being achieved.

The literature on forest ecology in general, and Western Australia's native forests in particular, is large, diverse and complex. Fortunately, two comprehensive reviews of research into Western Australia's native forest ecosystems have been published and can be purchased or are available at public libraries:

> The Jarrah Forest (1989). A Complex Mediterranean Ecosystem. B. Dell, J. Havel and N. Malajczuk editors. Academic Press, Kluwer, Dordrecht.
>
> The Karri Forest, its Conservation Significance and Management (1992). Per Christensen. Department of Conservation and Land Management, Perth, Western Australia.

These texts, together with other literature, provide the detailed scientific data which are the basis for the forest management strategies outlined here.

Additional information on the identification and management of national estate values can be found in the AHC/CALM joint study - "National Estate Values in the Southern Forest Region, South West Western Australia".

A number of public seminars and workshops were conducted to obtain community input on the issues discussed in the Draft document. Copies of the proceedings of these seminars and workshops are available upon request to CALM. During the two periods totalling six months available for public submissions a total of 169 substantive and 1720 proforma submissions were received. These submissions were analysed and where appropriate incorporated into the final strategies. The analysis of submissions and an indication of CALM's response to them can be seen in the document "Forest Management Strategies for the South-West Forests of Western Australia, A Review - Analysis of Public Submissions.

The Draft Strategy was considered by the Environmental Protection Authority, which released its findings in Bulletin 652. Some contentious matters arising from Bulletin 652 were addressed, but not finally resolved by a Ministerial Appeal Committee. The Minister for the Environment issued a statement that the proposal would be implemented subject to a number of conditions on 24 December 1992. The statement provided for an expert committee to further examine the crucial issue of the level of timber harvest from the jarrah forest. The incoming Minister for the Environment in February 1993 appointed the Scientific and Administrative Committee to examine this issue. A final Ministerial determination was made on 16 August 1993 and forms the basis of this aspect of the Forest Management Plan for Western Australia.

A small number of changes to the tenure and purpose of land vested in the NPNCA are proposed in this plan. These have been proposed with the concurrence of that controlling body.

Hon Barry Hodge
CHAIRMAN
LANDS AND FOREST COMMISSION

PREFACE

Publication of the Forest Management Plan 1994-2003 is the final stage of the production of a Management Plan for the State's forests, as required under Part V of the *Conservation and Land Management Act 1984*. Gazettal of approval of this Plan does not revoke the 1987 Forest Regional Management Plans for the Northern Forest (now incorporated in the Swan Region), Central Forest and Southern Forest Regions. However, where both this Plan and the 1987 Plans deal with the same issue, such as tenure, the provisions of the 1994 Plan replace those of the 1987 Plans. As such, the native hardwood timber supply proposals in the 1994 Plan replace those of the 1987 Timber Strategy. The 1987 Plans will remain current for all issues not covered in the 1994 Plan.

The Draft of this Plan has been assessed under the *Environmental Protection Act 1986*. It has been prepared with extensive public consultation by way of seminars and workshops, and, as required under the CALM Act, by the circulation of a Draft for public comment. An analysis of the public comments on the Draft is published separately.

The Plan complies with the principles set out in the 1992 Australian National Forest Policy Statement and is also in accordance with the nationally adopted principles of Ecologically Sustainable Development for forests and the National Conservation Strategy.

The expiry date for the Forest Management Plan will be 31 December 2003.

The management strategies outlined here are complex, and will take some time to implement fully, being constrained by the availability of resources, information or the need to train staff in new procedures.

CHAPTER ONE

Forest Policy Statement

PURPOSES OF RESERVATION OF STATE FORESTS OF THE SOUTH-WEST

In accordance with section 55(1a) of the *Conservation and Land Management Act* (1984). State forests and timber reserves within the Swan, Central Forest and Southern Forest Regions, to which this Management Plan applies, are reserved for the purposes of conservation, recreation, timber production on a sustained yield basis, water catchment protection and other purposes being a purpose prescribed by the regulations.

This Plan and the 1987 Forest Region Management Plans have indicated some areas of State forest and timber reserve which are intended to be vested in the NPNCA to ensure representativeness of the nature conservation reserve system. Until the vesting occurs these State forests and timber reserves will be managed as if that vesting had occurred and timber production will be excluded from them.

MANAGEMENT OF FORESTS OF THE SOUTH-WEST

Forest management objectives for Western Australia must incorporate legislative requirements, the principles of ecologically sustainable development and the Government's specific goals and policies.

Arising from amendments to the CALM Act, as well as consideration of national issues affecting land management (e.g. the National Forest Policy) a new overall objective for the management of native forest in Western Australia has been adopted. This is:

> *To manage the native forests of the south-west of Western Australia, in consultation with the community, so that they provide the values required by society while sustaining indefinitely their biological and social diversity.*

Flowing from this objective a number of subsidiary objectives and strategies have been derived. These are set out below under the headings of conservation, management, production, recreation and knowledge.

CONSERVATION OBJECTIVE

To maintain biological diversity at the genetic, species and ecosystem level in the forest, with special emphasis on the protection and conservation of threatened, rare and uncommon taxa and communities.

To achieve this objective CALM will:

- Seek security of tenure for all forested areas considered to have value for nature and resource conservation, and oppose alienation of reserved land.

- Prepare wildlife management programs for selected taxa; and identify, locate and seek to conserve threatened or endangered flora, fauna and communities in the forest.

- Establish and manage a representative and viable nature conservation reserve system within forests.

- Sustain biological diversity in forests managed for multiple purposes.

- Encourage retention or establishment and effective management of native vegetation on privately-owned land in the south-west.

MANAGEMENT OBJECTIVE

To protect and enhance identified forest values and to employ the best practices in managing forest ecosystems.

To achieve this objective CALM will:

- Identify and publish the values to be managed for in each forested area.

- Manage forests set aside for nature conservation and recreation to sustain those values.

- Manage forests for as many uses as their vesting purpose allows to satisfy and sustain, as far as possible, the diverse expectations of society.

- Identify areas of special significance for individual forest values and consider their protection in management planning and operations.

- Identify and protect Aboriginal and European cultural values during forest management operations.

- Develop and apply a wide range of procedures and techniques for community involvement in decisions on forest management.

- Prepare, publish and implement forest management plans.

- Manage timber harvesting to ensure economic efficiency while sustaining other forest values.

- Plan and implement the prevention of, and response to, wildfires at a level commensurate with their potential to damage life, property and identified forest values.

- Use prescribed fire in a manner which is consistent with the need to sustain identified forest values.

- Evaluate all forest operations before they commence for their potential to introduce, spread or intensify *Phytophthora* dieback disease and accept, reject or modify the operation following that evaluation.

- Where the presence of feral and introduced animals has a significant impact on nature conservation or resource production objectives, reduce their numbers to levels which have minimal impact.

- Monitor the impact of pests and diseases on forests and implement control measures where economically and ecologically justifiable.
- Take adequate measures to prevent the accidental introduction of weeds on CALM-managed lands, and where funds are available and priorities dictate, attempt the control of declared and non-declared weeds.
- Manage operations in ways that sustain the beauty of the forest through the application of landscape planning and design principles.
- Develop, constantly update and implement codes of "best practice" for all forest based operations.
- Limit activities that result in permanent loss of forest to those considered essential by Government, guide approved activities into areas of least conflict and ensure they proceed with appropriate controls and rehabilitation criteria.
- Implement long-term monitoring programs to identify and study significant management issues in the forests.

PRODUCTION OBJECTIVE

To manage the forest to produce the range of commercial values approved by Government, in a manner which is ecologically sustainable and provides a fair return to the State.

To achieve this objective CALM will:

- Identify the products it is required to supply from forests.
- Maintain inventories of forest resources.
- Review and update supply and demand predictions for forest resources.
- Supply the range of forest products approved by Government.
- Regulate the production of forest resources to levels which can be sustained.
- Manage the commercial resources of the forest to maximise social and economic benefits to the State, while having regard for other values.
- Preserve the quality of water supplies from forests.
- Supply timber to meet local and export demands in an economically efficient manner.
- Seek to develop new forests in conjunction with other land owners.
- Determine prices for forest resources, in consultation with industry, which reflect market value, recover the costs of production, promote good utilisation and encourage environmental and ecosystem protection.
- Assist private forest owners to maximise the productivity of, and the economic returns from, their forests, and provide advice on sustainability and the environmental benefits of tree planting.
- Promote the establishment of new forest plantations on cleared land, integrated with other management objectives.

TOURISM AND RECREATION OBJECTIVE

To facilitate the public enjoyment of the forest in a manner that is consistent with nature conservation and other objectives.

To achieve this objective CALM will within budgetary constraints:

- Facilitate a wide range of appropriate forest-based tourism and recreation activities consistent with the purpose or zoning of the land.
- Manage tourism and recreation to ensure other forest values are sustained.
- Survey tourists and recreationists and provide opportunities for public input to tourism and recreation planning and management.
- Use regional framework and site planning as a basis for tourism and recreation management in forests.

KNOWLEDGE OBJECTIVE

To seek a better understanding of the composition and function of forest ecosystems and to promote awareness and appreciation of their values.

To achieve this objective the Department will:

- Undertake research to improve the scientific basis for the protection of biodiversity and the production and regulation of forest resources.
- Study the interactions between wildlife populations, species, communities and the forest environment.
- Undertake research into community expectations and attitudes to forest values and management.
- Promote public understanding of forests, the values forests provide and their sustainable management through community education and forest interpretation programs.

IMPLEMENTATION OF OBJECTIVES

The above objectives will be put into effect through the following devices.

Firstly, through provision of the land tenure base for the conservation reserve system and the multiple purpose forest estate.

Secondly, by incorporation into area management plans for individual areas of the CALM-managed estate.

Thirdly, through the development of issue plans.

Fourthly, by incorporation into wildlife management programs and recovery plans for selected flora and fauna taxa.

Fifthly, through the development of departmental policies and prescriptions (e.g. for disease control or silviculture) which apply on all forests managed by CALM.

Sixthly, through the development of an annually updated five-year research plan which directs the priorities for research by CALM.

IMPLEMENTATION OF THIS PLAN

This Plan will be implemented as from the date of gazetting of the approval of the Minister for the Environment, for a period of ten years. As many of the individual strategies are complex, the various parts of the overall Plan will be implemented progressively, according to available resources.

CHAPTER TWO

The Strategies for the Sustainable Management of Native Forests

BACKGROUND

The Multiple Purpose Management Principle

The fundamental basis of the forest policy outlined in the previous chapter is the recognition of the multiple values of forests to the community. This means that the forests should be managed for multiple purposes.

This does not mean that all uses would, or should, be practised on every hectare of the forest at all times. What it does mean is that there should be a sensible balance of single uses, for example, where any other use at all would seriously diminish some special value, and multiple uses, where compatible uses may be practised concurrently or sequentially.

Mining in Forest Areas

On a large portion of the northern jarrah forest, land use allocation cannot be based on ecological attributes of the forest as it is the mineral value which has temporary priority. Whilst mining is a high disturbance activity, research has enabled mining to be undertaken in ways that minimise the impact on other forest values. In broad terms this is through:

- effective rehabilitation which restores land use values;
- effective measures to minimise environmental impact beyond the area directly affected by mining; and
- planning to minimise the area of forest constrained from other uses at any one time, and to minimise age differences in adjacent rehabilitated areas.

To maximise value of multiple purpose management in the presence of bauxite mining it is recognised that a high level of planning and integration is required. CALM, Worsley Alumina and Alcoa are continuing to develop integrated plans. The objective for the management of forests will be to achieve as many uses as required consistent with the designated land tenure. CALM and Alcoa will cooperate on development of an area management plan for forest inside ML1SA in order to better integrate mining with the output of other forest values.

Providing Secure Tenure for all Publicly Owned Forest

Following the passing of the Forests Act late in 1918, the Conservator of Forests, C E Lane Poole and his successor S L Kessell, vigorously pursued the dedication of large areas of

forest as State forest, but Governments of the period were reluctant to isolate land from settlement schemes resulting from post-war development. By 1924 only 51 000 hectares had been dedicated. This rose rapidly in the ensuing five years so that by 1930 approximately 1.21 million hectares had been dedicated.

Further reservations were progressively made such that by 1969 the total dedicated forest land in the south-west had reached 1.89 million hectares. The current gross area of land dominated by forest in the Swan, Central Forest and Southern Forest regions is 2 002 000 hectares.

The 1991-92 review of the forest reserve system has confirmed the values of about 284 000 hectares of unvested forest land identified in the 1987 Forest Regional Management Plans.

These 284 000 hectares are to be reserved and vested in the Lands and Forest Commission (≈ 124 000) or the National Parks and Nature Conservation Authority (≈ 160 000 hectares). These areas are included in the information presented in Maps 1 to 3.

With the addition of this land, the area of reserved forested land in Western Australia will be 2.45 million hectares. For all practical purposes, there is now no publicly owned forest land in the South-West Land Division which will not be securely reserved as State forest, national park, conservation park or nature reserve.

When the land use changes described in this document have been effected, there will also be in place a representative reserve system covering all main forest and allied vegetation types.

FOREST STRUCTURE

Forest structure is a key determinant of biophysical complexity, and therefore of ecological diversity. In Western Australian forests, the structure can be managed through land use decisions, silvicultural decisions and rotation length decisions. The structure of the understorey (in the absence of dieback disease caused by *Phytophthora*) is largely determined by the frequency, season and intensity of fire.

Karri Forest Structure

The karri forest is comprised of a mosaic of more or less even-aged stands of trees. The size of each stand varies from less than one hectare to hundreds of hectares depending on the scale and intensity of the event which initiated the stand.

If it is assumed that the ecological processes associated with the oldest stage of forest development commenced at between 100-140 years of age and that death occurred at 150 years, the maintenance of the oldest stage of development would require that for each hectare of forest 150 years old there should be one hectare 149 years old, one hectare 148 years old etc. If this simple model were correct, approximately one-third of the forest could be sustained in the mature stage of development.

But karri trees do not all die when they reach 150 years, although mortality of large trees occurs at this stage of development and progressively increases.

As a karri stand matures, the old trees become progressively more susceptible to high intensity fire. Consequently, in determining the forest structure that will sustain the oldest stage of development, allowance must be made for attrition of the oldest stands due to wildfire.

It is impossible to quantify accurately the factors which would determine the rate of attrition of karri forest stands once they reach the oldest stage of development. Under natural conditions the rate would have varied over time and between different sites.

If it is assumed, however, that *on average* karri stands reach an age of 200 years, the structure of the total karri forest area necessary to sustain the oldest stages of karri forest development is:

Stages of Development	*Percentage Representation*
Establishment	4%
Juvenile	8%
Immature	48%
Mature/Senescent	40%

Virgin stands will have some immature, juvenile and establishment stages occurring naturally amongst them, however, they are not mapped for structure and it is assumed that their total area is dominated by mature and senescent trees. Similarly past selection cutting has produced forest still dominated by mature and senescent but containing immature and juvenile stages as a result of regeneration following cutting. Where these are of significant area they have been mapped, however, it is assumed that the remaining forest is mature and senescent because of the dominant overstorey.

Karri Forest Structural Strategies

1. The minimum proportion of the area of karri forest dominated by the mature and senescent stages of development will be retained at approximately 40 percent.

2. Silviculture of the karri forest will be progressively modified to ensure that the preceding stages of development are represented in sufficient proportions to sustain the mature and senescent stages in perpetuity.

Jarrah Forest Structure

The jarrah forest is largely uneven aged. Its structure may be represented by a frequency distribution of size classes per unit area rather than areas of stands of even aged trees. Age can be inferred from size, however, small suppressed trees can be as old as the dominant largest trees, giving the impression of an uneven aged forest.

To sustain a tree of the maximum size that occurs in the forest, there need to be successively larger numbers of trees in each preceding size or age class. The resulting distribution of trees follows a general form known as the de Liocourt distribution.

While the distribution of trees of different size classes in uneven aged stands is similar, it varies between (and in) forests according to a number of factors such as species, site and the frequency of natural disturbances such as wildfire.

The existing structure of the jarrah forest reserved for multiple purpose management, which includes timber harvesting, falls within the range of structures found in virgin jarrah forest stands.

Jarrah Forest Structural Strategies

The forest can be stratified into four broad classes and structural goals related to the goals of management and the degree of acceptable disturbance. The four classes are:

1. *Minimal disturbance*

   Areas which will remain at a minimal level of disturbance include forest in the tenure categories nature reserve, national park, conservation park and some section 5g reserves. Although some of these areas have been disturbed in the past they represent forest to be kept in the least disturbed condition, although they must cater for recreation and include management for fire protection.

   Structural goal: to maintain at least 25 percent of the area of the total jarrah forest managed by CALM in the minimal disturbance category. Management will use natural processes to restore forest structure to that of a mature stand.

2. *Low disturbance*

   These areas will be disturbed to a low level by being set aside from high levels of productive use. They exist primarily to maintain natural processes at the local level and to protect specific values in forest managed at moderate/high levels of disturbance. They will include areas such as riparian zones, exclusion zones for visual resource management and rare flora sites.

   Structural goal: to maintain a minimum of five percent of the total jarrah forest managed by CALM in the low disturbance category. Management will maintain or develop a forest structure which best achieves the values present. In all instances so far envisaged, this will be similar to that for areas of minimal disturbance.

3. *Moderate disturbance*

   These areas will be disturbed by the productive use of the forest which may change its structure. The degree of change at any particular site will vary depending on the existing structure and the values other than timber present at the site and the forest structure which best suits them.

   Structural goal: at the broad level, the goal is to convert no more than an average of one percent of the multiple purpose jarrah forest to the establishment phase per year. In time, this will ensure forty percent of this disturbance class is dominated by mature and senescent stages of development, forty percent by the immature stage, 15 percent by the juvenile stage and five percent by the establishment stage.

   Forest structure will be developed in uniform patches varying from one to about 10 hectares, and in any one compartment, patches of the three developmental stages will be present.

4. *High disturbance*

   Where forest values are subordinated to other uses, such as surface mining, there is a complete loss of native forest and limited sensitivity to biological values. In these cases the immediate structural goal is of lesser importance than the value sought by the disturbing activity.

Structural goal: wherever possible maximise the retention of late development stages and seek early and rapid regeneration of as much of the pre-existing ecosystem as possible.

The structural goals for the minimal, low, moderate and high disturbance classes will be adopted and implemented as described above. All of these goals may be over-ridden in a particular area by the chance occurrence of high intensity fire, by wind damage, or by infection by dieback disease.

MANAGING FOREST STRUCTURE

The manipulation of forest stands to achieve a specific forest structure and composition is the science of silviculture. It includes the designation of the trees that are cut and retained in a forest stand, the size of the area harvested and the procedures necessary to ensure regeneration.

Techniques required to ensure regeneration and perpetuation of the jarrah, marri and karri forests have been developed and refined over several decades. Detailed prescriptions have been devised.

In this Plan, modifications to the existing system of silviculture are adopted which give greater assurance that when the forest is harvested, ecological processes are maintained and any adverse impacts of harvesting on other forest values are eliminated or minimised. The principal modifications relate to the size of area affected by harvesting, the dispersal of harvesting areas within the forest and the retention of mature tree habitat within or adjoining harvest areas.

Silviculture in the Karri Forest

The following management practices will be progressively applied to the karri forest:

1. In karri forests, the maximum coupe size is reduced from 200 hectares to 80 hectares.

2. Coupe size and dispersal, in combination with stream and river zones and retained patches of mature forest, will be planned to ensure that, where possible, there is a maximum distance of approximately 400 metres between areas of mature forest.

3. No harvesting will occur in river and stream zones, other than trees removed in the course of road construction or for fire control or public safety. An additional 3200 hectares of mature karri has been excluded from timber harvesting for retention as patches of mature habitat amongst clearfelled and regenerated karri stands. Travel route zones will remain unharvested except for those portions of regrowth forest where thinning can be undertaken in a manner consistent with the defined Visual Quality Objective.

4. Areas managed primarily for nature conservation and recreation, and retained habitat patches, will be managed to achieve natural life cycles.

Rotation lengths will be varied to ensure the forest structural goal is achieved:

5. Over 20 percent of pre-1940 regrowth will be deferred from clearfelling and "grown on" to develop mature/senescent characteristics. The remainder will be managed on a rotation length of at least 100 years.

6. Over 30 percent of the total area of regrowth forest regenerated between 1940 and 1975 will be deferred from clearfelling. The remainder will be managed on a rotation length of at least 100 years.

7. Stands regenerated between 1975 and 1990 will be scheduled for future harvesting to ensure that in any year approximately:

   10 percent will be felled and regenerated at 60 years*
   10 percent will be felled and regenerated at 80 years
   70 percent will be felled and regenerated at 100 years
   10 percent will be "grown on" to the senescent stage

   *UNDERSTOCKED OR FIRE-DAMAGED AREAS

8. 50 percent of all stands regenerated after 1990 will be grown on to the senescent stage.

Silviculture in the Jarrah Forest

The following silvicultural approach will be used in the jarrah forest. In some respects the principles are new and will require progressive implementation. As a result of Ministerial Condition 3, the jarrah silvicultural system will be implemented as a trial and reviewed during the period of the plan.

1. Harvesting of the forest will be constrained to meet the requirements of the structural goal.

2. The maximum gap size will be approximately 10 hectares and gap size and shape will be varied to meet visual resource and other management objectives. Notwithstanding gap size, sufficient trees in terms of number, age and condition will be retained to provide habitat for hollow nesting species.

3. The relationship of gap area and shape to visual impact will be studied in harvesting trials and will be incorporated into operational practice.

4. Within each coupe, a minimum of three age or size classes, representing the development stages of the forest, will be present. This may not be immediately possible when harvesting forest with a predominantly single age class (e.g. extensive regrowth forest near Dwellingup).

5. Strips of forest will be retained between gaps. Such strips will be large enough to ensure that when they are regenerated in a later cutting cycle, the regeneration can develop productively. Retained strips will be a minimum of 100 metres between gaps, except where gaps are reduced to below one hectare for aesthetic reasons; the minimum strip width then will be 50 metres. Thinning or shelterwood may be undertaken in retained strips.

6. In the intermediate and low rainfall zones of the jarrah forest where saline groundwaters are present, a minimum of 30 percent of the forest will be retained unharvested, or thinned to a minimum basal area of 15 square metres per hectare, in any 15 year period.

7. Regrowth stands will be thinned to a minimum density of 10 square metres per hectare of basal area except in areas with a high risk of discharging saline groundwaters, where the minimum basal area will be 15 square metres per hectare.

8. No harvesting will occur in river and stream zones, other than trees removed in the course of road construction or for fire control or public safety. Travel route zones will remain unharvested except for those portions of regrowth forest where thinning can be undertaken in a manner consistent with defined Visual Quality Objectives.

THE FOREST RESERVE SYSTEM

Conservation through reservation is one of a number of strategies aimed at ensuring that the biological diversity of the forest region is perpetuated and that intact ecosystems are protected. Reserves must be *managed* to prevent loss of biodiversity, even in apparently unchanged ecosystems. This is particularly the case in Western Australia where the nature conservation reserve system also provides for a component of the recreational needs of the public (see s56(c) of the CALM Act) and where wildfire, dieback disease caused by *Phytophthora*, and introduced animals and plants are threats.

Amendments to the Reserve System to Improve Representativeness

In 1992 the reserve system was reviewed with a view to improving the representation of less well reserved ecosystems. Vegetation complexes were examined which were "less than adequately" represented (less than five percent) or "just adequate" (5-10 percent) in existing or proposed reserves, and which occur on State forest, timber reserve or vacant Crown land. Priority was given to areas which were found to link or adjoin existing or proposed reserves, or to improve their boundaries for management purposes. The occurrence of declared threatened flora and fauna species, virgin forest and other significant biotic or geomorphological features were considered.

Threatened Frogs

Since the publication of the draft Plan, further information has been gathered on the conservation status of two geographically restricted frogs which occur in the southern forests. These are:

- *Geocrinea vitellina* (the Yellow Bellied Frog) whose distribution is restricted to an area of State forest of about 20 hectares near the Blackwood River; and

- *Geocrinea alba* (the White Bellied Frog) which occurs mainly on private property, but also on two areas managed by CALM and one area of vacant Crown land. The distribution of this animal is also extremely restricted.

Little is known yet about the ecology or the conservation of these species. A Recovery Team has been established, and further research is proposed. Until more detailed information is available, major land disturbance activities in the CALM-managed catchment areas where the frogs occur will be deferred pending research results. Activities on adjoining CALM-managed areas will be modified to minimise impact on frog habitat. A further option which may need to be considered during the life of the Plan will be to create a special reserve over the Crown lands in which the frogs occur. This could affect forests in the Forest Grove and Whichcliffe areas and parts of Adelaide and Chapman forest blocks.

The frogs appear to be highly vulnerable to summer and autumn fires, but are unlikely to be affected by mild, spring fires. This information will be taken into account in fire management planning for the area.

Wilderness

For the first time, wilderness was included as a factor in the selection of the reserve system. Using the criteria established in the National Wilderness Inventory, the southern forest area was evaluated for its wilderness quality. The results of this evaluation played an important part in determining the boundaries of new reserves, in the Southern Forest Region.

Recommendations

Following assessment of public comment on the Draft Strategy, amendments were made to the criteria for selection and new recommendations for additions to the conservation reserve system were submitted to the Minister. The Minister has approved a number of alterations to the previous proposals, and the final approved list of changes in tenure in the three forest regions is given in Table 1. Maps 1-3 illustrate the new reserve system and Table 2 provides an explanation for changes from the draft.

The balance of forest allocated to productive and conservation priority use is now such that if new conservation reserve proposals are accepted they can only be implemented by an exchange with existing conservation reserve or a reduction in the sustainable timber yields.

All proposals to change land tenure or to reserve vacant Crown Land will be subject to the normal review process by the Department of Land Administration. This will involve consultation with affected government and local government authorities. Furthermore, it will be necessary for both Houses of Parliament to agree to any changes involving A class reserves or State forest.

Resolution of Water Supply Requirements and Reserve Proposals

The Draft Forest Strategy focused attention on a number of locations where there is conflict between water supply development potential and a reserve proposal.

Where important future development sites exist, the Water Authority has adopted the general principle of seeking the establishment of Land Act Reserves vested in the Water Authority. Such reserves are required to cover the dam site, the site of all associated works such as spillways, pumping stations and treatment buildings, and the full maximum extent of any reservoir that would be formed. Such a principle is accepted by CALM.

In some instances it has been possible to resolve the conflicts. In others, it has not been possible, and resolution will have to await the outcome of future detailed planning exercises by both organisations over the next two years.

The conflicts and their resolution can be broken into four broad categories:

i) *Where there is minimal conflict with conservation values, or where key water supply development sites require a comparatively small boundary adjustment to a proposed park or reserve.*

   Such areas will be made Land Act Reserves vested in the Water Authority for the purpose of 'water supply and development'. In this category are sites on the Denmark, Kent and Bow rivers. These are shown on Map 3, identifier No. 66.

   In all instances where such reserves are created, the Water Authority will enter into an agreement with CALM to manage the areas in a manner appropriate to their forest values and to those of the surrounding area.

ii) *Where a small modification has been made to an existing boundary.*

In this category is the area of inundation which would result from the proposed raising of the Canning Dam in the Monadnocks Reserve. This area will remain as a Section 5g reserve under the CALM Act when the remainder is changed to a national park. This is shown on Map 1, identifier No. 6.

iii) *Where development of potential water supply sites would have inundated a large proportion of proposed reserves.*

The Water Authority has agreed to forgo development of dam site 26 on the Donnelly River, in conflict with the proposed Strickland nature reserve and dam site 21 on the Barlee Brook in conflict with the proposed Dickson nature reserve.

iv) *Where potential water supply development sites are in conflict with proposed reserves and where the relative significance of water and conservation values needs to be subject to more detailed regional planning studies.*

In this category are the Canterbury River and the proposed Boorara Conservation Park, the Margaret River and the proposed Rapids Conservation Park, the St John's Brook and the proposed St John's Brook Conservation Park, and the Barragoon groundwater development and the proposed Caraban Nature Reserve.

Table 1 **Changes in tenure, vesting and purpose for the Swan, Central Forest and Southern Forest Regions**

ID No.	*ID No. 1987 Plan*	*Area Name*	*Area (ha)*	*Current or Proposed(P) (1987) Classification*	*Proposed Classification this plan*
SWAN REGION					
Perth District					
1	-	Yanchep	45	VCL	national park
8(a)	-	Caraban	2205	nature reserve(P)	s5g reserve
8(b)	-	Caraban	3305	nature reserve(P)	conservation park
Mundaring District					
2	-	John Forrest	1 130	freehold	national park
3	46	Burkinshaw Road	10	conservation park(P)	no longer to be sought
Jarrahdale District					
4	34	Araluen-Canning	35	conservation park(P)	no longer to be sought
5	39	Monadnocks	15 090	conservation park(P)	national park,
6		Monadnocks	280	conservation park(P)	s5g reserve
7		Monadnocks	25	conservation park(P)	s5g reserve
9	-	Gibbs	5 850	State forest	conservation park
10	-	Gibbs	10	timber reserve	conservation park
Dwellingup District					
11	7	Meelon	5	nature reserve(P)	no longer to be sought
13	-	George	3 140	State forest	conservation park
12	-	Lane Poole Reserve (Icy Creek)	180	conservation park(P)	s5g reserve
14	26	Marradong	1930	conservation park(P)	retain as State forest
CENTRAL FOREST REGION					
Harvey District					
23	57,63	Lane Poole Reserve	26 420	conservation park(P)	national park
24	-	Lane Poole Reserve (Stene)	1 465	State forest	national park
22	-	Clarke (Falls Brook)	1 225	State forest	nature reserve
15	64	Wagerup	10	conservation park(P)	nature reserve
16	54	Kemerton	1165	s5g reserve	industrial site
17	-	Kemerton	495	freehold	s5g reserve
18	55,56	Kemerton	1 490	conservation park	s5g reserve
19	55	Kemerton	35	conservation park	industrial site
20	-	Kemerton	110	freehold	s5g reserve
21	-	Leschenault peninsula	1 115	freehold, conservation park	conservation park
Collie District					
253	36-40	Lane Poole Reserve	10 050	conservation park(P)	national park
26		Lennard	645	State forest	conservation park
27	-	Gervasse	2 015	State forest	conservation park
28	-	Roseneath	1 360	State forest	conservation park
29	32-35	Goonac	5 140	conservation park(P)	conservation park
Kirup District					
30	80	Goonac	30	conservation park(P)	conservation park
32		Preston	305	State forest	conservation park
31	-	Noggerup (north)	980	State forest	conservation park
39	84	Gwindinup	10	conservation park(P)	no longer to be sought
40	-	Hester (east)	780	State forest	conservation park
33	-	Ryall	260	State forest	conservation park
35	-	Noggerup (south)	710	State forest	State forest
34	-	Hovea	1 055	State forest	State forest
36	-	Camballan	6 380	State forest	conservation park
37	-	Camballan	1 430	State forest	conservation park

ID No.	*ID No. 1987 Plan*	*Area Name*	*Area (ha)*	*Current or Proposed(P) (1987) Classification*	*Proposed Classification this plan*
				Kirup district cont.	
38	-	Camballan	110	other reserve	conservation park
41	74	Maslin reserve	45	conservation park(P)	to be vested in Shire
42	-	Hester (west)	1 080	State forest	conservation park
Busselton District					
43	-	Leeuwin-Naturaliste	325	other reserve	national park
Nannup District					
44	-	Beaton	415	State forest	conservation park
SOUTHERN FOREST REGION					
Manjimup District					
51	6	Jardee	15	conservation park(P)	to be reviewed
50	14	Jervis Park	10	conservation park(P)	no longer to be sought
48	-	Dingup	210	State forest	conservation park
46	-	Keninup	6 730	State forest	nature reserve
53	-	Talling	6 410	State forest	nature reserve
52	-	Talling	5	other reserve	nature reserve
55	-	Chitelup (Mt Roe)	2 480	State forest	national park
54	11	Bolbelup	40	State forest(P)	to be reviewed
45	1	Blackbutt reserve	40	nature reserve	conservation park
49	-	King jarrah reserve 39199	190	other reserve	State forest
47	-	Mickalarup Swamp	115	unvested reserve	nature reserve
Pemberton District					
58	62	D'Entrecasteaux	35	national park	State forest
56	-	Charley	2 385	State forest	national park
57	-	Hawke	65	State forest	national park
Walpole District					
59	-	Mattaband	255	State forest	national park
64	223	Pardelup Road	30	nature reserve	to be reviewed
69	129,130	Gum Link Road	575	nature reserve	nature reserve
70	152,154	Thames	505	nature reserve	nature reserve
60	-	Mt Roe	10 405	vacant Crown land	appropriate multi-purpose reserve
61	-	Mt Roe	33 430	State forest	appropriate multi-purpose reserve
62	-	Mt Roe	28 740	other reserve	appropriate multi-purpose reserve
67		Mt Lindesay	260	State forest	national park
65	187	Quarram	45	State forest(P)	no longer to be sought
63	-	Mt Lindesay	1 260	State forest	national park
66	-		7 055	State forest, vacant Crown land	Land Act reserves vested in WAWA
68	-	Mt Lindesay	390	national park	State forest

MIDWEST REGION

LANCELIN

GINGIN

YANCHEP

WANNEROO

TOODYAY

NORTHAM

INDIAN

MOORE

WANNEROO

RIVER

BRAND

HIGHWAY

NORTHERN

GREAT

RIVER

AVON

RIVER

BROCKMAN

HIGHWAY

HIGHWAY

ROAD

1

8a

8b

2

EASTERN

GREAT

RIVER

GREAT NORTHERN

HIGHWAY

CALM Man
As proposed in

SW

Legend

National Pa

Nature Res

Conservati

Section 5(g

State Fores
Ex. Dir Lan

Marine Par

Area guide

500 hectar

10 5 0

MIDWEST REGION

BRAND HIGHWAY

GINGIN

GREAT NORTHERN HIGHWAY

8b

1

ROAD

WANNEROO

RIVER

GREAT NORTHERN HIGHWAY

2

AVON

BROCKMAN

RIVER

TOODYAY

GREAT EASTERN HIGHWAY

NORTHAM

GREAT

MAP 1

CALM Managed Lands and Waters
As proposed in the Forest Management Plan
March 1994

SWAN REGION

Legend

- National Park
- Nature Reserve
- Conservation Park
- Section 5(g) CALM Act Reserve
- State Forest, CALM Act Timber Reserve, Ex. Dir Land and Other CALM Reserves.
- Marine Park

Area guide

- 500 hectares

10 5 0 10 20 km

N

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OCEAN

Rottnest Island

FREMANTLE

CRAWLEY

PERTH

COMO

MIDLAND

SWAN RIVER

GREAT SOUTHERN HIGHWAY

MUNDARING

Helena River Reservoir

CANNING

KELMSCOTT

CANNING RIVER

Canning Reservoir

Wungong Dam

BROOKTON HIGHWAY

Garden Island

JARRAHDALE

Serpentine Dam

SOUTH WESTERN HIGHWAY

ALBANY HIGHWAY

SERPENTINE RIVER

MANDURAH

Peel Inlet

Harvey Estuary

MURRAY

Lake Banksiadale

DWELLINGUP

HOTHAM RIVER

1 2 3 4 5 6 7 8 9 10 11

MIDLAND
PERTH
CRAWLEY
COMO
FREMANTLE
KELMSCOTT
MUNDARING
JARRAHDALE
MANDURAH
DWELLINGUP
SWAN
RIVER
CANNING
GREAT
SOUTHERN
HIGHWAY
Helena River Reservoir
Canning Reservoir
Wungong Dam
BROOKTON
WESTERN
SERPENTINE
SOUTH
ALBANY
Serpentine Dam
Lake Banksiadale
Peel Inlet
Harvey Estuary
MURRAY
2
3
4
5
6
7
9
10
11
WHEATBELT REGION

OCEAN

Garden Island

MANDURAH

Peel Inlet

Harvey Estuary

SERPENTINE RIVER

MURRAY RIVER

SOUTH WESTERN HIGHWAY

Wungong Dam

Canning Reservoir

BROOKTON HIGHWAY

JARRAHDALE

Serpentine Dam

ALBANY HIGHWAY

Lake Banksiadale

DWELLINGUP

RIVER

HOTHAM RIVER

HIGHWAY

5

6

7

9

10

11

12

13

14

CENTRAL FOREST REGION

WHEATBELT REGION

n Island

HIGHWAY

Wungong Dam

Canning Reservoir

BROOKTON

6

5

7

5

WESTERN

RIVER

JARRAHDALE

Serpentine Dam

SOUTH

SERPENTINE

ALBANY

HIGHWAY

9

10

MANDURAH

Peel Inlet

Harvey Estuary

Lake Banksiadale

MURRAY

11

DWELLINGUP

12

RIVER

13

HOTHAM

RIVER

14

HIGHWAY

CENTRAL FOREST REGION

MAP 2

CALM Managed Lands and Waters
As proposed in the Forest Management Plan
March 1994

CENTRAL FOREST REGION

Legend

- National Park
- Nature Reserve
- Conservation Park
- Section 5(g) CALM Act Reserve
- State Forest, CALM Act Timber Reserve, Ex. Dir Land and Other CALM Reserves.

Area guide

- 500 hectares

10 5 0 10 20 km

N

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SWAN REGION

INDIAN

OCEAN

WAROONA
Lake Navarino
Lake Kabbamup
HIGHWAY
YARLOOP
15
Lake Brockman
ROAD
COAST
WESTERN
22
HARVEY
Stirling Dam
OLD
17
18
16
19
20
21
SOUTH
RIVER
BRUNSWICK
23
25
MORNINGTON
ROAD
COLLIE
RIVER
BUNBURY
COALFIELDS
COLLIE
26
27
Wellington Dam
PRESTON
ROAD
39

Plan

Reserve,
eserves.

20 km

d Information Branch, March 1994

SWAN REGION

WHEATBELT REGION

WAROONA

Lake Navarino

Lake Kabbamup

HIGHWAY

YARLOOP

15

ROAD

Lake Brockman

WESTERN

COAST

22

HARVEY

Stirling Dam

24

23

23

25

25

OLD

17

18

16

19

SOUTH

RIVER

21

20

BRUNSWICK

MORNINGTON

ROAD

COLLIE

RIVER

COALFIELDS

BUNBURY

COLLIE

26

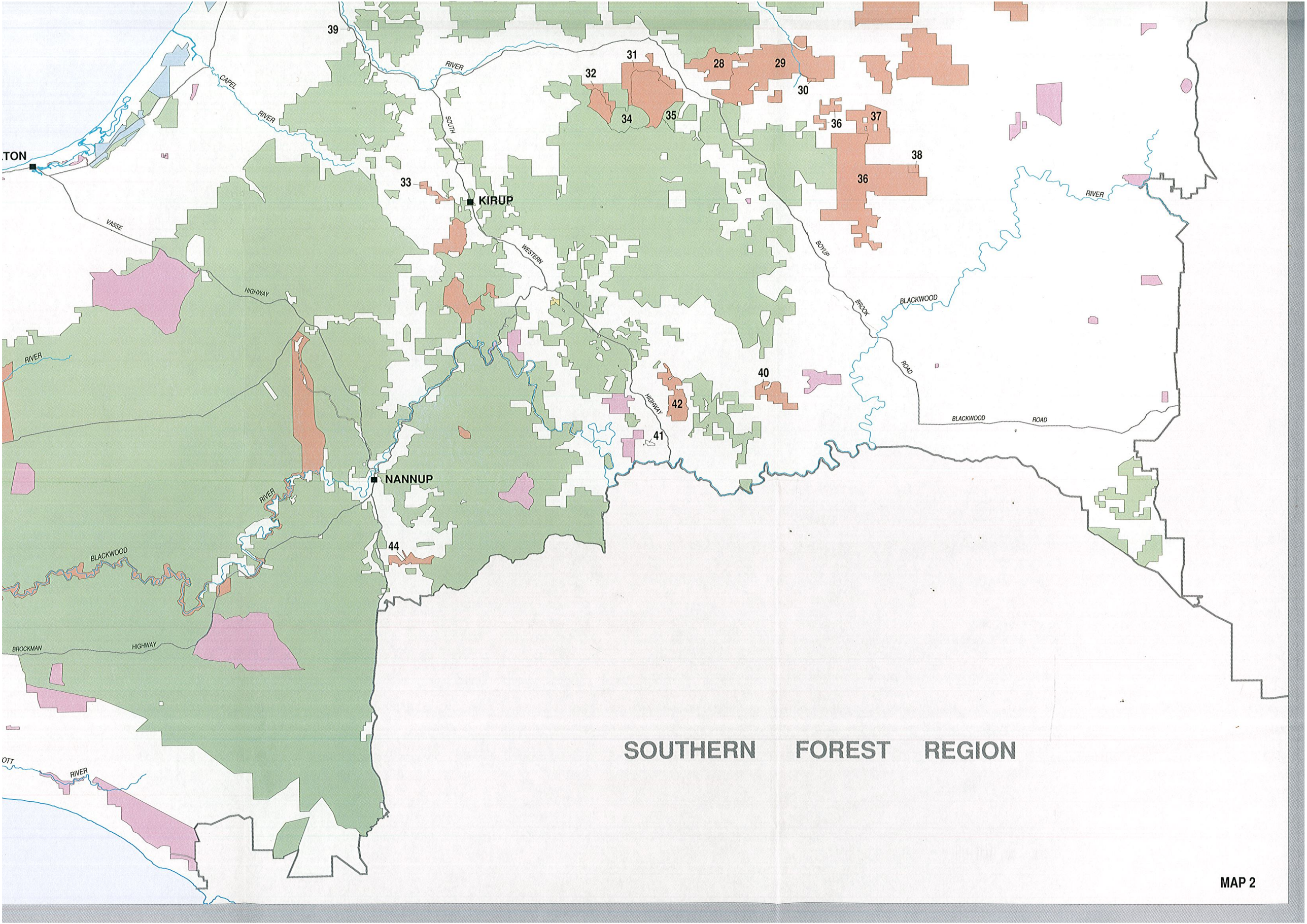
27

Wellington Dam

ROAD

PRESTON

39


39
31
32
28
29
30
34
35
36
37
38
36
33
KIRUP
40
42
41
44
NANNUP
CAPEL
RIVER
SOUTH
RIVER
VASSE
HIGHWAY
WESTERN
BOYUP
BROOK
ROAD
RIVER
BLACKWOOD
BLACKWOOD
ROAD
RIVER
HIGHWAY
RIVER
BLACKWOOD
BROCKMAN
HIGHWAY
RIVER
SOUTHERN FOREST REGION

MAP 2

BUSSELTON
CAPEL RIVER
VASSE HIGHWAY
BUSSELL HIGHWAY
MARGARET RIVER
MARGARET RIVER
KIRUP
SOUTH WESTERN HIGHWAY
BOYUP BROOK
BLACKWOOD
ROAD
NANNUP
BLACKWOOD RIVER
BROCKMAN HIGHWAY
SCOTT RIVER
AUGUSTA
39
31
32
28
29
30
34
35
36
37
38
33
40
42
41
44
43

SOUTHERN FOREST REG

CENTRAL FOREST REGION

WHEATBELT REGION

MANJIMUP

PEMBERTON

NORTHCLIFFE

Lake Muir

RIVER

SOUTH WESTERN HIGHWAY

VASSE

WARREN

DONNELLY

MUIRS

SHANNON

GARDNER

FRANKLAND

KENT

45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 67

MAP 3

CALM Managed Lands and Waters
As proposed in the Forest Management Plan
March 1994

SOUTHERN FOREST REGION

Legend

- National Park
- Nature Reserve
- Conservation Park
- Section 5(g) CALM Act Reserve
- State Forest, CALM Act Timber Reserve, Ex. Dir Land and Other CALM Reserves.

Area guide

- 500 hectares

10 5 0 10 20 km

N

Produced by Land Information Branch, March 1994

WHEATBELT REGION

ANJIMUP
BERTON
HCLIFFE
MT BARKER

46 47 48 49 51 52 53 54 55 58 59 60 61 62 63 64 67 68

Lake Muir

SOUTH RIVER
MUIRS
WESTERN
WARREN
HIGHWAY
RIVER
SHANNON
RIVER
GARDNER
FRANKLAND
KENT
DENMARK
ROAD
MT BARKER
ALBANY
HIGHWAY
RIVER

MANJIMUP
PEMBERTON
NORTHCLIFFE
WALPOLE
Lake Muir
SOUTHERN
OCEAN
RIVER
SOUTH
VASSE
HIGHWAY
DONNELLY
WARREN
WESTERN
MUIRS
HIGHWAY
RIVER
GARDNER
RIVER
SHANNON
RIVER
HIGHWAY
FRANKLAND
RIVER
DEEP
RIVER
KENT
RIVER
SOUTH
COAST
10
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
65
66
67
69
70

State Forest, CALM Act Timber Reserve,
Ex. Dir Land and Other CALM Reserves.

10 5 0 10 20 km

N

Produced by Land Information Branch, March 1994

49 48 51 54 52 53 55 61 60 67 59 58 64 63 68 62 56 70 66 69 65

NJIMUP ERTON WARREN CLIFFE MT BARKER WALPOLE DENMARK

SOUTH RIVER WESTERN HIGHWAY MUIRS Lake Muir ALBANY HIGHWAY RIVER KENT RIVER FRANKLAND RIVER SHANNON RIVER GARDNER RIVER DEEP RIVER SOUTH COAST HIGHWAY MT BARKER ROAD HIGHWAY DENMARK RIVER DENMARK HAY RIVER

SOUTH COAST REGION

Table 2 Explanation of Amendments to the Draft Proposal

Plan ID No.	*Area Name (1992)*	*Proposed Classification (1992 draft)*	*Proposed New Classification and Reason for Amendment*
8	Caraban	nature reserve	section 5(g) and conservation park Optimisation of mineral, water and conservation values.
7	Monadnocks	national park	Alcoa of Australia agreed to the creation of Monadnocks within its mineral lease (ML1SA) on the condition that the Company would be entitled to an access corridor across the reserve This was to enable ore bodies to be mined which would otherwise be cut off by the creation of the reserve. The corridor would contain any facility such as railway, road, conveyor, pipeline and powerline, which might be required to service the Company's mining operations. When Monadnocks becomes a national park, Clause 9A of the Alumina Refinery Agreement Act requires that the corridor remains as a s5g reserve, for the purpose of that Act and for conservation.
6	Monadnocks	national park	There is potential to raise the wall on Canning dam which would result in flooding back into a small area on the northern boundary of the park. The area of inundation will remain as a s5g reserve.
9,10	Gibbs	national park	conservation park Shown in error in Table 14 of the draft as a proposed national park.
14	Marradong	No change proposed from the 1987 conservation park (P)	retain as State forest The area has been subject to investigation of its conservation and mineral values since originally proposed as a conservation park in 1987. The study found no conservation values not represented elsewhere in the reserve system and because of its bauxite potential Government had decided it will remain as State forest and be available for multiple purpose and mining.
23	Lane Poole Reserve	national park	national park The area was shown in error in Table 16 of the draft as 4485 hectares. It should have been 26 420 hectares.
22	Clarke	nature reserve	nature reserve Boundary amended to take account of management difficulty, high impact dieback site and traditional recreational use.
16-20	Kemerton	conservation park	Section 5g reserve for the purpose of industrial buffer, resource use and conservation. This proposal of 5(g) now encompasses all the proposed buffer. Conservation park was not appropriate for its major purpose as a buffer to the industrial estate which will require development of utility corridors through it.
21	Leschenault peninsula	-	Government decision to make this area a conservation park since 1992 draft.

Plan ID No.	*Area Name (1992)*	*Proposed Classification (1992 draft)*	*Proposed New Classification and Reason for Amendment*
15	Wagerup (10 ha)	delete from plan	nature reserve An assessment has confirmed presence of remnants of the Ridge Hill Shelf vegetation complex making the area worth adding to the conservation estate.
25	Lane Poole Reserve	national park	national park The area was shown in error in Table 16 of the draft as 2355 hectares when it should have been 10 050 hectares.
28	Roseneath	national park	conservation park
29	Goonac	national park	conservation park
30	Goonac	national park	conservation park
32	Preston	national park	conservation park
34	Hovea	national park	retain as State forest to allow for Hester inclusion
31,35	Noggerup	national park	conservation park, amended boundary The Draft Strategy sought to add to the proposed conservation parks of Goonac, Preston and Noggerup and change their tenure to national park. Roseneath, Preston, Hovea and Noggerup are about to be excised from ML1SA to be made available for mineral exploration, hence it would not be possible to create a national park until exploration is completed. Goonac also has a pastoral lease which does not expire until 2015. It has been decided to abandon national park proposal and revert to conservation park tenure for the increased area. Hovea and the southern area of the Noggerup proposal have been retained as State forest to enable reservation of an additional section of Hester block.
42	Hester (west)	State forest	conservation park An additional section of Hester block has been proposed as conservation park to improve the spatial distribution of the reserve system and its efficiency in catering for the recreational needs of the Bridgetown community.
41	Maslin Reserve ↑ 18447	no change from 1987 RMP proposal of conservation park	to be vested in the Shire The reserve is on the edge of Bridgetown and a key area for that town. Bridgetown Shire were keen to acquire it and NPNCA has agreed. The change to the 1987 management plan was advertised for public comment. The reserve will be vested in the Shire of Bridgetown -Greenbushes.
51	Jardee (10 ha)	State forest	to be reviewed Continued uncertainty as to the appropriate tenure for this unvested national park has led to a decision not to seek it until further consideration.

ID No.	*Area Name (1992)*	*Proposed Classification (1992 draft)*	*Proposed New Classification and Reason for Amendment*
45	Blackbutt reserve	no change from 1987 RMP proposal to classify as a nature reserve	conservation park The area has a recreation focus with the Bibbulmun Track running through it, hence conservation park is seen as a more suitable classification.
48	Dingup	nature reserve	conservation park The area is surrounded by private property and is currently used for recreation. Because of this conservation park is seen as a more appropriate tenure category.
49	Reserve 39199 (King Jarrah)	no mention	State forest The area is a C class reserve vested in the Executive Director, CALM. It is proposed to change that to State forest.
55	Chitelup	national park	adjusted boundary Management efficiency.
47	Mickalarup Swamp	no mention	nature reserve Water body with wetland nature conservation values. Submission from the public supported by CALM.
58	D'Entrecasteaux	no change from 1987 RMP for national park	State forest This was shown in error in the 1987 plan. It is not intended to be added to the national park.
60-62	Mt Roe	national park	An appropriate multi-purpose reserve No action will be taken to make the area a national park for the period of the plan in order to provide a ten year phasing out period for the wildflower industry based on the area.
66	Mt Roe/ Mt Lindsay area	national park	WAWA have identified sites on the Denmark, Kent and Bow rivers needed for future dam sites and reservoir areas. It is intended to exclude these from the proposal and make them Land Act reserves vested in WAWA.
54	Bolbelup	no change from 1987 RMP proposal of State forest	To be reviewed. All other CALM land in the area is proposed or actual nature reserve. This piece and the adjoining State forest will be assessed for its suitability as a nature reserve.
65	Quarram	no change from 1987 RMP proposal of State forest	)))Investigations since 1987 have not established)adequate justification for these 1987
64	Pardelup	no change from 1987 RMP proposal of nature reserve	)proposals. They will no longer be sought.))

MANAGING THE VISUAL LANDSCAPE ON FOREST LANDS

The need to preserve the scenic beauty of forested landscapes resulted in the retention of undisturbed forest along major roads in the 1973 Woodchip Environmental Impact Statement. Since that time, this concept has been extended and formally adopted into CALM planning procedures known as the Visual Resource Management System (VRMS). This methodology is being progressively adopted in all forest areas where disturbance takes place. It is well recognised that active management of forest scenery is important to maintain the recreational and tourism values of forests.

To preserve scenic beauty the following approach will be adopted:

1. Visual landscape values will be evaluated and integrated into all forest management operations.

2. All landscape types in the forest will be identified and classified into Visual Landscape Management Zones.

3. Visual Quality Objectives will guide forest management for each zone.

4. Research will continue to allow increased understanding of human perceptions and preferences for forested landscape.

5. Use areas throughout the forests will be managed according to visual resource management principles and zone objectives.

6. In the southern forests, where clearfelling is the method of harvesting and regeneration of the karri forests, a new system of fixed travel route zones will be instituted:

   - level one travel routes, a zone of 200 metres either side;
   - level two travel routes, a zone of 100 metres either side.

   No clearfelling of mature forest will occur in these zones. Thinning of regrowth and the removal of dangerous trees will be acceptable provided visual quality objectives are met.

   The estimated area of forest, by forest type, occurring in the level one and level two travel route zones is shown in Table 3. These figures have been altered from the draft due to corrections to the forest type and travel route database in the Geographic Information System.

Table 3 **Estimated area of forest (ha) included in travel route zones Southern Forest Region**

Forest Type	*Area*
Mature karri	4 845
Regrowth karri	960
Jarrah	10 770
Other species	105
Non forest	2 030
TOTAL	18 710

7. In the central and northern forests, where group selection cutting and thinning are the harvesting methods employed, new silvicultural prescriptions will be applied adjacent to level one and level two travel routes to minimise the visual impact of harvesting and regeneration.

MANAGING NATIVE FORESTS FOR MULTIPLE PURPOSES

The provision of a representative reserve system where the priority value is nature conservation is an essential component of the overall Forest Management Plan. The contribution of the reserve system to forest nature conservation would be devalued, however, if the forest surrounding the reserve was managed exclusively for other forest values, with no consideration for nature conservation.

This Plan is designed to ensure that areas designated for productive purposes will be managed so that ecological processes and biological diversity are maintained. An essential feature of this Plan is how the maintenance and arrangement of a balanced forest structure within the multiple purpose forest contributes to sustaining all forest values, including nature conservation.

Identifying Areas of Special Significance

Integrated management requires the identification of areas of special significance for which specific management procedures are prescribed and careful management of intervening forest to protect the values of the reserves. Large areas of special significance are generally accommodated within the nature conservation reserve system, but there are also small areas which are dispersed throughout the multiple purpose forest that are of special significance for biological and other values.

The river and stream zones (riparian zones) of forests are sites of particular significance for both biological and hydrological reasons.

In addition to these zones, there are 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.

These sites often represent ecotones between major landscape features. Ecotonal features are known to be significant and valuable sites for wildlife conservation.

Concurrent with the review which lead to this Plan, the Department of Conservation and Land Management conduced a joint study with the Australian Heritage Commission in the Southern Forest Region to identify areas of national estate significance. By definition, areas with attributes that achieve the "threshold" level for national estate listing are areas of special significance. The methodology and results of this comprehensive study have been documented in detail in the joint draft CALM/AHC report.

Although there has been opportunistic recording of areas of cultural significance within the forests, there has been no systematic study of areas of historic and Aboriginal cultural attributes. In cooperation with local Aboriginal communities and the Australian Heritage Commission, a comprehensive study to identify sites of archaeological and anthropological significance within the forest has commenced.

The identification of areas of special significance within the forest is an ongoing process. The strategy is:

1. All areas of special cultural, biological, aesthetic or physical significance will be identified and recorded in CALM's geographic information system.

2. The process of identification of areas of special significance will be continually upgraded.

3. Management prescriptions will be applied to protect the values of areas of special significance.

River and Stream (Riparian) Zones

The biological, hydrological and aesthetic benefits of the provision of zones of undisturbed vegetation adjacent to rivers and streams can be summarised as follows:

- they minimise, and, in almost all situations, eliminate any adverse effects of timber harvesting on water quality for human use;
- they limit groundwater rise in stream lines, thus minimising the outflow of saline groundwaters on "high risk" sites;
- they are major focal points for fauna activity and hence their value as undisturbed habitats is high relative to the area they occupy;
- they provide corridors for fauna movement;
- they provide structural diversity in multiple purpose forest which is beneficial to both wildlife and aesthetics;
- they contribute significantly to the distribution of the mature and senescent stages of forest development, which assists the maintenance of a balanced forest structure at the regional and local level.

The river and stream zone system has been comprehensively reviewed within CALM and with the assistance of the community. It will now be extended into the jarrah forest of the Central Forest and Swan Regions. Thus, all streams in the forest will be protected by a zone of retained vegetation.

The following guidelines will be used for selection of riparian zone width:

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

Under this distribution of river and stream zones, the areas and forest types which will be allocated in the Southern Forest Region are shown in Table 4. The figures have varied from the draft due to corrections to the stream and forest type database in the Geographic Information System.

Table 4 **Estimated areas by forest type in river and stream zones, Southern Forest Region**

Forest Type	*Area (ha)*
Jarrah	24 545
Karri	
Even aged regeneration	3 900
Other karri	15 595
Other forest	455
Other	17 680
TOTAL	62 175

In CALM's Central Forest Region and Swan Region, approximately 90 000 hectares will be allocated to river and stream zones.

Diverse Ecotype Zones

The mosaic of heath, sedge and herb vegetation, rock outcrops, swamps, lakes, wetlands and woodland formations which occur throughout the forest are important sites for wildlife conservation and are often significant landscape features.

To protect these sites:

1. Diverse vegetation communities will be excluded from timber harvesting. Associated activities such as roading will be minimised. Rock outcrops (>0.2 hectares in size), lakes, swamps and other wetlands, heath, sedge, herb and woodland communities will be kept free of disturbance apart from necessary roading.

2. Transitional vegetation (ecotones) will be kept undisturbed for a distance of up to 50m from the edge of the feature and ecological characteristics will be used to determine the boundary of these zones.

It is estimated that approximately 200 000 hectares will be allocated to diverse vegetation communities for special management in multiple purpose forest in the three forest regions:

High-Value Old-Growth Forests

In addition to the reserve, stream, river and travel route zone systems, CALM will identify and prescribe management for additional areas of "high value old growth forest". These will be identified in the course of operational planning processes in line with Ministerial Condition 7.

PROTECTING THE FOREST

Fire Protection

CALM's Fire Protection Strategy recognises five facts:

(i) that forest fires starting from lightning or human activity are inevitable;

(ii) that each year weather conditions occur under which fires can be so intense as to be impossible to control;

(iii) that the intensity at which fires burn is directly related to the quantity of accumulated dry litter or available fuel on the forest floor;

(iv) that forest litter decomposes slowly and thus accumulates quickly, creating a fuel load in forests so high that fires occurring during extreme weather conditions are uncontrollable;

(v) that the strategic use of prescribed fire is the only way in which fuel can be maintained at levels that allow fires to be controlled and managed in the forest.

The principal fire management goal of CALM is to protect community and environmental values on, and adjacent to, land managed by the Department from damage or destruction from wildfire. The secondary goal is to use fire as a management tool to achieve land management objectives in accordance with designated land use priorities.

CALM has sought to achieve these goals through strategies dealing with fire management planning, fire protection, detection and suppression of fires, and research into fire behaviour and fire ecology.

The most important fire protection practice in forests is the use of prescribed fire to reduce fuels. This minimises the damage caused by severe wildfires, makes it easier and safer for fire fighters to control fires and permits the application of diverse fire regimes.

CALM's fire management approach in Western Australia's forests has been remarkably successful in minimising the extent and intensity of wildfires and the subsequent loss of life and property. Although fire ignitions in the native forest have ranged from 100-350 each year and fire weather conditions have been extreme, few large and damaging wildfires have occurred and loss of life from forest fires has been avoided since the implementation of regular prescribed burning.

At the same time research and operational experience continues to provide the basis for refinements to fire management policy and practice.

Fire Protection Strategies

1. All district fire management and prescribed burning programs in the forest areas will be based on a formal Wildfire Threat Analysis, which integrates the risks of fire starting, the factors which influence fire behaviour and suppression and the impact a fire might have on human or environmental values.

2. Fire regimes will be developed that take into account the response of threatened or endangered species or communities to burning.

3. Supplementary fire-fighting resources (especially from personnel employed in the timber industry) will be trained and used for fire management programs in the forest.

4. Research results on biological research, and system analysis and computer techniques in fire management will be implemented in all forest districts.

5. In carrying out its prescribed burning program, CALM will undertake careful planning to minimise atmospheric pollution of urban areas by smoke.

The Government has directed that prescribed burning policies will be reviewed by an expert committee. This review will be undertaken early in 1994.

Disease Management

Dieback Disease

Dieback is caused by introduced fungi belonging to the genus *Phytophthora*. It poses a significant threat to plants of the jarrah forest and adjacent coastal heathlands, and is the most serious ecological problem in southern Western Australia.

Approximately 15 percent of south-west forests are infected by *Phytophthora cinnamomi*. Other *Phytophthora* species can become pathogenic but *Phytophthora cinnamomi* is the most destructive.

Phytophthora cinnamomi can spread through the root systems of susceptible plants, from root to root contact, in overland flow or in special circumstances within soil water. It can also be spread artificially in soil or root material adhering to the tracks or wheels of machinery and vehicles, to bushwalker's boots or to the feet of native and feral animals.

Once the fungus is established, subsequent disease development is determined by a range of site, climatic and vegetation factors. In jarrah forests, the most severe disease develops in low lying, water-gaining sites or on upland sites where subsurface drainage is impeded. Throughout the jarrah forest, *Phytophthora cinnamomi* is able to survive the hot, desiccating conditions of summer within the roots of susceptible understorey species, such as *Banksia grandis*.

Although jarrah is the only eucalypt species which succumbs to the disease, it does develop in the understorey of some areas of karri and wandoo forests.

Over the last 25 years a detailed dieback control strategy has been developed and implemented in south-west forests. It focuses on the disease impact on jarrah. The strategy is fully integrated, and involves policy, research, planning, community education and liaison, field management, silviculture, control of access through the forest and monitoring. The implementation of this strategy has significantly reduced disease spread and intensification.

The principal factors to be considered in the management of dieback disease in the jarrah forest are:

- The most significant means of spread of the pathogen in forest areas is in contaminated soil carried as a result of human activities.
- Spread by humans can be minimised by application of stringent hygiene and management of access to the forest.
- A large component of the forest understorey and shrub layer are susceptible to the pathogen, resulting in irreversible decline in diversity of vegetation in infected areas, the severity of which is dependent on site factors.
- The impact on jarrah varies markedly as a result of site factors and to a lesser extent genetic resistance.
- Dense stands of *B. grandis* favour the survival and pathogenicity of *Phytophthora cinnamomi*. This is especially significant in the freely drained jarrah forest uplands.

The existing strategies for dieback management put very large efforts into preventing any artificial spread of the disease and into research. Disease management strategies need to be regularly reviewed and must consider impact on all vegetation species, the relationship between site and impact, the weighing up of site-specific risk with whole of forest risk, and the effect of disturbance on intensification and impact of the disease.

Dieback Disease Management Strategies

1. Priority will be given to studies into the relationship between disease intensification and impact with physical site characteristics, vegetation and disturbance.

2. Hygiene measures will be regularly reviewed and amended as necessary in the light of research findings and monitoring programs.

3. A study of the effectiveness and the cost of managing the existing quarantine areas, and the future application of quarantine areas will be carried out.

4. Populations of mature *Banksia grandis* trees will be reduced to a maximum of four mature cone-producing trees per hectare where such a reduction will reduce the spread and intensification of *Phytophthora cinnamomi*. Fire regimes will be implemented, where practical, to minimise the subsequent development of seed-producing trees.

5. Seeding and replanting of resistant strains of jarrah into old dieback areas will be investigated, and research into cryostorage of endangered forest understorey species will be supported.

7. Jarrah growth responses in areas where *Phytophthora cinnamomi* is present will be monitored.

8. Research findings on the use of phosphonate will be developed into operational prescriptions, for the protection of vulnerable species.

9. New opportunities and technologies for the interpretation, mapping, monitoring and management of dieback disease will be investigated.

10. The existing training and education program which is aimed at alerting all forest users to the threat posed by *Phytophthora cinnamomi* will be expanded.

11. Research priorities will be regularly reviewed.

12. Operational-scale trials and monitoring of hygiene effectiveness will continue.

Wood rots, stem and branch cankers and leaf spots

Infection points for wood rots and stem and branch cankers are mainly provided by wounds caused by fire, storm or logging. Leaf spots typically gain entry as a result of insect damage to leaves. The extent of disease resulting from leaf spot fungi is not significant, however, decline and death of trees as a result of wood rots and stem cankers, although small compared to phytophthora induced disease, warrants some attention.

Other Disease Management Strategies

1. Timber harvesting and fire operations will be managed to minimise secondary damage to trees.

2. Natural regrowth and plantations will be managed to minimise stress and physiological imbalance.

3. Research into the identification and life cycles of wood rot and canker fungi will be maintained.

4. Stands will be monitored for signs of outbreaks.

Weed Control

A weed is defined as any plant which is disadvantageous from the viewpoint of effective management for the land use concerned.

This includes weeds "declared" under provisions of the Agriculture and Related Resources Protection Act, and plants that are not declared but detract from values of the land use (such as eucalypt coppice in a plantation or veldt grass in a nature reserve).

The objective is to prevent the accidental introduction of weeds, control declared weeds and control non-declared "environmental" weeds on land managed by CALM.

The strategy to attain this objective is set out in a detailed CALM policy which requires each district to survey and record the location and extent of weed infestations annually. A weed control plan is then developed in liaison with the Agricultural Protection Board (APB) and implemented within the constraints of funds available. The method of control varies depending on the weed, its location and the impact of the control method on surrounding land use values. Physical removal, treatment with herbicides and the use of biological control agents are employed.

It is not possible to treat all known weed infestations. The priorities for forest weed control are:

PRIORITY 1:
- Areas of highest value from a conservation, recreation, production or protection aspect.
- Infestations adjacent to private property.

PRIORITY 2:
- Small new infestations, particularly in headwaters of streams.
- Infestations adjacent to private property.

PRIORITY 3:
- Large infestations adjacent to private property and likely to affect it.

PRIORITY 4:
- Remainder of CALM-managed land.

The large resources required to achieve complete control of weeds by physical removal or herbicides are not available. Consequently, while these techniques will continue to be used, it is proposed that a major expansion of the biological program for major weed species be sought with the assistance of Federal agencies and tertiary institutions.

Feral Animals Control

The aim is to achieve the systematic and safe control or eradication of feral and introduced animals on lands managed by CALM.

For CALM purposes, feral animals means domestic animals gone wild, including species introduced from outside Australia which may be declared under the Agriculture and Related Resources Protection (ARRP) Act (e.g. pigs, goats, rabbits and donkeys) or not declared (e.g. cats, cattle and camels). Introduced animals include foxes and rats. Native fauna "declared" under the ARRP Act but in their normal range (e.g. dingo) are not considered to be "declared" within CALM lands unless a specific management program is approved.

Feral and introduced animals have the potential to impact seriously on natural ecosystems through predation, habitat destruction, competition for food or territory or the introduction and spread of disease.

The priorities for control of feral and introduced animals on forested lands managed by CALM are:

PRIORITY 1: The protection of threatened animals, especially those ranked as endangered (i.e. where there is a high risk of extinction) and where threatened plants are endangered by browsing and habitat destruction.

PRIORITY 2: The eradication of introduced animals from offshore islands where their presence threatens populations of native species, particularly threatened species.

PRIORITY 3: Protection of threatened ecological communities and other important habitats subject to significant degradation.

PRIORITY 4: Control of feral and introduced animals adjacent to private property, around areas subject to regular public use, in harnessed catchments and in Disease Risk Areas.

PRIORITY 5: Remainder of CALM-managed land.

Research undertaken by CALM scientists has shown conclusively that control of the introduced European red fox leads to significant increases of critical weight range mammals in forest areas. It can be concluded that the fox is probably the greatest threat to conservation and biological diversity of the forest fauna. Research in forested areas of the south-west suggests that, in this area, feral cats may not be such a significant predator of threatened animals.

While the results of trial fox control programs have been dramatically successful, current operational-scale fox control programs have until recently been relatively small and coordination of the program with adjacent landholders has been inadequate. However, the development of "Operation Foxglove" is expected to improve these situations significantly.

Feral Animal Control Strategies

1. There will be a major expansion of the fox control program in forests. Because of the potential significance of the program and the importance of community involvement and support for it, the program is identified as Operation Foxglove.

2. Operation Foxglove will involve:

   - formal liaison with farmers and country shires;
   - allocation of funds to increase the effectiveness of existing programs and, subject to continued positive results, extend the program to ensure that 20 percent of the forest estate has fox numbers reduced to a level where they have negligible effects on native fauna by the year 2003;
   - preparation of -
     - a list of priority areas for an extended baiting program
     - a fox control manual
     - procedures for monitoring the effectiveness of baiting programs;
   - research into the potency and longevity of 1080 poison in baits;
   - continuation of support for research into the development of biological control agents;
   - continuation of experiments to test baiting methodology;

- continuation of experiments to monitor any adverse effects on native species, particularly the chuditch.

3. Control measures for pigs, goats, rabbits and cats will be continued according to the designated priorities.

Insect Control

Despite extensive research into jarrah leafminer by CSIRO and CALM no practical control measures have been found. A similar situation exists for gumleaf skeletoniser and the bullseye borer.

Insect Control Strategies

1. The current strategies will be continued by monitoring the extent or outbreaks each year and by continuing research into the cause of outbreaks and control measures.

2. Maps showing the extent of leafminer infestation will be prepared every five years using remote sensing techniques.

3. Additional research into forest impacts from repeated insect outbreaks will be initiated.

CHAPTER THREE

Managed Forest Values

HARVESTING TIMBER FROM STATE FORESTS

The quantity of timber which can be harvested from publicly owned native forest in Western Australia is constrained to be within the overall growth capacity of the forest. This means that the timber yield may be sustained in perpetuity. The growth capacity of the forest is taken to be the sum of the gross increment of the tree boles, or gross bole increment. The volume which can be used as sawlogs is much less than this figure, due to quality defects or to size constraints.

In addition to the bole volume, there is a substantial volume contained in the crowns of trees as branchwood. This wood may also be harvested provided it is obtained from integrated harvesting operations.

The Level of Timber Harvest

A determination of the annual sustainable timber resource available for allocation was made by the Minister for Environment on 16 August 1993. A copy of this determination is attached as Appendix I. The determination will apply from 1 January 1994 until 31 December 2003.

Karri and marri

The annual sustainable gross bole volume increment for karri is estimated to be 417 000 cubic metres and for marri 559 000 cubic metres. The Minister has determined that the level of harvest of karri should be not greater than 214 000 cubic metres per year of first grade sawlogs and 203 000 cubic metres of other logs averaged over the ten year period. The latter category includes low quality large karri logs and material arising from thinning of regrowth stands. The balance between these two sources will vary from year to year.

Similarly, the level of marri harvest has been set at 559 000 cubic metres per year averaged over the ten year period. This figure includes both sawlogs and logs used for woodchip production. No boundary between the two categories is set as the proportion varies from time to time. It is also essential to be able to accommodate improved technology which might lead to value adding uses. All this marri resource comes from felling operations in association with the harvest of jarrah and karri sawlogs and from thinning regrowth karri-marri forest.

Jarrah

For jarrah, the estimated sustainable annual gross bole volume increment is 1 360 000 cubic metres. The Minister has determined that the yield of first and second grade jarrah sawlogs for the next 10 years will be not greater than 490 000 cubic metres per year. A considerable quantity of lower grade and small sized material is available, if suitable markets could be found.

Allocation of the Timber Resource

The following principles will be followed in allocation of timber resources.

Sawlog resource

- Contracts for premium grade, first grade and second grade sawlogs current on 31 December 1993 will be re-negotiated on the basis of new contracts with a ten year term.

- Contracts for other grades of log timber current on 31 December 1993 may be re-negotiated for extended terms not to exceed ten years.

- Smaller mills which have access to mainly second grade sawlogs supplemented by 10 percent first grade sawlogs will be allocated 20 percent first grade sawlogs.

- Small sawmills will be encouraged to remain viable through longer term security of resource. It is recognised that most small mills tended to have short term security of log resource of lower quality and that in order to develop competitive value adding facilities longer term security and a more attractive log mix is necessary.

- The commitment to value adding which has already been adopted, mainly by larger mills, will be further developed and extended to smaller mills.

Pulpwood resource

In 1992 the State Government called for expressions of interest in the establishment of a pulpmill in the south-west of Western Australia. Undertakings in respect of pulpwood resources from publicly owned forest were part of the package put forward at that time. The Government has recently named Bunnings Ltd as the proponent for this project, subject to reaching agreement over the terms for a feasibility study for the development. If found to be feasible, a pulpmill is unlikely to commence production before 1997 at the earliest, but will affect the use of resources in the latter part of this Plan period. The existing Woodchip Licence Agreement also expires in 1997. As part of the feasibility study, CALM will define the quantity of pulpwood available from State-owned resources.

Value adding

Value adding includes any activity that economically converts an available resource into products of higher value which reflect or use the natural features or qualities of the resource. Value adding includes optimising the recovery of saleable products, including the use of previously wasted residues. Value adding was a cornerstone of the 1987 Timber Strategy and will be continued and extended in this Forest Management Plan. It applies to all forests products generated in Western Australia, but more particularly to the hardwood processing industry which is facing critical market-based challenges. The green structural market, which has historically been the major market for hardwoods in Western Australia is being progressively replaced by plantation grown softwood.

This Plan will promote the increasing end use of jarrah into dried appearance grade products and karri into dried structural grade products. It will also encourage the use of better quality marri for dried appearance grade products and poorer quality marri, branchwood and thinning material from regrowth stands into pulpwood or board manufacture.

Specific strategies to be followed include:

- Contracts to purchase premium grade, first grade and second grade jarrah sawlogs will require, by 31 December 1996, conversion of at least 50 percent of the sawn green output into value added timber products.

- Contracts to purchase premium grade, first and second grade karri sawlogs will be required to develop appropriate technology and markets to maximise value added timber products.

- The sawmilling of lower quality logs which would otherwise be processed into lower value products complies with the principle of value adding provided the recovery of sawn product is maximised. Therefore contracts to purchase low quality logs will not require further evidence of value adding.

- CALM will continue to encourage the production of higher value products from marri and low quality karri logs, within the set harvest limits for these species, capitalising on new processing technology or new high value markets.

- CALM will continue to actively seek markets for small diameter jarrah to allow thinning operations to proceed in the jarrah forest as described in this Plan, and where the cost of the operation is matched by the sale of residue logs.

Marketability of Timber Resource Contracts

Tendering of a component of the log resource has taken place over the last eight years. This system of free market allocation has successfully:

- Provided access for new companies and individuals to the available log resource.

- Acted as an indicator of the free market price for the pricing and royalty system.

- Improved bankability of contracts.

The tendering system does, however, have several disadvantages:

- Marginal pricing distorts log prices.

- Companies which can efficiently process additional resource operate at sub optimal levels with higher production costs when tenders are not won.

- Insecurity of resource inhibits optimal investment opportunities thereby inhibiting the value adding potential or the ability to maximise log utilisation.

Existing sale contracts between private companies and CALM are fully transferable. It is intended that free market trading will continue but the emphasis will be on the trading of contracts or parts of contracts. This will provide opportunities for new entrepreneurs or for existing successful sawmillers to grow at the expense of less successful operators who wish to leave the industry.

Log Pricing

The CALM hardwood log pricing system comprises a price structure for different log grades, and the various price components which reflect the cost of harvesting, selling and marketing logs. It also includes a means for varying the price components over time.

Component Price Structure

The existing component log price structure has been evolving since 1987 and is the result of periodic reviews, adjustments, indexation and testing on the free market through open tenders.

The delivered price of hardwood logs to a processor consists of a "base" royalty, which covers the value of the timber itself, a "gross" royalty which includes additional charges to cover roading, administration, and the costs of harvesting and delivery.

The base royalties are derived from the following considerations:

- the need for royalty to at least recover the cost of growing the resource, together with a return on the investment in providing that resource;
- encouraging the maximum utilisation of the various grades of log to their highest possible end use.

Base royalties are adjusted periodically as follows:

- indexation of log prices at frequent intervals (e.g. annually) to preserve the real value of the price;
- negotiation with the peak industry group to take into account the capacity of the industry to pay any proposed increases;
- a market premium where logs have been won by open tender.

Gross royalty is derived by adding to the base royalty the following charges:

1. Roading charge, which is levied to cover the cost of building and maintaining roads within the forest used for log hauling.
2. In-forest charge, which covers costs incurred by CALM in organising, preparing, supervising and implementing arrangements to harvest and deliver logs to processors.
3. Administration charge, which covers all contract registration and financial transaction costs incurred by CALM in managing log harvesting and sales contracts.

CALM supplies logs to processors under contracts of sale which include the gross royalty, plus a charge to cover the costs incurred by a CALM logging contractor to harvest and deliver the product.

In some special cases, log buyers are required, or have tendered, to pay additional money to fund:

1. The Tree Planting Fund, which finances plantation establishment on cleared private land, usually in sharefarming agreements with landowners.
2. The Research and Development Levy, which contributes to wood utilisation research.

It is recognised that log royalty needs to reflect the value-adding opportunities for each log grade. For this reason, royalties for lower quality third grade and marri sawlogs will continue to reflect their lower recovery factors and higher processing costs relative to first grade sawlogs. Similarly, the royalty applied to residue logs for the production of charcoal, firewood and pulpwood will continue to be at the lower end of the royalty scale.

Varying the price components

All components of the log price are subject to periodic variation. Any variation will include all the components of log price so that the total log cost is considered.

Variation can occur from periodic comprehensive reviews to adjust, if necessary, the base log price structure, or from special adjustments between reviews. In some cases there are constraints on this process imposed by legislation, such as State Agreement Acts.

A comprehensive review of hardwood log royalties and softwood stumpages was completed in 1993 to determine the cost of efficient resource production, as well as standard costs for processing logs into the finalised product and marketing the products.

The harvesting and delivery charge will be varied in line with conditions specified in CALM harvesting contracts, which are reviewed each half year.

The base royalty or stumpage will normally be adjusted in line with an appropriate market based index number.

Roading, in-forest and administrative charges will be varied by considering the actual costs incurred in providing the service for which the charge applies or by the Consumer Price Index.

FOREST RECREATION AND TOURISM

Forest Recreation

Community demands for recreation and tourism opportunities in forest areas is reflected in CALM's enabling legislation. Meeting these demands has been established as a major objective for forest regions.

In the development and interpretation of recreation policies, the following general principles have been adopted:

- *Preservation of Values* - The values of the land as a whole should be maintained. The natural systems (including landscapes, water, biota, etc.) should be able to sustain the form of recreation, or ancillary activity, which is occurring or is proposed. Consistent with preservation of values, facilities associated with recreation should be carefully controlled. Facilities for organised sports, for example, should generally be minimal. The intensity of recreational activity should be controlled if necessary to ensure that it does not destroy the value and nature of the activity.

- *Consistency of Recreation with Purpose of the Land* - Recreational activity should be compatible with the purpose or zoning of the land.

- *Equity* - Generally the widest range of activities consistent with the purpose of vesting should be allowed, but uses which impair other forms of use to an unreasonable extent or place the safety of other users in jeopardy, should be controlled or eliminated. In certain instances, priority use may be allocated to specialised recreation activities at sites which are uniquely suited to those activities.

- *Management* - The Department should provide any necessary degree of supervision of the activity, particularly where land values may be impaired. If this cannot be done the activity should, where practicable, be restricted, relocated or eliminated.

The forest recreation strategies to be followed are:

1. Intensively used visitor sites in the forest regions will be redeveloped or upgraded over the next 10 years according to recreation framework plans. Improved site design and facility development will provide for additional visitor capacity and enhance the level of visitor satisfaction without increasing the potential for environmental degradation.

2. Additional formal campsites will be developed in suitable forest areas to cater for increased demand for small and large group camping.

   At least ten new sites will be developed over the next ten years. Campsites in forest areas will be chosen in some cases to reduce camping pressure in adjacent, but more sensitive, coastal environments.

3. Fees will be charged for forest recreational use to raise funds for the provision of facilities and services for users, and to offset the costs of management. Fee charging will be introduced at appropriate recreation sites where facilities have been provided. The charging of a fee also provides a management tool for redirecting or controlling use.

Forest Tourism

Tourism is an aggregation of travel (for enjoyment), accommodation and attractions. Forests of the south-west region are significant natural attractions which tourists want to experience. Factors influencing the extent of tourism include proximity to population centres, landuse and ownership and the diversity of available opportunities. Goals for forest-based tourism are therefore:

- To maintain "naturalness", diversity of natural experiences and quality of attractions. Here quality not only refers to the natural environment but also to its visual attributes, information, infrastructures and services.

- To base forest tourism on the conservation of natural values particularly in terms of damage and overcrowding of attractions and recreation sites.

- To generate funds from tourism to manage parks, reserves, attractions and recreation sites.

Tourism is catered for in forest management planning through the establishment of a system of national parks and conservation parks, and use of travel route zones and visual resource management to protect scenic attractions, the use of stream zones and retained mature forest to preserve diversity, the provision of facilities for tourists such as picnic sites, walk tracks, lookouts, brochures, maps and talks and the regeneration of areas from which timber is produced.

COMMUNITY EDUCATION AND INTERPRETATION

Community Education and Interpretation Goal

The goal of CALM's education program is to promote community awareness and understanding of the natural environment and encourage public attitudes and behaviour sympathetic to conservation of flora and fauna and management of forests.

This will be achieved by providing opportunities to:

- improve community knowledge of forests;

- improve appreciation of the value of forests for recreation, protection, conservation, research, education, water catchment and production (forest products including timber, honey, wildflowers, minerals);

- improve understanding of the principles and practices of Western Australian forest management;

- provide opportunities for the community to become involved in forest management planning.

In structuring learning experiences about forest management, CALM will develop a comprehensive program providing focused and sequential experiences that encompass all the single issues in a broad framework.

Community Education and Interpretation Strategies

A range of educational strategies will be implemented to communicate comprehensive and accessible information to various audiences.

These include:

- Assessing the needs and expectations of general community, government, industry and special interest groups.
- Planning an annual program of community education programs at forest regions, coordinated by a Community Education Officer and regional information officers.
- Fostering understanding of south-west forests through increasing awareness of the role of forests and forest management within the natural, social, economic and political environment. This will be achieved through development of opportunities for personal experience in forests and production of interpretive resources for a wide range of ages and interest groups.
- Training CALM staff in the principles and techniques of community education and interpretation.
- The preparation of simple messages on forest operations for use by CALM officers during education and media contacts.
- Developing and implementing high standards for programs and productions that are effective in meeting program objectives, e.g. publications and interpretive activities.
- Consulting and liaising with groups outside CALM about the community education program for WA forests.

Demonstration Forests

CALM will develop and evaluate the effectiveness of demonstration forests at Collie, Manjimup, Margaret River, Dwellingup and Mundaring to assist community awareness and understanding of forests and forest management.

MANAGING AREAS OF SPECIAL SIGNIFICANCE

The areas identified by the processes outlined above will be managed by CALM to protect their special values.

Measures employed to protect these values will vary according to the nature of the values and their sensitivity and resilience to disturbance. Measures may range from exclusion of vehicles to the adoption of modified silvicultural practice.

River and Stream Zones

Timber harvest will be excluded from all river and stream zones. Vehicle movement across riparian zones will be restricted to properly engineered and sensitively constructed stream crossings.

Felling will be restricted to those trees removed in stream crossing construction and individual trees which may pose a safety hazard.

Because of the dissected nature of the riparian zone system, some prescribed burning will be required at the time of burning in adjoining areas.

Diverse Ecotype Zones

Timber harvest will be excluded from all diverse ecotype zones, and road construction and vehicle access will be restricted to the absolute minimum. The extensive nature of some of the occurrences of heath and sedge in the Southern Forest Region will make it impossible to avoid them crossing in some situations. Existing roads within these zones will be relocated and rehabilitated if the opportunity arises.

Preferred road alignments will be located in tall open forest communities.

Action to prevent the introduction of *Phytophthora* sp. to these sites will be taken.

Prescribed burning in these zones will be carried out in accordance with the habitat requirements of the site, and as part of strategic fuel reduced buffers, as determined from wildfire threat analysis.

NATURE CONSERVATION

Ecological Processes

Despite the heavy rates of harvesting of some forests in the latter part of the last century and the early part of this century, and the absence of any significant scientific management of the forest until 1920, there is no evidence to show that the ecological processes (i.e. the water, nutrient and carbon cycles) that maintain the forests have been impaired. For example:

- growth rates have not significantly increased or been reduced;
- the hydrological cycle is similar to that which occurred in the "natural forest";
- nutrient depletion of the forest ecosystem is not occurring;
- no species of native plant or vertebrate animal is known to have become extinct as a result of forest use. One of the most threatened vertebrates, the Yellow Bellied Frog, is currently the subject of investigation. See page 13 for a summary.

This Forest Management Plan will ensure that the ecological processes continue to be maintained by:

- increasing the area of forest land with secure tenure and purpose;
- minimising the spread and intensification of *Phytophthora cinnamomi*, the cause of dieback;
- maintaining a forest fire protection system which minimises the impact of wildfire on fire management programs;

- ensuring that the forest is subject to a diverse fire regime;
- ensuring that the level of timber removed from the forest is constrained within the growth capacity of the forest;
- ensuring that the current high water-quality levels in rivers, streams, wetlands and their catchments, in forest areas are maintained;
- ensuring that there is no loss of soil by disturbance (other than that associated with mining) or no net loss of nutrients from forest ecosystems;
- ensuring that all areas of forest which are harvested or disturbed by other activities are regenerated with the same mix of forest species which was present prior to the disturbance.

Biological Diversity

To the best of present knowledge, there is no single plant or animal species that is endangered in the native forest of the south-west as a consequence of any forest management practice.

The Plan seeks to preserve and enhance biological diversity in the forests by:

- maintaining a balanced forest structure, including a significant component of the mature and senescent stages of forest development, in perpetuity;
- increasing the area and representativeness of the reserve system (see below);
- providing for increased diversity of habitat within the forest reserved for multiple purposes by providing riparian zones, reducing cutting-coupe size and retaining individual large trees and patches of old trees;
- identifying special habitats, such as upland seepage sites, rock outcrops, heathlands, wetlands, ecotones and protecting them from soil disturbance;
- developing specific recovery programs for threatened species;
- reducing European fox populations over at least 20 percent of the forest in specifically targeted areas to levels at which they have minimal impact on native animals during the next 10 years;
- maintaining a diverse fire regime.

Conservation Reserve System

The 1987 Forest Region Management Plans proposed major additions to the forest conservation reserve system. The addition of the areas approved by the Government in this Plan will ensure that all major ecotypes are represented in the system, that the area of mature and senescent forests represented in the reserve system will be increased, and that areas with significant wilderness values will be reserved.

In the northern jarrah forest, a systematic analysis of the representativeness of vegetation complexes in the reserve system has resulted in the addition of significant areas of poorly represented complexes to the reserve system. See Table 5.

Table 5 **Representation of vegetation complexes in the nature conservation reserve system**

Vegetation Complex	*% Representation in Reserves Havel, 1987*	*% Representation including RMP (1987) Reserve Proposals*	*% Representation including new Reserve Proposals*
Helena (L/M)	-	25.5	25.5
Williams	-	0.1	0.9
Lowden	0.2	2.2	5.8
Darling Scarp	1.5	1.9	3.8
Michibin	3.5	6.2	9.0
Wilga	3.8	2.8	13.4
Muja	4.3	3.4	3.0
Cardiff	-	-	-
Coolakin (L)	7.5	12.9	17.4
Dwellingup (H)	6.0	5.0	6.5
Yarragil (Min Swamps)	5.7	6.0	6.7
Murray (L/M)	8.7	9.4	10.6
Murray (M/H)	8.9	17.0	18.1

NOTE: 1. The figures in column 1 are based on the mapped vegetation complexes within the System Six boundary. The figures in columns 2 and 3 are based on the total area of vegetation complexes depicted in maps published by the Department of Conservation and Environment (Heddle *et al.* 1980).

2. Significant representation of Helena and Darling Scarp complexes occur in the proposed Darling Range Regional Park.

3. The Muja and Cardiff complexes are found in the Collie Coal Basin. The issue of conservation reserves is being addressed by a detailed "Structure Plan" for the Collie Basin.

In the southern forest areas, representativeness has been increased by adding blackbutt forest and low jarrah woodland, all considered poorly represented, and significant areas with wilderness values.

BRIDGETOWN -

BOYUP BROOK

GREENBUSHES

KOJONUP

NANNUP

KENINUP

UPPER PERUP

TONE-PERUP

TONE RIVER

BLACKBUTT

WARRUP

DICKSON

MANJIMUP

DINGUP

LOWER PERUP

LOWER TONE

BOLBELUP EAST

TALLING

DONNELLY

STRICKLAND

BEAVIS

NORTH EAST CAREY BROOK

GIBLETT- HAWKE

SMITH BROOK

MANJIMUP

SOUTH WEST CAREY BROOK

LAKE MUIR

SCRUBIUP

BOLBELUP

QUINDINUP

BEEDELUP

PEMBERTON

LAKE JASPER

EAST BROOK

DORDAGUP

TOOTANELLUP NR

LOWER DONNELLY

WARREN

CHALLAR

POOLE

CURTIN

NAENUP

CHITELUP

YEAGARUP

MALIMUP

CROWEA

SPRING

JANE

NORTHCLIFFE

CALLCUP

BOGGY CREEK

MUIRILLUP

SHANNON

NORTH WELD

LONG

ANDREWS

FISH CREEK

ROE

WEST FRANKLAND

MOUNT ROE

BOORARA

WILLMOTT

MEERUP

GARDNER

FRANKLAND

KENT

CHUDALUP

MIDDLE SHANNON

WELD

EAST FRANKLAND

D'ENTRECASTEAUX

MARINGUP

PINGERUP

MAP 4
PLACES AND SUBAREAS PROPOSED FOR INCLUSION IN THE REGISTER OF NATIONAL ESTATE
SOUTHERN FOREST REGION

LEGEND

CHALLAR — Place

CALLCUP / MEERUP — Subarea

CALM Region boundary

Local Government Authority boundary

10 5 0 10 20 km

N

Produced by Land Information Branch, March 1994

RIDGETOWN -

BOYUP BROOK

GREENBUSHES

KOJONUP

KENINUP

UPPER PERUP

TONE-PERUP

WARRUP

LOWER PERUP

LOWER TONE

TONE RIVER

BOLBELUP EAST

DINGUP

SMITH BROOK

MANJIMUP

TALLING

LAKE MUIR

SCRUBIUP

BOLBELUP

QUINDINUP

CRANBROOK

RANDELL ROAD

TOOTANELLUP NR

WAMBALLUP NR

KWORNICUP NR

DORDAGUP

POOLE

CURTIN

CHALLAR

CHITELUP

SPRING

PLANTAGENET

JANE

NORTHCLIFFE

MUIRILLUP

SHANNON

FISH CREEK

ANDREWS

BOORARA

NORTH WELD

LONG

ROE

MOUNT ROE

WEST FRANKLAND

WILLMOTT

MT BARKER

ONGERUP LAGOON

CLEARILLUP

LAKE BARNES

SHEEPWASH CREEK NR

GARDNER

DENMARK

KENT

LINDESAY

MITCHELL

CHORKERUP

SLEEMAN CREEK NR

MIDDLE SHANNON

WELD

FRANKLAND

EAST FRANKLAND

MARINGUP

PINGERUP

DICKSON
MANJIMUP
DINGUP
PERUP
LOWER TONE
BOLBELUP EAST
DONNELLY
STRICKLAND
BEAVIS
NORTH EAST CAREY BROOK
GIBLETT- HAWKE
SMITH BROOK
TALLING
MANJIMUP
SOUTH WEST CAREY BROOK
BEEDELUP
LAKE MUIR
SCRUBIUP
BOLBELUP
QUINDINUP
CRANE
LAKE JASPER
PEMBERTON
EAST BROOK
DORDAGUP
TOOTANELLUP NR
LOWER DONNELLY
WARREN
CHALLAR
NAENUP
POOLE
CURTIN
CHITELUP
YEAGARUP
MALIMUP
CROWEA
SPRING
JANE
NORTHCLIFFE
CALLCUP
BOGGY CREEK
MUIRILLUP
SHANNON
FISH CREEK
NORTH WELD
LONG
ROE
ANDREWS
BOORARA
WEST FRANKLAND
MOUNT ROE
WILLMOTT
MEERUP
GARDNER
FRANKLAND
KENT
CHUDALUP
MIDDLE SHANNON
WELD
EAST FRANKLAND
D'ENTRECASTEAUX
MARINGUP
PINGERUP
COLLIS
GUM LINK
DEEP
SOUTH WELD
IRWIN BOW RIVER
THAMES
LOWER SHANNON
SOUTHERN
BROKE INLET
WALPOLE RIVER
WALPOLE
HILLTOP
GIANTS
LONG POINT
HOPKINS
IRWIN INLET
OCEAN
CHATHAM ISLAND NR
CONSPICUOUS
WALPOLE - NORNALUP

CALM Region boundary

Local Government Authority boundary

10 5 0 10 20 km

N

Produced by Land Information Branch, March 1994

PERUP
LOWER TONE
TALLING
DINGUP
SMITH BROOK
MANJIMUP
BOLBELUP EAST
LAKE MUIR
SCRUBIUP
BOLBELUP
QUINDINUP
CRANBROOK
RANDELL ROAD
TOOTANELLUP NR
WAMBALLUP NR
KWORNICUP NR
DORDAGUP
POOLE
CURTIN
CHALLAR
CHITELUP
SPRING
PLANTAGENET
JANE
NORTHCLIFFE
MUIRILLUP
SHANNON
FISH CREEK
ANDREWS
BOORARA
NORTH WELD
LONG
ROE
MOUNT ROE
WEST FRANKLAND
WILLMOTT
CLEARILLUP
MT BARKER
ONGERUP LAGOON
LAKE BARNES
SHEEPWASH CREEK NR
DENMARK
KENT
LINDESAY
MITCHELL
CHORKERUP
SLEEMAN CREEK NR
DENBARKER
HAY
BLUE GUM CREEK NR
GARDNER
MIDDLE SHANNON
WELD
FRANKLAND
EAST FRANKLAND
MARINGUP
PINGERUP
DEEP
SOUTH WELD
COLLIS
GUM LINK
IRWIN
BOW RIVER
THAMES
DENMARK
LOWER SHANNON
BROKE INLET
WALPOLE RIVER
WALPOLE
HILLTOP
GIANTS
LONG POINT
HOPKINS
IRWIN INLET
REDMOND ROAD
DENMARK
JAMIESON HILL
MT SHADFORTH NR
ALBANY
CHATHAM ISLAND NR
CONSPICUOUS
WALPOLE - NORNALUP

A tabular summary of the new forest reserve system is shown below:

Table 6 Summary of areas by primary forest type managed primarily for nature conservation

Existing or Proposed Tenure	*Jarrah Forest*	*Karri Forest*
	(ha rounded to nearest 1000)	
National Park	134	50
Conservation Park	114	1
Nature Reserve	83	2
Other Reserve	53	----
SUB TOTAL (CONSERVATION RESERVES)	384	53
VIRGIN FOREST IN RESERVES	135 (35%)	40 (75%)
Riparian Zones	* 117	19
Travel Route Zones (fixed)	11	6
Mature forest patches	--	3
TOTAL AREA MANAGED PRIMARILY FOR NATURE CONSERVATION	512	81
TOTAL AREA OF FOREST (ALL CALM MANAGED LAND)	1 564	174
PROPORTION OF TOTAL FOREST MANAGED PRIMARILY FOR NATURE CONSERVATION	33%	46%

* Areas for Central and Swan estimates only.

HERITAGE VALUES

The CALM/Heritage Commission Study

The assessment of national estate values in CALM's Southern Forest Region undertaken by CALM and the Australian Heritage Commission concurrently with the preparation of the Draft Forest Strategy and this Forest Management Plan has provided a model for protection of forest heritage values. The Commission and CALM have developed a comprehensive report and a Memorandum of Understanding to provide an agreed basis for applying the results of the joint study.

Forty places in the region meet the threshold of significance for a range of national estate values and have been given interim listing in the Register. The name and location of individual places listed on the Register are shown in Map 4.

National estate values do not occur uniformly throughout each place proposed for listing. Appendix 3 of the final joint CALM/AHC report will detail the values for each place and sub area.

It is evident from an earlier analysis conducted by the AHC on the original indicative areas and published in the Draft Strategy that the majority of the national estate values identified within the Southern Forest Region are well protected by the nature conservation reserve system. In most instances, more than half the expressions of value (i.e. individual areas where

a value is present) assessed as being above the threshold of significance are located in whole or part within the reserves. The extent of protection of many values is markedly improved by the proposed new reserves, particularly for extensive values such as forest and woodland with wilderness characteristics, areas significant for general biotic and abiotic processes, areas with a high diversity of plant community types, undisturbed forests and woodlands, and areas with good examples of particular vegetation assemblages.

A new analysis on the final national estate places which were interim listed in December 1993 will be published in the final CALM/AHC report due in early 1994.

Even though most heritage values are represented in the existing and proposed reserve system, management procedures will be adopted to minimise the impact of forest use on national estate values occurring within the forest reserved for multiple purpose use.

All national estate values vary in their sensitivity and resilience to disturbance and national estate values, and as with other forest values, will not remain static in space and time. The most appropriate measures for their protection also vary. Management practices can minimise the initial level of impact, and appropriate ongoing management can ensure such values re-establish in the future.

The forest structural distribution and site-sensitive silvicultural practices adopted in this Plan will assist in the protection of national estate values, which may be sensitive to disturbance, and because the ecological processes which maintain the forest ecosystem will not be impaired, these values will be re-established.

CALM and the Australian Heritage Commission will proceed with further joint work for identification and protection of national estate values in the remaining south-west forest areas.

National Estate Values Outside Reserves

The guidelines for management of forests with national estate values have been described in detail in the appendices to the joint report compiled by CALM and the AHC.

All national estate values vary in their sensitivity and resilience to particular forms of land-use, and thus the most appropriate measures for their protection will also vary.

At the local level, timber harvesting operations may have no adverse impact on some national estate values, for example those relating specifically to landforms. Management activities related to timber production do have the potential to adversely affect some national estate values relating to biological or ecological attributes, in the short term, depending on the nature of the activities and the characteristics of the value in question. However, management practices can be implemented to minimise the initial level of impact, and appropriate ongoing management implemented to ensure such values re-establish in the future.

For values which are sensitive to disturbance from timber production activities, the highest level of protection would be obtained at the local level by excluding harvesting and other operations in national estate places with these values. However, the AHC recognises that CALM is managing the forest for a wide range of values, including those related to timber production, and that it is neither realistic nor possible, nor desirable, to exclude harvesting and associated activities from every national estate place in the region. However, the intent of the Australian Heritage Commission Act 1975 is that consideration be given to national estate values when decisions are being made about activities likely to adversely affect listed places.

The planning and operational guidelines designed to minimise impacts on national estate values which are sensitive to timber production operations include:

- Scheduling of timber harvest within identified areas in priority order commencing with areas below threshold and finishing with areas of very high significance.

- Protection of vegetation communities within different parts of the topography or on different soil types.

- Care to avoid soil compaction, soil erosion and stream siltation.

- Ensuring that regeneration of the forest emulated the original mix and relationship of forest types.

- Ensuring that silvicultural operations do not prevent the re-establishment of the original structure of the forest type.

Cultural Sites

Cultural sites will be recorded and protected from disturbance which may affect the cultural values present.

In the case of European historic sites, maintenance and restoration programs will be programmed in consultation with local interest groups.

HYDROLOGICAL VALUES

The existing forest management strategies have ensured that Western Australia's native forested catchments have provided a large source of high-quality water for domestic and commercial uses. The forest management procedures to be followed under this Plan will ensure the maintenance of water quality by:

- the retention of zones of undisturbed vegetation on every river and stream throughout the publicly owned forest areas in the south-west of Western Australia;

- restrictions on the proportion of forest which may be harvested in forest areas with saline groundwater tables.

CALM and the Water Authority of Western Australia will cooperate to identify second order water catchments with high salt risk as is required by Ministerial Condition 16-1.

In addition to these measures, cooperative planning procedures with the Water Authority of Western Australia will ensure that, where possible, and depending on other conflicting forest values, potential water resource development sites are set aside for the future use and benefit of the community.

CALM will also continue to work, in cooperation with the Water Authority and other relevant agencies, to reverse stream salinity where this is a problem, by soundly planned reforestation.

OTHER NATURAL RESOURCES

Honey Production

The structural goal for the jarrah and karri forests outlined at the commencement of this chapter will ensure that there will be a sufficient representation of immature, mature and senescent development stages (flowering stages) in the forest overstorey to sustain the honey industry at current or increased levels of production.

The creation of new nature conservation reserves may require the relocation of some apiary sites. However, this will not be determined until individual area management plans for these reserves are drafted. Many apiary sites are currently poorly utilised and there is potential for new arrangements to be negotiated with beekeepers.

A greater emphasis will be placed on the strategic deployment of beehives in multiple purpose forests to promote seed production, which will make regeneration techniques in the forest more efficient. Liaison with beekeepers and timely placement of hives will ensure the maximum opportunity for seed set and seed fall in areas programmed for harvest and regeneration.

Wildflowers, Blossom and Seeds

Implementation of this Plan will maintain this industry at least at current levels. The increasing sophistication of the management plan and the formation of the Industry Advisory Committee should lead to greater efficiency in the industry which may result in an increase in its net worth.

The Forest Management Plan has also achieved a new level of sophistication in its approach to the conservation of biological diversity. A strategy that ensures the conservation of biological diversity, a component of which is genetic diversity, will assist the floriculture industry by protecting the genetic material which can be used in a cultivated environment and can produce the high-quality material demanded by the more lucrative export markets. A loss of genetic material, would be a considerable disadvantage to the industry.

Grazing

It is expected that sheep and cattle grazing in native forest areas will be phased out over the next three decades. This period of time is dictated by the terms of some grazing leases.

The minor advantage gained for forest management by reduction of fire hazard from grazing is offset by the degradation to other forest values. In particular, nature conservation (flora and fauna) values are threatened by forest grazing and the activity will be phased out as opportunities arise to do so.

MINERAL RESOURCES

Mineral Production

It is expected that mining in forest areas will continue around current levels depending on market fluctuations for mineral products. Mining is recognised as an activity which generates significant wealth for the State and the nation. Long term leases and Agreement Acts between the Government and mining companies have secured the continuation of mining in forest areas.

CALM's role is to ensure that the rehabilitation of mined areas is planned and effected in such a way that the structure and composition of the new forest complements the structural goal for the whole forest. Although mineral extraction from a forest site cannot be sustained, the rehabilitated forest may sustain other forest values such as water production, recreation, timber production and nature conservation.

Gravel, Sand and Stone Supplies

An interagency work party will be convened early in 1994 to produce a "Gravel Supply Strategy" for the State. The new strategy may result in altered arrangements but in the meantime the availability of gravel, sand and stone for supply to local government authorities and State Government departments will continue under the current policy and issue of leases.

All areas will be rehabilitated and the royalty obtained will be directed to purchase forest of sufficient area to replace that lost by extraction.

CHAPTER FOUR

Monitoring

Implicit in the undertaking of management action is the need to monitor the implementation and impact of those operations. Monitoring is important across the full range of management actions, e.g. use of a recreation site or how closely a burn achieved its prescribed intensity, because through it the success of meeting forest management objectives is evaluated and the opportunity to upgrade prescriptions is presented.

CALM's research programs also provide continuous input to the management process. The research programs are periodically adjusted to ensure they are providing information of the most important strategic value.

At the most fundamental level CALM's forest management objective is to preserve biological diversity and the ecological processes which sustain that diversity. Monitoring to check if that is being achieved is difficult, because natural changes in ecosystems interact with those caused by management-related disturbance and because the large number of ecosystem components all react differently. A comprehensive monitoring program will encompass three components of ascending complexity, as follows:

(a) Monitoring the effectiveness of measures to protect the environment.

Codes of practice are the guidelines used to control forest operations in the field. They set standards and measures of performance for activities and operations conducted by CALM, contractors and other users of public forests.

These codes aim to ensure that the people carrying out a forest operation such as road construction, tree planting, timber harvesting or recreation site maintenance complete it to the highest standard existing knowledge allows. They therefore constitute current best available practice.

"Codes of practice" collectively describe a range of documents including manuals, prescriptions, specifications, standards and guidelines. The codes are one of the instruments used to set standards for forest operations. Acts of Parliament, regulations, policies and contracts are other instruments used for this purpose.

CALM uses codes of practice for each of the major activities and operations conducted in the forest regions. Codes are reviewed and re-issued annually to reflect the results of the year's monitoring, or new research information.

Responsibility for implementing the codes is assigned to CALM's regional and district staff, assisted as necessary by specialist branches. Specialists and regional staff also have a role in ensuring that prescriptions are correctly followed in the field.

(b) **Monitoring the impact of disturbance-causing activities.**

In CALM this is carried out primarily through the Department's research program. Clearly, all species of the biota cannot be studied, and research is concentrated on what are believed to be keystone species.

Species known to be rare or under threat are given special emphasis in research, and in operational planning procedures. Threatened flora management programs will be progressively developed and implemented.

(c) **Monitoring ecosystem change through periodic measurement of an extensive system of permanent plots and selected vertebrate and invertebrate species.**

This is the most sophisticated level of monitoring because, if done adequately, it measures baseline ecosystem health and can detect management-induced change or natural environmental changes. It is, however, very difficult because:

- it requires considerable initial research to obtain a good dataset of regional biota;
- a large number of plots must be established and enough organisms sampled to ensure environmental diversity is covered.

Within the forest regions (a) is implemented, (b) partly implemented and (c) yet to be initiated. As resources allow, the monitoring program will be steadily upgraded through sophistication of (b) and, finally, full implementation of detailed ecosystem monitoring.

CHAPTER FIVE

Management Strategies for Native Forest on Private Property

There are approximately 500 000 hectares of native forests on private property in the south-west.

There are legislative constraints on the clearing of some private native forest but the care and management of these forests is variable. Some forests are in a healthy, productive and well-managed condition, providing a source of considerable benefit to the landowner. Other forests are in a very degraded condition because of the adverse impacts of grazing, fire, disease, pests, waterlogging, exposure or poor regeneration following timber harvest.

The agricultural development of the south-west of Western Australia has involved the clearing of millions of hectares of forest, woodland and shrubland in the past 100 years. This development has brought the State considerable economic benefit, but its adverse impacts in land and water degradation, including loss of nature conservation values, were never foreseen. It is now widely recognised that these adverse impacts can and must be arrested and reversed, and a strong landcare movement has emerged in the rural community to achieve that objective.

The advent of markets for log residue material and small sawlogs has facilitated the application of stand improvement operations such as thinning and regeneration of understocked stands. This is especially true for properties with jarrah and karri regrowth forests, where thinning yields have provided an interim financial return to the landowner and increased the potential for higher return from a sawlog harvest.

Since 1989, CALM has given private forest owners the opportunity to use CALM's harvesting contractors and log buyers for the harvesting and marketing of their timber. Under these arrangements the documentation, control and supervision of harvesting operations is provided by CALM for a percentage of the royalty charges paid to the landowner.

Concurrent with the provision of greater opportunities, CALM has developed a number of plantation establishment and management schemes to encourage the development of commercially viable tree crops on farms.

The principle underlying these schemes has been the integration of tree crops into the total farm enterprise. This ensures maximum financial return to farmers, maintenance of existing agricultural production levels, and the maximum benefit to the on-farm and regional environment. CALM will expand this concept to include the management of native vegetation on private property.

It is intended that the CALM Vegetation and Tree Planting Advisory Service, which has primarily been concerned with tree planting schemes, will be expanded to provide advice on the management of native forest on private property.

The Service will offer advice on:

- the management and restoration of forests on private property;
- the growth and yield of native forest on private property;
- the commercial aspects of native forest management;
- the contribution of native forest to the maintenance of local and regional environmental quality.

CALM will also continue to offer private owners of native forest the opportunity to supply logs to sawmills by providing access to CALM's integrated logging system.

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